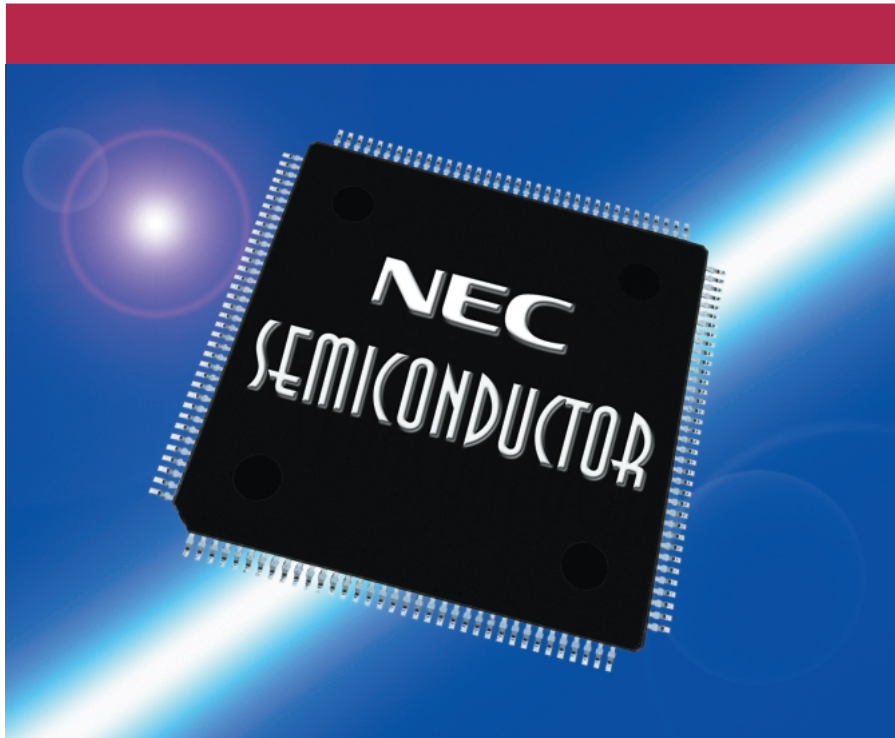


SEMICONDUCTOR SELECTION GUIDE



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October 2001

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Caution: The I²C bus interface circuit is incorporated in the μ PD17709A subseries, 17719 subseries, 178018A subseries, 178024 subseries, 178048 subseries, 178078 subseries, 178098 subseries, 789167Y subseries, 789177Y subseries, 780024AY subseries, 780034AY subseries, 780058Y subseries, 780078Y subseries, 78018FY subseries, 780308Y subseries, 780344Y subseries, 780354Y subseries, 78064Y subseries, 780702Y subseries, 78078Y subseries, 780833Y subseries, 784038Y subseries, 784216AY subseries, 784218AY subseries, 784225Y subseries, 784928Y subseries, μ PD17003A, 17005, 17P005, 17010, 17P010, 31577, 703014AY, 703014BY, 703015AY, 703015BY, 70F3015BY, 703017AY, 70F3017AY, 703030AY, 703031AY, 703032AY, 70F3032AY, 703033AY, 70F3033AY, 703034AY, 703035AY, 70F3035AY, 703036AY, 703037AY, 70F3037AY, 703031BY, 703033BY, 70F3033BY, 703030BY, 703032BY, 70F3032BY, 703034BY, 703035BY, 70F3035BY, 703036HY, 703037HY, 703037HY, 703038Y, 70F3038Y, 703039Y, 703040Y, 70F3040Y, 703041Y, 703078Y, 703079Y, 70F3079Y, 703068Y, 703069Y, 703088Y, 703089Y, 70F3089Y, 78070AY, μ PC1851B, 1854A, 1888E, 1888F, μ PD61030A, 61130, 61882A, 64082, 720100A, 720110, and 72255Y.

Those who use the I²C bus interface can be granted the license below by giving prior notification before ordering the custom code.

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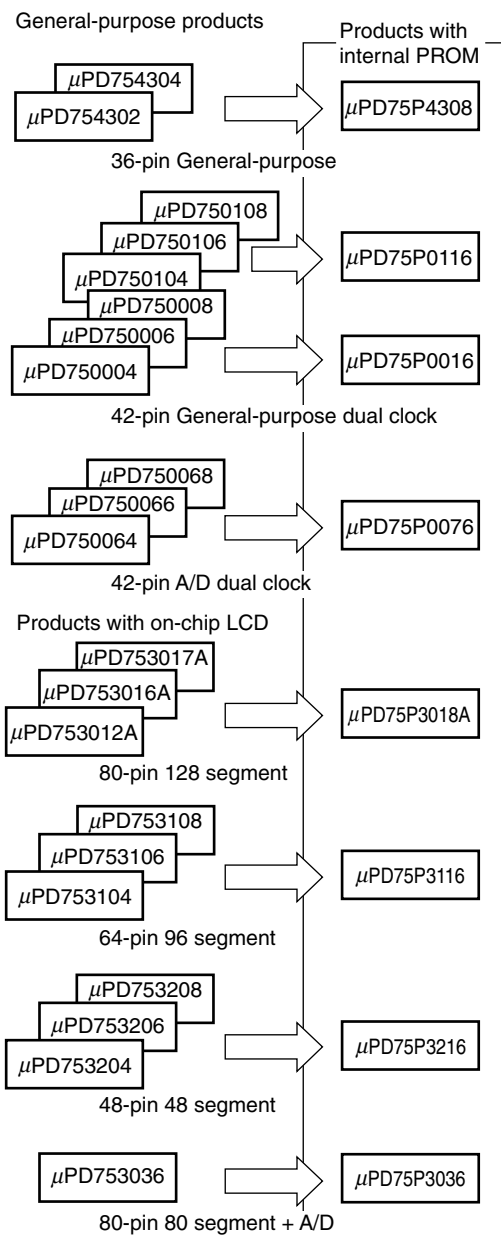
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4-Bit Single-Chip Microcontroller

75XL Series

75XL Series Product Evolution



4-Bit Single-Chip Microcontroller

75XL Series

■ General-Purpose 42-pin (1/2)

Part number	μ PD750004	μ PD750006	μ PD750008	μ PD75P0016
Internal ROM size	4096 bytes	6144 bytes	8192 bytes	16384 bytes
Internal ROM type	Mask ROM			One-time PROM
Internal RAM size	512 $\times$ 4 bits			
General-purpose register	(4-bit $\times$ 8) $\times$ 4 banks or (8-bit $\times$ 4) $\times$ 4 banks			
Instruction cycle	• 0.95 μs, 1.91 μs, 3.81 μs, 15.3 μs (With 4.19 MHz main system clock) • 0.67 μs, 1.33 μs, 2.67 μs, 10.7 μs (With 6.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)			
Minimum instruction execution time	• 0.67 μs (V_{DD} = 2.7 to 5.5 V) • 0.95 μs (V_{DD} = 2.2 to 5.5 V)			
Vectored interrupt	External: 3, Internal: 4			
I/O port	34 • CMOS input: 8 (On-chip pull-up resistors are connectable by software: 7) • CMOS I/O: 18 (Can drive LED, On-chip pull-up resistors are connectable by software) • N-ch open-drain I/O: 8 (Can drive LED, 13V withstand voltage, pull-up resistors can be incorporated by mask option)			34 • CMOS input: 8 (On-chip pull-up resistors are connectable by software: 7) • CMOS I/O: 18 (Can drive LED, On-chip pull-up resistors are connectable by software) • N-ch open-drain I/O: 8 (Can drive LED, 13V withstand voltage, no on-chip pull-up resistors)
Timer	4 channels • 8-bit timer/event counter $\times$ 1 channel • 8-bit timer $\times$ 1 channel • Basic interval timer/watchdog timer $\times$ 1 channel • Watch timer $\times$ 1 channel			
Serial interface	Any of three modes can be used • 3-wire serial I/O mode (MSB/LSB switchable) • 2-wire serial I/O mode • SBI mode			
Test input	External: 1, Internal: 1			
Clock output	• Φ, 524 kHz, 262 kHz, 65.5 kHz (With 4.19 MHz main system clock) • Φ, 750 kHz, 375 kHz, 93.8 kHz (With 6.0 MHz main system clock)			
Buzzer output	• 2 kHz, 4 kHz, 32 kHz (with 4.19 MHz main system clock, or 32.768 kHz subsystem clock) • 2.93 kHz, 5.86 kHz, 46.9 kHz (with 6.0 MHz main system clock)			
Instruction set	• Bit data set/reset/test/boolean operations • 4-/8-bit data transfer/operations/increment and decrement/comparison			
Power supply voltage	2.2 to 5.5 V			
Package	42-pin plastic SDIP, 44-pin plastic QFP (10 $\times$ 10 mm)			
Development tools	Assembler, IE controller, device file, in-circuit emulator			
Applications	VCRs, CD players, keyless entries, cordless telephones, radios, cameras, home electric appliances, etc.			

4-Bit Single-Chip Microcontroller

75XL Series

■ General-Purpose 42-pin (2/2)

Part number	μ PD750104	μ PD750106	μ PD750108	μ PD75P0116
Internal ROM size	4096 bytes	6144 bytes	8192 bytes	16384 bytes
Internal ROM type	Mask ROM			One-time PROM
Internal RAM size	512 × 4 bits			
General-purpose register	(4-bit × 8) × 4 banks or (8-bit × 4) × 4 banks			
Instruction cycle	• 2 μs, 4 μs, 8 μs, 32 μs (With RC 2 MHz main system clock) • 4 μs, 8 μs, 16μs, 64 μs (With RC 1 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)			
Minimum instruction execution time	2 μ s (V_{DD} = 1.8 to 5.5 V)			
Vectored interrupt	External: 3, Internal: 4			
I/O port	34 • CMOS input: 8 (On-chip pull-up resistors are connectable by software: 7) • CMOS I/O: 18 (Can drive LED, On-chip pull-up resistors are connectable by software) • N-ch open-drain I/O: 8 (Can drive LED, 13V withstand voltage, pull-up resistors can be incorporated by mask option)			34 • CMOS input: 8 (On-chip pull-up resistors are connectable by software: 7) • CMOS I/O: 18 (Can drive LED, On-chip pull-up resistors are connectable by software) • N-ch open-drain I/O: 8 (Can drive LED, 13V withstand voltage, no on-chip pull-up resistors)
Timer	4 channels • 8-bit timer/event counter × 1 channel • 8-bit timer × 1 channel • Basic interval timer/watchdog timer × 1 channel • Watch timer × 1 channel			
Serial interface	Any of three modes can be used • 3-wire serial I/O mode (MSB/LSB switchable) • 2-wire serial I/O mode • SBI mode			
Test input	External: 1, Internal: 1			
Clock output	Φ , 125 kHz, 62.5 kHz, 15.6 kHz (With 1MHz main system clock)			
Buzzer output	• 2 kHz, 4 kHz, 32 kHz (with 32.768 kHz subsystem clock) • 0.49 kHz, 0.98 kHz, 7.81 kHz (with 1MHz main system clock)			
Instruction set	• Bit data set/reset/test/boolean operations • 4-/8-bit data transfer/operations/increment and decrement/comparison			
Power supply voltage	1.8 to 5.5 V			
Package	42-pin plastic SDIP, 44-pin plastic QFP (10 × 10 mm)			
Development tools	Assembler, IE controller, device file, in-circuit emulator			
Applications	VCRs, CD players, cordless telephones, radios, cameras, home electric appliances, etc.			

4-Bit Single-Chip Microcontroller

75XL Series

■ General-Purpose 42-pin (A/D)

Part number	μ PD750064	μ PD750066	μ PD750068	μ PD75P0076
Internal ROM size	4096 bytes	6144 bytes	8192 bytes	16384 bytes
Internal ROM type	Mask ROM			One-time PROM
Internal RAM size	512 $\times$ 4 bits			
General-purpose register	(4-bit $\times$ 8) $\times$ 4 banks or (8-bit $\times$ 4) $\times$ 4 banks			
Instruction cycle	• 0.95 μs, 1.91 μs, 3.81 μs, 15.3 μs (With 4.19 MHz main system clock) • 0.67 μs, 1.33 μs, 2.67 μs, 10.7 μs (With 6.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)			
Minimum instruction execution time	• 0.67 μs ($V_{DD} = 2.7$ to 5.5 V) • 0.95 μs ($V_{DD} = 1.8$ to 5.5 V)			
Vectored interrupt	External: 3, Internal: 4			
I/O port	32 • CMOS input: 12 (On-chip pull-up resistors are connectable by software: 7, Also used for analog input: 4) • CMOS I/O: 12 (Can drive LED, On-chip pull-up resistors are connectable by software, Also used for analog input: 4) • N-ch open-drain I/O: 8 (Can drive LED, 13V withstand voltage, pull-up resistors can be incorporated by mask option)			32 • CMOS input: 12 (On-chip pull-up resistors are connectable by software: 7, Also used for analog input: 4) • CMOS I/O: 12 (Can drive LED, On-chip pull-up resistors are connectable by software, Also used for analog input: 4) • N-ch open-drain I/O: 8 (Can drive LED, 13V withstand voltage, no on-chip pull-up resistors)
Timer	4 channels • 8-bit timer/event counter $\times$ 2 channels (usable as 16-bit timer/event counter) • Basic interval timer/watchdog timer $\times$ 1 channel • Watch timer $\times$ 1 channel			
Serial interface	Any of two modes can be used • 3-wire serial I/O mode (MSB/LSB switchable) • 2-wire serial I/O mode			
A/D converter	8-bit resolution $\times$ 8 channels			
Test input	External: 1, Internal: 1			
Clock output	• Φ, 1.05 MHz, 262 kHz, 65.5 kHz (With 4.19 MHz main system clock) • Φ, 1.5 MHz, 375 kHz, 93.8 kHz (With 6.0 MHz main system clock)			
Buzzer output	• 2 kHz, 4 kHz, 32 kHz (with 4.19 MHz main system clock, or 32.768 kHz subsystem clock) • 2.93 kHz, 5.86 kHz, 46.9 kHz (with 6.0 MHz main system clock)			
Instruction set	• Bit data set/reset/test/boolean operations • 4-/8-bit data transfer/operations/increment and decrement/comparison			
Power supply voltage	1.8 to 5.5 V			
Package	42-pin plastic SDIP, 42-pin plastic SSOP			
Development tools	Assembler, IE controller, device file, in-circuit emulator			
Applications	Cordless telephones, AV equipment, home electric appliances, OA equipment, health equipment, meters, gas tables, etc.			

4-Bit Single-Chip Microcontroller

75XL Series

■ General-Purpose 36-pin

Part number	μ PD754302	μ PD754304	μ PD75P4308
Internal ROM size	2048 bytes	4096 bytes	8192 bytes
Internal ROM type	Mask ROM		One-time PROM
Internal RAM size	256 x 4 bits		
General-purpose register	(4-bit x 8) x 4 banks or (8-bit x 4) x 4 banks		
Instruction cycle	• 0.95 μs, 1.91 μs, 3.81 μs, 15.3μs (With 4.19 MHz main system clock) • 0.67 μs, 1.33 μs, 2.67 μs, 10.7μs (With 6.0 MHz main system clock)		
Minimum instruction execution time	• 0.67 μs (V_{DD} = 2.7 to 5.5 V) • 0.95 μs (V_{DD} = 1.8 to 5.5 V)		
Vectored interrupt	External: 3, Internal: 4		
I/O port	30 • CMOS input: 8 (On-chip pull-up resistors are connectable by software: 7) • CMOS I/O: 18 (Can drive LED, On-chip pull-up resistors are connectable by software) • N-ch open-drain I/O: 4 (Can drive LED, 13V withstand voltage, pull-up resistors can be incorporated by mask option)	30 • CMOS input: 8 (On-chip pull-up resistors are connectable by software: 7) • CMOS I/O: 18 (Can drive LED, On-chip pull-up resistors are connectable by software) • N-ch open-drain I/O: 4 (Can drive LED, 13V withstand voltage, no on-chip pull-up resistors)	
Timer	3 channels • 8-bit timer/event counter x 2 channels (usable as 16-bit timer/event counter) • Basic interval timer/watchdog timer x 1 channel		
Serial interface	Any of two modes can be used • 3-wire serial I/O mode (MSB/LSB switchable) • 2-wire serial I/O mode		
Test input	External: 1		
Clock output	• Φ, 524 kHz, 262 kHz, 65.5 kHz (With 4.19 MHz main system clock) • Φ, 750 kHz, 375 kHz, 93.8 kHz (With 6.0 MHz main system clock)		
Instruction set	• Bit data set/reset/test/boolean operations • 4-/8-bit data transfer/operations/increment and decrement/comparison		
Power supply voltage	1.8 to 5.5 V		
Package	36-pin plastic SSOP		
Development tools	Assembler, IE controller, device file, in-circuit emulator		
Applications	Cordless telephones, TVs, VCRs, audio equipment, home electric appliances, OA equipment, etc.		

4-Bit Single-Chip Microcontroller

75XL Series

■ LCD Driver 80-pin

Part number	μ PD753012A	μ PD753016A	μ PD753017A	μ PD75P3018A
Internal ROM size	12288 bytes	16384 bytes	24576 bytes	32768 bytes
Internal ROM type	Mask ROM			One-time PROM
Internal RAM size	1024 $\times$ 4 bits			
General-purpose register	(4-bit $\times$ 8) $\times$ 4 banks or (8-bit $\times$ 4) $\times$ 4 banks			
Instruction cycle	• 0.95 μs, 1.91 μs, 3.81 μs, 15.3 μs (With 4.19 MHz main system clock) • 0.67 μs, 1.33 μs, 2.67 μs, 10.7 μs (With 6.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)			
Minimum instruction execution time	• 0.67 μs ($V_{DD} = 2.7$ to 5.5 V) • 0.95 μs ($V_{DD} = 1.8$ to 5.5 V)			
Vectored interrupt	External: 3, Internal: 5			
I/O port	40 • CMOS input: 8 (On-chip pull-up resistors are connectable by software: 7) • CMOS I/O: 16 (Can drive LED, On-chip pull-up resistors are connectable by software) • CMOS output: 8 (Also used for segment pins) • N-ch open-drain I/O: 8 (Can drive LED, 13V withstand voltage, pull-up resistors can be incorporated by mask option)			40 • CMOS input: 8 (On-chip pull-up resistors are connectable by software: 7) • CMOS I/O: 16 (Can drive LED, On-chip pull-up resistors are connectable by software) • CMOS output: 8 (Also used for segment pins) • N-ch open-drain I/O: 8 (Can drive LED, 13V withstand voltage, no on-chip pull-up resistors)
LCD controller/driver	• Number of segments selectable: 24/28/32 (switchable to CMOS output ports in multiples of 4: 8 maximum) • Selectable display mode: Static, 1/2 duty (1/2 bias), 1/3 duty (1/2 bias), 1/3 duty (1/3 bias), 1/4 duty (1/3 bias) • Voltage driver resistors for LCD drive can be incorporated by mask option			• Number of segments selectable: 24/28/32 (switchable to CMOS output ports in multiples of 4: 8 maximum) • Selectable display mode: Static, 1/2 duty (1/2 bias), 1/3 duty (1/2 bias), 1/3 duty (1/3 bias), 1/4 duty (1/3 bias) • No on-chip voltage driver resistors for LCD drive
Timer	5 channels • 8-bit timer/event counter $\times$ 3 channels (usable as 16-bit timer/event counter or remote controller signal carrier generator) • Basic interval timer/watchdog timer $\times$ 1 channel • Watch timer $\times$ 1 channel			
Serial interface	Any of three modes can be used • 3-wire serial I/O mode (MSB/LSB switchable) • 2-wire serial I/O mode • SBI mode			
Test input	External: 1, Internal: 1			
Clock output	• Φ, 524 kHz, 262 kHz, 65.5 kHz (With 4.19 MHz main system clock) • Φ, 750 kHz, 375 kHz, 93.8 kHz (With 6.0 MHz main system clock)			
Buzzer output	• 2kHz, 4kHz, 32 kHz (with 4.19 MHz main system clock, or 32.768 kHz subsystem clock) • 2.93 kHz, 5.86 kHz, 46.9 kHz (with 6.0 MHz main system clock)			
Instruction set	• Bit data set/reset/test/boolean operations • 4-/8-bit data transfer/operations/increment and decrement/comparison			
Power supply voltage	1.8 to 5.5 V			
Package	80-pin plastic QFP (14 $\times$ 14 mm), 80-pin plastic TQFP (fine pitch) (12 $\times$ 12 mm)			
Development tools	Assembler, IE controller, device file, in-circuit emulator			
Applications	Camcorders, CD players, telephones, cameras, pagers, remote controllers, etc.			

4-Bit Single-Chip Microcontroller

75XL Series

■ LCD Driver 64-pin

Part number	μ PD753104	μ PD753106	μ PD753108	μ PD75P3116
Internal ROM size	4096 bytes	6144 bytes	8192 bytes	16384 bytes
Internal ROM type	Mask ROM			One-time PROM
Internal RAM size	512 $\times$ 4 bits			
General-purpose register	(4-bit $\times$ 8) $\times$ 4 banks or (8-bit $\times$ 4) $\times$ 4 banks			
Instruction cycle	• 0.95 μs, 1.91 μs, 3.81 μs, 15.3 μs (With 4.19 MHz main system clock) • 0.67 μs, 1.33 μs, 2.67 μs, 10.7 μs (With 6.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)			
Minimum instruction execution time	• 0.67 μs ($V_{DD} = 2.7$ to 5.5 V) • 0.95 μs ($V_{DD} = 1.8$ to 5.5 V)			
Vectored interrupt	External: 3, Internal: 5			
I/O port	32 • CMOS input: 8 (On-chip pull-up resistors are connectable by software: 7) • CMOS I/O: 20 (On-chip pull-up resistors are connectable by software: 20, Can drive LED: 12, Also used for segment pins: 8) • N-ch open-drain I/O: 4 (Can drive LED, 13V withstand voltage, pull-up resistors can be incorporated by mask option)			32 • CMOS input: 8 (On-chip pull-up resistors are connectable by software: 7) • CMOS I/O: 20 (On-chip pull-up resistors are connectable by software: 20, Can drive LED: 12, Also used for segment pins: 8) • N-ch open-drain I/O: 4 (Can drive LED, 13V withstand voltage, no on-chip pull-up resistors)
LCD controller/driver	• Number of segments selectable: 16/20/24 (switchable to CMOS I/O ports in multiples of 4: 8 maximum) • Selectable display mode: Static, 1/2 duty (1/2 bias), 1/3 duty (1/2 bias), 1/3 duty (1/3 bias), 1/4 duty (1/3 bias) • Voltage driver resistors for LCD drive can be incorporated by mask option			• Number of segments selectable: 16/20/24 (switchable to CMOS I/O ports in multiples of 4: 8 maximum) • Selectable display mode: Static, 1/2 duty (1/2 bias), 1/3 duty (1/2 bias), 1/3 duty (1/3 bias), 1/4 duty (1/3 bias) • No on-chip voltage driver resistors for LCD drive
Timer	5 channels • 8-bit timer/event counter $\times$ 3 channels (usable as 16-bit timer/event counter or remote controller signal carrier generator) • Basic interval timer/watchdog timer $\times$ 1 channel • Watch timer $\times$ 1 channel			
Serial interface	Any of three modes can be used • 3-wire serial I/O mode (MSB/LSB switchable) • 2-wire serial I/O mode • SBI mode			
Test input	External: 1, Internal: 1			
Clock output	• Φ, 524 kHz, 262 kHz, 65.5 kHz (With 4.19 MHz main system clock) • Φ, 750 kHz, 375 kHz, 93.8 kHz (With 6.0 MHz main system clock)			
Buzzer output	• 2 kHz, 4 kHz, 32 kHz (with 4.19 MHz main system clock, or 32.768 kHz subsystem clock) • 2.93 kHz, 5.86 kHz, 46.9 kHz (with 6.0 MHz main system clock)			
Instruction set	• Bit data set/reset/test/boolean operations • 4-/8-bit data transfer/operations/increment and decrement/comparison			
Power supply voltage	1.8 to 5.5 V			
Package	64-pin plastic QFP (14 $\times$ 14 mm), 64-pin plastic LQFP (12 $\times$ 12 mm)			
Development tools	Assembler, IE controller, device file, in-circuit emulator			
Applications	Telephones, cameras, sphygmomanometers, gas meters, electronic scales, remote controllers, etc.			

4-Bit Single-Chip Microcontroller

75XL Series

■ LCD Driver 48-pin

Part number	μ PD753204	μ PD753206	μ PD753208	μ PD75P3216
Internal ROM size	4096 bytes	6144 bytes	8192 bytes	16384 bytes
Internal ROM type	Mask ROM			One-time PROM
Internal RAM size	512 $\times$ 4 bits			
General-purpose register	(4-bit $\times$ 8) $\times$ 4 banks or (8-bit $\times$ 4) $\times$ 4 banks			
Instruction cycle	• 0.95 μs, 1.91 μs, 3.81 μs, 15.3 μs (With 4.19 MHz main system clock) • 0.67 μs, 1.33 μs, 2.67 μs, 10.7 μs (With 6.0 MHz main system clock)			
Minimum instruction execution time	• 0.67 μs ($V_{DD} = 2.7$ to 5.5 V) • 0.95 μs ($V_{DD} = 1.8$ to 5.5 V)			
Vectored interrupt	External: 2, Internal: 5			
I/O port	30 • CMOS input: 6 (On-chip pull-up resistors are connectable by software: 5) • CMOS I/O: 20 (On-chip pull-up resistors are connectable by software: 20, Can drive LED: 12, Also used for segment pins: 8) • N-ch open-drain I/O: 4 (Can drive LED, 13V withstand voltage, pull-up resistors can be incorporated by mask option)			30 • CMOS input: 6 (On-chip pull-up resistors are connectable by software: 5) • CMOS I/O: 20 (On-chip pull-up resistors are connectable by software: 20, Can drive LED: 12, Also used for segment pins: 8) • N-ch open-drain I/O: 4 (Can drive LED, 13V withstand voltage, no on-chip pull-up resistors)
LCD controller/driver	• Number of segments selectable: 4/8/12 (switchable to CMOS I/O ports in multiples of 4: 8 maximum) • Selectable display mode: Static, 1/2 duty (1/2 bias), 1/3 duty (1/2 bias), 1/3 duty (1/3 bias), 1/4 duty (1/3 bias) • Voltage driver resistors for LCD drive can be incorporated by mask option			• Number of segments selectable: 4/8/12 (switchable to CMOS I/O ports in multiples of 4: 8 maximum) • Selectable display mode: Static, 1/2 duty (1/2 bias), 1/3 duty (1/2 bias), 1/3 duty (1/3 bias), 1/4 duty (1/3 bias) • No on-chip voltage driver resistors for LCD drive
Timer	5 channels • 8-bit timer/event counter $\times$ 1 channel • 8-bit timer $\times$ 2 channels (usable as 16-bit timer or remote controller signal carrier generator) • Basic interval timer/watchdog timer $\times$ 1 channel • Watch timer $\times$ 1 channel			
Serial interface	Any of three modes can be used • 3-wire serial I/O mode (MSB/LSB switchable) • 2-wire serial I/O mode • SBI mode			
Test input	External: 1, Internal: 1			
Clock output	• Φ, 524 kHz, 262 kHz, 65.5 kHz (With 4.19 MHz main system clock) • Φ, 750 kHz, 375 kHz, 93.8 kHz (With 6.0 MHz main system clock)			
Buzzer output	• 2 kHz, 4 kHz, 32 kHz (with 4.19 MHz main system clock) • 2.93kHz, 5.86kHz, 46.9kHz (with 6.0MHz main system clock)			
Instruction set	• Bit data set/reset/test/boolean operations • 4-/8-bit data transfer/operations/increment and decrement/comparison			
Power supply voltage	1.8 to 5.5 V			
Package	48-pin plastic SSOP			
Development tools	Assembler, IE controller, device file, in-circuit emulator			
Applications	Remote controllers, cameras, sphygmomanometers, CD radio cassette players, gas meters, etc.			

4-Bit Single-Chip Microcontroller

75XL Series

■ LCD Driver 80-pin (A/D)

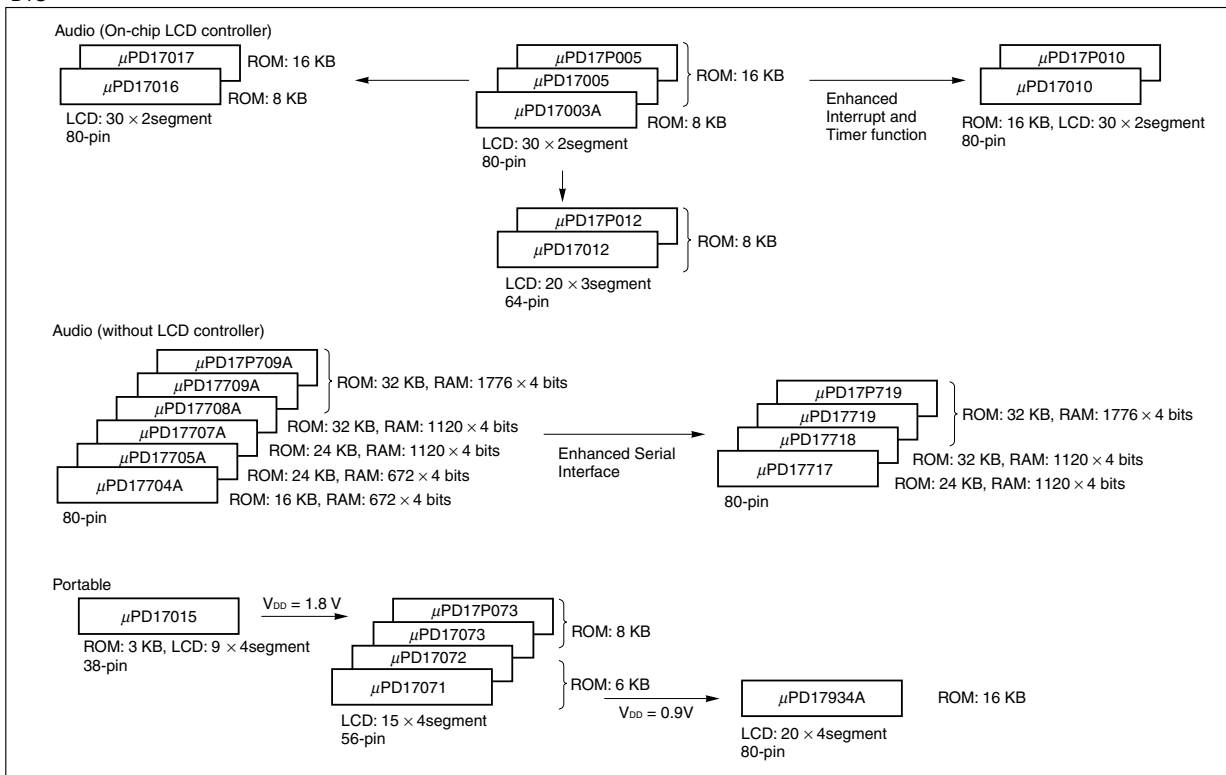
Part number	μ PD753036	μ PD75P3036
Internal ROM size	16384 bytes	
Internal ROM type	Mask ROM	One-time PROM
Internal RAM size	768 $\times$ 4 bits	
General-purpose register	(4-bit $\times$ 8) $\times$ 4 banks or (8-bit $\times$ 4) $\times$ 4 banks	
Instruction cycle	• 0.95 μs, 1.91 μs, 3.81 μs, 15.3 μs (With 4.19 MHz main system clock) • 0.67 μs, 1.33 μs, 2.67 μs, 10.7 μs (With 6.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)	
Minimum instruction execution time	• 0.67 μs ($V_{DD} = 2.7$ to 5.5 V) • 0.95 μs ($V_{DD} = 1.8$ to 5.5 V)	
Vectored interrupt	External: 3, Internal: 5	
I/O port	44 • CMOS input: 8 (On-chip pull-up resistors are connectable by software: 7) • CMOS I/O: 20 (Can drive LED, On-chip pull-up resistors are connectable by software) • CMOS output: 8 (Also used for segment pins) • N-ch open-drain I/O: 8 (Can drive LED, 13V withstand voltage, pull-up resistors can be incorporated by mask option)	44 • CMOS input: 8 (On-chip pull-up resistors are connectable by software: 7) • CMOS I/O: 20 (Can drive LED, On-chip pull-up resistors are connectable by software) • CMOS output: 8 (Also used for segment pins) • N-ch open-drain I/O: 8 (Can drive LED, 13V withstand voltage, no on-chip pull-up resistors)
LCD controller/driver	• Number of segments selectable: 12/16/20 (switchable to CMOS output ports in multiples of 4: 8 maximum) • Selectable display mode: Static, 1/2 duty (1/2 bias), 1/3 duty (1/2 bias), 1/3 duty (1/3 bias), 1/4 duty (1/3 bias) • Voltage driver resistors for LCD drive can be incorporated by mask option	• Number of segments selectable: 12/16/20 (switchable to CMOS output ports in multiples of 4: 8 maximum) • Selectable display mode: Static, 1/2 duty (1/2 bias), 1/3 duty (1/2 bias), 1/3 duty (1/3 bias), 1/4 duty (1/3 bias) • No on-chip voltage driver resistors for LCD drive
Timer	5 channels • 8-bit timer/event counter $\times$ 3 channels (usable as 16-bit timer/event counter or remote controller signal carrier generator) • Basic interval timer/watchdog timer $\times$ 1 channel • Watch timer $\times$ 1 channel	
Serial interface	Any of three modes can be used • 3-wire serial I/O mode (MSB/LSB switchable) • 2-wire serial I/O mode • SBI mode	
A/D converter	8-bit resolution $\times$ 8 channels	
Test input	External: 1, Internal: 1	
Clock output	• Φ, 524 kHz, 262 kHz, 65.5 kHz (With 4.19 MHz main system clock) • Φ, 750 kHz, 375 kHz, 93.8 kHz (With 6.0 MHz main system clock)	
Buzzer output	• 2 kHz, 4 kHz, 32 kHz (with 4.19 MHz main system clock, or 32.768 kHz subsystem clock) • 2.93kHz, 5.86 kHz, 46.9 kHz (with 6.0 MHz main system clock)	
Instruction set	• Bit data set/reset/test/boolean operations • 4-/8-bit data transfer/operations/increment and decrement/comparison	
Power supply voltage	1.8 to 5.5 V	
Package	80-pin plastic QFP (14 $\times$ 14 mm), 80-pin plastic TQFP (fine pitch) (12 $\times$ 12 mm)	
Development tools	Assembler, IE controller, device file, in-circuit emulator	
Applications	Cordless telephones, AV equipment, home electric appliances, OA equipment, health equipment, meters, gas tables, etc.	

4-Bit Single-Chip Microcontroller

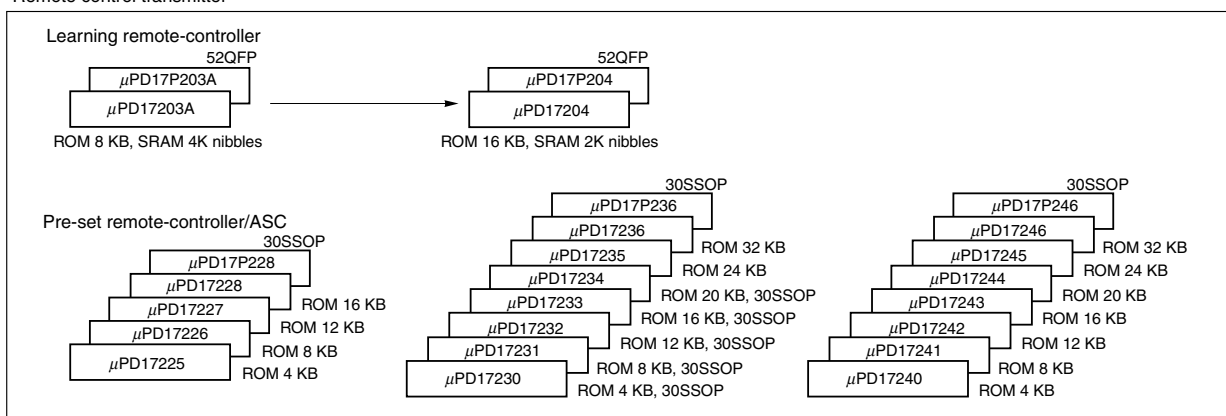
17K Series

■ 17K Series Product Evolution

DTS



Remote control transmitter



4-Bit Single-Chip Microcontroller

17K Series

■ Audio (On-Chip LCD Controller)

Part number	μ PD17003A	μ PD17005	μ PD17016	μ PD17017	μ PD17P005	μ PD17010	μ PD17P010	μ PD17012	μ PD17P012
Internal ROM size	3836 $\times$ 16 bits	7932 $\times$ 16 bits	3836 $\times$ 16 bits	7932 $\times$ 16 bits				4096 $\times$ 16 bits	
Internal ROM type	Mask ROM				One-time PROM	Mask ROM	One-time PROM	Mask ROM	One-time PROM
Internal RAM size	320 $\times$ 4 bits	432 $\times$ 4 bits	320 $\times$ 4 bits	432 $\times$ 4 bits				316 $\times$ 4 bits	
Interrupt function	External: 2, Internal: 3		External: 1, Internal: 1		External: 2, Internal: 3	External: 2, Internal: 5 (Also used for external: 1)		External: 1, Internal: 3	
I/O port	63 • Input: 8 • Output: 39 (Also used for segment pins: 30) • I/O: 16		41 • Input: 8 • Output: 17 (Also used for segment pins: 8) • I/O: 16		63 • Input: 8 • Output: 39 (Also used for segment pins: 30) • I/O: 16			50 • Input: 8 • Output: 28 (Also used for segment pins: 20) • I/O: 14	
PLL reference frequency	1, 1.25, 2.5, 3, 5, 6.25, 9, 10, 12.5, 25, 50, 100 kHz (V _{DD} = 4.5 to 5.5 V)								
Crystal oscillator	4.5 MHz								
Applicable prescaler	On-chip (150 MHz)							On-chip (250 MHz)	
LCD controller/driver	Segment signal output: 30, Common signal output: 2							Segment signal output: 20, Common signal output: 3	
Timer	Basic interval timer $\times$ 2 channels					12-bit timer $\times$ 1 channel Basic interval timer $\times$ 2 channels			
Serial interface	3 channels • 3-wire x 2 channels • 2-wire/I ² C bus mode (selectable) $\times$ 1 channel		3-wire $\times$ 1 channel		3 channels • 3-wire x 2 channels • 2-wire/I ² C bus mode (selectable) $\times$ 1 channel			3-wire $\times$ 1 channel	
A/D converter	6-bit resolution x 6 channels							6-bit resolution $\times$ 2 channels	
D/A converter	3 channels • 8-bit resolution $\times$ 3 channels (PWM output, 16V withstand voltage)		8-bit resolution $\times$ 2 channels (PWM output, 16V withstand voltage)		3 channels • 8-bit resolution $\times$ 3 channels (PWM output, 16V withstand voltage)			8-bit resolution $\times$ 2 channels (PWM output, 12 V withstand voltage)	
Power supply voltage	3.5 to 5.5 V								
Package	80-pin plastic QFP (14 $\times$ 20 mm)							64-pin plastic QFP (14 $\times$ 20 mm), 80-pin plastic QFP (14 $\times$ 14 mm)	
Developmet tools	Assembler, device file, integrated debugger, in-circuit emulator								
Applications	High-end tuner, automotive radio								

4-Bit Single-Chip Microcontroller

17K Series

■ Audio (without LCD Controller) (1/2)

Part number	μ PD17704A	μ PD17705A	μ PD17707A	μ PD17708A	μ PD17709A	μ PD17P709A
Internal ROM size	8192 $\times$ 16 bits	12288 $\times$ 16 bits		16384 $\times$ 16 bits		
Internal ROM type	Mask ROM					One-time PROM
Internal RAM size	672 $\times$ 4 bits		1120 $\times$ 4 bits		1776 $\times$ 4 bits	
Interrupt function	External: 6, Internal: 6					
I/O port	62 • Input: 12 • Output: 4 • I/O: 46					
PLL reference frequency	1, 1.25, 2.5, 3, 5, 6.25, 9, 10, 12.5, 18, 20, 25, 50 kHz (V_{DD} = 4.5 to 5.5 V)					
Crystal oscillator	4.5 MHz					
Applicable prescaler	On-chip (130 MHz)					
Timer	8-bit timer/counter $\times$ 1 channel 8-bit timer $\times$ 3 channels (Also used for PWM output: 1) Basic interval timer $\times$ 1 channel					
Serial interface	3 channels • 3-wire $\times$ 2 channels • 2-wire/I ² C bus mode (selectable) $\times$ 1 channel					
A/D converter	8-bit resolution $\times$ 6 channels					
D/A converter	8-/9-bit resolution $\times$ 3 channels (PWM output, 12 V withstand voltage)					
Power supply voltage	3.5 to 5.5 V					
Package	80-pin plastic QFP (14 $\times$ 14 mm)					
Development tools	Assembler, device file, integrated debugger, in-circuit emulator					
Applications	High-end tuner, automotive radio					

4-Bit Single-Chip Microcontroller

■ 17K Series

Audio (without LCD Controller) (2/2)

Part number	μ PD17717	μ PD17718	μ PD17719	μ PD17P719
Internal ROM size	12288 $\times$ 16 bits	16384 $\times$ 16 bits		
Internal ROM type	Mask ROM			One-time PROM
Internal RAM size	1120 $\times$ 4 bits		1776 $\times$ 4 bits	
Interrupt function	External: 6, Internal: 6			
I/O port	62 • Input: 12 • Output: 4 • I/O: 46			
PLL reference frequency	1, 1.25, 2.5, 3, 5, 6.25, 9, 10, 12.5, 18, 20, 25, 50 kHz (V_{DD} = 4.5 to 5.5 V)			
Crystal oscillator	4.5 MHz			
Applicable prescaler	On-chip (130 MHz)			
Timer	8-bit timer/counter $\times$ 1 channel 8-bit timer $\times$ 3 channels (Also used for PWM output: 1) Basic interval timer $\times$ 1 channel			
Serial interface	4 channels • 3-wire $\times$ 1 channel • SBI $\times$ 1 channel • 2-wire/I²C bus mode (selectable) $\times$ 1 channel • 3-wire/UART mode (selectable) $\times$ 1 channel			
A/D converter	8-bit resolution $\times$ 6 channels			
D/A converter	8-/9-bit resolution $\times$ 3 channels (PWM output, 12 V withstand voltage)			
Power supply voltage	3.5 to 5.5 V			
Package	80-pin plastic QFP (14 $\times$ 14 mm)			
Development tools	Assembler, device file, integrated debugger, in-circuit emulator			
Applications	High-end tuner, automotive radio			

4-Bit Single-Chip Microcontroller

17K Series

■ Portable

Part number	μ PD17015	μ PD17071	μ PD17072	μ PD17073	μ PD17P073	μ PD17934A
Internal ROM size	1528 $\times$ 16 bits	3072 $\times$ 16 bits		4096 $\times$ 16 bits		8192 $\times$ 16 bits
Internal ROM type	Mask ROM				One-time PROM	Mask ROM
Internal RAM size	97 $\times$ 4 bits	176 $\times$ 4 bits				448 $\times$ 4 bits
Interrupt function	-		External: 1, Internal: 2			External: 1, Internal: 3
I/O port	12 • Input: 3 • Output: 7 • I/O: 2	21 • Input: 4 • Output: 9 • I/O: 8				37 • Input: 11 (Also used for segment pins: 3) • Output: 6 • I/O: 20
PLL reference frequency	1, 3, 5, 25 kHz	1, 3, 5, 6.25, 12.5, 25 kHz				
Crystal oscillator	75 kHz					
Applicable prescaler	On-chip (220 MHz)	On-chip (230 MHz)				
LCD controller/driver	Segment signal output: 9, Common signal output: 4	Segment signal output: 15, Common signal output: 4				Segment signal output: 20, Common signal output: 4
Timer	Basic interval timer $\times$ 2 channels					8-bit timer/event counter $\times$ 1 channel Basic interval timer $\times$ 2 channels
Serial interface	-		3-wire/2-wire (selectable): 1 channel			
A/D converter	-		4-bit resolution $\times$ 2 channels			8-bit resolution $\times$ 3 channels
Power supply voltage	1.8 to 3.6 V				2.2 to 3.6 V	0.9 to 1.8 V
Package	38-pin plastic SSOP	56-pin plastic QFP (10 $\times$ 10 mm)	56-pin plastic QFP (10 $\times$ 10 mm), 64-pin plastic TQFP (fine pitch) (10 $\times$ 10 mm)			80-pin plastic TQFP (fine pitch) (12 $\times$ 12 mm)
Development tools	Assembler, device file, integrated debugger, in-circuit emulator					
Applications	Portable radio					

4-Bit Single-Chip Microcontroller

17K Series

■ Learning Remote-Controller

Part number	μ PD17203A	μ PD17P203A	μ PD17204	μ PD17P204
Internal ROM size	4096 $\times$ 16 bits		7936 $\times$ 16 bits	
Internal ROM type	Mask ROM	One-time PROM	Mask ROM	One-time PROM
Internal RAM size	336 $\times$ 4 bits			
Internal SRAM size	4096 $\times$ 4 bits		2048 $\times$ 4 bits	
Interrupt function	External : 1, Internal : 7			
Instruction cycle	• 4 μs (With 4 MHz main system clock, V_{DD} = 2.2 to 5.5 V) • 488 μs (With 32.768 kHz subsystem clock, V_{DD} = 2.0 to 5.5V)	• 4 μs (With 4 MHz main system clock, V_{DD} = 2.9 to 5.5 V) • 488 μs (With 32.768 kHz subsystem clock, V_{DD} = 2.0 to 5.5V)	• 4 μs (With 4 MHz main system clock, V_{DD} = 2.2 to 5.5 V) • 488 μs (With 32.768 kHz subsystem clock, V_{DD} = 2.0 to 5.5 V)	• 4 μs (With 4 MHz main system clock, V_{DD} = 2.9 to 5.5 V) • 488 μs (With 32.768 kHz subsystem clock, V_{DD} = 2.0 to 5.5V)
I/O port	28			
Remote controller function	Carrier generator for remote controller signal Remote controller signal receiver preamplifier			
LCD controller/driver	-			
Timer	4 channels • 8-bit timer $\times$ 1 channel (usable as remote controller signal carrier generator) • 10-bit timer $\times$ 1 channel • 16-bit timer $\times$ 1 channel • Watch timer/watchdog timer ($\overline{WDOUT}$ output) $\times$ 1 channel			
Serial interface	3-wire $\times$ 1 channel			
A/D converter	-			
Power supply voltage	2.2 to 5.5 V	2.9 to 5.5 V	2.2 to 5.5 V	2.9 to 5.5 V
Package	52-pin plastic QFP (14 $\times$ 14 mm)			
Development tools	Assembler, device file, integrated debugger, in-circuit emulator			
Applications	Remote controller for Learning			

4-Bit Single-Chip Microcontroller

17K Series

■ Pre-set Remote Controller/ASC (1/3)

Part number	μ PD17225	μ PD17226	μ PD17227	μ PD17228	μ PD17P228
Internal ROM size	2048 $\times$ 16 bits	4096 $\times$ 16 bits	6144 $\times$ 16 bits	8192 $\times$ 16 bits	
Internal ROM type	Mask ROM				One-time PROM
Internal RAM size	111 $\times$ 4 bits		223 $\times$ 4 bits		
Interrupt function	External: 1, Internal: 2				
Instruction cycle	• 2 μs (With 8MHz, V_{DD} = 2.2 to 3.6 V) • 4 μs (With 8MHz, V_{DD} = 2.0 to 3.6 V)				• 2 μs (With 8 MHz, V_{DD} = 3.0 to 3.6 V) • 4 μs (With 8 MHz, V_{DD} = 2.2 to 3.6 V)
I/O port	20 • Input: 8 • Output: 8 • I/O: 4				
Remote controller function	Carrier generator for remote controller signal				
Timer	2 channels • 8-bit timer $\times$ 1 channel (usable as remote controller signal carrier generator) • Basic interval timer/watchdog timer ($\overline{\text{WDOUT}}$ output) $\times$ 1 channel				
Other functions	Low voltage detection circuit ($\overline{\text{WDOUT}}$ output, mask option)				Low voltage detection circuit ($\overline{\text{WDOUT}}$ output)
Power supply voltage	2.0 to 3.6V				2.2 to 3.6 V
Package	30-pin plastic SSOP				
Development tools	Assembler, device file, integrated debugger, in-circuit emulator				
Applications	Pre-set remote controller, toy, portable system				

4-Bit Single-Chip Microcontroller

17K Series

■ Pre-set Remote Controller/ASC (2/3)

Part number	μ PD17230	μ PD17231	μ PD17232	μ PD17233	μ PD17234	μ PD17235	μ PD17236	μ PD17P236
Internal ROM size	2048 $\times$ 16 bits	4096 $\times$ 16 bits	6144 $\times$ 16 bits	8192 $\times$ 16 bits	10240 $\times$ 16 bits	12288 $\times$ 16 bits	16384 $\times$ 16 bits	
Internal ROM type	Mask ROM							One-time PROM
Internal RAM size	223 $\times$ 4 bits							
Interrupt function	External: 1, Internal: 2							
Instruction cycle	• 2 μs (With 8 MHz, V_{DD} = 2.2 to 3.6 V) • 4 μs (With 8 MHz, V_{DD} = 2.0 to 3.6 V)							• 2 μs (With 8 MHz, V_{DD} = 3.0 to 3.6 V) • 4 μs (With 8 MHz, V_{DD} = 2.2 to 3.6 V)
I/O port	21 • Input: 4 • I/O: 17							
Remote controller function	Carrier generator for remote controller signal							
Timer	2 channels • 8-bit timer $\times$ 1 channel (usable as remote controller signal carrier generator) • Basic interval timer/watchdog timer $\times$ 1 channel							
Other functions	Low voltage detection circuit (mask option)							Low voltage detection circuit
Power supply voltage	2.0 to 3.6 V							2.2 to 3.6 V
Package	30-pin plastic SSOP							
Development tools	Assembler, device file, integrated debugger, in-circuit emulator							
Applications	Pre-set remote controller, toy, portable system							

4-Bit Single-Chip Microcontroller

17K Series

■ Pre-set Remote Controller/ASC (3/3)

Part number	μ PD17240	μ PD17241	μ PD17242	μ PD17243	μ PD17244	μ PD17245	μ PD17246	μ PD17P246
Internal ROM size	2048 × 16 bits	4096 × 16 bits	6144 × 16 bits	8192 × 16 bits	10240 × 16 bits	12288 × 16 bits	16384 × 16 bits	
Internal ROM type	Mask ROM							One-time PROM
Internal RAM size	447 × 4 bits							
Interrupt function	External: 1, Internal: 2							
Instruction cycle	4 μ s (With 4MHz, $V_{DD} = 2.0$ to 3.6 V)							4 μ s (With 4MHz, $V_{DD} = 2.2$ to 3.6 V)
I/O port	24 • Input: 5 • I/O: 19							
Remote controller function	Carrier generator for remote controller signal							
Timer	2 channels • 8-bit timer × 1 channel (usable as remote controller signal carrier generator) • Basic interval timer/watchdog timer × 1 channel							
Other functions	• Low voltage detection circuit (mask option) • RAM retention detector							• Low voltage detection circuit • RAM retention detector
Power supply voltage	2.0 to 3.6 V							2.2 to 3.6 V
Package	30-pin plastic SSOP							
Development tools	Assembler, device file, integrated debugger, in-circuit emulator							
Applications	Pre-set remote controller, toy, portable system							

4-Bit Single-Chip Microcontroller

μ PD6604, 62A, 69 Series

■ Remote Controller (μ PD6604 Series)

Part number	μ PD6604	μ PD66P04B
Internal ROM size	1002 $\times$ 10 bits	
Internal ROM type	Mask ROM	One-time PROM
Internal RAM size	32 $\times$ 4 bits	
Number of supported keys	32 (standard) 48 (when using key expansion pin) 96 (when expanded by diode)	
Oscillator	300 kHz to 1 MHz (RC oscillator)	
Instruction cycle	16 μ s (With RC 500kHz)	
Modulation carrier frequency	f _x , f _x /2, f _x /8, f _x /12, f _x /16, f _x /24, no carrier	
Timer	9-bit programmable timer	
Other functions	POC circuit (mask option)	POC circuit
Power supply voltage	V _{DD} = 1.8 to 3.6V V _{DD} = 2.2 to 3.6V (when POC circuit is incorporated)	V _{DD} = 2.2 to 3.6V
Package	20-pin plastic SOP, 20-pin plastic SSOP	
Development tools	Assembler	
Applications	Remote controller for AV or household electric appliances, keyless entries	

4-Bit Single-Chip Microcontroller

μ PD6604, 62A, 69 Series

■ Remote Controller (μ PD62A Series)

Part number	μ PD62A	μ PD6P4B	μ PD64A	μ PD65	μ PD6P5
Internal ROM size	512 $\times$ 10 bits	1002 $\times$ 10 bits		2026 $\times$ 10 bits	
Internal ROM type	Mask ROM	One-time PROM	Mask ROM		One-time PROM
Internal RAM size	32 $\times$ 4 bits				
Number of supported keys	32 (standard)		32 (standard)		
	48 (when using key expansion pin)		56 (when using key expansion pin)		
	96 (when expanded by diode)				
Oscillator	2.4 MHz to 8 MHz (ceramic oscillator)				2.4 MHz to 4.8 MHz (ceramic oscillator)
Instruction cycle	16 μ s (With 4 MHz)				
Modulation carrier frequency	$f_x/8$, $f_x/16$, $f_x/64$, $f_x/96$, $f_x/128$, $f_x/192$, no carrier				
Timer	9-bit programmable timer				
Other functions	POC circuit (mask option)	POC circuit			
Power supply voltage	$V_{DD} = 2.0$ to 3.6 V	$V_{DD} = 2.2$ to 3.6 V	$V_{DD} = 2.0$ to 3.6 V		$V_{DD} = 2.2$ to 3.6 V
Package	20-pin plastic SSOP				
Development tools	Assembler				
Applications	Remote controller for AV or household electric appliances				

4-Bit Single-Chip Microcontroller

μ PD6604, 62A, 69 Series

■ Remote Controller (μ PD69 Series)

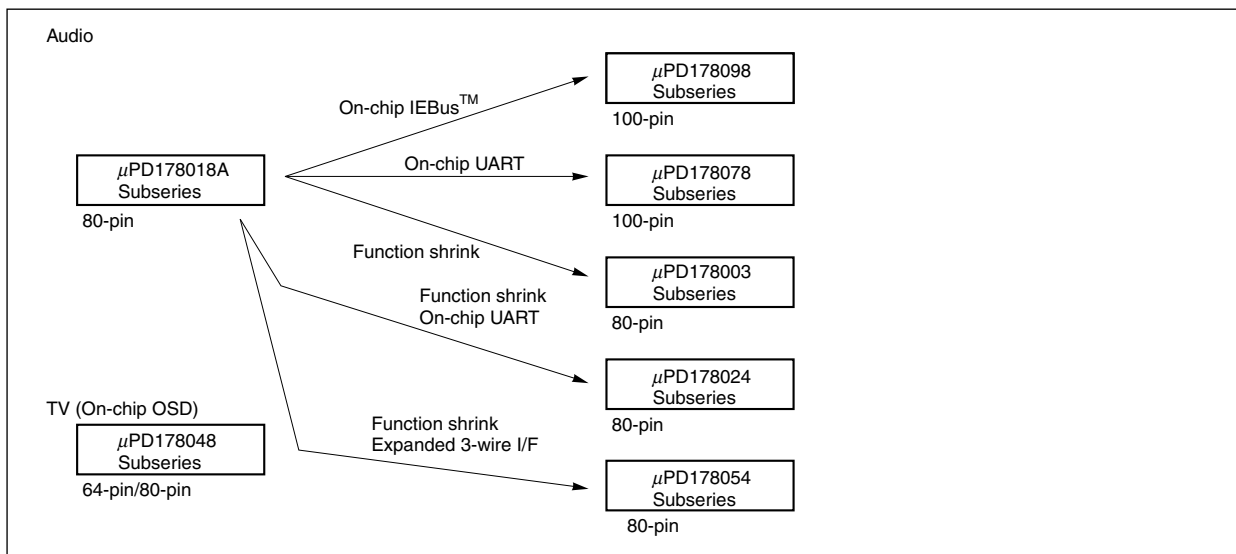
Part number	μ PD67	μ PD68	μ PD69	μ PD6P9
Internal ROM size	1002 $\times$ 10 bits	2026 $\times$ 10 bits	4074 $\times$ 10 bits	
Internal ROM type	Mask ROM			One-time PROM
Internal RAM size	32 $\times$ 4 bits			128 $\times$ 4 bits
Number of supported keys	32 (standard) 56 (when using key expansion pin)			
Oscillator	3.5 MHz to 4.5 MHz (ceramic oscillator)			
Instruction cycle	16 μ s (With 4 MHz)			
Modulation carrier frequency	9-bit programmable (7.8 kHz to 2 MHz)			
Timer	9-bit programmable timer			
Other functions	POC circuit, RAM protect detect circuit			
Power supply voltage	$V_{DD} = 2.0$ to 3.6 V			$V_{DD} = 2.2$ to 3.6 V
Package	20-pin plastic SSOP			
Development tools	Assembler			
Applications	Remote controller for AV or household electric appliances			

8-Bit Single-Chip Microcontroller

178K Series

■ 178K Series Product Evolution

DTS



■ Differences among the Subseries

Function Subseries name		ROM capacity	Timer			8-bit A/D	8-bit D/A	Serial interface	I/O	V _{DD} MIN. value	Remark
			8-bit	16-bit	WDT						
Audio	μPD178098	48K to 60K	2 ch	1 ch	1 ch	8 ch	—	4 ch (IEbus: 1 ch, I ² C: 1 ch)	80	3.5 V	—
	μPD178078							4 ch (UART: 1 ch, I ² C: 1 ch)			
	μPD178024	24K to 32K	—	6 ch	3ch	3 ch (I ² C: 1 ch, UART: 1 ch)	62				
	μPD178018A	32K to 60K				3 ch		2 ch (I ² C: 1 ch)			
	μPD178003	16K to 24K		2 ch	—	3 ch		1 ch			
	μPD178054	24K to 32K		4 ch	1 ch	6 ch		4 ch (shift register: 3 ch)			
TV	μPD178048	48K to 60K	4 ch	—	1 ch	4 ch	—	3 ch (I ² C: 2 ch)	46		

8-Bit Single-Chip Microcontroller

178K Series

■ Audio (μ PD178003, 178018A Subseries)

Subseries name	μPD178003 Subseries		μPD178018A Subseries				
Part number	μPD178002	μPD178003	μPD178004A	μPD178006A	μPD178016A	μPD178018A	μPD178P018A
Internal ROM size	16 KB	24 KB	32 KB	48 KB		60 KB	
Internal ROM type	Mask ROM						One-time PROM
Internal RAM size	512 bytes		1056 bytes		3104 bytes		
Interrupt function	External: 2, Internal: 6		External: 7, Internal: 10				
I/O port	62 • CMOS Input: 1 • CMOS I/O: 54 • N-ch open-drain output: 3 • N-ch open-drain I/O: 4						
PLL reference frequency	1, 3, 9, 10, 12.5, 25, 50 kHz (V _{DD} = 4.5 to 5.5 V)		1, 3, 5, 9, 10, 25, 50 kHz (V _{DD} = 4.5 to 5.5 V)				
Crystal oscillator	4.5 MHz						
Applicable prescaler	On-chip (160 MHz)						
Timer	8-bit timer/event counter × 2 channels Basic interval timer × 1 channel		8-bit timer/event counter × 2 channels 8-bit timer x 1 channel Basic interval timer × 1 channel Watchdog timer × 1 channel				
Serial interface	3-wire × 1 channel		3-wire/2-wire/SBI/I ² C bus mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel				
A/D converter	8-bit resolution × 3 channels		8-bit resolution × 6 channels				
D/A converter	-		8-/9-bit resolution × 3 channels (PWM output)				
Power supply voltage	3.5 to 5.5V						
Package	80-pin plastic QFP (14 × 14mm)						
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator						
Applications	High-end tuner, automotive radio						

8-Bit Single-Chip Microcontroller

178K Series

■ Audio (μPD178024 Subseries)

Part number	μPD178023	μPD178024	μPD178F124
Internal ROM size	24 KB	32 KB	
Internal ROM type	Mask ROM		Flash memory
Internal RAM size	1024 bytes		
Interrupt function	External: 5, Internal: 13		
I/O port	62 • CMOS Input: 6 • CMOS I/O: 53 • N-ch open-drain output: 3		
PLL reference frequency	1, 3, 9, 10, 12.5, 25, 50 kHz ($V_{DD} = 4.5$ to 5.5 V)		
Crystal oscillator	4.5 MHz		
Applicable prescaler	On-chip (160 MHz)		
Timer	8-bit timer/event counter × 2 channels Basic interval timer × 1 channel Watchdog timer × 1 channel		
Serial interface	3-wire × 1 channel I ² C bus: 1 channel UART: 1 channel		
A/D converter	8-bit resolution × 6 channels		
Power supply voltage	3.5 to 5.5 V		
Package	80-pin plastic QFP (14 × 14 mm), 80-pin plastic QFP (14 × 20 mm)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	High-end tuner, automotive radio		

8-Bit Single-Chip Microcontroller

178K Series

■ Audio (μPD178054 Subseries)

Part number	μPD178053	μPD178054	μPD178F054
Internal ROM size	24 KB	32 KB	
Internal ROM type	Mask ROM		Flash memory
Internal RAM size	1024 bytes		
Interrupt function	External: 5, Internal: 13		
I/O port	62 • CMOS Input: 6 • CMOS I/O: 53 • N-ch open-drain output: 3		
PLL reference frequency	1, 3, 9, 10, 12.5, 25, 50 kHz ($V_{DD} = 4.5$ to 5.5 V)		
Crystal oscillator	4.5 MHz		
Applicable prescaler	On-chip (160 MHz)		
Timer	8-bit timer/event counter × 4 channels Basic interval timer × 1 channel Watchdog timer × 1 channel		
Serial interface	3-wire: 4 channels		
A/D converter	8-bit resolution × 6 channels		
Power supply voltage	3.5 to 5.5 V		
Package	80-pin plastic QFP (14 × 14mm)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	High-end tuner, automotive radio		

8-Bit Single-Chip Microcontroller

178K Series

■ Audio (μPD178078, 178098 Subseries)

Subseries name	μPD178078 Subseries		μPD178098 Subseries		
Part number	μPD178076	μPD178078	μPD178096A	μPD178098A	μPD178F098
Internal ROM size	48 KB	60 KB	48 KB	60 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	2080 bytes	3104 bytes	2080 bytes	3104 bytes	
Interrupt function	External: 8, Internal: 15		External: 8, Internal: 14		External: 8, Internal: 17
I/O port	80 • CMOS Input: 8 • CMOS I/O: 64 • N-ch open-drain output: 8				
PLL reference frequency	1, 3, 5, 9, 10, 25, 50 kHz (V _{DD} = 4.5 to 5.5 V)				
Crystal oscillator	4.5 MHz		6.3 MHz		4.5 MHz, 6.3 MHz
Applicable prescaler	On-chip (160 MHz)				
Timer	16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Basic interval timer × 1 channel Watchdog timer × 1 channel				
Serial interface	3-wire/2-wire/SBI/I ² C bus mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel UART: 1 channel		3-wire/2-wire/SBI/I ² C bus mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel		3-wire/2-wire/SBI/I ² C bus mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel UART: 1 channel
Bus controller	-		IEBus controller		
A/D converter	8-bit resolution × 8 channels				
Power supply voltage	3.5 to 5.5 V				
Package	100-pin plastic QFP (14 × 20 mm)				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	High-end tuner, automotive radio				

8-Bit Single-Chip Microcontroller

178K Series

■ TV (μPD178048 Subseries)

Part number	μPD178046	μPD178048	μPD178F048 ^{Note}
Internal ROM size	48 KB	60 KB	
Internal ROM type	Mask ROM		Flash memory
Internal RAM size	1024 bytes		
Interrupt function	External: 5, Internal: 13		
I/O port	46 • CMOS Input: 4 • CMOS I/O: 37 • N-ch open-drain output: 5		
Crystal oscillator	5 MHz		
OSD	Kind of character: 256 Display character: 12 lines × 24 columns Character type: 12 × 18 dot Character color: 8		
Timer	8-bit timer/event counter × 1 channel 8-bit timer × 1 channel 8-bit event counter × 1 channel 8-bit remote controller timer × 1 channel Basic interval timer × 1 channel Watchdog timer × 1 channel		
Serial interface	3-wire: 1 channel I ² C bus: 2 channels		
A/D converter	8-bit resolution × 4 channels		
D/A converter	14-bit resolution × 1 channel (PWM output) 8-bit resolution × 4 channels (PWM output)		
Power supply voltage	3.5 to 5.5 V		
Package	80-pin plastic TQFP (fine pitch) (12 × 12 mm)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	TV sets, CATV		

Note ES (Engineering Sample) product only

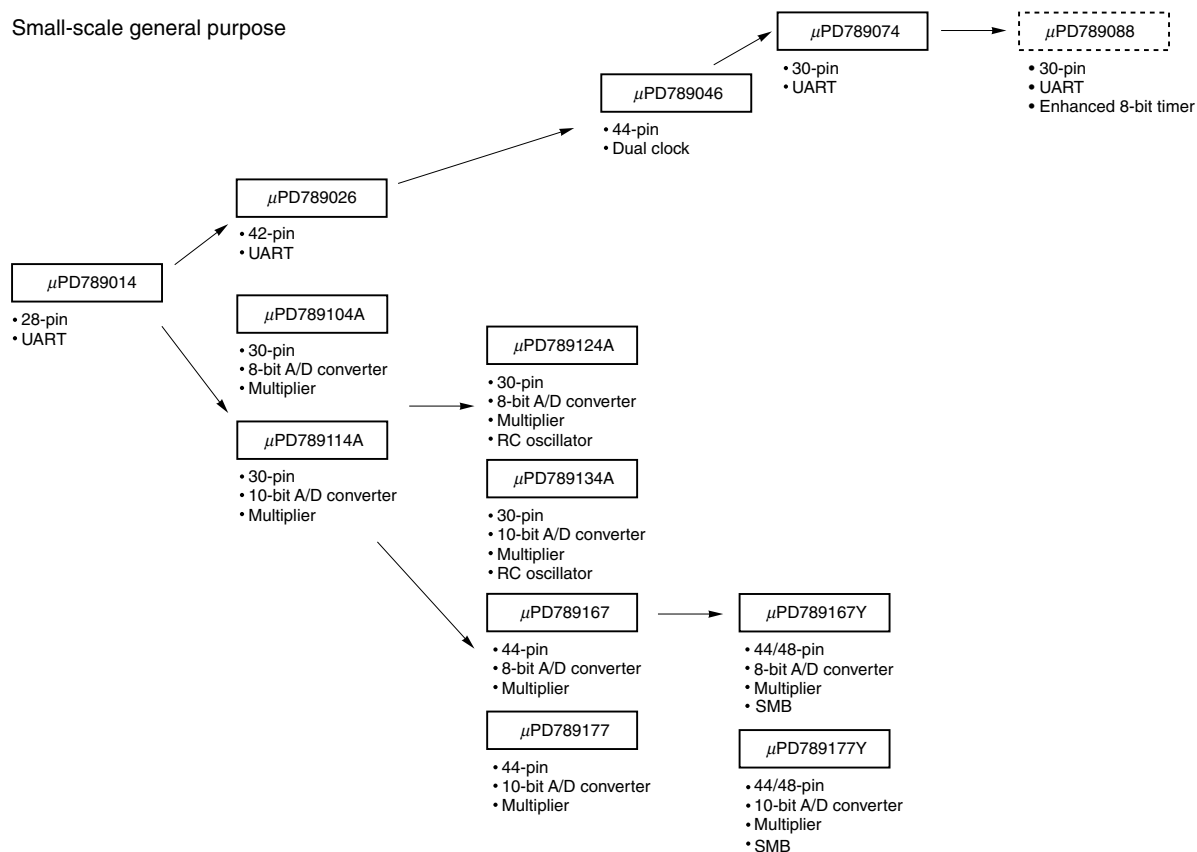
8-Bit Single-Chip Microcontroller

78K/0S Series

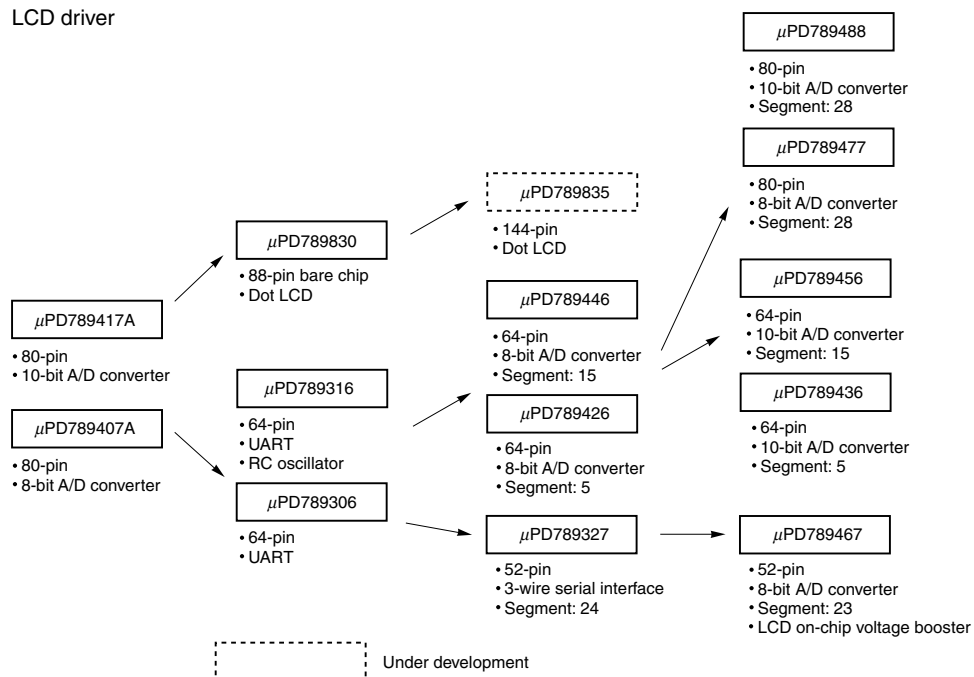
■ 78K/0S Series Product Evolution (1/2)

Subseries names are shown inside frames.

Small-scale general purpose



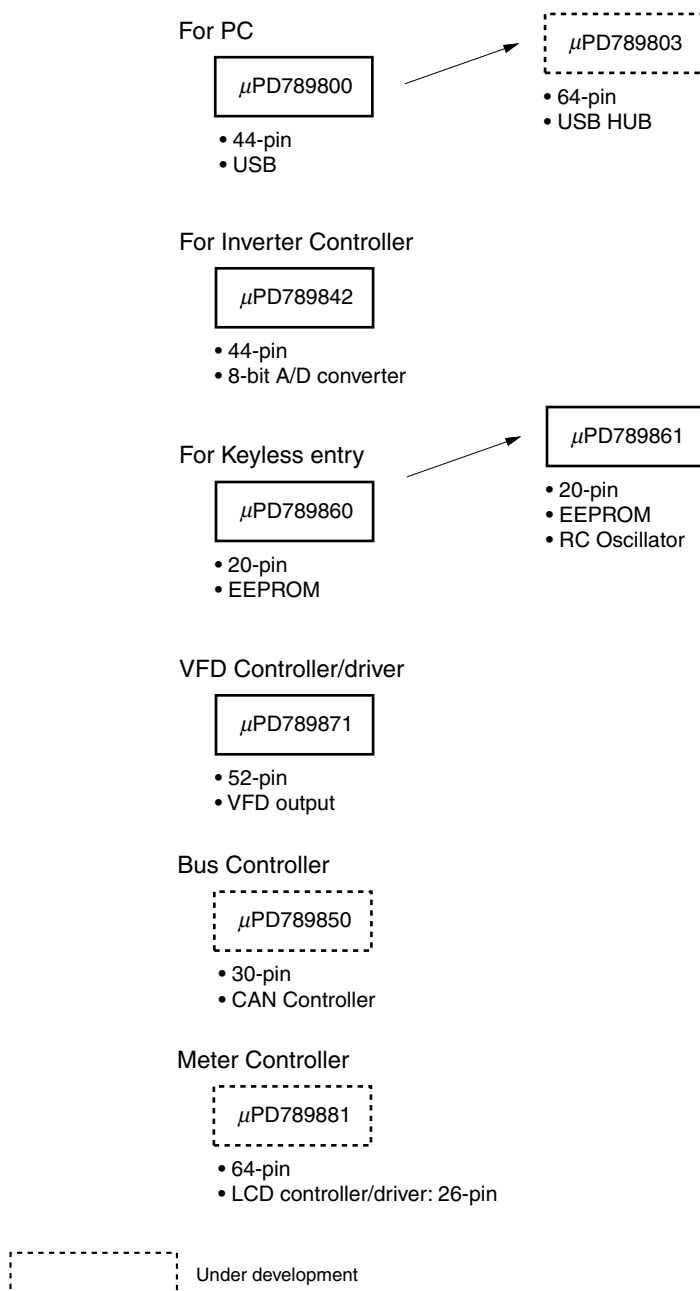
LCD driver



8-Bit Single-Chip Microcontroller

78K/0S Series

■ 78K/0S Series Product Evolution (2/2)



8-Bit Single-Chip Microcontroller

78K/0S Series

■ Differences among the Subseries

Subseries name	Function	ROM capacity	Timer				8-bit	10-bit	Serial interface	I/O	V _{DD} MIN. value	Remark
			8-bit	16-bit	Watch	WDT	A/D	A/D				
Small-scale general-purpose	μPD789046	16K	1 ch	1 ch	1 ch	1 ch	—	—	1 ch (UART: 1 ch)	34	1.8 V	—
	μPD789026	4K to 16K			—							
	μPD789014	2K to 4K	2 ch	—						22		
	μPD789074	2K to 8K	1 ch	1 ch						24		
	μPD789088	16K to 32K	3 ch									
Small-scale general-purpose + A/D	μPD789177Y	16K to 24K	3 ch	1 ch	1 ch	1 ch	—	8 ch	2 ch (UART: 1 ch) (SMB: 1 ch)	31	1.8 V	—
	μPD789167Y						8 ch	—				
	μPD789177						—	8 ch	1 ch (UART: 1 ch)			
	μPD789167						8 ch	—				
	μPD789134A	2K to 8K	1 ch		—		—	4 ch		20		RC oscillation
	μPD789124A						4 ch	—				
	μPD789114A						—	4 ch				—
	μPD789104A						4 ch	—				
Inverter controller	μPD789842	8K to 16K	3 ch	Note 1	1 ch	1 ch	8 ch	—	1 ch (UART: 1 ch)	30	4.0 V	—
LCD driver	μPD789417A	12K to 24K	3 ch	1 ch	1 ch	1 ch	—	7 ch	1 ch (UART: 1 ch)	43	1.8 V	—
	μPD789407A						7 ch	—				
	μPD789456	12K to 16K	2 ch				—	6 ch	1 ch (UART: 1 ch)	30	1.8 V	—
	μPD789446						6 ch	—		40		
	μPD789436						—	6 ch				
	μPD789426						6 ch	—				
	μPD789316	8K to 16K					—		2 ch (UART: 1 ch)	25		RC oscillation
	μPD789306											—
	μPD789467	4K to 24K		—			1 ch		—	18		
	μPD789327						—		1 ch	21		
	μPD789835	24K to 60K	6 ch	—			3 ch		1 ch (UART: 1 ch)	37	1.8 V ^{Note 2}	
	μPD789830	24K	1 ch	1 ch			—			30	2.7 V	
	μPD789477	24K	3 ch				8 ch	—	2 ch (UART: 1 ch)	45	1.8 V	
	μPD789488	32K					—	8 ch				
For PC	μPD789800	8K	2 ch	1 ch	—	1 ch	—	—	2 ch (USB: 1 ch)	31	4.0 V	—
	μPD789803	8K-16K								41	3.6 V	
For keyless entries	μPD789861	4K	2 ch	—	—	1 ch	—	—	—	14	1.8 V	RC oscillation
	μPD789860											—
Bus controller	μPD789850	16K	1 ch	1 ch	—	1 ch	4 ch	—	2 ch (UART: 1 ch)	18	4.0 V	—
VFD controller	μPD789871	4K to 8K	3 ch	—	1 ch	1 ch	—	—	1 ch	33	2.7 V	—
Meter controller	μPD789881	16K	2 ch	1 ch	—	1 ch	—	—	1 ch (UART)	28	2.7 V ^{Note 2}	—

Note 1. 10-bit timer: 1 channel

2. Flash version: 3.0 V

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose (μ PD789014 Subseries)

Part number	μ PD789011	μ PD789012	μ PD78P9014
Internal ROM size	2 KB	4 KB	8 KB
Internal ROM type	Mask ROM		One-time PROM
Internal RAM size	128 bytes		256 bytes
Instruction cycle	0.4 μ s, 1.6 μ s (With 5.0 MHz main system clock)		
Minimum instruction execution time	0.4 μ s (5.0 MHz)		
Interrupt function	External: 3, Internal: 7		
I/O port	CMOS I/O: 22		
Timer	8-bit timer/event counter $\times$ 2 channels Watchdog timer $\times$ 1 channel		
Timer output	2		
Serial interface	3-wire/UART mode (selectable): 1 channel		
Standby function	STOP/HALT		
Power supply voltage	1.8 to 5.5 V		
Package	28-pin plastic SDIP, 28-pin plastic SOP		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	Remote controllers, game machines, etc.		

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose (μ PD789026 Subseries)

Part number	μ PD789022	μ PD789024	μ PD789025	μ PD789026	μ PD78F9026A
Internal ROM size	4 KB	8 KB	12 KB	16 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	256 bytes		512 bytes		
Instruction cycle	0.4 μ s, 1.6 μ s (With 5.0 MHz main system clock)				
Minimum instruction execution time	0.4 μ s (5.0 MHz)				
Interrupt function	External: 4, Internal: 6				
I/O port	CMOS I/O: 34				
Timer	16-bit timer counter $\times$ 1 channel 8-bit timer/event counter $\times$ 1 channel Watchdog timer $\times$ 1 channel				
Timer output	2				
Serial interface	3-wire/UART mode (selectable): 1 channel				
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	• 44-pin plastic QFP (10 $\times$ 10 mm)		• 42-pin plastic SDIP • 44-pin plastic QFP (10 $\times$ 10 mm)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	Compact household appliances, car accessories, air-conditioners, game machines, etc.				

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose (μ PD789046 Subseries)

Part number	μ PD789046	μ PD78F9046
Internal ROM size	16 KB	
Internal ROM type	Mask ROM	Flash memory
Internal RAM size	512 bytes	
Instruction cycle	• 0.4 μs, 1.6 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)	
Minimum instruction execution time	0.4 μ s (5.0 MHz)	
Interrupt function	External: 4, Internal: 8	
I/O port	CMOS I/O: 34	
Timer	16-bit timer counter $\times$ 1 channel 8-bit timer/event counter $\times$ 1 channel Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel	
Timer output	2	
Serial interface	3-wire/UART mode (selectable): 1 channel	
Standby function	STOP/HALT	
Power supply voltage	1.8 to 5.5 V	
Package	44-pin plastic QFP (10 $\times$ 10mm)	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications	Cordless phones, etc.	

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose (μ PD789074 Subseries)

Part number	μ PD789071	μ PD789072	μ PD789074	μ PD78F9076
Internal ROM size	2 KB	4 KB	8 KB	16 KB
Internal ROM type	Mask ROM			Flash memory
Internal RAM size	256 bytes			
Instruction cycle	• 0.4 μ s, 1.6 μ s (With 5.0 MHz main system clock)			
Minimum instruction execution time	0.4 μ s (5.0 MHz)			
Interrupt function	External: 4, Internal: 4			
I/O port	CMOS I/O: 24			
Timer	16-bit timer counter $\times$ 1 channel 8-bit timer/event counter $\times$ 1 channel Watchdog timer $\times$ 1 channel			
Timer output	2			
Serial interface	3-wire/UART mode (selectable): 1 channel			
Standby function	STOP/HALT			
Power supply voltage	1.8 to 5.5 V			
Package	30-pin plastic SSOP			
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator			
Applications	Cordless phones, etc.			

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose (μ PD789088 Subseries)

Part number	μ PD789086 ★	μ PD789088 ★	μ PD78F9088 ★
Internal ROM size	16 KB	32 KB	
Internal ROM type	Mask ROM		Flash memory
Internal RAM size	256 bytes	320 bytes	
Instruction cycle	• 0.4 μ s, 0.8 μ s, 1.6 μ s (With 5.0 MHz main system clock and $V_{DD} = 2.7$ to 5.5 V)		
Minimum instruction execution time	0.4 μ s (5.0 MHz)		
Interrupt function	External: 3, Internal: 8		
I/O port	CMOS I/O: 24		
Timer	16-bit timer $\times$ 1 channel 8-bit timer $\times$ 3 channels Watchdog timer $\times$ 1 channel		
Timer output	1		
Serial interface	3-wire/UART mode (selectable): 1 channel		
Standby function	STOP/HALT		
Power supply voltage	1.8 to 5.5 V		
Package	30-pin plastic SSOP		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	Preset remote controllers, small home electronics, games, etc.		

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose + A/D (μPD789104A, 789114A Subseries)

Subseries name	μPD789104A Subseries			μPD789114A Subseries			
Part number	μPD789101A	μPD789102A	μPD789104A	μPD789111A	μPD789112A	μPD789114A	μPD78F9116A
Internal ROM size	2 KB	4 KB	8 KB	2 KB	4 KB	8 KB	16 KB
Internal ROM type	Mask ROM						Flash memory
Internal RAM size	256 bytes						
Instruction cycle	0.4 μs, 1.6 μs (With 5.0 MHz main system clock)						
Minimum instruction execution time	0.4 μs (5.0 MHz)						
Interrupt function	External: 3, Internal: 7						
Multiplier	8 × 8 = 16 bits						
I/O port	20 • CMOS input: 4 • CMOS I/O: 12 • N-ch open-drain I/O: 4						
Timer	16-bit timer counter × 1 channel 8-bit timer/event counter × 1 channel Watchdog timer × 1 channel						
Timer output	2						
Serial interface	3-wire/UART mode (selectable): 1 channel						
A/D converter	8-bit resolution × 4 channels			10-bit resolution × 4 channels			
Standby function	STOP/HALT						
Power supply voltage	1.8 to 5.5 V						
Package	30-pin plastic SSOP						
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator						
Applications	Keyless entries, cleaners, washing machines, refrigerators, etc.						

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose + A/D (μ PD789124A, 789134A Subseries)

Subseries name	μ PD789124A Subseries			μ PD789134A Subseries			
Part number	μ PD789121A	μ PD789122A	μ PD789124A	μ PD789131A	μ PD789132A	μ PD789134A	μ PD78F9136A
Internal ROM size	2 KB	4 KB	8 KB	2 KB	4 KB	8 KB	16 KB
Internal ROM type	Mask ROM						Flash memory
Internal RAM size	256 bytes						
Instruction cycle	0.5 μ s, 2.0 μ s (With RC 4.0 MHz main system clock)						
Minimum instruction execution time	0.5 μ s (RC 4.0 MHz)						
Interrupt function	External: 3, Internal: 7						
Multiplier	$8 \times 8 = 16$ bits						
I/O port	20 • CMOS input: 4 • CMOS I/O: 12 • N-ch open-drain I/O: 4						
Timer	16-bit timer counter $\times$ 1 channel 8-bit timer/event counter $\times$ 1 channel Watchdog timer $\times$ 1 channel						
Timer output	2						
Serial interface	3-wire/UART mode (selectable): 1 channel						
A/D converter	8-bit resolution $\times$ 4 channels			10-bit resolution $\times$ 4 channels			
Standby function	STOP/HALT						
Power supply voltage	1.8 to 5.5 V						
Package	30-pin plastic SSOP						
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator						
Applications	Battery chargers, etc.						

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose + A/D (μPD789167, 789177 Subseries)

Subseries name	μPD789167 Subseries		μPD789177 Subseries		
Part number	μPD789166	μPD789167	μPD789176	μPD789177	μPD78F9177
Internal ROM size	16 KB	24 KB	16 KB	24 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	512 bytes				
Instruction cycle	• 0.4 μs, 1.6 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.4μs (5.0 MHz)				
Interrupt function	External: 4, Internal: 11				
Multiplier	8 × 8 = 16 bits				
I/O port	31 • CMOS input: 8 • CMOS I/O: 17 • N-ch open-drain I/O: 6				
Timer	16-bit timer counter × 1 channel 8-bit timer counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	4				
Serial interface	3-wire/UART mode (selectable): 1 channel				
A/D converter	8-bit resolution × 8 channels		10-bit resolution × 8 channels		
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	44-pin plastic QFP (10 × 10 mm)				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	Power windows, keyless entries, battery management units, side air bags, etc.				

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose + A/D (μ PD789167Y, 789177Y Subseries)

Subseries name	μPD789167Y Subseries		μPD789177Y Subseries		
Part number	μPD789166Y	μPD789167Y	μPD789176Y	μPD789177Y	μPD78F9177Y
Internal ROM size	16 KB	24 KB	16 KB	24 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	512 bytes				
Instruction cycle	• 0.4 μs, 1.6 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.4 μs (5.0MHz)				
Interrupt function	External: 4, Internal: 13				
Multiplier	8 × 8 = 16 bits				
I/O port	31 • CMOS input: 8 • CMOS I/O: 17 • N-ch open-drain I/O: 6				
Timer	16-bit timer counter × 1 channel 8-bit timer counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	4				
Serial interface	3-wire/UART mode (selectable): 1 channel SMB: 1 channel				
A/D converter	8-bit resolution × 8 channels		10-bit resolution × 8 channels		
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	44-pin plastic QFP (10 × 10 mm), 48-pin plastic TQFP (fine pitch) (7 × 7 mm)				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	Power windows, keyless entries, battery management units, side air bags, etc.				

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μ PD789306, 789316 Subseries)

Subseries name	μPD789306 Subseries			μPD789316 Subseries		
Part number	μPD789304	μPD789306	μPD78F9306	μPD789314	μPD789316	μPD78F9316
Internal ROM size	8 KB	16 KB		8 KB	16 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM		Flash memory
Internal RAM size	512 bytes					
Internal LCD data RAM size	24 × 4 bits					
Instruction cycle	• 0.4 μs, 1.6 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)			• 0.5 μs, 2.0 μs (With RC 4.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)		
Minimum instruction execution time	0.4 μs (5.0 MHz)			0.5 μs (RC 4.0 MHz)		
Interrupt function	External: 5, Internal: 10					
I/O port	23 • CMOS I/O: 19 • N-ch open-drain I/O: 4					
LCD controller/driver	Segment signal outputs: 24 Common signal outputs: 4 Bias: 1/3, on-chip booster					
Timer	16-bit timer counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel					
Timer output	3					
Serial interface	3-wire/UART mode (selectable): 1 channel 3-wire: 1 channel					
Standby function	STOP/HALT					
Power supply voltage	1.8 to 5.5 V					
Package	64-pin plastic QFP (14 × 14 mm), 64-pin plastic TQFP (fine-pitch) (12 × 12 mm)					
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator					
Applications	Remote controllers, etc.					

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μPD789407A, 789417A Subseries)

Subseries name	μPD789407A Subseries			μPD789417A Subseries			
Part number	μPD789405A	μPD789406A	μPD789407A	μPD789415A	μPD789416A	μPD789417A	μPD78F9418A
Internal ROM size	12 KB	16 KB	24 KB	12 KB	16 KB	24 KB	32 KB
Internal ROM type	Mask ROM						Flash memory
Internal RAM size	512 bytes						
Internal LCD data RAM size	28 × 4 bits						
Instruction cycle	• 0.4 μs, 1.6μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)						
Minimum instruction execution time	0.4 μs (5.0 MHz)						
Interrupt function	External: 5, Internal: 12						
I/O port	43 • CMOS input: 7 • CMOS I/O: 32 (Also used for segment pins: 12) • N-ch open-drain I/O: 4						
LCD controller/driver	Segment signal outputs: 28 maximum Common signal outputs: 4 maximum Bias: 1/2 or 1/3 (switchable)						
Timer	16-bit timer counter × 1 channel 8-bit timer counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel						
Timer output	2						
Serial interface	3-wire/UART mode (selectable): 1 channel						
A/D converter	8-bit resolution × 7 channels			10-bit resolution × 7 channels			
Standby function	STOP/HALT						
Power supply voltage	1.8 to 5.5 V						
Package	80-pin plastic QFP (14 × 14 mm), 80-pin plastic TQFP (fine-pitch) (12 × 12 mm)						
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator						
Applications	APS compact cameras, etc.						

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μ PD789426, 789436 Subseries)

Subseries name	μPD789426 Subseries		μPD789436 Subseries		
Part number	μPD789425	μPD789426	μPD789435	μPD789436	μPD78F9436
Internal ROM size	12 KB	16 KB	12 KB	16 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	512 bytes				
Internal LCD data RAM size	5 × 4 bits				
Instruction cycle	• 0.4 μs, 1.6 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.4 μs (5.0 MHz)				
Interrupt function	External: 5, Internal: 10				
I/O port	40 • CMOS input: 6 • CMOS I/O: 30 • N-ch open-drain I/O: 4				
LCD controller/driver	Segment signal outputs: 5 maximum Common signal outputs: 4 maximum Bias: 1/3, on-chip booster				
Timer	16-bit timer counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	4				
Serial interface	3-wire/UART mode (selectable): 1 channel				
A/D converter	8-bit resolution × 6 channels		10-bit resolution × 6 channels		
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	64-pin plastic TQFP (12 × 12 mm), 64-pin plastic LQFP (10 × 10 mm)				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	Portable audio, etc.				

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μ PD789446, 789456 Subseries)

Subseries name	μPD789446 Subseries		μPD789456 Subseries		
Part number	μPD789445	μPD789446	μPD789455	μPD789456	μPD78F9456
Internal ROM size	12 KB	16 KB	12 KB	16 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	512 bytes				
Internal LCD data RAM size	15 × 4 bits				
Instruction cycle	• 0.4 μs, 1.6μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.4 μs (5.0 MHz)				
Interrupt function	External: 5, Internal: 10				
I/O port	30 • CMOS input: 6 • CMOS I/O: 20 • N-ch open-drain I/O: 4				
LCD controller/driver	Segment signal outputs: 15 maximum Common signal outputs: 4 maximum Bias: 1/3, on-chip booster				
Timer	16-bit timer counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	4				
Serial interface	3-wire/UART mode (selectable): 1 channel				
A/D converter	8-bit resolution × 6 channels		10-bit resolution × 6 channels		
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	64-pin plastic TQFP (12 × 12 mm), 64-pin plastic LQFP (10 × 10 mm)				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	Portable audio, etc.				

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μ PD789327 Subseries)

Part number	μ PD789322	μ PD789324	μ PD789326	μ PD789327	μ PD78F9328
Internal ROM size	4 KB	8 KB	16 KB	24 KB	32 KB
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	256 bytes		512 bytes		
Internal LCD data RAM size	24 $\times$ 4 bits				
Instruction cycle	• 0.4 μs, 1.6 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.4 μ s (5.0 MHz)				
Interrupt function	External: 2, Internal: 7				
I/O port	CMOS I/O: 21 (Also used for segment pins: 6)				
LCD controller/driver	Segment signal outputs: 24 maximum Common signal outputs: 4 Bias: 1/3				
Timer	8-bit timer $\times$ 2 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel				
Timer output	1				
Serial interface	3-wire: 1 channel				
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	52-pin plastic LQFP (10 $\times$ 10 mm)				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	Remote controllers, health care equipments, etc.				

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μ PD789467 Subseries)

Part number	μ PD789462	μ PD789464	μ PD789466 ★	μ PD789467 ★	μ PD78F9468
Internal ROM size	4 KB	8 KB	16 KB	24 KB	32 KB
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	256 bytes		512 bytes		
Internal LCD data RAM size	23 × 4 bits				
Instruction cycle	• 0.4 μs, 1.6 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.4 μ s (5.0 MHz)				
Interrupt function	External: 2, Internal: 7				
I/O port	18 • CMOS I/O: 12 • CMOS input: 6 (Also used for segment pins)				
LCD controller/driver	Segment signal outputs: 23 maximum Common signal outputs: 4 Bias: 1/3, on-chip booster				
Timer	8-bit timer × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	1				
A/D converter	8-bit resolution × 1 channel				
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	52-pin plastic LQFP (10 × 10 mm)				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	Remote controllers, health care equipments, etc.				

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μ PD789477, 789488 Subseries)

Subseries name	μPD789477 Subseries		μPD789488 Subseries	
Part number	μPD789477	μPD78F9478 ★	μPD789488	μPD78F9488 ★
Internal ROM size	24 KB	32 KB		
Internal ROM type	Mask ROM	Flash memory	Mask ROM	Flash memory
Internal RAM size	768 bytes	1024 bytes		
Internal LCD data RAM size	28 × 4 bits			
Instruction cycle	• 0.4 μs, 1.6 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock) • 15.26 μs (With 131 kHz subsystem clock × 4)			
Minimum instruction execution time	0.4 μs (5.0 MHz)			
Interrupt function	External: 5, Internal: 17			
I/O port	45 • CMOS input: 12 (Also used for segment pins: 4) • CMOS I/O: 29 (Also used for segment pins: 8) • N-ch open drain I/O: 4			
LCD controller/driver	Segment signal outputs: 28 Common signal outputs: 4 Bias: 1/3		Segment signal outputs: 28 Common signal outputs: 4 Bias: 1/3, on-chip booster	
Timer	16-bit timer counter × 1 channel 8-bit timer/event counter × 3 channels Watchdog timer × 1 channel Watch timer × 1 channel			
Timer output	4			
Serial interface	3-wire/UART mode (selectable): 1 channel 3-wire (with function for automatic transfer function): 1 channel			
A/D converter	8-bit resolution × 8 channels		10-bit resolution × 8 channels	
Other functions	On-chip infrared remote controller receiver		-	
Standby function	STOP/HALT			
Power supply voltage	1.8 to 5.5 V			
Package	80-pin plastic QFP (14 × 14 mm)		80-pin plastic QFP (14 × 14 mm), 80-pin plastic TQFP (fine-pitch) (12 × 12 mm)	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator			
Applications	Portable audio, health care equipments, etc.		Compact cameras, home cooking machines, etc.	

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μ PD789830 Subseries)

Part number	μ PD789830	μ PD78F9831
Internal ROM size	24 KB	48 KB
Internal ROM type	Mask ROM	Flash memory
Internal RAM size	1024 bytes	2048 bytes
Internal LCD data RAM size	40 × 16 bits	
Instruction cycle	• 0.4 μs, 1.6 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)	
Minimum instruction execution time	0.4 μ s (5.0 MHz)	
Interrupt function	External: 4, Internal: 11	External: 6, Internal: 11
I/O port	30 • CMOS I/O: 29 (Also used for segment pins: 8) • N-ch open drain I/O: 1	38 • CMOS I/O: 37 (Also used for segment pins: 8) • N-ch open drain I/O: 1
LCD controller/driver	Segment signal outputs: 40 maximum Common signal outputs: 16 maximum Bias: 1/5	
Timer	16-bit timer × 1 channel 8-bit timer × 1 channel Watchdog timer × 1 channel Watch timer × 1 channel	
Timer output	2	
Serial interface	UART: 1 channel	
Other functions	Clock output function Buzzer output function	
Standby function	STOP/HALT	
Power supply voltage	2.7 to 5.5 V	
Package	88-pin bare chip	100-pin plastic LQFP (fine pitch) (14 × 14mm)
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications	Card readers, etc.	

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μ PD789835 Subseries)

Part number	μPD789832 ★	μPD789833 ★	μPD789834 ★	μPD789835 ★	μPD78F9835 ★
Internal ROM size	24 KB	32 KB	48 KB	60 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	2240 bytes		3264 bytes		
Internal LCD data RAM size	288 × 2 bytes				
Instruction cycle	• 0.4 μs, 1.6 μs (With ceramic 5.0 MHz main system clock) • 1.0 μs, 4.0 μs (With RC 2.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.4 μs (5.0 MHz)				
Interrupt function	External: 5, Internal: 16				
I/O port	37 • CMOS input: 11 • CMOS I/O: 26				
LCD controller/driver	Dot LCD drive Four different display modes (48 × 48, 64 × 32, 80 × 16, 80 × 8)				
Timer	8-bit timer × 6 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	1				
Serial interface	3-wire/UART mode (selectable): 1 channel				
A/D converter	8-bit resolution × 3 channels				
Other functions	Sound generator SWAP function Low voltage detection circuit				
Standby function	STOP/HALT				
Power supply voltage	1.8 to 3.6 V				3.0 to 3.6 V
Package	144-pin plastic LQFP (fine pitch) (20 × 20 mm)				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	LCD game, remote controllers, etc.				

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ For PC (μPD789800 Subseries)

Part number	μPD789800	μPD78F9801
Internal ROM size	8 KB	16 KB
Internal ROM type	Mask ROM	Flash memory
Internal RAM size	256 bytes	
Instruction cycle	• 0.3 μs, 1.33 μs (With 6.0 MHz main system clock)	
Minimum instruction execution time	0.33 μs (6.0 MHz)	
Interrupt function	External: 2, Internal: 10	
I/O port	CMOS I/O: 31 (Usable as N-ch open drain I/O: 18)	
Timer	8-bit timer × 1 channel 8-bit timer/event counter × 1 channel Watchdog timer × 1 channel	
Timer output	1	
Serial interface	USB (Universal Serial Bus): 1 channel 3-wire: 1 channel	
Other functions	On-chip regulator (V _{REG} = 3.0 to 3.6V)	
Standby function	STOP/HALT	
Power supply voltage	4.0 to 5.5 V	
Package	44-pin plastic QFP (10 × 10 mm, 1.4 mm thick)	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications	USB keyboards, etc.	

8-Bit Single-Chip Microcontroller

78K/0S Series

■ For PC (μ PD789803 Subseries)

Part number	μ PD789802 ★	μ PD789803 ★	μ PD78F9803 ★
Internal ROM size	8 KB	16 KB	
Internal ROM type	Mask ROM		Flash memory
Internal RAM size	256 bytes	512 bytes	
Instruction cycle	• 0.25 μ s, 1.0 μ s (With 8.0 MHz main system clock)		
Minimum instruction execution time	0.25 μ s (8.0 MHz)		
Interrupt function	External: 5, Internal: 13		
I/O port	CMOS I/O: 41 (Usable as N-ch open drain I/O: 22)		
Timer	8-bit timer $\times$ 2 channels Watchdog timer $\times$ 1 channel		
Timer output	1		
Serial interface	USB (Universal Serial Bus): 1 channel 3-wire: 1 channel		
Other functions	On-chip regulator (V_{REG} = 3.0 to 3.6V)		
Standby function	STOP/HALT		
Power supply voltage	3.6 to 5.5 V		
Package	64-pin plastic LQFP (10 $\times$ 10 mm)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	USB keyboards, etc.		

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Inverter Controller (μPD789842 Subseries)

Part number	μPD789841	μPD789842	μPD78F9842
Internal ROM size	8 KB	16 KB	
Internal ROM type	Mask ROM		Flash memory
Internal RAM size	256 bytes		
Instruction cycle	• 0.24 μs, 0.96 μs (With 8.38 MHz main system clock)		
Minimum instruction execution time	0.24 μs (8.38 MHz)		
Interrupt function	External: 2, Internal: 12		
Multiplier	10 × 10 = 20 bits		
I/O port	30 • CMOS input: 8 • CMOS I/O: 22		
Timer	10-bit timer for inverter control × 1 channel 8-bit timer × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel		
Timer output	7 (inverter control output: 6)		
Serial interface	UART: 1 channel		
A/D converter	8-bit resolution × 8 channels		
Standby function	STOP/HALT		
Power supply voltage	4.0 to 5.5 V		
Package	44-pin plastic QFP (10 × 10 mm, 2.7 mm thick), 44-pin plastic QFP (10 × 10 mm, 1.4 mm thick)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	Motor control for inverter-type air-conditioners, etc.		

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Bus Controller (μPD789850 Subseries)

Part number	μPD789850(A) ★	μPD78F9850 ★
Internal ROM size	16 KB	
Internal ROM type	Mask ROM	Flash memory
Internal RAM size	512 bytes	
Instruction cycle	• 0.25 μs, 1.0 μs (With 8.0 MHz main system clock) • 100 μs (With 40 kHz subsystem clock)	
Minimum instruction execution time	0.25 μs (8.0 MHz)	
Interrupt function	External: 2, Internal: 14	
Multiplier	8 × 8 = 16 bits	
I/O port	18 • CMOS input: 4 • CMOS I/O: 14	
Timer	16-bit timer/event counter × 1 channel 8-bit timer × 1 channel Watchdog timer × 1 channel	
Timer output	2 (PWM output: 1)	
Serial interface	3-wire: 1 channel UART: 1 channel	
Bus controller	CAN controller: 1 channel Transmission speed: 500 kbps maximum CAN message storage RAM: 256 bytes	
A/D converter	8-bit resolution × 4 channels	
Standby function	STOP/HALT	
Power supply voltage	4.0 to 5.5 V	
Package	30-pin plastic SSOP	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications	Control of car electricals (side air bags, junction blocks, power windows, etc.)	

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Keyless Entry Series (μ PD789860, 789861 Subseries)

Subseries name	μ PD789860 Subseries		μ PD789861 Subseries	
Part number	μ PD789860	μ PD78E9860 ★	μ PD789861	μ PD78E9861 ★
Internal ROM size	4 KB			
Internal ROM type	Mask ROM	EEPROM	Mask ROM	EEPROM
Internal RAM size	128 bytes			
Internal SRAM size	32 bytes			
Instruction cycle	0.4 μ s, 1.6 μ s (With 5.0 MHz main system clock)		2.0 μ s, 8.0 μ s (With RC 1.0 MHz main system clock)	
Minimum instruction execution time	0.4 μ s (5.0 MHz)		2.0 μ s (RC 1.0 MHz)	
Interrupt function	External: 1, Internal: 6			
I/O port	14 • CMOS input: 4 • CMOS I/O: 10			
Timer	8-bit timer $\times$ 2 channels Watchdog timer $\times$ 1 channel			
Timer output	1			
Other functions	Power-on clear circuit Bit sequential buffer			
Standby function	STOP/HALT			
Power supply voltage	1.8 to 3.6 V			
Package	20-pin plastic SSOP			
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator			
Applications	Keyless entry and other automotive electrical equipment			

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ VFD Driver (μ PD789871 Subseries)

Part number	μ PD789870 ★	μ PD789871 ★	μ PD78F9872 ★
Internal ROM size	4 KB	8 KB	16 KB
Internal ROM type	Mask ROM		Flash memory
Internal RAM size	512 bytes		
VFD data RAM size	96 bytes		
Instruction cycle	• 0.4 μ s, 1.6 μ s (With 5.0 MHz main system clock)		
Minimum instruction execution time	0.4 μ s (5.0 MHz)		
Interrupt function	External: 4, Internal: 8		
I/O port	33 • CMOS I/O: 17 • P-ch open drain I/O: 8 (Also used for VFD output pins) • P-ch open drain outputs: 8 (Also used for VFD output pins)		
VFD controller/driver	Display outputs: 25 ($V_{DD} = 4.5$ to 5.5 V)		
Timer	8-bit remote control timer $\times$ 1 channel 8-bit timer $\times$ 2 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel		
Serial interface	3-wire: 1 channel		
Standby function	STOP/HALT		
Power supply voltage	2.7 to 5.5 V		
Package	52-pin plastic LQFP (10 $\times$ 10 mm)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	DVD, VCD, S-VCD, etc.		

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Meter Controller Series (μ PD789881 Subseries)

Part number	μ PD789881 ★ ☆	μ PD78F9882 ★ ☆
Internal ROM size	16 KB	32 KB
Internal ROM type	Mask ROM	Flash memory
Internal RAM size	512 bytes	
Internal LCD data RAM size	26 × 4 bits	
Instruction cycle	• 4 μs, 16 μs (With 500 kHz main system clock) • 122 μs (With 32.768 kHz subsystem clock) • 30.5 μs (With 131 kHz subsystem clock × 4)	
Minimum instruction execution time	4 μ s (500 kHz)	
Interrupt function	External: 4, Internal: 10	
I/O port	28 • CMOS I/O: 24 (Also used for segment pins: 11) • N-ch open drain I/O: 4	
LCD controller/driver	Segment signal outputs: 26 maximum Common signal outputs: 4 • Bias: 1/3	
Timer	16-bit timer counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel	
Timer output	3	
Serial interface	UART: 1 channel	
Standby function	STOP/HALT	
Power supply voltage	2.7 to 3.6 V ^{Note}	3.0 to 3.6 V
Package	64-pin plastic LQFP (10 × 10 mm)	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications	Heating meters, Gas meters, health care equipments, etc.	

★: Under development, ☆: Newly added product

Note When original subsystem clock (not changed) is selected as CPU clock: 2.4 to 3.6 V

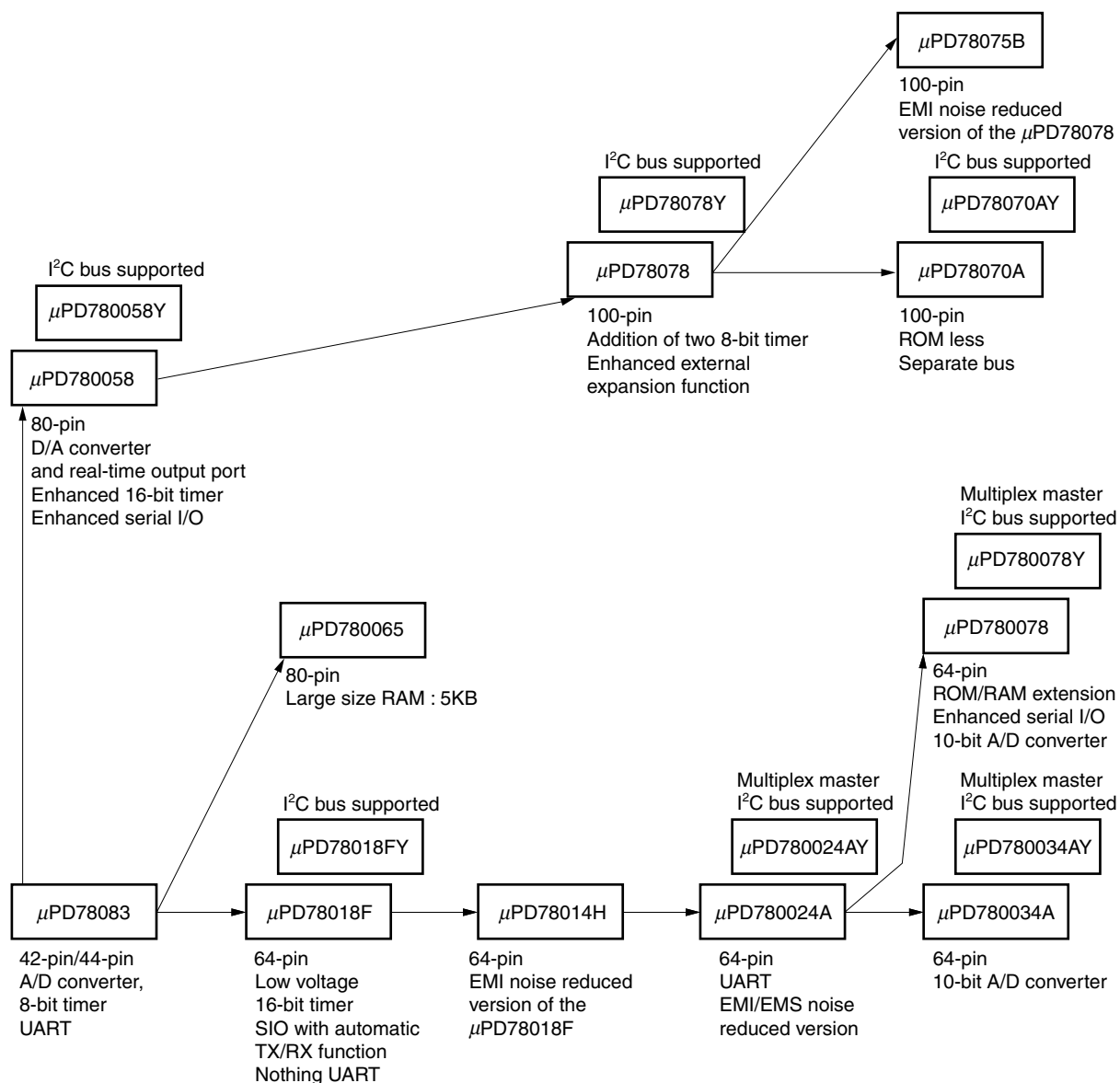
8-Bit Single-Chip Microcontroller

78K/0 Series

■ 78K/0 Series Product Evolution (1/3)

Subseries names are shown inside frames.

Controller series



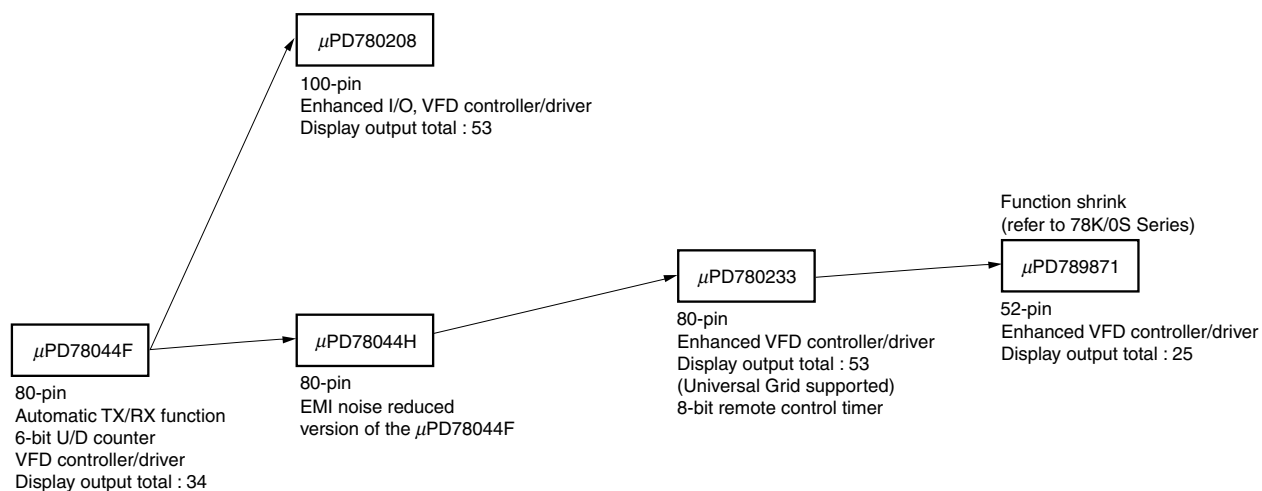
8-Bit Single-Chip Microcontroller

78K/0 Series

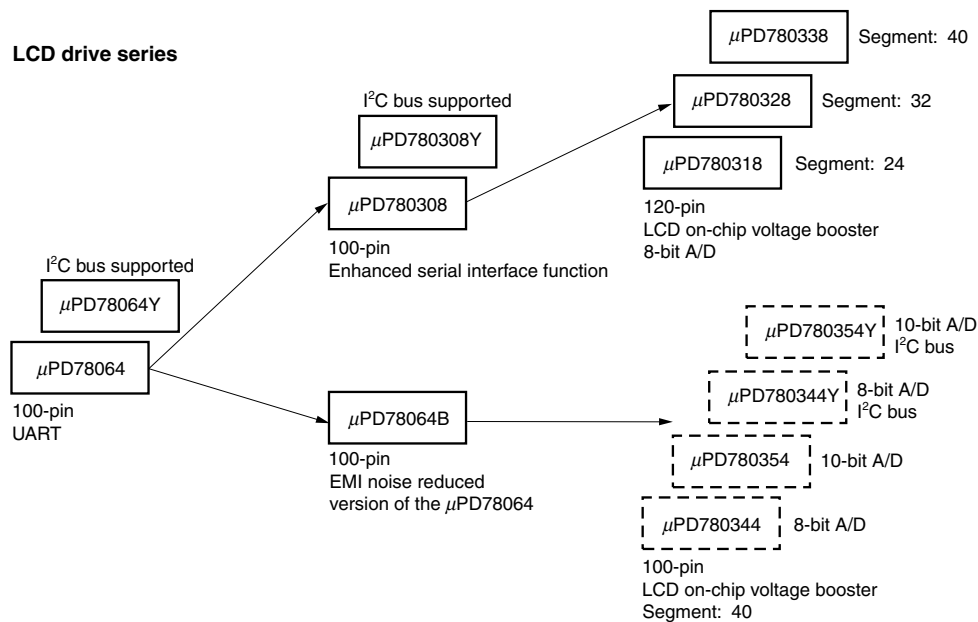
■ 78K/0 Series Product Evolution (2/3)

Subseries names are shown inside frames.

VFD drive series



LCD drive series



Inverter controller series



8-Bit Single-Chip Microcontroller

78K/0 Series

■ 78K/0 Series Product Evolution (3/3)

Subseries names are shown inside frames.

meter controller series

μPD780958

100-pin
Consumption current
When operating : 230 μA typical (1.0 MHz)
When operating : 6.0 μA typical (32.768 kHz)
When HALT : 2 μA typical (32.768 kHz)

Dashboard controller series

μPD780852

80-pin
Meter controller/driver

Bus controller series

μPD78098B

80-pin
IEBus controller

μPD780702Y

80-pin
IEBus controller
EMI noise reduced

μPD780833Y

80-pin
J1850 (CLASS2) controller



Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Differences among the Subseries (1/2)

Function Subseries name		ROM capacity	Timer				8-bit	10-bit	8-bit	Serial interface	I/O	V _{DD} MIN. value	External expansion
			8-bit	16-bit	Watch	WDT	A/D	A/D	D/A				
Controller	μPD78075B	32K to 40K	4 ch	1 ch	1 ch	1 ch	8 ch	—	2 ch	3 ch (UART: 1 ch)	88	1.8 V	√
	μPD78078	48K to 60K								3 ch (UART: 1 ch, I ² C: 1 ch)			
	μPD78078Y									3 ch (UART: 1 ch)	61	2.7 V	
	μPD78070A	—	3 ch (UART: 1 ch, I ² C: 1 ch)	68	1.8 V								
	μPD78070AY		3 ch (time-division UART: 1 ch)										
	μPD780058	24K to 60K	2 ch	3 ch (time-division UART: 1 ch, I ² C: 1 ch)	60	2.7 V							
	μPD780058Y			4 ch (UART: 1 ch)									
	μPD780065	40K to 48K	—	8 ch	3 ch (UART: 2 ch)	52	1.8 V						
	μPD780078	48K to 60K		4 ch (UART: 2 ch, I ² C: 1 ch)									
	μPD780078Y			3 ch (UART: 1 ch, time-division 3-wire: 1 ch)	51								
	μPD780034A	8K to 32K	1 ch	8 ch			—	3 ch (UART: 1 ch, I ² C: 1 ch)	53				
	μPD780024A			—			8 ch	2 ch					
	μPD780034AY			8 ch	—	2 ch (I ² C: 1 ch)							
	μPD780024AY					1 ch (UART: 1 ch)	33						
	μPD78014H												
	μPD78018F	8K to 60K											
	μPD78018FY												
	μPD78083	8K to 16K		—	—								
Inverter Controller	μPD780988	16K to 60K	3 ch	Note	—	1 ch	—	8 ch	—	3 ch (UART: 2 ch)	47	4.0 V	√

Note 16-bit timer 2 channels
10-bit timer 1 channel

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Differences among the Subseries (2/2)

Function Subseries name		ROM capacity	Timer				8-bit A/D	10-bit A/D	8-bit D/A	Serial interface	I/O	V _{DD} MIN. value	External expansion
			8-bit	16-bit	Watch	WDT							
VFD driver	μPD780208	32K to 60K	2 ch	1 ch	1 ch	1 ch	8 ch	—	—	2 ch	74	2.7 V	—
	μPD780233	16K to 24K	3 ch	—	—	4 ch	40			4.5 V			
	μPD78044H	32K to 48K	2 ch	1 ch	1 ch	8 ch	1 ch			68	2.7 V		
	μPD78044F	16K to 40K					2 ch						
LCD driver	μPD780354	24K to 32K	4 ch	1 ch	1 ch	1 ch	—	8 ch	—	3 ch (UART: 1 ch)	66	1.8 V	—
	μPD780344						8 ch	—					
	μPD780354Y						—	8 ch		4 ch (UART: 1 ch, I ² C: 1 ch)			
	μPD780344Y						8 ch	—					
	μPD780338	48K to 60K	3 ch	2 ch			—	10 ch	1 ch	2 ch (UART: 1 ch)	54		
	μPD780328									62			
	μPD780318									70			
	μPD780308						2 ch	1 ch	8 ch	—	—	3 ch (time-division UART: 1 ch)	
	μPD780308Y							3 ch (time-division UART: 1 ch, I ² C: 1 ch)					
	μPD78064B	32K						2 ch (UART: 1 ch)					
	μPD78064	16 K to 32K											
	μPD78064Y							2 ch (UART: 1 ch, I ² C: 1 ch)					
	On-chip bus controller	μPD78098B	40K to 60K	2 ch	1 ch	1 ch	1 ch	8 ch	—	2 ch	3 ch (UART: 1 ch)	69	
μPD780702Y		60K	3 ch	2 ch	16 ch			—		4 ch (UART: 1 ch, I ² C: 1 ch)	67	3.5 V	
μPD780833Y											65	4.5 V	
Meter controller	μPD780958	40K to 60K	4 ch	2 ch	—	1 ch	—	—	—	2 ch (UART: 1 ch)	69	2.2 V	—
Dashboard controller	μPD780852	32K to 40K	3 ch	1 ch	1 ch	1 ch	5 ch	—	—	3 ch (UART: 1 ch)	56	4.0 V	—

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD78018F Subseries)

Part number	μ PD78011F	μ PD78012F	μ PD78013F	μ PD78014F	μ PD78015F	μ PD78016F	μ PD78018F	μ PD78P018F
Internal ROM size	8 KB	16 KB	24 KB	32 KB	40 KB	48 KB	60 KB	
Internal ROM type	Mask ROM							One-time PROM
Internal RAM size	544 bytes		1056 bytes		1568 bytes		2080 bytes	
Address space	64 Kbytes							
Instruction cycle	0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs (With 10.0 MHz main system clock) 122 μs (With 32.768 kHz subsystem clock)							
Minimum instruction execution time	0.4 μ s (10.0 MHz)							
Interrupt function	External: 4, Internal: 10							
I/O port	53 - CMOS input: 2 - CMOS I/O: 47 - N-ch open-drain I/O: 4							
Timer	16-bit timer/event counter $\times$ 1 channel 8-bit timer/event counter $\times$ 2 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel							
Timer output	3 (PWM output: 1)							
Serial interface	3-wire/2-wire/SBI mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel							
A/D converter	8-bit resolution $\times$ 8 channels							
Other functions	Clock output function Buzzer output function							
Standby function	STOP/HALT							
Power supply voltage	1.8 to 5.5 V							
Package	64-pin plastic SDIP, 64-pin plastic QFP (14 $\times$ 14 mm), 64-pin plastic LQFP (12 $\times$ 12 mm)							
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator							
Applications	VCRs, TVs, audio equipments, etc.							

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD78018FY Subseries)

Part number	μ PD78011FY	μ PD78012FY	μ PD78013FY	μ PD78014FY	μ PD78015FY	μ PD78016FY	μ PD78018FY	μ PD78P018FY
Internal ROM size	8 KB	16 KB	24 KB	32 KB	40 KB	48 KB	60 KB	
Internal ROM type	Mask ROM							One-time PROM
Internal RAM size	544 bytes		1056 bytes		1568 bytes		2080 bytes	
Address space	64 Kbytes							
Instruction cycle	• 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s (With 10.0 MHz main system clock) • 122 μ s (With 32.768 kHz subsystem clock)							
Minimum instruction execution time	0.4 μ s (10.0 MHz)							
Interrupt function	External: 4, Internal: 10							
I/O port	53 • CMOS input: 2 • CMOS I/O: 47 • N-ch open-drain I/O: 4							
Timer	16-bit timer/event counter $\times$ 1 channel 8-bit timer/event counter $\times$ 2 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel							
Timer output	3 (PWM output: 1)							
Serial interface	3-wire/2-wire/I ² C bus mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel							
A/D converter	8-bit resolution $\times$ 8 channels							
Other functions	Clock output function Buzzer output function							
Standby function	STOP/HALT							
Power supply voltage	1.8 to 5.5 V							
Package	64-pin plastic SDIP, 64-pin plastic QFP (14 $\times$ 14 mm), 64-pin plastic LQFP (12 $\times$ 12 mm)							
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator							
Applications	VCRs, TVs, audio equipments, etc.							

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD78014H Subseries)

Part number	μ PD78011H	μ PD78012H	μ PD78013H	μ PD78014H
Internal ROM size	8 KB	16 KB	24 KB	32 KB
Internal ROM type	Mask ROM			
Internal RAM size	544 bytes		1056 bytes	
Address space	64 Kbytes			
Instruction cycle	• 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s (With 10.0 MHz main system clock) • 122 μ s (With 32.768 kHz subsystem clock)			
Minimum instruction execution time	0.4 μ s (10.0 MHz)			
Interrupt function	External: 4, Internal: 10			
I/O port	53 • CMOS input: 2 • CMOS I/O: 47 • N-ch open-drain I/O: 4			
Timer	16-bit timer/event counter $\times$ 1 channel 8-bit timer/event counter $\times$ 2 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel			
Timer output	3 (PWM output: 1)			
Serial interface	3-wire/2-wire/SBI mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel			
A/D converter	8-bit resolution $\times$ 8 channels			
Other functions	Clock output function Buzzer output function			
Standby function	STOP/HALT			
Power supply voltage	1.8 to 5.5 V			
Package	64-pin plastic SDIP, 64-pin plastic QFP (14 $\times$ 14 mm), 64-pin plastic LQFP (12 $\times$ 12 mm)			
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator			
Applications	Cellular phones, VCRs, audio equipments, cameras, home appliances etc.			

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD780024A, 780034A Subseries) (1/2)

Subseries name	μPD780024A Subseries				μPD780034A Subseries
Part number	μPD780021A	μPD780022A	μPD780023A	μPD780024A	μPD78F0034A
Internal ROM size	8 KB	16 KB	24 KB	32 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	512 bytes		1024 bytes		
Address space	64 Kbytes				
Instruction cycle	• 0.24 μs, 0.48 μs, 0.95 μs, 1.91 μs, 3.81 μs (With 8.38 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.24 μs (8.38 MHz)				
Interrupt function	External: 5, Internal: 15				
I/O port	51 • CMOS input: 8 • CMOS I/O: 39 • N-ch open-drain I/O: 4				
Timer	16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	3 (PWM output: 2)				
Serial interface	3-wire: 2 channels UART: 1 channel				
A/D converter	8-bit resolution × 8 channels				10-bit resolution × 8 channels
Other functions	Clock output function Buzzer output function				
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	64-pin plastic SDIP, 64-pin plastic QFP (14 × 14 mm), 64-pin plastic TQFP (12 × 12 mm), 64-pin plastic LQFP (10 × 10 mm), 73-pin CSP ^{Note}				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	Base unit for cordless telephone, VCRs, TVs, audio equipments, etc.				

Note Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD780024A, 780034A Subseries) (2/2)

Subseries name	μPD780034A Subseries				
Part number	μPD780031A	μPD780032A	μPD780033A	μPD780034A	μPD78F0034A
Internal ROM size	8 KB	16 KB	24 KB	32 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	512 bytes		1024 bytes		
Address space	64 Kbytes				
Instruction cycle	• 0.24 μs, 0.48 μs, 0.95 μs, 1.91 μs, 3.81 μs (With 8.38 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.24 μs (8.38MHz)				
Interrupt function	External: 5, Internal: 15				
I/O port	51 • CMOS input: 8 • CMOS I/O: 39 • N-ch open-drain I/O: 4				
Timer	16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	3 (PWM output: 2)				
Serial interface	3-wire: 2 channels UART: 1 channel				
A/D converter	10-bit resolution × 8 channels				
Other functions	Clock output function Buzzer output function				
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	64-pin plastic SDIP, 64-pin plastic QFP (14 × 14 mm), 64-pin plastic TQFP (12 × 12 mm), 64-pin plastic LQFP (10 × 10 mm), 73-pin CSP ^{Note}				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	VCRs, TVs, audio equipments, etc.				

Note Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD780024AY, 780034AY Subseries) (1/2)

Subseries name	μPD780024AY Subseries				μPD780034AY Subseries
Part number	μPD780021AY	μPD780022AY	μPD780023AY	μPD780024AY	μPD78F0034AY
Internal ROM size	8 KB	16 KB	24 KB	32 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	512 bytes		1024 bytes		
Address space	64 Kbytes				
Instruction cycle	• 0.24 μs, 0.48 μs, 0.95 μs, 1.91 μs, 3.81 μs (With 8.38 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.24 μs (8.38 MHz)				
Interrupt function	External: 5, Internal: 15				
I/O port	51 • CMOS input: 8 • CMOS I/O: 39 • N-ch open-drain I/O: 4				
Timer	16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	3 (PWM output: 2)				
Serial interface	3-wire: 1 channel UART: 1 channel I ² C bus (supporting multiplex master): 1 channel				
A/D converter	8-bit resolution × 8 channels				10-bit resolution × 8 channels
Other functions	Clock output function Buzzer output function				
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	64-pin plastic SDIP, 64-pin plastic QFP (14 × 14 mm), 64-pin plastic TQFP (12 × 12 mm), 64-pin plastic LQFP (10 × 10 mm), 73-pin CSP ^{Note}				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	VCRs, TVs, audio equipments, etc.				

Note Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD780024AY, 780034AY Subseries) (2/2)

Subseries name	μPD780034AY Subseries				
Part number	μPD780031AY	μPD780032AY	μPD780033AY	μPD780034AY	μPD78F0034AY
Internal ROM size	8 KB	16 KB	24 KB	32 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	512 bytes		1024 bytes		
Address space	64 Kbytes				
Instruction cycle	• 0.24 μs, 0.48 μs, 0.95 μs, 1.91 μs, 3.81 μs (With 8.38 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.24 μs (8.38 MHz)				
Interrupt function	External: 5, Internal: 15				
I/O port	51 • CMOS input: 8 • CMOS I/O: 39 • N-ch open-drain I/O: 4				
Timer	16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	3 (PWM output: 2)				
Serial interface	3-wire: 1 channel UART: 1 channel I ² C bus (supporting multiplex master): 1 channel				
A/D converter	10-bit resolution × 8 channels				
Other functions	Clock output function Buzzer output function				
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	64-pin plastic SDIP, 64-pin plastic QFP (14 × 14 mm), 64-pin plastic TQFP (12 × 12 mm), 64-pin plastic LQFP (10 × 10 mm), 73-pin CSP ^{Note}				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	VCRs, TVs, audio equipments, etc.				

Note Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD780078, 780078Y Subseries)

Subseries name	μPD780078 Subseries			μPD780078Y Subseries		
Part number	μPD780076	μPD780078	μPD78F0078	μPD780076Y	μPD780078Y	μPD78F0078Y
Internal ROM size	48 KB	60 KB		48 KB	60 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM		Flash memory
Internal RAM size	2048 bytes					
Address space	64 Kbytes					
Instruction cycle	• 0.24 μs, 0.48 μs, 0.95 μs, 1.91 μs, 3.81 μs (With 8.38 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)					
Minimum instruction execution time	0.24 μs (8.38 MHz)					
Interrupt function	External: 5, Internal: 15					
I/O port	52 • CMOS input: 8 • CMOS I/O: 40 • N-ch open-drain I/O: 4					
Timer	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel					
Timer output	4 (PWM output: 2)					
Serial interface	3-wire/UART mode (selectable): 1 channel 3-wire: 1 channel			3-wire/UART mode (selectable): 1 channel 3-wire: 1 channel		
A/D converter	10-bit resolution × 8 channels					
Other functions	Clock output function Buzzer output function					
Standby function	STOP/HALT					
Power supply voltage	1.8 to 5.5 V					
Package	64-pin plastic QFP (14 × 14 mm), 64-pin plastic TQFP (12 × 12 mm)					
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator					
Applications	Telephones, AV equipments, automotive electronics, etc.					

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD780065 Subseries)

Part number	μ PD780065	μ PD78F0066
Internal ROM size	40 KB	48 KB
Internal ROM type	Mask ROM	Flash memory
Internal RAM size	5152 bytes	
Address space	64 Kbytes	
Instruction cycle	• 0.24 μs, 0.48 μs, 0.95 μs, 1.91 μs, 3.81 μs, 7.63 μs (With 8.38 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)	
Minimum instruction execution time	0.24 μ s (8.38 MHz)	
Interrupt function	External: 4, Internal: 13	
I/O port	CMOS I/O: 53	
Timer	16-bit timer/event counter $\times$ 1 channel 8-bit timer $\times$ 2 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel	
Timer output	3 (PWM output: 2)	
Serial interface	3-wire: 1 channel 2-wire: 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel UART: 1 channel	
A/D converter	8-bit resolution $\times$ 8 channels	
Other functions	Clock output function	
Standby function	STOP/HALT	
Power supply voltage	2.7 to 5.5 V	
Package	80-pin plastic QFP (14 $\times$ 14 mm)	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications	Control of audio systems compatible with CD text, etc.	

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD780058 Subseries)

Part number	μPD780053	μPD780054	μPD780055	μPD780056	μPD780058B	μPD78F0058
Internal ROM size	24 KB	32 KB	40 KB	48 KB	60 KB	
Internal ROM type	Mask ROM					Flash memory
Internal RAM size	1056 bytes				2080 bytes	
Address space	64 Kbytes					
Instruction cycle	• 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, 12.8 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)					
Minimum instruction execution time	0.4 μs (5.0 MHz)					
Interrupt function	External: 6, Internal: 15					
I/O port	68 • CMOS input: 2 • CMOS I/O: 62 • N-ch open-drain I/O: 4					
Timer	16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel					
Timer output	3 (PWM output: 1)					
Serial interface	3-wire/2-wire/SBI mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel 3-wire/UART mode (with time-division transmission function) (selectable): 1 channel					
A/D converter	8-bit resolution × 8 channels					
D/A converter	8-bit resolution × 2 channels					
Other functions	Clock output function Buzzer output function					
Standby function	STOP/HALT					
Power supply voltage	1.8 to 5.5 V					2.7 to 5.5 V
Package	80-pin plastic QFP (14 × 14 mm), 80-pin plastic TQFP (fine pitch) (12 × 12 mm)					
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator					
Applications	Cellular phones, base unit for cordless telephone, pagers, printers, AV equipments, air conditioners, cameras, PPCs, fuzzy home appliances, vending machines, etc.					

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD780058Y Subseries)

Part number	μ PD780053Y	μ PD780054Y	μ PD780055Y	μ PD780056Y	μ PD780058BY	μ PD78F0058Y
Internal ROM size	24 KB	32 KB	40 KB	48 KB	60 KB	
Internal ROM type	Mask ROM					Flash memory
Internal RAM size	1056 bytes				2080 bytes	
Address space	64 Kbytes					
Instruction cycle	• 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s, 12.8 μ s (With 5.0 MHz main system clock) • 122 μ s (With 32.768 kHz subsystem clock)					
Minimum instruction execution time	0.4 μ s (5.0 MHz)					
Interrupt function	External: 6, Internal: 15					
I/O port	68 • CMOS input: 2 • CMOS I/O: 62 • N-ch open-drain I/O: 4					
Timer	16-bit timer/event counter $\times$ 1 channel 8-bit timer/event counter $\times$ 2 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel					
Timer output	3 (PWM output: 1)					
Serial interface	3-wire/2-wire/I ² C bus mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel 3-wire/UART mode (with time-division transmission function) (selectable): 1 channel					
A/D converter	8-bit resolution $\times$ 8 channels					
D/A converter	8-bit resolution $\times$ 2 channels					
Other functions	Clock output function Buzzer output function					
Standby function	STOP/HALT					
Power supply voltage	1.8 to 5.5 V					2.7 to 5.5 V
Package	80-pin plastic QFP (14 $\times$ 14 mm), 80-pin plastic TQFP (fine pitch) (12 $\times$ 12 mm)					
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator					
Applications	Cellular phones, pagers, printers, AV equipments, air conditioners, cameras, PPCs, fuzzy home appliances, vending machines, etc.					

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD78075B, 78078 Subseries)

Subseries name	μPD78075B Subseries		μPD78078 Subseries		
Part number	μPD78074B	μPD78075B	μPD78076	μPD78078	μPD78P078
Internal ROM size	32 KB	40 KB	48 KB	60 KB	
Internal ROM type	Mask ROM				One-time PROM
Internal RAM size	1056 bytes		2080 bytes		
Address space	64 Kbytes				
Instruction cycle	• 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, 12.8 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.4 μs (5.0 MHz)				
Interrupt function	External: 7, Internal: 17				
I/O port	88 • CMOS input: 2 • CMOS I/O: 78 • N-ch open-drain I/O: 8				
Timer	16-bit timer/event counter × 1 channel 8-bit timer/event counter × 4 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	5 (PWM output: 3)				
Serial interface	3-wire/2-wire/SBI mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel 3-wire/UART mode (with time-division transmission function) (selectable): 1 channel				
A/D converter	8-bit resolution × 8 channels				
D/A converter	8-bit resolution × 2 channels				
Other functions	Clock output function Buzzer output function				
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	100-pin plastic QFP (14 × 20 mm), 100-pin plastic LQFP (fine pitch) (14 × 14mm)				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	Cellular phones, cordless phones, audio equipments, VCRs, printers, etc.				

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD78078Y Subseries)

Part number	μ PD78076Y	μ PD78078Y	μ PD78P078Y
Internal ROM size	48 KB	60 KB	
Internal ROM type	Mask ROM		One-time PROM
Internal RAM size	2080 bytes		
Address space	64 Kbytes		
Instruction cycle	• 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, 12.8 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)		
Minimum instruction execution time	0.4 μ s (5.0 MHz)		
Interrupt function	External: 7, Internal: 17		
I/O port	88 • CMOS input: 2 • CMOS I/O: 78 • N-ch open-drain I/O: 8		
Timer	16-bit timer/event counter $\times$ 1 channel 8-bit timer/event counter $\times$ 4 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel		
Timer output	5 (PWM output: 3)		
Serial interface	3-wire/2-wire/I ² C bus mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel 3-wire/UART mode (with time-division transmission function) (selectable): 1 channel		
A/D converter	8-bit resolution $\times$ 8 channels		
D/A converter	8-bit resolution $\times$ 2 channels		
Other functions	Clock output function Buzzer output function		
Standby function	STOP/HALT		
Power supply voltage	1.8 to 5.5 V		
Package	100-pin plastic QFP (14 $\times$ 20 mm), 100-pin plastic LQFP (fine pitch) (14 $\times$ 14 mm)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	Cellular phones, cordless phones, car audio, audio equipments, VCRs, printers, etc.		

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD78070A, 78070AY)

Part number	μ PD78070A	μ PD78070AY
Internal ROM size	—	
Internal ROM type	ROM less	
Internal RAM size	1056 bytes	
Address space	64 KB	
Instruction cycle	• 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, 12.8 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)	
Minimum instruction execution time	0.4 μ s (5.0 MHz)	
Interrupt function	External: 7, Internal: 17	
I/O port	61 • CMOS input: 2 • CMOS I/O: 51 • N-ch open-drain I/O: 8	
Timer	16-bit timer/event counter $\times$ 1 channel 8-bit timer/event counter $\times$ 4 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel	
Timer output	5 (PWM output: 3)	
Serial interface	3-wire/2-wire/SBI mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel 3-wire/UART mode (with time-division transmission function) (selectable): 1 channel	3-wire/2-wire/I ² C bus mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel 3-wire/UART mode (with time-division transmission function) (selectable): 1 channel
A/D converter	8-bit resolution $\times$ 8 channels	
D/A converter	8-bit resolution $\times$ 2 channels	
Other functions	Clock output function Buzzer output function	
Standby function	STOP/HALT	
Power supply voltage	2.7 to 5.5 V	
Package	100-pin plastic QFP (14 $\times$ 20 mm), 100-pin plastic QFP (fine pitch) (14 $\times$ 14 mm)	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications	CD-ROMs, printers, PPCs, etc.	

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μ PD78083 Subseries)

Part number	μ PD78081	μ PD78082	μ PD78P083
Internal ROM size	8 KB	16 KB	24 KB
Internal ROM type	Mask ROM		One-time PROM
Internal RAM size	256 bytes	384 bytes	512 bytes
Instruction cycle	• 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s, 12.8 μ s (With 5.0 MHz main system clock)		
Minimum instruction execution time	0.4 μ s (5.0 MHz)		
Interrupt function	External: 3, Internal: 10		
I/O port	33 • CMOS input: 1 • CMOS I/O: 32		
Timer	8-bit timer/event counter $\times$ 2 channels Watchdog timer $\times$ 1 channel		
Timer output	2 (PWM output: 2)		
Serial interface	3-wire/UART mode (selectable): 1 channel		
A/D converter	8-bit resolution $\times$ 8 channels		
Other functions	Clock output function Buzzer output function		
Standby function	STOP/HALT		
Power supply voltage	1.8 to 5.5 V		
Package	42-pin plastic SDIP, 44-pin plastic QFP (10 $\times$ 10 mm)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	Automotive electronics, OA equipments, display equipments, air conditioners, keyless entriess, etc.		

8-Bit Single-Chip Microcontroller

78K/0 Series

■ VFD Driver Series (μ PD78044F Subseries)

Part number	μ PD78042F	μ PD78043F	μ PD78044F	μ PD78045F	μ PD78P048A
Internal ROM size	16 KB	24 KB	32 KB	40 KB	60 KB
Internal ROM type	Mask ROM				One-time PROM
Internal RAM size	576 bytes		1088 bytes		2116 bytes
VFD data RAM size	48 bytes				
Instruction cycle	• 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s (With 5.0 MHz main system clock) • 122 μ s (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.4 μ s (5.0 MHz)				
Interrupt function	External: 4, Internal: 12				
I/O port	68 • CMOS input: 2 • CMOS I/O: 27 • N-ch open-drain I/O: 5 • P-ch open-drain I/O: 16 (Also used for VFD output pins) • P-ch open-drain output: 18 (Also used for VFD output pins)				
VFD controller/driver	Total display outputs: 34 • Segment signal outputs: 9 to 24 • Common signal outputs: 2 to 16				
Timer	16-bit timer/event counter $\times$ 1 channel 8-bit timer/event counter $\times$ 2 channels 6-bit up/down counter $\times$ 1 channel Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel				
Timer output	3 (PWM output: 1)				
Serial interface	3-wire/2-wire/SBI mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 64 bytes): 1 channel				
A/D converter	8-bit resolution $\times$ 8 channels				
Other functions	Clock output function Buzzer output function				
Standby function	STOP/HALT				
Power supply voltage	2.7 to 5.5 V				
Package	80-pin plastic QFP (14 $\times$ 20 mm)				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	VCRs, audio equipments, microwave ovens, etc.				

8-Bit Single-Chip Microcontroller

78K/0 Series

■ VFD Driver Series (μ PD78044H Subseries)

Part number	μ PD78044H	μ PD78045H	μ PD78046H
Internal ROM size	32 KB	40 KB	48 KB
Internal ROM type	Mask ROM		
Internal RAM size	1024 bytes		
VFD data RAM size	48 bytes		
Instruction cycle	• 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)		
Minimum instruction execution time	0.4 μ s (5.0 MHz)		
Interrupt function	External: 4, Internal: 10		
I/O port	68 • CMOS input: 2 • CMOS I/O: 19 • N-ch open-drain I/O: 13 • P-ch open-drain I/O: 16 (Also used for VFD output pins) • P-ch open-drain output: 18 (Also used for VFD output pins)		
VFD controller/driver	Total display outputs: 34 • Segment signal outputs: 9 to 24 • Common signal outputs: 2 to 16		
Timer	16-bit timer/event counter $\times$ 1 channel 8-bit timer/event counter $\times$ 2 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel		
Timer output	3 (PWM output: 1)		
Serial interface	3-wire: 1 channel		
A/D converter	8-bit resolution $\times$ 8 channels		
Other functions	Clock output function Buzzer output function		
Standby function	STOP/HALT		
Power supply voltage	2.7 to 5.5 V		
Package	80-pin plastic QFP (14 $\times$ 20mm)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	VCRs, mini-component stereo systems, microwave ovens, ECRs, etc.		

8-Bit Single-Chip Microcontroller

78K/0 Series

■ VFD Driver Series (μ PD780208 Subseries)

Part number	μ PD780204	μ PD780205	μ PD780206	μ PD780208	μ PD78P0208
Internal ROM size	32 KB	40 KB	48 KB	60 KB	
Internal ROM type	Mask ROM				One-time PROM
Internal RAM size	1088 bytes		2112 bytes		
VFD data RAM size	80 bytes				
Instruction cycle	• 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s (With 5.0 MHz main system clock) • 122 μ s (With 32.768 kHz subsystem clock)				
Minimum instruction execution time	0.4 μ s (5.0 MHz)				
Interrupt function	External: 4, Internal: 11				
I/O port	74 • CMOS input: 2 • CMOS I/O: 27 • N-ch open-drain I/O: 5 • P-ch open-drain I/O: 24 (Also used for VFD output pins) • P-ch open-drain output: 16 (Also used for VFD output pins)				
VFD controller/driver	Total display outputs: 53 • Segment signal outputs: 9 to 40 • Common signal outputs: 2 to 16				
Timer	16-bit timer/event counter $\times$ 1 channel 8-bit timer/event counter $\times$ 2 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel				
Timer output	3 (PWM output: 1)				
Serial interface	3-wire/2-wire/SBI mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 64 bytes): 1 channel				
A/D converter	8-bit resolution $\times$ 8 channels				
Other functions	Clock output function Buzzer output function				
Standby function	STOP/HALT				
Power supply voltage	2.7 to 5.5 V				
Package	100-pin plastic QFP (14 $\times$ 20 mm)				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	VCRs, audio equipments, ,mini stereo component, microwave ovens, etc.				

8-Bit Single-Chip Microcontroller

78K/0 Series

■ VFD Driver Series (μ PD780233 Subseries)

Part number	μ PD780232	μ PD780233 ★ ☆	μ PD78F0233
Internal ROM size	16 KB	24 KB	
Internal ROM type	Mask ROM		Flash memory
Internal RAM size	800 bytes		
VFD data RAM size	112 bytes		
Instruction cycle	• 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s (With 5.0 MHz main system clock)		
Minimum instruction execution time	0.4 μ s (5.0 MHz)		
Interrupt function	External: 2, Internal: 12		
I/O port	40 • CMOS input: 11 • P-ch open-drain I/O: 13 (Also used for VFD output pins) • P-ch open-drain output: 16 (Also used for VFD output pins)		
VFD controller/driver	Display outputs: 53		
Timer	8-bit remote control timer $\times$ 1 channel 8-bit timer $\times$ 2 channels Watchdog timer $\times$ 1 channel		
Timer output	3 (PWM output: 2)		
Serial interface	2-wire: 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel		
A/D converter	8-bit resolution $\times$ 4 channels		
Standby function	STOP/HALT		
Power supply voltage	4.5 to 5.5 V		
Package	80-pin plastic QFP (14 $\times$ 14 mm)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	Combined mini-component stereo systems, separate mini-component stereo systems, tuners, cassette tape decks, compact disk/mini disk players, audio amplifiers, etc.		

★: Under development, ☆: Newly added product

8-Bit Single-Chip Microcontroller

78K/0 Series

■ LCD Driver Series (μ PD78064, 78064B Subseries)

Subseries name	μPD78064 Subseries				μPD78064B Subseries	
Part number	μPD78062	μPD78063	μPD78064	μPD78P064	μPD78064B	μPD78P064B
Internal ROM size	16 KB	24 KB	32 KB			
Internal ROM type	Mask ROM			One-time PROM	Mask ROM	One-time PROM
Internal RAM size	512 bytes	1024 bytes				
Internal LCD data RAM size	40 × 4 bits					
Instruction cycle	• 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, 12.8 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)					
Minimum instruction execution time	0.4 μs (5.0 MHz)					
Interrupt function	External: 6, Internal: 14					
I/O port	57 • CMOS input: 2 • CMOS I/O: 55 (Also used for segment pins: 16)					
LCD controller/driver	Segment signal outputs: 40 maximum Common signal outputs: 4 maximum Bias: 1/2 or 1/3 (switchable)					
Timer	16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel					
Timer output	3 (PWM output: 1)					
Serial interface	3-wire/2-wire/SBI mode (selectable): 1 channel 3-wire/UART mode (selectable): 1 channel					
A/D converter	8-bit resolution × 8 channels					
Other functions	Clock output function Buzzer output function					
Standby function	STOP/HALT					
Power supply voltage	2.0 to 6.0 V					
Package	100-pin plastic QFP (14 × 20 mm), 100-pin plastic LQFP (fine pitch) (14 × 14 mm)					
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator					
Applications	Cellular phones, CD players, cameras, etc.					

8-Bit Single-Chip Microcontroller

78K/0 Series

■ LCD Driver Series (μ PD78064Y Subseries)

Part number	μ PD78062Y	μ PD78063Y	μ PD78064Y
Internal ROM size	16 KB	24 KB	32 KB
Internal ROM type	Mask ROM		
Internal RAM size	512 bytes	1024 bytes	
Internal LCD data RAM size	40 × 4 bits		
Instruction cycle	• 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s, 12.8 μ s (With 5.0 MHz main system clock) • 122 μ s (With 32.768 kHz subsystem clock)		
Minimum instruction execution time	0.4 μ s (5.0 MHz)		
Interrupt function	External: 6, Internal: 14		
I/O port	57 •CMOS input: 2 •CMOS I/O: 55 (Also used for segment pins: 16)		
LCD controller/driver	Segment signal outputs: 40 maximum Common signal outputs: 4 maximum Bias: 1/2 or 1/3 (switchable)		
Timer	16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel		
Timer output	3 (PWM output: 1)		
Serial interface	3-wire/2-wire/I ² C bus mode (selectable): 1 channel 3-wire/UART mode (selectable): 1 channel		
A/D converter	8-bit resolution × 8 channels		
Other functions	Clock output function Buzzer output function		
Standby function	STOP/HALT		
Power supply voltage	2.0 to 6.0V		
Package	100-pin plastic QFP (14 × 20 mm), 100-pin plastic LQFP (fine pitch) (14 × 14 mm)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	Cellular phones, CD players, audio amplifier, cameras, etc.		

8-Bit Single-Chip Microcontroller

78K/0 Series

■ LCD Driver Series (μ PD780308, 780308Y Subseries)

Subseries name	μPD780308 Subseries			μPD780308Y Subseries		
Part number	μPD780306	μPD780308	μPD78P0308	μPD780306Y	μPD780308Y	μPD78P0308Y
Internal ROM size	48 KB	60 KB		48 KB	60 KB	
Internal ROM type	Mask ROM		One-time PROM	Mask ROM		One-time PROM
Internal RAM size	2048 bytes					
Internal LCD data RAM size	40 × 4 bits					
Instruction cycle	• 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, 12.8 μs (With 5.0 MHz main system clock) • 122 μs (With 32.768 kHz subsystem clock)					
Minimum instruction execution time	0.4 μs (5.0 MHz)					
Interrupt function	External: 6, Internal: 15					
I/O port	57 • CMOS input: 2 • CMOS I/O: 55 (Also used for segment pins: 16)					
LCD controller/driver	Segment signal outputs: 40 maximum Common signal outputs: 4 Bias: 1/2 or 1/3 (switchable)					
Timer	16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel					
Timer output	3 (PWM output: 1)					
Serial interface	3-wire/2-wire/SBI mode (selectable): 1 channel 3-wire/UART mode (selectable): 1 channel 3-wire (with time-division transmission function): 1 channel			3-wire/2-wire/I ² C bus mode (selectable): 1 channel 3-wire/UART mode (selectable): 1 channel 3-wire (with time-division transmission function): 1 channel		
A/D converter	8-bit resolution × 8 channels					
Other functions	Clock output function Buzzer output function					
Standby function	STOP/HALT					
Power supply voltage	2.0 to 5.5 V					
Package	100-pin plastic QFP (14 × 20 mm), 100-pin plastic LQFP (fine pitch) (14 × 14 mm)					
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator					
Applications	Cellular phones, pagers, CD players, audio amplifier, meters, etc.					

8-Bit Single-Chip Microcontroller

78K/0 Series

■ LCD Driver Series (μ PD780318, 780328, 780338 Subseries)

Subseries name	μ PD780318 Subseries		μ PD780328 Subseries		μ PD780338 Subseries		
Part number	μ PD780316 ★	μ PD780318 ★	μ PD780326 ★	μ PD780328 ★	μ PD780336 ★	μ PD780338 ★	μ PD78F0338 ★
Internal ROM size	48 KB	60 KB	48 KB	60 KB	48 KB	60 KB	
Internal ROM type	Mask ROM						Flash memory
Internal RAM size	2560 bytes						
Internal LCD data RAM size	40 × 8 bits						
Instruction cycle	• 0.2 μ s, 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s (With 10.0 MHz main system clock) • 122 μ s (With 32.768 kHz subsystem clock)						
Minimum instruction execution time	0.2 μ s (10.0 MHz)						
Interrupt function	External: 7, Internal: 17						
I/O port	70 • CMOS input: 8 • CMOS output: 16 • CMOS I/O: 42 • N-ch open-drain I/O: 4		62 • CMOS input: 8 • CMOS output: 8 • CMOS I/O: 42 • N-ch open-drain I/O: 4		54 • CMOS input: 8 • CMOS I/O: 42 • N-ch open-drain I/O: 4		70 • CMOS input: 8 • CMOS output: 16 (Also used for segment pins) • CMOS I/O: 42 • N-ch open-drain I/O: 4
LCD controller/driver	Segment signal outputs: 24 maximum Common signal outputs: 4 maximum (dynamic display), 1 maximum (static display) Bias: 1/3, on-chip booster Blinking display is possible		Segment signal outputs: 32 maximum Common signal outputs: 4 maximum (dynamic display), 1 maximum (static display) Bias: 1/3, on-chip booster Blinking display is possible		Segment signal outputs: 40 maximum Common signal outputs: 4 maximum (dynamic display), 1 maximum (static display) Bias: 1/3, on-chip booster Blinking display is possible		
Timer	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 3 channels Watchdog timer × 1 channel Watch timer × 1 channel						
Timer output	5 (PWM output: 3)						
Serial interface	3-wire/UART mode (selectable): 1 channel 3-wire: 1 channel						
A/D converter	10-bit resolution × 10 channels						
D/A converter	8-bit resolution × 1 channel						
Other functions	Clock output function Buzzer output function						
Standby function	STOP/HALT						
Power supply voltage	1.8 to 5.5 V						
Package	120-pin plastic TQFP (fine pitch) (14 × 14 mm)						
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator						
Applications	Cordless phones (local unit), compact cameras, CD players, etc.						

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ LCD Driver Series (μ PD780344, 780354 Subseries)

Subseries name	μ PD780344 Subseries		μ PD780354 Subseries		
Part number	μ PD780343 ★ ☆	μ PD780344 ★ ☆	μ PD780353 ★ ☆	μ PD780354 ★ ☆	μ PD78F0354 ★ ☆
Internal ROM size	24 KB	32 KB	24 KB	32 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	1024 bytes				1536 bytes
Internal LCD data RAM size	40 × 8 bits				
Instruction cycle	• 0.2 μ s, 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s (With 10.0 MHz main system clock) • 122 μ s (With 32.768 kHz subsystem clock) • 30.5 μ s (With 131 kHz subsystem clock × 4)				
Minimum instruction execution time	0.2 μ s (10.0 MHz)				
Interrupt function	External: 8, Internal: 16				
I/O port	66 • CMOS input: 8 • CMOS I/O: 52 (Also used for segment pins: 28) • N-ch open drain I/O: 6				
LCD controller/driver	Segment signal outputs: 40 maximum Common signal outputs: 4 Bias: 1/3, on-chip booster Blinking display is possible				
Timer	16-bit timer counter × 1 channel 8-bit timer/event counter × 4 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	5 (PWM output: 3)				
Serial interface	3-wire: 2 channels UART: 1 channel				
A/D converter	8-bit resolution × 8 channels		10-bit resolution × 8 channels		
Other functions	Clock output function				
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	100-pin plastic LQFP (14 × 14 mm), 113-pin CSP				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	APS cameras, digital cameras, AV equipments, household appliances, etc.				

★: Under development, ☆: Newly added product

8-Bit Single-Chip Microcontroller

78K/0 Series

■ LCD Driver Series (μ PD780344Y, 780354Y Subseries)

Subseries name	μ PD780344Y Subseries		μ PD780354Y Subseries		
Part number	μ PD780343Y ★★	μ PD780344Y ★★	μ PD780353Y ★★	μ PD780354Y ★★	μ PD78F0354Y ★★
Internal ROM size	24 KB	32 KB	24 KB	32 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	1024 bytes				1536 bytes
Internal LCD data RAM size	40 × 8 bits				
Instruction cycle	• 0.2 μ s, 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s (With 10.0 MHz main system clock) • 122 μ s (With 32.768 kHz subsystem clock) • 30.5 μ s (With 131 kHz subsystem clock × 4)				
Minimum instruction execution time	0.2 μ s (10.0 MHz)				
Interrupt function	External: 8, Internal: 16				
I/O port	66 • CMOS input: 8 • CMOS I/O: 52 (Also used for segment pins: 28) • N-ch open drain I/O: 6				
LCD controller/driver	Segment signal outputs: 40 maximum Common signal outputs: 4 Bias: 1/3, on-chip booster Blinking display is possible				
Timer	16-bit timer counter × 1 channel 8-bit timer/event counter × 4 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Timer output	5 (PWM output: 3)				
Serial interface	3-wire: 2 channels UART: 1 channel I ² C bus: 1 channel				
A/D converter	8-bit resolution × 8 channels		10-bit resolution × 8 channels		
Other functions	Clock output function				
Standby function	STOP/HALT				
Power supply voltage	1.8 to 5.5 V				
Package	100-pin plastic LQFP (14 × 14 mm), 113-pin CSP				
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	APS cameras, digital cameras, AV equipments, household appliances, etc.				

★: Under development, ☆: Newly added product

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Inverter Controller Series (μ PD780988 Subseries)

Part number	μ PD780982	μ PD780983	μ PD780984	μ PD780986	μ PD780988	μ PD78F0988A
Internal ROM size	16 KB	24 KB	32 KB	48 KB	60 KB	
Internal ROM type	Mask ROM					Flash memory
Internal RAM size	1024 bytes			2048 bytes		
Instruction cycle	• 0.24 μ s, 0.48 μ s, 0.95 μ s, 1.9 μ s, 3.8 μ s (With 8.38 MHz main system clock)					
Minimum instruction execution time	0.24 μ s (8.38 MHz)					
Interrupt function	External: 8, Internal: 16					
I/O port	47 • CMOS input: 8 • CMOS I/O: 39					
Timer	16-bit inverter control timer $\times$ 1 channel 16-bit timer/event counter $\times$ 2 channels 8-bit timer/event counter $\times$ 3 channels Watchdog timer $\times$ 1 channel					
Timer output	11 (PWM output: 3, inverter control output: 6)					
Serial interface	3-wire: 1 channel UART: 2 channels					
A/D converter	10-bit resolution $\times$ 8 channels					
Other functions	8-bit real-time output ports: 8 External memory expansion space: 256 bytes				8-bit real-time output ports: 8	
Standby function	STOP/HALT					
Power supply voltage	4.0 to 5.5 V					
Package	64-pin plastic SDIP, 64-pin plastic QFP (14 $\times$ 14 mm)					
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator					
Applications	Moter control for inverter-type air conditioners, washing machines, etc.					

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Meter Controller Series (μ PD780958 Subseries)

Part number	μ PD780957(A)	μ PD780958(A)
Internal ROM size	48 KB	60 KB
Internal ROM type	Mask ROM	
Internal RAM size	2048 bytes	
Internal LCD data RAM size	30 × 3 bits	
Instruction cycle	• 2 μs, 4 μs, 8 μs (With 1.0MHz main system clock) • 61 μs (With 32.768kHz subsystem clock)	
Minimum instruction execution time	2 μ s (1.0 MHz)	
Interrupt function	External: 12, Internal: 19	
I/O port	69 • CMOS I/O: 66 (Also used for segment pins: 22) • N-ch open-drain I/O: 3	
LCD controller/driver	Segment signal outputs: 30 maximum Common signal outputs: 3 • Bias: Static or 1/3 (switchable)	
Timer	16-bit timer/event counter × 2 channels 8-bit timer × 4 channels Watchdog timer × 1 channel	
Timer output	1	
Serial interface	3-wire: 1 channel UART: 1 channel	
Feature	MR control function Sampling output function Quality grade: Special (μ PD780957(A), 780958(A)) only (for high reliability electronic equipment)	
Other functions	Clock output function	
Standby function	HALT	
Power supply voltage	2.2 to 3.5 V	
Package	100-pin plastic LQFP (fine pitch) (14 × 14 mm)	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications	Gas meters, etc.	

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Dashboard Controller Series (μ PD780852 Subseries)

Part number	μ PD780851(A)	μ PD780852(A)	μ PD78F0852 ★
Internal ROM size	32 KB	40 KB	
Internal ROM type	Mask ROM		Flash memory
Internal RAM size	1536 bytes		
Internal LCD data RAM size	20 × 4 bits		
Instruction cycle	• 0.24 μ s, 0.48 μ s, 0.95 μ s, 1.91 μ s, 3.81 μ s (With 8.38 MHz main system clock)		
Minimum instruction execution time	0.24 μ s (8.38 MHz)		
Interrupt function	External: 3, Internal: 18		
I/O port	56 • CMOS input: 5 • CMOS output: 16 • CMOS I/O: 35 (Also used for segment pins: 15)		
LCD controller/driver	Segment signal outputs: 20 maximum Common signal outputs: 4 maximum • Bias: 1/3		
Timer	16-bit timer × 1 channel 8-bit timer × 1 channel 8-bit timer/event counter × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel		
Timer output	PWM output: 2		
Serial interface	3-wire: 2 channels UART: 1 channel		
A/D converter	8-bit resolution × 5 channels		
Feature	Meter controller/driver: 4 meter control (Cross-coil or stepper motor) Sound generator: Buzzer output signal with composed amplitude		
Other functions	Power fail detect function (battery voltage detect) Clock output function		
Standby function	STOP/HALT		
Power supply voltage	4.0 to 5.5 V		
Package	80-pin plastic QFP (14 × 14 mm)		
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	Vehicle meters control (dashboard mounted)		

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Bus Controller Series (μ PD78098B Subseries)

Part number	μ PD78095B	μ PD78096B	μ PD78098B	μ PD78P098B
Internal ROM size	40 KB	48 KB	60 KB	
Internal ROM type	Mask ROM			One-time PROM
Internal RAM size	1056 bytes		3104 bytes	
Address space	64 Kbytes			
Instruction cycle	0.5 μ s, 1.0 μ s, 2.0 μ s, 4.0 μ s, 8.0 μ s, 16.0 μ s (With 6.0 MHz main system clock) • 122 μ s (With 32.768 kHz subsystem clock)			
Minimum instruction execution time	0.4 μ s (5.0 MHz)			
Interrupt function	External: 7, Internal: 16			
I/O port	69 • CMOS input: 2 • CMOS I/O: 63 • N-ch open-drain I/O: 4			
Timer	16-bit timer/event counter $\times$ 1 channel 8-bit timer/event counter $\times$ 2 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel			
Timer output	3 (PWM output: 1)			
Serial interface	3-wire/2-wire/SBI mode (selectable): 1 channel 3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel 3-wire/UART mode (selectable): 1 channel			
Bus controller	IEBus controller (effective transmission speed: 26 kbps maximum)			
A/D converter	8-bit resolution $\times$ 8 channels			
D/A converter	8-bit resolution $\times$ 2 channels			
Other functions	Clock output function Buzzer output function			
Standby function	STOP/HALT			
Power supply voltage	2.7 to 5.5 V			
Package	80-pin plastic QFP (14 $\times$ 14 mm)			
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator			
Applications	Car audios, CD changers, etc.			

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Bus Controller Series (μ PD780702Y Subseries)

Part number	μ PD780702Y ★	μ PD78F0701Y
Internal ROM size	60 KB	
Internal ROM type	Mask ROM	Flash memory
Internal RAM size	3360 bytes	3072 bytes
Instruction cycle	0.32 μ s, 0.64 μ s, 1.27 μ s, 2.54 μ s, 5.09 μ s (With 6.29 MHz main system clock)	
Minimum instruction execution time	0.32 μ s (6.29 MHz)	
Interrupt function	External: 8, Internal: 21	
I/O port	67 • CMOS I/O: 56 • TTL input/CMOS output: 8 • N-ch open-drain I/O: 3	
Timer	16-bit timer/event counter $\times$ 2 channels 8-bit timer/event counter $\times$ 3 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel	
Timer output	5 (PWM output: 3)	
Serial interface	3-wire: 2 channels UART: 1 channel I ² C bus (supporting multiplex master): 1 channel	
Bus controller	IEBus controller	
A/D converter	8-bit resolution $\times$ 16 channels	
Other functions	Power fail detect function (battery voltage detect) Clock output function Buzzer output function	
Standby function	STOP/HALT	
Power supply voltage	3.5 to 5.5 V	
Package	80-pin plastic QFP (14 $\times$ 14 mm)	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications	Car audio systems, etc.	

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Bus Controller Series (μ PD780833Y Subseries)

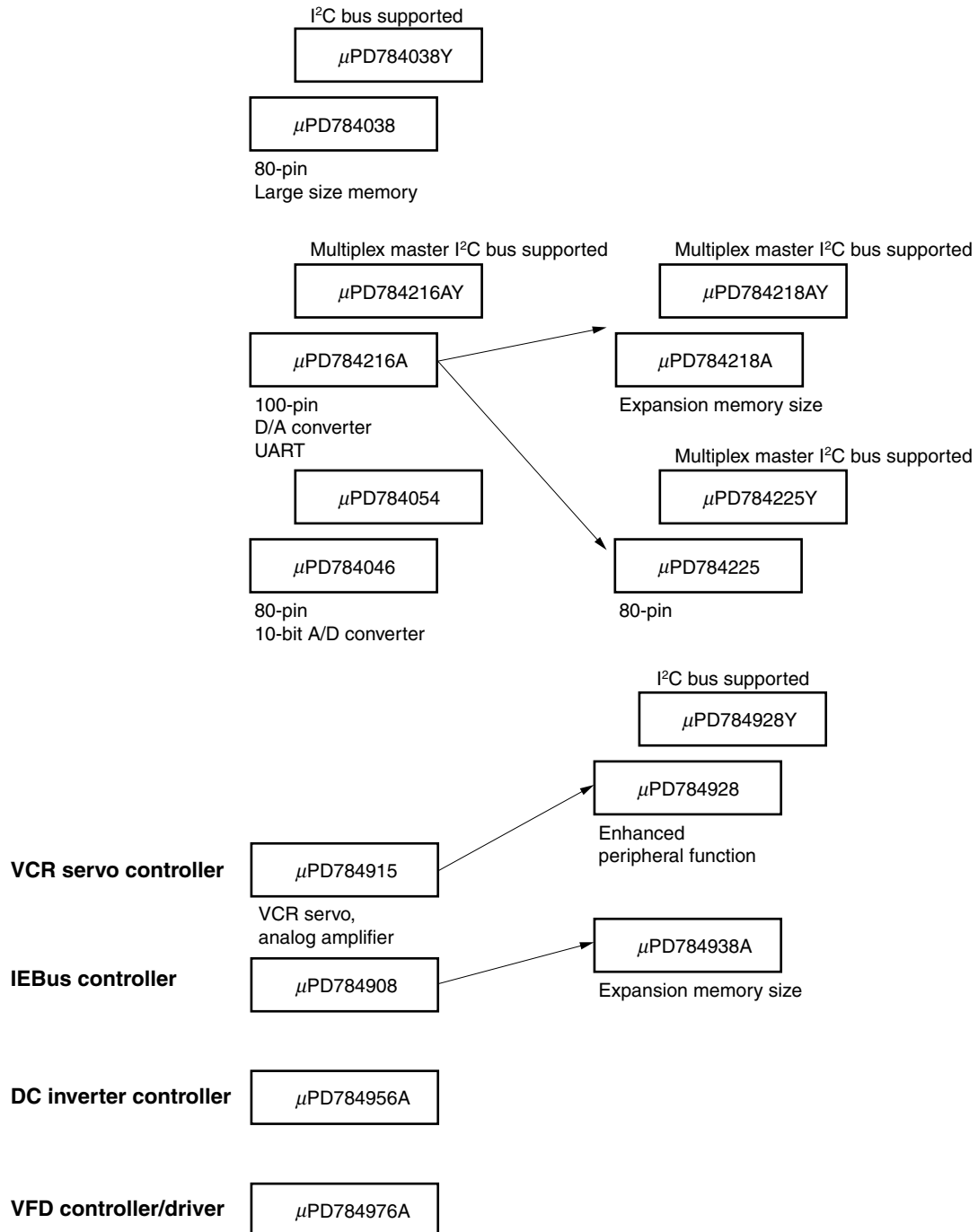
Part number	μ PD780833Y	μ PD78F0833Y
Internal ROM size	60 KB	
Internal ROM type	Mask ROM	Flash memory
Internal RAM size	3072 bytes	
Instruction cycle	• 0.48 μ s, 0.95 μ s, 1.91 μ s, 3.81 μ s, 7.63 μ s (With 8.38 MHz main system clock)	
Minimum instruction execution time	0.48 μ s (4.19 MHz)	
Interrupt function	External: 9, Internal: 20	
I/O port	65 • CMOS I/O: 54 • TTL input/CMOS output: 8 • N-ch open-drain I/O: 3	
Timer	16-bit timer/event counter $\times$ 2 channels 8-bit timer/event counter $\times$ 3 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel	
Timer output	5 (PWM output: 3)	
Serial interface	3-wire: 2 channels UART: 1 channel I ² C bus (supporting multiplex master): 1 channel	
Bus controller	J1850 (CLASS2) bus interface	
A/D converter	8-bit resolution $\times$ 16 channels	
Other functions	Clock output function	
Standby function	STOP/HALT	
Power supply voltage	4.5 to 5.5 V	
Package	80-pin plastic QFP (14 $\times$ 14 mm)	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications	Car audio systems, etc.	

16-Bit Single-Chip Microcontroller

78K/IV Series

■ 78K/IV Series Product Evolution

Subseries names are shown inside frames.



16-Bit Single-Chip Microcontroller

78K/IV Series

■ Differences among the Subseries

Function Subseries name		ROM capacity	Timer				8-bit	10-bit	8-bit	Serial interface	I/O	V _{DD} MIN. value
			8-bit	16-bit	Watch	WDT	A/D	A/D	D/A			
General-purpose	μPD784225	96K to 128K	4 ch	1 ch	1 ch	1 ch	8 ch	–	2 ch	3 ch (UART: 2 ch)	67	1.8 V ^{Note}
	μPD784225Y									3 ch (UART: 2 ch, I ² C: 1 ch)		
	μPD784218A	192K to 256K	6 ch							3 ch (UART: 2 ch)	86	1.8 V ^{Note}
	μPD784218AY									3 ch (UART: 2 ch, I ² C: 1 ch)		
	μPD784216A	96K to 128K	3 ch (UART: 2 ch)									
	μPD784216AY		3 ch (UART: 2 ch, I ² C: 1 ch)									
	μPD784054	32K	–	3 ch	–	–	16 ch	–	2 ch (UART: 2 ch)	64	4.5 V	
	μPD784046			5 ch						65		
	μPD784038			48K to 128K		4 ch	8 ch	–	2 ch	3 ch (UART: 2 ch)	46/64	2.7 V
	μPD784038Y	3 ch (UART: 2 ch, I ² C: 1 ch)										
VCR servo controller	μPD784928	96K to 128K	2 ch	6 ch	–	–	12 ch	–	–	2 ch	74	2.7 V
	μPD784928Y									3 ch (I ² C: 1 ch)		
	μPD784915	48K to 62K							2 ch	54		
On-chip IEBus controller	μPD784938A	96K to 256K	–	4 ch	1 ch	1 ch	8 ch	–	–	4 ch (UART: 2 ch)	80	4.0 V
	μPD784908	96K to 128K										
DC inverter controller	μPD784956A	24K to 64K	2 ch	6 ch	–	1 ch	8 ch	–	–	2 ch (UART: 1 ch)	67	4.5 V
VFD controller /driver	μPD784976A	96K to 128 K	2 ch	1 ch	1 ch	1 ch	12 ch	–	–	3 ch (UART: 1 ch)	72	4.5 V

Note Flash version: 1.9 V

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μ PD784038 Subseries)

Part number	μPD784031	μPD784035	μPD784036	μPD784037	μPD784038	μPD78P4038
Internal ROM size	—	48 KB	64 KB	96 KB	128 KB	
Internal ROM type	ROM less	Mask ROM				One-time PROM
Internal RAM size	2048 bytes			3584 bytes	4352 bytes	
Address space	Total of 1 Mbytes for both programs and data					
Minimum instruction execution time	125ns (32 MHz)					
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 7, Internal: 16 Number of interrupts supporting the use of a macro service: 19, Type of macro service: 4 types, 19 kinds					
I/O port	46 • Input: 8 • Output: 4 • I/O: 34 (LED direct drive: 8, transistor direct drive: 8)	64 • Input: 8 • I/O: 56 (LED direct drive: 24, transistor direct drive: 8)				
Timer	16-bit timer/event counter × 3 channels 16-bit timer × 1 channel Watchdog timer × 1 channel					
PWM output	12-bit resolution × 2 channels					
Real-time output port	4-bit x 2 ports or 8-bit × 1 port					
Serial interface	UART/IOE (with on-chip baud rate generator): 2 channels 3-wire/2-wire: 1 channel					
A/D converter	8-bit resolution × 8 channels					
D/A converter	8-bit resolution × 2 channels					
Clock output	Select of f _{CLK} , f _{CLK} /2, f _{CLK} /2 ² , f _{CLK} /2 ³ , f _{CLK} /2 ⁴					
Other functions	• Large internal memory • System clock dividing function (1/2, 1/4, 1/8, 1/16) • Pseudo-SRAM refresh function					
Standby function	STOP/IDLE/HALT					
Power supply voltage	2.7 to 5.5 V					
Package	80-pin plastic QFP (14 × 14 mm, 2.7 mm thick), 80-pin plastic QFP (14 × 14 mm, 1.4 mm thick), 80-pin plastic TQFP (fine pitch) (12 × 12 mm)					
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator					
Applications	PPCs, LBPs, autofocus cameras, etc.					

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μ PD784038Y Subseries)

Part number	μ PD784031Y	μ PD784035Y	μ PD784036Y	μ PD784037Y	μ PD784038Y	μ PD78P4038Y
Internal ROM size	—	48 KB	64 KB	96 KB	128 KB	
Internal ROM type	ROM less	Mask ROM				One-time PROM
Internal RAM size	2048 bytes			3584 bytes	4352 bytes	
Address space	Total of 1 Mbytes for both programs and data					
Minimum instruction execution time	125ns (32 MHz)					
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 7, Internal: 17 Number of interrupts supporting the use of a macro service: 20, Type of macro service: 4 types, 20 kinds					
I/O port	46 • Input: 8 • Output: 4 • I/O: 34 (LED direct drive: 8, transistor direct drive: 8)	64 • Input: 8 • I/O: 56 (LED direct drive: 24, transistor direct drive: 8)				
Timer	16-bit timer/event counter $\times$ 3 channels 16-bit timer $\times$ 1 channel Watchdog timer $\times$ 1 channel					
PWM output	12-bit resolution $\times$ 2 channels					
Real-time output port	4-bit $\times$ 2 ports or 8-bit $\times$ 1 port					
Serial interface	UART/IOE (with on-chip baud rate generator): 2 channels 3-wire/2-wire/I ² C bus mode: 1 channel					
A/D converter	8-bit resolution $\times$ 8 channels					
D/A converter	8-bit resolution $\times$ 2 channels					
Clock output	Select of f_{CLK} , $f_{CLK}/2$, $f_{CLK}/2^2$, $f_{CLK}/2^3$, $f_{CLK}/2^4$					
Other functions	• Large internal memory • System clock dividing function (1/2, 1/4, 1/8, 1/16) • Pseudo-SRAM refresh function					
Standby function	STOP/IDLE/HALT					
Power supply voltage	2.7 to 5.5 V					
Package	80-pin plastic QFP (14 $\times$ 14 mm, 2.7 mm thick), 80-pin plastic QFP (14 $\times$ 14 mm, 1.4 mm thick), 80-pin plastic TQFP (fine pitch) (12 $\times$ 12 mm)					
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator					
Applications	Cellular phones, cordless phones, AV equipments, etc.					

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μ PD784046 Subseries, μ PD784054)

Subseries name	μPD784046 Subseries			μPD784054
Part number	μPD784044	μPD784046	μPD78F4046	μPD784054
Internal ROM size	32 KB	64 KB		32 KB
Internal ROM type	Mask ROM		Flash memory	Mask ROM
Internal RAM size	1024 bytes	2048 bytes		1024 bytes
Address space	Total of 1 Mbytes for both programs and data			
Minimum instruction execution time	125ns (32 MHz)			
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 8, Internal: 23 Number of interrupts supporting the use of a macro service: 25, Type of macro service: 7 types, 27 kinds			4-level programmable priority, macro service, vectored interrupt, context switching function External: 8, Internal: 19 Number of interrupts supporting the use of a macro service: 21, Type of macro service: 7 types, 23 kinds
I/O port	65 • Input: 17 • I/O: 48			64 • Input: 17 • I/O: 47
Timer	16-bit timer/event counter × 2 channels 16-bit timer × 3 channels Watchdog timer × 1 channel			16-bit timer × 3 channels Watchdog timer × 1 channel
Real-time output port	4-bit × 1 port			
Serial interface	UART/IOE (with on-chip baud rate generator): 2 channels			
A/D converter	10-bit resolution × 16 channels			
Other functions	On-chip timer unit optimum for real-time control			
Standby function	STOP/IDLE/HALT			STOP/IDLE/HALT/Standby invalidation mode
Power supply voltage	4.5 to 5.5 V			
Package	80-pin plastic QFP (14 × 14 mm, 2.7 mm thick)			
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator			
Applications	Hot water supplier, vending machines, etc.			

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μ PD784216A Subseries)

Part number	μ PD784214A	μ PD784215A	μ PD784216A	μ PD78F4216A
Internal ROM size	96 KB	128 KB		
Internal ROM type	Mask ROM			Flash memory
Internal RAM size	3584 bytes	5120 bytes	8192 bytes	
Address space	Total of 1 Mbytes for both programs and data			
Minimum instruction execution time	160ns (Main system clock: 12.5 MHz) 61 μ s (Subsystem clock: 32.768 kHz)			
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 9, Internal: 19 Number of interrupts supporting the use of a macro service: 27, Type of macro service: 4 types, 27 kinds			
I/O port	86 • CMOS input: 8 • CMOS I/O: 72 (LED direct drive: 16) • N-ch open-drain I/O: 6 (LED direct drive)			
Timer	16-bit timer/counter $\times$ 1 channel 8-bit timer/counter $\times$ 6 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel			
Real-time output port	4-bit $\times$ 2 ports or 8-bit $\times$ 1 port			
Serial interface	UART/IOE (with on-chip baud rate generator): 2 channels 3-wire: 1 channel			
A/D converter	8-bit resolution $\times$ 8 channels			
D/A converter	8-bit resolution $\times$ 2 channels			
Clock output	Select of f_{xx} , $f_{xx}/2$, $f_{xx}/2^2$, $f_{xx}/2^3$, $f_{xx}/2^4$, $f_{xx}/2^5$, $f_{xx}/2^6$, $f_{xx}/2^7$, f_{XT}			
Buzzer output	Select of $f_{xx}/2^{10}$, $f_{xx}/2^{11}$, $f_{xx}/2^{12}$, $f_{xx}/2^{13}$			
Other functions	• Large internal memory • Using peripheral functions of 78K/0 Series			
Standby function	STOP/IDLE/HALT HALT/IDLE at low power consumption mode			
Power supply voltage	1.8 to 5.5 V			1.9 to 5.5 V
Package	100-pin plastic LQFP (fine pitch) (14 $\times$ 14 mm), 100-pin plastic QFP (14 $\times$ 20 mm)			
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator			
Applications	Cellular phones, PHS, cordless phones, CD-ROMs, AV equipments, etc.			

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μ PD784216AY Subseries)

Part number	μPD784214AY	μPD784215AY	μPD784216AY	μPD78F4216AY
Internal ROM size	96 KB	128 KB		
Internal ROM type	Mask ROM			Flash memory
Internal RAM size	3584 bytes	5120 bytes	8192 bytes	
Address space	Total of 1 Mbytes for both programs and data			
Minimum instruction execution time	160 ns (Main system clock: 12.5 MHz) 61 μs (Subsystem clock: 32.768 kHz)			
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 9, Internal: 19 Number of interrupts supporting the use of a macro service: 27, Type of macro service: 4 types, 27 kinds			
I/O port	86 • CMOS input: 8 • CMOS I/O: 72 (LED direct drive: 16) • N-ch open-drain I/O: 6 (LED direct drive)			
Timer	16-bit timer/counter × 1 channel 8-bit timer/counter × 6 channels Watchdog timer × 1 channel Watch timer × 1 channel			
Real-time output port	4-bit × 2 ports or 8-bit × 1 port			
Serial interface	UART/IOE (with on-chip baud rate generator): 2 channels 3-wire/I ² C bus (supporting multiplex master): 1 channel			
A/D converter	8-bit resolution × 8 channels			
D/A converter	8-bit resolution × 2 channels			
Clock output	Select of f _{xx} , f _{xx} /2, f _{xx} /2 ² , f _{xx} /2 ³ , f _{xx} /2 ⁴ , f _{xx} /2 ⁵ , f _{xx} /2 ⁶ , f _{xx} /2 ⁷ , f _{XT}			
Buzzer output	Select of f _{xx} /2 ¹⁰ , f _{xx} /2 ¹¹ , f _{xx} /2 ¹² , f _{xx} /2 ¹³			
Other functions	• Large internal memory • Using peripheral functions of 78K/0 Series			
Standby function	STOP/IDLE/HALT HALT/IDLE at low power consumption mode			
Power supply voltage	1.8 to 5.5 V			1.9 to 5.5 V
Package	100-pin plastic LQFP (fine pitch) (14 × 14 mm), 100-pin plastic QFP (14 × 20 mm)			
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator			
Applications	Cellular phones, PHS, cordless phones, CD-ROMs, AV equipments, etc.			

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μ PD784218A Subseries)

Part number	μ PD784217A	μ PD784218A	μ PD78F4218A
Internal ROM size	192 KB	256 KB	
Internal ROM type	Mask ROM		Flash memory
Internal RAM size	12800 bytes		
Address space	Total of 1 Mbytes for both programs and data		
Minimum instruction execution time	160 ns (Main system clock: 12.5 MHz) 61 μ s (Subsystem clock: 32.768 kHz)		
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 9, Internal: 19 Number of interrupts supporting the use of a macro service: 27, Type of macro service: 4 types, 27 kinds		
I/O port	86 • CMOS input: 8 • CMOS I/O: 72 (LED direct drive: 16) • N-ch open-drain I/O: 6 (LED direct drive)		
Timer	16-bit timer/counter $\times$ 1 channel 8-bit timer/counter $\times$ 6 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel		
Real-time output port	4-bit $\times$ 2 ports or 8-bit $\times$ 1 port		
Serial interface	UART/IOE (with on-chip baud rate generator): 2 channels 3-wire: 1 channel		
A/D converter	8-bit resolution $\times$ 8 channels		
D/A converter	8-bit resolution $\times$ 2 channels		
Clock output	Select of f_{xx} , $f_{xx}/2$, $f_{xx}/2^2$, $f_{xx}/2^3$, $f_{xx}/2^4$, $f_{xx}/2^5$, $f_{xx}/2^6$, $f_{xx}/2^7$, f_{xt}		
Buzzer output	Select of $f_{xx}/2^{10}$, $f_{xx}/2^{11}$, $f_{xx}/2^{12}$, $f_{xx}/2^{13}$		
Other functions	• Large internal memory • Using peripheral functions of 78K/0 Series		
Standby function	STOP/IDLE/HALT HALT/IDLE at low power consumption mode		
Power supply voltage	1.8 to 5.5 V		1.9 to 5.5 V
Package	100-pin plastic LQFP (fine pitch) (14 $\times$ 14 mm), 100-pin plastic QFP (14 $\times$ 20 mm)		
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	Cellular phones, PHS, cordless phones, CD-ROMs, AV equipments, etc.		

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μ PD784218AY Subseries)

Part number	μ PD784217AY	μ PD784218AY	μ PD78F4218AY
Internal ROM size	192 KB	256 KB	
Internal ROM type	Mask ROM		Flash memory
Internal RAM size	12800 bytes		
Address space	Total of 1 Mbytes for both programs and data		
Minimum instruction execution time	160 ns (Main system clock: 12.5 MHz) 61 μ s (Subsystem clock: 32.768 kHz)		
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 9, Internal: 19 Number of interrupts supporting the use of a macro service: 27, Type of macro service: 4 types, 27 kinds		
I/O port	86 • CMOS input: 8 • CMOS I/O: 72 (LED direct drive: 16) • N-ch open-drain I/O: 6 (LED direct drive)		
Timer	16-bit timer/counter $\times$ 1 channel 8-bit timer/counter $\times$ 6 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel		
Real-time output port	4-bit $\times$ 2 ports or 8-bit $\times$ 1 port		
Serial interface	UART/IOE (with on-chip baud rate generator): 2 channels 3-wire/I ² C bus (supporting multiplex master): 1 channel		
A/D converter	8-bit resolution $\times$ 8 channels		
D/A converter	8-bit resolution $\times$ 2 channels		
Clock output	Select of f_{xx} , $f_{xx}/2$, $f_{xx}/2^2$, $f_{xx}/2^3$, $f_{xx}/2^4$, $f_{xx}/2^5$, $f_{xx}/2^6$, $f_{xx}/2^7$, f_{xt}		
Buzzer output	Select of $f_{xx}/2^{10}$, $f_{xx}/2^{11}$, $f_{xx}/2^{12}$, $f_{xx}/2^{13}$		
Other functions	• Large internal memory • Using peripheral functions of 78K/0 Series		
Standby function	STOP/IDLE/HALT HALT/IDLE at low power consumption mode		
Power supply voltage	1.8 to 5.5 V		1.9 to 5.5 V
Package	100-pin plastic LQFP (fine pitch) (14 $\times$ 14 mm), 100-pin plastic QFP (14 $\times$ 20 mm)		
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	Cellular phones, PHS, cordless phones, CD-ROMs, AV equipments, etc.		

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μ PD784225, 784225Y Subseries)

Part number	μ PD784224	μ PD784225	μ PD78F4225	μ PD784224Y	μ PD784225Y	μ PD78F4225Y
Internal ROM size	96 KB	128 KB		96 KB	128 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM		Flash memory
Internal RAM size	3584 bytes	4352 bytes		3584 bytes	4352 bytes	
Address space	Total of 1 Mbytes for both programs and data					
Minimum instruction execution time	160 ns (Main system clock: 12.5 MHz) 61 μ s (Subsystem clock: 32.768 kHz)					
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 7, Internal: 17 Number of interrupts supporting the use of a macro service: 23, Type of macro service: 4 types, 23 kinds					
I/O port	67 • CMOS input: 8 • CMOS I/O: 59 (LED direct drive: 16)					
Timer	16-bit timer/counter $\times$ 1 channel 8-bit timer/counter $\times$ 4 channels Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel					
Real-time output port	4-bit $\times$ 2 ports or 8-bit $\times$ 1 port					
Serial interface	UART/IOE (with on-chip baud rate generator): 2 channels 3-wire: 1 channel			UART/IOE (with on-chip baud rate generator): 2 channels 3-wire/I ² C bus (supporting multiplex master): 1 channel		
A/D converter	8-bit resolution $\times$ 8 channels					
D/A converter	8-bit resolution $\times$ 2 channels					
Clock output	Select of f_{xx} , $f_{xx}/2$, $f_{xx}/2^2$, $f_{xx}/2^3$, $f_{xx}/2^4$, $f_{xx}/2^5$, $f_{xx}/2^6$, $f_{xx}/2^7$, f_{XT}					
Buzzer output	Select of $f_{xx}/2^{10}$, $f_{xx}/2^{11}$, $f_{xx}/2^{12}$, $f_{xx}/2^{13}$					
Other functions	• Large internal memory • Using peripheral functions of 78K/0 Series					
Standby function	STOP/IDLE/HALT HALT/IDLE at low power consumption mode					
Power supply voltage	1.8 to 5.5 V		1.9 to 5.5 V	1.8 to 5.5 V		1.9 to 5.5 V
Package	80-pin plastic QFP (14 $\times$ 14 mm), 80-pin plastic TQFP (fine pitch) (12 $\times$ 12 mm)					
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator					
Applications	Car audio, Portable audio, telephones, etc.					

16-Bit Single-Chip Microcontroller

78K/IV Series

■ VCR Servo Controller (μ PD784915 Subseries)

Part number	μ PD784915B	μ PD784916B	μ PD78P4916
Internal ROM size	48 KB	62 KB	
Internal ROM type	Mask ROM		One-time PROM
Internal RAM size	1280 bytes		2048 bytes
Address space	Total of 1 Mbytes for both programs and data		
Minimum instruction execution time	250 ns (Main system clock: 8 or 16 MHz) 61 μ s (Subsystem clock: 32.768 kHz)		
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 9, Internal: 20 Number of interrupts supporting the use of a macro service: 24, Type of macro service: 4 types, 24 kinds		
I/O port	54 • CMOS input: 8 • CMOS I/O: 46		
Timer	22-bit free running counter $\times$ 1 channel 16-bit timer: 6 channels (general-purpose timer $\times$ 3 channels) 8-bit timer $\times$ 2 channels 5-bit up down counter $\times$ 1 channel Watch timer $\times$ 1 channel Vsync separator circuit, Hsync separator circuit VISS detection circuit, wide aspect detection circuit Field identification circuit Head amplifier switch/chroma-rotation circuit		
PWM output	Carrier frequency: 62.5 kHz 16-bit resolution $\times$ 3 channels 8-bit resolution $\times$ 3 channels		
Real-time output port	11 (including pseudo Vsync, head amplifier switch, chroma-rotation outputs)		
Serial interface	3-wire: 2 channels (supporting Busy/Strobe control: 1 channel)		
A/D converter	8-bit resolution $\times$ 12 channels		
Clock output	Select of $f_{CLK}/2$, $f_{CLK}/2^2$, $f_{CLK}/2^3$, $f_{CLK}/2^4$		
Buzzer output	Select of 2.048 kHz, 4.096 kHz, 32.768 kHz		
Feature	CTL amplifier, RECCTL driver (with rewrite capability) CFG amplifier DFG amplifier, DPG comparator, DPGF separator circuit (3-value separator circuit) Reel FG comparator (2 channels) Csync comparator		
Standby function	STOP/HALT/Low power consumption/HALT mode for low power consumption		
Power supply voltage	2.7 to 5.5 V		
Package	100-pin plastic QFP (14 $\times$ 20 mm)		
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	VCRs, camcorders, integrated TV-VCR machines, etc.		

16-Bit Single-Chip Microcontroller

78K/IV Series

■ VCR Servo Controller (μ PD784928, 784928Y Subseries)

Subseries name	μ PD784928 Subseries			μ PD784928Y Subseries		
Part number	μ PD784927	μ PD784928	μ PD78F4928	μ PD784927Y	μ PD784928Y	μ PD78F4928Y
Internal ROM size	96 KB	128 KB		96 KB	128 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM		Flash memory
Internal RAM size	2048 bytes	3584 bytes		2048 bytes	3584 bytes	
Address space	Total of 1 Mbytes for both programs and data					
Minimum instruction execution time	250 ns (Main system clock: 8 or 16 MHz) 61 μ s (Subsystem clock: 32.768 kHz)					
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 9, Internal: 22 Number of interrupts supporting the use of a macro service: 26, Type of macro service: 4 types, 26 kinds					
I/O port	74 • CMOS input: 20 • CMOS I/O: 54 (LED direct drive: 8)					
Timer	22-bit free running counter $\times$ 1 channel 16-bit timer: 6 channels (general-purpose timer $\times$ 3 channels) 8-bit timer $\times$ 2 channels 5-bit up down counter $\times$ 1 channel Watch timer $\times$ 1 channel Vsync separator circuit, Hsync separator circuit VISS detection circuit, wide aspect detection circuit Field identification circuit Head amplifier switch/chroma-rotation circuit					
PWM output	Carrier frequency: 62.5kHz 16-bit resolution $\times$ 3 channels 8-bit resolution $\times$ 3 channels					
Real-time output port	11 (including pseudo Vsync, head amplifier switch, chroma-rotation outputs)					
Serial interface	3-wire: 2 channels (supporting Busy/Strobe control: 1 channel)			3-wire: 2 channels (supporting Busy/Strobe control: 1 channel) I ² C bus: 1 channel		
A/D converter	8-bit resolution $\times$ 12 channels					
Clock output	Select of $f_{CLK}/2$, $f_{CLK}/2^2$, $f_{CLK}/2^3$, $f_{CLK}/2^4$, $f_{CLK}/2^5$, $f_{CLK}/2^6$, $f_{CLK}/2^7$					
Buzzer output	Select of 2.048 kHz, 4.096 kHz, 32.768 kHz					
Feature	CTL amplifier, RECCTL driver (with rewrite capability) CFG amplifier DFG amplifier, DPG comparator, DPG amplifier, DPFG separator circuit (3-value separator circuit) Reel FG comparator (2 channels) Csync comparator					
Standby function	STOP/HALT/Low power consumption/HALT mode for low power consumption					
Power supply voltage	2.7 to 5.5 V					
Package	100-pin plastic QFP (14 $\times$ 20 mm) 100-pin plastic LQFP (14 $\times$ 14 mm)			100-pin plastic QFP (14 $\times$ 20 mm)		
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator					
Applications	VCRs, camcorders, integrated TV-VCR machines, etc.					

16-Bit Single-Chip Microcontroller

78K/IV Series

■ IEBus Controller (μ PD784908 Subseries)

Part number	μ PD784907	μ PD784908	μ PD78P4908
Internal ROM size	96 KB	128 KB	
Internal ROM type	Mask ROM		One-time PROM
Internal RAM size	3584 bytes	4352 bytes	
Address space	Total of 1 Mbytes for both programs and data		
Minimum instruction execution time	160 ns (12.58 MHz, V_{DD} = 4.0 to 5.5V)		160 ns (12.58 MHz, V_{DD} = 4.5 to 5.5V)
	320 ns (6.29 MHz, V_{DD} = 3.5 to 5.5V)		320 ns (6.29 MHz, V_{DD} = 4.0 to 5.5V)
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 7, Internal: 20 Number of interrupts supporting the use of a macro service: 23, Type of macro service: 4 types, 24 kinds		
I/O port	80 • CMOS input: 8 • CMOS I/O: 68 (LED direct drive: 24, transistor direct drive: 8) • N-ch open-drain I/O: 4		
Timer	16-bit timer/counter $\times$ 3 channels 16-bit timer $\times$ 1 channel Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel		
PWM output	12-bit resolution $\times$ 2 channels		
Real-time output port	4-bit $\times$ 2 ports or 8-bit $\times$ 1 port		
Serial interface	UART/IOE (3-wire): 2 channels 3-wire: 2 channels		
Bus controller	IEBus controller (simple version)		
A/D converter	8-bit resolution $\times$ 8 channels		
Clock output	Select of f_{CLK} , $f_{CLK}/2$, $f_{CLK}/2^2$, $f_{CLK}/2^3$, $f_{CLK}/2^4$		
Standby function	STOP/IDLE/HALT		
Power supply voltage	V_{DD} = 4.0 to 5.5 V		V_{DD} = 4.5 to 5.5 V
Package	100-pin plastic QFP (14 $\times$ 20mm)		
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	Car audio, etc.		

16-Bit Single-Chip Microcontroller

78K/IV Series

■ IEBus Controller (μ PD784938A Subseries)

Part number	μ PD784935A	μ PD784936A	μ PD784937A	μ PD784938A	μ PD78F4938A
Internal ROM size	96 KB	128 KB	192 KB	256 KB	
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	5120 bytes	6656 bytes	8192 bytes	10496 bytes	
Address space	Total of 1 Mbytes for both programs and data				
Minimum instruction execution time	160 ns (12.58 MHz) 320 ns (6.29 MHz)				
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 7, Internal: 20 Number of interrupts supporting the use of a macro service: 24, Type of macro service: 4 types, 24 kinds				
I/O port	80 • CMOS input: 8 • CMOS I/O: 68 (LED direct drive: 24, transistor direct drive: 8) • N-ch open-drain I/O: 4				
Timer	16-bit timer/counter $\times$ 3 channels 16-bit timer $\times$ 1 channel Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel				
PWM output	12-bit resolution $\times$ 2 channels				
Real-time output port	4-bit $\times$ 2 ports or 8-bit $\times$ 1 port				
Serial interface	UART/IOE (3-wire): 2 channels 3-wire: 2 channels				
Bus controller	IEBus controller (simple version)				
A/D converter	8-bit resolution $\times$ 8 channels				
Clock output	Select of f_{CLK} , $f_{CLK}/2$, $f_{CLK}/2^2$, $f_{CLK}/2^3$, $f_{CLK}/2^4$				
Standby function	STOP/IDLE/HALT				
Power supply voltage	V_{DD} = 4.0 to 5.5 V				
Package	100-pin plastic QFP (14 $\times$ 20 mm)				
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator				
Applications	Car audio, etc.				

16-Bit Single-Chip Microcontroller

78K/IV Series

■ DC Inverter Controller (μ PD784956A Subseries)

Part number	μ PD784953A	μ PD784956A	μ PD78F4956A ★
Internal ROM size	24 KB	64 KB	
Internal ROM type	Mask ROM		Flash memory
Internal RAM size	768 bytes	2048 bytes	
Minimum instruction execution time	160 ns (12.5 MHz)		
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 7, Internal: 20 Number of interrupts supporting the use of a macro service: 26, Type of macro service: 4 types, 26 kinds		
I/O port	67 • CMOS input: 8 • CMOS I/O: 59 (LED direct drive: 32)		
Timer	16-bit timer/counter $\times$ 6 channels 8-bit timer/counter $\times$ 2 channels Watchdog timer $\times$ 1 channel		
Real-time output port	6-bit $\times$ 2 ports		
Serial interface	3-wire: 1 channel UART: 1 channel		
A/D converter	8-bit resolution $\times$ 8 channels		
Standby function	STOP/IDLE/HALT		
Power supply voltage	4.5 to 5.5 V		
Package	80-pin plastic QFP (14 $\times$ 14 mm)		
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator		
Applications	Motor control for inverter air-conditioners, etc.		

★: Under development

16-Bit Single-Chip Microcontroller

78K/IV Series

■ VFD Driver (μPD784976A Subseries)

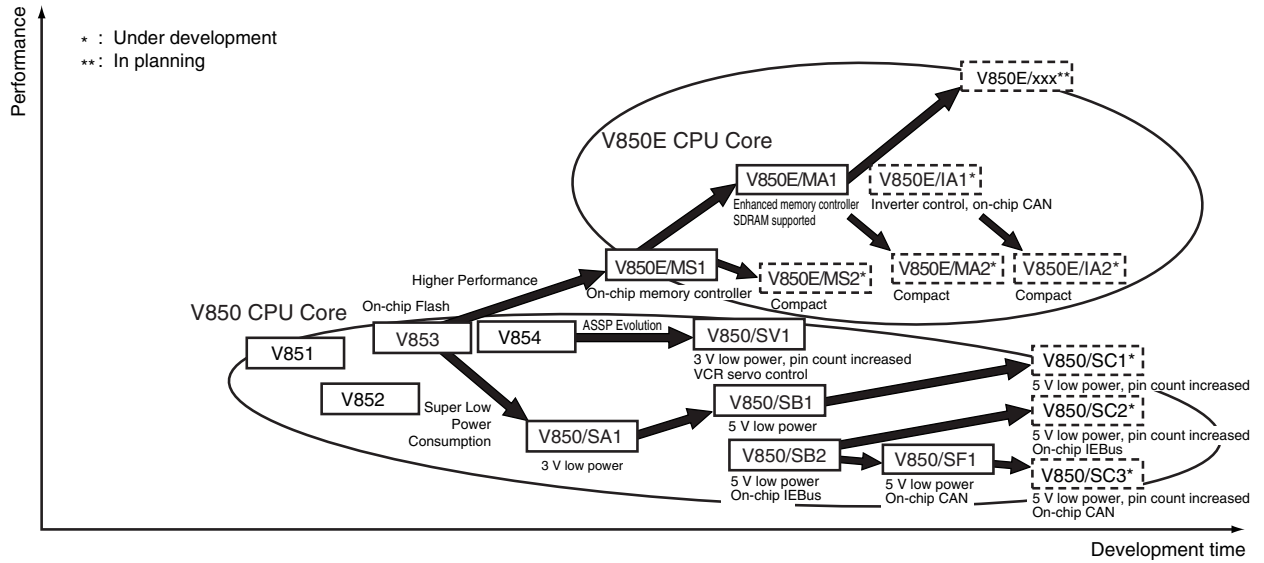
Part number	μPD784975A	μPD78F4976A ★
Internal ROM size	96 KB	128 KB
Internal ROM type	Mask ROM	Flash memory
Internal RAM size	3584 bytes	5120 bytes
VFD data RAM size	96 bytes	
Address space	Total of 1 Mbytes for both programs and data	
Minimum instruction execution time	160 ns (12.5 MHz)	
Interrupt function	4-level programmable priority, macro service, vectored interrupt, context switching function External: 3, Internal: 14 (also used for external: 2) Number of interrupts supporting the use of a macro service: 19, Type of macro service: 4 types, 19 kinds	
I/O port	72 • CMOS input: 12 • CMOS I/O: 20 • N-ch open-drain I/O: 8 • P-ch open-drain I/O: 24 (Also used for VFD output pins) • P-ch open-drain output: 8 (Also used for VFD output pins)	
VFD controller/driver	Display outputs: 48	
Timer	16-bit timer/counter × 1 channel 8-bit timer × 2 channels Watchdog timer × 1 channel Watch timer × 1 channel	
Serial interface	UART/IOE (3-wire): 1 channel 3-wire: 2 channels	
A/D converter	8-bit resolution × 12 channels	
Standby function	STOP/IDLE/HALT	
Power supply voltage	4.5 to 5.5 V	
Package	100-pin plastic QFP (14 × 20 mm)	
Development tools	Assembler, C compiler, real-time OS, system performance analyzer, integrated debugger, system simulator, device file, in-circuit emulator	
Applications	Audio equipments, etc.	

★: Under development

32-Bit Microprocessor

V850 Family

■ V850 Family Road Map



32-Bit Single-Chip Microcontroller

V850 Family

■ V850E/MS1 (1/2)

Part number	μPD703100-40	μPD703100-33	μPD703101-33	μPD703102-33	μPD70F3102-33
CPU core	V850E1				
CPU performance (Dhrystone)	—		43 MIPS (33 MHz)		
Internal ROM size	—		96 KB	128 KB	
Internal ROM type	ROM less		Mask ROM		Flash memory
Internal RAM size	4 KB				
Address bus	24-bit				
Data bus	16-bit				
Interrupt function	External: 25, Internal: 47				
DSP function	32 × 32 = 64: 25 to 50 ns (40 MHz) 32 × 32 + 32 = 32: 75 ns (40 MHz)	32 × 32 = 64: 30 to 60 ns (33 MHz) 32 × 32 + 32 = 32: 90 ns (33 MHz)			
Timer	16-bit timer/event counter × 6 channels 16-bit timer × 2 channels				
Serial interface	CSI: 2 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels				
A/D converter	10-bit resolution × 8 channels				
DMA controller	4 channels				
I/O port	123 • Input: 9 • I/O: 114				
Other functions	Memory Access control function (direct connectable various memory)				
Power save function	STOP/IDLE/HALT				
Operating frequency	2 to 40 MHz	2 to 33 MHz			
Power supply voltage	Internal unit: 3.3 V, A/D converter: 5 V, External pins: 5 V				
Power consumption (Typ.)	624 mW (40 MHz)	514.8 mW (33 MHz)			
Package	144-pin plastic LQFP (fine pitch) (20 × 20 mm)				144-pin plastic LQFP (fine pitch) (20 × 20 mm)
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator				
Applications	Printers, facsimiles, PPCs, digital still cameras, video printers, DVD systems, etc.				

32-Bit Single-Chip Microcontroller

V850 Family

■ V850E/MS1 (2/2)

Part number	μPD703100A-40	μPD703100A-33	μPD703101A-33	μPD703102A-33	μPD70F3102A-33
CPU core	V850E1				
CPU performance (Dhrystone)	—		43 MIPS (33 MHz)		
Internal ROM size	—		96 KB	128 KB	
Internal ROM type	ROM less		Mask ROM		Flash memory
Internal RAM size	4 KB				
Address bus	24-bit				
Data bus	16-bit				
Interrupt function	External: 25, Internal: 47				
DSP function	32 × 32 = 64: 25 to 50ns (40MHz) 32 × 32 + 32 = 32: 75 ns (40 MHz)	32 × 32 = 64: 30 to 60 ns (33 MHz) 32 × 32 + 32 = 32: 90 ns (33 MHz)			
Timer	16-bit timer/event counter × 6 channels 16-bit timer × 2 channels				
Serial interface	CSI: 2 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels				
A/D converter	10-bit resolution × 8 channels				
DMA controller	4channels				
I/O port	123 • Input: 9 • I/O: 114				
Other functions	Memory Access control function (direct connectable various memory)				
Power save function	STOP/IDLE/HALT				
Operating frequency	2 to 40 MHz	2 to 33 MHz			
Power supply voltage	Internal unit, A/D converter, External pins: 3.3 V				
Power consumption (Typ.)	330 mW (40 MHz)	270 mW (33 MHz)			
Package	144-pin plastic LQFP (fine pitch) (20 × 20 mm)	144-pin plastic LQFP (fine pitch) (20 × 20 mm), 157-pin plastic FBGA (14 × 14 mm)			144-pin plastic LQFP (fine pitch) (20 × 20 mm), 157-pin plastic FBGA (14 × 14 mm)
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator				
Applications	Printers, facsimiles, PPCs, digital still cameras, video printers, DVD systems, etc.				

32-Bit Single-Chip Microcontroller

V850 Family

■ V850E/MS2

Part number	μPD703130 ★
CPU core	V850E1
CPU performance (Dhrystone)	—
Internal ROM size	—
Internal ROM type	ROM less
Internal RAM size	4 KB
Address bus	24-bit
Data bus	16-bit
Interrupt function	External: 10, Internal: 35
DSP function	$32 \times 32 = 64$: 30 to 60 ns (33 MHz) $32 \times 32 + 32 = 32$: 90 ns (33 MHz)
Timer	16-bit timer/event counter $\times$ 4 channels 16-bit timer $\times$ 2 channels
Serial interface	CSI/UART: 2 channels Dedicated baud rate generator: 2 channels
A/D converter	10-bit resolution $\times$ 4 channels
DMA controller	4 channels
I/O port	57 • Input: 5 • I/O: 52
Other functions	Memory Access control function (direct connectable various memory)
Power save function	STOP/IDLE/HALT
Operating frequency	10 to 33 MHz
Power supply voltage	Internal unit: 3.3 V, A/D converter: 5 V, External pins: 5 V
Power consumption (Typ.)	465.3 mW (33 MHz)
Package	100-pin plastic LQFP (fine pitch) (14 $\times$ 14 mm)
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator
Applications	Optical storage equipment (DVD systems, etc.), system control for digital consumer equipment, etc.

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V850E/MA1

Part number	μPD703103A	μPD703105A	μPD703106A	μPD703107A	μPD70F3107A
CPU core	V850E1				
CPU performance (Dhrystone)	–	62 MIPS (50 MHz)			
Internal ROM size	–	128 KB		256 KB	
Internal ROM type	ROM less	Mask ROM			Flash memory
Internal RAM size	4 KB		10 KB		
Address bus	26-bit				
Data bus	16-bit				
Interrupt function	External: 25, Internal: 33				
DSP function	32 × 32 = 64: 20 to 40ns (50 MHz) 32 × 32 + 32 = 32: 60ns (50 MHz)				
Timer	16-bit timer/event counter × 4 channels 16-bit timer × 4 channels				
Serial interface	CSI: 1 channel CSI/UART: 2 channels UART: 1 channel Dedicated baud rate generator: 3 channels				
A/D converter	10-bit resolution × 8 channels				
DMA controller	4 channels				
PWM functions	8/9/10/12-bit resolution × 2 channels				
I/O port	115 • Input: 9 • I/O: 106				
Other functions	Memory Access control function (direct connectable SDRAM, SRAM, EDO DRAM, Page-ROM, etc.)				
Power save function	STOP/IDLE/HALT				
Operating frequency	4 to 50 MHz				
Power supply voltage	3.0 to 3.6 V				
Power consumption (Typ.)	528 mW (3.3 V, 50 MHz)				
Package	144-pin plastic LQFP (fine pitch) (20 × 20 mm)		144-pin plastic LQFP (fine pitch) (20 × 20 mm), 161-pin plastic FBGA (13 × 13 mm)		
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator				
Applications	Printers, facsimiles, PPCs, digital still cameras, DVD systems, etc.				

32-Bit Single-Chip Microcontroller

V850 Family

■ V850E/MA2

Part number	μ PD703108 ★
CPU core	V850E1
CPU performance (Dhrystone)	—
Internal ROM size	—
Internal ROM type	ROM less
Internal RAM size	4 KB
Address bus	25-bit
Data bus	16-bit
Interrupt function	External: 8, Internal: 23
DSP function	$32 \times 32 = 64$: 25 to 50 ns (40 MHz) $32 \times 32 + 32 = 32$: 75 ns (40 MHz)
Timer	16-bit timer/event counter $\times$ 2 channels 16-bit timer $\times$ 4 channels
Serial interface	CSI/UART: 2 channels Dedicated baud rate generator: 2 channels
A/D converter	10-bit resolution $\times$ 4 channels
DMA controller	4 channels
I/O port	79 • Input: 5 • I/O: 74
Other functions	Memory Access control function (direct connectable SDRAM, SRAM, Page-ROM, etc.)
Power save function	STOP/IDLE/HALT
Operating frequency	4 to 40 MHz
Power supply voltage	3.0 to 3.6 V
Power consumption (Typ.)	376 mW (3.3 V, 40 MHz)
Package	100-pin plastic LQFP (fine pitch) (14 $\times$ 14 mm)
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator
Applications	Printers, facsimiles, PPCs, digital still cameras, DVD systems, etc.

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V850E/IA1

Part number	μ PD703116 ★	μ PD70F3116 ★
CPU core	V850E1	
CPU performance (Dhrystone)	62 MIPS (50MHz)	
Internal ROM size	256 KB	
Internal ROM type	Mask ROM	Flash memory
Internal RAM size	10 KB	
Address bus	24-bit	
Data bus	16-bit	
Interrupt function	External: 20, Internal: 46	
DSP function	$32 \times 32 = 64$: 20 to 40 ns (50 MHz) $32 \times 32 + 32 = 32$: 60 ns (50 MHz)	
Timer	16-bit three-phase sine-wave PWM timer $\times$ 2 channels 16-bit encoder counter/timer $\times$ 2 channels 16-bit timer/counter $\times$ 2 channels 16-bit timer/event counter $\times$ 1 channel 16-bit interval timer $\times$ 1 channel	
Serial interface	CSI: 2 channels UART: 3 channels Dedicated baud rate generator: 4 channels	
Bus controller	FCAN controller (conformed on CAN protocol Ver.2.0 (part B), transmission speed: 1 Mbps maximum)	
A/D converter	10-bit resolution $\times$ 8 channels $\times$ 2 circuits	
DMA controller	4 channels	
I/O port	83 • Input: 8 • I/O: 75	
Other functions	Memory Access control function (connectable SRAM, ROM)	
Power save function	STOP/IDLE/HALT	
Operating frequency	4 to 50 MHz	
Power supply voltage	Internal unit: 3.3 V, A/D converter: 5 V, External pins: 5 V	
Power consumption (Typ.)	630 mW (Internal unit: 3.3 V, External pins: 5 V, 50 MHz)	
Package	144-pin plastic LQFP (fine pitch) (20 $\times$ 20 mm)	
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator	
Applications	Electric power steering, Hybrid electric vehicle, Motor control for air conditioners, general-purpose inverter, etc.	

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V850E/IA2

Part number	μ PD703114	μ PD70F3114 ★
CPU core	V850E1	
CPU performance (Dhrystone)	50 MIPS (40MHz)	
Internal ROM size	128 KB	
Internal ROM type	Mask ROM	Flash memory
Internal RAM size	6 KB	
Address bus	22-bit	
Data bus	16-bit	
Interrupt function	External: 16, Internal: 42	
DSP function	$32 \times 32 = 64$: 25 to 50 ns (40 MHz) $32 \times 32 + 32 = 32$: 75 ns (40 MHz)	
Timer	16-bit three-phase sine-wave PWM timer $\times$ 2 channels 16-bit encoder counter/timer $\times$ 1 channel 16-bit timer/counter $\times$ 2 channels 16-bit timer/event counter $\times$ 1 channel 16-bit interval timer $\times$ 1 channel	
Serial interface	CSI: 2 channels UART: 2 channels Dedicated baud rate generator: 3 channels	
A/D converter	10-bit resolution $\times$ 6 channels: A/D converter 0 10-bit resolution $\times$ 8 channels: A/D converter 1	
DMA controller	4 channels	
I/O port	53 • Input: 6 • I/O: 47	
Other functions	Memory Access control function (connectable SRAM, ROM)	
Power save function	STOP/IDLE/HALT	
Operating frequency	4 to 40 MHz	
Power supply voltage	4.5-5.5 V (On-chip regulator circuit)	
Power consumption (Typ.)	440 mW	
Package	100-pin plastic LQFP (fine pitch) (14 $\times$ 14 mm)	
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator	
Applications	Refrigerators, washing machines, motor control for air conditioners, general-purpose inverter, etc.	

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SA1 (1/2)

Part number	μPD703014A	μPD703014B	μPD703015A	μPD703015B	μPD70F3015B	μPD703017A	μPD70F3017A
CPU core	V850						
CPU performance (Dhrystone)	23 MIPS (20 MHz)/19 MIPS (17 MHz)						
Internal ROM size	64 KB		128 KB			256 KB	
Internal ROM type	Mask ROM				Flash memory	Mask ROM	Flash memory
Internal RAM size	4 KB					8 KB	
Address bus	22-bit						
Data bus	16-bit						
Interrupt function	External: 8, Internal: 23						
DSP function	16 × 16 = 32: 50 to 100 ns (20 MHz) 16 × 16 + 32 = 32: 150 ns (20 MHz)						
Timer	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 4 channels (Usable as 16-bit timer/event counter × 2 channels) Watchdog timer × 1 channel Watch timer × 1 channel						
Serial interface	CSI: 2 channels CSI/UART: 1 channel UART: 1 channel Dedicated baud rate generator: 2 channels						
A/D converter	10-bit resolution × 12 channels						
DMA controller	3 channels						
Real-time output port	4-bit × 2 ports or 8-bit × 1 port						
I/O port	85 • Input: 13 • I/O: 72						
Power save function	STOP/IDLE/HALT						
Operating frequency	Main clock: 2 to 20 MHz (3.3 V)/2 to 17 MHz (3 V) Subclock: 32.768 kHz						
Power supply voltage	3.0 to 3.6 V (20 MHz) 2.7 to 3.6 V (17 MHz)						
Power consumption (Typ.)	66 mW (3.3 V, 20 MHz)/56 mW (3.3 V, 17 MHz)				105 mW (3.3 V, 20 MHz) / 99 mW (3.3 V, 17 MHz)	66 mW (3.3 V, 20 MHz) / 56 mW (3.3 V, 17 MHz)	105 mW (3.3 V, 20 MHz)/ 99 mW (3.3 V, 17 MHz)
Package	121-pin plastic FBGA (12 × 12 mm)	100-pin plastic LQFP (fine pitch) (14 × 14 mm)	121-pin plastic FBGA (12 × 12 mm)	100-pin plastic LQFP (fine pitch) (14 × 14 mm)		100-pin plastic LQFP (fine pitch) (14 × 14 mm), 121-pin plastic FBGA (12 × 12 mm)	
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator						
Applications	Portable equipment such as DVCs, analog camcorders, PHSs, DSCs, cellular phones, portable MDs, etc.						

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SA1 (2/2)

Part number	μPD703014AY	μPD703014BY	μPD703015AY	μPD703015BY	μPD70F3015BY	μPD703017AY	μPD70F3017AY
CPU core	V850						
CPU performance (Dhrystone)	23MIPS (20 MHz)/19 MIPS (17 MHz)						
Internal ROM size	64 KB		128 KB			256 KB	
Internal ROM type	Mask ROM				Flash memory	Mask ROM	Flash memory
Internal RAM size	4 KB					8 KB	
Address bus	22-bit						
Data bus	16-bit						
Interrupt function	External: 8, Internal: 23						
DSP function	16 × 16 = 32: 50 to 100 ns (20 MHz) 16 × 16 + 32 = 32: 150 ns (20 MHz)						
Timer	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 4 channels (Usable as 16-bit timer/event counter × 2 channels) Watchdog timer × 1 channel Watch timer × 1 channel						
Serial interface	CSI: 1 channel CSI/I ² C bus: 1 channel CSI/UART: 1 channel UART: 1 channel Dedicated baud rate generator: 2 channels						
A/D converter	10-bit resolution × 12 channels						
DMA controller	3 channels						
Real-time output port	4-bit × 2 ports or 8-bit × 1 port						
I/O port	85 • Input: 13 • I/O: 72						
Power save function	STOP/IDLE/HALT						
Operating frequency	Main clock: 2 to 20 MHz (3.3 V)/2 to 17 MHz (3 V) Subclock: 32.768 kHz						
Power supply voltage	3.0 to 3.6 V (20 MHz) 2.7 to 3.6V (17 MHz)						
Power consumption (Typ.)	66 mW (3.3 V, 20 MHz)/56 mW (3.3 V, 17 MHz)				105 mW (3.3 V, 20 MHz) / 99 mW (3.3 V, 17 MHz)	66 mW (3.3 V, 20 MHz) / 56 mW (3.3 V, 17 MHz)	105 mW (3.3 V, 20 MHz)/ 99 mW (3.3 V, 17 MHz)
Package	121-pin plastic FBGA (12 × 12 mm)	100-pin plastic LQFP (fine pitch) (14 × 14 mm)	121-pin plastic FBGA (12 × 12 mm)	100-pin plastic LQFP (fine pitch) (14 × 14 mm)		100-pin plastic LQFP (fine pitch) (14 × 14 mm), 121-pin plastic FBGA (12 × 12 mm)	
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator						
Applications	Portable equipment such as DVCs, analog camcorders, PHSSs, DSCs, cellular phones, portable MDs, etc.						

Caution The maximum operating frequency of the I²C bus is 17 MHz.

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SB1 (1/4)

Part number	μPD703031A	μPD703033A	μPD70F3033A	μPD703030A ★	μPD703032A	μPD70F3032A
CPU core	V850					
CPU performance (Dhrystone)	23 MIPS (20 MHz)					
Internal ROM size	128 KB	256 KB		384 KB	512 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM		Flash memory
Internal RAM size	12 KB	16 KB		20 KB	24 KB	
Address bus	22-bit					
Data bus	16-bit					
Interrupt function	External: 8, Internal: 31					
DSP function	16 × 16 = 32: 50 to 100 ns (20 MHz) 16 × 16 + 32 = 32: 150 ns (20 MHz)					
Timer	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 4 channels (Usable as 16-bit timer/event counter × 2 channels) 8-bit timer × 2 channels (Usable as 16-bit timer × 1 channel) Watchdog timer × 1 channel Watch timer × 1 channel					
Serial interface	CSI: 3 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels					
A/D converter	10-bit resolution × 12 channels					
DMA controller	6 channels					
Real-time output port	4-bit × 2 ports or 8-bit × 1 port					
I/O port	83 • Input: 12 • I/O: 71					
Power save function	STOP/IDLE/HALT					
Operating frequency	Main clock: 2 to 20 MHz (5 V) Subclock: 32.768 kHz					
Power supply voltage	4.0 to 5.5 V (A/D converter: 4.5 to 5.5 V)					
Power consumption (Typ.)	125 mW (5 V, 20 MHz)		165 mW (5 V, 20 MHz)	125 mW (5 V, 20 MHz)		165 mW (5 V, 20 MHz)
Package	100-pin plastic LQFP (fine pitch) (14 × 14 mm), 100-pin plastic QFP (14 × 20 mm)			100-pin plastic QFP (14 × 20 mm)		
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator					
Applications	AV equipment such as car audio systems, TVs, VCRs, and other applications					

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SB1 (2/4)

Part number	μ PD703031AY	μ PD703033AY	μ PD70F3033AY	μ PD703030AY★	μ PD703032AY	μ PD70F3032AY
CPU core	V850					
CPU performance (Dhrystone)	23 MIPS (20 MHz)					
Internal ROM size	128 KB	256 KB		384 KB	512 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM		Flash memory
Internal RAM size	12 KB	16 KB		20 KB	24 KB	
Address bus	22-bit					
Data bus	16-bit					
Interrupt function	External: 8, Internal: 32					
DSP function	16 × 16 = 32: 50 to 100 ns (20 MHz) 16 × 16 + 32 = 32: 150 ns (20 MHz)					
Timer	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 4 channels (Usable as 16-bit timer/event counter × 2 channels) 8-bit timer × 2 channels (Usable as 16-bit timer × 1 channel) Watchdog timer × 1 channel Watch timer × 1 channel					
Serial interface	CSI: 1 channel CSI/I ² C bus: 2 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels					
A/D converter	10-bit resolution × 12 channels					
DMA controller	6 channels					
Real-time output port	4-bit × 2 ports or 8-bit × 1 port					
I/O port	83 • Input: 12 • I/O: 71					
Power save function	STOP/IDLE/HALT					
Operating frequency	Main clock: 2 to 20 MHz (5V) Subclock: 32.768 kHz					
Power supply voltage	4.0 to 5.5 V (A/D converter: 4.5 to 5.5 V)					
Power consumption (Typ.)	125 mW (5 V, 20 MHz)		165 mW (5 V, 20 MHz)	125 mW (5 V, 20 MHz)		165 mW (5 V, 20 MHz)
Package	100-pin plastic LQFP (fine pitch) (14 × 14 mm), 100-pin plastic QFP (14 × 20 mm)			100-pin plastic QFP (14 × 20mm)		
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator					
Applications	AV equipment such as car audio systems, TVs, VCRs, and other applications					

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SB1 (3/4)

Part number	μPD703031B ★★	μPD703033B ★★	μPD70F3033B ★★	μPD703030B ★★	μPD703032B ★★	μPD70F3032B ★★
CPU core	V850					
CPU performance (Dhrystone)	23 MIPS (20 MHz)					
Internal ROM size	128 KB	256 KB		384 KB	512 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM		Flash memory
Internal RAM size	8 KB	16 KB		24 KB		
Address bus	22-bit					
Data bus	16-bit					
Interrupt function	External: 8, Internal: 31					
DSP function	16 × 16 = 32: 50 to 100 ns (20 MHz) 16 × 16 + 32 = 32: 150 ns (20 MHz)					
Timer	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 4 channels (Usable as 16-bit timer/event counter × 2 channels) 8-bit timer × 2 channels (Usable as 16-bit timer × 1 channel) Watchdog timer × 1 channel Watch timer × 1 channel					
Serial interface	CSI: 3 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels					
A/D converter	10-bit resolution × 12 channels					
DMA controller	6 channels					
Real-time output port	4-bit × 2 ports or 8-bit × 1 port					
I/O port	83 • Input: 12 • I/O: 71					
Power save function	STOP/IDLE/HALT					
Operating frequency	Main clock: 2 to 20 MHz (5 V) Subclock: 32.768 kHz					
Power supply voltage	4.0 to 5.5 V (A/D converter: 4.5 to 5.5 V)					
Power consumption (Typ.)	125 mW (target value) (5 V, 20 MHz)		165 mW (target value) (5 V, 20 MHz)	125 mW (target value) (5 V, 20 MHz)		165 mW (target value) (5 V, 20 MHz)
Package	100-pin plastic LQFP (fine pitch) (14 × 14 mm), 100-pin plastic QFP (14 × 20 mm)			100-pin plastic QFP (14 × 20 mm)		
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator					
Applications	AV equipment such as car audio systems, TVs, VCRs, and other applications					

★: Under development, ☆: Newly added product

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SB1 (4/4)

Part number	μPD703031BY ★★	μPD703033BY ★★	μPD70F3033BY ★★	μPD703030BY ★★	μPD703032BY ★★	μPD70F3032BY ★★
CPU core	V850					
CPU performance (Dhrystone)	23 MIPS (20 MHz)					
Internal ROM size	128 KB	256 KB		384 KB	512 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM		Flash memory
Internal RAM size	8 KB	16 KB		24 KB		
Address bus	22-bit					
Data bus	16-bit					
Interrupt function	External: 8, Internal: 32					
DSP function	16 × 16 = 32: 50 to 100 ns (20 MHz) 16 × 16 + 32 = 32: 150 ns (20 MHz)					
Timer	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 4 channels (Usable as 16-bit timer/event counter × 2 channels) 8-bit timer × 2 channels (Usable as 16-bit timer × 1 channel) Watchdog timer × 1 channel Watch timer × 1 channel					
Serial interface	CSI: 1 channel CSI/I ² C bus: 2 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels					
A/D converter	10-bit resolution × 12 channels					
DMA controller	6 channels					
Real-time output port	4-bit × 2 ports or 8-bit × 1 port					
I/O port	83 • Input: 12 • I/O: 71					
Power save function	STOP/IDLE/HALT					
Operating frequency	Main clock: 2 to 20 MHz (5V) Subclock: 32.768 kHz					
Power supply voltage	4.0 to 5.5 V (A/D converter: 4.5 to 5.5 V)					
Power consumption (Typ.)	125 mW (target value) (5 V, 20 MHz)		165 mW (target value) (5 V, 20 MHz)	125 mW (target value) (5 V, 20 MHz)		165 mW (target value) (5 V, 20 MHz)
Package	100-pin plastic LQFP (fine pitch) (14 × 14 mm), 100-pin plastic QFP (14 × 20 mm)			100-pin plastic QFP (14 × 20mm)		
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator					
Applications	AV equipment such as car audio systems, TVs, VCRs, and other applications					

★: Under development, ☆: Newly added product

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SB2 (1/4)

Part number	μPD703034A	μPD703035A	μPD70F3035A	μPD703036A ★	μPD703037A	μPD70F3037A
CPU core	V850					
CPU performance (Dhrystone)	15 MIPS (13 MHz)					
Internal ROM size	128 KB	256 KB		384 KB	512 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM		Flash memory
Internal RAM size	12 KB	16 KB		20 KB	24 KB	
Address bus	22-bit					
Data bus	16-bit					
Interrupt function	External: 8, Internal: 33					
DSP function	16 × 16 = 32: 77 to 154 ns (13 MHz) 16 × 16 + 32 = 32: 231 ns (13 MHz)					
Timer	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 4 channels (Usable as 16-bit timer/event counter × 2 channels) 8-bit timer × 2 channels (Usable as 16-bit timer × 1 channel) Watchdog timer × 1 channel Watch timer × 1 channel					
Serial interface	CSI: 3 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels					
Bus controller	IEBus controller (Simple version)					
A/D converter	10-bit resolution × 12 channels					
DMA controller	6 channels					
Real-time output port	4-bit × 2 ports or 8-bit × 1 port					
I/O port	83 • Input: 12 • I/O: 71					
Power save function	STOP/IDLE/HALT					
Operating frequency	Main clock: 2 to 13 MHz (5 V) Subclock: 32.768 kHz					
Power supply voltage	4.0 to 5.5 V (A/D converter: 4.5 to 5.5 V)					
Power consumption (Typ.)	75 mW (5 V, 13 MHz)		125 mW (5 V, 13 MHz)	75 mW (5 V, 13 MHz)		125 mW (5 V, 13 MHz)
Package	100-pin plastic LQFP (fine pitch) (14 × 14 mm), 100-pin plastic QFP (14 × 20 mm)			100-pin plastic QFP (14 × 20 mm)		
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator					
Applications	AV equipment such as car audio systems, TVs, VCRs, and other applications					

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SB2 (2/4)

Part number	μPD703034AY	μPD703035AY	μPD70F3035AY	μPD703036AY★	μPD703037AY	μPD70F3037AY
CPU core	V850					
CPU performance (Dhrystone)	15 MIPS (13 MHz)					
Internal ROM size	128 KB	256 KB		384 KB	512 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM		Flash memory
Internal RAM size	12 KB	16 KB		20 KB	24 KB	
Address bus	22-bit					
Data bus	16-bit					
Interrupt function	External: 8, Internal: 34					
DSP function	16 × 16 = 32: 77 to 154 ns (13 MHz) 16 × 16 + 32 = 32: 231 ns (13 MHz)					
Timer	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 4 channels (Usable as 16-bit timer/event counter x 2 channels) 8-bit timer × 2 channels (Usable as 16-bit timer × 1 channel) Watchdog timer × 1 channel Watch timer × 1 channel					
Serial interface	CSI: 1 channel CSI/I ² C bus: 2 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels					
Bus controller	IEBus controller (Simple version)					
A/D converter	10-bit resolution × 12 channels					
DMA controller	6 channels					
Real-time output port	4-bit × 2 ports or 8-bit × 1 port					
I/O port	83 • Input: 12 • I/O: 71					
Power save function	STOP/IDLE/HALT					
Operating frequency	Main clock: 2 to 13 MHz (5 V) Subclock: 32.768 kHz					
Power supply voltage	4.0 to 5.5 V (A/D converter: 4.5 to 5.5 V)					
Power consumption (Typ.)	75 mW (5 V, 13 MHz)		125 mW (5 V, 13 MHz)	75 mW (5 V, 13 MHz)		125 mW (5 V, 13 MHz)
Package	100-pin plastic LQFP (fine pitch) (14 × 14 mm), 100-pin plastic QFP (14 × 20 mm)			100-pin plastic QFP (14 × 20 mm)		
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator					
Applications	AV equipment such as car audio systems, TVs, VCRs, and other applications					

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SB2 (3/4)

Part number	μPD703034B★★	μPD703035B★★	μPD70F3035B★★	μPD703036H★★	μPD703037H★★	μPD70F3037H★★
CPU core	V850					
CPU performance (Dhrystone)	15 MIPS (13 MHz)			21 MIPS (19 MHz)		
Internal ROM size	128 KB	256 KB		384 KB	512 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM		Flash memory
Internal RAM size	8 KB	16 KB		24 KB		
Address bus	22-bit					
Data bus	16-bit					
Interrupt function	External: 8, Internal: 33					
DSP function	16 × 16 = 32: 77 to 154 ns (13 MHz) 16 × 16 + 32 = 32: 231 ns (13 MHz)			16 × 16 = 32: 53 to 106 ns (19 MHz) 16 × 16 + 32 = 32: 159 ns (19 MHz)		
Timer	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 4 channels (Usable as 16-bit timer/event counter × 2 channels) 8-bit timer × 2 channels (Usable as 16-bit timer × 1 channel) Watchdog timer × 1 channel Watch timer × 1 channel					
Serial interface	CSI: 3 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels					
Bus controller	IEBus controller (Simple version)					
A/D converter	10-bit resolution × 12 channels					
DMA controller	6 channels					
Real-time output port	4-bit × 2 ports or 8-bit × 1 port					
I/O port	83 • Input: 12 • I/O: 71					
Power save function	STOP/IDLE/HALT					
Operating frequency	Main clock: 2 to 13 MHz (5 V) Subclock: 32.768 kHz			Main clock: 2 to 19 MHz (5 V) Subclock: 32.768 kHz		
Power supply voltage	4.0 to 5.5 V (A/D converter: 4.5 to 5.5 V)					
Power consumption (Typ.)	75 mW (target value) (5 V, 13 MHz)	125 mW (target value) (5 V, 13 MHz)		120 mW (target value) (5 V, 19 MHz)		160 mW (target value) (5 V, 19 MHz)
Package	100-pin plastic LQFP (fine pitch) (14 × 14 mm), 100-pin plastic QFP (14 × 20 mm)			100-pin plastic QFP (14 × 20 mm)		
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator					
Applications	AV equipment such as car audio systems, TVs, VCRs, and other applications					

★: Under development, ☆: Newly added product

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SB2 (4/4)

Part number	μPD703034BY ★ ☆	μPD703035BY ★ ☆	μPD70F3035BY ★ ☆	μPD703036HY ★ ☆	μPD703037HY ★ ☆	μPD70F3037HY ★ ☆
CPU core	V850					
CPU performance (Dhrystone)	15 MIPS (13 MHz)			21 MIPS (19 MHz)		
Internal ROM size	128 KB	256 KB		384 KB	512 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM		Flash memory
Internal RAM size	8 KB	16 KB		24 KB		
Address bus	22-bit					
Data bus	16-bit					
Interrupt function	External: 8, Internal: 34					
DSP function	16 × 16 = 32: 77 to 154 ns (13 MHz) 16 × 16 + 32 = 32: 231 ns (13 MHz)			16 × 16 = 32: 53 to 106 ns (19 MHz) 16 × 16 + 32 = 32: 159 ns (19 MHz)		
Timer	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 4 channels (Usable as 16-bit timer/event counter x 2 channels) 8-bit timer × 2 channels (Usable as 16-bit timer × 1 channel) Watchdog timer × 1 channel Watch timer × 1 channel					
Serial interface	CSI: 1 channel CSI/I ² C bus: 2 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels					
Bus controller	IEBus controller (Simple version)					
A/D converter	10-bit resolution × 12 channels					
DMA controller	6 channels					
Real-time output port	4-bit × 2 ports or 8-bit × 1 port					
I/O port	83 • Input: 12 • I/O: 71					
Power save function	STOP/IDLE/HALT					
Operating frequency	Main clock: 2 to 13 MHz (5 V) Subclock: 32.768 kHz			Main clock: 2 to 19 MHz (5 V) Subclock: 32.768 kHz		
Power supply voltage	4.0 to 5.5 V (A/D converter: 4.5 to 5.5 V)					
Power consumption (Typ.)	75 mW (target value) (5 V, 13 MHz)	125 mW (target value) (5 V, 13 MHz)		120 mW (target value) (5 V, 19 MHz)		160 mW (target value) (5 V, 19 MHz)
Package	100-pin plastic LQFP (fine pitch) (14 × 14 mm), 100-pin plastic QFP (14 × 20 mm)			100-pin plastic QFP (14 × 20 mm)		
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator					
Applications	AV equipment such as car audio systems, TVs, VCRs, and other applications					

★: Under development, ☆: Newly added product

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SC1, V850/SC2, V850/SC3

Part number	μPD703068Y ★ ★	μPD703069Y ★ ★	μPD703088Y ★ ★	μPD703089Y ★ ★	μPD70F3089Y ★ ★
CPU core	V850				
Alias	V850/SC1	V850/SC2	V850/SC3		V850/SC1 V850/SC2 V850/SC3
CPU performance (Dhrystone)	23 MIPS (20 MHz)	21 MIPS (19 MHz)	18 MIPS (16 MHz)		23 MIPS (20 MHz)
Internal ROM size	512 KB				
Internal ROM type	Mask ROM				Flash memory
Internal RAM size	24 KB				
Address bus	22-bit				
Data bus	16-bit				
Interrupt function	External: 11, Internal: 40	External: 11, Internal: 42	External: 11, Internal: 44	External: 11, Internal: 47	
DSP function	16 × 16 = 32: 50 to 100 ns (20 MHz) 16 × 16 + 32 = 32: 150 ns (20 MHz)	16 × 16 = 32: 53 to 106 ns (19 MHz) 16 × 16 + 32 = 32: 159 ns (19 MHz)	16 × 16 = 32: 60 to 120 ns (16 MHz) 16 × 16 + 32 = 32: 180 ns (16 MHz)		16 × 16 = 32: 50 to 100 ns (20 MHz) 16 × 16 + 32 = 32: 150 ns (20 MHz)
Timer	16-bit timer/event counter × 10 channels Watchdog timer × 1 channel Watch timer × 1 channel				
Serial interface	CSI (8-bit)/UART: 1 channel CSI (8- to 16-bit variable)/UART: 1 channel CSI (8-bit)/I ² C: 2 channels CSI (8- or 16-bit): 2 channels UART: 2 channels Dedicated baud rate generator: 5 channels				
Bus controller	—	IEBus controller (Simple version) × 1 channel	FCAN controller × 1 channel (conformed on CAN protocol Ver. 2.0 (part B), transmission speed: 1 Mbps maximum)	FCAN controller × 2 channels (conformed on CAN protocol Ver. 2.0 (part B), transmission speed: 1 Mbps maximum)	IEBus controller (Simple version) × 1 channel, FCAN controller × 2 channels (conformed on CAN protocol Ver. 2.0 (part B), transmission speed: 1 Mbps maximum)
A/D converter	10-bit resolution × 12 channels				
DMA controller	6 channels				
I/O port	124 • Input: 12 • I/O: 112				
Power save function	STOP/IDLE/HALT				
Operating frequency	Main clock: 4 to 20 MHz (5 V) Subclock: 32.768 kHz	Main clock: 4 to 19 MHz (5 V) Subclock: 32.768 kHz	Main clock: 4 to 16 MHz (5 V) Subclock: 32.768 kHz		Main clock: 4 to 20 MHz (5 V) Subclock: 32.768 kHz
Power supply voltage	3.5 to 5.5 V (A/D converter: 4.5 to 5.5 V)				4.0 to 5.5 V (A/D converter: 4.5 to 5.5 V)
Power consumption (Typ.)	125 mW (target value) (5 V, 20 MHz)	120 mW (target value) (5 V, 19 MHz)	110 mW (target value) (5 V, 16 MHz)		150 mW (target value) (5 V, 20 MHz)
Package	144-pin plastic LQFP (fine pitch) (20 × 20 mm)				
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator				
Applications	Audio equipments, and other applications	Car audio systems			Car audio systems, audio equipments, and other applications

★: Under development, ☆: Newly added product

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SF1

Part number	μPD703078Y	μPD703079Y	μPD70F3079Y
CPU core	V850		
CPU performance (Dhrystone)	18 MIPS (16 MHz)		
Internal ROM size	256 KB		
Internal ROM type	Mask ROM	Flash memory	
Internal RAM size	16 KB		
Address bus	22-bit		
Data bus	16-bit		
Interrupt function	External: 8, Internal: 33	External: 8, Internal: 36	
DSP function	16 × 16 = 32: 62.5 to 125 ns (16 MHz) 16 × 16 + 32 = 32: 187.5 ns (16 MHz)		
Timer	16-bit timer/event counter × 8 channels Watchdog timer × 1 channel Watch timer × 1 channel		
Serial interface	CSI: 1 channel CSI/I ² C bus: 1 channel CSI/UART: 2 channels Dedicated baud rate generator: 3 channels		
Bus controller	FCAN controller × 1 channel (conformed on CAN protocol Ver.2.0 (part B), transmission speed: 1 Mbps maximum)	FCAN controller × 2 channels (conformed on CAN protocol Ver.2.0 (part B), transmission speed: 1 Mbps maximum)	
A/D converter	10-bit resolution × 12 channels		
DMA controller	6 channels		
I/O port	84 • Input: 12 • I/O: 72		
Power save function	STOP/IDLE/HALT		
Operating frequency	Main clock: 4 to 16 MHz (5 V) Subclock: 32.768 kHz		
Power supply voltage	4.0 to 5.5 V (A/D converter: 4.5 to 5.5 V) (16 MHz)		
Power consumption (Typ.)	75 mW (5 V, 16 MHz)		125 mW (5 V, 16 MHz)
Package	100-pin plastic LQFP (fine pitch) (14 × 14 mm), 100-pin plastic QFP (14 × 20 mm)		
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator		
Applications	Car audio systems		

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SV1 (1/2)

Part number	μ PD703041	μ PD703039	μ PD703040	μ PD70F3040	μ PD703038	μ PD70F3038
CPU core	V850					
CPU performance (Dhrystone)	23 MIPS (20 MHz)/18 MIPS (16 MHz)					
Internal ROM size	192 KB	256 KB			384 KB	
Internal ROM type	Mask ROM			Flash memory	Mask ROM	Flash memory
Internal RAM size	8 KB		16 KB			
Address bus	22-bit					
Data bus	16-bit					
Interrupt function	External: 8, Internal: 44					
DSP function	16 $\times$ 16 = 32: 50 to 100 ns (20 MHz) 16 $\times$ 16 + 32 = 32: 150 ns (20 MHz)					
Timer	24-bit timer/event counter $\times$ 2 channels 16-bit timer/event counter $\times$ 2 channels 8-bit timer/event counter $\times$ 8 channels (Usable as 16-bit timer/event counter $\times$ 4 channels) Watchdog timer $\times$ 1 channel Watch timer $\times$ 1 channel					
Serial interface	CSI: 3 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels					
A/D converter	10-bit resolution $\times$ 16 channels					
DMA controller	6 channels					
Real-time output port	2 channels: 4-bit $\times$ 2 ports or 8-bit $\times$ 1 port					
I/O port	151 • Input: 16 • I/O: 135					
Other functions	Vsync/Hsync separator circuit PWM: 12 to 16-bit resolution $\times$ 4 channels					
Power save function	STOP/IDLE/HALT					
Operating frequency	Main clock: 4 to 20 MHz (3.3 V)/4 to 16 MHz (3 V)					
Power supply voltage	3.1 to 3.6 V (20 MHz) 2.7 to 3.6 V (16 MHz)					
Power consumption (Typ.)	82mW (3.3 V, 20 MHz)/72 mW (3.3 V, 16 MHz)			148mW (3.3 V, 20 MHz)/ 132 mW (3.3 V, 16 MHz)	82 mW (3.3 V, 20 MHz)/ 72 mW (3.3 V, 16 MHz)	148 mW (3.3 V, 20 MHz)/ 132 mW (3.3 V, 16 MHz)
Package	176-pin plastic LQFP (fine pitch) (24 $\times$ 24 mm)	176-pin plastic LQFP (fine pitch) (24 $\times$ 24mm), 180-pin plastic FBGA (13 $\times$ 13 mm)			180-pin plastic FBGA (13 $\times$ 13 mm)	
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator					
Applications	Analog camcorders, battery-driven equipment (DVC, mobile terminals, etc.)					

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SV1 (2/2)

Part number	μPD703041Y	μPD703039Y	μPD703040Y	μPD70F3040Y	μPD703038Y	μPD70F3038Y
CPU core	V850					
CPU performance (Dhrystone)	23 MIPS (20 MHz)/18 MIPS (16 MHz)					
Internal ROM size	192 KB	256 KB			384 KB	
Internal ROM type	Mask ROM			Flash memory	Mask ROM	Flash memory
Internal RAM size	8 KB		16 KB			
Address bus	22-bit					
Data bus	16-bit					
Interrupt function	External: 8, Internal: 45					
DSP function	16 × 16 = 32: 50 to 100 ns (20 MHz) 16 × 16 + 32 = 32: 150 ns (20 MHz)					
Timer	24-bit timer/event counter × 2 channels 16-bit timer/event counter × 2 channels 8-bit timer/event counter × 8 channels (Usable as 16-bit timer/event counter × 4 channels) Watchdog timer × 1 channel Watch timer × 1 channel					
Serial interface	CSI: 1 channel CSI/I ² C bus: 2 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels					
A/D converter	10-bit resolution x 16 channels					
DMA controller	6 channels					
Real-time output port	2 channels: 4-bit × 2 ports or 8-bit × 1 port					
I/O port	151 • Input: 16 • I/O: 135					
Other functions	Vsync/Hsync separator circuit PWM: 12 to 16-bit resolution × 4 channels					
Power save function	STOP/IDLE/HALT					
Operating frequency	Main clock: 4 to 20 MHz (3.3 V)/4 to 16 MHz (3 V)					
Power supply voltage	3.1 to 3.6 V (20 MHz) 2.7 to 3.6 V (16 MHz)					
Power consumption (Typ.)	82 mW (3.3 V, 20 MHz)/72 mW (3.3 V, 16 MHz)			148 mW (3.3 V, 20 MHz)/ 132 mW (3.3 V, 16 MHz)	82 mW (3.3 V, 20 MHz) / 72 mW (3.3 V, 16 MHz)	148 mW (3.3 V, 20 MHz) / 132 mW (3.3 V, 16 MHz)
Package	176-pin plastic LQFP (fine pitch) (24 × 24mm)	176-pin plastic LQFP (fine pitch) (24 × 24 mm), 180-pin plastic FBGA (13 × 13 mm)			180-pin plastic FBGA (13 × 13 mm)	
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator					
Applications	Analog camcorders, battery-driven equipment (DVC, mobile terminals, etc.)					

Caution The maximum operating frequency of the I²C bus is 17 MHz.

32-Bit Single-Chip Microcontroller

V850 Family

■ V853

Part number	μPD703003A	μPD703004A	μPD70F3003A	μPD703025A	μPD70F3025A
CPU core	V850				
CPU performance (Dhrystone)	38 MIPS (33 MHz)				
Internal ROM size	128 KB	96 KB	128 KB	256 KB	
Internal ROM type	Mask ROM		Flash memory	Mask ROM	Flash memory
Internal RAM size	4 KB			8 KB	
Address bus	20-bit				
Data bus	16-bit				
Interrupt function	External: 17, Internal: 32				
DSP function	16 × 16 = 32: 30 to 60 ns (33 MHz) 16 × 16 + 32 = 32: 90 ns (33 MHz)				
Timer	16-bit timer/event counter × 4 channels 16-bit timer × 1 channel				
Serial interface	CSI: 2 channels CSI/UART: 2 channels Dedicated baud rate generator: 3 channels				
A/D converter	10-bit resolution × 8 channels				
I/O port	75 • Input: 8 • I/O: 67				
Other functions	PWM: 8/9/10/12-bit resolution × 2 channels D/A converter: 8-bit resolution × 2 channels				
Power save function	STOP/IDLE/HALT				
Operating frequency	5 to 33 MHz (5 V)				
Power supply voltage	4.5 to 5.5 V				
Power consumption (Typ.)	365 mW (5 V, 33 MHz)		425 mW (5V, 33 MHz)	450 mW (5 V, 33 MHz)	480 mW (5 V, 33 MHz)
Package	100-pin plastic LQFP (fine pitch) (14 × 14 mm)				
Development tools	Real-time OS, task debugger, C compiler, integrated debugger, system simulator, system performance analyzer, device file, in-circuit emulator				
Applications	HDDs, PPCs, VCRs, motor control, robots, LBPs, printers, NC machine tools, single-lens reflex cameras, digital still cameras, automotive electronics, etc.				

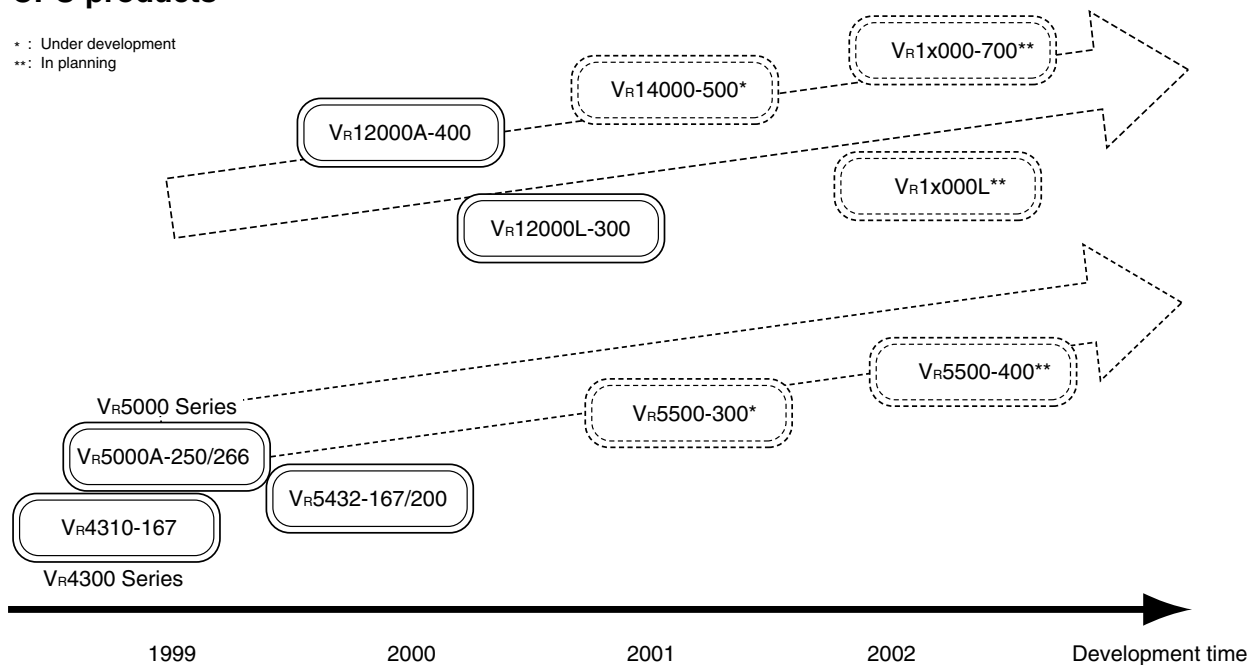
64-Bit Microprocessor

V_R Series

■ V_R Series Road Map

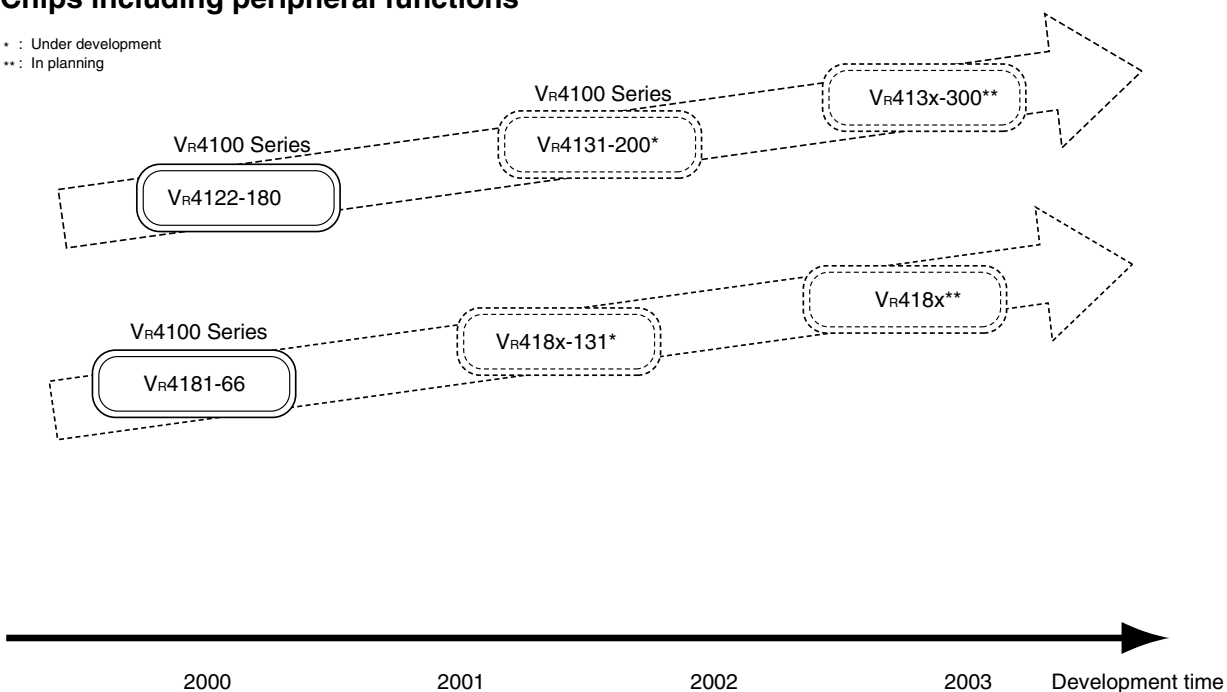
CPU products

- * : Under development
** : In planning



Chips including peripheral functions

- * : Under development
** : In planning



64-Bit Microprocessor

V_R Series

■ V_R4100 Series

Part number	μPD30121-131	μPD30121-168	μPD30122-150 ☆	μPD30122-180	μPD30131 ☆ ☆	μPD30181
Alias	V _R 4121		V _R 4122		V _R 4131	V _R 4181
Internal frequency	131 MHz	168 MHz	150 MHz	180 MHz	200 MHz	66 MHz
Power supply voltage	External: 3.3 V, Internal: 2.5 V		External: 3.3 V, Internal: 1.8 V		External: 3.3 V, Internal: 1.5V	External: 3.3 V, Internal: 2.5 V
Cache	Instruction: 16 KB, data: 8 KB Direct map		Instruction: 32 KB, data: 16 KB Direct map		Instruction: 16 KB, data: 16 KB Two-way set associative	Instruction: 4 KB, data: 4 KB Direct map
CPU performance	157 MIPS	202 MIPS	180 MIPS	216 MIPS	340 MIPS	87 MIPS
Features	• CPU core: V_R4120 • On-chip peripheral functions ideal for PDAs • Low power consumption • Employs 0.25 μm process rule		• CPU core: V_R4120 • On-chip peripheral functions ideal for PDAs • On-chip PCI bus interface • Low power consumption • High-speed processing by 180 MHz operation and 0.18 μm process rule		• CPU core: V_R4130 • On-chip peripheral functions ideal for PDAs • Low power consumption • On-chip PCI bus interface • High-speed processing by 200 MHz operation and 0.13 μm process rule	• CPU core: V_R4110 • On-chip peripheral functions ideal for palm-size PCs • On-chip LCD controller • On-chip CompactFlash interface • Low power consumption • Employs 0.25 μm process rule
Package	224-pin plastic FBGA (16 × 16 mm)				224-pin plastic FBGA (16 × 16 mm)	160-pin plastic LQFP (fine pitch) (24 × 24 mm)
Applications	PDAs, various embedded equipment		PDAs, various embedded equipment		PDAs, various embedded equipment	PDAs, various embedded equipment

★: Under development, ☆: Newly added product

64-Bit Microprocessor**V_R Series****■ V_R4300 Series**

Part number	μPD30200-100	μPD30200-80	μPD30210-133	μPD30210-167
Alias	V _R 4300	V _R 4305	V _R 4310	
Internal frequency	100 MHz	80 MHz	133 MHz	167 MHz
Power supply voltage	3.3 V			
Cache	Instruction: 16 KB, data: 8 KB Direct map			
CPU performance	131 MIPS 60 SPECint92 45 SPECfp92	106 MIPS 48 SPECint92 36 SPECfp92	177 MIPS 80 SPECint92 60 SPECfp92	221 MIPS 100 SPECint92 75 SPECfp92
Features	• Software compatible with V _R 4000 Series • 32-bit external bus • High-speed floating-point operation		• Software compatible with V _R 4300 • 32-bit external bus • High-speed floating-point operation	
Package	120-pin plastic QFP (28 × 28 mm)			
Applications	Embedded equipment for LBPs, game machines, etc.			

64-Bit Microprocessor

V_R Series

■ V_R5000 Series

Part number	μPD30500-150	μPD30500-180	μPD30500-200	μPD30500A-250	μPD30500A-266
Alias	V _R 5000			V _R 5000A	
Internal frequency	150 MHz	180 MHz	200 MHz	250 MHz	266 MHz
Power supply voltage	3.3 V			External: 3.3 V, Internal: 2.5 V	
Cache	Instruction: 32 KB, data: 32 KB Two-way set associative				
CPU performance	278 MIPS 5.5 SPECint95 5.5 SPECfp95 (200 MHz)			376 MIPS 7.0 SPECint95 7.0 SPECfp95 (266 MHz)	
Features	• Two-way superscalar • On-chip large primary cache • On-chip secondary cache interface				
Package	272-pin plastic BGA (C/D advanced type) (29 × 29 mm), 223-pin ceramic PGA (48 × 48 mm)			272-pin plastic BGA (C/D advanced type) (29 × 29 mm)	
Applications	High-end embedded equipment for color LBPs, network routers, etc.				

64-Bit Microprocessor**V_R Series****■ V_R5432, V_R5500**

Part number	μ PD30541-167	μ PD30541-200★	μ PD30550★★
Alias	V _R 5432		V _R 5500
Internal frequency	167 MHz	200 MHz	300 MHz
Power supply voltage	External: 3.3 V, Internal: 2.5 V	External: 3.3 V, Internal: 2.7 V	External: 3.3 V, Internal: 1.5 V
Cache	Instruction: 32 KB, data: 32 KB Two-way set associative		
CPU performance	316 MIPS 6.6 SPECint95 3.6 SPECfp95	376 MIPS 7.8 SPECint95 4.2 SPECfp95	603 MIPS
Features	• Two-way superscalar • On-chip large primary cache with line-lock function • Hardware debugging function		• Two-way superscalar • On-chip large primary cache with line-lock function • Hardware debugging function • Low power consumption
Package	208-pin plastic QFP (fine pitch) (28 × 28 mm)		272-pin plastic BGA (C/D advanced type) (29 × 29 mm)
Applications	High-end embedded equipment for color LBPs, STBs, etc.		High-end embedded equipment for STBs, RAIDs, etc.

★: Under development, ★★: Newly added product

64-Bit Microprocessor

V_R Series

■ V_R12000

Part number	μPD30710A	μPD30710L ☆
Alias	V _R 12000A	V _R 12000L
Internal frequency	400 MHz	300 MHz
Power supply voltage	1.9 V	1.8 V
Cache	Instruction : 32 KB, data : 32 KB Two-way set associative	
CPU performance	353 SPECint2000, 407 SPECfp2000	18.4 SPECint95, 34.4 SPECfp95
Features	• Four-way superscalar • On-chip FPU and MMU • On-chip multiprocessor interface • On-chip secondary cache interface • On-chip branch prediction	
Package	1153-pin plastic BGA (flip chip type) (35 × 35 mm)	576-pin plastic BGA (C/D advanced type) (40 × 40 mm)
Applications	Advanced computers for workstations, servers, etc.	Servers, advanced embedded equipment

☆: Newly added product

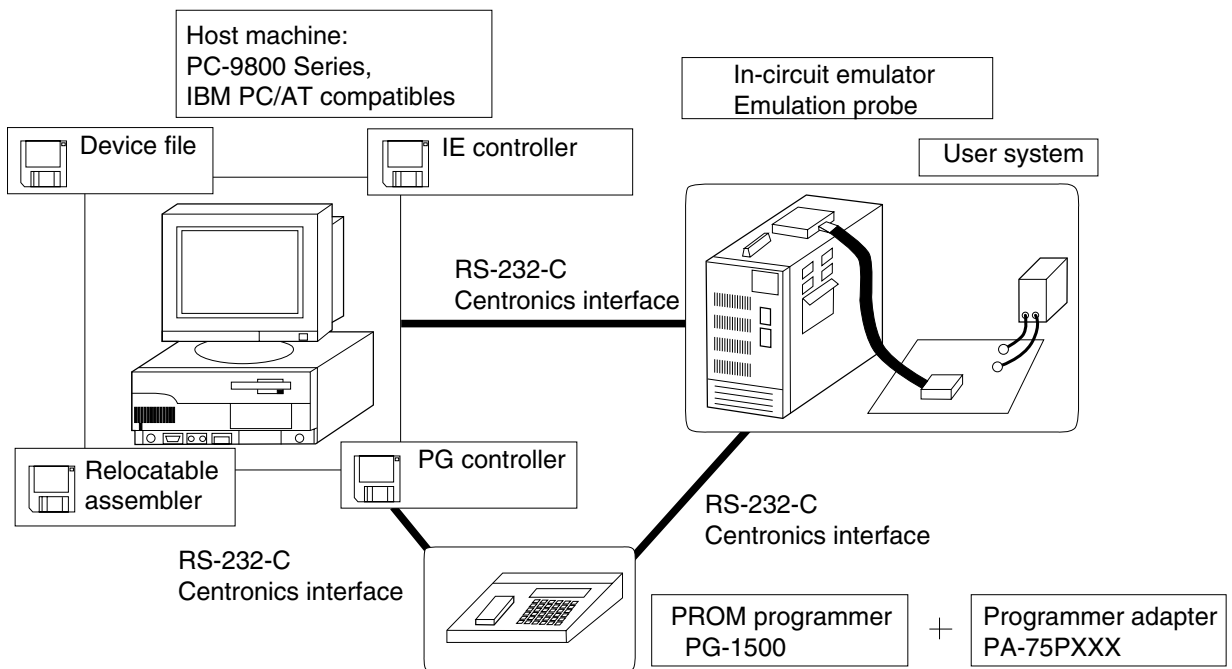
64-Bit Microprocessor

V_R Series

■ Companion Chips for V_R Series

Part number	μ PD31172	μ PD31173	μ PD31577 ★ ☆
Alias	V _{RC} 4172	V _{RC} 4173	V _{RC} 5477
Target CPU	V _R 4121	V _R 4122, V _R 4131	V _R 5432, V _R 5500
Internal frequency	48 MHz		83 MHz
Power supply voltage	3.0 to 3.6 V		External: 3.3 V, Internal: 2.5 V
Features	• Extends peripheral functions for CPU • On-chip SDRAM controller, USB controller, and parallel interface	• Extends peripheral functions for CPU • On-chip USB host controller, PC card controller, and AC-Link interface	• Extends peripheral functions for CPU • On-chip memory controller, USB host/peripheral controller, and AC-Link interface
Package	208-pin plastic FBGA (15 × 15 mm)	304-pin plastic FBGA (19 × 19 mm)	352-pin plastic BGA (35 × 35 mm)
Applications	PDAs such as handheld PCs, palm-size PCs, etc.		High-end embedded equipment for STBs, RAIDs, etc.

★: Under development, ☆: Newly added product

Development Tools**75XL Series Development Environment**

Development Tools

75XL Series Software Tools**■ List of Software Tools**

Host machine	Software tool name
PC-9800 Series	Relocatable assembler RA75X
IBM PC/AT and compatibles	
PC98-NX Series	IE control program IE75X

■ List of Device Files

Target device	Device file name	Target device	Device file name
μPD750004	DF750008	μPD753036	DF753036
μPD750006		μPD75P3036	
μPD750008			
μPD75P0016			
μPD750104		μPD753104	DF753108
μPD750106		μPD753106	
μPD750108		μPD753108	
μPD75P0116		μPD75P3116	
μPD750064	DF750068	μPD753204	DF753208
μPD750066		μPD753206	
μPD750068		μPD753208	
μPD75P0076		μPD75P3216	
μPD753012A	DF753017	μPD754302	DF754304
μPD753016A		μPD754304	
μPD753017A		μPD75P4308	
μPD75P3018A			

Development Tools

75XL Series Hardware Tools

■ Common Hardware Tools

Tool name	Product name
In-circuit emulator	IE-75001-R
Emulation board	IE-75300-R-EM

■ List of Hardware Tools

Target device		Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Device name	Package		
μ PD750004 μ PD750006	42-pin SDIP	EP-75008CU-R	—
μ PD750008 μ PD75P0016	44-pin QFP (10 × 10 mm)	EP-75008GB-R	EV-9200G-44
μ PD750104 μ PD750106	42-pin SDIP	EP-75008CU-R	—
μ PD750108 μ PD75P0116	44-pin QFP (10 × 10 mm)	EP-75008GB-R	EV-9200G-44
μ PD750064 μ PD750066	42-pin SDIP	EP-750068CU-R	—
μ PD750068 μ PD75P0076	42-pin SSOP	EP-750068GT-R	EV-9500GT-42
μ PD753012A μ PD753016A	80-pin QFP (14 × 14 mm)	EP-753017GC-R	EV-9200GC-80
μ PD753017A μ PD75P3018A	80-pin TQFP (12 × 12 mm)	EP-753017GK-R	TGK-080SDW ^{Note}
μ PD753036 μ PD75P3036	80-pin QFP (14 × 14 mm)	EP-75336GC-R	EV-9200GC-80
	80-pin TQFP (12 × 12 mm)	EP-75336GK-R	TGK-080SDW ^{Note}
μ PD753104 μ PD753106	64-pin QFP (14 × 14 mm)	EP-753108GC-R	EV-9200GC-64
μ PD753108 μ PD75P3116	64-pin LQFP (12 × 12 mm)	EP-753108GK-R	TGK-064SBW ^{Note}
μ PD753204 μ PD753206 μ PD753208 μ PD75P3216	48-pin SSOP	EP-753208GT-R	EV-9500GT-48
μ PD754302 μ PD754304 μ PD75P4308	36-pin SSOP	EP-754304GS-R	EV-9500GS-36

Note This is a product of Tokyo Eletech Corporation.

Development Tools

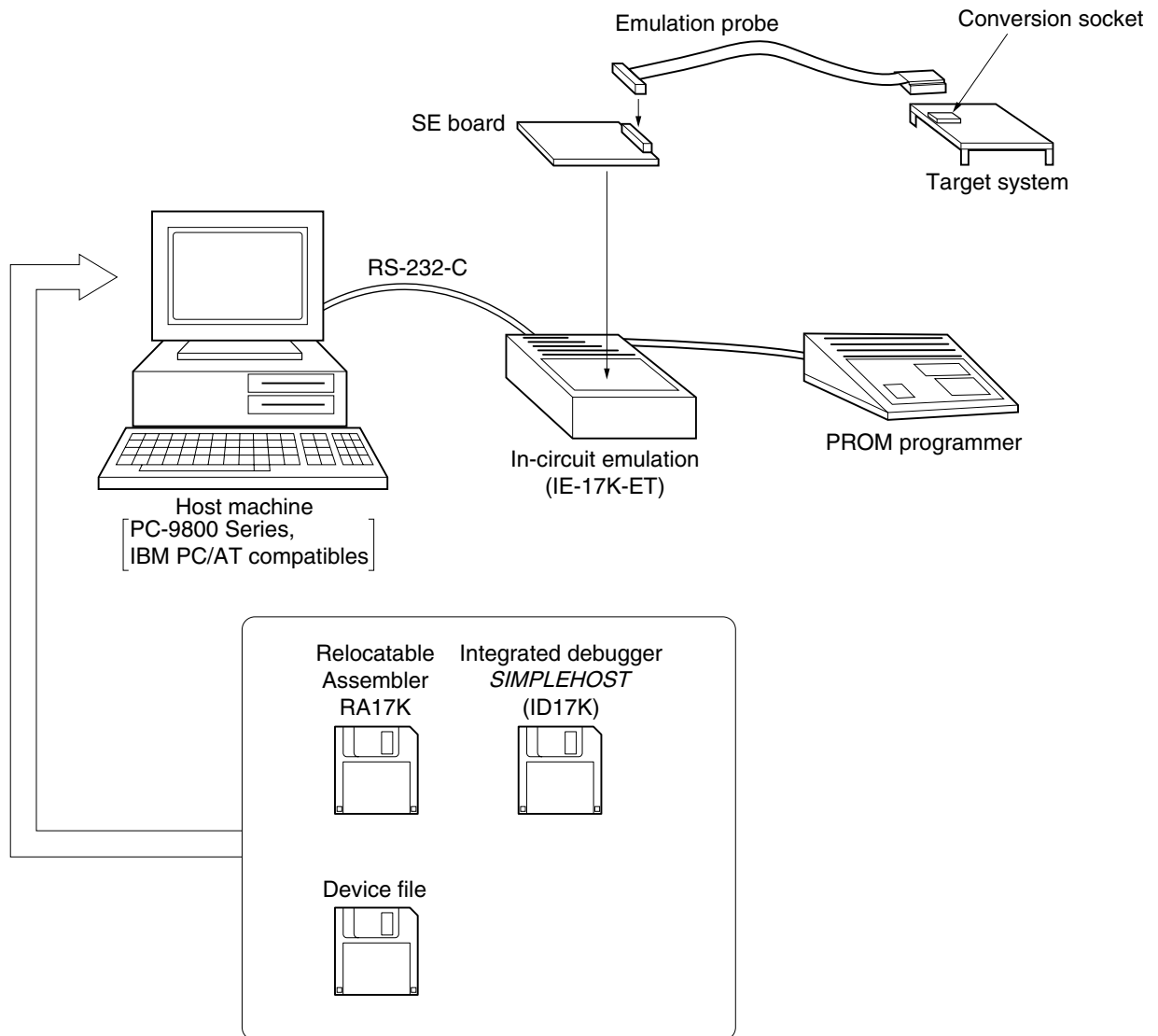
75XL Series Programming Environment

■ Common PROM Programming Tools

Tool name	Product name
PROM programmer	PG-1500
Writing module	Writing module Adapter board for 4-bit microcontroller (supplied with PG-1500)

■ PROM Programming Environment

Target device		Corresponding PROM product	Programmer adapter
Device name	Package		
μ PD750004	42-pin SDIP	μ PD75P0016CU	PA-75P008CU
μ PD750006	44-pin QFP (10 × 10 mm)	μ PD75P0016GB-3B4	PA-75P0016GB
μ PD750008		μ PD75P0016GB-3BS	
μ PD750104	42-pin SDIP	μ PD75P0116CU	PA-75P008CU
μ PD750106	44-pin QFP (10 × 10 mm)	μ PD75P0116GB	PA-75P008CU
μ PD750108		μ PD75P0116GB-3BS-MTX	PA-75P0016GB
μ PD750064	42-pin SDIP	μ PD75P0076CU	PA-75P008CU
μ PD750066			PA-75P0076CU
μ PD750068	42-pin SSOP	μ PD75P0076GT	PA-75P0076CU
μ PD753012A	80-pin QFP (14 × 14 mm)	μ PD75P3018AGC-3B9	PA-75P316BGC
μ PD753016A		μ PD75P3018AGC-8BT	PA-75P3018AGC-8BT
μ PD753017A	80-pin TQFP (12 × 12 mm)	μ PD75P3018AGK-BE9	PA-75P316BGK
		μ PD75P3018AGK-9EU	PA-75P3018AGK-9EU
μ PD753036	80-pin QFP (14 × 14 mm)	μ PD75P3036GC	PA-75P328GC
	80-pin TQFP (12 × 12 mm)	μ PD75P3036GK	PA-75P336GK
μ PD753104	64-pin QFP (14 × 14 mm)	μ PD75P3116GC-8BS	PA-75P3116GC-8BS
μ PD753106			
μ PD753108	64-pin LQFP (12 × 12 mm)	μ PD75P3116GK	PA-75P3116GK
μ PD753204	48-pin SSOP	μ PD75P3216GT	PA-75P3216GT
μ PD753206			
μ PD753208			
μ PD754302	36-pin SSOP	μ PD75P4308GS	PA-75P4308GS
μ PD754304			

Development Tools**17K Series Development Environment**

Development Tools

17K Series Software Tools

■ List of Software Tools

Host machine	Software tool name
PC-9800 Series	Relocatable assembler RA17K
IBM PC/AT and compatibles	
PC98-NX Series	Integrated debugger <i>SIMPLEHOST</i>

■ List of Device Files

Target device	Device file name	Target device	Device file name	Target device	Device file name
μ PD17003A	AS17003	μ PD17704A	AS17707	μ PD17225	AS17225
		μ PD17705A		μ PD17226	
μ PD17005	AS17005	μ PD17707A		μ PD17227	
μ PD17P005		μ PD17708A		μ PD17228	
		μ PD17709A		μ PD17P228	
μ PD17010	AS17010	μ PD17P709A		μ PD17230	AS17235
μ PD17P010		μ PD17717		μ PD17231	
		μ PD17718		μ PD17232	
		μ PD17719		μ PD17233	
		μ PD17P719		μ PD17234	
μ PD17012	AS17012	μ PD17934A	AS17934	μ PD17235	
μ PD17P012				μ PD17236	
				μ PD17P236	
μ PD17015	AS17015			μ PD17240	AS17246*
μ PD17016	AS17016	μ PD17203A	AS17203	μ PD17241	
μ PD17017		μ PD17P203A		μ PD17242	
				μ PD17243	
μ PD17071	AS17071	μ PD17204	AS17204	μ PD17244	
μ PD17072		μ PD17P204		μ PD17245	
μ PD17073				μ PD17246	
μ PD17P073				μ PD17P246	

★: Under development

Development Tools**17K Series Hardware Tools****■ Common Hardware Tools**

Tool name	Product name
In-circuit emulator	IE-17K-ET

Development Tools

17K Series Hardware Tools

■ List of Hardware Tools (1/2)

Target device		SE board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Device name	Package			
μ PD17003A	80-pin QFP (14 × 20 mm)	SE-17010	EP-17003GF	EV-9200G-80
μ PD17005 μ PD17P005	80-pin QFP (14 × 20 mm)	SE-17010	EP-17003GF	EV-9200G-80
μ PD17010 μ PD17P010	80-pin QFP (14 × 20 mm)	SE-17010	EP-17003GF	EV-9200G-80
μ PD17012 μ PD17P012	64-pin QFP (14 × 20 mm)	SE-17012	EP-17202GF	EV-9200G-64
	80-pin QFP (14 × 14 mm)		EP-17K80GC	EV-9200GC-80
μ PD17015	38-pin SSOP	SE-17015	EP-17K38GT	EV-9500GT-38
μ PD17016 μ PD17017	80-pin QFP (14 × 20 mm)	SE-17010	EP-17003GF	EV-9200G-80
μ PD17071	56-pin QFP (10 × 10 mm)	SE-17072	EP-17K56GB-1 (Bend lead package) EP-17K56GB-2 (Inverted lead package)	TGB-056SBW ^{Note}
μ PD17072 μ PD17073 μ PD17P073	56-pin QFP (10 × 10 mm)	SE-17072	EP-17K56GB-1 (Bend lead package) EP-17K56GB-2 (Inverted lead package)	TGB-056SBW ^{Note}
	64-pin TQFP (10 × 10 mm)		EP-17K64GB	TGB-064SDP ^{Note}
μ PD17704A μ PD17705A μ PD17707A μ PD17708A μ PD17709A μ PD17P709A μ PD17717 μ PD17718 μ PD17719 μ PD17P719	80-pin QFP (14 × 14 mm)	SE-17709	EP-17K80GC	EV-9200GC-80
μ PD17934A	80-pin TQFP (12 × 12 mm)	SE-17934	EP-17K80GK	TGB-080SDP ^{Note}
μ PD17203A μ PD17P203A μ PD17204 μ PD17P204	52-pin QFP (14 × 14 mm)	SE-17204	EP-17203GC	EV-9200G-52

Note This is a product of Tokyo Eitech Corporation.

Development Tools

17K Series Hardware Tools■ **List of Hardware Tools (2/2)**

Target device		SE board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Device name	Package			
μ PD17225 μ PD17226 μ PD17227 μ PD17228 μ PD17P228	30-pin SSOP	SE-17225	EP-17K30GS	EV-9500GT-30
μ PD17230 μ PD17231 μ PD17232 μ PD17233 μ PD17234 μ PD17235 μ PD17236 μ PD17P236	30-pin SSOP	SE-17235	EP-17K30GS	EV-9500GT-30
μ PD17240 μ PD17241 μ PD17242 μ PD17243 μ PD17244 μ PD17245 μ PD17246 μ PD17P246	30-pin SSOP	EM-17246 ^{Note}	EP-17K30GS	EV-9500GT-30

Note This is a product of Naito Densai Machida Mfg. Co., Ltd.

Development Tools

17K Series Programming Environment

■ Common PROM Programming Tools

Tool name	Product name
PROM programmer	PG-1500 (Programmer adapter PA-17KDZ is necessary)

■ PROM Programming Environment (1/2)

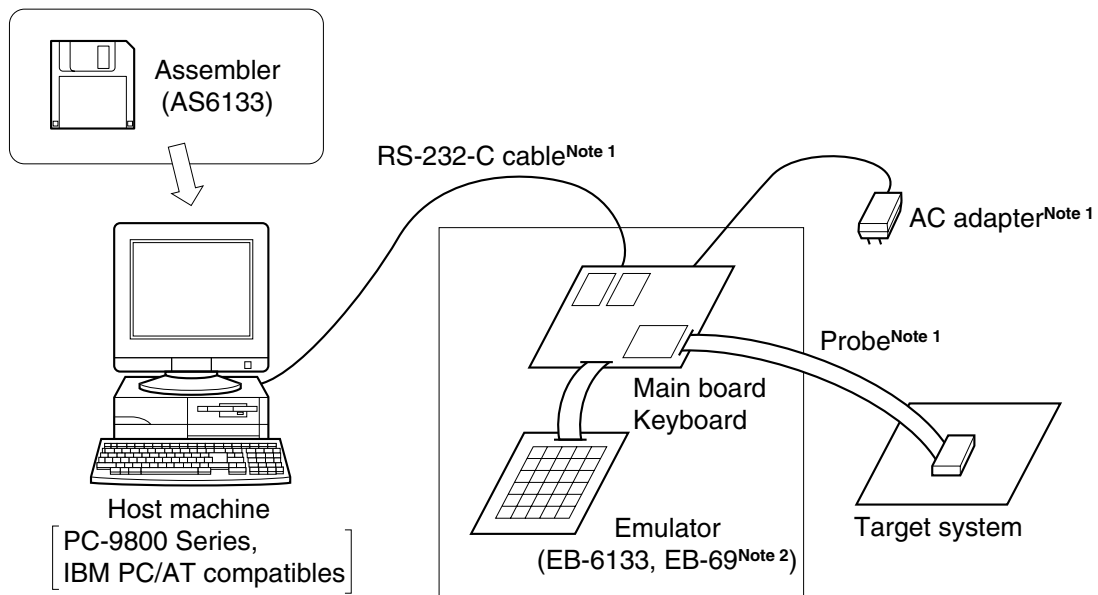
Target device		Corresponding PROM product	Programmer adapter
Device name	Package		
μ PD17003A	80-pin QFP (14 × 20 mm)	μ PD17P005GF	AF-9803
μ PD17005	80-pin QFP (14 × 20 mm)	μ PD17P005GF	AF-9803
μ PD17010	80-pin QFP (14 × 20 mm)	μ PD17P010GF	AF-9803
μ PD17012	64-pin QFP (14 × 20 mm)	μ PD17P012GF	AF-9776B PA-17P012
	80-pin QFP (14 × 14 mm)	μ PD17P012GC	PA-17P012
μ PD17015	38-pin SSOP	No corresponding PROM/flash memory product for this device.	
μ PD17016 μ PD17017	80-pin QFP (14 × 20 mm)	μ PD17P005GF	AF-9803
μ PD17071 μ PD17072 μ PD17073	56-pin QFP (10 × 10 mm)	μ PD17P073GB-1A7	PA-17P073GB
	64-pin TQFP (10 × 10 mm)	μ PD17P073GB-9EU	
μ PD17704A μ PD17705A μ PD17707A μ PD17708A μ PD17709A	80-pin QFP (14 × 14 mm)	μ PD17P709AGC	PA-17P709GC
μ PD17717 μ PD17718 μ PD17719	80-pin QFP (14 × 14 mm)	μ PD17P719GC	PA-17P709GC
μ PD17933A μ PD17934A	80-pin QFP (14 × 14 mm)	No corresponding PROM/flash memory product for this device.	
μ PD17203A	52-pin QFP (14 × 20 mm)	μ PD17P203AGC	AF-9808B
μ PD17204		μ PD17P204GC	
μ PD17225 μ PD17226 μ PD17227 μ PD17228	30-pin SSOP	μ PD17P228MC	PA-17P236

Remark The AF-xxxx PROM programmer is a product of Ando Electric Co., Ltd.
For details, contact Ando Electric Co., Ltd. (Tel: 0120-40-0211).

Development Tools

17K Series Programming Environment■ **PROM Programming Environment (2/2)**

Target device		Corresponding PROM product	Programmer adapter
Device name	Package		
μPD17230 μPD17231 μPD17232 μPD17233 μPD17234 μPD17235 μPD17236	30-pin SSOP	μPD17P236M1MC μPD17P236M2MC μPD17P236M3MC μPD17P236M4MC	PA-17P236MC
μPD17240 μPD17241 μPD17242 μPD17243 μPD17244 μPD17245 μPD17246	30-pin SSOP	μPD17P246M1MC μPD17P246M2MC	PA-17P236MC

Development Tools **μ PD6604, 62A, 69 Series Development Environment**

Notes 1. The RS-232C cable, Probe, and AC adapter are sold separately.

2. The EB-6133 and EB-69 are manufactured by Naito Densetsu Machidaseisakusho, Co., Ltd.

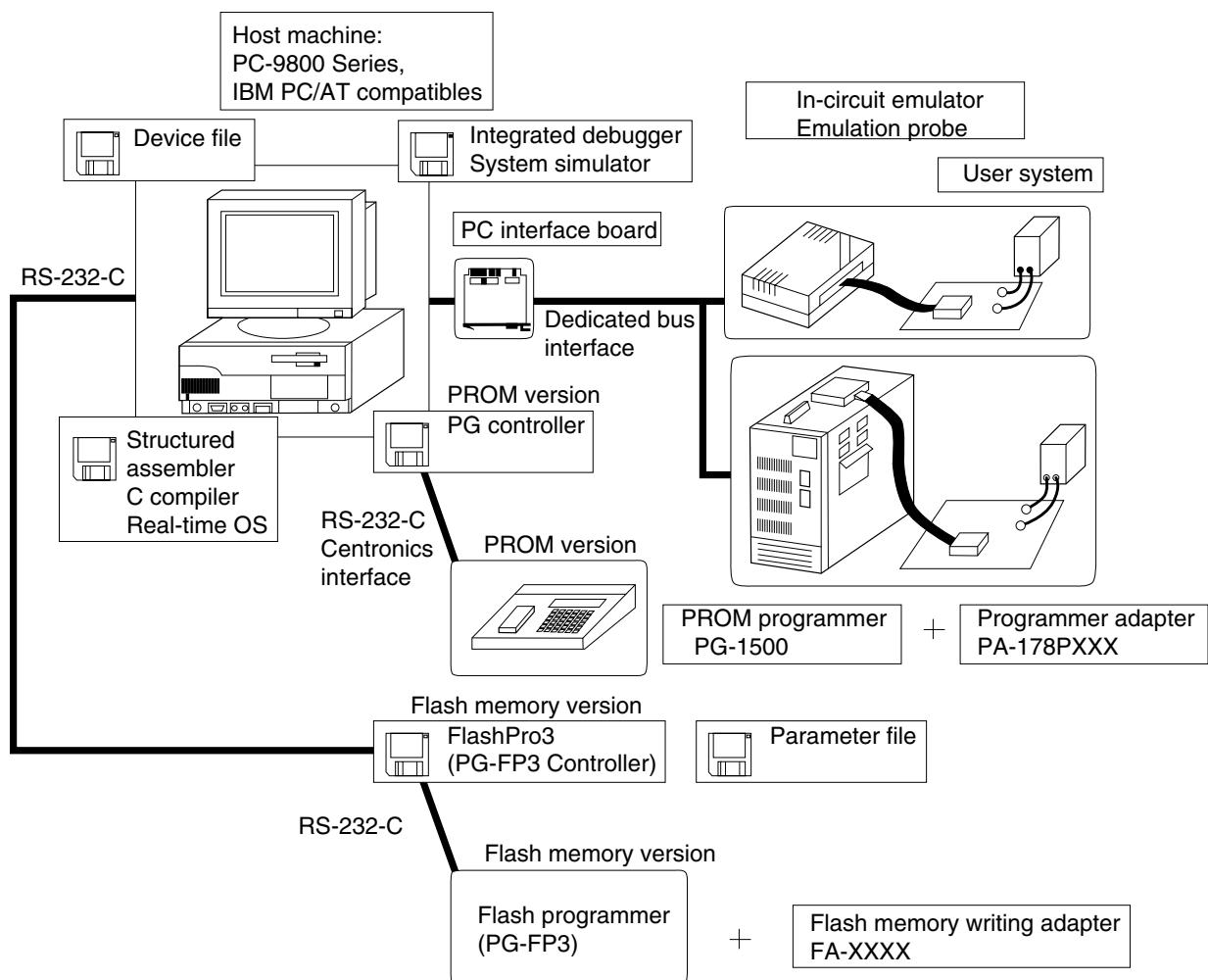
Development Tools**μPD6604, 62A, 69 Series Software Tools****■ List of Software Tools**

Host machine	Product name
PC-9800 Series IBM PC/AT and compatibles PC98-NX Series	Absolute assembler AS6133

Development Tools

178K Series Development Environment

■ Windows based



Caution The following software is not Windows-compatible:
 Real-time OS
 PG controller

Development Tools

178K Series Software Tools

■ List of Device Files

Target device	Device file name	Target device	Device file name	Target device	Device file name
μ PD178002 μ PD178003	DF178018	μ PD178023 μ PD178024 μ PD178F124	DF178024	μ PD178076 μ PD178078	DF178098
μ PD178004A μ PD178006A μ PD178016A μ PD178018A		μ PD178046 μ PD178048 μ PD178F048	DF178048	μ PD178096A μ PD178098A μ PD178F098	
		μ PD178053 μ PD178054 μ PD178F054	DF178054 [★]		

★: Under development

Software tools other than device files are common to the 178K Series and the 78K/0 Series. See **78K/0 Series List of Software Tools** for details.

Development Tools

178K Series Hardware Tools

You can select either of the following two in-circuit emulators for the 178K Series.

- (1) IE-78K0-NS, IE-78K0-NS-A
- (2) IE-78001-R-A

(1) When using the in-circuit emulator IE-78K0-NS, IE-78K0-NS-A

■ Common Hardware Tools (When using IE-78K0-NS, IE-78K0-NS-A)

Tool name	Product name
In-circuit emulator	IE-78K0-NS IE-78K0-NS-A (with Performance board)
Performance board	IE-78K0-NS-PA
Power supply unit	IE-70000-MC-PS-B
Interface adapter	IE-70000-98-IF-C for C bus of PC-9800 Series ^{Note 1} IE-70000-PC-IF-C for ISA bus of PC/AT and compatibles ^{Note 1} IE-70000-PCI-IF-A for PCI bus ^{Note 2} IE-70000-CD-IF-A for PCMCIA socket ^{Note 2}

Notes 1. Not available for PC98-NX Series.

2. Available for PC98-NX Series.

■ List of Hardware Tools (When using IE-78K0-NS, IE-78K0-NS-A)

Target device		Emulation board I/O board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μPD178002 μPD178003	80-pin QFP (14 × 14 mm)	IE-178018-NS-EM1	NP-80GC ^{Note 1}	EV-9200GC-80
μPD178004A μPD178006A μPD178016A μPD178018A μPD178P018A	80-pin QFP (14 × 14 mm)	IE-178018-NS-EM1	NP-80GC ^{Note 1}	EV-9200GC-80
μPD178023 μPD178024 μPD178F124	80-pin QFP (14 × 20 mm) 80-pin QFP (14 × 14 mm)	IE-178134-NS-EM1	NP-80GF ^{Note 1} NP-80GC ^{Note 1} NP-80GC-TQ ^{Note 1} NP-H80GC-TQ ^{Note 1}	EV-9200G-80 EV-9200GC-80 TGC-080SBP ^{Note 2}
μPD178046 μPD178048 μPD178F048	80-pin TQFP (12 × 12 mm)	IE-178048-NS-EM1	NP-80GK ^{Note 1}	TGK-080SDW ^{Note 2}
μPD178053 μPD178054 μPD178F054	80-pin QFP (14 × 14 mm)	IE-178054-NS-EM1	NP-80GC ^{Note 1} NP-80GC-TQ ^{Note 1} NP-H80GC-TQ ^{Note 1}	EV-9200GC-80 TGC-080SBP ^{Note 2}
μPD178076 μPD178078	100-pin QFP (14 × 20 mm)	IE-178098-NS-EM1	NP-100GF ^{Note 1} NP-100GF-TQ ^{Note 1} NP-H100GF-TQ ^{Note 1}	EV-9200GF-100 TGF-100RBP ^{Note 2}
μPD178096A μPD178098A μPD178F098	100-pin QFP (14 × 20 mm)	IE-178098-NS-EM1	NP-100GF ^{Note 1} NP-100GF-TQ ^{Note 1} NP-H100GF-TQ ^{Note 1}	EV-9200GF-100 TGF-100RBP ^{Note 2}

Notes 1. This is a product of Naito Densai Machida Mfg. Co., Ltd.

2. This is a product of Tokyo Eletech Corporation.

Development Tools

178K Series Hardware Tools

(2) When using the in-circuit emulator IE-78001-R-A

■ Common Hardware Tools (When using IE-78001-R-A)

Tool name	Product name
In-circuit emulator	IE-78001-R-A
Interface adapter	IE-70000-98-IF-C for C bus of PC-9800 Series ^{Note 1} IE-70000-PC-IF-C for ISA bus of PC/AT and compatibles ^{Note 1} IE-70000-PCI-IF-A for PCI bus ^{Note 2}

Notes 1. Not available for PC98-NX Series.

2. Available for PC98-NX Series.

■ List of Hardware Tools (When using IE-78001-R-A)

Target device		Emulation board I/O board Emulation probe conversion board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μPD178002 μPD178003	80-pin QFP (14 × 14 mm)	IE-178018-R-EM	EP-78230GC-R	EV-9200GC-80
μPD178004A μPD178006A μPD178016A μPD178018A μPD178P018A	80-pin QFP (14 × 14 mm)	IE-178018-R-EM	EP-78230GC-R	EV-9200GC-80
μPD178023 μPD178024 μPD178F124	80-pin QFP (14 × 20 mm) 80-pin QFP (14 × 14 mm)	IE-178134-NS-EM1 IE-78K0-R-EX1	EP-78130GF-R EP-78230GC-R	EV-9200G-80 EV-9200GC-80
μPD178046 μPD178048 μPD178F048	80-pin TQFP (12 × 12 mm)	Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.		
μPD178053 μPD178054 μPD178F054	80-pin QFP (14 × 14 mm)	IE-178054-NS-EM1 IE-78K0-R-EX1	EP-78230GC-R	EV-9200GC-80
μPD178076 μPD178078	100-pin QFP (14 × 20 mm)	IE-178098-NS-EM1 IE-78K0-R-EX1	EP-78064GF-R	EV-9200GF-100
μPD178096 μPD178098 μPD178F098	100-pin QFP (14 × 20 mm)	IE-178098-NS-EM1 IE-78K0-R-EX1	EP-78064GF-R	EV-9200GF-100

Development Tools

178K Series Programming Environment**(1) PROM Programming Environment****■ Common PROM Programming Tools**

Tool name	Product name
PROM programmer	PG-1500

■ PROM Programming Environment

Target device		Corresponding PROM product	Programmer adapter
Device name	Package		
μPD178002	80-pin QFP (14 × 14 mm)	μPD178P018AGC	PA-178P018GC
μPD178003		μPD178P018AKK-T	PA-178P018KK-T
μPD178004A	80-pin QFP (14 × 14 mm)	μPD178P018AGC	PA-178P018GC
μPD178006A			
μPD178016A		μPD178P018AKK-T	PA-178P018KK-T
μPD178018A			

Flash memory products of EEPROM products are supported for the devices other than above.

See **(2) Flash Programming Environment**.

Development Tools

178K Series Programming Environment

(2) Flash Programming Environment

■ Common Flash Programming Tools

Tool name	Product name
Flash programmer	PG-FP3

■ Flash Programming Environment

Target device		Corresponding flash/ EEPROM memory product	Programmer adapter
Device name	Package		
μ PD178023	80-pin QFP (14 × 20 mm)	μ PD178F124GF	FA-80GF
μ PD178024	80-pin QFP (14 × 14 mm)	μ PD178F124GC	FA-80GC-8BT
μ PD178046 μ PD178048	80-pin TQFP (12 × 12 mm)	μ PD178F048GK	FA-80GK
μ PD178053 μ PD178054	80-pin QFP (14 × 14 mm)	μ PD178F054GC	FA-80GC-8BT
μ PD178076 μ PD178078	100-pin QFP (14 × 20 mm)	μ PD178F098GF	FA-100GF
μ PD178096A μ PD178098A	100-pin QFP (14 × 20 mm)	μ PD178F098GF	FA-100GF

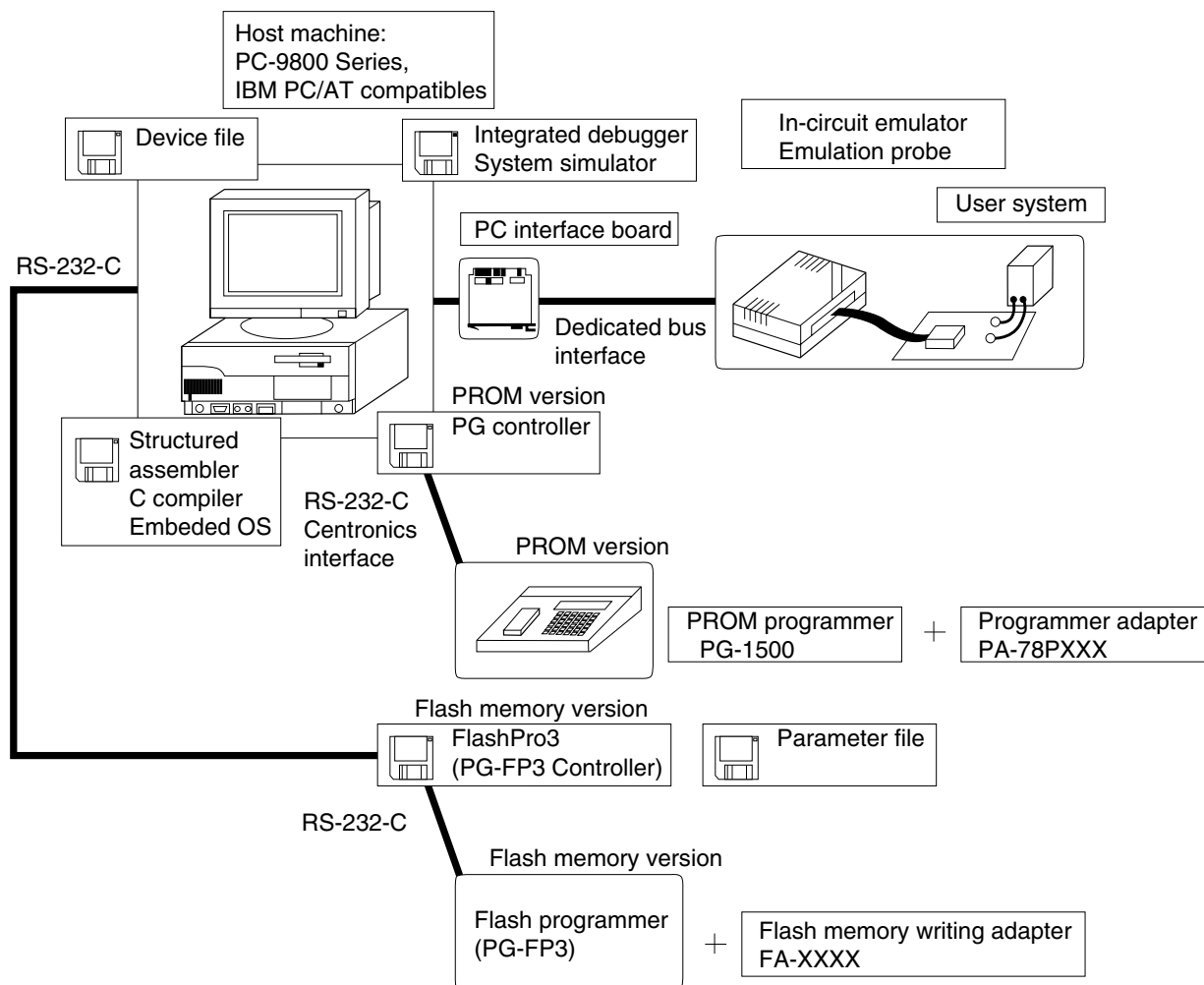
Remark FA-xxxx is a product of Naito Densai Machida Mfg. Co., Ltd.

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Development Tools

78K/0S Series Development Environment

■ Windows based



Caution The following software is not Windows-compatible:
 Real-time OS
 PG controller

Development Tools

78K/0S Series Software Tools

■ List of Software Tools

Host machine	Software tool name
PC-9800 Series IBM PC/AT and compatibles PC98-NX Series	Software package SP78K0S
	Assembler package RA78K0S
	C compiler CC78K0S
	C library source file CC78K0S-L
	Integrated debugger ID78K0S-NS
	System simulator SM78K0S
EWS	Assembler package RA78K0S
	C compiler CC78K0S
	C library source file CC78K0S-L

■ List of Device Files

Subseries name	Device file name	Subseries name	Device file name	Subseries name	Device file name
μ PD789014	DF789014	μ PD789306	DF789306	μ PD789800	DF789801
μ PD789026	DF789026	μ PD789316		μ PD789803 [★]	DF789803 [★]
μ PD789046	DF789046	μ PD789327	DF789328	μ PD789830	DF789831
μ PD789074	DF789076	μ PD789407A	DF789418	μ PD789835 [★]	DF789835
μ PD789088 [★]	DF789088 [★]	μ PD789417A		μ PD789842	DF789842
μ PD789104A	DF789136	μ PD789426	DF789456	μ PD789850 [★]	DF789850
μ PD789114A		μ PD789436		μ PD789860	DF789861
μ PD789124A		μ PD789446		μ PD789861	
μ PD789134A		μ PD789456		μ PD789871	DF789872
μ PD789167	DF789178	μ PD789467	DF789468 [★]	μ PD789881 [★] [☆]	DF789882 [★] [☆]
μ PD789167Y		μ PD789477	DF789488		
μ PD789177		μ PD789488			
μ PD789177Y					

★: Under development, ☆: Newly added product

Development Tools

78K/0S Series Hardware Tools

Common Hardware Tools

Tool name	Product name
In-circuit emulator	IE-78K0S-NS, IE-78K0S-NS-A
Power supply unit	IE-70000-MC-PS-B
Interface adapter	IE-70000-98-IF-C for C bus of PC-9800 Series ^{Note 1}
	IE-70000-PC-IF-C for ISA bus of PC/AT and compatibles ^{Note 1}
	IE-70000-PCI-IF-A for PCI bus ^{Note 2}
	IE-70000-CD-IF-A for PCMCIA socket ^{Note 2}

Notes 1. Not available for PC98-NX Series.

2. Available for PC98-NX Series.

List of Hardware Tools (1/3)

Target device		Emulation board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μ PD789011	28-pin SDIP	IE-789014-NS-EM1	NP-28CT ^{Note 1}	—
μ PD789012			NP-H28CT ^{Note 1}	
μ PD78P9014	28-pin SOP		NP-28GT ^{Note 1}	AXS628119P ^{Note 1} AXS662821 ^{Note 1}
μ PD789022	42-pin SDIP	IE-789026-NS-EM1	NP-42CU ^{Note 1}	—
μ PD789024			NP-H42CU ^{Note 1}	
μ PD789025	44-pin QFP (10 × 10 mm)		NP-44GB ^{Note 1}	EV-9200G-44
μ PD789026			NP-44GB-TQ ^{Note 1}	TGB-044SAP ^{Note 2}
μ PD78F9026A			NP-H44GB-TQ ^{Note 1}	
μ PD789046	44-pin QFP (10 × 10 mm)	IE-789046-NS-EM1	NP-44GB ^{Note 1}	EV-9200G-44
μ PD78F9046			NP-44GB-TQ ^{Note 1}	TGB-044SAP ^{Note 2}
			NP-H44GB-TQ ^{Note 1}	
μ PD789071	30-pin SSOP	IE-789046-NS-EM1 NP-K907	NP-36GS ^{Note 1}	NGS-30 ^{Note 1}
μ PD789072			NP-H36GS ^{Note 1}	
μ PD789074				
μ PD78F9076				
μ PD789086★	30-pin SSOP	IE-789088-NS-EM1★	NP-36GS ^{Note 1}	NGS-30 ^{Note 1}
μ PD789088★			NP-H36GS ^{Note 1}	
μ PD78F9088★				
μ PD789101A	30-pin SSOP	IE-789136-NS-EM1	NP-36GS ^{Note 1}	NGS-30 ^{Note 1}
μ PD789102A			NP-H36GS ^{Note 1}	
μ PD789104A				
μ PD789111A	30-pin SSOP	IE-789136-NS-EM1	NP-36GS ^{Note 1}	NGS-30 ^{Note 1}
μ PD789112A			NP-H36GS ^{Note 1}	
μ PD789114A				
μ PD78F9116A				
μ PD789121A	30-pin SSOP	IE-789136-NS-EM1	NP-36GS ^{Note 1}	NGS-30 ^{Note 1}
μ PD789122A			NP-H36GS ^{Note 1}	
μ PD789124A				
μ PD789131A	30-pin SSOP	IE-789136-NS-EM1	NP-36GS ^{Note 1}	NGS-30 ^{Note 1}
μ PD789132A			NP-H36GS ^{Note 1}	
μ PD789134A				
μ PD78F9136A				

Notes 1. This is a product of Naito Densetsu Machida Mfg. Co., Ltd.

★: Under development

2. This is a product of Tokyo Eletech Corporation.

Development Tools

78K/0S Series Hardware Tools

■ List of Hardware Tools (2/3)

Target device		Emulation board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μ PD789166 μ PD789167	44-pin QFP (10 × 10 mm)	IE-789177-NS-EM1	NP-44GB ^{Note 1} NP-44GB-TQ ^{Note 1} NP-H44GB-TQ ^{Note 1}	EV-9200G-44 TGB-044SAP ^{Note 2}
μ PD789166Y μ PD789167Y	44-pin QFP (10 × 10 mm) 48-pin TQFP (7 × 7 mm)	IE-789177-NS-EM1	NP-44GB ^{Note 1} NP-44GB-TQ ^{Note 1} NP-H44GB-TQ ^{Note 1} NP-48GA ^{Note 1}	EV-9200G-44 TGB-044SAP ^{Note 2} TGA-048SDP ^{Note 2}
μ PD789176 μ PD789177 μ PD78F9177	44-pin QFP (10 × 10 mm)	IE-789177-NS-EM1	NP-44GB ^{Note 1} NP-44GB-TQ ^{Note 1} NP-H44GB-TQ ^{Note 1}	EV-9200G-44 TGB-044SAP ^{Note 2}
μ PD789176Y μ PD789177Y μ PD78F9177Y	44-pin QFP (10 × 10 mm) 48-pin TQFP (7 × 7 mm)	IE-789177-NS-EM1	NP-44GB ^{Note 1} NP-44GB-TQ ^{Note 1} NP-H44GB-TQ ^{Note 1} NP-48GA ^{Note 1}	EV-9200G-44 TGB-044SAP ^{Note 2} TGA-048SDP ^{Note 2}
μ PD789304 μ PD789306 μ PD78F9306 μ PD789314 μ PD789316 μ PD78F9316	64-pin QFP (14 × 14 mm) 64-pin TQFP (12 × 12 mm)	IE-789306-NS-EM1	NP-64GC ^{Note 1} NP-64GC-TQ ^{Note 1} NP-H64GC-TQ ^{Note 1} NP-64GK ^{Note 1} NP-H64GK-TQ ^{Note 1}	EV-9200GC-64 TGC-064SAP ^{Note 2} TGC-064SAP ^{Note 2} TGC-064SAP ^{Note 2} TGC-064SAP ^{Note 2}
μ PD789322 μ PD789324 μ PD789326 μ PD789327 μ PD78F9328	52-pin LQFP (10 × 10 mm)	IE-789468-NS-EM1 [*]	NP-H52GB-TQ ^{Note 1}	TQPACK052SB ^{Note 2} TQSOCKET052SBP ^{Note 2}
μ PD789405A μ PD789406A μ PD789407A	80-pin QFP (14 × 14 mm) 80-pin TQFP (12 × 12 mm)	IE-789418-NS-EM1	NP-80GC ^{Note 1} NP-80GC-TQ ^{Note 1} NP-H80GC-TQ ^{Note 1} NP-80GK ^{Note 1} NP-H80GK-TQ ^{Note 1}	EV-9200GC-80 TGC-080SBP ^{Note 2} TGC-080SBP ^{Note 2} TGC-080SBP ^{Note 2} TGC-080SBP ^{Note 2}
μ PD789415A μ PD789416A μ PD789417A μ PD78F9418A	80-pin QFP (14 × 14 mm) 80-pin TQFP (12 × 12 mm)	IE-789418-NS-EM1	NP-80GC ^{Note 1} NP-80GC-TQ ^{Note 1} NP-H80GC-TQ ^{Note 1} NP-80GK ^{Note 1} NP-H80GK-TQ ^{Note 1}	EV-9200GC-80 TGC-080SBP ^{Note 2} TGC-080SBP ^{Note 2} TGC-080SBP ^{Note 2} TGC-080SBP ^{Note 2}
μ PD789425 μ PD789426 μ PD789435 μ PD789436 μ PD78F9436	64-pin TQFP (12 × 12 mm) 64-pin LQFP (10 × 10 mm)	IE-789436-NS-EM1	NP-64GK ^{Note 1} NP-H64GK-TQ ^{Note 1} NP-H64GB-TQ ^{Note 1}	TGC-064SAP ^{Note 2} TGC-064SAP ^{Note 2} TGC-064SAP ^{Note 2} TGC-064SAP ^{Note 2} TGC-064SAP ^{Note 2}
μ PD789445 μ PD789446 μ PD789455 μ PD789456 μ PD78F9456	64-pin TQFP (12 × 12 mm) 64-pin LQFP (10 × 10 mm)	IE-789456-NS-EM1	NP-64GK ^{Note 1} NP-H64GK-TQ ^{Note 1} NP-H64GB-TQ ^{Note 1}	TGC-064SAP ^{Note 2} TGC-064SAP ^{Note 2} TGC-064SAP ^{Note 2} TGC-064SAP ^{Note 2} TGC-064SAP ^{Note 2}

Notes 1. This is a product of Naito Densai Machida Mfg. Co., Ltd.

★: Under development

2. This is a product of Tokyo Eletech Corporation.

Development Tools

78K/0S Series Hardware Tools

■ List of Hardware Tools (3/3)

Target device		Emulation board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μ PD789462 μ PD789464 μ PD789466 [★] μ PD789467 [★] μ PD78F9468	52-pin LQFP (10 × 10 mm)	IE-789468-NS-EM1 [★]	NP-H52GB-TQ ^{Note 1}	TQPACK052SB ^{Note 2} TQSOCKET052SBP ^{Note 2}
μ PD789477 μ PD78F9478	80-pin QFP (14 × 14 mm)	IE-789488-NS-EM1	NP-80GC ^{Note 1} NP-80GC-TQ ^{Note 1} NP-H80GC-TQ ^{Note 1}	EV-9200GC-80 TGC-080SBP ^{Note 2}
μ PD789488 μ PD78F9488	80-pin QFP (14 × 14 mm)	IE-789488-NS-EM1	NP-80GC ^{Note 1} NP-80GC-TQ ^{Note 1} NP-H80GC-TQ ^{Note 1}	EV-9200GC-80 TGC-080SBP ^{Note 2}
	80-pin TQFP (12 × 12 mm)		NP-80GK ^{Note 1} NP-H80GK-TQ ^{Note 1}	TGK-080SDW ^{Note 2}
μ PD789800 μ PD78F9801	44-pin QFP (10 × 10 mm)	IE-789801-NS-EM1	NP-44GB ^{Note 1} NP-44GB-TQ ^{Note 1} NP-H44GB-TQ ^{Note 1}	EV-9200G-44 TGB-044SAP ^{Note 2}
μ PD789802 [★] μ PD789803 [★] μ PD78F9803 [★]	64-pin LQFP (10 × 10 mm)	IE-789803-NS-EM1 [★]	NP-H64GB-TQ ^{Note 1}	TGB-064SDP ^{Note 2}
μ PD789830	88-pin bare chip	IE-789831-NS-EM1	—	—
μ PD78F9831	100-pin LQFP (14 × 14 mm)		NP-100GC ^{Note 1} NP-H100GC-TQ ^{Note 1}	TGC-100SDW ^{Note 2}
μ PD789832 [★] μ PD789833 [★] μ PD789834 [★] μ PD789835 [★] μ PD78F9835 [★]	144-pin LQFP (20 × 20 mm)	IE-789835-NS-EM1 [★]	SWEX-144SD ^{Note 2}	TQPACK144SD ^{Note 2} TQSOCKET144SDP ^{Note 2}
μ PD789841 μ PD789842 μ PD78F9842	44-pin QFP (10 × 10 mm)	IE-789842-NS-EM1	NP-44GB ^{Note 1} NP-44GB-TQ ^{Note 1} NP-H44GB-TQ ^{Note 1}	EV-9200G-44 TGB-044SAP ^{Note 2}
μ PD789850(A) [★] μ PD78F9850 [★]	30-pin SSOP	IE-789850-NS-EM1	NP-36GS ^{Note 1} NP-H36GS ^{Note 1}	NGS-30 ^{Note 1}
μ PD789860 μ PD78E9860 [★]	20-pin SSOP	IE-789860-NS-EM1	NP-20GS ^{Note 1}	EV-9500GS-20
μ PD789861 μ PD78E9861 [★]	20-pin SSOP	IE-789860-NS-EM1	NP-20GS ^{Note 1}	EV-9500GS-20
μ PD789870 [★] μ PD789871 μ PD78F9872 [★]	52-pin QFP (10 × 10 mm)	IE-789871-NS-EM1 [★]	NP-H52GB-TQ ^{Note 1}	TQPACK052SB ^{Note 2} TQSOCKET052SBP ^{Note 2}
μ PD789881 [★] μ PD78F9882 [★]	64-pin LQFP (10 × 10 mm)	IE-789882-NS-EM1	NP-H64GB-TQ ^{Note 1}	TQPACK064SD ^{Note 2} TQSOCKET064SDP ^{Note 2}

Notes 1. This is a product of Naito Densai Machida Mfg. Co., Ltd.

★: Under development, ☆: Newly added product

2. This is a product of Tokyo Eletech Corporation.

Development Tools

78K/0S Series Programming Environment

(1) PROM Programming Environment

■ Common PROM Programming Tools

Tool name	Product name
PROM programmer	PG-1500 (Programmer adapter PA-17KDZ is necessary)

■ PROM Programming Environment

Target device		Corresponding PROM product	Programmer adapter
Subseries name	Package		
μ PD789014	28-pin SDIP	μ PD78P9014CT	PA-78P9014GT
	28-pin SOP	μ PD78P9014GT	

Flash memory products or EEPROM products are supported for the devices other than above.
See **(2) Flash/EEPROM Programming Environment**.

Development Tools

78K/0S Series Programming Environment

(2) Flash/EEPROM Programming Environment

■ Common Flash/EEPROM Programming Tools

Tool name	Product name
Flash programmer	PG-FP3

■ Flash/EEPROM Programming Environment (1/2)

Target device		Corresponding flash/ EEPROM memory product	Programmer adapter
Subseries name	Package		
μ PD789026	42-pin SDIP	μ PD78F9026ACU	FA-42CU
	44-pin QFP (10 × 10 mm)	μ PD78F9026AGB-8ES	FA-44GB-8ES
μ PD789046	44-pin QFP (10 × 10 mm)	μ PD78F9046GB-8ES	FA-44GB-8ES
μ PD789074	30-pin SSOP	μ PD78F9076MC	FA-30MC
μ PD789088	30-pin SSOP	μ PD78F9088MC*	FA-30MC
μ PD789104A	30-pin SSOP	μ PD78F9116AMC	FA-30MC
μ PD789114A	30-pin SSOP	μ PD78F9116AMC	FA-30MC
μ PD789124A	30-pin SSOP	μ PD78F9136AMC	FA-30MC
μ PD789134A	30-pin SSOP	μ PD78F9136AMC	FA-30MC
μ PD789167	44-pin QFP (10 × 10 mm)	μ PD78F9177GB-8ES	FA-44GB-8ES
μ PD789167Y	44-pin QFP (10 × 10 mm)	μ PD78F9177YGB-8ES	FA-44GB-8ES
	48-pin TQFP (7 × 7 mm)	μ PD78F9177YGA	FA-48GA
μ PD789177	44-pin QFP (10 × 10 mm)	μ PD78F9177GB-8ES	FA-44GB-8ES
μ PD789177Y	44-pin QFP (10 × 10 mm)	μ PD78F9177YGB-8ES	FA-44GB-8ES
	48-pin TQFP (7 × 7 mm)	μ PD78F9177YGA	FA-48GA
μ PD789306	64-pin QFP (14 × 14 mm)	μ PD78F9306GC	FA-64GC
	64-pin TQFP (12 × 12 mm)	μ PD78F9306GK	FA-64GK-9ET
μ PD789316	64-pin QFP (14 × 14 mm)	μ PD78F9316GC	FA-64GC
	64-pin TQFP (12 × 12 mm)	μ PD78F9316GK	FA-64GK-9ET
μ PD789327	52-pin LQFP (10 × 10 mm)	μ PD78F9328GB	FA-52GB-8ET
μ PD789407A	80-pin QFP (14 × 14 mm)	μ PD78F9418AGC	FA-80GC-8BT
	80-pin TQFP (12 × 12 mm)	μ PD78F9418AGK-BE9	FA-80GK
		μ PD78F9418AGK-9EU	FA-80GK-9EU
μ PD789417A	80-pin QFP (14 × 14 mm)	μ PD78F9418AGC	FA-80GC-8BT
	80-pin TQFP (12 × 12 mm)	μ PD78F9418AGK-BE9	FA-80GK
		μ PD78F9418AGK-9EU	FA-80GK-9EU

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★: Under development

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Development Tools

78K/0S Series Programming Environment

■ Flash/EEPROM Programming Environment (2/2)

Target device		Corresponding flash/ EEPROM memory product	Programmer adapter
Subseries name	Package		
μPD789426	64-pin TQFP (12 × 12 mm)	μPD78F9436GK	FA-64GK-9ET
	64-pin LQFP (10 × 10 mm)	μPD78F9436GB	FA-64GB-8EU
μPD789436	64-pin TQFP (12 × 12 mm)	μPD78F9436GK	FA-64GK-9ET
	64-pin LQFP (10 × 10 mm)	μPD78F9436GB	FA-64GB-8EU
μPD789446	64-pin TQFP (12 × 12 mm)	μPD78F9456GK	FA-64GK-9ET
	64-pin LQFP (10 × 10 mm)	μPD78F9456GB	FA-64GB-8EU
μPD789456	64-pin TQFP (12 × 12 mm)	μPD78F9456GK	FA-64GK-9ET
	64-pin LQFP (10 × 10 mm)	μPD78F9456GB	FA-64GB-8EU
μPD789467	52-pin LQFP (10 × 10 mm)	μPD78F9468GB	FA-52GB-8ET
μPD789477	80-pin QFP (14 × 14 mm)	μPD78F9478GC★	FA-80GC-8BT
μPD789488	80-pin QFP (14 × 14 mm)	μPD78F9488GC★	FA-80GC-8BT
	80-pin TQFP (12 × 12 mm)	μPD78F9488GK★	FA-80GK-9EU
μPD789800	44-pin QFP (10 × 10 mm)	μPD78F9801GB-3BS	FA-44GB
		μPD78F9801GB-8ES	FA-44GB-8ES
μPD789803	64-pin LQFP (10 × 10 mm)	μPD78F9803GB★	FA-64GB-8EU
μPD789830	88-pin bare chip	—	—
	100-pin LQFP (14 × 14 mm)	μPD78F9831GC	FA-100GC
μPD789835	144-pin LQFP (20 × 20 mm)	μPD78F9835GJ★	FA-144GJ-UEN
μPD789842	44-pin QFP (10 × 10 mm)	μPD78F9842GB-3BS	FA-44GB
		μPD78F9842GB-8ES	FA-44GB-8ES
μPD789850	30-pin SSOP	μPD78F9850MC★	FA-30MC
μPD789860	20-pin SSOP	μPD78F9860MC★	FA-20MC
μPD789861	20-pin SSOP	μPD78F9861MC★	FA-20MC
μPD789871	52-pin QFP (10 × 10 mm)	μPD78F9872GB★	FA-52GB-8ET
μPD789881	64-pin LQFP (10 × 10 mm)	μPD78F9882GB★	FA-64GB-8EU

Remark FA-xxxx is a product of Naito Densai Machida Mfg. Co., Ltd.

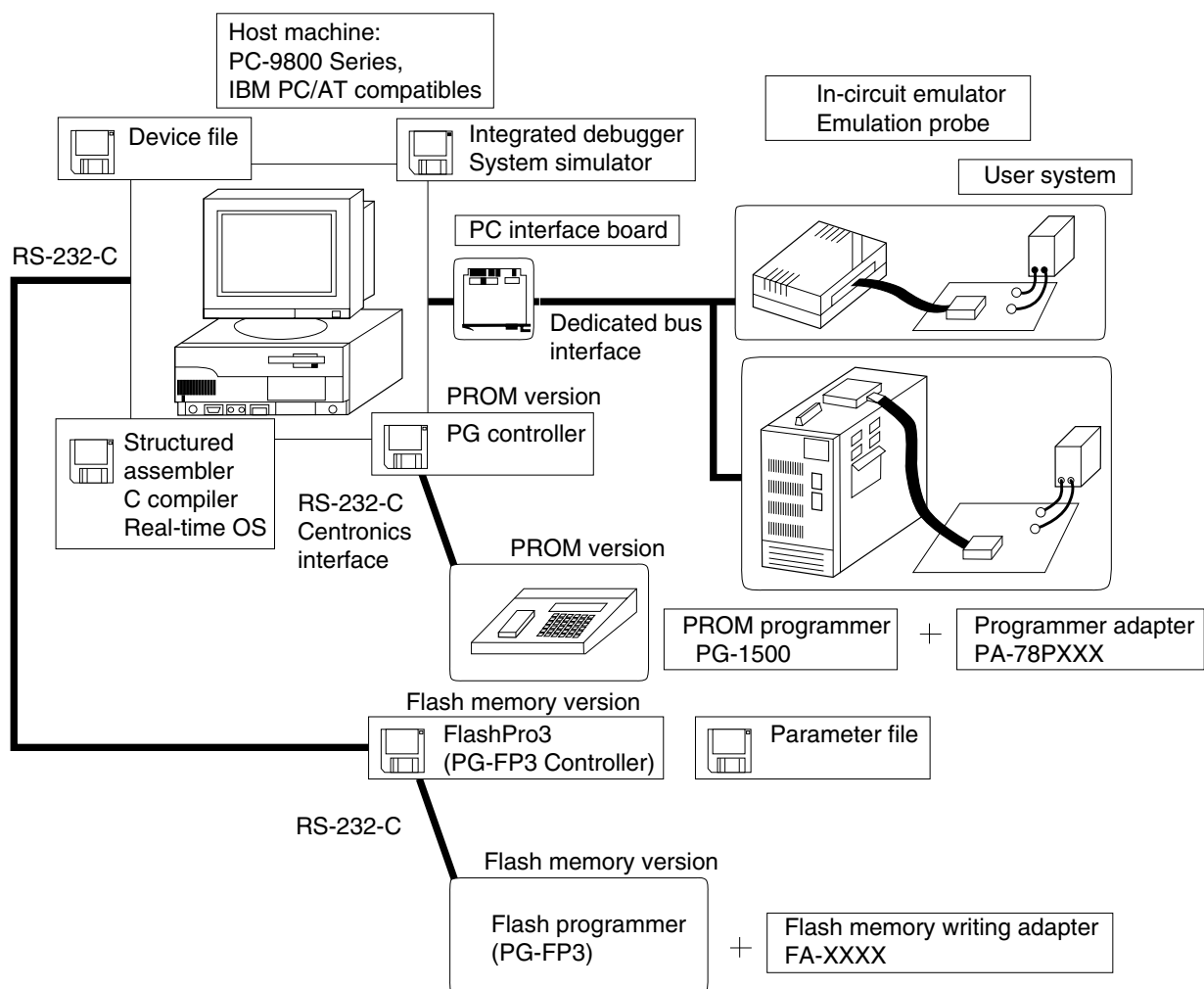
★: Under development

For further information, contact Naito Densai Machida Mfg. Co., Ltd. (TEL: +81-45-475-4191)

Development Tools

78K/0 Series Development Environment

■ Windows based



Caution The following software is not Windows-compatible:
Real-time OS
PG controller

Development Tools

78K/0 Series Software Tools

■ List of Software Tools

Host machine	Software tools name
PC-9800 Series IBM PC/AT and compatibles PC98-NX Series	Software package SP78K0
	Assembler package RA78K0
	C compiler CC78K0
	C library source file CC78K0-L
	Integrated debugger ID78K0-NS
	Integrated debugger ID78K0
	System simulator SM78K0
	Real-time OS RX78K0
EWS	Assembler package RA78K0
	C compiler CC78K0
	C library source file CC78K0-L

■ List of Device Files

Subseries name	Device file name	Subseries name	Device file name	Subseries name	Device file name
μ PD78018F	DF78014	μ PD78083	DF78083	μ PD780308	DF780308
μ PD78018FY		μ PD78098B	DF78098	μ PD780308Y	
μ PD78014H		μ PD780024A	DF780024	μ PD780318	DF780338 [★]
μ PD78044F	DF78044	μ PD780024AY		μ PD780328	DF780338 [★]
μ PD78044H		μ PD780034A	DF780034	μ PD780338	DF780338 [★]
μ PD78064	DF78064	μ PD780034AY		μ PD780344 [★] [☆]	DF780344 [★]
μ PD78064Y		μ PD780058	DF780058	μ PD780354 [★] [☆]	DF780354 [★]
μ PD78064B		μ PD780058Y		μ PD780344Y [★] [☆]	DF780344 [★]
μ PD78070A	DF78078	μ PD780065	DF780066	μ PD780354Y [★] [☆]	DF780354 [★]
μ PD78070AY		μ PD780078	DF780078	μ PD780702Y [★]	DF780702 [★]
μ PD78078		μ PD780078Y		μ PD780833Y	DF780833
μ PD78078Y		μ PD780208	DF780208	μ PD780852	DF780852 [★]
μ PD78075B		μ PD780233	DF780233	μ PD780958	DF780958
				μ PD780988	DF780988

★: Under development, ☆: Newly added product

Development Tools

78K/0 Series Hardware Tools

You can select either of the following two in-circuit emulators for the 78K/0 Series.

- (1) IE-78K0-NS, IE-78K0-NS-A
- (2) IE-78001-R-A

(1) When using the in-circuit emulator IE-78K0-NS, IE-78K0-NS-A

■ Common Hardware Tools (When using IE-78K0-NS, IE-78K0-NS-A)

Tool name	Product name
In-circuit emulator	IE-78K0-NS IE-78K0-NS-A (with Performance board)
Performance board	IE-78K0-NS-PA
Power supply unit	IE-70000-MC-PS-B
Interface adapter	IE-70000-98-IF-C for C bus of PC-9800 Series ^{Note 1} IE-70000-PC-IF-C for ISA bus of PC/AT and compatibles ^{Note 1} IE-70000-PCI-IF-A for PCI bus ^{Note 2} IE-70000-CD-IF-A for PCMCIA socket ^{Note 2}

Notes 1. Not available for PC98-NX Series.

2. Available for PC98-NX Series.

■ List of Hardware Tools (When using IE-78K0-NS, IE-78K0-NS-A) (1/5)

Target device		Emulation board I/O board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μ PD78011F	64-pin SDIP	IE-78018-NS-EM1	NP-64CW ^{Note 1}	—
μ PD78012F	64-pin QFP (14 × 14 mm)		NP-64GC ^{Note 1}	EV-9200GC-64
μ PD78013F				
μ PD78014F				
μ PD78015F	64-pin LQFP (12 × 12 mm)		NP-64GK ^{Note 1}	TGK-064SBW ^{Note 2}
μ PD78016F				
μ PD78018F				
μ PD78P018F				
μ PD78011FY	64-pin SDIP	IE-78018-NS-EM1	NP-64CW ^{Note 1}	—
μ PD78012FY	64-pin QFP (14 × 14 mm)		NP-64GC ^{Note 1}	EV-9200GC-64
μ PD78013FY				
μ PD78014FY				
μ PD78015FY	64-pin LQFP (12 × 12 mm)		NP-64GK ^{Note 1}	TGK-064SBW ^{Note 2}
μ PD78016FY				
μ PD78018FY				
μ PD78P018FY				
μ PD78011H	64-pin SDIP	IE-78018-NS-EM1	NP-64CW ^{Note 1}	—
μ PD78012H	64-pin QFP (14 × 14 mm)		NP-64GC ^{Note 1}	EV-9200GC-64
μ PD78013H	64-pin LQFP (12 × 12 mm)			
μ PD78014H				NP-64GK ^{Note 1}

Notes 1. This is a product of Naito Densetsu Machida Mfg. Co., Ltd.

2. This is a product of Tokyo Eletech Corporation.

Development Tools

78K/0 Series Hardware Tools

■ List of Hardware Tools (When using IE-78K0-NS, IE-78K0-NS-A) (2/5)

Target device		Emulation board I/O board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μPD78042F μPD78043F μPD78044F μPD78045F μPD78P048A	80-pin QFP (14 × 20 mm)	IE-78048-NS-EM1	NP-80GF ^{Note 1}	EV-9200G-80
			NP-80GF-TQ ^{Note 1}	TGF-080RAP ^{Note 2}
μPD78044H μPD78045H μPD78046H	80-pin QFP (14 × 20 mm)	IE-78048-NS-EM1	NP-80GF ^{Note 1}	TGF-080RAW ^{Note 2}
μPD78062 μPD78063 μPD78064 μPD78P064	100-pin QFP (14 × 20 mm)	IE-780308-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}
			NP-H100GF-TQ ^{Note 1}	
	100-pin LQFP (14 × 14 mm)		NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
			NP-H100GC-TQ ^{Note 1}	
μPD78062Y μPD78063Y μPD78064Y	100-pin QFP (14 × 20 mm)	IE-780308-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}
			NP-H100GF-TQ ^{Note 1}	
	100-pin LQFP (14 × 14 mm)		NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
			NP-H100GC-TQ ^{Note 1}	
μPD78064B μPD78P064B	100-pin QFP (14 × 20 mm)	IE-780308-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}
			NP-H100GF-TQ ^{Note 1}	
	100-pin LQFP (14 × 14 mm)		NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
			NP-H100GC-TQ ^{Note 1}	
μPD78070A	100-pin QFP (14 × 20 mm)	IE-78078-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}
			NP-H100GF-TQ ^{Note 1}	
	100-pin QFP (14 × 14 mm)		NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
			NP-H100GC-TQ ^{Note 1}	
μPD78070AY	100-pin QFP (14 × 20 mm)	IE-78078-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}
			NP-H100GF-TQ ^{Note 1}	
	100-pin QFP (14 × 14 mm)		NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
			NP-H100GC-TQ ^{Note 1}	
μPD78076 μPD78078 μPD78P078	100-pin QFP (14 × 20 mm)	IE-78078-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}
			NP-H100GF-TQ ^{Note 1}	
	100-pin LQFP (14 × 14 mm)		NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
			NP-H100GC-TQ ^{Note 1}	
μPD78076Y μPD78078Y μPD78P078Y	100-pin QFP (14 × 20 mm)	IE-78078-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}
			NP-H100GF-TQ ^{Note 1}	
	100-pin LQFP (14 × 14 mm)		NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
			NP-H100GC-TQ ^{Note 1}	

Notes 1. This is a product of Naito Densai Machida Mfg. Co., Ltd.

2. This is a product of Tokyo Eletech Corporation.

Development Tools

78K/0 Series Hardware Tools

■ List of Hardware Tools (When using IE-78K0-NS, IE-78K0-NS-A) (3/5)

Target device		Emulation board I/O board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μ PD78074B μ PD78075B	100-pin QFP (14 × 20 mm)	IE-78078-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}
			NP-H100GF-TQ ^{Note 1}	
	100-pin LQFP (14 × 14 mm)		NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
			NP-H100GC-TQ ^{Note 1}	
μ PD78081 μ PD78082 μ PD78P083	42-pin SDIP	IE-78078-NS-EM1	NP-42CU ^{Note 1}	—
	44-pin QFP (10 × 10 mm)		NP-H42CU ^{Note 1}	
			NP-44GB ^{Note 1}	EV-9200G-44
			NP-44GB-TQ ^{Note 1}	TGB-044SAP ^{Note 2}
			NP-H44GB-TQ ^{Note 1}	
μ PD78095B μ PD78096B μ PD78098B μ PD78P098B	80-pin QFP (14 × 14 mm)	IE-78098-NS-EM1	NP-80GC ^{Note 1}	EV-9200GC-80
			NP-80GC-TQ ^{Note 1}	TGC-080SBP ^{Note 2}
			NP-H80GC-TQ ^{Note 1}	
μ PD780021A μ PD780022A μ PD780023A μ PD780024A	64-pin SDIP	IE-780034-NS-EM1	NP-64CW ^{Note 1}	—
	64-pin QFP (14 × 14 mm)		NP-H64CW ^{Note 1}	
			NP-64GC ^{Note 1}	EV-9200GC-64
			NP-64GC-TQ ^{Note 1}	TGC-064SAP ^{Note 2}
			NP-H64GC-TQ ^{Note 1}	
			64-pin TQFP (12 × 12 mm)	NP-64GK ^{Note 1}
	64-pin LQFP (10 × 10 mm)		NP-H64GK-TQ ^{Note 1}	
			NP-H64GB-TQ ^{Note 1}	TGB-064SDP ^{Note 2}
	73-pin CSP		Under development	
μ PD780021AY μ PD780022AY μ PD780023AY μ PD780024AY	64-pin SDIP	IE-780034-NS-EM1	NP-64CW ^{Note 1}	—
	64-pin QFP (14 × 14 mm)		NP-H64CW ^{Note 1}	
			NP-64GC ^{Note 1}	EV-9200GC-64
			NP-64GC-TQ ^{Note 1}	TGC-064SAP ^{Note 2}
			NP-H64GC-TQ ^{Note 1}	
			64-pin TQFP (12 × 12 mm)	NP-64GK ^{Note 1}
	64-pin LQFP (10 × 10 mm)		NP-H64GK-TQ ^{Note 1}	
			NP-H64GB-TQ ^{Note 1}	TGB-064SDP ^{Note 2}
73-pin CSP	Under development			
μ PD780031A μ PD780032A μ PD780033A μ PD780034A μ PD78F0034A	64-pin SDIP	IE-780034-NS-EM1	NP-64CW ^{Note 1}	—
	64-pin QFP (14 × 14 mm)		NP-H64CW ^{Note 1}	
			NP-64GC ^{Note 1}	EV-9200GC-64
			NP-64GC-TQ ^{Note 1}	TGC-064SAP ^{Note 2}
			NP-H64GC-TQ ^{Note 1}	
			64-pin TQFP (12 × 12 mm)	NP-64GK ^{Note 1}
	64-pin LQFP (10 × 10 mm)		NP-H64GK-TQ ^{Note 1}	
			NP-H64GB-TQ ^{Note 1}	TGB-064SDP ^{Note 2}
	73-pin CSP		Under development	

Notes 1. This is a product of Naito Densai Machida Mfg. Co., Ltd.

2. This is a product of Tokyo Eletech Corporation.

Development Tools

78K/0 Series Hardware Tools

■ List of Hardware Tools (When using IE-78K0-NS, IE-78K0-NS-A) (4/5)

Target device		Emulation board I/O board	Emulation probe	Conversion socket/ Conversion adapter				
Device name	Package							
μ PD780031AY μ PD780032AY μ PD780033AY μ PD780034AY μ PD78F0034AY	64-pin SDIP 64-pin QFP (14 × 14 mm) 64-pin TQFP (12 × 12 mm) 64-pin LQFP (10 × 10 mm) 73-pin CSP	IE-780034-NS-EM1	NP-64CW ^{Note 1} NP-H64CW ^{Note 1} NP-64GC ^{Note 1} NP-64GC-TQ ^{Note 1} NP-H64GC-TQ ^{Note 1} NP-64GK ^{Note 1} NP-H64GK-TQ ^{Note 1} NP-H64GB-TQ ^{Note 1} Under development	— EV-9200GC-64 TGC-064SAP ^{Note 2} TGK-064SBP ^{Note 2} TGB-064SDP ^{Note 2}				
μ PD780053 μ PD780054 μ PD780055 μ PD780056 μ PD780058B μ PD78F0058	80-pin QFP (14 × 14 mm) 80-pin TQFP (12 × 12 mm)		IE-780308-NS-EM1	NP-80GC ^{Note 1} NP-80GC-TQ ^{Note 1} NP-H80GC-TQ ^{Note 1} NP-80GK ^{Note 1} NP-H80GK-TQ ^{Note 1}	EV-9200GC-80 TGC-080SBP ^{Note 2} TGK-080SDW ^{Note 2}			
μ PD780053Y μ PD780054Y μ PD780055Y μ PD780056Y μ PD780058BY μ PD78F0058Y	80-pin QFP (14 × 14 mm) 80-pin TQFP (12 × 12 mm)			IE-780308-NS-EM1	NP-80GC ^{Note 1} NP-80GC-TQ ^{Note 1} NP-H80GC-TQ ^{Note 1} NP-80GK ^{Note 1} NP-H80GK-TQ ^{Note 1}	EV-9200GC-80 TGC-080SBP ^{Note 2} TGK-080SDW ^{Note 2}		
μ PD780065 μ PD78F0066	80-pin QFP (14 × 14 mm)				IE-780066-NS-EM4 IE-78K0-NS-P01	NP-80GC ^{Note 1} NP-80GC-TQ ^{Note 1} NP-H80GC-TQ ^{Note 1}	EV-9200GC-80 TGC-080SBP ^{Note 2}	
μ PD780076 μ PD780078 μ PD78F0078	64-pin QFP (14 × 14 mm) 64-pin TQFP (12 × 12 mm)					IE-780078-NS-EM1	NP-64GC ^{Note 1} NP-64GC-TQ ^{Note 1} NP-H64GC-TQ ^{Note 1} NP-64GK ^{Note 1} NP-H64GK-TQ ^{Note 1}	EV-9200GC-64 TGC-064SAP ^{Note 2} TGK-064SBP ^{Note 2}
μ PD780076Y μ PD780078Y μ PD78F0078Y	64-pin QFP (14 × 14 mm) 64-pin TQFP (12 × 12 mm)						IE-780078-NS-EM1	NP-64GC ^{Note 1} NP-64GC-TQ ^{Note 1} NP-H64GC-TQ ^{Note 1} NP-64GK ^{Note 1} NP-H64GK-TQ ^{Note 1}
μ PD780204 μ PD780205 μ PD780206 μ PD780208 μ PD78P0208	100-pin QFP (14 × 20 mm)				IE-780208-NS-EM1			NP-100GF ^{Note 1} NP-100GF-TQ ^{Note 1} NP-H100GF-TQ ^{Note 1}
μ PD780232 μ PD780233 μ PD78F0233	80-pin QFP (14 × 14 mm)		IE-780233-NS-EM4 IE-78K0-NS-P01					NP-80GC ^{Note 1} NP-80GC-TQ ^{Note 1} NP-H80GC-TQ ^{Note 1}

Notes 1. This is a product of Naito Densai Machida Mfg. Co., Ltd.

2. This is a product of Tokyo Eletech Corporation.

Development Tools

78K/0 Series Hardware Tools

■ List of Hardware Tools (When using IE-78K0-NS, IE-78K0-NS-A) (5/5)

Target device		Emulation board I/O board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μPD780306	100-pin QFP (14 × 20 mm)	IE-780308-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
μPD780308	100-pin LQFP (14 × 14 mm)		NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
μPD78P0308			NP-H100GC-TQ ^{Note 1}	
μPD780306Y	100-pin QFP (14 × 20 mm)	IE-780308-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
μPD780308Y	100-pin LQFP (14 × 14 mm)		NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
μPD78P0308Y			NP-H100GC-TQ ^{Note 1}	
μPD780316	120-pin QFP (14 × 14 mm)	IE-780338-NS-EM1	SWEX-120SE ^{Note 2}	NQPACK120SE ^{Note 2}
μPD780318				YQPACK120SE ^{Note 2} YQGUIDE ^{Note 2}
μPD780326	120-pin QFP (14 × 14 mm)	IE-780338-NS-EM1	SWEX-120SE ^{Note 2}	NQPACK120SE ^{Note 2}
μPD780328				YQPACK120SE ^{Note 2} YQGUIDE ^{Note 2}
μPD780336	120-pin QFP (14 × 14 mm)	IE-780338-NS-EM1	SWEX-120SE ^{Note 2}	NQPACK120SE ^{Note 2}
μPD780338				YQPACK120SE ^{Note 2}
μPD78F0338★				YQGUIDE ^{Note 2}
μPD780343★☆☆	100-pin QFP (10 × 10 mm)	IE-780354-NS-EM1★	NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
μPD780344★☆☆			NP-H100GC-TQ ^{Note 1}	
	113-pin CSP		Under development	
μPD780353★☆☆	100-pin QFP (10 × 10 mm)	IE-780354-NS-EM1★	NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
μPD780354★☆☆			NP-H100GC-TQ ^{Note 1}	
μPD78F0354★☆☆	113-pin CSP		Under development	
μPD780343Y☆☆	100-pin QFP (10 × 10 mm)	IE-780354-NS-EM1★	NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
μPD780344Y☆☆			NP-H100GC-TQ ^{Note 1}	
	113-pin CSP		Under development	
μPD780353Y☆☆	100-pin QFP (10 × 10 mm)	IE-780354-NS-EM1★	NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
μPD780354Y☆☆			NP-H100GC-TQ ^{Note 1}	
μPD78F0354Y★☆☆	113-pin CSP		Under development	
μPD780702Y★	80-pin QFP (14 × 14 mm)	IE-780701-NS-EM1	NP-80GC ^{Note 1}	EV-9200GC-80
μPD78F0701Y			NP-80GC-TQ ^{Note 1}	TGC-080SBP ^{Note 2}
			NP-H80GC-TQ ^{Note 1}	
μPD780833Y	80-pin QFP (14 × 14 mm)	IE-780831-NS-EM4	NP-80GC ^{Note 1}	EV-9200GC-80
μPD78F0833Y		IE-78K0-NS-P02	NP-80GC-TQ ^{Note 1}	TGC-080SBP ^{Note 2}
			NP-H80GC-TQ ^{Note 1}	
μPD780851(A)	80-pin QFP (14 × 14 mm)	IE-780852-NS-EM4-A	NP-80GC ^{Note 1}	EV-9200GC-80
μPD780852(A)		IE-78K0-NS-P04	NP-80GC-TQ ^{Note 1}	TGC-080SBP ^{Note 2}
μPD78F0852★			NP-H80GC-TQ ^{Note 1}	
μPD780957(A)	100-pin LQFP (14 × 14 mm)	IE-780958-NS-EM4	NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}
μPD780958(A)		IE-78K0-NS-P02	NP-H100GC-TQ ^{Note 1}	
μPD780982	64-pin SDIP	IE-780988-NS-EM4	NP-64CW ^{Note 1}	—
μPD780983			NP-H64CW ^{Note 1}	
μPD780984		IE-78K0-NS-P01	NP-64GC ^{Note 1}	EV-9200GC-64
μPD780986			NP-64GC-TQ ^{Note 1}	TGC-064SAP ^{Note 2}
μPD780988			NP-H64GC-TQ ^{Note 1}	
μPD78F0988A			NP-H64GC-TQ ^{Note 1}	

Notes 1. This is a product of Naito Densai Machida Mfg. Co., Ltd.

★: Under development, ☆: Newly added product

2. This is a product of Tokyo Eletech Corporation.

Development Tools

78K/0 Series Hardware Tools

(2) When using the in-circuit emulator IE-78001-R-A

■ Common Hardware Tools (When using IE-78001-R-A)

Tool name	Product name
In-circuit emulator	IE-78001-R-A
Interface adapter	IE-70000-98-IF-C for C bus of PC-9800 Series ^{Note 1} IE-70000-PC-IF-C for ISA bus of PC/AT and compatibles ^{Note 1} IE-70000-PCI-IF-A for PCI bus ^{Note 2}

Notes 1. Not available for PC98-NX Series.

2. Available for PC98-NX Series.

■ List of Hardware Tools (When using IE-78001-R-A) (1/4)

Target device		Emulation board I/O board Emulation probe conversion board	Emulation probe	Conversion socket/ Conversion adapter	
Device name	Package				
μ PD78011F μ PD78012F μ PD78013F	64-pin SDIP	IE-78014-R-EM-A	EP-78240CW-R	—	
μ PD78014F μ PD78015F	64-pin QFP (14 × 14 mm)		EP-78240GC-R	EV-9200GC-64	
μ PD78016F μ PD78018F μ PD78P018F	64-pin LQFP (12 × 12 mm)		EP-78012GK-R	TGK-064SBW ^{Note}	
μ PD78011FY μ PD78012FY μ PD78013FY	64-pin SDIP		IE-78014-R-EM-A	EP-78240CW-R	—
μ PD78014FY μ PD78015FY	64-pin QFP (14 × 14 mm)			EP-78240GC-R	EV-9200GC-64
μ PD78016FY μ PD78018FY μ PD78P018FY	64-pin LQFP (12 × 12 mm)	EP-78012GK-R		TGK-064SBW ^{Note}	
μ PD78011H μ PD78012H μ PD78013H	64-pin SDIP	IE-78014-R-EM-A		EP-78240CW-R	—
μ PD78014H	64-pin QFP (14 × 14 mm)			EP-78240GC-R	EV-9200GC-64
	64-pin LQFP (12 × 12 mm)		EP-78012GK-R	TGK-064SBW ^{Note}	
μ PD78042F μ PD78043F μ PD78044F μ PD78045F μ PD78P048A	80-pin QFP (14 × 20 mm)	IE-78044-R-EM	EP-78130GF-R	EV-9200G-80	

Note This is a product of Tokyo Eletech Corporation.

Development Tools

78K/0 Series Hardware Tools

■ List of Hardware Tools (When using IE-78001-R-A) (2/4)

Target device		Emulation board	Emulation probe	Conversion socket/ Conversion adapter
Subseries name	Package	I/O board Emulation probe conversion board		
μPD78044H μPD78045H μPD78046H	80-pin QFP (14 × 20 mm)	IE-78044-R-EM	EP-78130GF-R	EV-9200G-80
μPD78062 μPD78063 μPD78064 μPD78P064	100-pin QFP (14 × 20 mm) 100-pin LQFP (14 × 14 mm)	IE-780308-R-EM	EP-78064GF-R EP-78064GC-R	EV-9200GF-100 TGC-100SDW ^{Note}
μPD78062Y μPD78063Y μPD78064Y	100-pin QFP (14 × 20 mm) 100-pin LQFP (14 × 14 mm)	IE-780308-R-EM	EP-78064GF-R EP-78064GC-R	EV-9200GF-100 TGC-100SDW ^{Note}
μPD78064B μPD78P064B	100-pin QFP (14 × 20 mm) 100-pin LQFP (14 × 14 mm)	IE-780308-R-EM	EP-78064GF-R EP-78064GC-R	EV-9200GF-100 TGC-100SDW ^{Note}
μPD78070A	100-pin QFP (14 × 20 mm) 100-pin QFP (14 × 14 mm)	Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.		
μPD78070AY	100-pin QFP (14 × 20 mm) 100-pin QFP (14 × 14 mm)	Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.		
μPD78076 μPD78078 μPD78P078	100-pin QFP (14 × 20 mm) 100-pin LQFP (14 × 14 mm)	IE-78078-R-EM	EP-78064GF-R EP-78064GC-R	EV-9200GF-100 TGC-100SDW ^{Note}
μPD78076Y μPD78078Y μPD78P078Y	100-pin QFP (14 × 20 mm) 100-pin LQFP (14 × 14 mm)	IE-78078-R-EM	EP-78064GF-R EP-78064GC-R	EV-9200GF-100 TGC-100SDW ^{Note}
μPD78074B μPD78075B	100-pin QFP (14 × 20 mm) 100-pin LQFP (14 × 14 mm)	IE-78078-R-EM	EP-78064GF-R EP-78064GC-R	EV-9200GF-100 TGC-100SDW ^{Note}
μPD78081 μPD78082 μPD78P083	42-pin SDIP 44-pin QFP (10 × 10 mm)	IE-78078-R-EM	EP-78083CU-R EP-78083GB-R	— EV-9200G-44
μPD78095B μPD78096B μPD78098B μPD78P098B	80-pin QFP (14 × 14 mm)	Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.		
μPD780021A μPD780022A μPD780023A μPD780024A	64-pin SDIP 64-pin QFP (14 × 14 mm) 64-pin TQFP (14 × 14 mm) 64-pin LQFP (10 × 10 mm)	IE-780034-NS-EM1 IE-78K0-R-EX1	EP-78240CW-R EP-78240GC-R EP-78012GK-R	— EV-9200GC-64 TGK-064SBP ^{Note}
μPD780021AY μPD780022AY μPD780023AY μPD780024AY	64-pin SDIP 64-pin QFP (14 × 14 mm) 64-pin LQFP (12 × 12 mm) 64-pin LQFP (10 × 10 mm)	IE-780034-NS-EM1 IE-78K0-R-EX1	EP-78240CW-R EP-78240GC-R EP-78012GK-R	— EV-9200GC-64 TGK-064SBP ^{Note}
		Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.		

Note This is a product of Tokyo Eletech Corporation.

Development Tools

78K/0 Series Hardware Tools

■ List of Hardware Tools (When using IE-78001-R-A) (3/4)

Target device		Emulation board I/O board Emulation probe conversion board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μ PD780031A	64-pin SDIP	IE-780034-NS-EM1	EP-78240CW-R	—
μ PD780032A	64-pin QFP (14 × 14 mm)	IE-78K0-R-EX1	EP-78240GC-R	EV-9200GC-64
μ PD780033A	64-pin TQFP (12 × 12 mm)		EP-78012GK-R	TGK-064SBP ^{Note}
μ PD780034A	64-pin LQFP (10 × 10 mm)		Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.	
μ PD78F0034A				
μ PD780031AY	64-pin SDIP	IE-780034-NS-EM1	EP-78240CW-R	—
μ PD780032AY	64-pin QFP (14 × 14 mm)	IE-78K0-R-EX1	EP-78240GC-R	EV-9200GC-64
μ PD780033AY	64-pin TQFP (12 × 12 mm)		EP-78012GK-R	TGK-064SBP ^{Note}
μ PD780034AY	64-pin LQFP (10 × 10 mm)		Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.	
μ PD78F0034AY				
μ PD780053	80-pin QFP (14 × 14 mm)	IE-780308-R-EM	EP-78230GC-R	EV-9200GC-80
μ PD780054				
μ PD780055				
μ PD780056	80-pin TQFP (12 × 12 mm)		EP-78054GK-R	TGK-080SDW ^{Note}
μ PD780058B				
μ PD78F0058				
μ PD780053Y	80-pin QFP (14 × 14 mm)	IE-780308-R-EM	EP-78230GC-R	EV-9200GC-80
μ PD780054Y				
μ PD780055Y				
μ PD780056Y	80-pin TQFP (12 × 12 mm)		EP-78054GK-R	TGK-080SDW ^{Note}
μ PD780058BY				
μ PD78F0058Y				
μ PD780065	80-pin QFP (14 × 14 mm)	IE-780066-NS-EM4	EP-78230GC-R	EV-9200GC-80
μ PD78F0066		IE-78K0-NS-P01		
		IE-78K0-R-EX1		
μ PD780076	64-pin QFP (14 × 14 mm)	IE-780078-NS-EM1	EP-78240GC-R	EV-9200GC-64
μ PD780078		IE-78K0-R-EX1		
μ PD78F0078	64-pin TQFP (12 × 12 mm)		EP-78012GK-R	TGK-064SBP ^{Note}
μ PD780076Y	64-pin QFP (14 × 14 mm)	IE-780078-NS-EM1	EP-78240GC-R	EV-9200GC-64
μ PD780078Y		IE-78K0-R-EX1		
μ PD78F0078Y	64-pin TQFP (12 × 12 mm)		EP-78012GK-R	TGK-064SBP ^{Note}
μ PD780204	100-pin QFP (14 × 20 mm)	IE-780208-R-EM	EP-78064GF-R	EV-9200GF-100
μ PD780205				
μ PD780206				
μ PD780208				
μ PD78P0208				
μ PD780232	80-pin QFP (14 × 14 mm)	IE-780233-NS-EM4	EP-78230GC-R	EV-9200GC-80
μ PD780233		IE-78K0-NS-P01		
μ PD78F0233		IE-78K0-R-EX1		

Note This is a product of Tokyo Eletech Corporation.

Development Tools

78K/0 Series Hardware Tools

■ List of Hardware Tools (When using IE-78001-R-A) (4/4)

Target device		Emulation board I/O board Emulation probe conversion board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μ PD780306	100-pin QFP (14 × 20 mm)	IE-780308-R-EM	EP-78064GF-R	EV-9200GF-100
μ PD780308	100-pin LQFP (14 × 14 mm)		EP-78064GC-R	TGC-100SDW ^{Note}
μ PD78P0308				
μ PD780306Y	100-pin QFP (14 × 20 mm)	IE-780308-R-EM	EP-78064GF-R	EV-9200GF-100
μ PD780308Y	100-pin LQFP (14 × 14 mm)		EP-78064GC-R	TGC-100SDW ^{Note}
μ PD78P0308Y				
μ PD780316	120-pin QFP (14 × 14 mm)	Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.		
μ PD780318				
μ PD780326	120-pin QFP (14 × 14 mm)	Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.		
μ PD780328				
μ PD780336	120-pin QFP (14 × 14 mm)	Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.		
μ PD780338				
μ PD78F0338 [*]				
μ PD780343 ^{☆☆}	100-pin QFP (10 × 10 mm)	Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.		
μ PD780344 ^{☆☆}				
μ PD780353 ^{☆☆}	100-pin QFP (10 × 10 mm)	Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.		
μ PD780354 ^{☆☆}				
μ PD78F0354 ^{☆☆}				
μ PD780343Y ^{☆☆}	100-pin QFP (10 × 10 mm)	Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.		
μ PD780344Y ^{☆☆}				
μ PD780353Y ^{☆☆}	100-pin QFP (10 × 10 mm)	Not supported. Use IE-78K0-NS, IE-78K0-NS-A for these devices.		
μ PD780354Y ^{☆☆}				
μ PD78F0354Y ^{☆☆}				
μ PD780702Y [*]	80-pin QFP (14 × 14 mm)	IE-780701-NS-EM1	EP-78230GC-R	EV-9200GC-80
μ PD78F0701Y		IE-78K0-R-EX1		
μ PD780833Y	80-pin QFP (14 × 14 mm)	IE-780831-NS-EM4	EP-78230GC-R	EV-9200GC-80
μ PD78F0833Y		IE-78K0-NS-P02		
		IE-78K0-R-EX1		
μ PD780851(A)	80-pin QFP (14 × 14 mm)	IE-780852-NS-EM4-A	EP-78230GC-R	EV-9200GC-80
μ PD780852(A)		IE-78K0-NS-P04		
μ PD78F0852 [*]		IE-78K0-R-EX1		
μ PD780957(A)	100-pin LQFP (14 × 14 mm)	IE-780958-NS-EM4	EP-78064GC-R	TGC-100SDW
μ PD780958(A)		IE-78K0-NS-P02		
		IE-78K0-R-EX1		
μ PD780982	64-pin SDIP	IE-780988-NS-EM4	EP-78024CW-R	—
μ PD780983		IE-78K0-NS-P01		
μ PD780984		IE-78K0-R-EX1		
μ PD780986	64-pin QFP (14 × 14 mm)		EP-78240GC-R	EV-9200GC-64
μ PD780988				
μ PD78F0988A				

Note This is a product of Tokyo Eletech Corporation.

★: Under development, ☆: Newly added product

Development Tools

78K/0 Series Programming Environment

(1) PROM Programming Environment

■ Common PROM Programming Tools

Tool name	Product name
PROM programmer	PG-1500

■ PROM Programming Environment (1/2)

Target device		Corresponding PROM product	Programmer adapter
Subseries name	Package		
μPD78018F	64-pin SDIP	μPD78P018FCW	PA-78P018CW
		μPD78P018FDW	
	64-pin QFP (14 × 14 mm)	μPD78P018FGC-8BS	PA-78P018GC-8BS
		μPD78P018FKK-S	PA-78P018KK-S
	64-pin LQFP (12 × 12 mm)	μPD78P018FGK	PA-78P018GK
μPD78018FY	64-pin SDIP	μPD78P018FYCW	PA-78P018CW
		μPD78P018FYDW	
	64-pin QFP (14 × 14 mm)	μPD78P018FYGC-8BS	PA-78P018GC-8BS
		μPD78P018FYKK-S	PA-78P018KK-S
	64-pin LQFP (12 × 12 mm)	μPD78P018FYGK	PA-78P018GK
μPD78014H	64-pin SDIP	No corresponding PROM/flash memory product for this device.	
	64-pin QFP (14 × 14 mm)		
	64-pin LQFP (12 × 12 mm)		
μPD78044F	80-pin QFP (14 × 20 mm)	μPD78P048AGF	PA-78P048GF
		μPD78P048AKL-S	PA-78P048KL-S
μPD78044H	80-pin QFP (14 × 20 mm)	μPD78P048AGF	PA-78P048GF
		μPD78P048AKL-S	PA-78P048KL-S
μPD78064	100-pin QFP (14 × 20 mm)	μPD78P064GF	PA-78P064GF or PA-78P0308GF
		μPD78P064KL-T	PA-78P064KL-T or PA-78P0308KL-T
	100-pin LQFP (14 × 14 mm)	μPD78P064GC-8EU	PA-78P0308GC-8EU
μPD78064Y	100-pin QFP (14 × 20 mm)	μPD78P064YGF	PA-78P064GF or PA-78P0308GF
		μPD78P064YKL-T	PA-78P064KL-T or PA-78P0308KL-T
	100-pin LQFP (14 × 14 mm)	μPD78P064YGC	PA-78P064GC or PA-78P0308GC

Development Tools

78K/0 Series Programming Environment

■ PROM Programming Environment (2/2)

Target device		Corresponding PROM product	Programmer adapter
Subseries name	Package		
μPD78064B	100-pin QFP (14 × 20 mm)	μPD78P064BGF	PA-78P064GF or PA78P0308GF
	100-pin LQFP (14 × 14 mm)	μPD78P064BGC-8EU	PA-78P0308GC-8EU
μPD78070A	100-pin QFP (14 × 20 mm)	No corresponding PROM/flash memory product for this device.	
	100-pin QFP (14 × 14 mm)		
μPD78070AY	100-pin QFP (14 × 20 mm)	No corresponding PROM/flash memory product for this device.	
	100-pin QFP (14 × 14 mm)		
μPD78078	100-pin QFP (14 × 20 mm)	μPD78P078GF	PA-78P078GF
		μPD78P078KL-T	PA-78P078KL-T
	100-pin LQFP (14 × 14 mm)	μPD78P078GC	PA-78P078GC
μPD78078Y	100-pin QFP (14 × 20 mm)	μPD78P078YGF	PA-78P078GF
		μPD78P078YKL-T	PA-78P078KL-T
	100-pin LQFP (14 × 14 mm)	μPD78P078YGC	PA-78P078GC
μPD78075B	100-pin QFP (14 × 20 mm)	μPD78P078GF	PA-78P078GF
		μPD78P078KL-T	PA-78P078KL-T
	100-pin LQFP (14 × 14 mm)	μPD78P078GC	PA-78P078GC
μPD78083	42-pin SDIP	μPD78P083CU	PA-78P083CU
		μPD78P083DU	PA-78P083KK-T
	44-pin QFP (10 × 10 mm)	μPD78P083GB	PA-78P083GB
		μPD78P083GB-3BS	PA-78P083GB-3BS
μPD78098B	80-pin QFP (14 × 14 mm)	μPD78P098BGC	PA-78P054GC
		μPD78P098BKK-T	PA-78P054KK-T
μPD780208	100-pin QFP (14 × 20 mm)	μPD78P0208GF	PA-78P0208GF
		μPD78P0208KL-T	PA-78P0208KL-T
μPD780308	100-pin QFP (14 × 20 mm)	μPD78P0308GF	PA-78P0308GF
		μPD78P0308KL-T	PA-78P0308GF
	100-pin LQFP (14 × 14 mm)	μPD78P0308GC	PA-78P0308GC
		μPD78P064GC-8EU	PA-78P0308GC-8EU
μPD780308Y	100-pin QFP (14 × 20 mm)	μPD78P0308YGF	PA-78P0308GF
		μPD78P0308YKL-T	PA-78P0308GF
	100-pin LQFP (14 × 14 mm)	μPD78P0308YGC	PA-78P0308GC
		μPD78P064GC-8EU	PA-78P0308GC-8EU

Flash memory products or EEPROM products are supported for the devices other than above.
See (2) Flash/EEPROM Programming Environment.

Development Tools

78K/0 Series Programming Environment

(2) Flash Programming Environment

■ Common Flash Programming Tools

Tool name	Product name
Flash programmer	PG-FP3

■ Flash Programming Environment (1/2)

Target device		Corresponding flash/ EEPROM memory product	Programmer adapter
Subseries name	Package		
μ PD780024A	64-pin SDIP	μ PD78F0034ACW	FA-64CW
	64-pin QFP (14 × 14 mm)	μ PD78F0034AGC	FA-64GC
	64-pin TQFP (12 × 12 mm)	μ PD78F0034AGK-8A8	FA-64GK
		μ PD78F0034AGK-9ET	FA-64GK-9ET
	64-pin LQFP (10 × 10 mm)	μ PD78F0034AGB	FA-64GB-8EU
μ PD780024AY	64-pin SDIP	μ PD78F0034AYCW	FA-64CW
	64-pin QFP (14 × 14 mm)	μ PD78F0034AYGC	FA-64GC
	64-pin TQFP (12 × 12 mm)	μ PD78F0034AYGK-8A8	FA-64GK
		μ PD78F0034AYGK-9ET	FA-64GK-9ET
	64-pin LQFP (10 × 10 mm)	μ PD78F0034AYGB	FA-64GB-8EU
μ PD780034A	64-pin SDIP	μ PD78F0034ACW	FA-64CW
	64-pin QFP (14 × 14 mm)	μ PD78F0034AGC	FA-64GC
	64-pin TQFP (12 × 12 mm)	μ PD78F0034AGK-8A8	FA-64GK
		μ PD78F0034AGK-9ET	FA-64GK-9ET
	64-pin LQFP (10 × 10 mm)	μ PD78F0034AGB	FA-64GB-8EU
μ PD780034AY	64-pin SDIP	μ PD78F0034AYCW	FA-64CW
	64-pin QFP (14 × 14 mm)	μ PD78F0034AYGC	FA-64GC
	64-pin TQFP (12 × 12 mm)	μ PD78F0034AYGK-8A8	FA-64GK
		μ PD78F0034AYGK-9ET	FA-64GK-9ET
	64-pin LQFP (10 × 10 mm)	μ PD78F0034AYGB	FA-64GB-8EU
μ PD780058	80-pin QFP (14 × 14 mm)	μ PD78F0058GC-8BT	FA-80GC-8BT
	80-pin TQFP (12 × 12 mm)	μ PD78F0058GK-9EU	FA-80GK-9EU
μ PD780058Y	80-pin QFP (14 × 14 mm)	μ PD78F0058YGC-8BT	FA-80GC-8BT
	80-pin TQFP (12 × 12 mm)	μ PD78F0058YGK-9EU	FA-80GK-9EU
μ PD780065	80-pin QFP (14 × 14 mm)	μ PD78F0066GC	FA-80GC-8BT
μ PD780078	64-pin QFP (14 × 14 mm)	μ PD78F0078GC	FA-64GC
	64-pin TQFP (12 × 12 mm)	μ PD78F0078GK	FA-64GK-9ET
μ PD780078Y	64-pin QFP (14 × 14 mm)	μ PD78F0078YGC	FA-64GC
	64-pin TQFP (12 × 12 mm)	μ PD78F0078YGK	FA-64GK-9ET

Remark FA-xxxx is a product of Naito Densai Machida Mfg. Co., Ltd.

For further information, contact Naito Densai Machida Mfg. Co., Ltd. (TEL: +81-45-475-4191)

Development Tools

78K/0 Series Programming Environment

■ Flash Programming Environment (2/2)

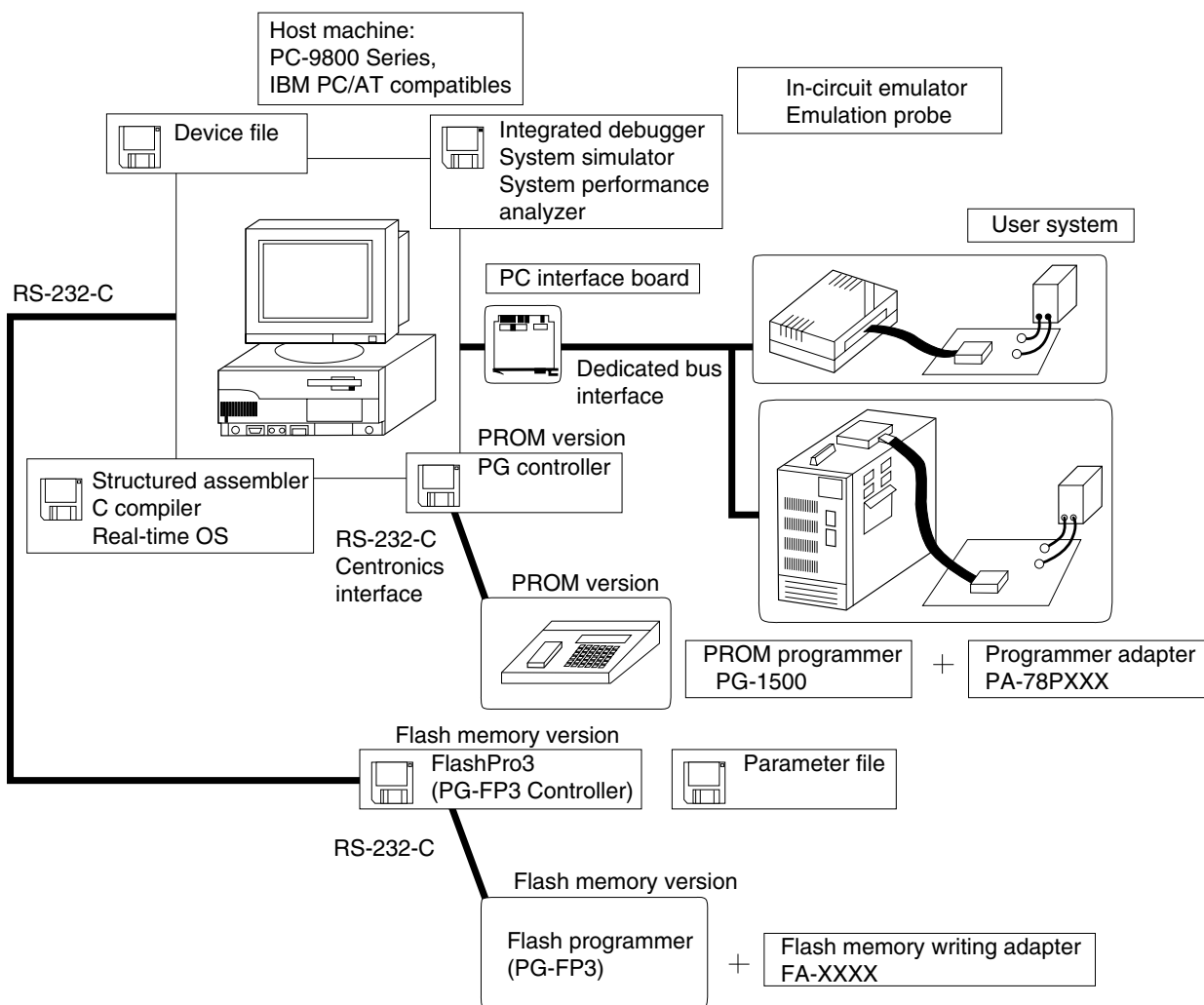
Target device		Corresponding flash/ EEPROM memory product	Programmer adapter
Subseries name	Package		
μ PD780233	80-pin QFP (14 × 14 mm)	μ PD78F0233GC-8BT	FA-80GC-8BT
μ PD780318	120-pin QFP (14 × 14 mm)	μ PD78F0338GC*	FA-120GC
μ PD780328	120-pin QFP (14 × 14 mm)	μ PD78F0338GC*	FA-120GC
μ PD780338	120-pin QFP (14 × 14 mm)	μ PD78F0338GC*	FA-120GC
μ PD780344	100-pin LQFP (10 × 10 mm)	μ PD78F0354GB*	FA-100GC-8EU
μ PD780354	100-pin LQFP (10 × 10 mm)	μ PD78F0354GB*	FA-100GC-8EU
μ PD780344Y	100-pin LQFP (10 × 10 mm)	μ PD78F0354GB*	FA-100GC-8EU
μ PD780354Y	100-pin LQFP (10 × 10 mm)	μ PD78F0354GB*	FA-100GC-8EU
μ PD780702Y	80-pin QFP (14 × 14 mm)	μ PD78F0701YGC	FA-80GC-8BT
μ PD780833Y	80-pin QFP (14 × 14 mm)	μ PD78F0833YGC	FA-80GC
μ PD780852	80-pin QFP (14 × 14 mm)	μ PD78F0852GC*	FA-80GC-8BT
μ PD780958	100-pin LQFP (14 × 14 mm)	No corresponding PROM/flash memory product for this device.	
μ PD780988	64-pin SDIP	μ PD78F0988ACW	FA-64CW
	64-pin QFP (14 × 14 mm)	μ PD78F0988AGC	FA-64GC

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Development Tools

78K/IV Series Development Environment

■ Windows based



Caution The following software is not Windows-compatible:

Real-time OS
PG controller

Development Tools

78K/IV Series Software Tools

■ List of Software Tools

Host machine	Software tool name
PC-9800 Series IBM PC/AT and compatibles PC98-NX Series	Software package SP78K4
	Assembler package RA78K4
	C compiler CC78K4
	C library source file CC78K4-L
	Integrated debugger (for NS-type IE) ID78K4-NS
	Integrated debugger ID78K4
	System simulator SM78K4
	System performance analyzer AZ78K4
	Real-time OS RX78K4
EWS	Assembler package RA78K4
	C compiler CC78K4
	C library source file CC78K4-L

■ List of Device Files

Subseries name	Device file name	Subseries name	Device file name	Subseries name	Device file name
μ PD784038	DF784038	μ PD784218A	DF784218	μ PD784928	DF784928
μ PD784038Y		μ PD784218AY		μ PD784928Y	
μ PD784046	DF784046	μ PD784225	DF784225	μ PD784938A	DF784937
μ PD784054		μ PD784225Y		μ PD784956A	DF784956
μ PD784216A	DF784218	μ PD784908	DF784908	μ PD784976A *	DF784976
μ PD784216AY		μ PD784915	DF784916		

*: Under development

Development Tools

78K/IV Series Hardware Tools

You can select either of the following two in-circuit emulators for the 78K/IV Series.

- (1) IE-78K4-NS
- (2) IE-784000-R

(1) When using the in-circuit emulator IE-78K4-NS

■ Common Hardware Tools (When using IE-78K4-NS)

Tool name	Product name
In-circuit emulator	IE-78K4-NS
Power supply unit	IE-70000-MC-PS-B
Interface adapter	IE-70000-98-IF-C for C bus of PC-9800 Series ^{Note 1}
	IE-70000-PC-IF-C for ISA bus of PC/AT and compatibles ^{Note 1}
	IE-70000-PCI-IF-A for PCI bus ^{Note 2}
	IE-70000-CD-IF-A for PCMCIA socket ^{Note 2}

Notes 1. Not available for PC98-NX Series.

2. Available for PC98-NX Series.

Development Tools

78K/IV Series Hardware Tools

■ List of Hardware Tools (When using IE-78K4-NS) (1/2)

Target device		Emulation board	Emulation probe	Conversion socket/ Conversion adapter	
Device name	Package				
μ PD784031	80-pin QFP (14 × 14 mm)	IE-784038-NS-EM1	NP-80GC ^{Note 1}	EV-9200GC-80	
μ PD784035			NP-80GC-TQ ^{Note 1}	TGC-080SBP ^{Note 2}	
μ PD784036			NP-H80GC-TQ ^{Note 1}		
μ PD784037			80-pin TQFP (12 × 12 mm)	NP-80GK ^{Note 1}	TGK-080SDW ^{Note 2}
μ PD784038				NP-H80GK-TQ ^{Note 1}	
μ PD78P4038					
μ PD784031Y	80-pin QFP (14 × 14 mm)	IE-784038-NS-EM1	NP-80GC ^{Note 1}	EV-9200GC-80	
μ PD784035Y			NP-80GC-TQ ^{Note 1}	TGC-080SBP ^{Note 2}	
μ PD784036Y			NP-H80GC-TQ ^{Note 1}		
μ PD784037Y			80-pin TQFP (12 × 12 mm)	NP-80GK ^{Note 1}	TGK-080SDW ^{Note 2}
μ PD784038Y				NP-H80GK-TQ ^{Note 1}	
μ PD78P4038Y					
μ PD784044	80-pin QFP (14 × 14 mm)	IE-784046-NS-EM1	NP-80GC ^{Note 1}	EV-9200GC-80	
μ PD784046			NP-80GC-TQ ^{Note 1}	TGC-080SBP ^{Note 2}	
μ PD78F4046			NP-H80GC-TQ ^{Note 1}		
μ PD784054	80-pin QFP (14 × 14 mm)	IE-784046-NS-EM1	NP-80GC ^{Note 1}	EV-9200GC-80	
			NP-80GC-TQ ^{Note 1}	TGC-080SBP ^{Note 2}	
			NP-H80GC-TQ ^{Note 1}		
μ PD784214A	100-pin QFP (14 × 20 mm)	IE-784225-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100	
μ PD784215A			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}	
μ PD784216A			NP-H100GF-TQ ^{Note 1}		
μ PD78F4216A	100-pin LQFP (14 × 14 mm)		NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}	
			NP-H100GC-TQ ^{Note 1}		
μ PD784214AY	100-pin QFP (14 × 20 mm)		IE-784225-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
μ PD784215AY		NP-100GF-TQ ^{Note 1}		TGF-100RBP ^{Note 2}	
μ PD784216AY		NP-H100GF-TQ ^{Note 1}			
μ PD78F4216AY	100-pin LQFP (14 × 14 mm)	NP-100GC ^{Note 1}		TGC-100SDW ^{Note 2}	
		NP-H100GC-TQ ^{Note 1}			
μ PD784217A	100-pin QFP (14 × 20 mm)	IE-784225-NS-EM1		NP-100GF ^{Note 1}	EV-9200GF-100
μ PD784218A			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}	
μ PD78F4218A			NP-H100GF-TQ ^{Note 1}		
	100-pin LQFP (14 × 14 mm)		NP-100GC ^{Note 1}	TGC-100SDW ^{Note 2}	
			NP-H100GC-TQ ^{Note 1}		
μ PD784217AY	100-pin QFP (14 × 20 mm)		IE-784225-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
μ PD784218AY		NP-100GF-TQ ^{Note 1}		TGF-100RBP ^{Note 2}	
μ PD78F4218AY		NP-H100GF-TQ ^{Note 1}			
	100-pin LQFP (14 × 14 mm)	NP-100GC ^{Note 1}		TGC-100SDW ^{Note 2}	
		NP-H100GC-TQ ^{Note 1}			
μ PD784224	80-pin QFP (14 × 14 mm)	IE-784225-NS-EM1		NP-80GC ^{Note 1}	EV-9200GC-80
μ PD784225			NP-80GC-TQ ^{Note 1}	TGC-080SBP ^{Note 2}	
μ PD78F4225			NP-H80GC-TQ ^{Note 1}		
	80-pin TQFP (12 × 12 mm)		NP-80GK ^{Note 1}	TGK-080SDW ^{Note 2}	
			NP-H80GK-TQ ^{Note 1}		

Notes 1. This is a product of Naito Densai Machida Mfg. Co., Ltd.

2. This is a product of Tokyo Eletech Corporation.

Development Tools

78K/IV Series Hardware Tools

■ List of Hardware Tools (When using IE-78K4-NS) (2/2)

Target device		Emulation board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μ PD784224Y	80-pin QFP (14 × 14 mm)	IE-784225-NS-EM1	NP-80GC ^{Note 1}	EV-9200GC-80
μ PD784225Y			NP-80GC-TQ ^{Note 1}	TGC-080SBP ^{Note 2}
μ PD78F4225Y			NP-H80GC-TQ ^{Note 1}	
	80-pin TQFP (12 × 12 mm)		NP-80GK ^{Note 1}	TGK-080SDW ^{Note 2}
			NP-H80GK-TQ ^{Note 1}	
μ PD784907	100-pin QFP (14 × 20 mm)	IE-784908-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
μ PD784908			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}
μ PD78F4908			NP-H100GF-TQ ^{Note 1}	
μ PD784915B	100-pin QFP (14 × 20 mm)	IE-784928-NS-EM1	EP-784928GF-NS	NEV-921GF-100
μ PD784916B			4915 YQPACK PKG	(attached to
μ PD78P4916			(attached to EP-784928GF-NS)	EP-784928GF-NS)
μ PD784927	100-pin QFP (14 × 20 mm)	IE-784928-NS-EM1	EP-784928GF-NS	NQPACK100RB ^{Note 2}
μ PD784928			4915 YQPACK PKG	+ HQPACK100RB ^{Note 2}
μ PD78F4928			(attached to EP-784928GF-NS)	(attached to
	100-pin QFP (14 × 14 mm)		EP-784928GF-NS	EP-784928GF-NS)
			4928GC DUMMY	TGC-100SDW ^{Note 2}
			(attached to EP-784928GF-NS)	
μ PD784927Y	100-pin QFP (14 × 20 mm)	IE-784928-NS-EM1	EP-784928GF-NS	NQPACK100RB ^{Note 2}
μ PD784928Y			4915 YQPACK PKG	+ HQPACK100RB ^{Note 2}
μ PD78F4928Y			(attached to EP-784928GF-NS)	(attached to
				EP-784928GF-NS)
μ PD784935A	100-pin QFP (14 × 20 mm)	IE-784937-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
μ PD784936A				
μ PD784937A			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}
μ PD784938A			NP-H100GF-TQ ^{Note 1}	
μ PD78F4938A				
μ PD784953A	80-pin QFP (14 × 14 mm)	IE-784956-NS-EM1	NP-80GC ^{Note 1}	EV-9200GC-80
μ PD784956A			NP-80GC-TQ ^{Note 1}	TGC-080SBP ^{Note 2}
μ PD78F4956A			NP-H80GC-TQ ^{Note 1}	
μ PD784975A	100-pin QFP (14 × 20 mm)	IE-784976-NS-EM1	NP-100GF ^{Note 1}	EV-9200GF-100
μ PD78F4976A [★]			NP-100GF-TQ ^{Note 1}	TGF-100RBP ^{Note 2}
			NP-H100GF-TQ ^{Note 1}	

Notes 1. This is a product of Naito Densai Machida Mfg. Co., Ltd.

★: Under development

2. This is a product of Tokyo Eletech Corporation.

Development Tools

78K/IV Series Hardware Tools**(2) When using the in-circuit emulator IE-784000-R****■ Common Hardware Tools (When using IE-784000-R)**

Tool name	Product name
In-circuit emulator	IE-784000-R
Emulation board	IE-784000-R-EM
Interface board	IE-70000-98-IF-C for C bus of PC-9800 Series ^{Note 1}
	IE-70000-PC-IF-C for ISA bus of PC/AT and compatibles ^{Note 1}
	IE-70000-PCI-IF-A for PCI bus ^{Note 2}

Notes 1. Not available for PC98-NX Series.

2. Available for PC98-NX Series.

Development Tools

78K/IV Series Hardware Tools

■ List of Hardware Tools (When using IE-784000-R) (1/2)

Target device		I/O emulation board (emulation board) Emulation probe conversion board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μ PD784031 μ PD784035 μ PD784036	80-pin QFP (14 × 14 mm)	IE-784038-R-EM1	EP-78230GC-R	EV-9200GC-80
μ PD784037 μ PD784038 μ PD78P4038	80-pin TQFP (12 × 12 mm)		EP-78054GK-R	TGK-080SDW ^{Note}
μ PD784031Y μ PD784035Y μ PD784036Y	80-pin QFP (14 × 14 mm)		EP-78230GC-R	EV-9200GC-80
μ PD784037Y μ PD784038Y μ PD78P4038Y	80-pin TQFP (12 × 12 mm)		EP-78054GK-R	TGK-080SDW ^{Note}
μ PD784044 μ PD784046 μ PD78F4046	80-pin QFP (14 × 14 mm)	IE-784046-R-EM1	EP-78230GC-R	EV-9200GC-80
μ PD784054	80-pin QFP (14 × 14 mm)	IE-784046-R-EM1	EP-78230GC-R	EV-9200GC-80
μ PD784214A μ PD784215A	100-pin QFP (14 × 20 mm)	IE-784225-NS-EM1 IE-78K4-R-EX3	EP-784218GF-R	EV-9200GF-100
μ PD784216A μ PD78F4216A	100-pin LQFP (14 × 14 mm)	IE-784225-NS-EM1 IE-78K4-R-EX3	EP-78064GC-R	TGC-100SDW ^{Note}
μ PD784214AY μ PD784215AY	100-pin QFP (14 × 20 mm)		EP-784218GF-R	EV-9200GF-100
μ PD784216AY μ PD78F4216AY	100-pin LQFP (14 × 14 mm)		EP-78064GC-R	TGC-100SDW ^{Note}
μ PD784217A μ PD784218A μ PD78F4218A	100-pin QFP (14 × 20 mm) 100-pin LQFP (14 × 14 mm)		EP-784218GF-R EP-78064GC-R	EV-9200GF-100 TGC-100SDW ^{Note}
μ PD784217AY μ PD784218AY μ PD78F4218AY	100-pin QFP (14 × 20 mm) 100-pin LQFP (14 × 14 mm)		EP-784218GF-R EP-78064GC-R	EV-9200GF-100 TGC-100SDW ^{Note}
μ PD784224 μ PD784225	80-pin QFP (14 × 14 mm)	IE-784225-NS-EM1 IE-78K4-R-EX2	EP-78230GC-R	EV-9200GC-80
μ PD78F4225	80-pin TQFP (12 × 12 mm)		EP-78054GK-R	TGK-080SDW ^{Note}

Note This is a product of Tokyo Eletech Corporation.

Development Tools

78K/IV Series Hardware Tools

■ List of Hardware Tools (When using IE-784000-R) (2/2)

Target device		I/O emulation board (emulation board) Emulation probe conversion board	Emulation probe	Conversion socket/ Conversion adapter
Device name	Package			
μ PD784224Y	80-pin QFP (14 × 14 mm)	IE-784225-NS-EM1	EP-78230GC-R	EV-9200GC-80
μ PD784225Y	80-pin TQFP (12 × 12 mm)	IE-78K4-R-EX2	EP-78054GK-R	TGK-080SDW ^{Note}
μ PD78F4225Y				
μ PD784907	100-pin QFP (14 × 20 mm)	IE-784908-R-EM1	EP-78064GF-R	EV-9200GF-100
μ PD784908				
μ PD78P4908				
μ PD784915B	100-pin QFP (14 × 20 mm)	IE-784928-NS-EM1 IE-78K4-R-EX3	EP-784915GF-R	EV-9200GF-100
μ PD784916B				
μ PD78P4916				
μ PD784927	100-pin QFP (14 × 20 mm)	IE-784928-NS-EM1	EP-784915GF-R	EV-9200GF-100
μ PD784928		IE-78K4-R-EX3		
μ PD78F4928	100-pin QFP (14 × 14 mm)	When using the IE-784000-R, please contact an NEC sales representative.		
μ PD784927Y	100-pin QFP (14 × 20 mm)	IE-784928-NS-EM1	EP-784915GF-R	EV-9200GF-100
μ PD784928Y		IE-78K4-R-EX3		
μ PD78F4928Y				
μ PD784935A	100-pin QFP (14 × 20 mm)	IE-784937-NS-EM1	EP-78064GF-R	EV-9200GF-100
μ PD784936A		IE-78K4-R-EX3		
μ PD784937A				
μ PD784938A				
μ PD78F4938A				
μ PD784953A	80-pin QFP (14 × 14 mm)	IE-784956-NS-EM1	EP-78230GC-R	EV-9200GC-80
μ PD784956A		IE-78K4-R-EX2		
μ PD78F4956A				
μ PD784975A	100-pin QFP (14 × 20 mm)	Not supported. Use IE-78K4-NS for these devices.		
μ PD78F4976A★				

Note This is a product of Tokyo Eletech Corporation.

★: Under development

Development Tools

78K/IV Series Programming Environment

(1) PROM Programming Environment

■ Common PROM Programming Tools

Tool name	Product name
PROM programmer	PG-1500

■ PROM Programming Environment

Target device		Corresponding PROM product	Programmer adapter
Subseries name	Package		
μPD784038	80-pin QFP (14 × 14 mm)	μPD78P4038GC-3B9	PA-78P4026GC
		μPD78P4038GC-8BT	PA-78P4038GC-8BT
		μPD78P4038KK-T	PA-78P4026KK
	80-pin TQFP (12 × 12 mm)	μPD78P4038GK	PA-78P4038GK
μPD784038Y	80-pin QFP (14 × 14 mm)	μPD78P4038YGC-3B9	PA-78P4026GC
		μPD78P4038YGC-8BT	PA-78P4038GC-8BT
		μPD78P4038YKK-T	PA-78P4026KK
	80-pin TQFP (12 × 12 mm)	μPD78P4038YGK	PA-78P4038GK
μPD784908	100-pin QFP (14 × 20 mm)	μPD78P4908GF	PA-78P4908GF
μPD784915	100-pin QFP (14 × 20 mm)	μPD78P4916GF	PA-78P4916GF

Flash memory products or EEPROM products are supported for the devices other than above.
See **(2) Flash/EEPROM Programming Environment**.

Development Tools

78K/IV Series Programming Environment

(2) Flash Programming Environment

■ Common Flash Programming Tools

Tool name	Product name
Flash programmer	PG-FP3

■ Flash Programming Environment

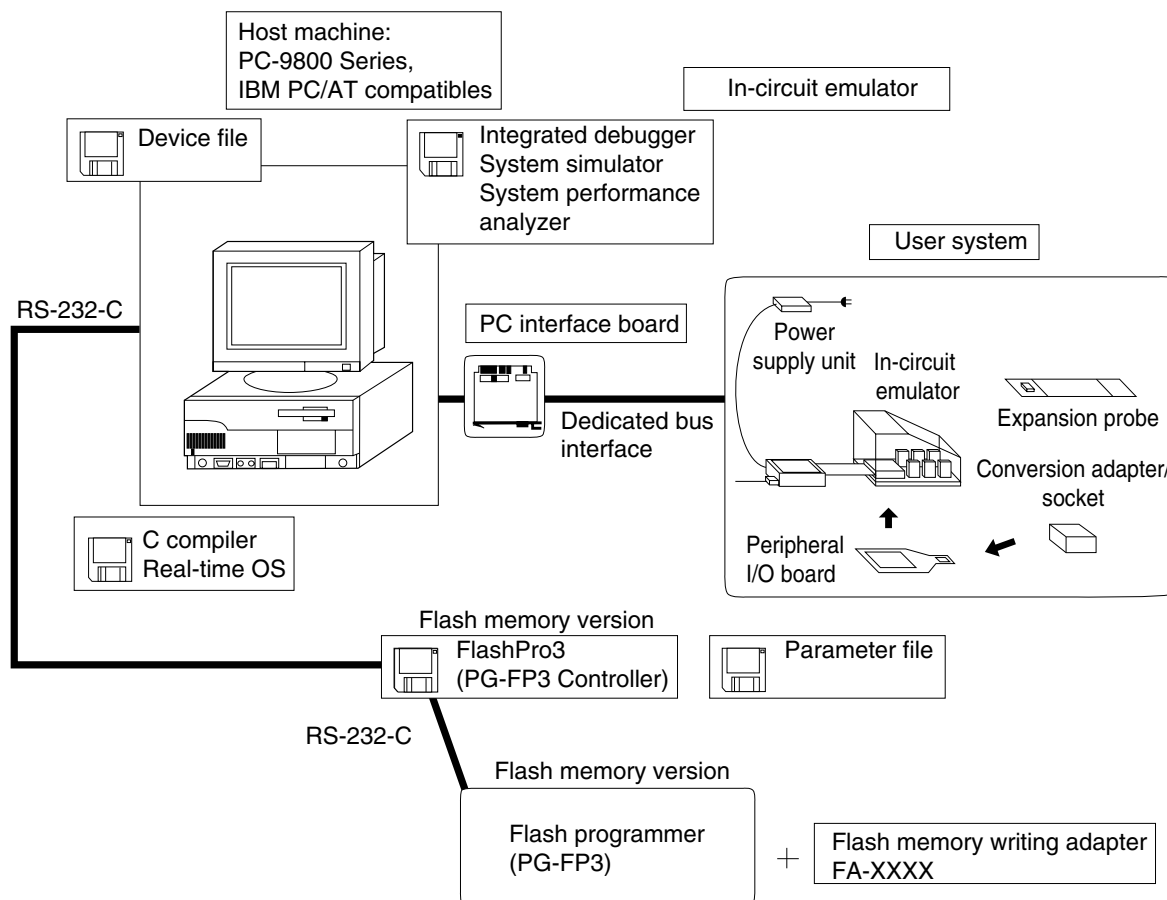
Target device		Corresponding flash/ memory product	Programmer adapter
Subseries name	Package		
μ PD784046	80-pin QFP (14 × 14 mm)	μ PD78F4046GC	FA-80GC-8BT
μ PD784054	80-pin QFP (14 × 14 mm)	μ PD78F4046GC	FA-80GC-8BT
μ PD784216A	100-pin QFP (14 × 20 mm)	μ PD78F4216AGF	FA-100GF-3BA
	100-pin QFP (14 × 14 mm)	μ PD78F4216AGC	FA-100GC-8EU
μ PD784216AY	100-pin QFP (14 × 20 mm)	μ PD78F4216AYGF	FA-100GF-3BA
	100-pin QFP (14 × 14 mm)	μ PD78F4216AYGC	FA-100GC-8EU
μ PD784218A	100-pin QFP (14 × 20 mm)	μ PD78F4218AGF	FA-100GF-3BA
	100-pin QFP (14 × 14 mm)	μ PD78F4218AGC	FA-100GC-8EU
μ PD784218AY	100-pin QFP (14 × 20 mm)	μ PD78F4218AYGF	FA-100GF-3BA
	100-pin QFP (14 × 14 mm)	μ PD78F4218AYGC	FA-100GC-8EU
μ PD784225	80-pin QFP (14 × 14 mm)	μ PD78F4225GC	FA-80GC-8BT
	80-pin QFP (12 × 12 mm)	μ PD78F4225GK	FA-80GK-9EU
μ PD784225Y	80-pin QFP (14 × 14 mm)	μ PD78F4225YGC	FA-80GC-8BT
	80-pin QFP (12 × 12 mm)	μ PD78F4225YGK	FA-80GK-9EU
μ PD784928	100-pin QFP (14 × 20 mm)	μ PD78F4928GF	FA-100GF-3BA
	100-pin QFP (14 × 14 mm)	μ PD78F4928GC	FA-100GC-8EU
μ PD784928Y	100-pin QFP (14 × 20 mm)	μ PD78F4928YGF	FA-100GF
μ PD784938A	100-pin QFP (14 × 20 mm)	μ PD78F4938AGF	FA-100GF
μ PD784956A	80-pin QFP (14 × 14 mm)	μ PD78F4956AGC	FA-80GC-8BT
μ PD784976A	100-pin QFP (14 × 20 mm)	μ PD78F4976AGF★	FA-100GF

Remark FA-xxxx is a product of Naito Densai Machida Mfg. Co., Ltd. ★: Under development
For further information, contact Naito Densai Machida Mfg. Co., Ltd. (TEL: +81-45-475-4191)

Development Tools

V850 Family Development Environment

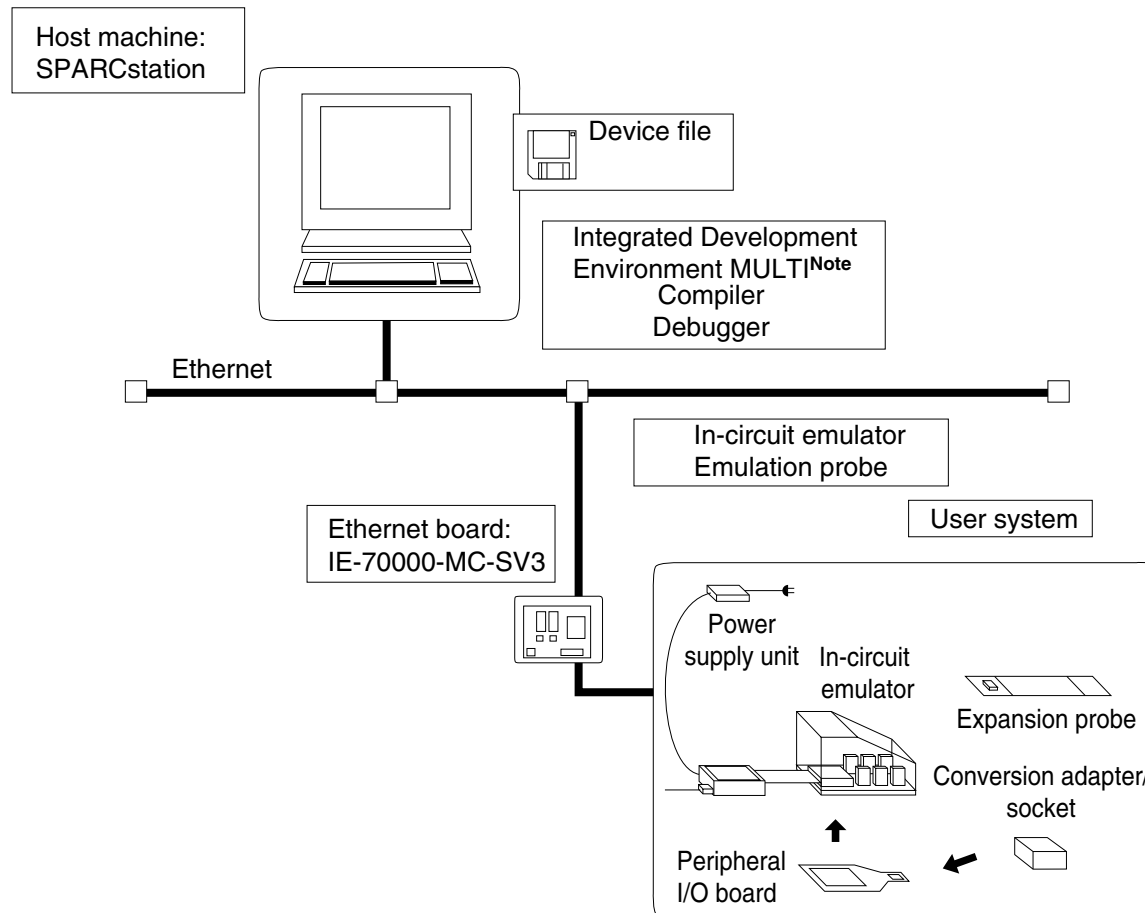
■ Windows based



Development Tools

V850 Family Development Environment

■ EWS based



Note MULTI is a product of Green Hills Software.

Development Tools

V850 Family Software Tools

■ List of Software Tools

Product name		Target device	Host machine
Software Package	SP850	V850 Family	PC-9800 Series IBM PC/AT and compatibles PC98-NX Series
Real-time OS	RX850		PC-9800 Series IBM PC/AT and compatibles PC98-NX Series SPARCstation
	RX850 Pro		
Compiler CA850			PC-9800 Series IBM PC/AT and compatibles PC98-NX Series SPARCstation
Debugger ID850			PC-9800 Series IBM PC/AT and compatibles PC98-NX Series
Simulator SM850			PC-9800 Series IBM PC/AT and compatibles PC98-NX Series
System performance analyzer AZ850			PC-9800 Series IBM PC/AT and compatibles PC98-NX Series

Remark Please contact an NEC sales representative if you use host machines not mentioned above.

■ List of Device Files

Target device	Device file name	Target device	Device file name
V853	DF703003	V850E/MS1	DF703102
V850/SA1	DF703017	V850E/MS2	DF703130★
V850/SB1	DF703037	V850E/MA1	DF703107
V850/SB2		V850E/MA2	DF703108★
V850/SV1	DF703040	V850E/IA1	DF703116
V850/SF1	DF703079	V850E/IA2	DF703114★
V850/SC1	DF703089★	★: Under development	
V850/SC2			
V850/SC3			

Development Tools

V850 Family Hardware Tools

■ List of Hardware Tools (1/3)

Product name	Target device	Part number	Remarks
In-circuit emulator	V850E/MS1, V850E/MS2	IE-703102-MC	A PC interface cable, external logic probe, and conversion sockets ^{Note 1} are included
	V850/SA1, V850/SB1, V850/SB2, V850/SV1, V850/SF1, V850/SC1, V850/SC2, V850/SC3, V853	IE-703002-MC	
	V850E/MA1, V850E/MA2, NB85E Core	IE-V850E-MC-A	A PC interface cable and external logic probe are included
	V850E/IA1, V850E/IA2	IE-V850E-MC	
In-circuit emulator option board	V850/SA1	IE-703017-MC-EM1	NQPACK100SD ^{Note 2} is included
	V850/SB1, V850/SB2	IE-703037-MC-EM1	Conversion socket is not included
	V850/SV1	IE-703040-MC-EM1	Conversion socket ^{Note 1} is included
	V850/SF1	IE-703079-MC-EM1	Conversion socket not included
	V850/SC1, V850/SC2, V850/SC3	IE-703089-MC-EM1★	Conversion socket ^{Note 1} is included
	V853	IE-703003-MC-EM1	NQPACK100SD ^{Note 2} is included
	V850E/MS1	IE-703102-MC-EM1	For 5V, conversion socket not included
		IE-703102-MC-EM1-A	For 3.3V, conversion socket not included
	V850E/MS2	IE-703102-MC-EM1	For 5V, conversion socket is not included VP-V850E/MS1-MS2 ^{Note 3} is necessary when using this
	V850E/MA1, V850E/MA2	IE-703107-MC-EM1	Conversion socket ^{Note 1} is included
	V850E/IA1	IE-703116-MC-EM1	
	V850E/IA2	IE-703114-MC-EM1	
	NB85E Core	IE-V850E-MC-EM1-B	Core adapter for system on chip (3.3V)
		IE-V850E-MC-EM1-A	Core adapter for system on chip (2.5V)
N-Wire In-circuit emulator	NB85ET Core, NU85ET Core	IE-70000-MC-NW-A	ROM probe (sold separately) is necessary when using this
Power supply unit	V850/SA1, V850/SB1, V850/SB2, V850/SV1, V850/SF1, V850/SC1, V850/SC2, V850/SC3, V850E/MS1, V850E/MS2, V850E/MA1, V850E/MA2, V850E/IA1, V850E/IA2, V853, NB85E Core, NB85ET Core, NU85ET Core	IE-70000-MC-PS-B	Power supply cable for AC100 to 240V is included

★: Under development

Notes 1. The following conversion sockets, which are products of Tokyo Eletech Corporation, are included.

IE-703102-MC : NQPACK144SD, YQPACK144SD, HQPACK144SD, YQGUIDE

IE-703002-MC : NQPACK100SD, YQPACK100SD, HQPACK100SD, YQSOCKET100SDN, YQGUIDE

IE-703040-MC-EM1: NQPACK176SD, YQPACK176SD, YQGUIDE

IE-703089-MC-EM1: NQPACK144SD, YQPACK144SD, HQPACK144SD, YQGUIDE

IE-703107-MC-EM1: NQPACK144SD, YQPACK144SD, HQPACK144SD, YQGUIDE

IE-703116-MC-EM1: NQPACK144SD, YQPACK144SD, HQPACK144SD, YQGUIDE

IE-703114-MC-EM1: NQPACK100SD, YQPACK100SD, HQPACK100SD, YQGUIDE

2. This is a product of Tokyo Eletech Corporation.

3. This is a product of Naito Densai Machida Mfg. Co., Ltd.

Development Tools

V850 Family Hardware Tools

■ List of Hardware Tools (2/3)

Product name	Target device	Part number	Remarks
PC interface board	V850/SA1, V850/SB1, V850/SB2, V850/SV1, V850/SF1, V850/SC1, V850/SC2, V850/SC3, V850E/MS1, V850E/MS2, V853, NB85ET Core, NU85ET Core	IE-70000-98-IF-C	For PC-9800 (C bus) ^{Note 1}
		IE-70000-PC-IF-C	For IBM PC/AT and compatibles (ISA bus) ^{Note 1}
		IE-70000-CD-IF-A	For PCMCIA socket ^{Note 2}
		IE-70000-PCI-IF-A	For PCI bus ^{Note 2}
Conversion adapter/ conversion socket	V850/SA1 (FPBGA)	CSPACK121A1312N02 ^{Note 3}	Conversion socket for 121-pin FPBGA
		CSICE121A1312N02 ^{Note 3}	Conversion adapter for 121-pin FPBGA CSPACK121A1312N02 ^{Note 3} is necessary when using this
	V850/SA1, V850/SB1(GC), V850/SB2(GC), V853, V850/SF1(GC), V850E/MS2, V850E/IA2	NQPACK100SD ^{Note 3}	Conversion socket for target board (for 100-pin QFP (0.5-mm pitch))
		YQPACK100SD ^{Note 3}	Conversion socket for connection to an in-circuit emulator
		HQPACK100SD ^{Note 3}	Cover of the socket for 100-pin QFP
		YQSOCKET100SDN ^{Note 3}	Socket for spacer
		YQGUIDE ^{Note 3}	Fixing screws
	V850/SB1(GF), V850/SB2(GF)	NEXB-100SD/RB ^{Note 3}	100-pin GC-GF conversion board for V850/SB1, V850/SB2
		NQPACK100RB ^{Note 3}	Conversion socket for target board (for 100-pin QFP (14 × 20 mm, 0.65-mm pitch))
		YQPACK100RB ^{Note 3}	Conversion socket for connection to an in-circuit emulator
		HQPACK100RB ^{Note 3}	Cover of the socket for 100-pin QFP
		YQSOCKET100RBN ^{Note 3}	Socket for spacer
		YQGUIDE ^{Note 3}	Fixing screws
	V850/SV1	NQPACK176SD ^{Note 3}	Conversion socket for target board (for 176-pin QFP (0.5-mm pitch))
		YQPACK176SD ^{Note 3}	Conversion socket for connection to an in-circuit emulator
		HQPACK176SD ^{Note 3}	Cover of the socket for 176-pin QFP
		YQSOCKET176SDN ^{Note 3}	Socket for spacer
		YQGUIDE ^{Note 3}	Fixing screws
	V850/SV1(BGA)	EXC-180A/SV1 ^{Note 3, Note 4}	Conversion probe for connection to an in-circuit emulator
		CSSOCKET180A1513N01 ^{Note 3, Note 4}	Socket for mounting on target board
		CSSOCKET180A1513N01S01 ^{Note 3, Note 4}	Stack-type socket
	V850E/MS1(QFP), V850E/MA1, V850E/IA1, V850/SC1, V850/SC2, V850/SC3	NQPACK144SD ^{Note 3}	Conversion socket for target board (for 144-pin QFP (0.5-mm pitch))
		YQPACK144SD ^{Note 3}	Conversion socket for connection to an in-circuit emulator
		HQPACK144SD ^{Note 3}	Cover of the socket for 144-pin QFP
		YQSOCKET144SDN ^{Note 3}	Socket for spacer
		YQGUIDE ^{Note 3}	Fixing screws

Notes 1. Not available for PC98-NX Series.

2. Available for PC98-NX Series.

3. This is a product of Tokyo Eletech Corporation.

4. Under evaluation

Development Tools

V850 Family Hardware Tools

■ List of Hardware Tools (3/3)

Product name	Target device	Part number	Remarks
Conversion adapter/ conversion socket	V850E/MA1(BGA)	CSSOCKET161A1413N01 ★ ^{Note 1}	Conversion socket for target
		LSPACK161A1413N01 ★ ^{Note 1}	Conversion adapter/Socket for connection to device
		CSICE161A1413N02 ★ ^{Note 1}	FPBGA-QFP conversion adapter
	V850E/MA2	VP-V850E/MA1-MA2 ^{Note 2}	Conversion adapter for V850E/MA2
		NQPACK100SD ^{Note 1}	Conversion socket for target board (for 100-pin QFP (0.5-mm pitch))
		YQPACK100SD ^{Note 1}	Conversion socket for connection to an in-circuit emulator
		HQPACK100SD ^{Note 1}	Cover of the socket for connection 100-pin QFP
		YQSOCKET100SDN ^{Note 1}	Socket for spacer
		YQGUIDE ^{Note 1}	Fixing screws
	V850E/MS1(BGA)	CSPACK157A1614N01 ^{Note 1}	Conversion socket for 157-pin FPBGA
		CSICE157A1614N01 ^{Note 1}	Conversion adapter for 157-pin FPBGA CSPACK157A1614N01 ^{Note 1} is necessary when using this
	V850/SF1(GF)	NQPACK100RB ^{Note 1}	Conversion socket for target board (for 100-pin QFP (14 × 20 mm, 0.65-mm pitch))
		YQPACK100RB ^{Note 1}	Conversion socket for connection to an in-circuit emulator
		HQPACK100RB ^{Note 1}	Cover of the socket for 100-pin QFP
		YQSOCKET100RBN ^{Note 1}	Socket for spacer
		YQGUIDE ^{Note 1}	Fixing screws
Expansion probe	V852, V853, V850/SA1, V850/SB1(GC), V850/SB2 (GC), V850/SF1 (GC), V850E/MA2, V850E/IA2	SC-100SDN ^{Note 1}	Expansion probe 100-pin QFP (0.5-mm pitch) Length 144mm, Flexible probe
		SWEX-100SD ^{Note 1}	Expansion probe 100-pin QFP (0.5-mm pitch) Length 364mm, Coaxial probe
	V850/SV1	SC-176SDN ^{Note 1}	Expansion probe 176-pin QFP (0.5-mm pitch) Length 222mm, Flexible probe
	V854, V850E/MS1, V850E/MA1, V850E/IA1, V850/SC1, V850/SC2, V850/SC3	SC-144SDN ^{Note 1}	Expansion probe 144-pin QFP (0.5-mm pitch) Length 211mm, Flexible probe
		SWEX-144SD-1 ★ ^{Note 1}	Expansion probe 144-pin QFP (0.5-mm pitch) Length 378mm, Coaxial probe
	V850/SF1 (GF)	SWEX-100SD/GF-N17D ^{Note 1}	Extension probe for GC-GF conversion dedicated to V850/SF1 Length 364mm, Coaxial probe
	ROM probe	EP-16000C	Probe for 278000/2716000 type ROM
		EP-16384C	Probe for 274096 type ROM

★: Under development

Notes 1. This is a product of Tokyo Eletech Corporation.

2. This is a product of Naito Densai Machida Mfg. co., Ltd.

Development Tools

V850 Family Programming Environment**■ Flash Programming Environment**

Product name	Target device	Part number	Remarks
Flash programmer	All products, excluding the V850E/MS2, V850E/MA2	PG-FP3	Flash memory programmer
Program adapter	V850/SA1 (121-pin FBGA)	FA-121PBGA	Flash program adapter for 121-pin FBGA (121S1-YJC)
		FA-121F1-EA6	Flash program adapter for 121-pin FBGA (121F1-EA6)
	V850E/MS1 (157-pin FBGA)	FA-157FPBGA	Flash program adapter for 157-pin FBGA (167F1-FA1)
	V853 (100-pin QFP)	FA-100GC	Flash program adapter for 100-pin QFP (100GC-7EA, 100GC-9EU)
	V853, V850/SA1, V850/SB1, V850/SB2, V850/SF1 (100-pin QFP), V850E/IA2	FA-100GC-8EU	Flash program adapter for 100-pin QFP (100GC-8EU)
	V850E/MS1, V850E/MA1 (144-pin QFP), V850E/IA1 (144-pin QFP), V850/SC1, V850/SC2, V850/SC3	FA-144GJ-UEN	Flash program adapter for 144-pin QFP (144-GJ-8EU, 144-GJ-UEN)
	V850/SB1, V850/SB2, V850/SF1 (100-pin QFP)	FA-100GF-3BA	100-pin QFP (100GF-3BA)
	V850/SV1 (176-pin QFP)	FA-176GM-UEU	Flash program adapter for 176-pin QFP (176GM-UEU)
	V850/SV1 (180-pin FBGA)	FA-180FPBGA	Flash program adapter for 180-pin FBGA (180F1-EN2)
	V850E/MA1 (161-pin FBGA)	FA-161F1-EN4	Flash program adapter for 161-pin FBGA (161F1-EN4)

Remark FA-xxxx is a product of Naito Densai Machida Mfg. Co., Ltd.

For further information, contact Naito Densai Machida Mfg. Co., Ltd. (TEL: +81-45-475-4191)

Development Tools

V_R Series Development Tools

■ List of Software Tools

Product name	Target device	Host machine
Real-time OS RX4000	V _R 4100 Series V _R 4300 Series V _R 5432 Series	PC-9800 Series IBM PC/AT and compatibles PC98-NX Series
System Performance Analyzer AZ4000	V _R 4100 Series V _R 4300 Series V _R 5432 Series	PC-9800 Series IBM PC/AT and compatibles PC98-NX Series

Other than above, tools as follows are also provided by development tool makers for V_R Series.

Software tools	Hardware tools
Operating system Real-time OS Optimization compiler Source debugger	Evaluation board ROM emulator

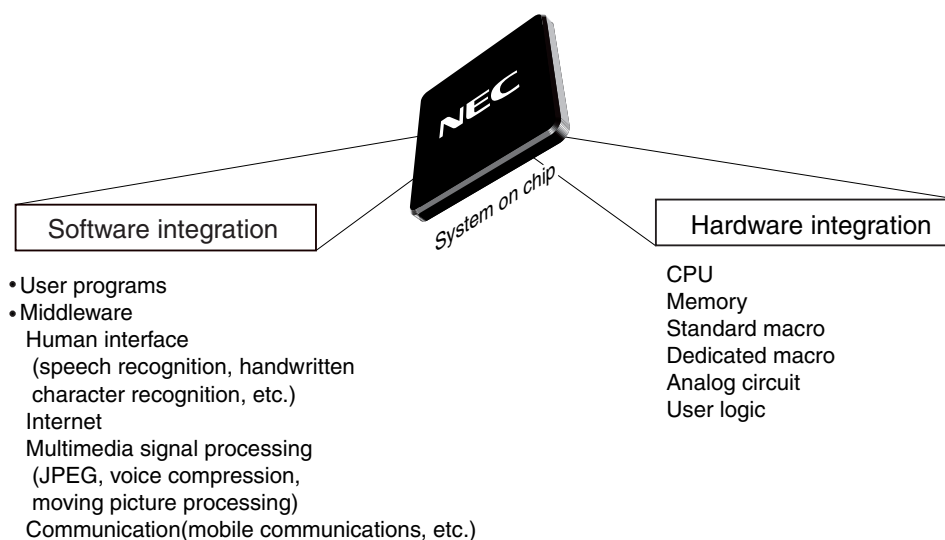
Middleware

What is Middleware?

■ Middleware that Holds the Key to Multimedia

Various key technologies are needed to realize multimedia applications, such as a human-machine interface as speech recognition, and data compression/decompression including data communications. And these technologies require high-performance RISC microcomputers and DSP capable of high-speed data processing. The V850 Family, V_R Series and DSP answer these requirements with powerful performance and function complemented by middleware support based on multimedia performance.

■ The positioning of middleware



■ Features

◦ Reduced overall costs due to shorter TAT development and lower development costs

If middleware that has been optimized to the CPU architecture is used, the amount of time taken, to develop each individual system can be markedly reduced. Moreover, as there is no need to use dedicated devices, the cost is further streamlined.

◦ Improved CPU performance

The CPU, due to the improvement in CPU performance, can now easily realize applications that could previously only be performed by dedicated hardware or personal computers/workstations. The addition, modification and deletion of functions difficult to perform with hardware, as well as the organization of user-friendly interfaces have now been made simpler.

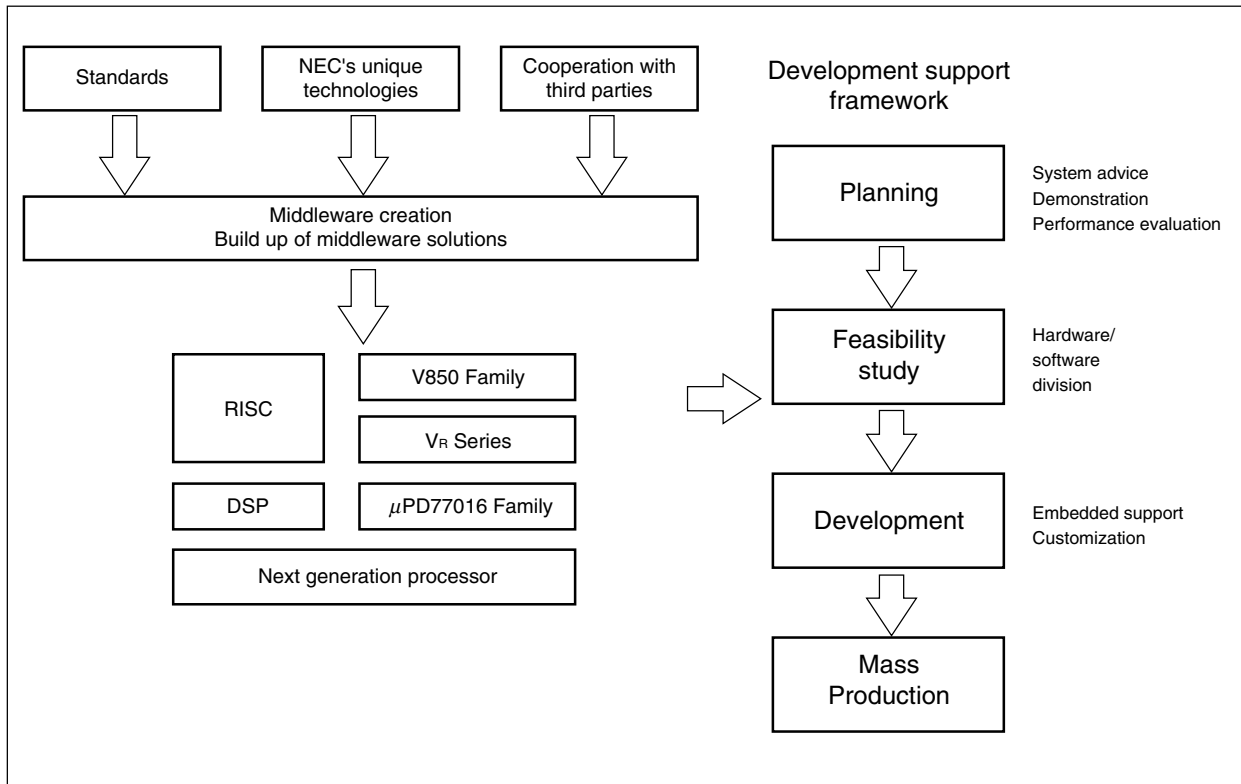
◦ Spread of Internet and multimedia signal-processing applications

Through the popularity of the Internet, the management of multimedia information such as picture images and speech has expanded considerably. To employ dedicated hardware to process this information would take a large-scale system and considerable cost. By using middleware, the processing of this information can be easily realized by the CPU alone.

Middleware

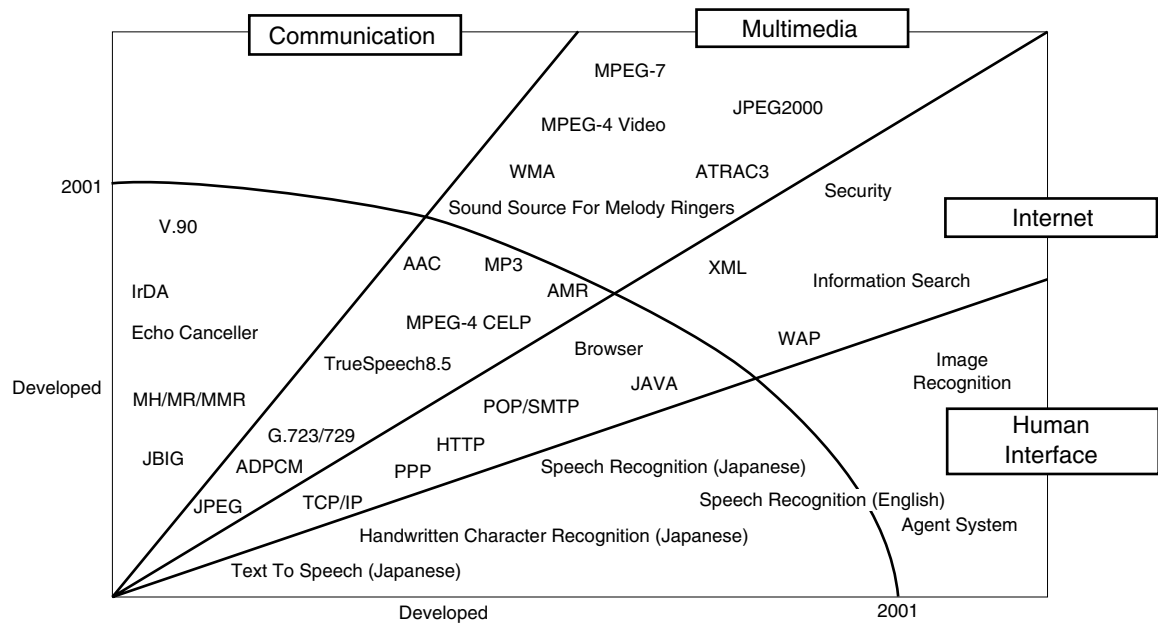
Middleware Development Framework

NEC middleware will gradually develop into optimal processor for each system. Furthermore, NEC plans to realize standardized middleware by using not only NEC's uniquely developed technologies, but also the most outstanding third party technologies and standards.



Middleware

Middleware Road Map



Middleware

Middleware Products

(1/2)

Field	Middleware		RISC		DSP
			V850 Family	V _R Series	μPD77016 Family
Image	MH/MR/MMR		◎	◎	—
	JBIG		◎	—	—
	JPEG		◎	◎	—
	H.263/MPEG-4 Video		—	—	○
Speech	Text To Speech	Japanese	◎	◎	—
		Multilingual version (TTS3000/C ^{Note 1})	—	△ ^{Note 2}	—
	Speech CODEC	TrueSpeech8.5	—	◎	—
		G.723.1 Annex A/C	—	—	◎
		G.726 (ADPCM)	◎	—	—
		G.729 Annex A/B	—	—	◎
		AMR	—	—	◎
		MPEG-4 CELP	—	—	◎
	Acoustic Echo Canceller (for hands-free application)		—	—	◎
Sound	Sound DECODER	AAC	—	—	◎
		MP3	—	—	◎
		Sound Source For Melody Ringers	—	—	○

Notes 1. This is a product of Lemout & Hauspie Speech Products N.V.**2.** WindowsCE (CPU:V_R4111/V_R4121) supported.**Remarks 1.** ◎: Developed

○: Under Development

△: Under Planning

2. The products and CPUs supported and targeted by third parties differ depending on the company. For details, contact the relevant third party company.

Middleware

(2/2)

Field	Middleware		RISC		DSP
			V850 Family	V _R Series	μPD77016 Family
Recognition	Speech Recognition	Japanese (Large vocabulary)	—	◎	—
		Japanese (Small vocabulary)	◎	—	◎
		English (Small vocabulary)	○	—	◎
		Multilingual version (ASR1600/C ^{Note 1})	—	△ ^{Note 2}	—
	Handwritten Character Recognition	Japanese (with input frame)	◎	◎	—
		Japanese (without input frame)	—	◎	—
Internet	Browser ^{Note 3}		◎	◎	—
	TCP/IP ^{Note 4}		◎	◎	—
Communication	Controller MODEM: V.90 ^{Note 5, 6}		—	◎	—
	Software MODEM: V.90 ^{Note 5, 7}		—	◎	—
Driver	IrDA protocol stack ^{Note 8}		◎	△	—
	PCMCIA/CF card ^{Note 9}		○	△	—
	PC-compatible file system ^{Note 10}		○	△	—
Other	Fonts ^{Note 11}		◎	◎	—

- Notes**
1. This is a product of Lemout & Hauspie Speech Products N.V.
 2. WindowsCE (CPU:V_R4111/V_R4121) supported.
 3. This is a product of Accesss Corporation and Aplix Corporation.
 4. This is also made by Access Corporation, Aplix Corporation, AI Corporation, and Elmic Systems, Inc. other than NEC.
 5. A product supporting WindowsCE is also available.
 6. This is a product of Conexant Systems, Inc.
 7. This is a product of PCTEL, Inc.
 8. This is a product of Okaya Systemware Co., Ltd.
 9. This is a product of SanDisk Corporation.
 10. This is a product of AI Corporation.
 11. This is a product of NEC (NEC Solutions)

- Remarks**
1. ◎: Developed
○: Under Development
△: Under Planning
 2. The products and CPUs supported and targeted by third parties differ depending on the company. For details, contact the relevant third party company.

Middleware

Middleware Performance

(1/2)

Middleware	CPU	Performance	Power (MIPS)	ROM	RAM
MH/MR/MMR	V850 Family	MH Chart 1 : Enc 0.12 s/Dec 0.08 s	–	64 KB	200 bytes
	V _R 4100 Series	MH Chart 1 : Enc 0.18 s/Dec 0.19 s	–	64 KB	200 bytes
JBIG	V850 Family	Chart 1 : Enc 0.73 s/Dec 0.83 s	–	21 KB	2.6 KB
JPEG	V850 Family	QVGA × 24 : Enc 0.32 s/Dec 0.24 s	–	17.5 KB	15 KB
	V _R 4100 (40 MHz)	QVGA × 24 : Enc 0.56 s/Dec 0.08 s	–	56 KB	7.7 KB
	V _R 4300 (133 MHz)	QVGA × 24 : Enc 0.12 s/Dec 0.08 s	–	78 KB	6.5 KB
Text To Speech (Japanese)	V _R Series	390 ms for 3 seconds of speech	10	2 MB	250 KB
	V850 Family	1872 ms for 3 seconds of speech	18	2 MB	250 KB
TrueSpeech 8.5	V _R 4100 Series	8.5 kbps	Enc 38.5/Dec 6	27 KB	4.2 KB
	V _R 4300 (100 MHz)	8.5 kbps	Enc 38.5/Dec 5.3	28 KB	4 KB
G.723.1 Annex A	μPD77016 Family	6.3 kbps, 5.3 kbps	Enc 17.5/Dec 1.5	5.6 Kwords ^{Note1}	4.1 Kwords ^{Note2}
				9.5 Kwords ^{Note2}	
G.723.1 Annex C	μPD77016 Family	+0.7 to 14.3 kbps	Enc 18.5/Dec 3	7.9 Kwords ^{Note1}	4.2 Kwords ^{Note2}
				12.1 Kwords ^{Note2}	
G.726 (ADPCM)	V850 Family	32 kbps, 16 kbps	Enc 8/Dec 8.2	9 KB	80 bytes
	μPD77016 Family ^{Note3}	40 kbps, 32 kbps, 24 kbps, 16 kbps	Enc 5.7/Dec 6	1287 words ^{Note1}	117 words ^{Note2}
				271 words ^{Note2}	
G.729	μPD77016 Family	8 kbps	Enc 15.7/Dec 3.3	8.8 Kwords ^{Note1}	3.7 Kwords ^{Note2}
				5.1 Kwords ^{Note2}	
G.729 Annex A	μPD77016 Family	8 kbps	Enc 9/Dec 2.2	7.7 Kwords ^{Note1}	3.4 Kwords ^{Note2}
				4.6 Kwords ^{Note2}	
G.729 Annex B	μPD77016 Family	8 kbps	Enc 16.5/Dec 3.5	12.2 Kwords ^{Note1}	3.9 Kwords ^{Note2}
				5.5 Kwords ^{Note2}	
G.729 Annex A+B	μPD77016 Family	8 kbps	Enc 9.5/Dec 3.7	11.2 Kwords ^{Note1}	3.6 Kwords ^{Note2}
				5.0 Kwords ^{Note2}	
G.729 Annex B Multi	μPD77016 Family	8 kbps	Enc 13.9/Dec 2.8	7.5 Kwords ^{Note1}	1856N + 2541 words
				4.6 Kwords ^{Note2}	

- Notes**
1. Instruction ROM (1 word = 4 bytes)
 2. Data ROM and RAM (1 word = 2 bytes)
 3. Sample only

Middleware

Middleware Performance

(2/2)

Middleware	CPU	Performance	Power (MIPS)	ROM	RAM
AMR	μPD77016 Family	1.8 to 12.2 kbps	Enc 21.3/Dec 2.7 (max)	13.9 Kwords ^{Note1} 14.8 Kwords ^{Note2}	5.3 Kwords
MPEG-4 CELP	μPD77016 Family	3.85 to 23.8 kbps	NB : Enc 22.3/Dec 3.5 WB : Enc 60.8/Dec 12.5	14.6 Kwords ^{Note1} 18.6 Kwords ^{Note2}	15.6 Kwords ^{Note2}
Acoustic Echo Cancellor	μPD77016 Family	Dependant on the system	Number of taps × 4 [cycles] × (number of memory waits + 1) + (170 to 259) [cycle]	249 words ^{Note1}	Number of taps × 3 + 19 words
MP3 Decoder	μPD77016 Family	8 to 320 kbps	32/2ch (max)	6.4 Kwords ^{Note1} 7.1 Kwords ^{Note2}	8.8 Kwords ^{Note2}
AAC Decoder	μPD77016 Family	up to 576 kbps	48.4/2ch (max)	8.4 Kwords ^{Note1} 7.8 Kwords ^{Note2}	10.6 Kwords ^{Note2}
Speech Recognition (Japanese/6000 words)	V _R Series	0.4 s	130	660 KB	820 KB
Speech Recognition (Small vocabulary)	V850 Family	0.4 s	19 (30 words) 63 (100 words)	82 KB	3.5 KB (15 words)
Handwritten Character Recognition (Japanese/with input frame)	V850 Family	0.1 s/character	14	570 KB	34 KB
Handwritten Character Recognition (Japanese/without input frame)	V _R 4300 (133 MHz)	1 s/character	60 to 100	740 K to 1140 KB	52 KB
IrDA Protocol Stack	V850 Family	—	—	60 KB	16 KB

Notes 1. Instruction ROM (1 word = 4 bytes)

2. Data ROM and RAM (1 word = 2 bytes)

[MEMO]

IC Memory

Static RAM	208
Mobile Specified RAM.....	221
Mask ROM	222
Stacked Type MCP	223
Line Buffer	224

Static RAM

■ Low Power SRAM (Temperature range $T_A = 0$ to 70°C): 1M, 256K bits

Density (bits)	Organization (words $\times$ bits)	Part Number	Supply Voltage (V)	Class	Access Time Max. (ns)	Maximum Supply Current			Package
						Active (mA)	Standby (μA)	Data Retention (μA)	
1M	128K $\times$ 8	$\mu\text{PD431000A}$	4.5 to 5.5	70L	70	70	100	15 ($T_A \leq 40^\circ\text{C}$)	CZ: 32-pin DIP (15.24 mm) GW: 32-pin SOP (13.34 mm)
				85L	85				CZ: 32-pin DIP (15.24 mm) GW: 32-pin SOP (13.34 mm) GZ: 32-pin TSOP(I) (8 $\times$ 20 mm) (Normal bent)
				70LL	70	70	20	3 ($T_A \leq 40^\circ\text{C}$)	CZ: 32-pin DIP (15.24 mm) GW: 32-pin SOP (13.34 mm) GZ: 32-pin TSOP(I) (8 $\times$ 20 mm) (Normal bent) (Reverse bent)
				85LL	85				CZ: 32-pin DIP (15.24 mm) GW: 32-pin SOP (13.34 mm) GZ: 32-pin TSOP(I) (8 $\times$ 20 mm) (Normal bent)
			3.0 to 5.5	A10	100 (70: $V_{CC} \geq 4.5\text{ V}$)	70 (35: $V_{CC} \leq 3.6\text{ V}$)	20 (13: $V_{CC} \leq 3.6\text{ V}$)	3 ($T_A \leq 40^\circ\text{C}$)	GW: 32-pin SOP (13.34 mm)
			2.7 to 5.5	B12	120 (70: $V_{CC} \geq 4.5\text{ V}$)	70 (30: $V_{CC} \leq 3.3\text{ V}$)	20 (11: $V_{CC} \leq 3.3\text{ V}$)	3 ($T_A \leq 40^\circ\text{C}$)	GW: 32-pin SOP (13.34 mm) GU: 32-pin TSOP(I) (8 $\times$ 13.4 mm) (Normal bent)
				B15	150 (70: $V_{CC} \geq 4.5\text{ V}$)				GW: 32-pin SOP (13.34 mm) GU: 32-pin TSOP(I) (8 $\times$ 13.4 mm) (Normal bent) GZ: 32-pin TSOP(I) (8 $\times$ 20 mm) (Normal bent) (Reverse bent)
256K	32K $\times$ 8	$\mu\text{PD43257B}$	4.5 to 5.5	70L	70	45	50	20	CZ: 28-pin DIP (15.24 mm) GU: 28-pin SOP (11.43 mm)
				85L	85				
				70LL	70	45	15	7	
				85LL	85				
		$\mu\text{PD43256B}$	4.5 to 5.5	70L	70	45	50	3 ($T_A \leq 40^\circ\text{C}$, $V_{CC} = 3.0\text{ V}$)	CZ: 28-pin DIP (15.24 mm) GU: 28-pin SOP (11.43 mm)
				85L	85				
				70LL	70	45	15	2 ($T_A \leq 40^\circ\text{C}$, $V_{CC} = 3.0\text{ V}$)	CZ: 28-pin DIP (15.24 mm) GU: 28-pin SOP (11.43 mm) GW: 28-pin TSOP(I) (8 $\times$ 13.4 mm) (Normal bent) (Reverse bent)
				85LL	85				
			3.0 to 5.5	A85	85	45	15	2 ($T_A \leq 40^\circ\text{C}$, $V_{CC} = 3.0\text{ V}$)	GU: 28-pin SOP (11.43 mm) GW: 28-pin TSOP(I) (8 $\times$ 13.4 mm) (Normal bent) (Reverse bent)
				A10	100 (85: $V_{CC} \geq 4.5\text{ V}$)				
				A12	120 (85: $V_{CC} \geq 4.5\text{ V}$)				
			2.7 to 5.5	B10	100 (85: $V_{CC} \geq 4.5\text{ V}$)	45 (20: $V_{CC} \leq 3.3\text{ V}$)	15 (10: $V_{CC} \leq 3.3\text{ V}$)	2 ($T_A \leq 40^\circ\text{C}$, $V_{CC} = 3.0\text{ V}$)	
				B12	120 (85: $V_{CC} \geq 4.5\text{ V}$)				
				B15	150 (85: $V_{CC} \geq 4.5\text{ V}$)				

Static RAM

■ Low Power SRAM (Extended Temperature $T_A = -25$ to $+85$ °C): 1M, 256K bits

Density (bits)	Organization (words × bits)	Part Number	Supply Voltage (V)	Class	Access Time Max.(ns)	Maximum Supply Current			Package
						Active (mA)	Standby (μA)	Data Retention (μA)	
1M	128K × 8	μPD441000L-X	2.7 to 3.6	B70	70	25	2	2 (0.5:TA ≤ 40 °C)	GW: 32-pin SOP (13.34 mm) GU: 32-pin TSOP(I) (8 × 13.4 mm) (Normal bent) (Reverse bent) GZ:32-pin TSOP(I) (8 × 20 mm) (Normal bent) (Reverse bent)
				B85	85				
				B10	100				
			2.2 to 3.6	C10	100	25 (23:Vcc ≤ 2.7 V)	2	2 (0.5:TA ≤ 40 °C)	
				C12	120				
			1.8 to 3.6	D12	120	25 (20:Vcc ≤ 2.2 V) (23:Vcc ≤ 2.7 V)	2 (1.5:Vcc ≤ 2.2 V)	2 (0.5:TA ≤ 40 °C)	
		D15		150					
		μPD431000A-X	4.5 to 5.5	70	70	70	50	2.5 (TA ≤ 40 °C)	
				85	85				
			3.0 to 5.5	A10	100 (70:Vcc ≥ 4.5 V)	70 (35:Vcc ≤ 3.6 V)	50 (26:Vcc ≤ 3.6 V)	2.5 (TA ≤ 40 °C)	
			2.7 to 5.5	B12	120 (70:Vcc ≥ 4.5 V)	70 (30:Vcc ≤ 3.3 V)	50 (22:Vcc ≤ 3.3 V)	2.5 (TA ≤ 40 °C)	
				B15	150 (70:Vcc ≥ 4.5 V)				
256K	32K × 8		μPD43256B-X	4.5 to 5.5	70	70	45	50	2 (TA ≤ 40 °C, Vcc = 3.0 V)
		85			85				
		3.0 to 5.5		A85	85 (100:Vcc ≥ 4.5 V)	45	50	2 (TA ≤ 40 °C, Vcc = 3.0 V)	
				A10	100	40			
				A12	120 (100:Vcc ≥ 4.5 V)				
		2.7 to 5.5		B10	100	40 (25:Vcc ≤ 3.3 V)	50 (25:Vcc ≤ 3.3 V)	2 (TA ≤ 40 °C, Vcc = 3.0 V)	
				B12	120 (100:Vcc ≥ 4.5 V)				
				B15	150 (100:Vcc ≥ 4.5 V)				

Static RAM

■ Asynchronous Fast SRAM (Extended Temperature T_A = -40 to +85 °C): 4M bits

Density (bits)	Organization (words × bits)	Part Number	Class	Access Time Max. (ns)	Maximum Supply Current		Supply Voltage (V)	Package	Remark
					Active (mA)	Standby (μA)			
4M	256K × 16	μPD444016-Y ☆	8	8	220	10	5.0±0.5	G5: 44-pin TSOP(II) (10.16 mm)	
			10	10	200	10			
			12	12	190	10			
		μPD444016L-Y ☆	8	8	210	5	3.3±0.3		
			10	10	190	5			
			12	12	180	5			

☆: Newly added product

Static RAM

■ Late Write Synchronous SRAM: 8M, 4M bits

Density (bits)	Organization (words × bits)	Part Number	Class	Clock Frequency (MHz)	Clock Access Time Max. (ns)	Maximum Supply Current		Supply Voltage (V)	Interface Level	Package	Remark
						Active (mA)	Standby (mA)				
8M	256K × 36	μPD4383362	A75	133	3.8	480	—	3.3±0.165	HSTL	GF: 100-pin LQFP (14 × 20 mm)	CMOS Register-Register Not support JTAG
		μPD4483362 ☆	A75	133	3.8	350	—	3.3±0.165	HSTL	GF: 100-pin LQFP (14 × 20 mm)	CMOS Register-Register Not support JTAG
4M	256K × 18	μPD464318AL	A4	250	2.0	550	530	3.3±0.15	HSTL	S1: 119-pin BGA	Bi-CMOS Register-Register
			A44	225	2.3						
			A5	200	2.5						
		μPD464518AL	A55	182	5.5	450	430	3.3±0.15	LVTTTL	S1: 119-pin BGA	Bi-CMOS Register-Latch
			A6	166	6.0						
			A7	143	7.0						
	128K × 36	μPD464336AL	A4	250	2.0	750	730	3.3±0.15	HSTL	S1: 119-pin BGA	Bi-CMOS Register-Register
			A44	225	2.3						
			A5	200	2.5						
		μPD464536AL	A55	182	5.5	650	630	3.3±0.15	LVTTTL	S1: 119-pin BGA	Bi-CMOS Register-Latch
			A6	166	6.0						
			A7	143	7.0						
		μPD4443362	A75	133	3.8	350	—	3.3±0.165	HSTL	GF: 100-pin LQFP (14 × 20 mm)	CMOS Register-Register Not support JTAG

☆: Newly added product

Static RAM

■ ZEROSB Synchronous SRAM: 16M, 8M bits

Density (bits)	Organization (words × bits)	Part Number	Class	Clock Frequency (MHz)	Clock Access Time Max. (ns)	Maximum Supply Current			Supply Voltage (V)		Package	Remark
						Active (mA)	Standby (mA)	Power Down (mA)	Chip	I/O		
16M	1M × 16	μPD44161161 ★	TBD	133	6.5	TBD	TBD	TBD	2.5±0.125	2.5±0.125	GF: 100-pin LQFP (14 × 20 mm)	Flow Through operation
			TBD	117	7.5	TBD						
		μPD44161162 ★	TBD	200	3.2	TBD	TBD	TBD	2.5±0.125	2.5±0.125	GF: 100-pin LQFP (14 × 20 mm)	Pipeline operation
			TBD	167	3.5	TBD						
	1M × 18	μPD44161181 ★	TBD	133	6.5	TBD	TBD	TBD	2.5±0.125	2.5±0.125	GF: 100-pin LQFP (14 × 20 mm)	Flow Through operation
			TBD	117	7.5	TBD						
		μPD44161182 ★	TBD	200	3.2	TBD	TBD	TBD	2.5±0.125	2.5±0.125	GF: 100-pin LQFP (14 × 20 mm)	Pipeline operation
			TBD	167	3.5	TBD						
	512K × 32	μPD44161321 ★	TBD	133	6.5	TBD	TBD	TBD	2.5±0.125	2.5±0.125	GF: 100-pin LQFP (14 × 20 mm)	Flow Through operation
			TBD	117	7.5	TBD						
		μPD44161322 ★	TBD	200	3.2	TBD	TBD	TBD	2.5±0.125	2.5±0.125	GF: 100-pin LQFP (14 × 20 mm)	Pipeline operation
			TBD	167	3.5	TBD						
	512K × 36	μPD44161361 ★	TBD	133	6.5	TBD	TBD	TBD	2.5±0.125	2.5±0.125	GF: 100-pin LQFP (14 × 20 mm)	Flow Through operation
			TBD	117	7.5	TBD						
		μPD44161362 ★	TBD	200	3.2	TBD	TBD	TBD	2.5±0.125	2.5±0.125	GF: 100-pin LQFP (14 × 20 mm)	Pipeline operation
			TBD	167	3.5	TBD						
8M	512K × 16	μPD4381161 ★	A90	90	9.0	300	10	10	3.3±0.165	3.3±0.165	GF: 100-pin LQFP (14 × 20 mm)	Flow Through operation
			A10	83	10.0	270						
		μPD4381162 ★	A75	133	4.2	400	10	10	3.3±0.165	3.3±0.165	GF: 100-pin LQFP (14 × 20 mm)	Pipeline operation
			A10	100	5.0	300						
	512K × 18	μPD4381181 ★	A90	90	9.0	300	10	10	3.3±0.165	3.3±0.165	GF: 100-pin LQFP (14 × 20 mm)	Flow Through operation
			A10	83	10.0	270						
		μPD4381182 ★	A75	133	4.2	400	10	10	3.3±0.165	3.3±0.165	GF: 100-pin LQFP (14 × 20 mm)	Pipeline operation
			A10	100	5.0	300						
	256K × 32	μPD4381321 ★	A85	100	8.5	320	10	10	3.3±0.165	3.3±0.165	GF: 100-pin LQFP (14 × 20 mm)	Flow Through operation
			A90	90	9.0	300						
		μPD4381322 ★	A67	150	3.8	440	10	10	3.3±0.165	3.3±0.165	GF: 100-pin LQFP (14 × 20 mm)	Pipeline operation
			A75	133	4.2	400						
	256K × 36	μPD4381361 ★	A85	100	8.5	320	10	10	3.3±0.165	3.3±0.165	GF: 100-pin LQFP (14 × 20 mm)	Flow Through operation
			A90	90	9.0	300						
		μPD4381362 ★	A67	150	3.8	440	10	10	3.3±0.165	3.3±0.165	GF: 100-pin LQFP (14 × 20 mm)	Pipeline operation
			A75	133	4.2	400						

★: Under development, ☆: Newly added product

Remark

ZEROSB is equivalent to ZBT.

Static RAM

■ DDR Synchronous SRAM: 16M bits

Density (bits)	Organization (words × bits)	Part Number	Class	Clock Frequency (MHz)	Clock Access Time Max. (ns)	Maximum Supply Current			Supply Voltage (V)		Interface Level	Package	Remark
						Active (mA)	Standby (mA)	Power Down (mA)	Chip	I/O			
16M	2M × 8	μPD44164084 ★ ☆	TBD	250	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Common I/O, Burst Length of 4
			TBD	225	TBD	TBD							
			TBD	200	TBD	TBD							
		μPD44164082 ★ ☆	TBD	250	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Common I/O, Burst Length of 2
			TBD	225	TBD	TBD							
			TBD	200	TBD	TBD							
		μPD44166082 ★ ☆	TBD	250	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Separate I/O, Burst Length of 2
			TBD	225	TBD	TBD							
			TBD	200	TBD	TBD							
	1M × 18	μPD44164184 ★ ☆	TBD	250	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Common I/O, Burst Length of 4
			TBD	225	TBD	TBD							
			TBD	200	TBD	TBD							
		μPD44164182 ★ ☆	TBD	250	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Common I/O, Burst Length of 2
			TBD	225	TBD	TBD							
			TBD	200	TBD	TBD							
		μPD44166182 ★ ☆	TBD	250	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Separate I/O, Burst Length of 2
			TBD	225	TBD	TBD							
			TBD	200	TBD	TBD							
	512K × 36	μPD44164364 ★ ☆	TBD	250	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Common I/O, Burst Length of 4
			TBD	225	TBD	TBD							
			TBD	200	TBD	TBD							
		μPD44164362 ★ ☆	TBD	250	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Common I/O, Burst Length of 2
			TBD	225	TBD	TBD							
			TBD	200	TBD	TBD							
		μPD44166362 ★ ☆	TBD	250	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Separate I/O, Burst Length of 2
			TBD	225	TBD	TBD							
			TBD	200	TBD	TBD							

★: Under development, ☆: Newly added product

Static RAM

■ QDR^{Note} SRAM: 16M bits

Density (bits)	Organization (words × bits)	Part Number	Class	Clock Frequency (MHz)	Clock Access Time Max. (ns)	Maximum Supply Current			Supply Voltage (V)		Interface Level	Package	Remark
						Active (mA)	Standby (mA)	Power Down (mA)	Chip	I/O			
16M	2M × 8	μPD44165084 ★ ☆	TBD	250	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Burst Length of 4
			TBD	225	TBD	TBD							
			TBD	200	TBD	TBD							
		μPD44165082 ★ ☆	TBD	167	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Burst Length of 2
			TBD	150	TBD	TBD							
			TBD	133	TBD	TBD							
	1M × 18	μPD44165184 ★ ☆	TBD	250	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Burst Length of 4
			TBD	225	TBD	TBD							
			TBD	200	TBD	TBD							
		μPD44165182 ★ ☆	TBD	167	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Burst Length of 2
			TBD	150	TBD	TBD							
			TBD	133	TBD	TBD							
	512K × 36	μPD44165364 ★ ☆	TBD	250	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Burst Length of 4
			TBD	225	TBD	TBD							
			TBD	200	TBD	TBD							
		μPD44165362 ★ ☆	TBD	167	TBD	TBD	TBD	TBD	2.5±0.1 or 1.8±0.1	1.5 or 1.8	HSTL	160-pin FBGA (13 × 15 mm)	Burst Length of 2
			TBD	150	TBD	TBD							
			TBD	133	TBD	TBD							

★: Under development, ☆: Newly added product

Note

QDR RAMs and Quad Data Rate RAMs comprise a new family of products supported by Cypress Semiconductor, IDT, Micron Technology, NEC and Samsung.

Mobile Specified RAM

■ Mobile Specified RAM: 32M, 16M bits

Density (bits)	Organization (words × bits)	Part Number	Class	Clock Access Time Max. (ns)	Maximum Supply Current			Supply Voltage (V)	Package	Remark
					Active (mA)	Standby (Data Retention) (μA)	Standby (Not Data Retention) (μA)			
32M	2M × 16	μPD4632312-X ★ ☆	B80	80	35	100	10	2.6 to 3.1	F9-BT3: 77-pin FBGA (12 × 7 mm)	Partial Standby function
			B90	90						
			B10	100						
			C80	80	35	100	10	2.3 to 2.7	F9-BT3: 77-pin FBGA (12 × 7 mm)	Partial Standby function
			C90	90						
			C10	100						
16M	1M × 16	μPD4616112 ☆	BC80	80	35	100	10	2.6 to 3.0	F9-BC2: 48-pin FBGA (6 × 8 mm)	T _A = -20 to +70 °C
			BC90	90						
			BC10	100						
		μPD4616112-X ★ ☆	B80L	80	35	70	10	2.6 to 3.1	F9-BC2: 48-pin FBGA (6 × 8 mm)	T _A = -25 to +85 °C
			B90L	90						
			B10L	100						

★: Under development, ☆: Newly added product

Mask ROM

■ Mask ROM: 128M, 64M bits

Density (bits)	Organization (words × bits)	Part Number	Access Time Max. (ns)		Maximum Supply Current		Supply Voltage (V)	Package
			Normal	Page Access	Active (mA)	Standby (μA)		
128M	16M × 8 or 8M × 16	μPD23C128000AL	100	–	55	30	3.3±0.3	GY: 48-pin TSOP (I) (12 × 18 mm) (Normal bent) (Reverse bent)
			120		50		3.0±0.3	
		μPD23C128040AL	100	25	70	30	3.3±0.3	GY: 48-pin TSOP (I) (12 × 18 mm) (Normal bent) (Reverse bent)
			120		65		3.0±0.3	
64M	8M × 8 or 4M × 16	μPD23C64000BL	90	–	55	30	3.3±0.3	GY: 48-pin TSOP (I) (12 × 18 mm) (Normal bent) (Reverse bent)
			100		40		3.0±0.3	
		μPD23C64040BL	90	25	65	30	3.3±0.3	GY: 48-pin TSOP (I) (12 × 18 mm) (Normal bent) (Reverse bent)
			100		55		3.0±0.3	

■ Synchronous Mask ROM: 64M, 32M bits

Density (bits)	Organization (words × bits)	Part Number	Clock Frequency (MHz)	/CAS Latency Min.	/RAS Latency Min.	Clock Access Time Max. (ns)	Maximum Supply Current Active (mA)	Supply Voltage (V)	Interface Level	Package	Remark
64M	4M × 16 or 2M × 32	μPD23C64202L	100	5	2	6	200	3.3±0.3	LVTTL	G5: 86-pin TSOP (II) (10.16 mm)	
			83	5	2	8					
			66	5	2	9					
			50	4	1	9					
			33	3	1	9					
32M	2M × 16 or 1M × 32	μPD23C32202L	66	5	2	10	150	3.3±0.3	LVTTL	G5: 86-pin TSOP (II) (10.16 mm)	
			50	4	1	15					
			33	3	1	25					

■ NAND Flash Compatible ROM: 256M bits

Density (bits)	Organization (words × bits)	Part Number	1st Access Time Max. (μs)	Serial Data Access Time Max. (ns)	Maximum Supply Current		Supply Voltage (V)	Package	Remark
					Active (mA)	Standby (μA)			
256M	(512 + 16) bytes × 32 pages × 2048 blocks	μPD23C256112	7	35	30	100	3.3±0.3	GY: 48-pin TSOP (I) (12 × 18 mm) (Normal bent) (Reverse bent)	

Stacked Type MCP

■ Stacked Type MCP: 32M bits Flash Memory +16M bits Mobile Specified RAM

Flash Memory Organization (bits)	Mobile Specified RAM Organization (bits)	Part Number	Class	Flash Memory Access Time Max. (ns)	Mobile Specified RAM Access Time Max. (ns)	Flash Memory Bank Organization	Flash Memory Top/ Bottom	Supply Voltage (V)	Package	Remark
32M	16M	MC-242442☆	B90	90 (85: $V_{ccf} \geq 2.7\text{ V}$)	80	4M bits +28M bits	Top	2.6 to 3.0	F9-BT3: 77-pin FBGA (12 × 7 mm) (Wiring: 54-pin)	
			B95★		90					
			B10		100					
		MC-242443☆	B90	90 (85: $V_{ccf} \geq 2.7\text{ V}$)	80	8M bits +24M bits	Top	2.6 to 3.0	F9-BT3: 77-pin FBGA (12 × 7 mm) (Wiring: 54-pin) F9-BS1★: 71-pin FBGA (11 × 7 mm) (Wiring: 54-pin)	
			B95★		90					
			B10		100					
		MC-242444☆	B90	90 (85: $V_{ccf} \geq 2.7\text{ V}$)	80	16M bits +16M bits	Top	2.6 to 3.0	F9-BT3: 77-pin FBGA (12 × 7 mm) (Wiring: 54-pin) F9-BS1★: 71-pin FBGA (11 × 7 mm) (Wiring: 54-pin)	
			B95★		90					
			B10		100					
		MC-242452☆	B90	90 (85: $V_{ccf} \geq 2.7\text{ V}$)	80	4M bits +28M bits	Bottom	2.6 to 3.0	F9-BT3: 77-pin FBGA (12 × 7 mm) (Wiring: 54-pin)	
			B95★		90					
			B10		100					
		MC-242453☆	B90	90 (85: $V_{ccf} \geq 2.7\text{ V}$)	80	8M bits +24M bits	Bottom	2.6 to 3.0	F9-BT3: 77-pin FBGA (12 × 7 mm) (Wiring: 54-pin) F9-BS1★: 71-pin FBGA (11 × 7 mm) (Wiring: 54-pin)	
			B95★		90					
			B10		100					
		MC-242454☆	B90	90 (85: $V_{ccf} \geq 2.7\text{ V}$)	80	16M bits +16M bits	Bottom	2.6 to 3.0	F9-BT3: 77-pin FBGA (12 × 7 mm) (Wiring: 54-pin) F9-BS1★: 71-pin FBGA (11 × 7 mm) (Wiring: 54-pin)	
			B95★		90					
			B10		100					

★: Under development, ☆: Newly added product

■ Stacked Type MCP: 32M bits Flash Memory +8M bits Low Power SRAM

Flash Memory Organization (bits)	Low Power SRAM Organization (bits)	Part Number	Class	Flash Memory Access Time Max. (ns)	Low Power SRAM Access Time Max. (ns)	Flash Memory Bank Organization	Flash Memory Top/Bottom	Supply Voltage (V)	Package	Remark
32M	8M	MC-222262-X☆	B85	85	70	4M bits +28M bits	Top	2.7 to 3.6	F9-BT3: 77-pin FBGA (12 × 7 mm) (Wiring: 54-pin)	
		MC-222263-X☆	B85	85	70	8M bits +24M bits	Top	2.7 to 3.6	F9-BT3: 77-pin FBGA (12 × 7 mm) (Wiring: 54-pin)	
		MC-222264-X☆	B85	85	70	16M bits +16M bits	Top	2.7 to 3.6	F9-BT3: 77-pin FBGA (12 × 7 mm) (Wiring: 54-pin)	
		MC-222272-X☆	B85	85	70	4M bits +28M bits	Bottom	2.7 to 3.6	F9-BT3: 77-pin FBGA (12 × 7 mm) (Wiring: 54-pin)	
		MC-222273-X☆	B85	85	70	8M bits +24M bits	Bottom	2.7 to 3.6	F9-BT3: 77-pin FBGA (12 × 7 mm) (Wiring: 54-pin)	
		MC-222274-X☆	B85	85	70	16M bits +16M bits	Bottom	2.7 to 3.6	F9-BT3: 77-pin FBGA (12 × 7 mm) (Wiring: 54-pin)	

☆: Newly added product

Stacked Type MCP

■ Stacked Type MCP: 32M bits Flash Memory +4M bits Low Power SRAM

Flash Memory Organization (bits)	Low Power SRAM Organization (bits)	Part Number	Class	Flash Memory Access Time Max. (ns)	Low Power SRAM Access Time Max. (ns)	Flash Memory Bank Organization	Flash Memory Top/Bottom	Supply Voltage (V)	Package	Remark
32M	4M	MC-222242A-X☆	B85	85	70	4M bits +28M bits	Top	2.7 to 3.6	F9-BT3: 77-pin FBGA (12×7 mm) (Wiring: 54-pin)	
		MC-222243A-X☆	B85	85	70	8M bits +24M bits	Top	2.7 to 3.6	F9-BT3: 77-pin FBGA (12×7 mm) (Wiring: 54-pin)	
		MC-222244A-X☆	B85	85	70	16M bits +16M bits	Top	2.7 to 3.6	F9-BT3: 77-pin FBGA (12×7 mm) (Wiring: 54-pin)	
		MC-222252A-X☆	B85	85	70	4M bits +28M bits	Bottom	2.7 to 3.6	F9-BT3: 77-pin FBGA (12×7 mm) (Wiring: 54-pin)	
		MC-222253A-X☆	B85	85	70	8M bits +24M bits	Bottom	2.7 to 3.6	F9-BT3: 77-pin FBGA (12×7 mm) (Wiring: 54-pin)	
		MC-222254A-X☆	B85	85	70	16M bits +16M bits	Bottom	2.7 to 3.6	F9-BT3: 77-pin FBGA (12×7 mm) (Wiring: 54-pin)	

☆: Newly added product

Line Buffer

■ Line Buffer: 80K, 40K bits

Density (bits)	Organization (words × bits)	Part Number	Read/Write Cycle Time Min. (ns)	Maximum Supply Current Active (mA)	Supply Voltage (V)	Package	Remark
80K	10096 × 8	μPD485506	25/25	140	5.0±0.5	G5: 44-pin TSOP (II) (10.16 mm)	FAX, PPC Line buffer FIFO structure SRAM Cell
	5048 × 16		35/35				
40K	5048 × 8	μPD485505	25/25	80	5.0±0.5	G: 24-pin SOP (11.43 mm)	
			35/35				

Semi-Custom IC

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- Analog Master 285
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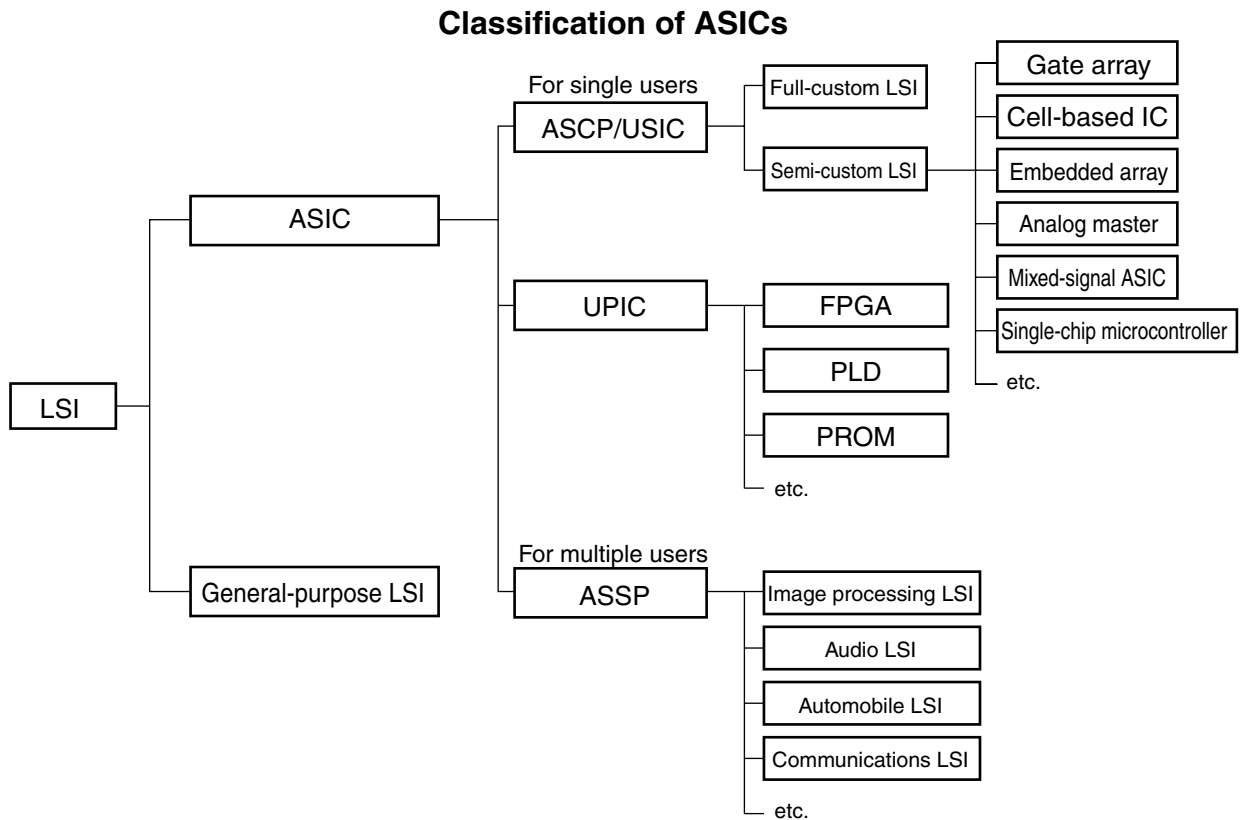
NEC's ASICs

■ What Are ASICs? (1/2)

Large-scale integrated circuits (LSI) are broadly classified into two types: general-purpose LSIs and application-specific ICs (ASICs).

General-purpose LSIs are designed and supplied as standard products by manufacturers. Because these LSIs are mass-produced, generally they are inexpensive and do not require much work or expense for development by the user even in only small quantities. However, because they are general-purpose products, some of their functions may be redundant for some users, and some functions may not be available. Moreover, user's unique functions cannot be provided.

In contrast, ASICs are for specific applications and can be further classified as illustrated below.



Remarks ASCP Application-Specific Custom Product
 ASSP Application-Specific Standard Product
 FPGA Field-Programmable Gate Array
 PLD Programmable Logic Device
 PROM Programmable Read Only Memory
 USIC User-Specific IC
 UPIC User Programmable IC

ASICs are broadly classified into LSIs for single users (ASCPs, USICs, and UPICs) and those for multiple users, as shown above.

NEC's ASICs

■ What Are ASICs? (2/2)

● ASICs for single users (ASCP/USIC)

ASICs of this type are designed for a specific user and are used for security and performance improvement (such as increasing speed and reducing power consumption). However, the burden on the user for development is heavy. These ASICs are classified into full-custom LSIs and semi-custom LSIs.

Full-custom LSIs are developed by users who have mastered LSI production technologies; they require a long development time and incur large costs. A production contract with a manufacturer is made on the assumption of mass production of the application system. Usually, the LSIs developed in this way offer extremely high performance.

With full-custom LSIs, all the development processes, from circuit design to photomask, are tailored to that particular design. In contrast, the elements on the chip of a semi-custom LSI are designed and produced in advance by the manufacturer, and the user builds his own unique functions using these elements. In gate arrays, for example, a common photomask is used for the diffusion process and only the photomask for the wiring process is created according to the specifications of the user. An LSI can therefore be developed in less time.

● ASICs for single users (UPIC)

FPGAs, PLDs, and PROMs are collectively called UPICs. These are ASICs that can be developed by the user with dedicated development tools for production runs as small as a single sample.

In particular, because the logical operations of FPGAs and PLDs are the same as those of gate arrays, these UPICs are highly useful as sample LSIs to evaluate the breadboard and circuit operations prior to the development of gate arrays. Compared with those for gate array products, the development costs of UPICs can be kept very low and the development period is short. For these reasons, UPICs are also used to check parts of large-scale for LSIs developed.

● ASIC for multiple users (ASSP)

ASSPs are standard LSIs produced by the manufacturer for specific fields. Because they are designed and produced by the manufacturer, the user does not have to shoulder any development burden and there is no limit to the production quantity. These LSIs include graphics display controllers and field memories.

NEC's ASICs

■ Selecting an LSI

Users' products increasingly require the following features:

High added value
Implementation in software
Total solutions
System integration, etc.

Integrating the circuits formerly implemented with conventional ICs using an ASIC is the best way to meet these requirements. Consequently, it is important to select an ASIC manufacturer who can provide you with powerful device technology, system technology, and upstream software support.

NEC offers a variety of ASIC products that can satisfy every user's needs, including comprehensive support. The key to selecting the most suitable ASIC product is completely understanding the characteristics required by the entire system to be developed and the circuits to be integrated into an ASIC. These characteristics include the following conditions:

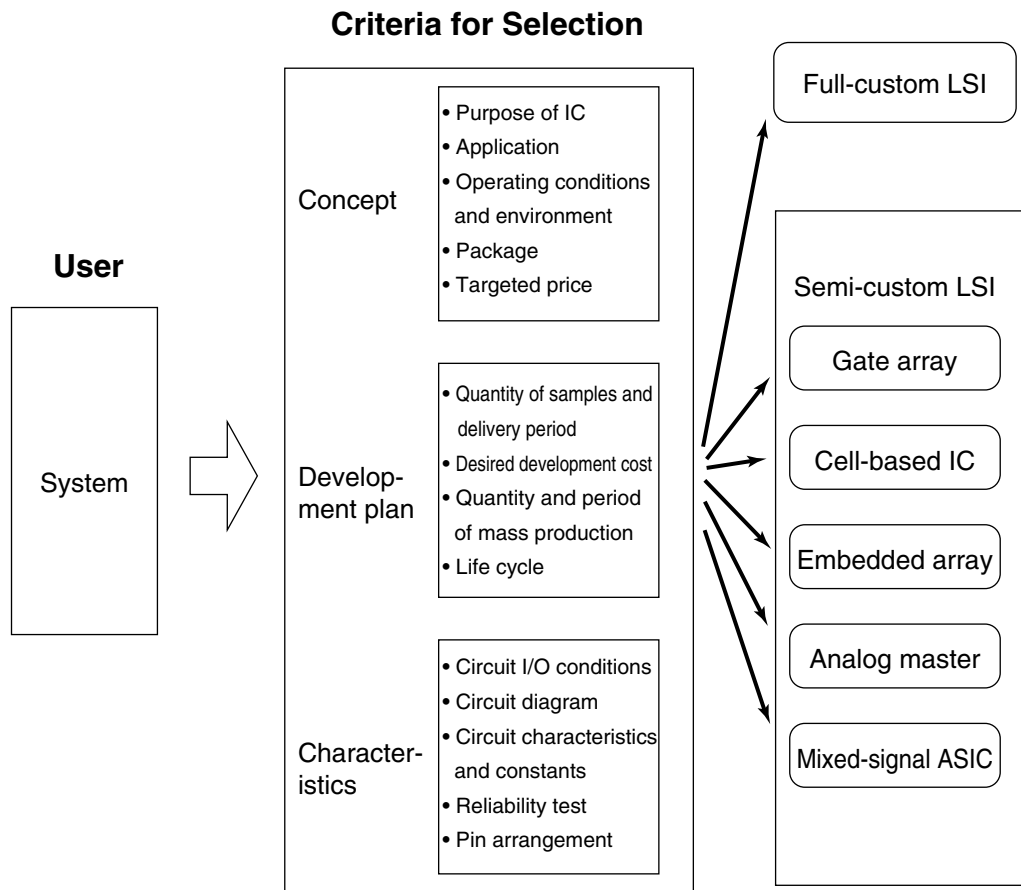
- Development investment
- Development period (delivery period)
- Quantity of production
- Necessary functions and performance
- Application

Using the list of criteria on the next page and taking these points into consideration, you can find the ASIC you really need.

NEC's ASICs

■ Criteria for Selection (1/4)

Use of a full-custom or semi-custom LSI, an ASSP, or a general-purpose LSI depends on your concept, development plan, and required characteristics. By considering the items in the following diagram you can select the products that satisfy all your requirements. The subsequent sections compare the major semi-custom LSI and full-custom LSI products for your reference.



NEC's ASICs

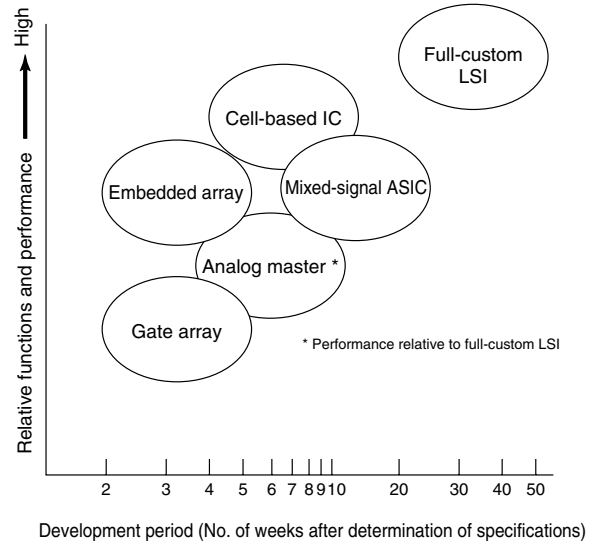
■ Criteria for Selection (2/4)

● Development Period and Relative Performance

As shown in the figure on the right, full-custom LSIs have high performance but require a long development period. In contrast, the development period of semi-custom LSIs, such as gate arrays and analog masters, is shorter, although these LSIs have some redundant functions.

For embedded arrays, the wafer is produced when the macros to be used have been determined. In the meantime, the circuits are determined through simulation. After simulation has been completed, only the wiring process is left, and development can be completed in almost the same period as for gate arrays. If the macros and gate scale of the wafer are the same as those of gate arrays, the wafer can be used as a master wafer; consequently, the development period is equivalent to that of gate arrays.

Cell-based ICs and new semi-custom LSIs fall somewhere between full-custom LSIs and gate arrays. Although these LSIs offer performance and functions comparable to those of full-custom LSIs, their development period is only slightly longer than that of gate arrays.



NEC's ASICs

■ Criteria for Selection (3/4)

● Development Investment and Element Cost

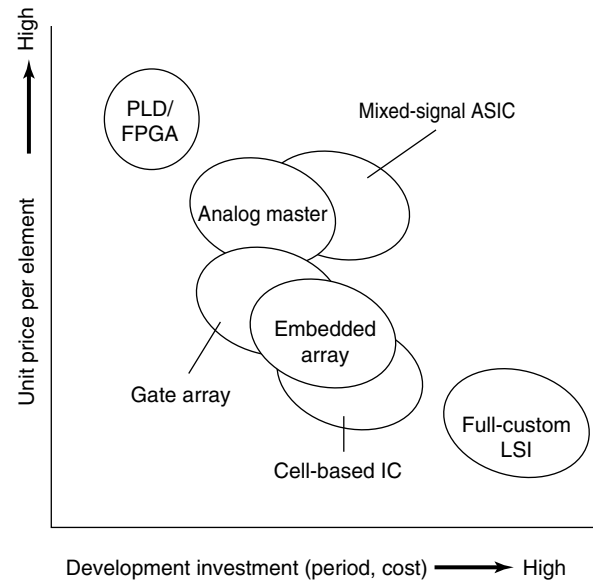
As shown in the figure on the right, there is a clear relationship between the development investment and unit cost.

PLDs (programmable logic devices) and FPGAs (field-programmable gate array) are types of general-purpose LSIs with a design philosophy close to that of gate arrays. You can purchase one unit of these LSIs and can program and use it on the day you purchase it. Therefore, the development investment is extremely low. However, the price per element of PLDs and FPGAs is high.

Conversely, although the development period and cost of a full-custom LSI are greater, the unit price of each element is very low, partly because almost 100% of the elements are used and partly because the full-custom LSI is usually mass-produced.

The various semi-custom LSI products fall between these two. Therefore, semi-custom LSIs are ideal if the development period and cost are limited and, at the same time, the unit price of the element must be kept low.

In addition, because many development tools and standard cell libraries are available for semi-custom LSIs, the development period can be further shortened.



NEC's ASICs

■ Criteria for Selection (4/4)

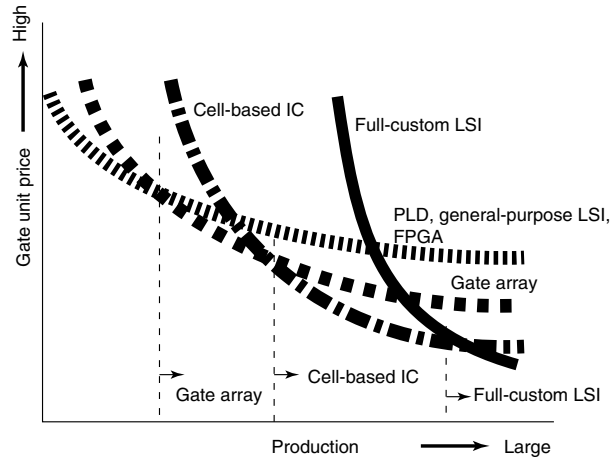
● Total Production and Gate Units (Guideline)

One of the indexes of the price of an LSI is the gate unit price. The gate unit price of PLDs and general-purpose LSIs is low if the production is small. However, the unit price does not decrease even if the volume of production increases.

Full-custom LSIs are not profitable unless they are produced in a large quantity.

Semi-custom LSIs can be profitable whether they are produced in a small or large quantity.

Of these semi-custom LSIs, gate arrays are more suitable for small-scale production than cell-based ICs.

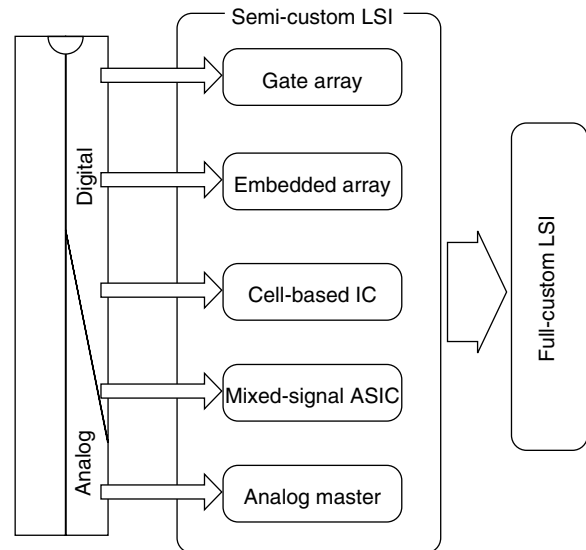


● Suitability for Different Types of Circuits

Circuits can be broadly classified into analog circuits and digital circuits.

As shown in the figure on the right, among the semi-custom LSIs, gate arrays are suitable for digital circuits and analog masters can be used to integrate analog circuits. Cell-based ICs are mainly used for digital circuits, but can also be used to combine analog and digital circuits.

A complicated circuit with a special configuration that cannot be realized using a semi-custom LSI must be created as a full-custom LSI. A full-custom LSI can be used to integrate both analog circuits and digital circuits.



NEC's ASICs

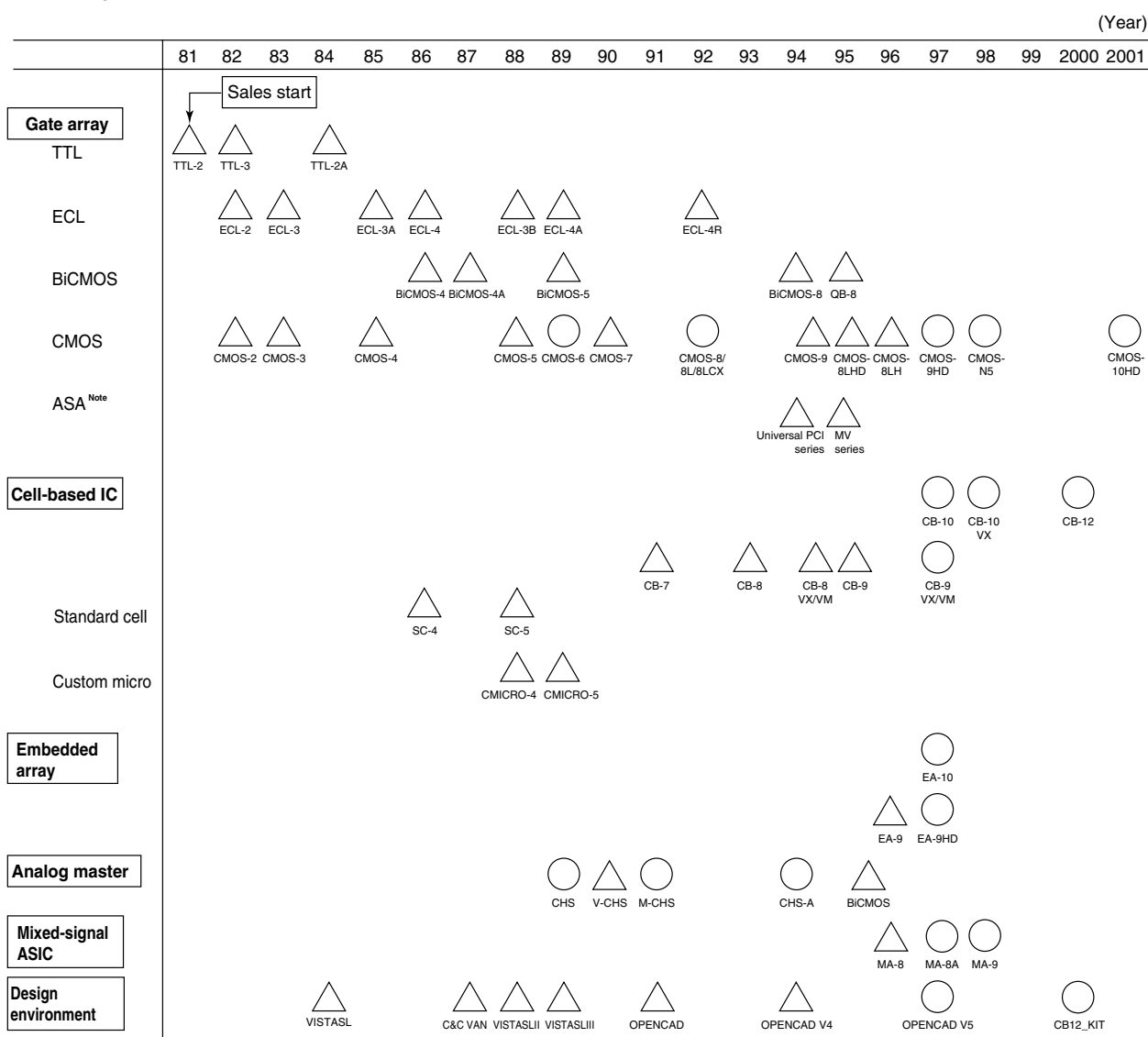
History of ASIC Development

NEC developed the device technology and basic software for its ASICs in the 1970s and begun selling its ASICs in 1981.

Semi-custom LSIs were first developed in response to demands to improve the performance of systems such as computers and private branch exchanges. When the advantages of ASICs became more widely recognized as device development and tool organization advanced in the 1980s, the use of ASICs became widespread.

Today, users who have experience of development using gate arrays wish to develop using ASICs to achieve larger scale and higher performance. Consequently, device manufacturers are required to supply state-of-the-art semiconductor chips and efficient design environments.

To satisfy these requirements, NEC supplies a wide range of services including an extensive line-up of technologies, and integrated CAD systems using original EWS and networking.



Note Application Specific Arrays

Remark △ : Maintenance parts

NEC's ASICs

■ NEC's ASIC Products (1/2)

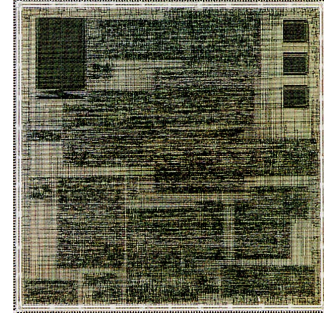
● Gate array

Gate arrays are semi-custom LSIs. Gates are laid out on master wafers in the form of an array. These gates are wired together to create the desired LSI.

To lay out gates, an area where no gates are placed may be provided on the wafer (channel structure) or gates may be laid out over the entire surface of the wafer (channel-less structure).

The channel gate arrays have fixed wiring areas and gate areas. Almost all the gates of these gate arrays can be used. However, it is difficult to integrate memories on these gate arrays.

The channel-less gate arrays can be used to integrate a large-scale system on a single chip. They allow users to determine the width of the wiring area and the shape of the gates freely and to integrate memories efficiently.

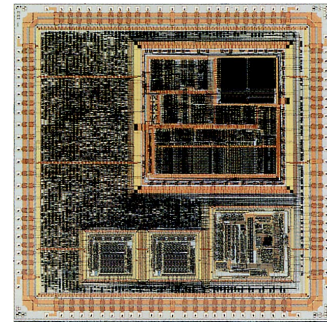


● Cell-based IC

Cell-based ICs are high-performance semi-custom LSIs for integrating memories such as RAM and ROM, CPU, CPU peripherals, and analog circuits, as well as logic, on a single-chip by means of a building block-type standard cell-design technique.

Cell-based ICs cannot only be denser than gate arrays and embedded arrays, but also integrate high-performance macros. Therefore, they have grown increasingly popular as semi-custom LSIs for achieving systems-on-a-chip.

Unlike gate arrays, no master wafers are available for cell-based ICs; a cell-based IC is processed to satisfy the user's particular requirements from the very first process, i.e., the diffusion process.



NEC's ASICs

■ NEC's ASIC Products (2/2)

● Embedded array

Embedded arrays are high-performance semi-custom LSIs that use the basic cells of a gate array in the internal area and that can be used to integrate memories like cell-based ICs, such as RAM and ROM.

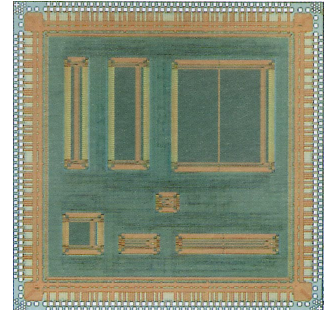
LSIs with sophisticated functions and high performance comparable to those of cell-based ICs can be created.

Because the wafer is produced in parallel with simulation, only the wiring process must be done after simulation is complete. Consequently, the development period up to completion of a sample is as short as that of gate arrays.

If a cell-based IC is used for initial production, the production of the system can be started in a short time.

If the macro configuration and gate scale are the same, the same master wafer can be used to develop other LSIs. Therefore, many variations of LSIs can be created at a lower cost than with cell-based ICs.

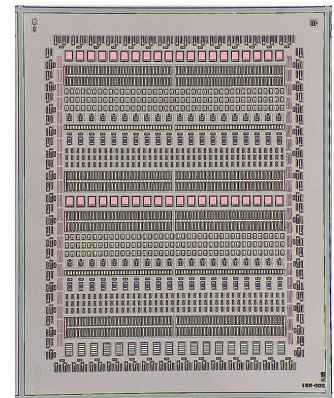
In addition, the circuits of embedded arrays can be easily modified, reducing the risk involved in development.



● Analog master

An analog master is used to create an analog LSI by using a master wafer on which transistors, resistors, and capacitors are laid out in advance, and designing the appropriate wiring in a similar way to when a gate array is used.

If creating a full-custom analog circuit seems too difficult in terms of development, cost, and the number of ICs used, the analog master is the ideal product.

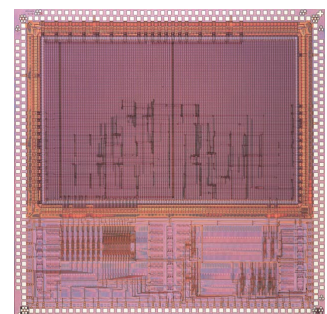


● Mixed-signal ASIC

This is a semi-custom LSI that integrates the functions of a CMOS gate array and an analog semi-custom IC on a single chip.

The gate array block consists of the basic cells of a CMOS gate array, and can be designed in the same manner as a gate array.

The analog delay block incorporates CMOS transistors and bipolar transistors for analog circuits, so high-performance analog circuits can be constructed.



Gate Array

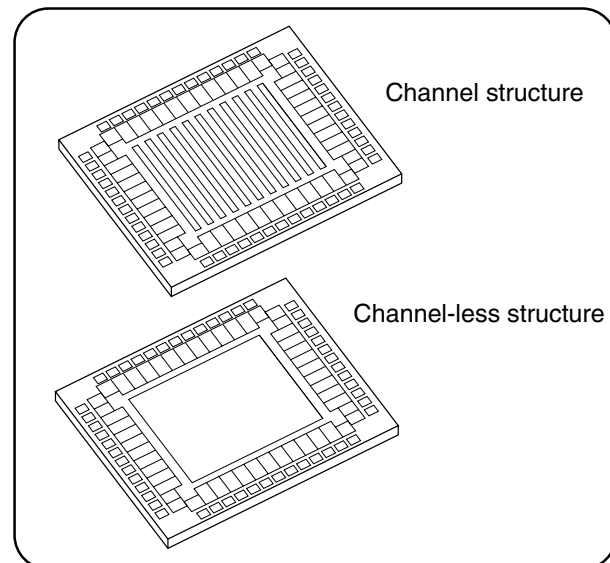
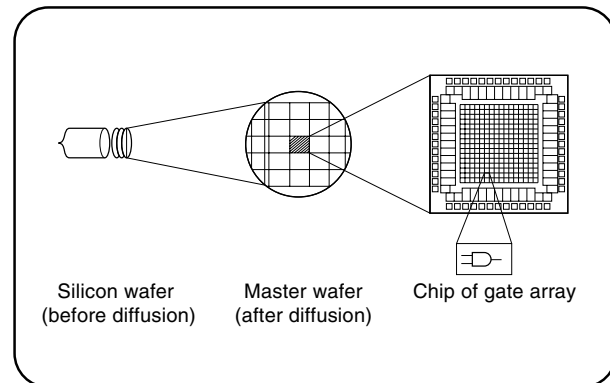
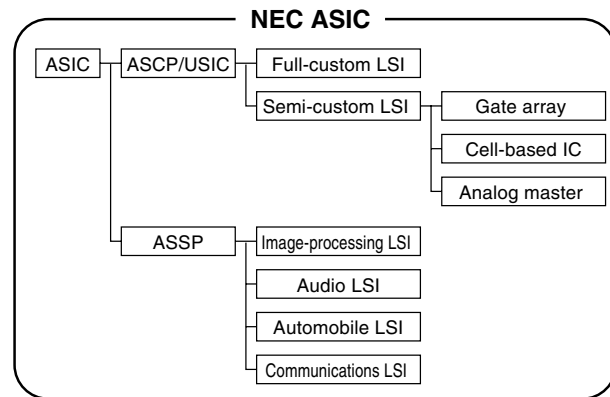
■ What Is a Gate Array?

When producing LSIs, the diffusion process that forms elements such as transistors on a silicon wafer takes a long time. With gate arrays, manufacturers can supply wafers called master wafers on which the diffusion process has been completed. On a master wafer, logic gates (basic cells) are arranged in the shape of a grid (array). These basic cells are not wired to each other at first, and are electrically independent. When the required circuit has been determined, these basic cells are combined to create it. Therefore, because users can produce products in the short time required for the processes following the wiring process, very short development times are possible. In addition, even a small quantity of products can be produced at a low cost by individually wiring master wafers chosen from the many different types readily available.

As the density of gate arrays has increased, a type called the channel-less gate array, which can be used to integrate a large-scale system on a single chip, has come into the spotlight.

A channel-less gate array does not have a wiring area, unlike conventional gate arrays, but has transistors over its entire surface. The major features of the channel-less gate array, in addition to a short development period, are as follows:

- Memories can be efficiently implemented.
- The width of the wiring area and the shapes of the gates can be determined as you like.

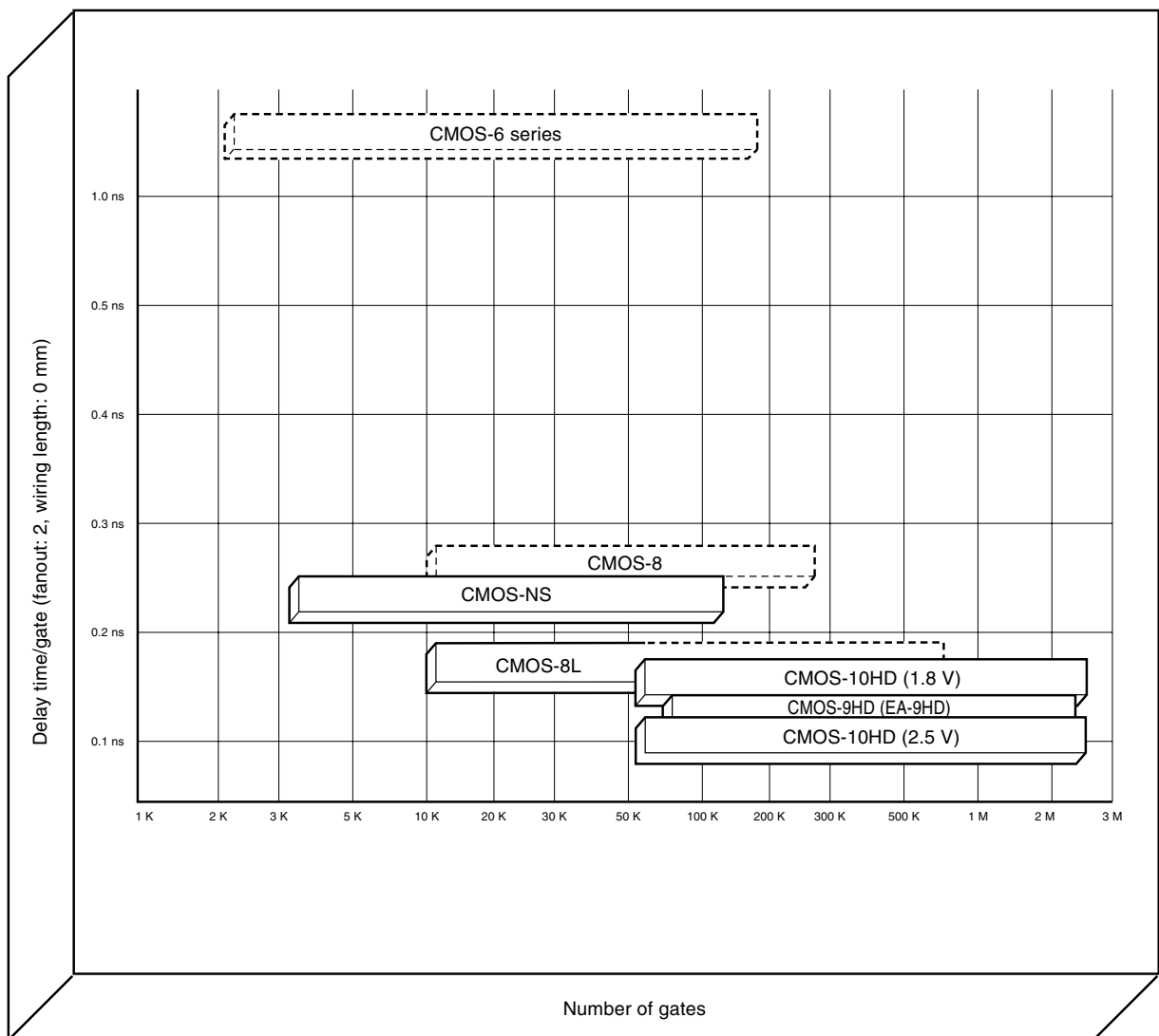


Gate Array

■ Product Line-Up

NEC offers 127 different gate array models (110 CMOS gate array models, 17 CMOS embedded array models) with the world's highest performance and density, backed up by its leading-edge technology. These gate arrays are employed in a wide range of fields, such as electronic games, household appliances, optical communications equipment, and supercomputers.

Product Line-Up



Channel-less CMOS : CMOS-8L, CMOS-NS, CMOS-9HD, CMOS-10HD (1.8 V/2.5 V), EA-9HD (CMOS-6, CMOS-6A, CMOS-6S, CMOS-8)

Gate Array

■ Features of NEC Gate Arrays

Wide variety of models

Many different models are available, suitable for all kinds of systems

CMOS gate arrays: 4 families, 110 models

CMOS embedded arrays: 1 family, 17 models

Realization of high integration and high speed operation with a dual power-supply using leading-edge technology

The CMOS-10HD family is a channel-less gate array to which a 0.25 μm CMOS process has been applied. This family supports a low internal power-supply voltage of 2.5/1.8 V and provides two types of power-line master; single power-supply and dual power-supply. This family can be applied to medium or large sized systems with a 2.5/1.8 V single drive or a 3.3/2.5 V and 3.3/1.8 V mixed interface.

Realization of high density and high speed operation

The CMOS-9HD family employs a 0.35 μm CMOS technology, 3- or 4-layer wiring technology, and channel-less structure. As a result, a density of up to 2.5M gates (1.5M usable gates) and a speed of 107ps have been achieved, enabling large-scale system integration on a single chip.

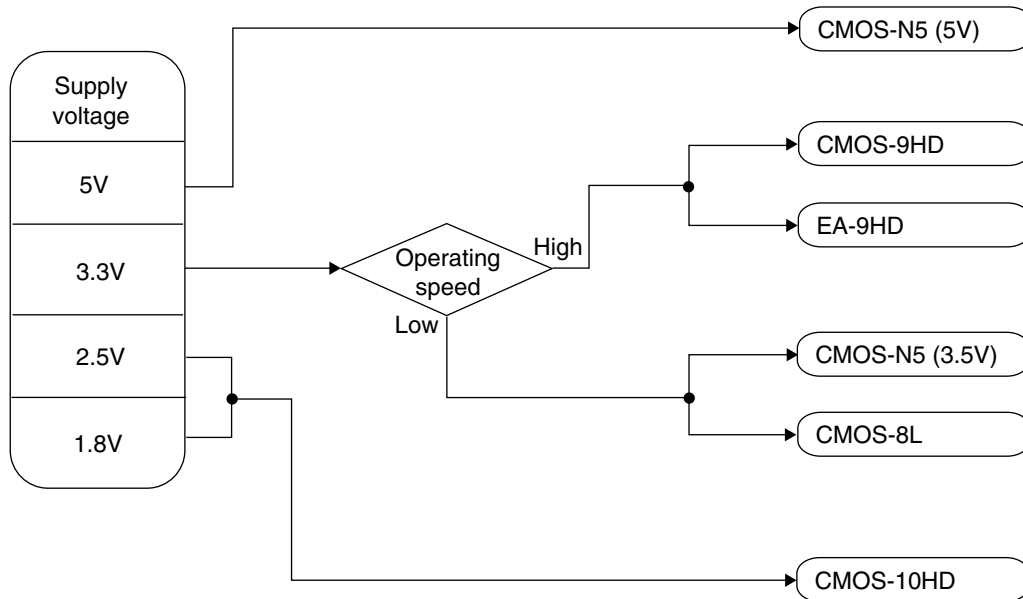
Realization of drastic cost reduction

The CMOS-N5 family is a gate array that provides high-speed operation with a 5 V power supply voltage. Drastic cost reductions have been achieved thanks to higher integration by the adoption of 0.5 μm technology (2-layer wiring), and lowering the package assembly cost.

High-level gate arrays from many libraries

Because many library functions are available, it is easy to improve the functionality of your system. Moreover, every technology is standardized to facilitate design.

Macros of large-scale CPU peripheral circuits are available for CMOS gate arrays, shortening the design period and improving the functionality of your systems.

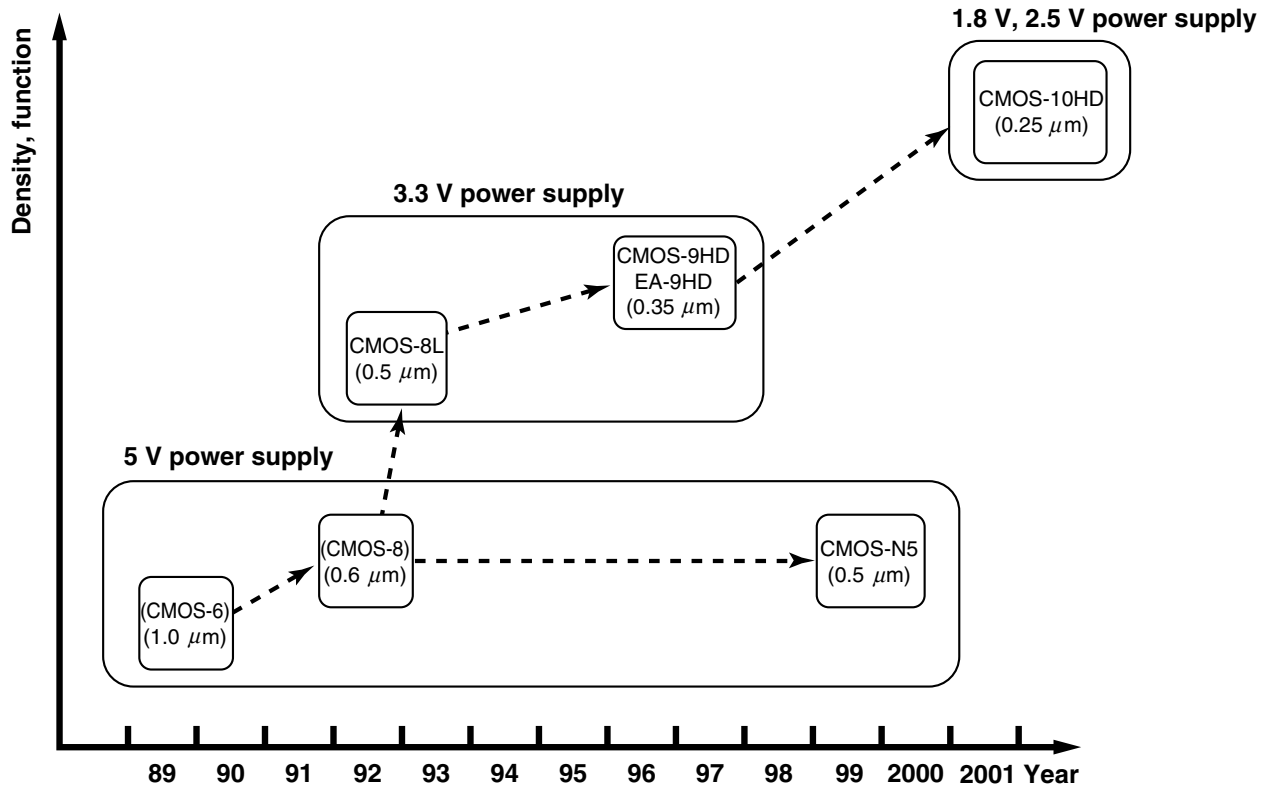
Gate Array**■ Which Gate Arrays Is Best Suited to Your System?**

Gate Array

- CMOS Gate Array
- Product Line-Up

NEC offers some types of CMOS gate arrays, including the CMOS-N5 family with a design technology of $0.5\ \mu\text{m}$ and the CMOS-10HD family with a design technology of $0.25\ \mu\text{m}$.

These CMOS gate arrays have densities from 3.5K gates to 2.6M gates (127 models) and satisfy a wide range of user needs by providing compound functions with integrated memories and keeping the operating voltage low.



Gate Array

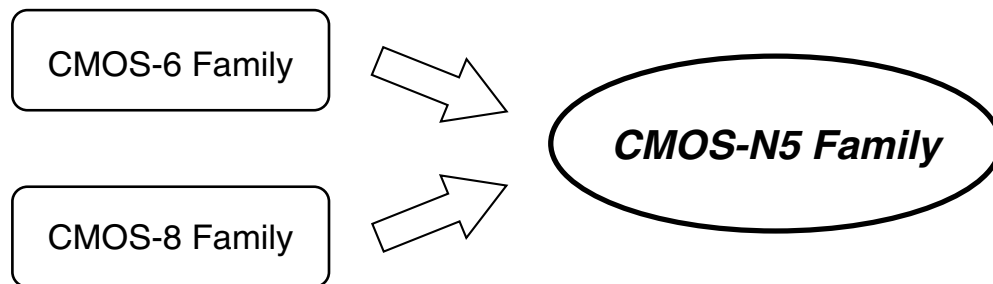
CMOS Gate Array

■ CMOS-N5 Family

● Features

The CMOS-N5 family is a channel-less type gate array that provides high-speed operation with a 5 V power supply voltage.

Drastic cost reductions have been achieved compared with the conventional CMOS-6 and CMOS-8 families due to higher integration by the adoption of 0.5 μm technology (2-layer wiring), and lowering the package assembly cost.



Integration

- 3.5K to 120K gates (number of integrated gates)
- 2.8K to 86K gates (number of usable gates)

High-speed operation

- $t_{PD} = 0.2 \text{ ns}$ (2-input NAND (power gate), fanout = 2, standard wiring length)
- Operating frequency: 60 MHz max.

Function blocks

- RAM block (1 port/2 ports)
- Oscillation block
- CTS block
- Mega Macro
- Boundary Scan

Gate Array

CMOS Gate Array

■ CMOS-N5 Family

● Available Models

Part number		μPD65880	μPD65881	μPD65882	μPD65883	μPD65884	μPD65885	μPD65887	μPD65889	μPD65890	μPD65893
Density	Number of integrated gates ^{Note 1}	3456	5880	13952	25344	33864	40768	38948	76000	99528	123384
	Number of usable gates ^{Note 2}	2764	4704	11161	20275	27091	28537	55640	53200	69669	86368
	Number of pads ^{Note 3}	72	88	120	160	184	244	284	324	372	412
Delay time	Internal gate	0.29 ns (fanout: 2, standard wiring length)									
	Power gate	0.20 ns (fanout: 2, standard wiring length)									
	Input buffer	0.36 ns (fanout: 2, standard wiring length)									
	Output buffer	1.73 ns (C _L = 15 pF)									
Output drive capability		I _{OL} = 3, 6, 9, 12, 18, 24 mA									
Supply voltage		3 V ± 10%, 5 V ± 10% (CMOS level)									

Notes 1. 2-input NAND conversion.

2. Cell utilization rate: 70 to 80% (70% in the largest five masters)

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

Gate Array

CMOS Gate Array

■ CMOS-8L Family

● Available Models (2-layer wiring)

Part number		μ PD65837	μ PD65839	μ PD65840	μ PD65841	μ PD65842	μ PD65843	μ PD65845
Density	Number of integrated gates ^{Note 1}	4480	7904	10912	20832	30192	40592	52528
	Number of usable gates ^{Note 2}	2912	5137	6547	12499	18115	24355	31516
	Number of pads ^{Note 3}	80	104	164	204	212	244	276
Delay time	Internal gate	0.33 ns (fanout: 2, wiring length: 2 mm)						
	Power gate	0.21 ns (fanout: 2, wiring length: 2 mm)						
	Input buffer	0.71 ns (fanout: 2, wiring length: 2 mm)						
	Output buffer	1.44 ns (C _L = 15 pF)						
Output drive capability		I _{OL} = 1, 2, 3, 6, 9, 12, 18, 24 mA						
Supply voltage		3.3 ± 0.3 V						

Notes 1. 2-input NAND conversion (1 cell = 1 gate).

2. Cell utilization rate: 60%

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

● Library

I/O buffer	Function block	Memory block	Mega macro
3 V	Logic gate	High-speed single port RAM	DMA controller
Input buffer	Buffer	High-speed dual-port RAM	Serial interface unit
Output buffer	Inverter	High-density single-port RAM	Parallel interface unit
Bidirectional buffer	3-state output buffer	ROM	Timer/counter
PCI buffer	Clock driver		Interrupt controller
5 V (level shifter)	Delay		
Input buffer	Adder		
Output buffer	Decoder		
Bidirectional buffer	Multiplexer		
GTL	Latch		
DPLL	Flip-flop		
	Shift register		
	Counter		
	Others		

Gate Array

CMOS Gate Array

■ CMOS-8L Family

● Characteristics

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V_{DD}	-0.5 to +4.6	V
Input/output voltage (3 V interface block)	V_I/V_O	-0.5 to +4.6	V
Input/output voltage (5 V interface block)	V_I/V_O	-0.5 to +6.6	V
Output current	I_O	3 ^{Note 1}	mA
Output current	I_O	7 ^{Note 2}	mA
Output current	I_O	10 ^{Note 3}	mA
Output current	I_O	20 ^{Note 4}	mA
Output current	I_O	30 ^{Note 5}	mA
Output current	I_O	40 ^{Note 6}	mA
Output current	I_O	60 ^{Note 7}	mA
Output current	I_O	80 ^{Note 8}	mA
Operating temperature	T_A	-40 to +85	°C
Storage temperature	T_{stg}	-65 to +150	°C

Notes

1. I_{OL} (Min.) = 1.0 mA type
2. I_{OL} (Min.) = 2.0 mA type
3. I_{OL} (Min.) = 3.0 mA type
4. I_{OL} (Min.) = 6.0 mA type
5. I_{OL} (Min.) = 9.0 mA type
6. I_{OL} (Min.) = 12.0 mA type
7. I_{OL} (Min.) = 18.0 mA type
8. I_{OL} (Min.) = 24.0 mA type

Recommended Operating Conditions

Parameter	Symbol	$V_{DD} = 3.3 \pm 0.3$ V		Unit
		Min.	Max.	
Supply voltage	V_{DD}	3.0	3.6	V
High-level input voltage (3 V interface block)	V_{IH}	2.0	V_{DD}	V
High-level input voltage (5 V interface block)	V_{IH}	2.0	5.5	V
Low-level input voltage (3 V interface block)	V_{IL}	0	0.8	V
Low-level input voltage (5 V interface block)	V_{IL}	0	0.8	V
Input rise time	t_r	0	200	ns
Input fall time	t_f	0	200	ns
Positive trigger voltage (3 V interface block)	V_P	1.70	2.70	V
Positive trigger voltage (5 V interface block)	V_P	2.20	2.55	V
Negative trigger voltage (3 V interface block)	V_N	0.60	1.20	V
Negative trigger voltage (5 V interface block)	V_N	0.84	1.01	V
Hysteresis voltage (3 V interface block)	V_H	1.10	1.50	V
Hysteresis voltage (5 V interface block)	V_H	1.36	1.54	V

Caution If any of the parameters exceeds the absolute maximum ratings, even momentarily, the quality of the product may be impaired. The absolute maximum ratings are values that may physically damage the product(s). Be sure to use the product(s) within the ratings.

DC Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Static current consumption	I_{DDs}				300	μ A
Off-state output leakage current	I_{OZ}				± 18	μ A
Output short-circuit current	I_{OS}				-250	mA
Input leakage current	Normal input	$V_I = V_{DD}$ or GND		$\pm 10^{-5}$	± 10	μ A
	with pull-up (50 k Ω)	$V_I =$ GND	-10	-40	-80	μ A
	with pull-up (5 k Ω)	$V_I =$ GND	-130	-350	-640	μ A
	with pull-down (50 k Ω)	$V_I = V_{DD}$	30	65	130	μ A
High-level output voltage (3 V interface block)	V_{OH}	$I_{OH} = 0$ mA	$V_{DD} - 0.1$			V
High-level output voltage (5 V interface block)	V_{OH}	$I_{OH} = 0$ mA	$V_{DD} - 0.2$			V
Low-level output voltage	V_{OL}	$I_{OL} = 0$ mA			0.1	V

Remarks 1. The above values are under the recommended operating conditions shown on the above-mentioned.

For details, refer to the **Design Manual**.

2. Blank indicates value is under study.

Gate Array

CMOS Gate Array

■ CMOS-9HD Family

● Features

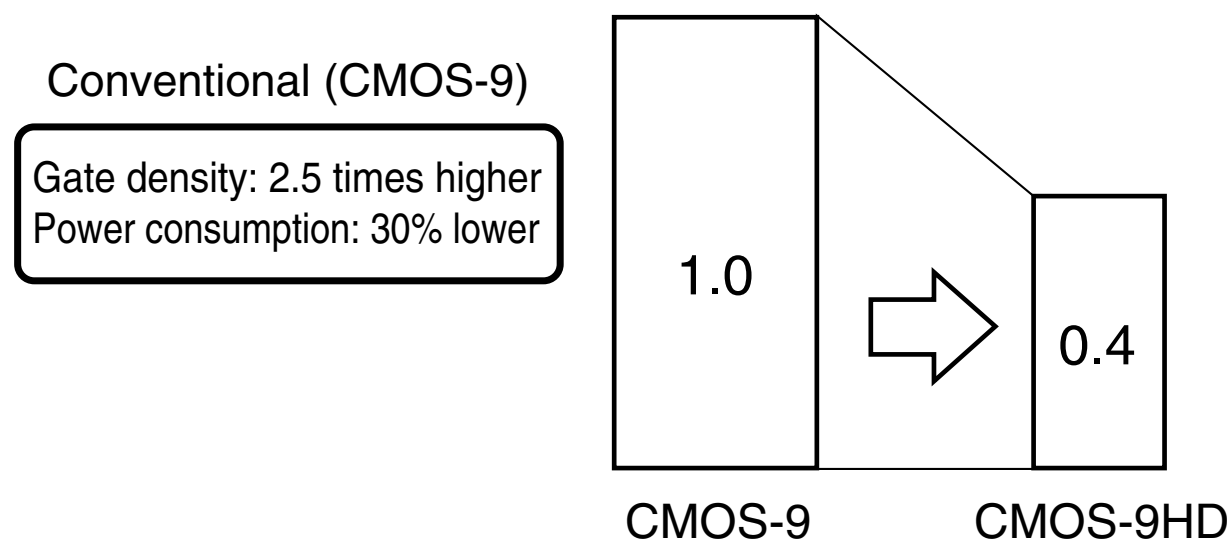
The CMOS-9HD family is a collection of channel-less gate arrays employing a 0.35 μm technology.

This family consists of 17 masters with 75K to 2.5M gates.

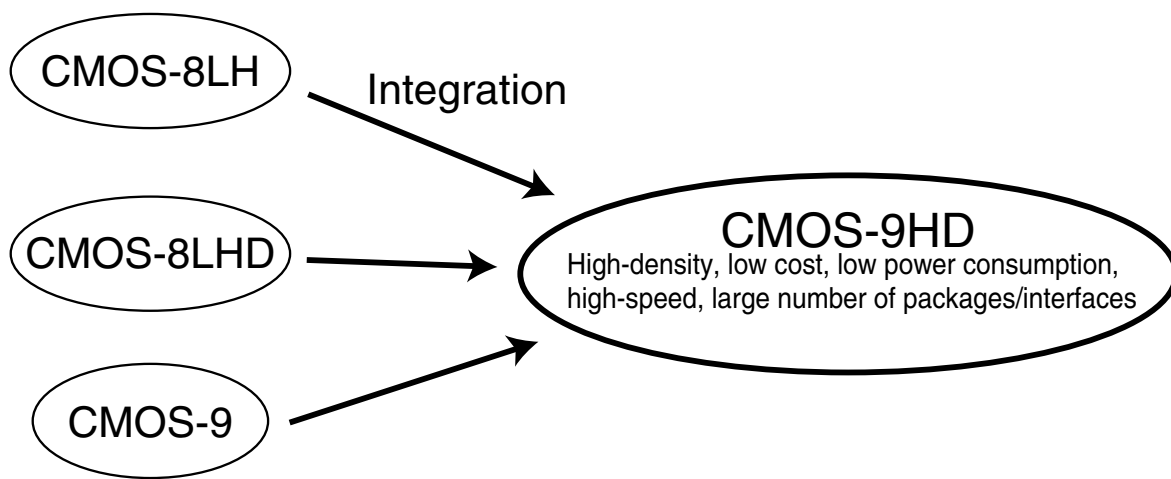
The most outstanding feature of this family is the 2.5scale of integration.

The gate density of this family is about 2.5 times higher than that of the existing CMOS-9 family of 0.35 μm gate arrays, due to improvement of the cell structure.

In addition, the power consumption is 30% lower, and because of new I/O pad layout technology, this family offers a large number of pins in addition to the high density.



Conventional



Gate Array

CMOS Gate Array

■ CMOS-9HD Family

● Available Models (3-layer wiring)

Part number		μPD65943	μPD65944	μPD65945	μPD65946	μPD65948	μPD65949	μPD65951	μPD65954	μPD65956	μPD65958
Density	Internal gates ^{Note 1}	75740	100602	128338	202630	312684	437136	585390	835664	1096452	1615646
	Number of usable gates ^{Note 2}	53018	70421	89836	141841	218879	262281	321964	459615	603048	807823
	Number of pads ^{Note 3}	172	196	216	268	324	380	436	516	588	708
Delay time	Internal gate	131 ps (2-input NAND, fanout: 1, standard wiring length)									
	Power gate	107 ps (2-input NAND, fanout: 1, standard wiring length)									
	Input buffer	229 ps (fanout: 2, standard wiring length)									
	Output buffer	1396 ps ($C_L = 15$ pF, $I_{OL} = 9$ mA)									
Output drive capability		$I_{OL} = 1, 2, 3, 6, 9, 12, 18, 24$ mA									
Supply voltage		3.3 ± 0.3 V									

Notes 1. 2-input NAND conversion.

2. Cell utilization rate: 50 to 70% (60% in the largest four masters)

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

● Available Models (4-layer wiring)

Part number		μPD65961	μPD65964	μPD65966	μPD65968	μPD65969	μPD65970	μPD65971
Density	Internal gates ^{Note 1}	585390	835664	1096452	1615646	1904700	2196592	2509284
	Number of usable gates ^{Note 2}	380503	543181	712693	969387	1142820	1317955	1505570
	Number of pads ^{Note 3}	436	516	588	708	764	820	876
Delay time	Internal gate	131 ps (2-input NAND, fanout: 1, standard wiring length)						
	Power gate	107 ps (2-input NAND, fanout: 1, standard wiring length)						
	Input buffer	229 ps (fanout: 2, standard wiring length)						
	Output buffer	1396 ps ($C_L = 15$ pF, $I_{OL} = 9$ mA)						
Output drive capability		$I_{OL} = 1, 2, 3, 6, 9, 12, 18, 24$ mA						
Supply voltage		3.3 ± 0.3 V						

Notes 1. 2-input NAND conversion.

2. Cell utilization rate: 60 to 65% (60% in the largest four masters)

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

Gate Array

CMOS Gate Array■ **CMOS-9HD Family**● **Library**

I/O buffer	Function block	Memory block	Mega macro
3 V	Logic gate	Asynchronous 1-port RAM	Serial interface unit
Input buffer	Buffer	(Fixed type/Compiled type)	Timer/counter
Output buffer	Inverter	Asynchronous 2-port RAM	Interrupt controller
Bidirectional buffer	3-state output buffer	(Fixed type/Compiled type)	UART + FIFO
PCI buffer	Clock driver	Synchronous 2-port RAM	
Low-noise buffer	Delay	(Compiled type)	
Fail-safe buffer	Adder	ROM	
5 V (level shifter)	Decoder	(Fixed type)	
Input buffer	Multiplexer		
Output buffer	Latch		
Bidirectional buffer	Flip-flop		
GTL +	Shift register		
DPLL (for skew adjustment)	Counter		
DPLL (for multiplier)	Others		

Gate Array

CMOS Gate Array

- CMOS-9HD Family
- Characteristics (1/5)

Absolute Maximum Ratings

Parameter		Symbol	Conditions	Rating	Unit
Supply voltage		V_{DD}		−0.5 to +4.6	V
Input voltage	LVTTL input buffer	V_I	$V_I < V_{DD} + 0.5 \text{ V}$	−0.5 to +4.6	V
	LVTTL input buffer with fail-safe function	V_I	$V_I < V_{DD} + 0.5 \text{ V}$	−0.5 to +4.6	V
	5 V input buffer	V_I	$V_I < V_{DD} + 0.5 \text{ V}$	−0.5 to +6.6	V
Output voltage	LVTTL output buffer	V_O	$V_O < V_{DD} + 0.5 \text{ V}$	−0.5 to +4.6	V
	TTL 5 V output buffer	V_O	$V_O < V_{DD} + 3.0 \text{ V}$	−0.5 to +6.6	V
	CMOS 5 V output buffer	V_O	$V_O < V_{DD} + 3.0 \text{ V}$	−0.5 to +6.6	V
Output current ^{Note}		I_O	$I_{OL} = 1 \text{ mA (FV0B)}$	3	mA
			$I_{OL} = 2 \text{ mA (FV0B)}$	7	mA
			$I_{OL} = 3 \text{ mA (FO09, FV09)}$	10	mA
			$I_{OL} = 6 \text{ mA (FO04, FV04)}$	20	mA
			$I_{OL} = 9 \text{ mA (FO01, FV01)}$	30	mA
			$I_{OL} = 12 \text{ mA (FO02)}$	40	mA
			$I_{OL} = 18 \text{ mA (FO03)}$	60	mA
			$I_{OL} = 24 \text{ mA (FO06)}$	75	mA
Operating temperature		T_A		−40 to +85	°C
Storage temperature		T_{stg}		−65 to +150	°C

Note Maximum DC current that can flow through output pin

Caution If any of the parameters exceeds the absolute maximum ratings, even momentarily, the quality of the product may be impaired. The absolute maximum ratings are values that may physically damage the product(s). Be sure to use the product(s) within the ratings.

Remark Apart from the buffer with the fail-safe function, apply 5 V or 3 V to the I/O pin after the supply voltage has been stabilized.

Gate Array

CMOS Gate Array

■ CMOS-9HD Family

● Characteristics (2/5)

Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}		3.00	3.30	3.60	V
High-level input voltage	V_{IH}	• LVTTL interface buffer	2.00		V_{DD}	V
Low-level input voltage	V_{IL}	• LVTTL interface buffer with	0		0.80	V
Positive trigger voltage ^{Note 1}	V_P	failsafe function	1.40		2.40	V
Negative trigger voltage ^{Note 1}	V_N		0.80		1.60	V
Hysteresis voltage ^{Note 1}	V_H		0.30		1.50	V
High-level input voltage	V_{IH}	• TTL 5 V tolerant interface buffer	2.00		5.50	V
Low-level input voltage	V_{IL}	• 5 V input buffer	0		0.80	V
Positive trigger voltage ^{Note 1}	V_P		1.40		2.40	V
Negative trigger voltage ^{Note 1}	V_N		0.80		1.60	V
Hysteresis voltage ^{Note 1}	V_H		0.30		1.50	V
Input rise time	t_{ri}	Normal input	0		200	ns
Input fall time	t_{fi}		0		200	ns
Input rise time	t_{ri}	Schmitt input ^{Note 2}	0		10	ms
Input fall time	t_{fi}		0		10	ms

Notes 1. Schmitt input.

2. Do not use this for the clock.

Remark If a signal with a long rise/fall time is input, use a Schmitt trigger input buffer to prevent malfunctioning due to noise superimposed on the signal line.

Fluctuation of power caused by simultaneous operation of output buffers lowers the capability of the Schmitt trigger input buffer and, therefore, care must be exercised in laying out the pins.

Gate Array

CMOS Gate Array

■ CMOS-9HD Family

● Characteristics (3/5)

The following values are under the recommended operating conditions shown above. For details, refer to the **Design Manual**.

DC Characteristics (1/3)

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Unit
Static current consumption ^{Note 1}	μ PD65943, 65944, 65945	I_{DD5}	$V_I = V_{DD}$ or GND	2.0	300	μA	
	μ PD65946, 65948, 65949						
	μ PD65951, 65954, 65956				3.0	400	μA
	μ PD65958				4.0	800	μA
Off-state output leakage current ^{Note 2}	LVTTL output	I_{OZ}	$V_O = V_{DD}$ or GND			± 10	μA
	TTL 5 V output	I_{OZ}	$V_O = V_{DD}$ or GND			± 10	μA
	CMOS 5 V tolerant output	I_{OZ}	$V_O = V_{DD}$ or GND			± 10	μA
Output sink current ^{Note 3} CMOS 5 V tolerant output		I_R	$V_{PU} = 5.5 V$, $R_{PU} = 2 k\Omega$, $V_O = 3.0 V$			10	μA
Output short-circuit current ^{Note 4}		I_{OS}	$V_O = GND$			-250	mA
Input leakage current	Normal input	I_I	$V_I = V_{DD}$ or GND			± 1.0	μA
	With pull-up resistor (50 k Ω)	I_I	$V_I = GND$	-28	-83	-190	μA
	With pull-up resistor (5 k Ω)	I_I	$V_I = GND$	-280	-700	-1900	μA
	With pull-down resistor (50 k Ω)	I_I	$V_I = V_{DD}$	28	83	190	μA
Pull-up resistor (50 k Ω) ^{Note 5}		R_{PU}		18.9	39.8	107.1	k Ω
Pull-up resistor (5 k Ω) ^{Note 5}		R_{PU}		1.9	4.7	10.7	k Ω
Pull-down resistor (50 k Ω) ^{Note 5}		R_{PU}		18.9	39.8	107.1	k Ω

Notes 1. The static current consumption increases when an I/O block with pull-up/pull-down resistor is used.

2. The output off-state current of the TTL and CMOS 5 V 3-state buffer and I/O buffer slightly increases because of the bias of the 5 V protection circuit.

3. A sink current flows from the output pin to the internal circuit of the LSI if the TTL and CMOS 5 V output buffer are pulled up at a voltage higher than the supply voltage of the LSI.

4. The output short-circuit time is 1 second or less for only 1 pin of the LSI.

5. The pull-up resistance and pull-down resistance vary depending on the input and output voltages.

Remark The + and - symbols next to the current values in the table above indicate the direction of the current. Current flowing into the device is indicated by + and current flowing out is indicated by -.

Note that the CMOS 5 V tolerant output buffer cannot output a DC high level because of its structure.

Gate Array

CMOS Gate Array

■ CMOS-9HD Family

● Characteristics (4/5)

DC Characteristics (2/3)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Low-level output current ^{Note 1}	LVTTL output type					
	3.0 mA type	FO09	3.00 ^{Note 2}			mA
	6.0 mA type	FO04	6.00			mA
	9.0 mA type	FO01	9.00			mA
	12.0 mA type	FO02	12.00			mA
	18.0 mA type	FO03	18.00			mA
	24.0 mA type	FO06	24.00			mA
	TTL 5 V output					
	1.0 mA type	FV0A	1.00			mA
	2.0 mA type	FV0B	2.00			mA
	3.0 mA type	FV09	3.00			mA
	6.0 mA type	FV04	6.00			mA
	9.0 mA type	FV01	9.00			mA
	12.0 mA type	FV02	12.00			mA
	18.0 mA type	FV03	18.00			mA
	24.0 mA type	FV06	24.00			mA
	CMOS 5 V tolerant output					
	3.0 mA type	FY09	3.00			mA
	6.0 mA type	FY04	6.00			mA
	9.0 mA type	FY01	9.00			mA
	12.0 mA type	FY02	12.00			mA
	18.0 mA type	FY03	18.00			mA
	24.0 mA type	FY06	24.00			mA

Notes 1. The specifications of the buffers with the same driving capabilities are the same.

2. 2.00 mA for type with 5 k Ω pull-up resistor

Remark Note that the CMOS 5 V tolerant output buffer cannot output a DC high level because of its structure.

Gate Array

CMOS Gate Array

■ CMOS-9HD Family

● Characteristics (5/5)

DC Characteristics (3/3)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
High-level output current ^{Note}	LVTTTL output type					
	3.0 mA type	FO09	–3.00			mA
	6.0 mA type	FO04	–6.00			mA
	9.0 mA type	FO01	–9.00			mA
	12.0 mA type	FO02	–12.00			mA
	18.0 mA type	FO03	–18.00			mA
	24.0 mA type	FO06	–24.00			mA
	TTL 5 V output					
	1.0 mA type	FV0A	–1.00			mA
	2.0 mA type	FV0B	–1.00			mA
	3.0 mA type	FV09	–3.00			mA
	6.0 mA type	FV04	–3.00			mA
	9.0 mA type	FV01	–3.00			mA
	12.0 mA type	FV02	–3.00			mA
	18.0 mA type	FV03	–6.00			mA
	24.0 mA type	FV06	–6.00			mA
Low-level output voltage	LVTTTL output type				0.1	V
	LVTTTL output type (with 5 k Ω pull-up resistor)				0.2	V
	TTL 5 V output				0.1	V
	CMOS 5 V tolerant output				0.1	V
High-level output voltage	LVTTTL output type					V
	TTL 5 V output					V

Note The specifications of the buffers with the same driving capabilities are the same.

Remark The + and – symbols next to the current values in the table above indicate the direction of the current. Current flowing into the device is indicated by + and current flowing out is indicated by –.

Note that the CMOS 5 V tolerant output buffer can not output a DC high level because of its structure.

Gate Array

CMOS Gate Array

■ CMOS-10HD Family

● Features (1/2)

High-density, high-speed, 3- or 4-layer wiring channel-less gate array achieved through the employment of a 0.25 μm CMOS process.

Supports a low internal power-supply voltage of 2.5/1.8 V (0.042 $\mu\text{W}/\text{MHz}/\text{gate}$, operation rate 30% when operating at 1.8 V).

Two types of power-line masters are provided: single power-supply and dual power-supply.

Two types of interfaces are available for the dual power-supply master: external 3.3 V, internal 2.5 V or external 3.3 V, internal 1.8 V

2.5 V or 1.8 V available both internally and externally for the single power-supply master.

Between 29,000 and 1,563,000 usable gates provided.

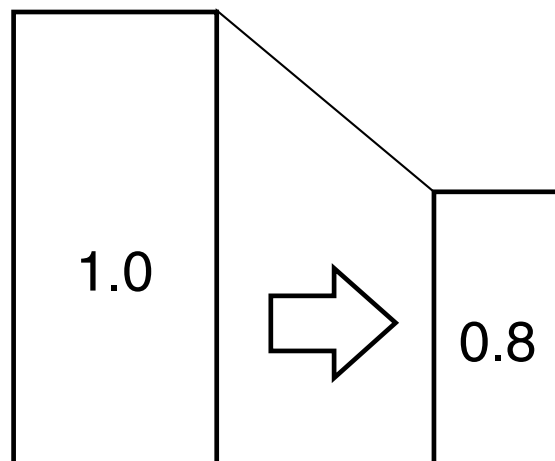
Enables lower development costs, easier design, and shorter TAT than the CMOS-9HD Family.

A device architecture that makes allowances for SI (Signal Integrity) and an excellent development environment have enabled a significant improvement in design convergence following placement and routing.

Extensive lineup provided including low-gate-count/high-pin-count products.

Conventional (CMOS-9HD)

Gate density: 1.5 times higher
Power consumption: 60% lower^{Note}



CMOS-9HD

CMOS-10HD

Note CMOS-10HD Family (2.5 V)

Gate Array

CMOS Gate Array

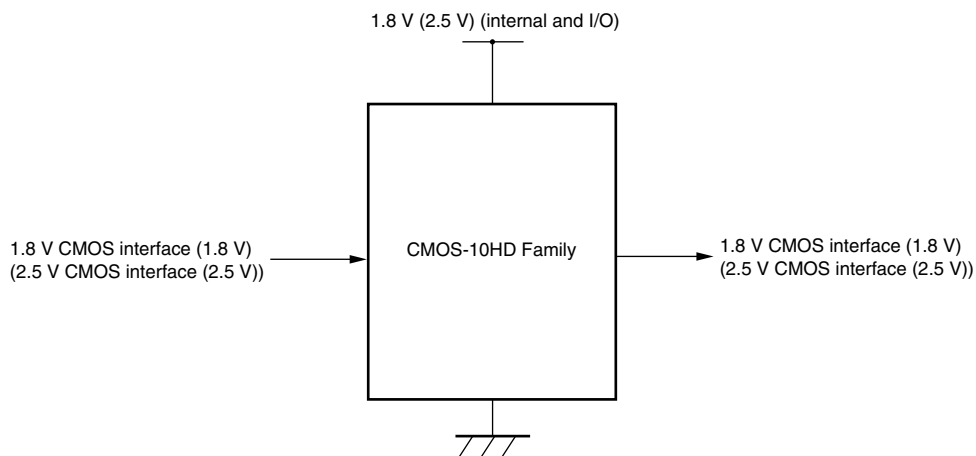
■ CMOS-10HD Family

● Features (2/2)

I/O Interface

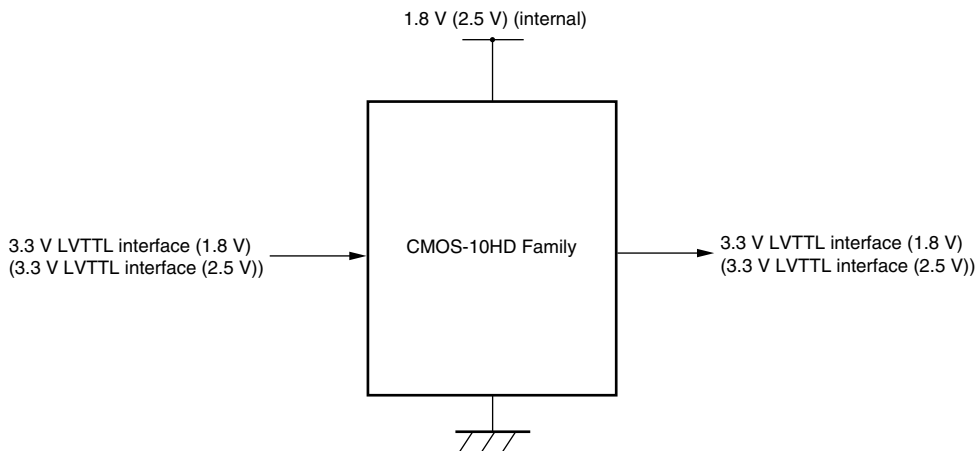
In the CMOS-10HD Family, a 1.8 V (2.5 V) single power supply type or 1.8 V (2.5 V)/3.3 V dual power supply type can be selected for the I/O power supply. The standard interface level of a single power supply type (1.8 V (2.5 V)) is 1.8 V CMOS (2.5 V CMOS), and that of a dual power supply type is 1.8 V (2.5 V)/3.3 V.

(a) 1.8 V (2.5 V) single power supply



Remark Internal 2.5 V is under development.

(b) I/O: 1.8 V (2.5 V)/3.3 V, internal: 1.8 V (2.5 V)



Remark Internal 2.5 V is under development.

Gate Array

CMOS Gate Array

■ CMOS-10HD Family

● Available Models (1/4) (3-layer wiring)

Part number	Single power-supply	μ PD65301☆	μ PD65302☆	μ PD65303☆	μ PD65304☆	μ PD65305☆	μ PD65306☆
	Dual power-supply	μ PD65341☆	μ PD65342☆	μ PD65343☆	μ PD65344☆	μ PD65345☆	μ PD65346☆
Density	Internal gates ^{Note 1}	58682	128338	192058	299472	409920	545008
	Number of usable gates ^{Note 2}	29341	64169	96029	149736	204960	272504
	Number of pads ^{Note 3}	140	196	236	292	340	388
Delay time	Internal gate	163 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 113 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)					
	Power gate	139 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 91 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)					
	Input buffer	243 ps (1.8 V operation, 1.8 V input buffer, fanout: 1, standard wiring length) 330 ps (1.8 V operation, 3.3 V input buffer, fanout: 1, standard wiring length) 173 ps (2.5 V operation, 2.5 V input buffer, fanout: 1, standard wiring length) 294 ps (2.5 V operation, 3.3 V input buffer, fanout: 1 standard wiring length)					
	Output buffer	1246 ps (1.8 V operation, 1.8 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 1366 ps (1.8 V operation, 3.3 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 776 ps (2.5 V operation, 2.5 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 1169 ps (2.5 V operation, 3.3 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA)					
Output drive capability		$I_{OL} = 1, 2, 3, 6, 9, 12, 18, 24$ mA					
Supply voltage		3.3 ± 0.3 V, 1.8 ± 0.15 V					

Notes 1. 2-input NAND conversion.

☆: Newly added product

2. Cell utilization rate: 50%

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

Part number	Single power-supply	μ PD65307☆	μ PD65308☆	μ PD65309☆	μ PD65310☆	μ PD65311☆
	Dual power-supply	μ PD65347☆	μ PD65348☆	μ PD65349☆	μ PD65350☆	μ PD65351☆
Density	Internal gates ^{Note 1}	721224	1014542	1404790	1974700	2605764
	Number of usable gates ^{Note 2}	360612	507271	702395	987350	1302882
	Number of pads ^{Note 3}	444	524	612	724	828
Delay time	Internal gate	163 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 113 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)				
	Power gate	139 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 91 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)				
	Input buffer	243 ps (1.8 V operation, 1.8 V input buffer, fanout: 1, standard wiring length) 330 ps (1.8 V operation, 3.3 V input buffer, fanout: 1, standard wiring length) 173 ps (2.5 V operation, 2.5 V input buffer, fanout: 1, standard wiring length) 294 ps (2.5 V operation, 3.3 V input buffer, fanout: 1 standard wiring length)				
	Output buffer	1246 ps (1.8 V operation, 1.8 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 1366 ps (1.8 V operation, 3.3 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 776 ps (2.5 V operation, 2.5 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 1169 ps (2.5 V operation, 3.3 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA)				
Output drive capability		$I_{OL} = 1, 2, 3, 6, 9, 12, 18, 24$ mA				
Supply voltage		3.3 ± 0.3 V, 1.8 ± 0.15 V				

Notes 1. 2-input NAND conversion.

☆: Newly added product

2. Cell utilization rate: 50%

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

Gate Array

CMOS Gate Array

■ CMOS-10HD Family

● Available Models (2/4) (3-layer wiring for tape BGA packages)

Part number	Single power-supply	μ PD65324 [☆]	μ PD65325 [☆]	μ PD65326 [☆]	μ PD65327 [☆]
	Dual power-supply	μ PD65364 [☆]	μ PD65365 [☆]	μ PD65366 [☆]	μ PD65367 [☆]
Density	Internal gates ^{Note 1}	299472	409920	545008	721224
	Number of usable gates ^{Note 2}	149736	204960	272504	360612
	Number of pads ^{Note 3}	284	332	380	436
Delay time	Internal gate	163 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 113 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)			
	Power gate	139 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 91 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)			
	Input buffer	243 ps (1.8 V operation, 1.8 V input buffer, fanout: 1, standard wiring length) 330 ps (1.8 V operation, 3.3 V input buffer, fanout: 1, standard wiring length) 173 ps (2.5 V operation, 2.5 V input buffer, fanout: 1, standard wiring length) 294 ps (2.5 V operation, 3.3 V input buffer, fanout: 1 standard wiring length)			
	Output buffer	1246 ps (1.8 V operation, 1.8 V output buffer, C _L = 15 pF, I _{OL} = 12 mA) 1366 ps (1.8 V operation, 3.3 V output buffer, C _L = 15 pF, I _{OL} = 12 mA) 776 ps (2.5 V operation, 2.5 V output buffer, C _L = 15 pF, I _{OL} = 12 mA) 1169 ps (2.5 V operation, 3.3 V output buffer, C _L = 15 pF, I _{OL} = 12 mA)			
Output drive capability		I _{OL} = 1, 2, 3, 6, 9, 12, 18, 24 mA			
Supply voltage		3.3 ± 0.3 V, 1.8 ± 0.15 V			

Notes 1. 2-input NAND conversion.

☆: Newly added product

2. Cell utilization rate: 50%

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

Part number	Single power-supply	μ PD65328 [☆]	μ PD65329 [☆]	μ PD65330 [☆]	μ PD65331 [☆]
	Dual power-supply	μ PD65368 [☆]	μ PD65369 [☆]	μ PD65370 [☆]	μ PD65371 [☆]
Density	Internal gates ^{Note 1}	1014542	1404790	1974700	2605764
	Number of usable gates ^{Note 2}	507271	702395	987350	1302882
	Number of pads ^{Note 3}	516	604	716	820
Delay time	Internal gate	163 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 113 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)			
	Power gate	139 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 91 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)			
	Input buffer	243 ps (1.8 V operation, 1.8 V input buffer, fanout: 1, standard wiring length) 330 ps (1.8 V operation, 3.3 V input buffer, fanout: 1, standard wiring length) 173 ps (2.5 V operation, 2.5 V input buffer, fanout: 1, standard wiring length) 294 ps (2.5 V operation, 3.3 V input buffer, fanout: 1 standard wiring length)			
	Output buffer	1246 ps (1.8 V operation, 1.8 V output buffer, C _L = 15 pF, I _{OL} = 12 mA) 1366 ps (1.8 V operation, 3.3 V output buffer, C _L = 15 pF, I _{OL} = 12 mA) 776 ps (2.5 V operation, 2.5 V output buffer, C _L = 15 pF, I _{OL} = 12 mA) 1169 ps (2.5 V operation, 3.3 V output buffer, C _L = 15 pF, I _{OL} = 12 mA)			
Output drive capability		I _{OL} = 1, 2, 3, 6, 9, 12, 18, 24 mA			
Supply voltage		3.3 ± 0.3 V, 1.8 ± 0.15 V			

Notes 1. 2-input NAND conversion.

☆: Newly added product

2. Cell utilization rate: 50%

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

Gate Array

CMOS Gate Array

■ CMOS-10HD Family

● Available Models (3/4) (4-layer wiring)

Part number	Single power-supply	μ PD65501☆	μ PD65502☆	μ PD65503☆	μ PD65504☆	μ PD65505☆	μ PD65506☆
	Dual power-supply	μ PD65541☆	μ PD65542☆	μ PD65543☆	μ PD65544☆	μ PD65545☆	μ PD65546☆
Density	Internal gates ^{Note 1}	58682	128338	192058	299472	409920	545008
	Number of usable gates ^{Note 2}	35209	77003	115235	179683	245952	327005
	Number of pads ^{Note 3}	140	196	236	292	340	388
Delay time	Internal gate	163 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 113 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)					
	Power gate	139 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 91 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)					
	Input buffer	243 ps (1.8 V operation, 1.8 V input buffer, fanout: 1, standard wiring length) 330 ps (1.8 V operation, 3.3 V input buffer, fanout: 1, standard wiring length) 173 ps (2.5 V operation, 2.5 V input buffer, fanout: 1, standard wiring length) 294 ps (2.5 V operation, 3.3 V input buffer, fanout: 1 standard wiring length)					
	Output buffer	1246 ps (1.8 V operation, 1.8 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 1366 ps (1.8 V operation, 3.3 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 776 ps (2.5 V operation, 2.5 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 1169 ps (2.5 V operation, 3.3 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA)					
Output drive capability		$I_{OL} = 1, 2, 3, 6, 9, 12, 18, 24$ mA					
Supply voltage		3.3 ± 0.3 V, 1.8 ± 0.15 V					

Notes 1. 2-input NAND conversion.

☆: Newly added product

2. Cell utilization rate: 60%

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

Part number	Single power-supply	μ PD65507☆	μ PD65508☆	μ PD65509☆	μ PD65510☆	μ PD65511☆
	Dual power-supply	μ PD65547☆	μ PD65548☆	μ PD65549☆	μ PD65550☆	μ PD65551☆
Density	Internal gates ^{Note 1}	721224	1014542	1404790	1974700	2605764
	Number of usable gates ^{Note 2}	432734	608725	842874	1184820	1563458
	Number of pads ^{Note 3}	444	524	612	724	828
Delay time	Internal gate	163 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 113 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)				
	Power gate	139 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 91 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)				
	Input buffer	243 ps (1.8 V operation, 1.8 V input buffer, fanout: 1, standard wiring length) 330 ps (1.8 V operation, 3.3 V input buffer, fanout: 1, standard wiring length) 173 ps (2.5 V operation, 2.5 V input buffer, fanout: 1, standard wiring length) 294 ps (2.5 V operation, 3.3 V input buffer, fanout: 1 standard wiring length)				
	Output buffer	1246 ps (1.8 V operation, 1.8 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 1366 ps (1.8 V operation, 3.3 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 776 ps (2.5 V operation, 2.5 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 1169 ps (2.5 V operation, 3.3 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA)				
Output drive capability		$I_{OL} = 1, 2, 3, 6, 9, 12, 18, 24$ mA				
Supply voltage		3.3 ± 0.3 V, 1.8 ± 0.15 V				

Notes 1. 2-input NAND conversion.

☆: Newly added product

2. Cell utilization rate: 60%

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

Gate Array

CMOS Gate Array

■ CMOS-10HD Family

● Available Models (4/4) (4-layer wiring for tape BGA packages)

Part number	Single power-supply	μ PD65524 [☆]	μ PD65525 [☆]	μ PD65526 [☆]	μ PD65527 [☆]
	Dual power-supply	μ PD65564 [☆]	μ PD65565 [☆]	μ PD65566 [☆]	μ PD65567 [☆]
Density	Internal gates ^{Note 1}	299472	409920	545008	721224
	Number of usable gates ^{Note 2}	179683	245952	327005	432734
	Number of pads ^{Note 3}	284	332	380	436
Delay time	Internal gate	163 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 113 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)			
	Power gate	139 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 91 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)			
	Input buffer	243 ps (1.8 V operation, 1.8 V input buffer, fanout: 1, standard wiring length) 330 ps (1.8 V operation, 3.3 V input buffer, fanout: 1, standard wiring length) 173 ps (2.5 V operation, 2.5 V input buffer, fanout: 1, standard wiring length) 294 ps (2.5 V operation, 3.3 V input buffer, fanout: 1 standard wiring length)			
	Output buffer	1246 ps (1.8 V operation, 1.8 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 1366 ps (1.8 V operation, 3.3 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 776 ps (2.5 V operation, 2.5 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 1169 ps (2.5 V operation, 3.3 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA)			
Output drive capability		$I_{OL} = 1, 2, 3, 6, 9, 12, 18, 24$ mA			
Supply voltage		3.3 ± 0.3 V, 1.8 ± 0.15 V			

Notes 1. 2-input NAND conversion.

☆: Newly added product

2. Cell utilization rate: 60%

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

Part number	Single power-supply	μ PD65528 [☆]	μ PD65529 [☆]	μ PD65530 [☆]	μ PD65531 [☆]
	Dual power-supply	μ PD65568 [☆]	μ PD65569 [☆]	μ PD65570 [☆]	μ PD65571 [☆]
Density	Internal gates ^{Note 1}	1014542	1404790	1974700	2605764
	Number of usable gates ^{Note 2}	608725	842874	1184820	1563458
	Number of pads ^{Note 3}	516	604	716	820
Delay time	Internal gate	163 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 113 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)			
	Power gate	139 ps (1.8 V operation, 2-input NAND, fanout: 1, standard wiring length) 91 ps (2.5 V operation, 2-input NAND, fanout: 1, standard wiring length)			
	Input buffer	243 ps (1.8 V operation, 1.8 V input buffer, fanout: 1, standard wiring length) 330 ps (1.8 V operation, 3.3 V input buffer, fanout: 1, standard wiring length) 173 ps (2.5 V operation, 2.5 V input buffer, fanout: 1, standard wiring length) 294 ps (2.5 V operation, 3.3 V input buffer, fanout: 1 standard wiring length)			
	Output buffer	1246 ps (1.8 V operation, 1.8 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 1366 ps (1.8 V operation, 3.3 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 776 ps (2.5 V operation, 2.5 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA) 1169 ps (2.5 V operation, 3.3 V output buffer, $C_L = 15$ pF, $I_{OL} = 12$ mA)			
Output drive capability		$I_{OL} = 1, 2, 3, 6, 9, 12, 18, 24$ mA			
Supply voltage		3.3 ± 0.3 V, 1.8 ± 0.15 V			

Notes 1. 2-input NAND conversion.

☆: Newly added product

2. Cell utilization rate: 60%

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

Cell-Based IC**■ Cell-Based IC Line-Up (1/3)**

A cell-based IC is an LSI designed by combining large-scale macros (such as existing CPU and memories) and the user's own circuits. Because its internal logic cells are optimally designed according to their functions, a high degree of integration with low current consumption is possible even if the circuit consists of only logic, as compared with gate arrays.

In addition, a system-on-a-chip that integrates a high-performance CPU core with analog macros such as A/D and D/A converters can be produced.

Many families available

Families are available for each technology.

0.35 μm CMOS family : CB-9 family VX/VM type

0.25 μm CMOS family : CB-10 family, CB-10 family VX type

0.13 μm CMOS family : CB-12 family L/M/H type

The CB-9 family VM type can easily interface with 5 V and 3.3 V signals by using a buffer with a level shifter in systems where 5 V and 3.3 V are used together.

The CB-9 family VX type internally operates at 2.0 V and has a 3.3 V interface; it is ideal for portable systems where low power consumption is required, such as cellular telephones.

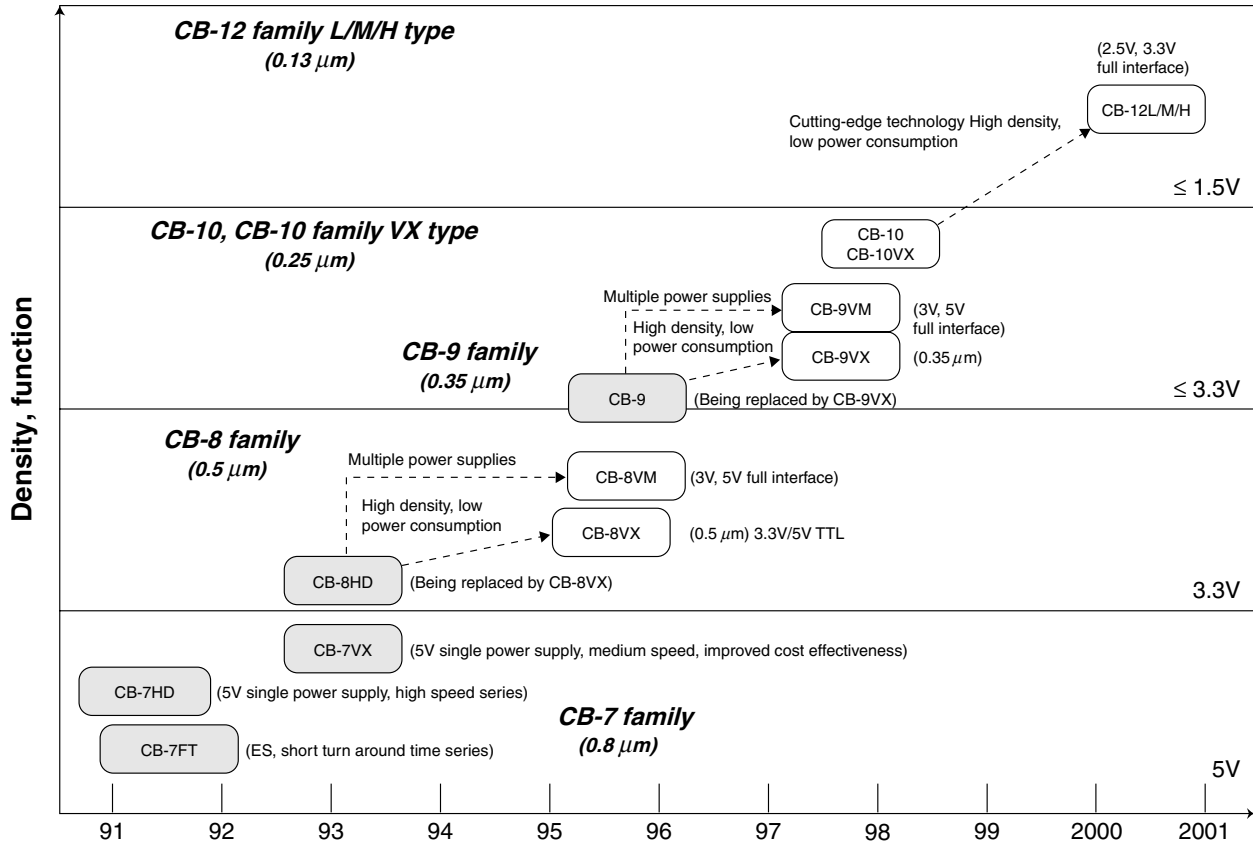
The CB-10 family and CB-10 family VX type internally operates at 2.5 V and has a 2.5 or 3.3 V interface to allow larger-scale systems with lower power consumption.

The CB-12 family L/M/H type internally operates at 1.5 V and has a 2.5 V/3.3 V interface that allows much larger-scale systems and higher-speed operation, while consuming less power than the CB-10 family.

Cell-Based IC

■ Cell-Based IC Line-Up (2/3)

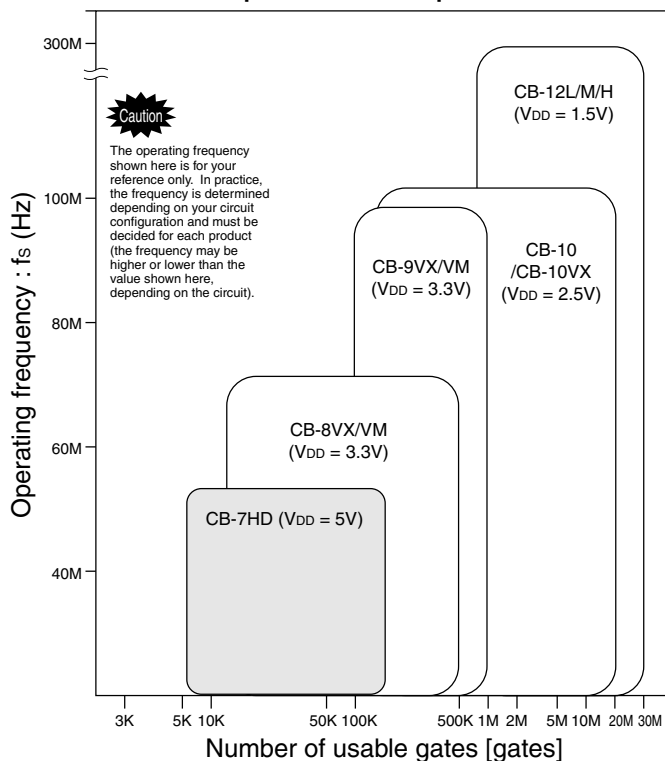
Series development of Cell-Based ICs



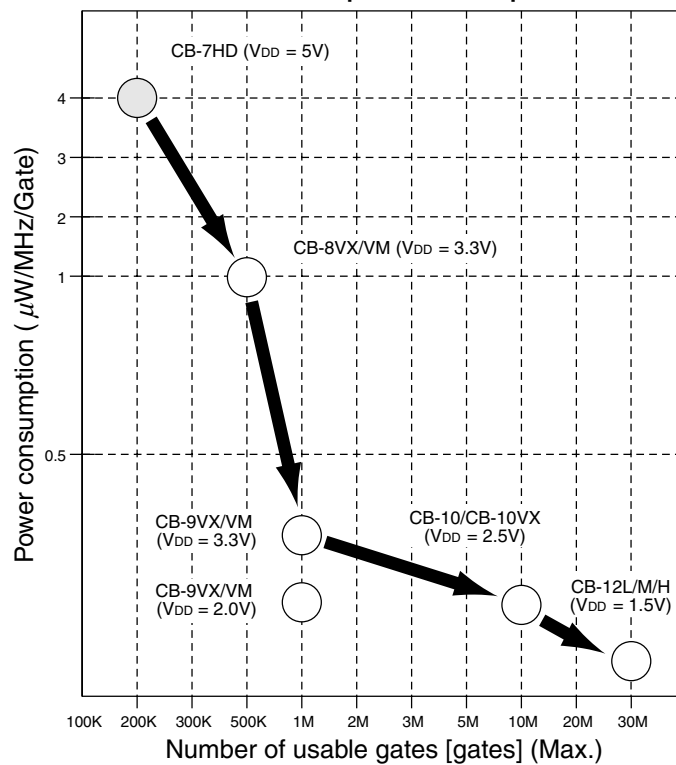
Cell-Based IC

■ Cell-Based IC Line-Up (3/3)

Comparison of series performance

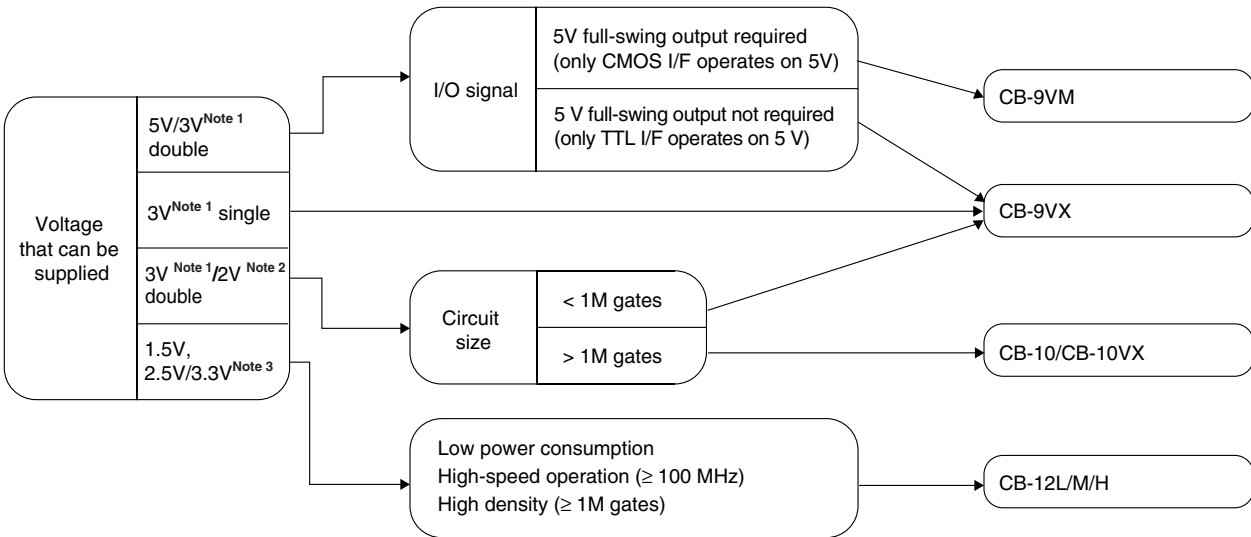


Transition of power consumption



Cell-Based IC

■ Guide to Selecting Cell-Based ICs



- Notes**
1. CB-9VX/VM, CB-10, CB-10VX: $V_{DD} = 3.3 \pm 0.3 \text{ V}$
 2. CB-9VX, 2V: $V_{DD} = 2.0 \pm 0.2 \text{ V}$
CB-10, CB-10VX: $V_{DD} = 2.5 \pm 0.2 \text{ V}$
 3. CB-12L/M/H: $V_{DD} (\text{internal}) = 1.5 \pm 0.15 \text{ V}$, $V_{DD} (\text{I/O}) = 2.5 \pm 0.2 \text{ V}/3.3 \pm 0.3 \text{ V}$

Many cores available

The need for a system-on-a-chip is satisfied by CPU peripheral cores, memory macros, and analog masters such as A/D and D/A, as well as a high-performance CPU.

High-density memory macros, RAM and ROM, can be integrated by means of compiled memory technology.

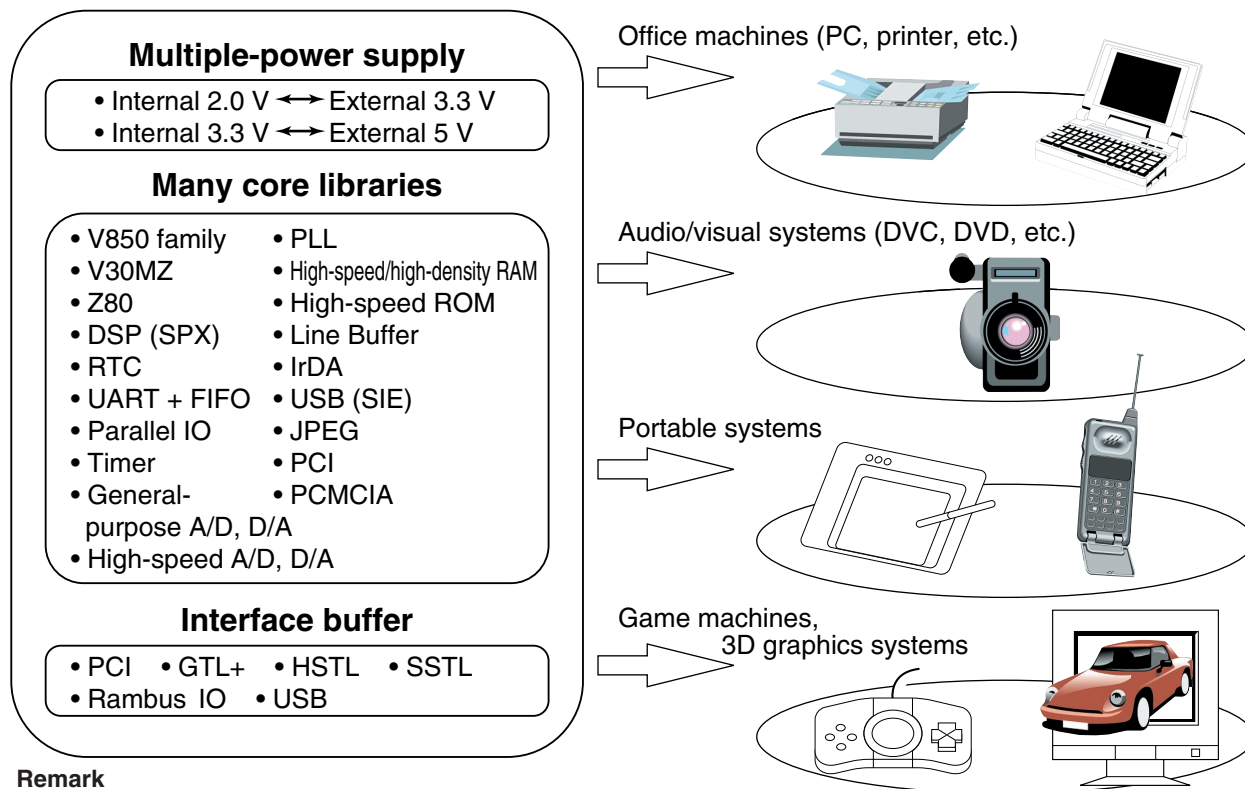
Cell-Based IC

■ CB-9 Family VX/VM Type

● Features

The CB-9 family VX/VM type is a collection of cell-based ICs employing a 0.35 μm technology. The VX type realizes an I/O voltage of 3.3 V and internal voltage of 2.0 V, and the VM type realizes an I/O voltage of 5 V and internal voltage of 3.3 V. These cell-based ICs are suitable for systems where low power consumption is required.

CB-9 family VX/VM type



Cell-Based IC

■ CB-9 Family VX/VM Type

● Product Outline (VX/VM type)

Type name		VX type		VM type	
Part Number		μ PD822xx		μ PD826xx	
Derivative models ^{Note 1}		○			
Technology		0.35 μ m technology CMOS, aluminum 2-layer/3-layer wiring			
Supply voltage I/O block		3.3 $\pm$ 0.3 V		5.0 V $\pm$ 10%	3.3 $\pm$ 0.3 V
Supply voltage internal block		3.3 $\pm$ 0.3 V	2.0 $\pm$ 0.2 V	3.3 $\pm$ 0.3 V	
Interface level		LVTTTL, TTL, 5 V CMOS (VM Type only)			
Number of usable gates ^{Note 2}		1.7 M usable gate		1.6 M usable gate	
Delay time	Internal gate ^{Note 3}	114 ps	207 ps	114 ps	114 ps
	Input buffer ^{Note 4}	169 ps	—	690 ps	169 ps
	Output buffer ^{Note 5}	864 ps	—	2045 ps	864 ps
Power consumption (internal gate)		0.3 μ W/MHz/gate	0.12 μ W/MHz/gate	0.3 μ W/MHz/gate	

- Notes**
1. ROM code changeable. ○: Derivative models available
 2. Number of gates if hard macro is not integrated (2-input NAND conversion)
 3. 2-input NAND power gate, fanout = 2, standard wiring length
 4. fanout = 2, standard wiring length
 5. Load capacitance: 15 pF, I_{OL} = 18 mA

Cell-Based IC

■ CB-10 Family

● Features (1/3)

High-density, and low-power consumption cell-based IC using a 0.25 μm technology

In addition to featuring a high-density of 7 million 500 thousand gates (Max.) and low-power consumption, high-speed internal gates, the CB-10 Family achieves system-on-chip capabilities through a wide variety of application-oriented macros.

Furthermore, a macro library which operates on low voltage (to 1.8 V) is also being prepared.

Family Name		CB-10
Maximum density (number of usable gates)		7.5M gates (3M gates)
Supply voltage		2.5 $\pm$ 0.2 V
Delay time	Internal gate ^{Note 1}	32.3 ps
	Input buffer ^{Note 2}	81 ps
	Output buffer ^{Note 3}	698 ps
Power consumption		0.04 $\mu\text{W}/\text{MHz/gate}$

Notes 1. 2-input NAND power gate, fanout: 1, standard wiring length

2. Fanout: 2, standard wiring length

3. Load capacitance: 15 pF, I_{OL} = 12 mA

Cell-Based IC

■ CB-10 Family

● Features (2/3)

Wide variety of macro libraries (1/2)

Function cell
Logic gate
Delay gate
Adder
Decoder
Multiplexer
Latch
Flip-flop
Shift register
Counter

Compiled macro
High-speed 2-port RAM
High-density 1-port RAM
High-density 2-port RAM
High-speed ROM

Mega macro to be developed					
Core name	PC	Consumer	Portable equipment	Communication	Graphic
PCI controller	○				
USB	○				
IEEE1394	○	○			
MPEG2 (decoder)		○			
A/D, D/A		○			
Modem CODEC		○			
DSP (SPRX, OAK/Pine)	○	○	○		
ARM CPU		○	○		
ATM (25MHz, 155MHz)				○	
Ethernet 10/100 Base PHY, MAC				○	
RAC (Rambus ASIC Core cell)					○
2D, 3D accelerator					○

Remarks 1. The release schedule differs depending on the macro. For details, consult NEC.
 2. Including macro libraries under development and under study

Cell-Based IC

■ CB-10 Family

● Features (3/3)

Wide variety of macro libraries (2/2)

I/O buffer
LVC MOS/LVTTL
Low-noise buffer
3-state output buffer
Open-drain buffer

High-speed I/O
GTL + (gunning transceiver logic)
PCI ^{Note} (peripheral component interconnect)
HSTL (high-speed transceiver logic)
pECL (pseudo emitter coupled logic)
SSTL (stub series terminated transfer logic)
LVDS (low voltage differential signaling)
USB (universal serial bus)
IEEE1394

Others
DPLL (to 250 MHz)
APLL (to 500 MHz)
Multiplier
UART
Register file
DRAM
Flash memory
Scan block
JTAG

Note Interface standard proposed by Intel.

Remarks 1. The release schedule differs depending on the macro. For details, consult NEC.
2. Including macro libraries under development and under study

Cell-Based IC

■ CB-10 Family VX Type

● Features

High-speed access is possible by processing and tuning the first generation 0.25 μm cell-based IC CB-10 Family. The basic specifications are the same as those in the CB-10 family.

Family Name		CB-10VX
Maximum density (number of usable gates)		7.5M gates (3M gates)
Supply voltage		$2.5 \pm 0.2 \text{ V}$
Delay time	Internal gate ^{Note 1}	88.3 ps
	Input buffer ^{Note 2}	74.8 ps
	Output buffer ^{Note 3}	1.264 ns
Power consumption		$0.04 \mu\text{W/MHz/gate}$

Notes 1. 2-input NAND power gate, fanout: 1, wiring length: 0.5 mm

2. Fanout: 2 wiring length: 0 mm

3. Load capacitance: 15 pF, $I_{OL} = 9 \text{ mA}$

Cell-Based IC

■ CB-12 Family L/M/H Type

● Features (1/3)

High-density, low-power consumption, and high-speed type cell-based IC using the cutting-edge 0.13 μm technology

With its high density of up to 32 million gates, low power consumption, high-speed gates, and abundant macro line up, the CB-12 family L/M/H type can completely satisfy your needs.

L type: A library with transistor characteristics in which leakage current is controlled, making it ideal for sets that require low power consumption, such as portable equipment. Use this library to backup the power of a circuit.

M type: A library with high-speed operation transistor characteristics, ideal for sets that require high-speed processing.

H type: A library with ultra-high-speed operation transistor characteristics, ideal for sets that require ultra-high-speed processing.

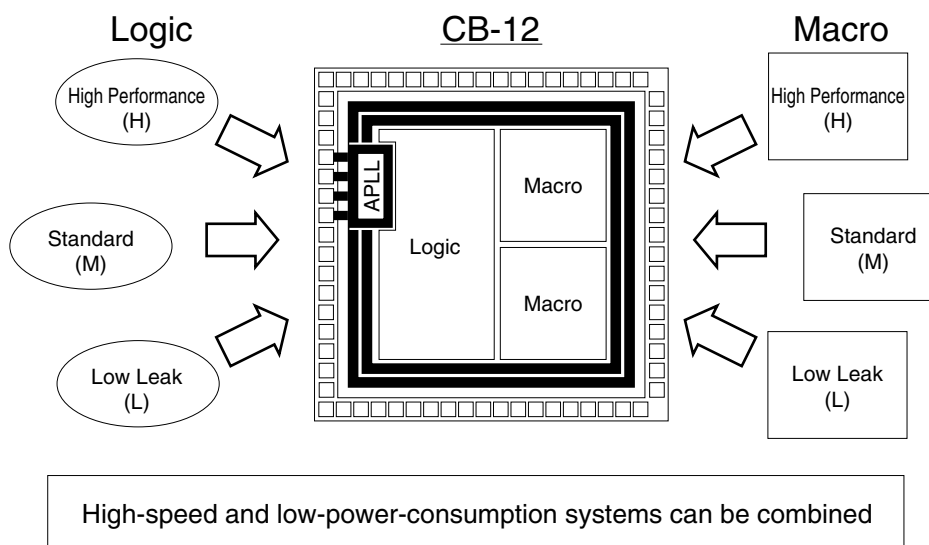
Family Name		CB-12L/M/H
Maximum density		32 million gates
Supply voltage	Internal	$1.5 \pm 0.15 \text{ V}$
	I/O	$2.5 \pm 0.2 \text{ V}$, $3.3 \pm 0.3 \text{ V}$
Delay time	Internal gate ^{Note 1}	20.7 ps
	Input buffer ^{Note 2}	249 ps
	Output buffer ^{Note 3}	1187 ps
Power consumption		13 nW/MHz/gate

Notes 1. 2-input NAND power gate, fanout: 2, wiring length: 0 mm

2. $V_{DD} = 2.5 \text{ V}$, Fanout: 1, wiring length: 30 μm

3. $V_{DD} = 2.5 \text{ V}$, Load capacitance: 15 pF, $I_{OL} = 12 \text{ mA}$

CB-12 Family L/M/H Type



Cell-Based IC

■ CB-12 Family L/M/H Type

● Features (2/3)

Wide variety of macro libraries (1/2)

Function cell
Logic gate
Delay gate
Adder
Decoder
Multiplexer
Latch
Flip-flop
Shift register
Counter

Compiled macro
1-port RAM
2-port RAM
ROM

Mega macro to be developed					
Core name	PC	Consumer	Portable equipment	Communication	Graphic
PCI controller	○				
USB	○				
IEEE1394	○	○			
V8xx CPU		○	○		
V30MZ		○	○		
MPEG2 (decoder)		○			
A/D, D/A		○			
Modem CODEC		○			
DSP (SPRX, OAK/Pine)	○	○	○		
ARM CPU		○	○		
ATM (25MHz, 155MHz)				○	
Ethernet 10/100 Base PHY, MAC				○	
RAC (Rambus ASIC Core cell)					○
2D, 3D accelerator					○

Remarks 1. The release schedule differs depending on the macro. For details, consult NEC.
 2. Including macro libraries under development and under study

Cell-Based IC

■ CB-12 Family L/M/H Type

● Features (3/3)

Wide variety of macro libraries (2/2)

I/O buffer
LVTTL Low-noise buffer 3-state output buffer Open-drain buffer

High-speed I/O
GTL + (gunning transceiver logic) PCI ^{Note} (peripheral component interconnect) HSTL (high-speed transceiver logic) pECL (pseudo emitter coupled logic) SSTL (stub series terminated transfer logic) LVDS (low voltage differential signaling) USB (universal serial bus) IEEE1394 AGP (Accelerated Graphics Port)

Others
DPLL (to 250 MHz) APLL (to 500 MHz) Multiplier UART Register file DRAM Flash memory Scan block JTAG

Note Interface standard proposed by Intel.

Remarks 1. The release schedule differs depending on the macro. For details, consult NEC.
 2. Including macro libraries under development and under study

Cell-Based IC

■ Library

● CPU core

Library	General-purpose model	CB-9VX/VM	CB-10	CB-10VX	CB-12
Z80	μ PD70008A	○	—	—	—
V30MZ		○	—	○	—
V851		○	—	—	—
V853		○	—	—	—
V850E		○	—	○	△

Remark ○: can be supported. △: under development. —: cannot be supported.

Cell-Based IC

■ Library

● Features of the V850E core

CPU performance: Operating frequency 66 MHz (CB-9VX/VM), 75 MHz^{Note} (CB-12), 100 MHz (CB-10VX)

V850E RISC CPU adopting 5-stage pipeline method. The object coding efficiency of C compiler has been improved and the program size has been reduced using 2 byte length basic instructions and instructions compatible with high-level language.

Note With on-chip debug function

Two kinds of bus interface, VSB and NPB

- VSB : Bus operates synchronously with the CPU clock. It is used for connecting high-speed peripheral macros such as peripheral I/O provided with a memory controller and FIFO interface.
- NPB : Bus operates asynchronously with the CPU clock. It is used for connecting low-speed peripheral macros such as a timer and serial interface.

Instruction set: Completely compatible with V850E series 32 bit single-chip microcontrollers.

● Functional Outline of the V850E Core

Item		Function
Register set		General-purpose registers 32 bits × 32 + dedicated registers 32 bits × 11
Instruction set		Upward compatible with V850 CPU Signed multiplication (32 bits × 32 bits → 64 bits) Saturated operation instruction (with overflow/underflow detection function) 32 bit shift instruction: 1 clock Bit manipulation instruction Load/store instruction with long/short format Signed load instruction
Memory space		Program area: 64 MB linear Data area: 4 GB linear { Internal ROM size: 0 to 1 MB Internal RAM size: 4/12/28/60 KB } Memory bank division function
External bus interface		VSB (V850E system bus) • Separate address/data bus (28 bit address/32 bit data bus) • 32/16/8 bit bus sizing function • Bus hold function • External wait function NPB (NEC peripheral I/O bus) • Separate address/data bus (14 bit address/16 bit data bus) • Programmable wait function • Retry function
Interrupts	Non-maskable	3
	Maskable	64 (8 priority levels can be specified.)
	Exception	1
DMA control function		4-channel configuration Transfer unit: 8 bits, 16 bits, 32 bits Maximum number of transfer: 65536 (2 ¹⁶) times Transfer type: Fly-by (1 cycle) transfer, 2-cycle transfer Transfer mode: Single transfer, single-step transfer, line transfer, block transfer Terminal count output signal
Power save function		HALT, software STOP, hardware STOP modes

Cell-Based IC

■ Library

● Features of the V851 and the V853 core

CPU performance (Dhrystone): 38 MIPS (at 33 MHz)

Executes almost all instructions in 1 clock under the control of a 5-stage pipeline based on RISC architecture

Linear address space of up to 4 GB

Supports linear address space of up to 4 GB as data area and up to 16 MB as program area

Instruction set: Completely compatible with V850 family 32 bit single-chip microcontrollers

● Functional Outline of the V851 Core

Item		Function
Internal memory	Mask ROM ^{Note}	48 KB, 64 KB, 96 KB, 128 KB, 256 KB
	RAM	4 KB, 8 KB, 16 KB, 24 KB
Register set		General-purpose register 32 bits × 32 + dedicated register 32 bits × 6
Minimum instruction execution time		30 ns (at 33 MHz)
Instruction set		Signed multiplication (16 bits × 16 bits → 32 bits): 1 to 2 clocks Saturated operation instruction (with overflow/underflow detection function) 32 bit shift instruction: 1 clock Bit manipulation instruction Load/store instruction with long/short format
External bus interface		16 bit data bus (DIN/DOUT separated) 24 bit address bus
Interrupts	Non-maskable	1
	Maskable	14 (8 priority levels can be specified)
Real-time pulse unit		16 bit timer/event counter: 1 ch 16 bit interval timer: 1 ch
Serial interface		Asynchronous serial interface (UART): 1 ch Clocked serial interface (CSI): 1 ch
Power save function		HALT, STOP, IDLE modes Clock output stop function

Note ROM may not be provided.

Cell-Based IC

■ Library

● Functional Outline of the V853 Core

Item		Function
Internal memory	Mask ROM ^{Note}	48 KB, 64KB, 96 KB, 128 KB, 256 KB
	RAM	4 KB, 8 KB, 16 KB, 24 KB
Register set		General-purpose register 32 bits × 32 + dedicated register 32 bits × 6
Minimum instruction execution time		30 ns (at 33 MHz)
Instruction set		Signed multiplication (16 bits × 16 bits → 32 bits): 1 to 2 clocks Saturated operation instruction (with overflow/underflow detection function) 32 bit shift instruction: 1 clock Bit manipulation instruction Load/storer instruction with long/short format
External bus interface		16 bit data bus (DIN/DOOUT separated) 24 bit address bus
Interrupts	Non-maskable	1
	Maskable	31 (8 priority levels can be specified)
Real-time pulse unit		16 bit timer/event counter: 4 chs 16 bit interval timer: 1 ch
Serial interface		Asynchronous serial interface (UART) Clocked serial interface (CSI) UART/CSI: 2 chs CSI: 2 chs
PWM output		8/9/10/12 bit resolution PWM: 2 chs
Power save function		HALT, STOP, IDLE modes Clock output stop function

Note ROM may not be provided.

Cell-Based IC

■ Library

● Features of the V30MZ Core

- Processing performance comparable to RISC due to internal pipeline processing of 35 MIPS (66 MHz, 0 wait)
- 1-clock bus cycle
- IE conforming to N-Wire
- Software compatible with V30HL
- 2.0 V supported for CB-9VX/VM ($f_{\text{MAX}} = 32 \text{ MHz}$)

Cell-Based IC

■ Library

● Peripheral macros

Function	General-purpose model	CB-9VX/VM	CB-10	CB-10VX	CB-12
Serial I/O	μ PD71051	○	○	○	
Timer	μ PD71054	○	○	○	
Interrupt controller	μ PD71059	○	○	○	
Watch	μ PD4991AL	○	○	○	
UART + FIFO	PC16550D	○	○	○	○
FDC + DVFO	μ PD72065B	△			
IrDA1.1		○	△	—	
SIE for USB1.1 full speed		○	—	△	
USB function controller for printer		△	—	△	
USB function controller for display		△	—	△	
Line buffer for PPC (7.5 kW)		○			

Remark ○: can be supported. △: under development. —: cannot be supported. Blank: under study

● Analog macros

Function	Performance	CB-9VX/VM	CB-10	CB-10VX	CB-12
A/D	8 bits, 200 ksps (1/8chs)	○	—	—	—
	8 bits, 500 ksps (8chs)	—	○	○	
	10 bits, 100 ksps (1/8chs)	○	—	—	—
	10 bits, 500 ksps (8chs)	—	○	○	△
	12 bits, 300 ksps (4chs)	○			
	8 bits, 8 Msps	○	—	△	
	8 bits, 30 Msps	—	—	△	
	8 bits, 50 Msps	○	—		
	10 bits, 20 Msps	—	○	○	
	10 bits, 30 Msps	○	—	—	
	6 bits, 75 Msps	○	—	—	—
	6 bits, 95 Msps	—	—	○	△
D/A	8 bits, 300 kHz (1ch)	○	○	○	
	10 bits, 100 kHz (1ch)	○			
	8 bits, 30 MHz (1/2/3chs)	○	—	—	—
	8 bits, 35 MHz (1/2/3chs)	—	—	○	△
	10 bits, 30 MHz (1/2/3chs)	○	—	—	—
	10 bits, 35 MHz (1/2/3chs)	—	—	○	△
	10 bits, 135 MHz (1ch)	○	—		
Analog switch		○			
PLL	For multiplication	○	○	○	○
	For skew adjustment	○	○	○	△

Remark ○: can be supported. △: under development. —: cannot be supported. Blank: under study

Cell-Based IC

■ Library

● Compiled macros

Function	CB-9VX/VM	CB-10	CB-10VX	CB-12
Register file (2 ports)	○	○	○	—
Register file (3 ports)	—	—	—	—
Low-power synchronous 1-port RAM	—	—	—	△
High-density synchronous 1-port RAM	○	○	○	△
High-density synchronous 2-port (R + W) RAM	○	—	○	△
High-speed synchronous 1-port RAM	○	—	—	△
High-speed synchronous 2-port (R/W + R) RAM	○	—	—	△
High-speed synchronous 2-port (R/W + R/W) RAM	○	○	○	△
Super high-speed synchronous 1-port RAM	○	—	—	△
Low-power asynchronous 1-port ROM	—	—	—	—
High-speed synchronous 1-port ROM	○	○	○	—
Large capacity ROM	—	—	○	△

Remark ○: can be supported. △: under development. —: cannot be supported.

Embedded Array

■ EA-9HD Family

● Features (1/2)

High-density, super high-speed, and low-power consumption embedded array using a 0.35 μm technology

- High-level function and high-performance LSI compatible to cell-based IC
- Easy development and modification of derivative models
- Short turn around time equivalent to gate array
- Macro maintenance common to cell-based IC (CB-9 family VX type)

The EA-9HD family is a collection of embedded arrays employing a 0.35 μm technology.

This family consists of 17 masters with 76K to 2.5M gates.

The gate density of this family is about 2.5 times higher than that of the existing EA-9 family of 0.35 μm embedded arrays, due to improvement of the cell structure.

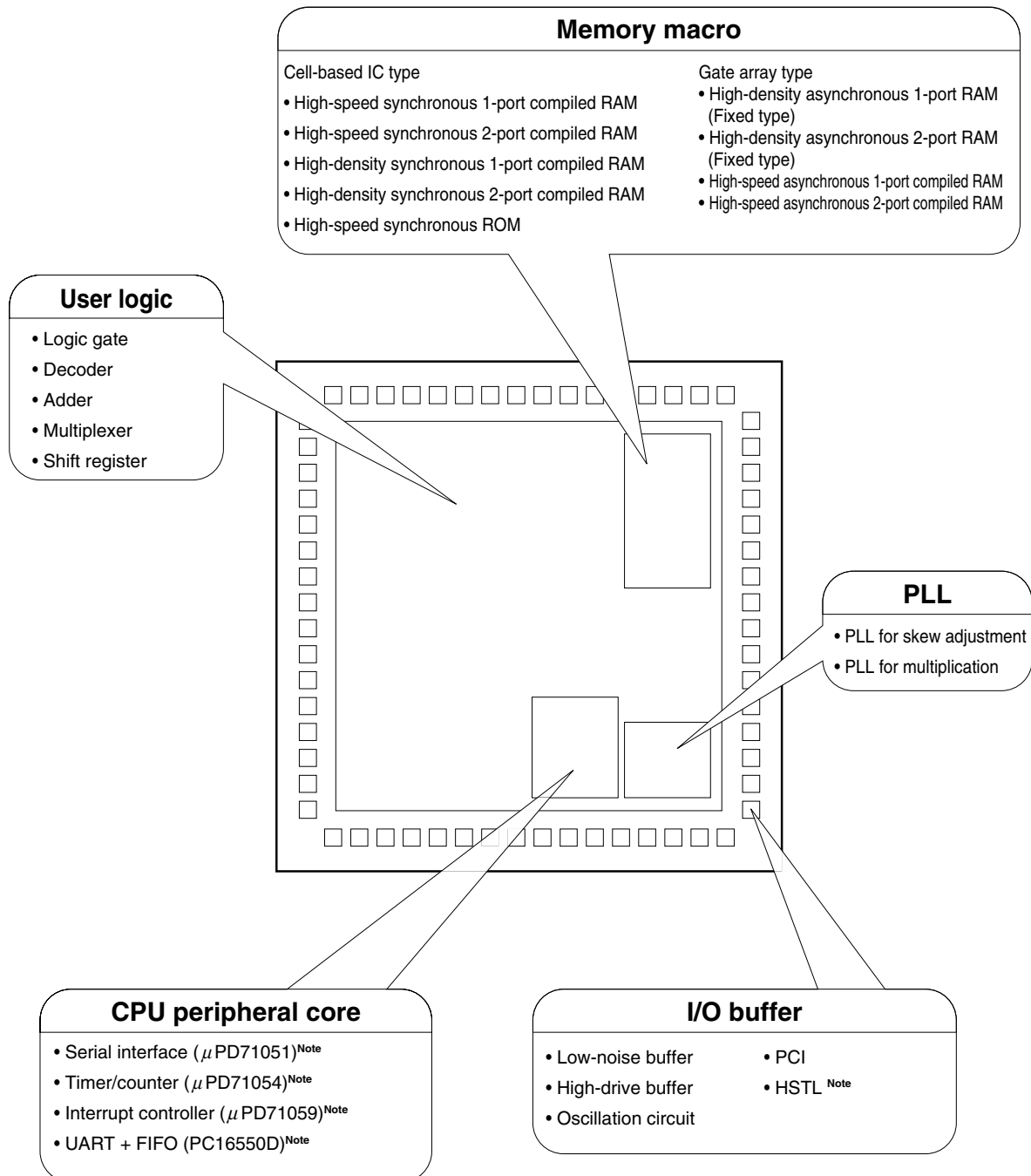
In addition, the power consumption is 40% lower, and because of new I/O pad layout technology, this family offers a large number of pins in addition to the high density.

Embedded Array

■ EA-9HD Family

● Features (2/2)

Wide variety of macro libraries



Note

Macros under development or under study

Embedded Array

■ EA-9HD Family

● Available Models (3-layer wiring)

Part number		μPD65443	μPD65444	μPD65445	μPD65446	μPD65448	μPD65449	μPD65451	μPD65454	μPD65456	μPD65458
Density	Internal gates ^{Note 1}	76720	103032	128872	207000	314104	440832	592020	840768	1104432	1626628
	Number of usable gates ^{Note 2}	42196	56667	70879	113850	172757	220416	296010	420384	552216	731982
	Number of pads ^{Note 3}	172	196	216	268	324	380	436	516	588	708
Delay time	Internal gate	131 ps (2-input NAND, fanout: 1, standard wiring length)									
	Power gate	107 ps (2-input NAND, fanout: 1, standard wiring length)									
	Input buffer	229 ps (fanout: 1, standard wiring length)									
	Output buffer	1396 ps (C _L = 15 pF, I _{OL} = 9 mA)									
Output drive capability		I _{OL} = 1, 2, 3, 6, 9, 12, 18, 24 mA									
Supply voltage		3.3 ± 0.3 V									

Notes 1. 2-input NAND conversion.

2. Cell utilization rate: 45 to 55% (Differs depending on the number of pin pairs and the occupation rate of the macro)

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

● Available Models (4-layer wiring)

Part number		μPD65461	μPD65464	μPD65466	μPD65468	μPD65469	μPD65470	μPD65471
Density	Internal gates ^{Note 1}	592020	840768	1104432	1626628	1906800	2203360	2521344
	Number of usable gates ^{Note 2}	355212	504460	662659	894645	1048740	1211848	1386739
	Number of pads ^{Note 3}	436	516	588	708	764	820	876
Delay time	Internal gate	131 ps (2-input NAND, fanout: 1, standard wiring length)						
	Power gate	107 ps (2-input NAND, fanout: 1, standard wiring length)						
	Input buffer	229 ps (fanout: 1, standard wiring length)						
	Output buffer	1396 ps (C _L = 15 pF, I _{OL} = 9 mA)						
Output drive capability		I _{OL} = 1, 2, 3, 6, 9, 12, 18, 24 mA						
Supply voltage		3.3 ± 0.3 V						

Notes 1. 2-input NAND conversion.

2. Cell utilization rate: 55 to 60% (Differs depending on the number of pin pairs and the occupation rate of the macro)

3. Including the power supply and GND pins. The number of pins that can actually be used differs depending on the type of package.

Embedded Array

■ EA-10 Family

● Features (1/3)

High-density, super high-speed, and low-power consumption embedded array using the most advanced 0.25 μm technology

- High-level function and high-performance LSI compatible to cell-based IC
- 2.5 V/3.3 V interface
- Short turn around time equivalent to gate array
- High-density of system-on-a-chip level
- Easy development and modification of derivative models
- Macro maintenance common to cell-based IC (CB-10)

Family Name		EA-10
Maximum density (total number of gates)		7 million gates
Supply voltage		$2.5 \pm 0.2 \text{ V}$
Delay time	Internal gate ^{Note 1}	59 ps
	Input buffer ^{Note 2}	79 ps
	Output buffer ^{Note 3}	1363 ps
Power consumption		$0.14 \mu\text{W/MHz/cell}$ (internal gates)

Notes 1. 2-input NAND power gate, fanout: 1, wiring length: 0.5 mm

2. Fanout: 2, wiring length: 0 mm

3. Load capacitance: 50 pF, $I_{OL} = 12 \text{ mA}$

Embedded Array

■ EA-10 Family

● Features (2/3)

Wide variety of macro libraries (1/2)

Functional cell
Logic gate
Delay gate
Adder
Decoder
Multiplexer
Latch
Flip-flop
Shift register
Counter

Compiled macro (Cell-based IC type)
High-speed 1-port RAM
High-speed 2-port RAM
Super high-speed 1-port RAM
High-density 1-port RAM
High-density 2-port RAM
High-speed ROM

Mega macro to be developed					
Macro name	PC	Consumer	Portable equipment	Communication	Graphic
PCI controller	○				
USB	○				
IEEE1394	○	○			
V8xx CPU		○	○		
V _R 4xx CPU		○	○		
V30MZ		○	○		
MPEG2 (decoder)		○			
A/D, D/A		○			
Modem CODEC		○			
DSP (SPRX, OAK/Pine)	○	○	○		
ARM CPU		○	○		
ATM (25MHz, 155MHz)				○	
Ethernet 10/100 Base PHY, MAC				○	
RAC (Rambus ASIC Core cell)					○
2D, 3D accelerator					○

Remarks 1. The release schedule differs depending on the macro. For details, consult NEC.
 2. Including macro libraries under development and under study

Embedded Array

■ EA-10 Family

● Features (3/3)

Wide variety of macro libraries (2/2)

I/O buffer
LVCMOS/LVTTL Low-noise buffer 3-state output buffer Open-drain buffer

High-speed I/O
GTL/GTL + (gunning transceiver logic) PCI ^{Note} (peripheral component interconnect) HSTL (high-speed transceiver logic) pECL (pseudo emitter coupled logic) SSTL (stub series terminated transfer logic) LVDS (low voltage differential signaling) USB (universal serial bus) IEEE1394

Others
DPLL (to 250 MHz) APLL (to 500 MHz) Multiplier UART Register file Flash memory Scan block JTAG

Note Interface standard proposed by Intel.

Remarks 1. The release schedule differs depending on the macro. For details, consult NEC.
 2. Including macro libraries under development and under study

Analog Master

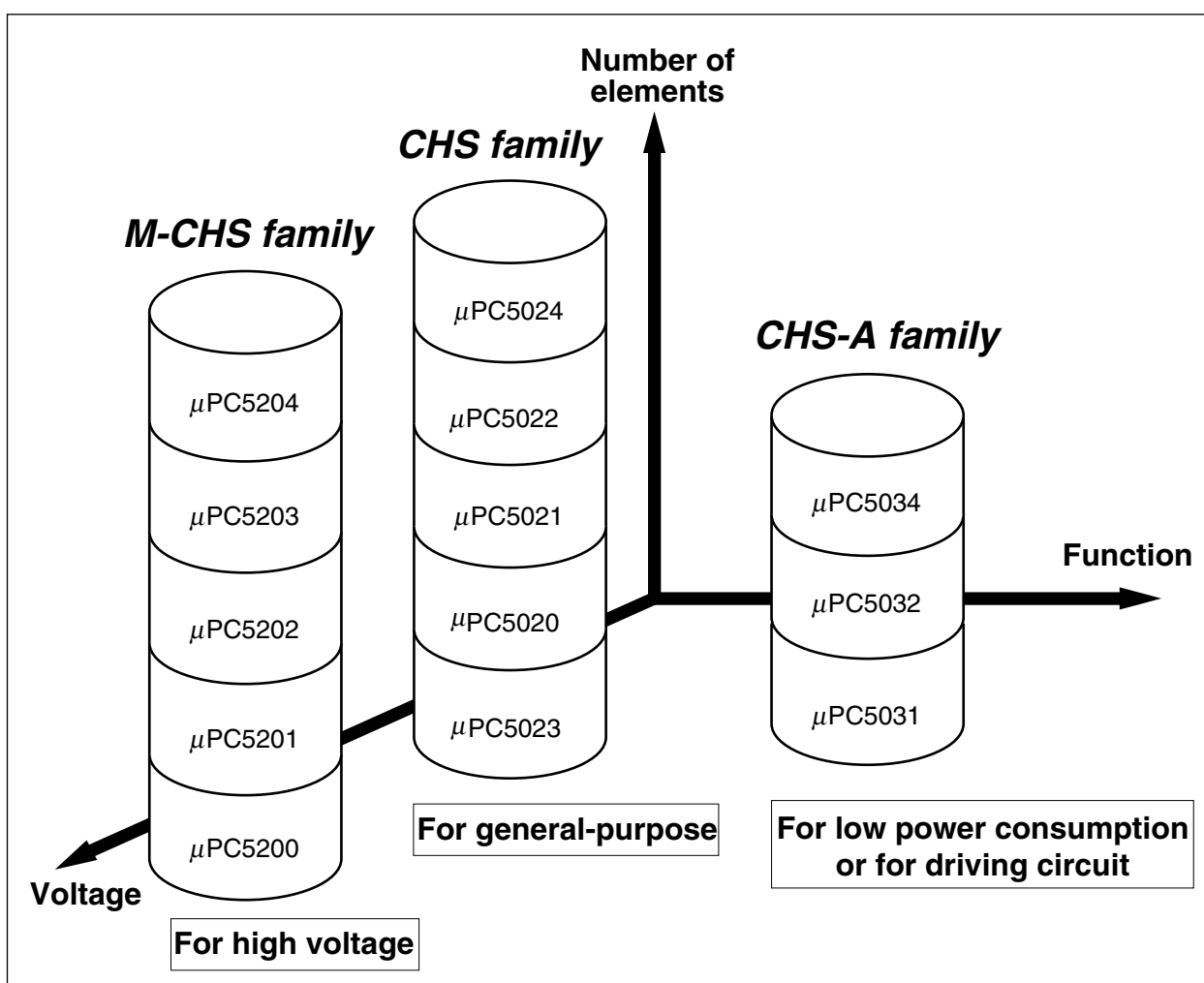
■ Analog Master Line-Up

NEC's analog master is classified into the following three families (refer to the figure below).

- CHS family and CHS-A family for wide application field
- M-CHS family for high voltage

From this wide line-up (three families, 13 masters), users can achieve the optimum analog LSI.

Line-up and features

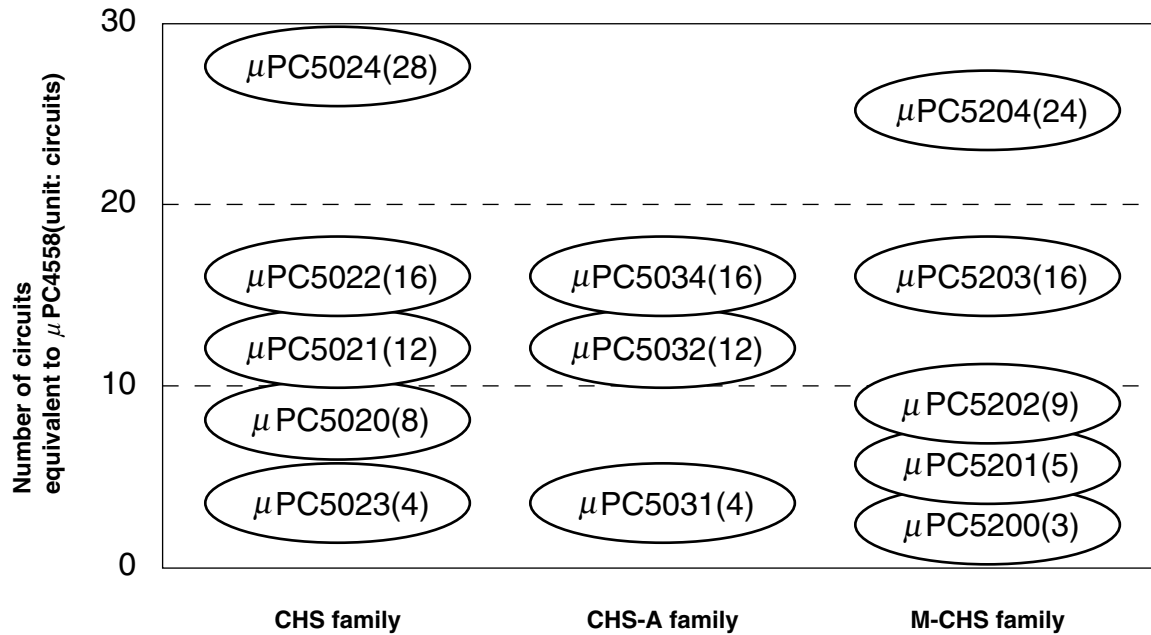


Analog Master

■ Circuit Scale of Each Family

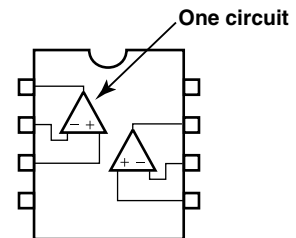
The scale of the circuit that can be integrated on the analog master differs depending on the model of each family.

The scale of the circuit that can be integrated shown below is roughly calculated in terms of the number of circuits where one circuit is equivalent to the general-purpose operational amplifier μPC4558 ^{Note 1}.



(Numbers in the parentheses indicate the number of circuits^{Notes 2} that can be integrated.)

Notes 1. One of the two operational amplifiers in the general-purpose operational amplifier μPC4558 package (8-pin DIP) is counted as one circuit.



2. The number of circuits shown above is a guideline in which only operational amplifiers are integrated, and does not include operational amplifier peripheral circuits (such as feedback circuits).

When selecting a model, estimate the circuit scale by taking these peripheral circuits into consideration.

Analog Master

Available Models

Family Name	CHS Family					CHS-A Family		
Technology	High-speed bipolar							
Absolute maximum ratings	14 V							
Features	• High-speed analog signal processing circuit can be created. • $f \leq$ several 10 MHz					• High-speed analog signal processing circuit can be created. • $f \leq$ several 10 MHz • Many pins • Internal driver • High resistance		
Part number	μ PC5020	μ PC5021	μ PC5022	μ PC5023	μ PC5024	μ PC5031	μ PC5032	μ PC5034
Total number of elements	1628	2328	3042	727	6152	576	1472	2252
NPN transistor ^{Note 1}	260	368	476	129	836	118(13)	298(18)	446(26)
PNP transistor	224	320	416	116	672	105	280	450
Resistor	1116	1600	2098	468	4560	338	854	1266
Capacitor	28	40	52	14	84	15	40	90
Macro library	Operational amplifiers, comparators, regulators, switches, timers					Operational amplifiers, comparators, regulators, switches, super white TEG ^{Note2}		

Notes 1. (): Products with driver

2. Super white TEG: TEG (Test Element Group) containing analog function macros (operational amplifiers, comparators, regulators, switches, drivers, and reset circuits) used as peripherals of microcontroller in one package

Family Name	M-CHS Family				
Technology	High voltage bipolar				
Absolute maximum ratings	44 V				
Features	- High voltage: $V_{CC(MAX.)} = 44$ V $f \leq$ several MHz				
Part number	μ PC5200	μ PC5201	μ PC5202	μ PC5203	μ PC5204
Total number of elements	654	1030	1787	3088	4562
NPN transistor	105	163	283	484	710
PNP transistor	84	140	252	448	672
Resistor	456	712	1225	2108	3108
Capacitor	9	15	27	48	72
Macro library	Operational amplifiers, comparators, regulators, switches				

Mixed-Signal ASIC**■ MA-9 Family****● Features**

The MA-9 Family (μ PD681xx) consists of leading-edge mixed-signal ASICs that aim for system-on-a-chip through the use of a 0.35 μ m BiCMOS technology.

While aiming for ultra-high integration for large-scale digital/analog mixed systems in the field of multimedia, the MA-9 Family achieves high-speed, high-accuracy stable signal processing.

Support of analog core

NEC supports the analog core, using its rich analog circuit design resources.

Mixed-signal ASICs aiming for system-on-a-chip

Large-scale mixed-signal systems can now be created on a single-chip using the cell-based form.

NEC supports mixed-signal cores that include a high-speed ADC, DAC and other analog cores, digital/analog mixed circuits, etc.

BiCMOS technology

High-speed digital circuits and high-accuracy, sophisticated analog circuits can now be produced on a single chip by employing NEC's 0.35 μ m BiCMOS technology.

Low power consumption

A low power consumption is achieved for LSIs by employing a low-voltage operation technology (3.3 V)

Flexible mixed-signal development environment

NEC's development environment for cell-based ICs can be used for the internal logic.

For mixed-signal cores, NEC supports a development environment using analog arrays that enables a short turn around time comparable to that of embedded arrays.

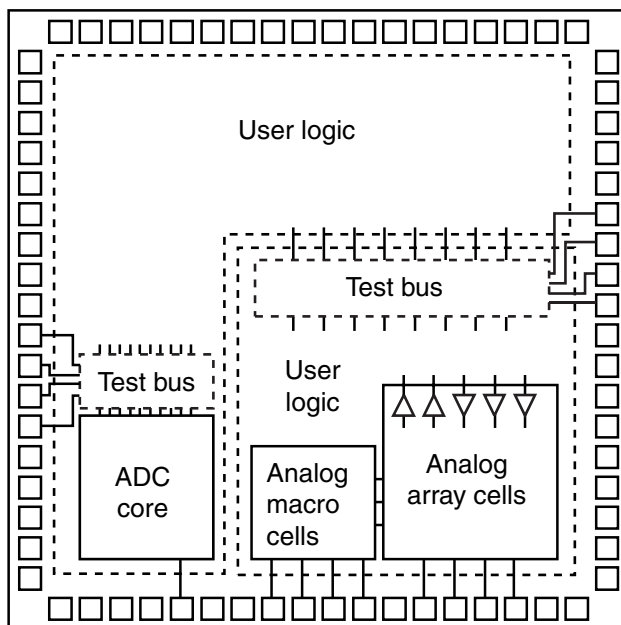
Moreover, for circuit blocks, for which analog characteristics particularly matter, NEC supports a development environment using macro cells.

Mixed-Signal ASIC

■ MA-9 Family

● Chip Configuration

The MA-9 Family features a digital/analog mixed circuit configured as a core (mixed-signal core) in its internal logic.



Internal Logic

- User logic
Logic gates, decoder, adder, multiplexer, counter, shift register, etc.
- I/O buffer
- Cores
Analog core
Mixed-signal core

Mixed-signal core

Analog array cells

(analog macro)

Operational amplifier, comparator, reference voltage source, analog switches, sample and hold, VCA, filters, etc.

+

User logic

(analog circuit operation and related logic circuits)

Logic gates, decoder, latches, shift registers, etc.

Mixed-Signal ASIC

■ MA-9 Family

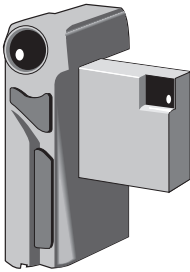
● Analog Cores (1/3)

The MA-9 Family supports analog cores which combine NEC's rich analog circuit design technology and NEC's analog ASIC technology cultivated through its analog master products, using the BiCMOS technology.

In the area of digital/analog mixed circuits, NEC provides custom designed analog circuits that require advanced circuit technology as cores, thereby reducing the development load of users and supporting the creation of high-quality mixed-signal systems within a short time.

Analog Front-End Cores for CCD Signal Processing

Through the use of bipolar transistors, which have outstanding analog characteristics compared to CMOS transistors, NEC offers cores with superb low-noise characteristics made possible only by the use of the BiCMOS technology.

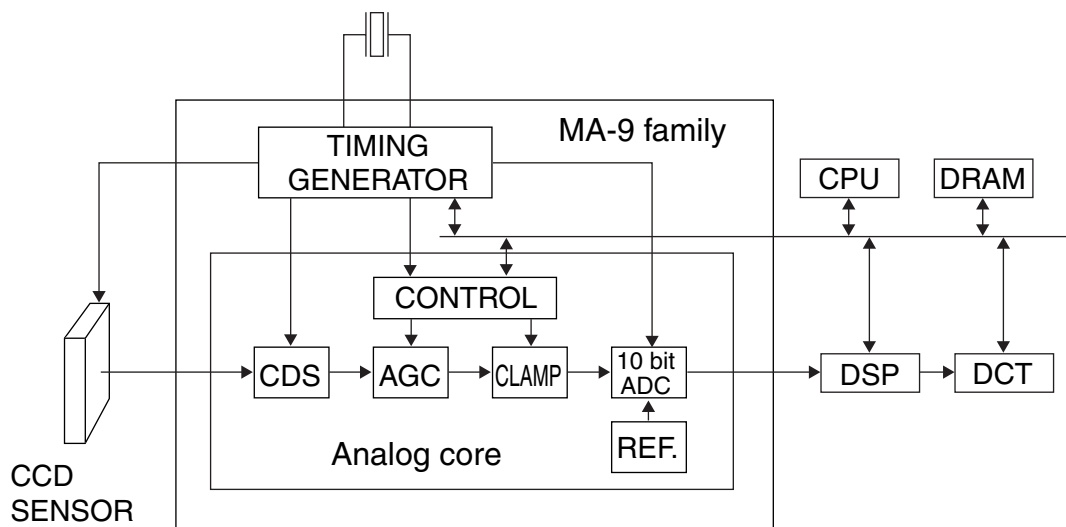


Features

- CDS optimum for digital still cameras (correlated double sampling) .
- High-gain AGC for higher sensitivity.
- Low-consumption-power-type 10 bit ADC and reference voltage.
- Controller circuit inside DAC for analog circuit characteristics correction

Under planning

Application Example (Digital Still Camera)



Mixed-Signal ASIC

- MA-9 Family
- Analog Cores (2/3)

High-Speed ADC Cores for Video

The MA-9 Family supports high-speed ADC cores through the use of the 0.35 μm BiCMOS technology.

NEC can provide high-speed ADC, which is difficult to be realized with a CMOS technology, optimally designed using CMOS transistors and bipolar transistors that can be created only by employing the BiCMOS technology.

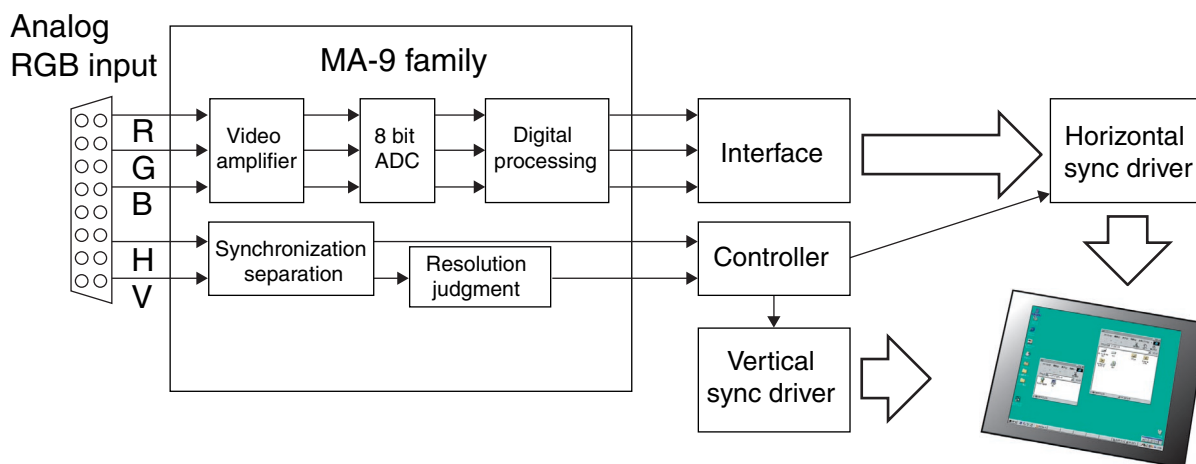
Moreover, by offering these ADCs as cores, NEC makes these products available for a wide range of applications.

For video	8 bit, 80 MHz	
------------------	---------------	--

Application Example (LCD Display Video Signal Input)

By combining an analog circuit and a high-speed ADC core on a single chip, it is possible to realize high-precision analog/digital conversion by avoiding the attenuation and degradation of high-speed analog signals caused by the capacitance load of the package I/O pins of analog LSIs and high-speed ADC LSIs externally connected to conventional LSIs and the capacitance load of the printed wiring board.

Moreover, the reduction of these load capacitances enables the simplification of the output stage of the analog circuit, thereby making it relatively easy to achieve high bandwidth analog circuits and enabling the reduction of the power consumption of the LSI.



Mixed-Signal ASIC

- MA-9 Family
- Analog Cores (3/3)

ADC Core

NEC provides both video and general-purpose ADC cores.

For video	10 bit, 30 MHz	$V_{DD} = 3.3 \text{ V (Typ.)}$, $I_{DD} = 60 \text{ mA (Typ.)}$
		Differential linearity error: $\pm 1.0 \text{ LSB (Max.)}$
		Integral linearity error: $\pm 2.0 \text{ LSB (Max.)}$
	10 bit, 15 MHz	Analog input range: 0.8 to 1.8 V
		$V_{DD} = 3.3 \text{ V (Typ.)}$, $I_{DD} = 30 \text{ mA (Typ.)}$
		Differential linearity error: $\pm 1.0 \text{ LSB (Max.)}$
General-purpose	10 bit, 100 kHz	Integral linearity error: $\pm 2.0 \text{ LSB (Max.)}$
		Analog input range: 0.3 to 3.0 V
		$V_{DD} = 3.3 \text{ V (Typ.)}$, $I_{DD} = 1.5 \text{ mA (Typ.)}$
	8 bit, 100 kHz	Differential linearity error: $\pm 1.0 \text{ LSB (Max.)}$
		Integral linearity error: $\pm 2.0 \text{ LSB (Max.)}$
		Analog input range: 0.3 to 3.0 V

DAC Core

NEC provides both video and general-purpose DAC cores.

For video	10 bit, 30 MHz	$V_{DD} = 3.3 \text{ V (Typ.)}$, $I_{DD} = 7 \text{ mA (Typ.)}$
		Differential linearity error: $\pm 1.0 \text{ LSB (Max.)}$
		Integral linearity error: $\pm 2.0 \text{ LSB (Max.)}$
	8 bit, 30 MHz	Analog output voltage: 1.2 to 2.2 V
		$V_{DD} = 3.3 \text{ V (Typ.)}$, $I_{DD} = 5 \text{ mA (Typ.)}$
		Differential linearity error: $\pm 0.5 \text{ LSB (Max.)}$
General-purpose	10 bit, 100 kHz	Integral linearity error: $\pm 1.5 \text{ LSB (Max.)}$
		Analog output voltage: 1.4 to 2.4 V
		$V_{DD} = 3.3 \text{ V (Typ.)}$, $I_{DD} = 40 \mu\text{A (Typ.)}$
	8 bit, 100 kHz	Differential linearity error: $\pm 1.0 \text{ LSB (Max.)}$
		Integral linearity error: $\pm 1.0 \text{ LSB (Max.)}$
		Analog output voltage: 0 to 3.2 V

Mixed-Signal ASIC

■ MA-9 Family

● Basic Specifications

Logic Block

Product Name		μ PD681xx
Technology		0.35 μ m BiCMOS technology
Supply Voltage		3.3 $\pm$ 0.3 V (I/O block, internal gates)
Maximum integration (logic only)		1.7 million gates (usable)
Interface level		LVTTL
Delay time	Internal gates ^{Note 1}	114 ps (Typ.)
	Input buffer ^{Note 2}	169 ps (Typ.)
	Output buffer ^{Note 3}	864 ps (Typ.)

Notes 1. Value assuming 2-input NAND power gate, fanout 2, and standard wiring length.

2. Value assuming fanout 2 and standard wiring length.

3. Value assuming load capacitance 15 pF, $I_{OL} = 18$ mA.

Analog Block

Product Name		μ PD681xx
Technology		0.35 μ m BiCMOS technology
Supply Voltage		3.3 $\pm$ 0.3 V
Transistors	NPN type	$f_T = 10$ GHz, $h_{FE} = 70$ (all Typ.)
	PNP type (Vertical type)	$f_T = 2$ GHz, $h_{FE} = 30$ (all Typ.)
	MOS	N-ch type, P-ch type for analog circuit
Polysilicon resistor ^{Note}		Absolute precision: $\pm 20\%$, relative precision: $\pm 2\%$
Capacitor (MIM type) ^{Note}		Absolute precision: $\pm 20\%$, relative precision: $\pm 2\%$

Note Values indicated are for reference only. The relative precision applies only to when the pin is positioned in an adjacent location.

Mixed-Signal ASIC

- MA-9 Family
- Electrical Characteristics

Absolute Maximum Ratings

Item		Symbol	Conditions	Rating	Unit
Supply voltage	3.3 V	V _{DD}		−0.5 to +4.6	V
I/O voltage	LVTTL buffer	V _I /V _O	V _I /V _O < V _{DD} + 0.5 V	−0.5 to +4.6	V
Output current		I _O	I _{OL} = 1 mA	3	mA
			I _{OL} = 2 mA	7	mA
			I _{OL} = 3 mA	10	mA
			I _{OL} = 6 mA	20	mA
			I _{OL} = 9 mA	30	mA
			I _{OL} = 12 mA	40	mA
			I _{OL} = 18 mA	60	mA
			I _{OL} = 24 mA	75	mA
Operating ambient temperature		T _A		−40 to +85	°C
Storage temperature		T _{stg}		−65 to +150	°C

Caution If any of the parameters exceeds the absolute maximum ratings, even momentarily, the quality of the product may be impaired. The absolute maximum ratings are values that may physically damage the product(s). Be sure to use the product(s) within the ratings.

Definition of absolute maximum ratings terms

Item	Symbol	Meaning
Supply voltage	V_{DD}	The range of voltage that, even if applied to the V_{DD} pin, will not cause destruction or lower reliability.
Input voltage	V_I	The range of voltage that, even if applied to the input pin, will not cause destruction or lower reliability.
Output voltage	V_O	The range of voltage that, even if applied to the output pin, will not cause destruction or lower reliability.
Input current	I_I	The absolute value of current capacity that, even if applied to the input pin, will not cause latchup to occur.
Output current	I_O	The absolute value of DC current capacity that, even if output from or input to the output pin, will not cause destruction or lower reliability.
Operating ambient temperature	T_A	Range of ambient temperature in which normal logical operation will occur.
Storage temperature	T_{stg}	Range of pin temperature that will not cause destruction or lower reliability when voltage and current are not applied.

Particular Purpose IC

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On-screen Character Display IC	329
Clock IC	330
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DSP**■ DSP (1/3)**

		μPD77110	μPD77111	μPD77112
Instruction Cycle (ns)		15.3	13.3	13.3
Data Type		Fixed point decimal	Fixed point decimal	Fixed point decimal
Multiplier Precision (bits)		$40 + 16 \times 16 \rightarrow 40$	$40 + 16 \times 16 \rightarrow 40$	$40 + 16 \times 16 \rightarrow 40$
ALU Precision (bits)		40	40	40
Internal Memory (words × bits)	Program ROM	–	31.75 K × 32	31.75 K × 32
	Program RAM	35.5 K × 32	1 K × 32	1 K × 32
	Data ROM	–	32 K × 16	32 K × 16
	Data RAM	48 K × 16	6 K × 16	6 K × 16
External Memory (words × bits)		64 K × 16 (data)	–	32 K × 16 (data)
Peripheral		Serial interface: 2 channels, Host interface(8 bits parallel), General purpose I/O ports(4 bits)		
Power Supply		DSP core: 2.5 V I/O pins: 3.0 V	DSP core: 2.5 V I/O pins: 3.0 V	DSP core: 2.5 V I/O pins: 3.0 V
Power Consumption (Typ.)		0.5 mA/MHz	0.5 mA/MHz	0.5 mA/MHz
Package		• 100-pin plastic TQFP	• 80-pin plastic TQFP • 80-pin plastic FBGA	• 100-pin plastic TQFP

■ DSP (2/3)

		μPD77113A	μPD77114	μPD77115
Instruction Cycle (ns)		13.3	13.3	13.3
Data Type		Fixed point decimal	Fixed point decimal	Fixed point decimal
Multiplier Precision (bits)		$40 + 16 \times 16 \rightarrow 40$	$40 + 16 \times 16 \rightarrow 40$	$40 + 16 \times 16 \rightarrow 40$
ALU Precision (bits)		40	40	40
Internal Memory (words × bits)	Program ROM	48 K × 32	48 K × 32	–
	Program RAM	3.5 K × 32	3.5 K × 32	11.5 K × 32
	Data ROM	64 K × 16	64 K × 16	–
	Data RAM	32 K × 16	32 K × 16	32 K × 16
External Memory (words × bits)		–	16 K × 16 (data)	–
Peripheral		Serial interface: 2 channels, Host interface(8 bits parallel), General purpose I/O ports(4 bits)		Audio serial interface, Host interface(8/16 bits parallel), General purpose I/O ports(8 bits), SD card interface, Timer
Power Supply		DSP core: 2.5 V I/O pins: 3.0 V	DSP core: 2.5 V I/O pins: 3.0 V	DSP core: 2.5 V I/O pins: 3.0 V
Power Consumption (Typ.)		0.5 mA/MHz	0.5 mA/MHz	0.5 mA/MHz
Package		• 80-pin plastic FBGA	• 100-pin plastic TQFP	• 80-pin plastic TQFP • 80-pin plastic FBGA

DSP

■ DSP (3/3)

Part Number		μ PD77210 ★★	μ PD77213 ★★
Instruction Cycle (ns)		6.25	8.33
Data Type		Fixed point decimal	Fixed point decimal
Multiplier Precision (bits)		$40 + 16 \times 16 \rightarrow 40$	$40 + 16 \times 16 \rightarrow 40$
ALU Precision (bits)		40	40
Internal Memory (words $\times$ bits)	Program ROM	–	64 K $\times$ 32
	Program RAM	31.5 K $\times$ 32	15.5 K $\times$ 32
	Data ROM	–	64 K $\times$ 16
	Data RAM	60 K $\times$ 16	36 K $\times$ 16
External Memory (words $\times$ bits)		1 M $\times$ 16	1 M $\times$ 16
Peripheral		Audio serial interface, Time-division serial interface, Host interface (8/16 bits parallel), General purpose I/O ports (16 bits MAX.), Timer	Audio serial interface, Time-division serial interface, Host interface (8/16 bits parallel), SD card interface General purpose I/O ports (16 bits MAX.), Timer
Power Supply		DSP core: 1.425 to 1.65 V (@ 120 MHz operation) I/O pins: 2.7 to 3.6 V	DSP core: 1.425 to 1.65 V (@ 120 MHz operation) I/O pins: 2.7 to 3.6 V
Power Consumption (Typ.)		0.35 mA/MHz	0.35 mA/MHz
Package		• 144-pin plastic LQFP • 161-pin plastic FBGA	• 144-pin plastic LQFP • 161-pin plastic FBGA

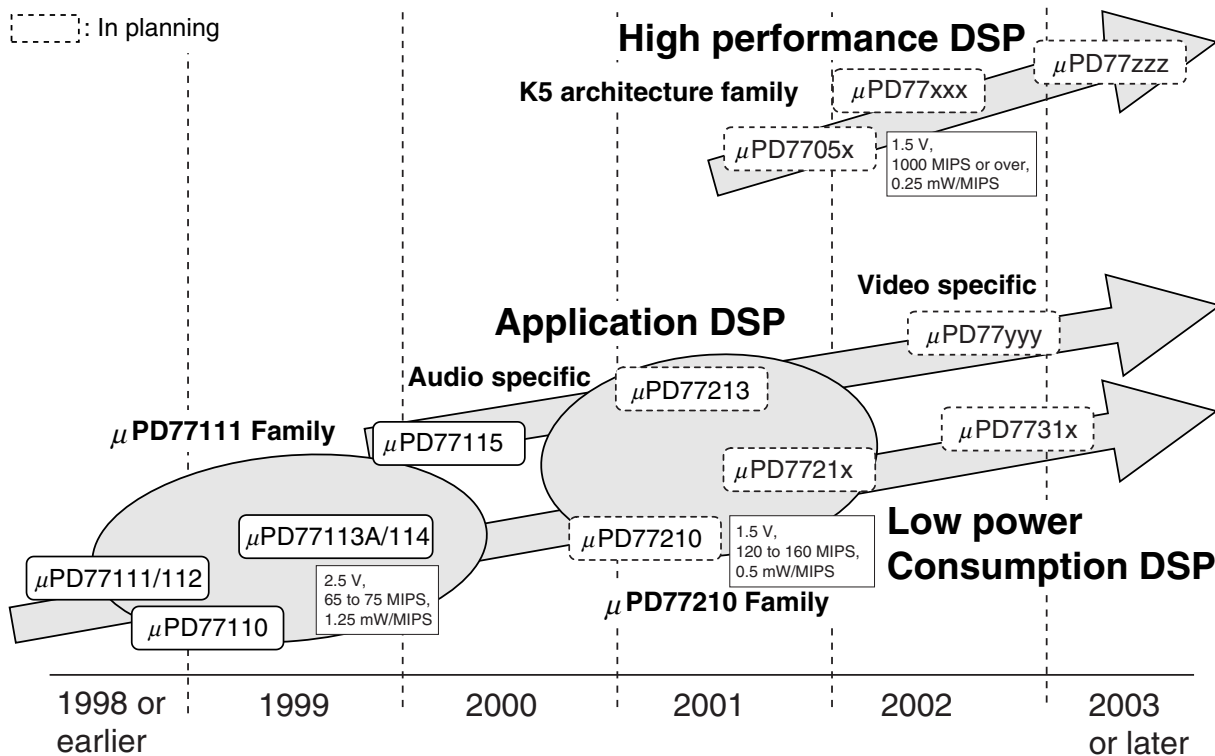
★ : Under development, ☆ : Newly added product

DSP

DSP Road Map

 : Under development

 : In planning



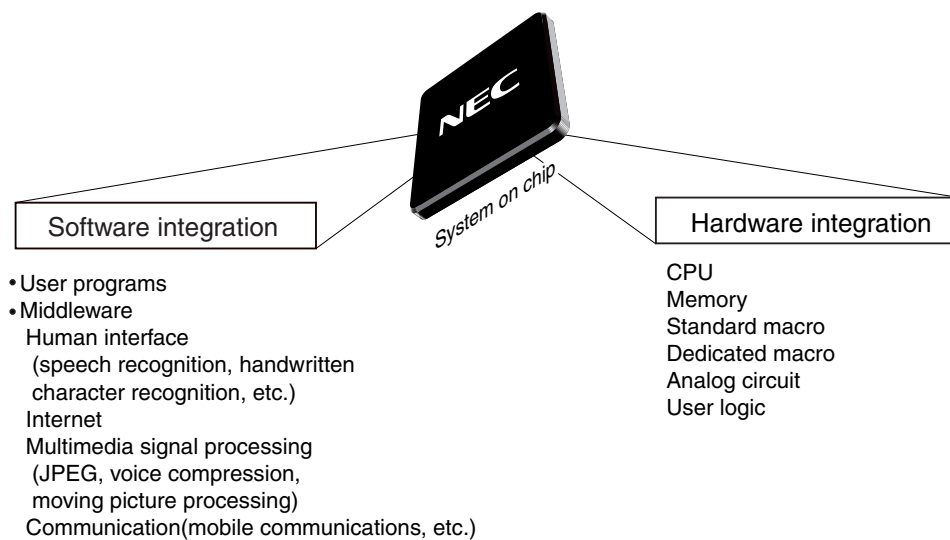
Middleware

What is Middleware?

■ Middleware that Holds the Key to Multimedia

Various key technologies are needed to realize multimedia applications, such as a human-machine interface as speech recognition, and data compression/decompression including data communications. And these technologies require high-performance RISC microcomputers and DSP capable of high-speed data processing. The V850 Family, VR Series and DSP answer these requirements with powerful performance and function complemented by middleware support based on multimedia performance.

■ The positioning of middleware



■ Features

◦ Reduced overall costs due to shorter TAT development and lower development costs

If middleware that has been optimized to the CPU architecture is used, the amount of time taken, to develop each individual system can be markedly reduced. Moreover, as there is no need to use dedicated devices, the cost is further streamlined.

◦ Improved CPU performance

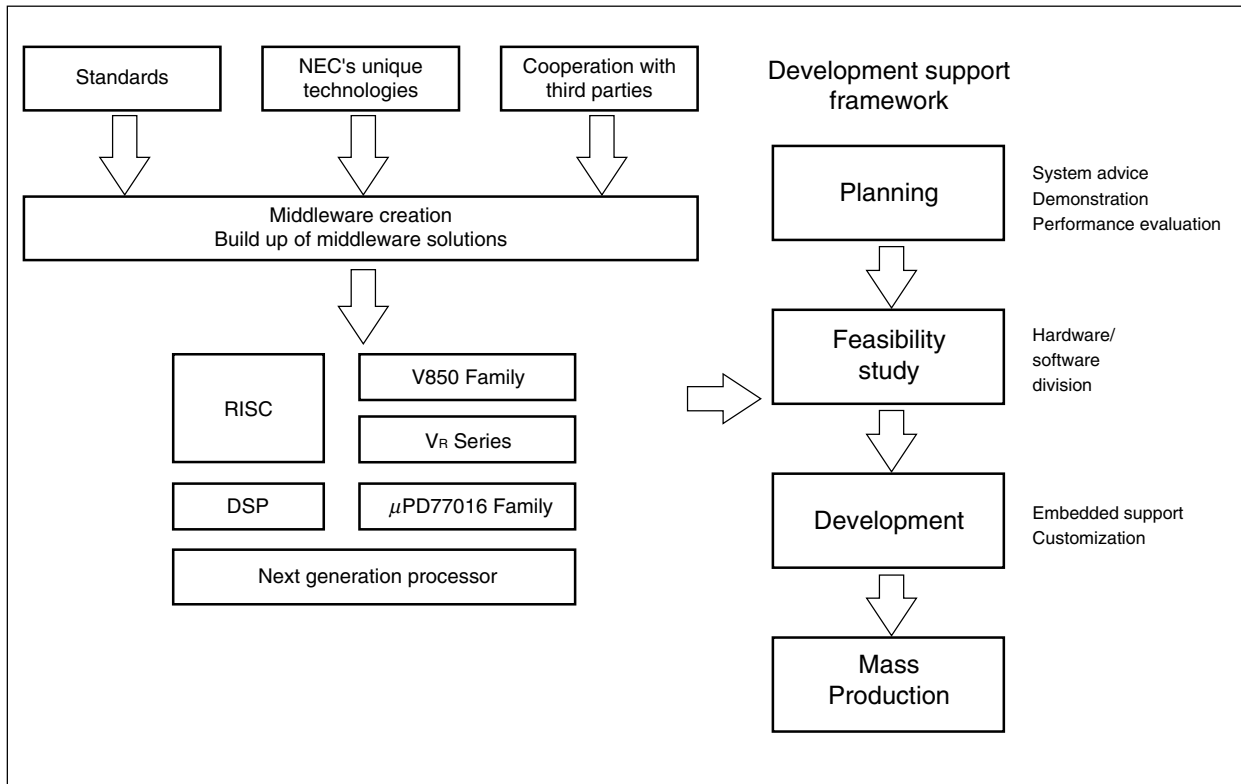
The CPU, due to the improvement in CPU performance, can now easily realize applications that could previously only be performed by dedicated hardware or personal computers/workstations. The addition, modification and deletion of functions difficult to perform with hardware, as well as the organization of user-friendly interfaces have now been made simpler.

◦ Spread of Internet and multimedia signal-processing applications

Through the popularity of the Internet, the management of multimedia information such as picture images and speech has expanded considerably. To employ dedicated hardware to process this information would take a large-scale system and considerable cost. By using middleware, the processing of this information can be easily realized by the CPU alone.

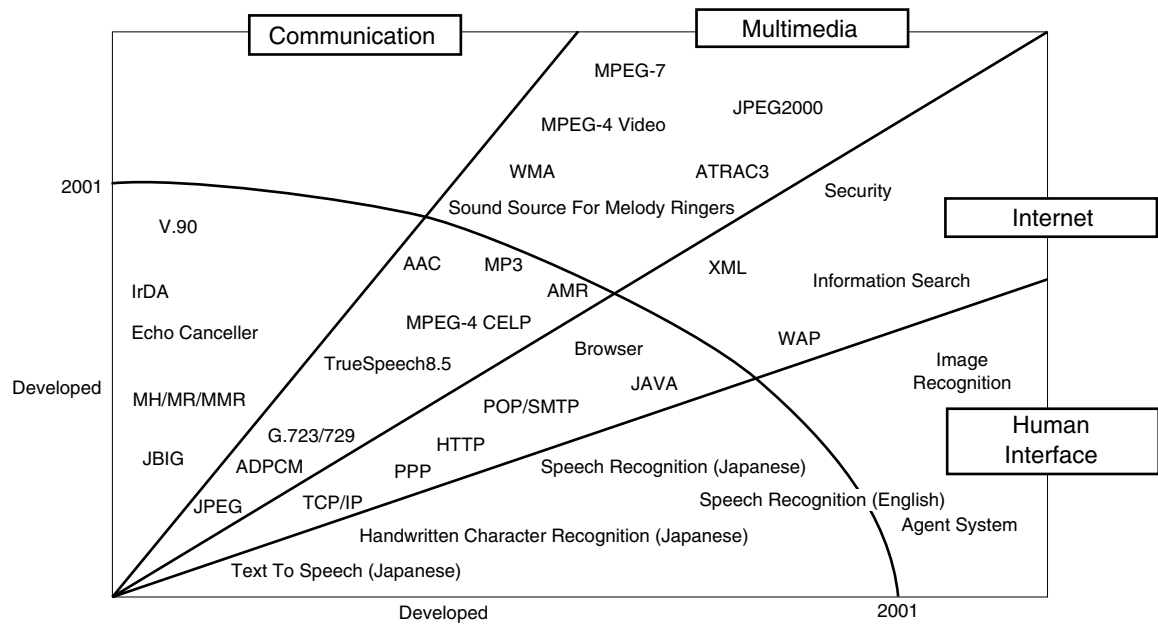
Middleware**Middleware Development Framework**

NEC middleware will gradually develop into optimal processor for each system. Furthermore, NEC plans to realize standardized middleware by using not only NEC's uniquely developed technologies, but also the most outstanding third party technologies and standards.



Middleware

Middleware Road Map



Middleware

Middleware Products

(1/2)

Field	Middleware		RISC		DSP
			V850 Family	V _R Series	μPD77016 Family
Image	MH/MR/MMR		◎	◎	—
	JBIG		◎	—	—
	JPEG		◎	◎	—
	H.263/MPEG-4 Video		—	—	○
Speech	Text To Speech	Japanese	◎	◎	—
		Multilingual version (TTS3000/C ^{Note 1})	—	△ ^{Note 2}	—
	Speech CODEC	TrueSpeech8.5	—	◎	—
		G.723.1 Annex A/C	—	—	◎
		G.726 (ADPCM)	◎	—	—
		G.729 Annex A/B	—	—	◎
		AMR	—	—	◎
		MPEG-4 CELP	—	—	◎
	Acoustic Echo Canceller (for hands-free application)		—	—	◎
Sound	Sound DECODER	AAC	—	—	◎
		MP3	—	—	◎
		Sound Source For Melody Ringers	—	—	○

Notes 1. This is a product of Lemout & Hauspie Speech Products N.V.**2.** WindowsCE (CPU:V_R4111/V_R4121) supported.**Remarks 1.** ◎: Developed

○: Under Development

△: Under Planning

2. The products and CPUs supported and targeted by third parties differ depending on the company. For details, contact the relevant third party company.

Middleware

(2/2)

Field	Middleware		RISC		DSP
			V850 Family	V _R Series	μPD77016 Family
Recognition	Speech Recognition	Japanese (Large vocabulary)	—	◎	—
		Japanese (Small vocabulary)	◎	—	◎
		English (Small vocabulary)	○	—	◎
		Multilingual version (ASR1600/C ^{Note 1})	—	△ ^{Note 2}	—
	Handwritten Character Recognition	Japanese (with input frame)	◎	◎	—
		Japanese (without input frame)	—	◎	—
Internet	Browser ^{Note 3}		◎	◎	—
	TCP/IP ^{Note 4}		◎	◎	—
Communication	Controller MODEM: V.90 ^{Note 5, 6}		—	◎	—
	Software MODEM: V.90 ^{Note 5, 7}		—	◎	—
Driver	IrDA protocol stack ^{Note 8}		◎	△	—
	PCMCIA/CF card ^{Note 9}		○	△	—
	PC-compatible file system ^{Note 10}		○	△	—
Other	Fonts ^{Note 11}		◎	◎	—

- Notes**
1. This is a product of Lemout & Hauspie Speech Products N.V.
 2. WindowsCE (CPU:V_R4111/V_R4121) supported.
 3. This is a product of Accesss Corporation and Aplix Corporation.
 4. This is also made by Access Corporation, Aplix Corporation, AI Corporation, and Elmic Systems, Inc. other than NEC.
 5. A product supporting WindowsCE is also available.
 6. This is a product of Conexant Systems, Inc.
 7. This is a product of PCTEL, Inc.
 8. This is a product of Okaya Systemware Co., Ltd.
 9. This is a product of SanDisk Corporation.
 10. This is a product of AI Corporation.
 11. This is a product of NEC (NEC Solutions)

- Remarks**
1. ◎: Developed
○: Under Development
△: Under Planning
 2. The products and CPUs supported and targeted by third parties differ depending on the company. For details, contact the relevant third party company.

Middleware

Middleware Performance

(1/2)

Middleware	CPU	Performance	Power (MIPS)	ROM	RAM
MH/MR/MMR	V850 Family	MH Chart 1 : Enc 0.12 s/Dec 0.08 s	–	64 KB	200 bytes
	V _R 4100 Series	MH Chart 1 : Enc 0.18 s/Dec 0.19 s	–	64 KB	200 bytes
JBIG	V850 Family	Chart 1 : Enc 0.73 s/Dec 0.83 s	–	21 KB	2.6 KB
JPEG	V850 Family	QVGA × 24 : Enc 0.32 s/Dec 0.24 s	–	17.5 KB	15 KB
	V _R 4100 (40 MHz)	QVGA × 24 : Enc 0.56 s/Dec 0.08 s	–	56 KB	7.7 KB
	V _R 4300 (133 MHz)	QVGA × 24 : Enc 0.12 s/Dec 0.08 s	–	78 KB	6.5 KB
Text To Speech (Japanese)	V _R Series	390 ms for 3 seconds of speech	10	2 MB	250 KB
	V850 Family	1872 ms for 3 seconds of speech	18	2 MB	250 KB
TrueSpeech 8.5	V _R 4100 Series	8.5 kbps	Enc 38.5/Dec 6	27 KB	4.2 KB
	V _R 4300 (100 MHz)	8.5 kbps	Enc 38.5/Dec 5.3	28 KB	4 KB
G.723.1 Annex A	μPD77016 Family	6.3 kbps, 5.3 kbps	Enc 17.5/Dec 1.5	5.6 Kwords ^{Note1}	4.1 Kwords ^{Note2}
				9.5 Kwords ^{Note2}	
G.723.1 Annex C	μPD77016 Family	+0.7 to 14.3 kbps	Enc 18.5/Dec 3	7.9 Kwords ^{Note1}	4.2 Kwords ^{Note2}
				12.1 Kwords ^{Note2}	
G.726 (ADPCM)	V850 Family	32 kbps, 16 kbps	Enc 8/Dec 8.2	9 KB	80 bytes
	μPD77016 Family ^{Note3}	40 kbps, 32 kbps, 24 kbps, 16 kbps	Enc 5.7/Dec 6	1287 words ^{Note1}	117 words ^{Note2}
				271 words ^{Note2}	
G.729	μPD77016 Family	8 kbps	Enc 15.7/Dec 3.3	8.8 Kwords ^{Note1}	3.7 Kwords ^{Note2}
				5.1 Kwords ^{Note2}	
G.729 Annex A	μPD77016 Family	8 kbps	Enc 9/Dec 2.2	7.7 Kwords ^{Note1}	3.4 Kwords ^{Note2}
				4.6 Kwords ^{Note2}	
G.729 Annex B	μPD77016 Family	8 kbps	Enc 16.5/Dec 3.5	12.2 Kwords ^{Note1}	3.9 Kwords ^{Note2}
				5.5 Kwords ^{Note2}	
G.729 Annex A+B	μPD77016 Family	8 kbps	Enc 9.5/Dec 3.7	11.2 Kwords ^{Note1}	3.6 Kwords ^{Note2}
				5.0 Kwords ^{Note2}	
G.729 Annex B Multi	μPD77016 Family	8 kbps	Enc 13.9/Dec 2.8	7.5 Kwords ^{Note1}	1856N + 2541 words
				4.6 Kwords ^{Note2}	

- Notes**
1. Instruction ROM (1 word = 4 bytes)
 2. Data ROM and RAM (1 word = 2 bytes)
 3. Sample only

Middleware

Middleware Performance

(2/2)

Middleware	CPU	Performance	Power (MIPS)	ROM	RAM
AMR	μPD77016 Family	1.8 to 12.2 kbps	Enc 21.3/Dec 2.7 (max)	13.9 Kwords ^{Note1} 14.8 Kwords ^{Note2}	5.3 Kwords
MPEG-4 CELP	μPD77016 Family	3.85 to 23.8 kbps	NB : Enc 22.3/Dec 3.5 WB : Enc 60.8/Dec 12.5	14.6 Kwords ^{Note1} 18.6 Kwords ^{Note2}	15.6 Kwords ^{Note2}
Acoustic Echo Cancellor	μPD77016 Family	Dependant on the system	Number of taps × 4 [cycles] × (number of memory waits + 1) + (170 to 259) [cycle]	249 words ^{Note1}	Number of taps × 3 + 19 words
MP3 Decoder	μPD77016 Family	8 to 320 kbps	32/2ch (max)	6.4 Kwords ^{Note1} 7.1 Kwords ^{Note2}	8.8 Kwords ^{Note2}
AAC Decoder	μPD77016 Family	up to 576 kbps	48.4/2ch (max)	8.4 Kwords ^{Note1} 7.8 Kwords ^{Note2}	10.6 Kwords ^{Note2}
Speech Recognition (Japanese/6000 words)	V _R Series	0.4 s	130	660 KB	820 KB
Speech Recognition (Small vocabulary)	V850 Family	0.4 s	19 (30 words) 63 (100 words)	82 KB	3.5 KB (15 words)
Handwritten Character Recognition (Japanese/with input frame)	V850 Family	0.1 s/character	14	570 KB	34 KB
Handwritten Character Recognition (Japanese/without input frame)	V _R 4300 (133 MHz)	1 s/character	60 to 100	740 K to 1140 KB	52 KB
IrDA Protocol Stack	V850 Family	—	—	60 KB	16 KB

Notes 1. Instruction ROM (1 word = 4 bytes)

2. Data ROM and RAM (1 word = 2 bytes)

Graphics LSI for Car Navigation

■ Graphics LSI for Car Navigation

Part Number	Function	Features	Package
μPD72255Y ★ ☆	Graphics LSI for Car Multimedia	Hardware scroll, Graphics accelerator, 800 × 600 screen size, α-blending	240-pin plastic FBGA

★ : Under development, ☆ : Newly added product

ITS/ETC-applied LSI

■ MAC-LSI

Part Number	μPD6750 ☆
Function	L2 layer (MAC sublayer) communication control • Split-phase coding/decoding of communicating data • Clock recovery with inner D-PLL • Data communication control • Cyclic Redundancy check processing • ACK/NAC return User-friendly RF Interface User-friendly CPU Interface
Reception Characteristic	Allowable duty ratio of the received split-phase code: 50±20%
Inner Hardware	• D-PLL circuit for clock recovery • DPRAM for communication data buffer
Supply Voltage	3.0 to 3.6 V (Consumption power: 40 mW)
Operating Ambient Temperature	−40 to +85°C
Quality Grade	Special
Package	80-pin plastic QFP

☆ : Newly added product

■ ETC DSRC-communication control middleware

Part Number	μSAP703107-B29 ☆
Function	• MAC Layer communication control • L2 Data transmission/reception control • L7 Data transmission/reception control • AP interface processing
Communication Performance	1 Mbps
Target Device	V850E1 CPU core
Target OS	RTOS: μITRON
AP	Cunning-coexistence with user AP
DATA handling	With RTOS Function
Source Value	10 k line
Object Size	60 KB (for load module in ROM)
Language	C
Task Number	5 (related only to main realtime-performing task, not included sub evaluation task)

☆ : Newly added product

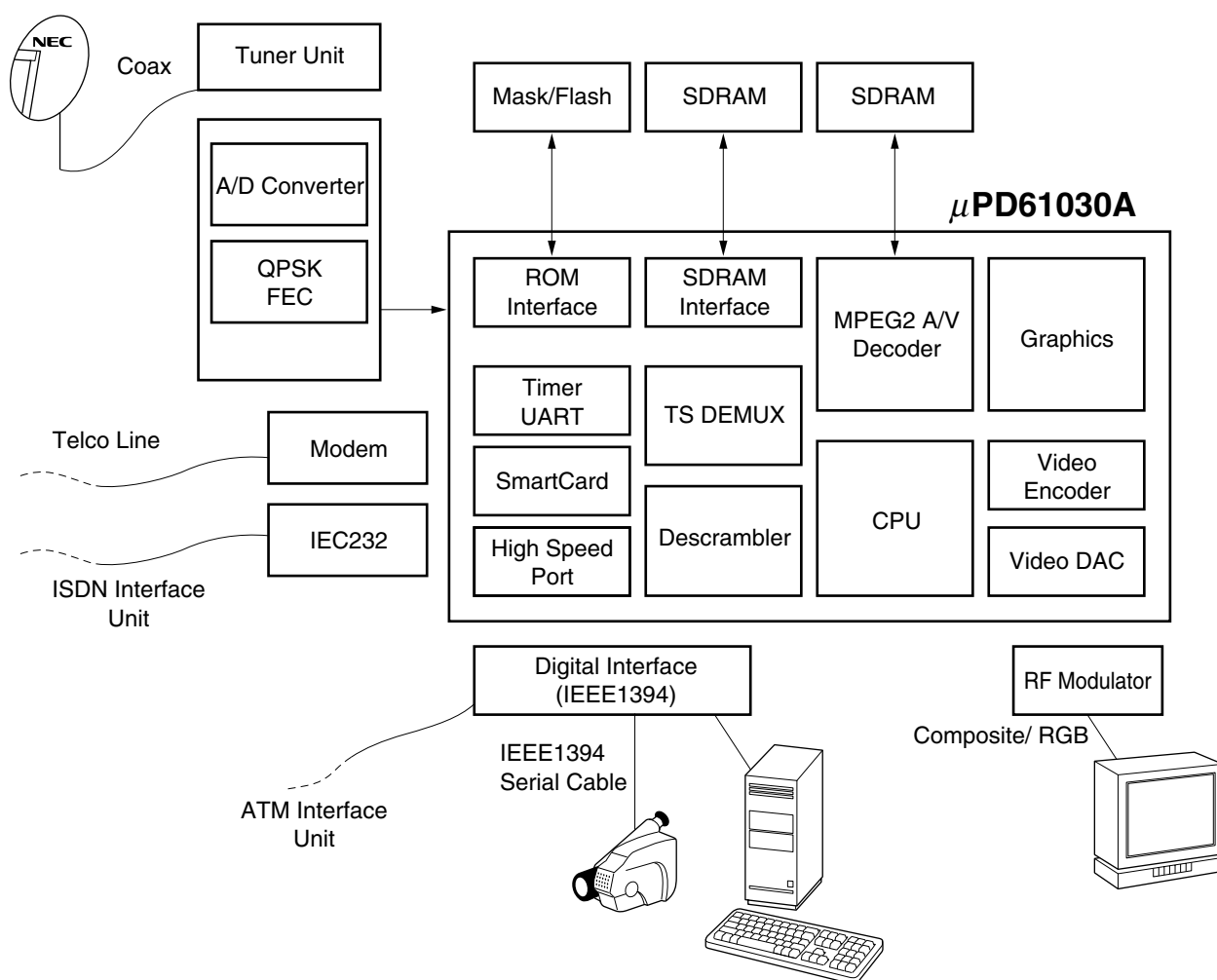
MPEG IC

■ MPEG IC

Part Number	Function	Package
μPD61030A	Signal processing for STB, includes MPEG2 audio/video decoder, TS demultiplexer, graphics and V _R 4120A CPU	• 304-pin plastic QFP (Fine pitch) (40 × 40 mm)
μPD61130 ★☆	Next Generation STB LSI with HDD I/F, includes 3ch Multi-TS demultiplexer, 2ch MPEG2 video decoder, MPEG2, Dolby Digital, MP3 audio decoder	• 352-pin plastic BGA (35 × 35 mm)

★ : Under development, ☆ : Newly added product

■ Digital IRD System Block Diagram



CCD Linear Image Sensor

■ Monochrome (1/2)

Part Number	μ PD3753	μ PD3734A
Pixel Number	2,088	2,660
Resolution (dpi/sheet)	200/B4	300/A4
Pixel Size (μ m)	14 × 14	11 × 11
Sensitivity (Typ.) (V/lx•s)	90	70
Data Rate (Max.) (MHz)	2	5 (S/H in use)
Readout Method	Single-sided	Dual-sided
Output (ch)	1	1
S/H Circuit	Not included	Included
Package	22-pin plastic DIP	22-pin plastic DIP
Features	5 V power supply	Low image lag

Light source of the Sensitivity: Daylight color fluorescent lamp

■ Monochrome (2/2)

Part Number	μ PD3737	μ PD3739	μ PD3747
Pixel Number	5,150	5,000	7,400
Resolution (dpi/sheet)	400/A3, 600/A4	400/A3	600/A3
Pixel Size (μ m)	7 × 7	7 × 7	4.7 × 4.7
Sensitivity (Typ.) (V/lx•s)	7.5	9.0	19
Data Rate (Max.) (MHz)	20	40 (20 × 2)	44 (22 × 2)
Readout Method	Dual-sided	Dual-sided	Dual-sided
Output (ch)	1	2 (in or out of phase)	2 (in phase)
S/H Circuit	Not included	Not included	Not included
Package	22-pin ceramic DIP (CERDIP)	22-pin ceramic DIP (CERDIP)	22-pin ceramic DIP (CERDIP)
Features	Low image lag	μ PD35H71A pin compatible	Low image lag

Light source of the Sensitivity: Daylight color fluorescent lamp

CCD Linear Image Sensor

■ Color (1/4)

Part Number		μ PD8861	μ PD3798	μ PD3799
Pixel Number		$5,400 \times 3$	$5,348 \times 3$	$5,300 \times 3$
Resolution (dpi/sheet)		600/A4	600/A4	600/A4
Pixel Size (μ m)		5.25×5.25	7×7	7×7
Sensitivity (Typ.) (V/lx•s)	R	5.94	11.2	11.2
	G	5.82	10.2	10.2
	B	3.38	6.1	6.1
Line Spacing		8 (42 μ m)	4 (28 μ m)	4 (28 μ m)
Data Rate (Max.) (MHz)		6	5	4
Readout Method		Single-sided	Single-sided	Single-sided
Output (ch)		3	3	3
Clamp Pulse Generator		Not included	Not included	Included
Package		22-pin plastic DIP	32-pin plastic DIP	32-pin plastic DIP
Features		Upgraded from μ PD3777	Upgraded from μ PD3797	Upgraded from μ PD3797

Light source of the Sensitivity: 3,200K halogen lamp + C-500S (infrared cut filter, $t = 1$ mm) + HA-50 (heat absorbing filter, $t = 3$ mm)

■ Color (2/4)

Part Number		μ PD3778	μ PD8870	μ PD8871
Pixel Number		$10,600 \times 3$	$10,680 \times 3$	$10,680 \times 3$
Resolution (dpi/sheet)		1200/A4	1,200/A4	1,200/A4
Pixel Size (μ m)		4×4	4×4	4×4
Sensitivity (Typ.) (V/lx•s)	R	3.6	3.6	3.6
	G	3.3	3.3	3.3
	B	2.0	2.2	2.2
Line Spacing		12 (48 μ m)	12 (48 μ m)	8 (32 μ m)
Data Rate (Max.) (MHz)		5	10	10
Readout Method		Dual-sided	Dual-sided	Single-sided
Output (ch)		3	3	3
Clamp Pulse Generator		Not included	Not included	Not included
Package		32-pin plastic DIP	32-pin plastic DIP	32-pin plastic DIP
Features		For color image scanner	High speed version of μ PD3778	Single-sided readout method version of μ PD8870

Light source of the Sensitivity: 3,200K halogen lamp + C-500S (infrared cut filter, $t = 1$ mm) + HA-50 (heat absorbing filter, $t = 3$ mm)

CCD Linear Image Sensor

■ Color (3/4)

Part Number		μ PD8872 ★	μ PD8880 ★
Pixel Number		$(5,400+5,400) \times 3$	$(10,680+10,680) \times 3$
Resolution (dpi/sheet)		1,200/A4	2,400/A4
Pixel Size (μ m)		5.25×5.25	4×4
Sensitivity (Typ.) (V/lx•s)	R	(5.94)	(3.6)
	G	(5.24)	(3.3)
	B	(3.38)	(2.2)
Line Spacing		12 (63 μ m) [R-G, G-B Odd lines], 2 (10.5 μ m) [Odd-Even line/Color]	16 (64 μ m) [R-G, G-B Odd lines], 2 (8 μ m) [Odd-Even line/Color]
Data Rate (Max.) (MHz)		10	10
Readout Method		Dual-sided [staggered pixel]	Dual-sided [staggered pixel]
Output (ch)		3	3
Clamp Pulse Generator		Not included	Not included
Package		22-pin plastic DIP	32-pin plastic DIP
Features		For color image scanner	For high resolution color image scanner

★ : Under development

Light source of the Sensitivity: 3,200 K halogen lamp + C-500S (infrared cut filter, t = 1 mm) + HA-50 (heat absorbing filter, t = 3 mm)

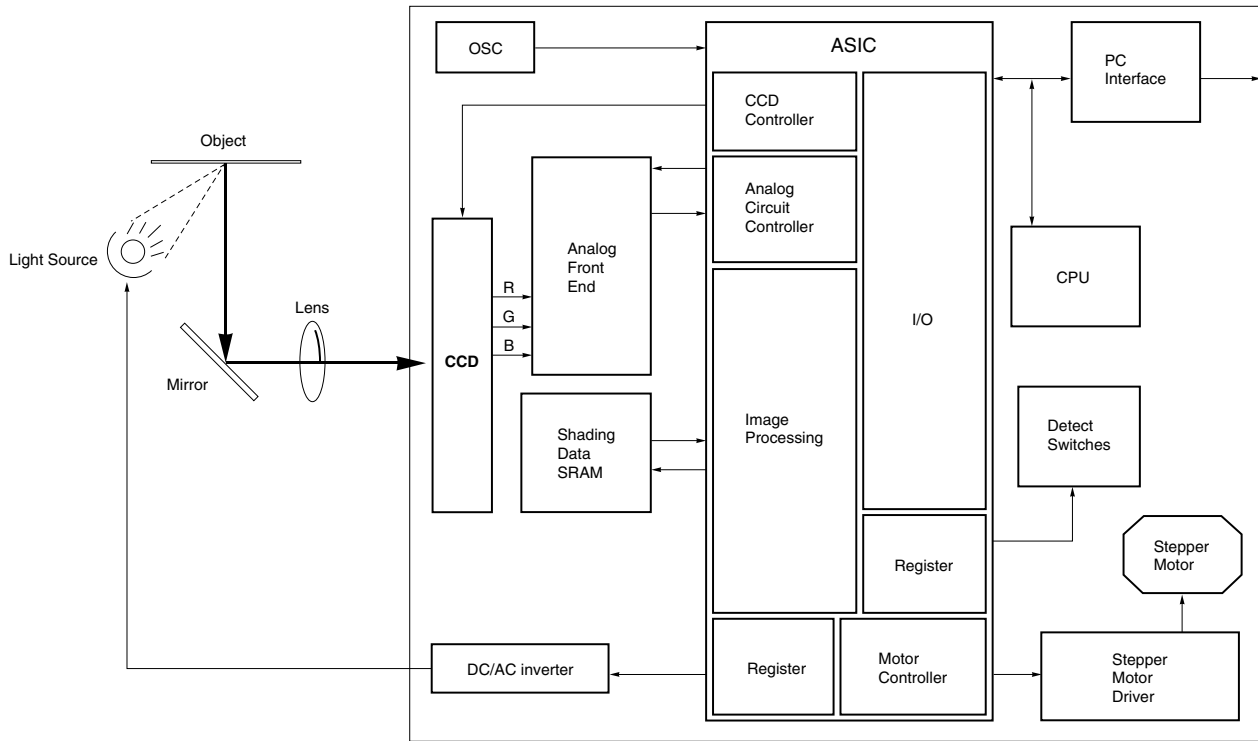
■ Color (4/4)

Part Number		μ PD3788	μ PD3728DZ	μ PD3768
Pixel Number		$7,300 \times 3$	$7,300 \times 3$	$7,500 \times 3$
Resolution (dpi/sheet)		600/A3	600/A3	600/A3
Pixel Size (μ m)		10×10	10×10	9.325×9.325
Sensitivity (Typ.) (V/lx•s)	R	5.5	5.6	22.0
	G	5.4	5.1	18.0
	B	2.5	6.4	8.0
Line Spacing		4 (40 μ m)	4 (40 μ m)	4 (37.3 μ m)
Data Rate (Max.) (MHz)		40 (20 $\times$ 2)	40 (20 $\times$ 2)	44 (22 $\times$ 2)
Readout Method		Dual-sided	Dual-sided	Dual-sided
Output (ch)		6 (2-output/color (in phase))	6 (2-output/color (in phase))	6 (2-output/color (in phase))
Clamp Pulse Generator		Not included	Not included	Not included
Package		36-pin ceramic DIP	36-pin ceramic DIP (CERDIP)	36-pin ceramic DIP (CERDIP)
Features		High speed For digital copiers	High speed For digital copiers	10-V power supply, high speed For digital copiers

Light source of the Sensitivity: 3,200 K halogen lamp + C-500S (infrared cut filter, t = 1 mm) + HA-50 (heat absorbing filter, t = 3 mm)

CCD Linear Image Sensor

■ CCD Linear Image Sensor System Block Diagram



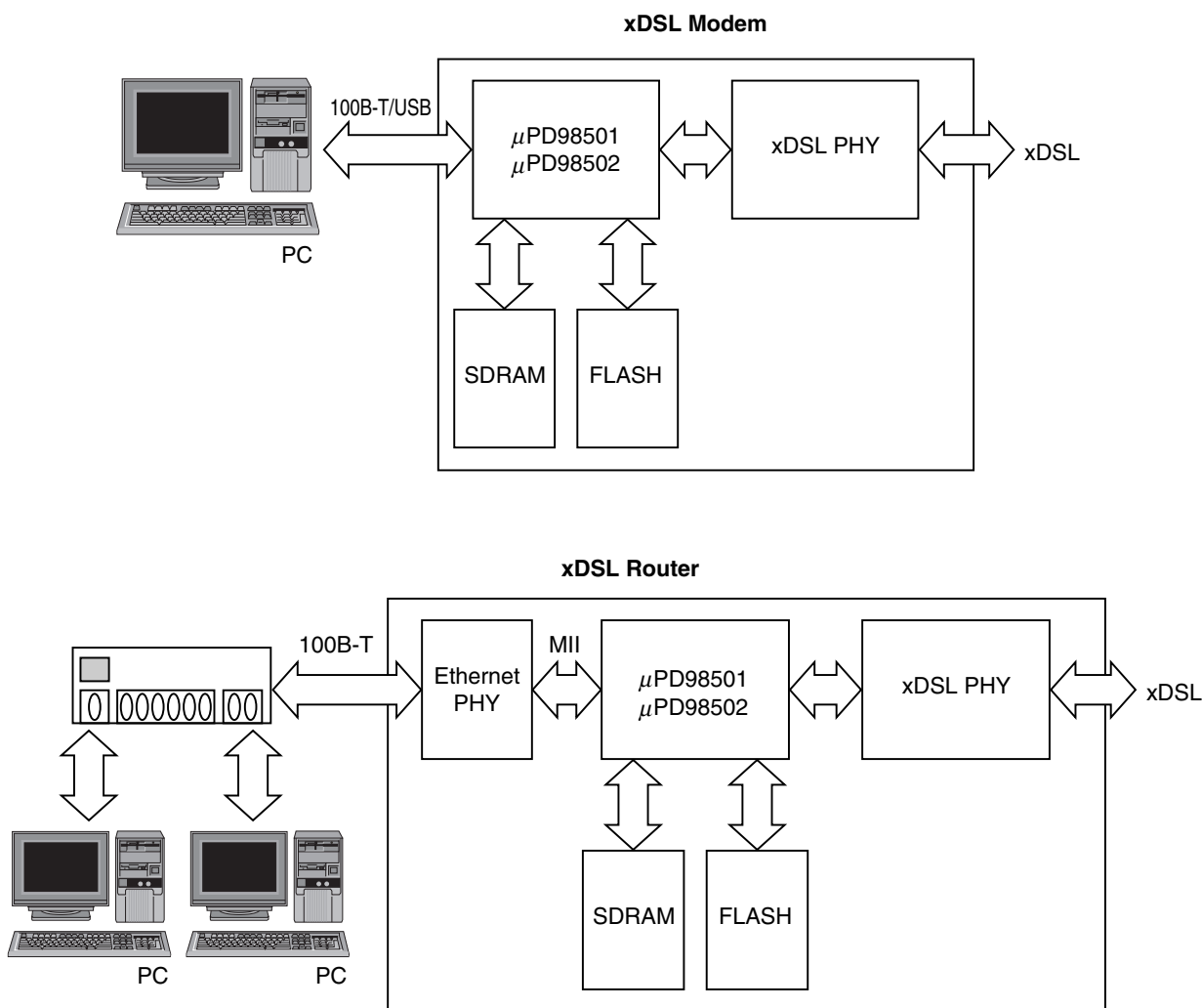
Communication IC

■ xDSL Communication LSI

Part Number	Function	Features	Package
μPD98501	Network controller	Control processor for upper communication layer Includes V _R 4120A core (@100 MHz) Includes ATM cell processor Supports USB I/F (x1ch), Ethernet I/F (x2ch), UTOPIA I/F (x1ch)	352-pin tape BGA
μPD98502 ★ ☆	Network controller	Control processor for upper communication layer Includes V _R 4120A core (@100 MHz) Includes ATM cell processor Supports USB I/F (x1ch), Ethernet I/F (x2ch), UTOPIA I/F (x1ch), PCI I/F (x1ch)	500-pin tape BGA

★ : Under development, ☆ : Newly added product

■ xDSL System Block



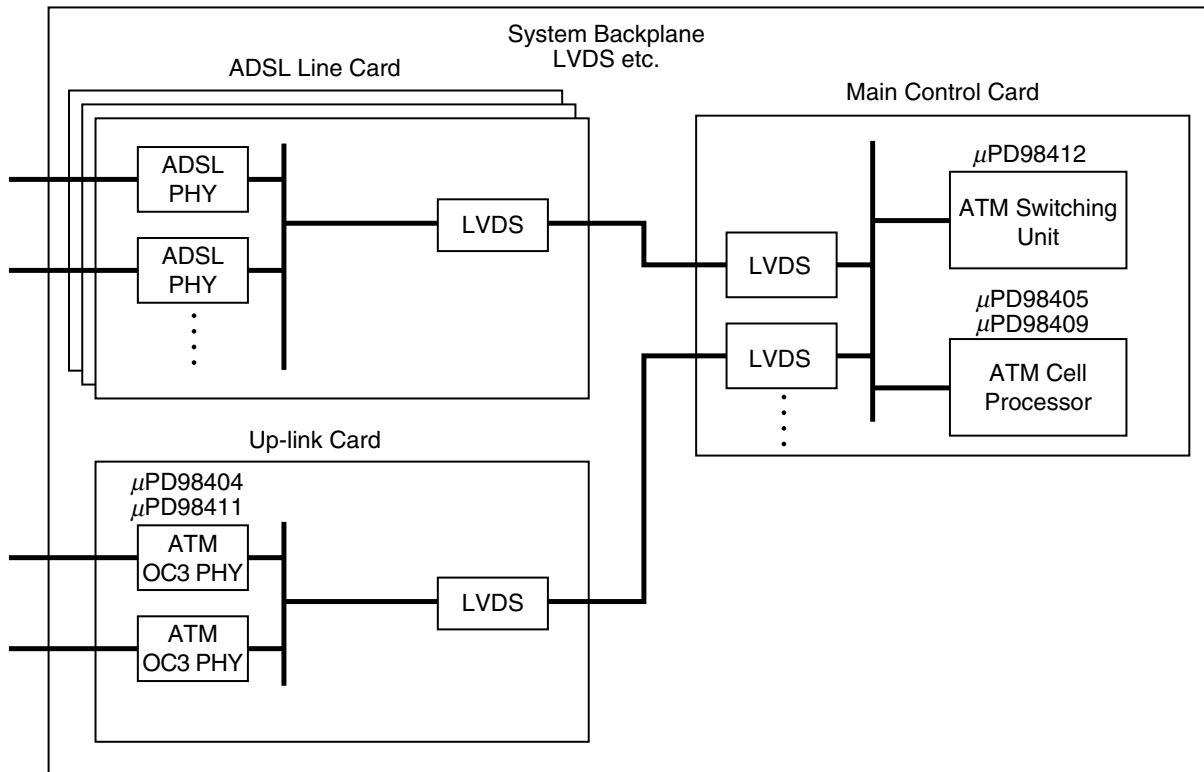
Communication IC

■ ATM LSI

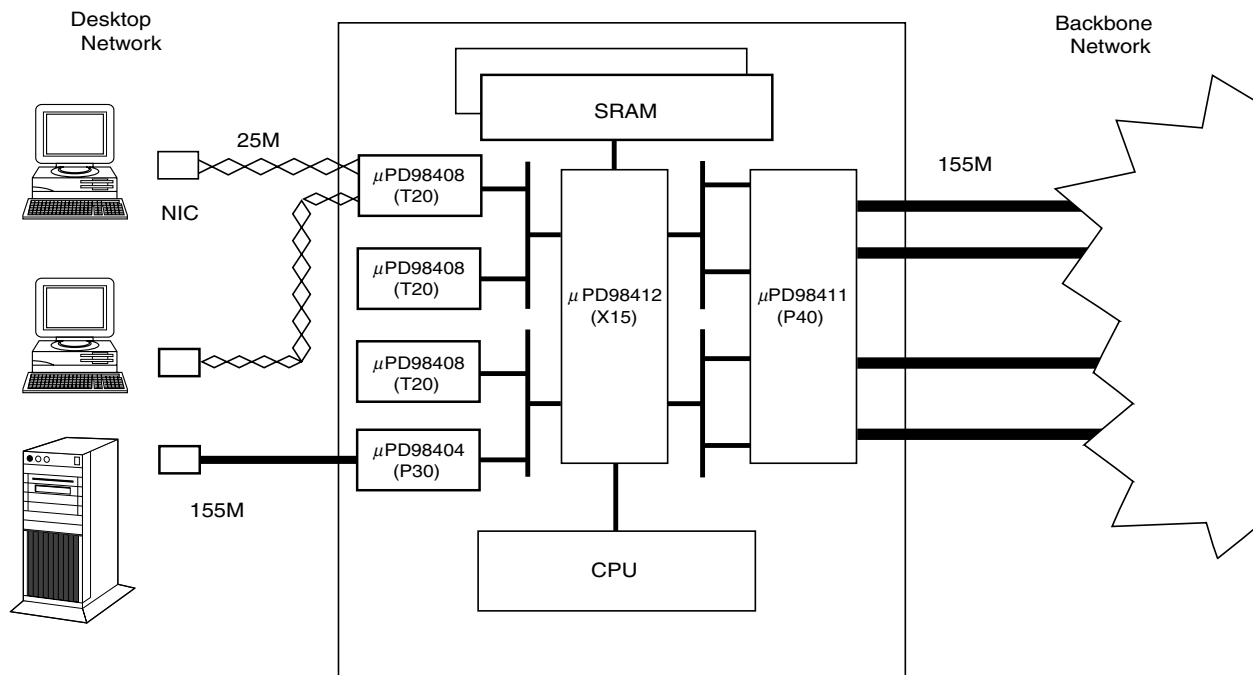
Part Number	Function	Features	Package
μPD98404	ATM advanced SONET framer	• Supports TC sublayer in PHY layer • Implements SONET STS-3c/SDH STM-1 (155 Mbps) framer function • Integrated clock recovery/clock synthesis function • UTOPIA level 2 interface	• 144-pin plastic QFP (Fine pitch)
μPD98405	ATM integrated SAR controller	• SONET STS-3c/SDH STM-1 (155 Mbps), framer and SAR controller with ABR function in a single chip • Support both PCI bus and generic bus	• 304-pin plastic QFP (Fine pitch) • 304-pin plastic BGA (Fine pitch)
μPD98408	6-port 25 Mbps ATM PHY	• 25.6 Mbps ATM PHY (PMD & TC) function for six circuits • UTOPIA level 2 interface	• 208-pin plastic QFP (Fine pitch)
μPD98409	ATM light SAR controller	• Implements AAL-5 SAR sublayer and ATM layer function • Supports PCI bus interface • MPEG packet transfer engine	• 240-pin plastic QFP (Fine pitch)
μPD98411	ATM quad SONET framer	• Implements 4 ports SONET STS-3c/SDH-1 (155 Mbps) framer function on chip	• 240-pin plastic QFP (Fine pitch)
μPD98412	Advanced ATM switch	• ATM switching function in a single chip • 1.5 Gbps with non blocking • 16-bit UTOPIA level2 interface	• 576-pin tape BGA (Heat spreader type)
μPD98414	ATM 2.4 Gbps SONET framer	• Supports SONET STS-48c/SDH STM-16 frame • Can access all overhead byte area	• 352-pin plastic BGA (Advanced)

Communication IC

■ DSLAM System Block



■ ATM Switch System Block



Communication IC

■ Ethernet LSI

Part Number	Function	Features	Package
μPD98421	High speed address search engine	• 64-bit × 8K entry • High speed address search operation by Longest prefix match	• 240-pin plastic BGA (Fine pitch)
μPD98431	8-port 10/100 Mbps Ethernet controller	• 8-port 10/100 Mbps Ethernet MAC • MII and 10 Mbps serial interface	• 352-pin plastic BGA

■ IEBus Controller/Driver IC

Part Number	Function	Features	Package
μPD6708	IEBus controller/driver	Transmit data buffer: 4 bytes Receive data buffer: 20 bytes	• 16-pin plastic SOP
μPD72042B		Transmit data buffer: 33 bytes Receive data buffer: 40 bytes	• 16-pin plastic SOP

Communication IC

■ LSI for IEEE1394

● PHY Family

Part Number	Function	Features	Package
μPD72850B ★	IEEE1394 400 Mbps PHY	- Compliant with P1394a draft3.0 - Selectable for 1/2/3 port - Data rate: 100/200/400 Mbps - Compliant with MD8405E (FFM)	80-pin plastic TQFP (Fine pitch)
μPD72852	IEEE1394a-2000 400 Mbps 2-port PHY	- Compliant with IEEE1394a-2000 - Super low power - Data rate: 100/200/400 Mbps	64-pin plastic LQFP
μPD72880 ★ ☆	IEEE1394 400 Mbps long-haul PHY	- DS port: 2 (Compliant with P1394a draft) - Beta port: 1 (P1394b) - Data rate: 100/200/400 Mbps	144-pin plastic LQFP (Fine pitch)
μPD72882 ★ ☆	IEEE1394 400 Mbps long-haul PHY	- DS port: 1 (Compliant with IEEE1394a-2000) - Beta port: 1 (P1394b) - Data rate: 100/200/400 Mbps	100-pin plastic TQFP (Fine pitch)

★ : Under development, ☆ : Newly added product

● Link Family

Part Number	Function	Features	Package
μPD72890 ★	IEEE1394 Link layer controller	- Compliant with IEEE1394-1995 and IEEE1394a-2000 - All functions required for Digital AV IEEE1394 interface are equipped in a single chip	208-pin plastic QFP (Fine pitch)
μPD72892 ★ ☆	IEEE1394 Link layer controller	- On chip 32-bit RISC CPU - Copy protection circuit (μPD72890 only) - IEC61883 function	208-pin plastic QFP (Fine pitch)
μPD72891 ★ ☆	IEEE1394 Link layer controller	- Compliant with IEEE1394-1995 and IEEE1394a-2000 - DV codec function - All functions required for Digital AV IEEE1394 interface are equipped in a single chip	208-pin plastic QFP (Fine pitch)
μPD72893 ★ ☆	IEEE1394 Link layer controller	- On chip 32-bit RISC CPU - Copy protection circuit (μPD72891 only) - IEC61883 function	208-pin plastic QFP (Fine pitch)

★ : Under development, ☆ : Newly added product

● Combo Family (Firewarden Series)

Part Number	Function	Features	Package
μPD72870B	IEEE1394 1-chip host controller	- Integrated OHCI 1.0 Link + P1394a PHY in a single chip - μPD72870B: 3 ports	160-pin plastic LQFP (Fine pitch)
μPD72872	IEEE1394 1-chip host controller	- μPD72872: 2 ports - μPD72870A shrink version (μPD72872 only)	120-pin plastic TQFP (Fine pitch)
μPD72873 ★ ☆	IEEE1394 OHCI 1.1 compliant PHY/Link 1-chip host controller	Integrated OHCI 1.1 Link + IEEE1394a-2000 PHY in a single chip	120-pin plastic TQFP (Fine pitch)
μPD72874 ★ ☆	IEEE1394 OHCI 1.1 compliant PHY/Link 1-chip host controller	- μPD72873: 2 ports - μPD72874: 3 ports	120-pin plastic TQFP (Fine pitch)

★ : Under development, ☆ : Newly added product

Communication IC

■ Standard USB

Part Number	Function	Features	Package
μPD72012	USB1.1 hub controller	• All USB hub function in a single chip • Supports self-powered and bus-powered • Four or five downstream ports selectable • Compliant with USB1.1 • Available customize for user's descriptor	• 42-pin plastic SDIP • 44-pin plastic QFP
μPD720100A ☆	USB2.0 host controller (PCI multi-function device)	• Up to five USB downstream ports • PCI Interface • Compliant with USB2.0 (Maximum data transfer rate: 480 Mbps) • EHCI Compliant • 2 OHCI support double bandwidth of USB1.1 connectivity when USB1.1 device attached • Automatic speed detection (480 Mbps/12 Mbps/1.5 Mbps) • USB2.0 PHY layer included	• 160-pin plastic LQFP • 176-pin plastic FBGA
μPD720110 ☆	USB2.0 hub controller	• Up to four USB downstream ports • Compliant with USB2.0 (Maximum data transfer rate: 480 Mbps) • Transaction Translator that supports Split Transaction • Automatic speed detection (480 Mbps/12 Mbps/1.5 Mbps) • Available customize for user's descriptor • USB2.0 PHY layer included	• 100-pin plastic LQFP
μPD720120 ☆ ☆	USB2.0 PHY layer chip	• For building USB2.0 function device • Compliant with USB2.0 (Maximum data transfer rate: 480 Mbps) • Automatic speed detection (480 Mbps/12 Mbps/1.5 Mbps) • Both USB1.x SIE and USB2.0 SIE (Serial Interface Engine) included • Local Bus is compatible with NEC USB1.x SIE Core Block's	• 100-pin plastic TQFP
μPD720121 ☆ ☆	USB2.0 to IDE bridge	• USB2.0 PHY layer implemented with IDE interface • Compliant with USB2.0 (Maximum data transfer rate: 480 Mbps) • IDE function supports ATA/ATAPI-4/Ultra DMA/33 • Easy of built IDE system with only firmware flash memory	• 120-pin plastic TQFP

★ : Under development, ☆ : Newly added product

■ Power Switch for USB Application

Part Number	Function	Internal Circuit	Input Voltage (V)	Circuit Current (mA)	Output Current (A)	Over Current Detect (A)	Package	Main Application
μPD16874	Pch high-side switch for USB (Low-active, on-chip pull-down resistor)	4	4.0 to 5.5	0.15	0.5	0.6 to 1.25	• 16-pin plastic SOP	CRT monitor, LCD monitor
μPD16875	Pch high-side switch for USB	2		0.1			• 8-pin plastic SOP	Keyboard, hub box
μPD16876	Pch high-side switch for USB (Low-active, output latch selective function)	1		0.08			• 8-pin plastic SOP	Note PC, keyboard

Display IC

■ Vacuum Fluorescent Display (VFD) Driver IC

Part Number	Drives	Number of Outputs	Withstand Voltage (V)	Output Current (mA)	Output Type	Package	Main Applications
μPD6340	Dynamic	20	80	25	NPN+Nch	• 52-pin QFP	ECR, PPC
μPD6700	Static	47	18	1	CMOS	• 56-pin QFP	Car stereo
μPD16306B	Dynamic	64	80	50		• 100-pin QFP	Graphic VFD module
μPD16306A				25			
μPD16310		40		50		• 80-pin QFP ^{Note}	
μPD16326A		32		20		• 44-pin QFP	

Note Three direction lead

■ Vacuum Fluorescent Display (VFD) Controller/Driver IC

Part Number	Drives	Duty (Max.)	Number of Outputs		Number of Characters ^{Note}	Logic Voltage (V)/ Drive Voltage (V)	Package	Main Application	Remarks
			Segments	Grids					
μPD16311	Segment	1/16	12	16	192 segments	5/35	• 52-pin QFP	VCR	Included key scan
μPD16312		1/11	11	11	121 segments		• 44-pin QFP		
μPD16313									
μPD16315	Segment	1/12	16	12	192 segments	5/35	• 44-pin QFP	VCR	Included key scan

Note At maximum duty

Display IC

■ Liquid Crystal Display (LCD) Driver IC

Part Number	Drives	Number of Outputs	Driver Voltage (V)	Logic Voltage (V)	Package	Main Applications	
μPD16448A	TFT (source) analog	240	5.0	3.3	• TCP	Navigation/LCD-TV	
μPD16780		288/300		3.3/5.0			
μPD16780A		300					
μPD16781		480					
μPD16640C	TFT (source) 64 gray scale	300/309	3.3/5.0	3.3		SVGA/XGA	
μPD16647		402	5.0	SVGA			
μPD16716		384	15	2.5/3.3		XGA/SXGA	
μPD16718 ☆ ☆		480/420	12.5			SXGA/UXGA	
μPD16732A		384	8.5			XGA/SXGA	
μPD16732B						XGA/SXGA	
μPD16732C							
μPD16732D ☆							
μPD16732E ☆							
μPD16770		420	SXGA+				
μPD16772		480	UXGA				
μPD16772A							
μPD16721 ☆		TFT (source) 256 gray scale	384	13/15		3.3	XGA/SXGA
μPD16750				9.0		XGA	
μPD16650	TFT (gate)	120/128	40	3.3/5.0		—	
μPD16654		150/154		3.3			
μPD16655		240	31	3.3/5.0			
μPD16700		256	40	3.3			
μPD16702		256/263					
μPD16703 ☆ ☆		308/300					
μPD16704 ☆ ☆		240					
μPD16705 ☆ ☆		256/263					

★: Under development, ☆: Newly added product

Display IC

■ Liquid Crystal Display (LCD) Controller/Driver IC

Part Number	Drives	Duty (Max.)	Number of Outputs		Number of Characters ^{Note 1}	Logic Voltage (V)/ Drive Voltage (V)	Package	Main Application	Remarks	
			Segments	Commons						
μPD7225	Segment	1/4	32	4	128 segments	2.7 to 5.5/ 2.7 to 5.5	• 52-pin QFP • 56-pin QFP	–	–	
μPD16430A			60		240 segments	3.5 to 6/ 3.5 to 14	• 80-pin QFP	Car audio	–	
μPD16431A			56		224 segments	2.7 to 5.5/ 2.7 to 6.5			Included key scan	
μPD16432B	Dot character	1/15	60/65	15/8	12 × 2 characters + 60 pictographs	2.7 to 5.5/12	• 100-pin TQFP	–	–	
μPD16434		1/16	42	16	8 × 2 characters		• 80-pin QFP			
μPD16661A		1/240	160	–	1/8VGA to VGA	3.0 to 3.6/5	• TCP	PDA	4-gray scales	
μPD16662		1/160	240	–	1/8VGA to 1/2VGA				16-gray scales	
μPD16663				–					4-gray scales	
μPD16664			208	–	144 × 128 dots to 416 × 320 dots	2.4 to 3.6/5				
μPD16666A		1/240	–	240	1/8VGA to VGA	5/36			–	
μPD16667		1/160	–	160	1/8VGA to 1/2VGA				–	
μPD16675A		Graphic	1/36	128	34	128 × 32 dots + 128 × 2 pictographs	2.7 to 5.5/10 ^{Note 2}	• CHIP • TCP	Pager	Included DC/DC converter
μPD16676	1/16 1/32		61	16	61 × 16 dots	2.7 to 5.5/12	• CHIP • 100-pin QFP	–		
μPD16680	1/53 1/40		100	53	100 × 51 dots + 100 pictographs	2.7 to 3.6/12 ^{Note 2}	• CHIP	Mobile phone	Included DC/DC converter	
μPD16681A	1/52 1/39		96	52	96 × 51 dots + 96 pictographs (8 × 4 japanese kanji character)	2.0 to 4.0V/12V ^{Note 2}			• Included DC/DC converter • Included japanese kanji ROM	
μPD16682	1/65		132	65	132 × 64 dots + 132 pictographs	1.8 to 4.5/12 ^{Note 2}	• CHIP • TCP		• Included DC/DC converter • For TCP, COF	
μPD16682A							• CHIP		• Included DC/DC converter • For COG	
μPD16686	1/128		128	128	128 × 128 dots + 20 pictographs (4-gray scales)	1.8 to 3.6 V/18 V			• Included DC/DC converter • For COF	
μPD16687										

- Notes** 1. At maximum duty
2. Internal DC/DC converter

Display IC

■ Plasma Display, EL Display Driver IC

Part Number	Drives	Number of Outputs	Withstand Voltage (V)	Output Current (mA)	Output Type	Package
μ PD16305	AC-PDF row	40	200	400	CMOS	• 80-pin QFP ^{Note}
μ PD16344 [☆]		64	120			• 100-pin QFP
μ PD16306B	AC-PDF/EL column	64	80	50		• 100-pin QFP
μ PD16306A				25		
μ PD16310	AC-PDP/EL	40		50		• 80-pin QFP ^{Note}
μ PD16331	AC-PDP column	40	100	150		• 80-pin QFP
μ PD16334		96	80	50		• For module
μ PD16335						
μ PD16337		64	150	40		• 100-pin QFP
μ PD16340		96	80	50		• For module
μ PD16341			120	15		
μ PD16342 [☆]			80			
μ PD16364	EL column	160	60	25		• TCP

Note Three direction lead

☆: Newly added product

■ Other Driver IC

Part Number	Number of Outputs	Withstand Voltage (V)	Output Current (mA)	Output Type	Package	Main Applications
μ PD6345	8	40	100	NPN-O.C	• 16-pin DIP • 16-pin SOP	Thermal head, LED, solenoid

NPN-O.C: NPN open-collector output (sink driver)

Intelligent Power MOS LSI

Motor Driver

Part Number	Function	Recommended Operation Voltage Range (V)		Output Current (A)	Package	Main Application
		Control Part	Output Part			
μPD16804	DC motor driver	3 to 6	Up to 7.5	±0.5	• 16-pin plastic SOP	Camera, DSC
μPD16805	1-ch H bridge			±1.0	• 16-pin plastic SOP • 24-pin plastic TSSOP	
μPD16823	DC motor driver 1.5-ch H bridge	2.5 to 6		±0.5	• 20-pin plastic SOP	
μPD16803	Stepping motor driver 2-ch H bridge	4 to 6	4 to 13.2	±0.38		FDD (2 aspects excitation)
μPD16808				±0.45		FDD (1-2 aspects excitation)
μPD16813		4 to 6		±0.31		• 16-pin plastic SOP
μPD16814				±0.415	FDD (1-2 aspects excitation)	
μPD16818			2.7 to 6		±0.38	• 20-pin plastic SOP • 20-pin plastic SSOP
μPD16833A	Stepping motor driver 4-ch H bridge	2.5 to 5.5	2.7 to 5.5	±0.3	• 30-pin plastic SSOP • 26-pin plastic TSSOP	Camcorder
μPD16835	Stepping motor driver	2.7 to 5.5	4.8 to 11	±0.15	• 38-pin plastic SSOP	Camcorder
μPD16835A	Microstep drive 4-ch H bridge					
μPD16837	Stepping motor driver 4-ch H bridge	4 to 6	10.8 to 13.2	±1.0 peak	• 30-pin plastic SSOP	CD-ROM/DVD
μPD16856	3-phase blush-less DC motor driver PWM drive	4.5 to 5.5	10.8 to 13.2	±2.0 peak	• 30-pin plastic SSOP	CD-ROM
μPD16857	Stepping motor driver 6-ch H bridge	3.0 to 3.6		±1.0 peak	• 38-pin plastic SSOP	DVD-RAM
μPD16873	3-phase blush-less	4.5 to 5.5		±1.9 peak	• 30-pin plastic TSSOP	CD-ROM
μPD16873A	DC motor driver					
μPD16873B	PWM drive					
μPD16873C						
μPD16877	Stepping motor driver 4-ch H bridge	2.5 to 5.5	2.7 to 5.5	±0.25	• 24-pin plastic TSSOP	Camcorder
μPD16879	Stepping motor driver Microstep drive 4-ch H bridge	2.7 to 5.5	4.0 to 11	±0.1	• 38-pin plastic SSOP	Camcorder
μPD16882	3-phase blush-less DC motor driver PWM drive	4.5 to 5.5	10.8 to 13.2	±2.0 peak	• 30-pin plastic SSOP	CD-ROM, DVD-ROM
μPD168101	Stepping motor driver 4-ch H bridge	2.5 to 5.5	2.7 to 5.5	±0.25	• 24-pin plastic TSSOP	DSC, Camcorder

Power Switch for USB Application

■ Power Switch for USB Application

Part Number	Function	Internal Circuit	Input Voltage (V)	Circuit Current (mA)	Output Current (A)	Over Current Detect (A)	Package	Main Application
μPD16874	Pch high-side switch for USB (Low-active, on-chip pull-down resistor)	4	4.0 to 5.5	0.15	0.5	0.6 to 1.25	• 16-pin plastic SOP	CRT monitor, LCD monitor
μPD16875	Pch high-side switch for USB (Low-active)	2		0.1			• 8-pin plastic SOP	Keyboard, hub box
μPD16876	Pch high-side switch for USB (Low-active, output latch selective function)	1		0.08			• 8-pin plastic SOP	Note PC, keyboard

Audio IC

■ D/A Converter for Audio System

Part Number	Recommended Operating Voltage Range (V)	Function	Recommended Application			Package
			Home Stereo	Portable	Car Stereo	
μPD6376	4.5 to 5.5	16-bit D/A converter	●	●	●	• 16-pin plastic SOP
μPD6379	4.5 to 5.5 3.0 to 5.5	16-bit D/A converter	●	●	●	• 8-pin plastic SOP
μPD6379A						
μPD6379L						
μPD6379AL						
μPD63200	4.5 to 5.5	18-bit D/A converter	●	●	●	• 16-pin plastic SOP
μPD63210	4.5 to 5.5	16-bit D/A converter with digital filter	●	●	●	• 28-pin plastic SOP
μPD63210L	3.0 to 5.5					

Audio IC

■ Sound CODEC

Part Number	Function	Features	Package
μPD63310	Sound CODEC	• $\Delta\Sigma$ type ADCs and DACs are incorporated. • Mixers are incorporated into the analog input section and analog output section. • Low-noise microphone amplifiers are incorporated. • Sampling frequency: 2 to 48 kHz (master clock: 256 fs) • Single power source: +3 to 5.5 V • Operating temperature range: -20 to +80°C	• 80-pin plastic TQFP (Fine pitch)
μPD63335 *		• Two channels of $\Delta\Sigma$ type ADC and DAC • Built-in mixer in analog output block • Built-in multiplexer in analog input block • Low-noise microphone amplifiers • Sampling frequency: 0.4 to 48 kHz • Power supply: +3 to 3.6 V • Operating temperature range: -40 to +85°C	• 48-pin plastic TQFP (Fine pitch)

★: Under development

■ AC'97 CODEC

Part Number	Function	Features	Package
μPD63315 *	AC'97 CODEC	• AC'97 Rev. 2.1 compliant • Sample rate conversion support • 18-bit resolution A/D, D/A • Four analog stereo inputs: LINE, CD, AUX and video • Two analog mono inputs: speakerphone and PC BEEP • Two independent inputs for microphone • Power supply: +3.3 V • Power management support	• 48-pin plastic TQFP (Fine pitch)

★: Under development

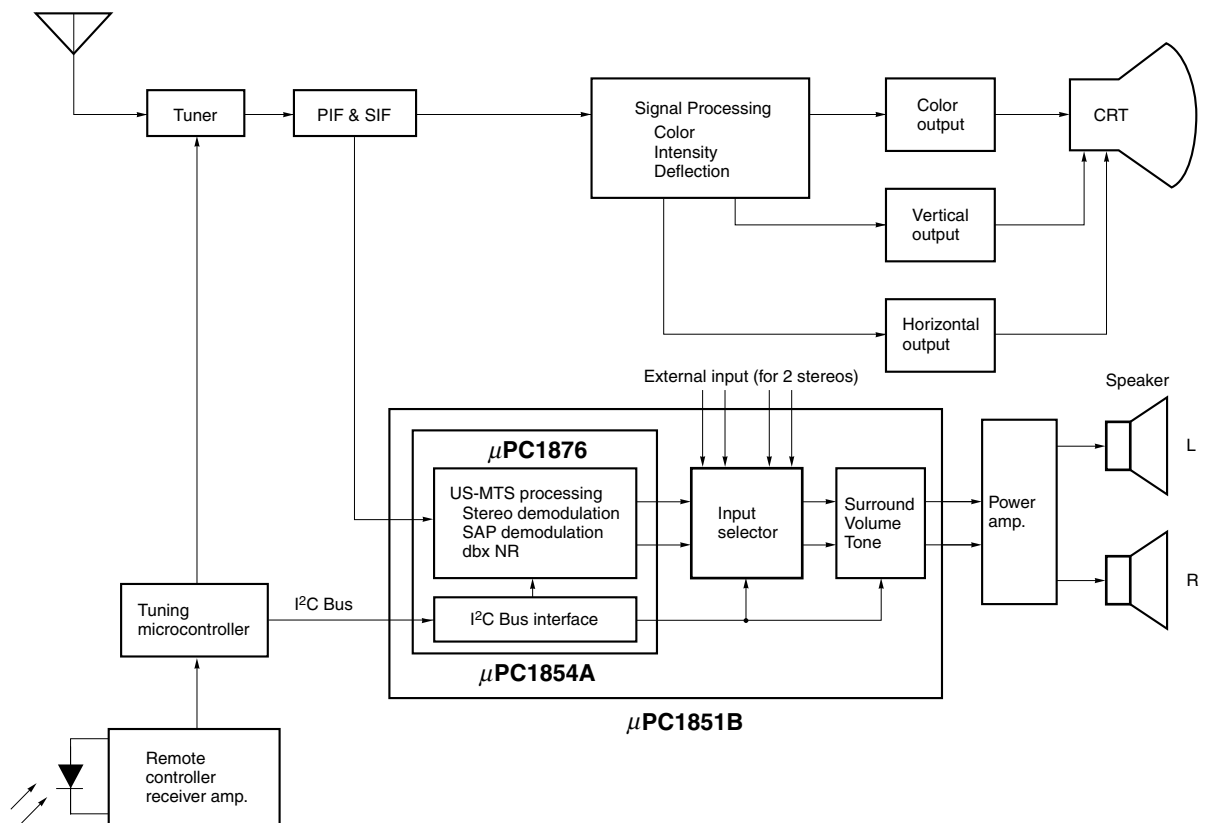
TV IC

■ US MTS Decoder

US MTS: Multi-channel television sound for USA specifications

Part Number	Function	Package
μPC1851B	I ² C Bus, input selector (2 ch), dbx NR, SAP decoder, tone/volume control	• 42-pin plastic SDIP
μPC1876	dbx NR, SAP decoder	• 42-pin plastic SSOP
μPC1854A	I ² C Bus, dbx NR, SAP decoder, normal output	• 28-pin plastic SDIP • 28-pin plastic SOP

■ US MTS (TV) System Block Diagram



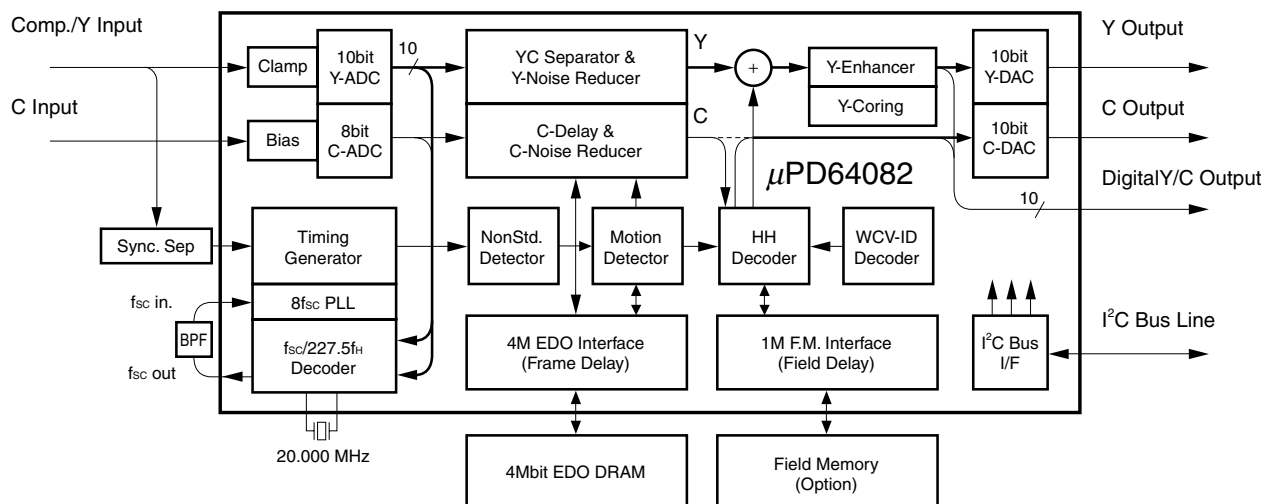
Remark MTS: Multichannel Television Sound
PIF: Picture Intermediate Frequency
SIF: Sound Intermediate Frequency

Digital Image IC

■ 3D Y/C Separator

Part Number	Function	Package
μPD64082	3D Y/C separator and noise reducer with 10-bit A/D converter	100-pin plastic QFP (14 × 20 mm)

■ 3D Y/C Separation System Block Diagram

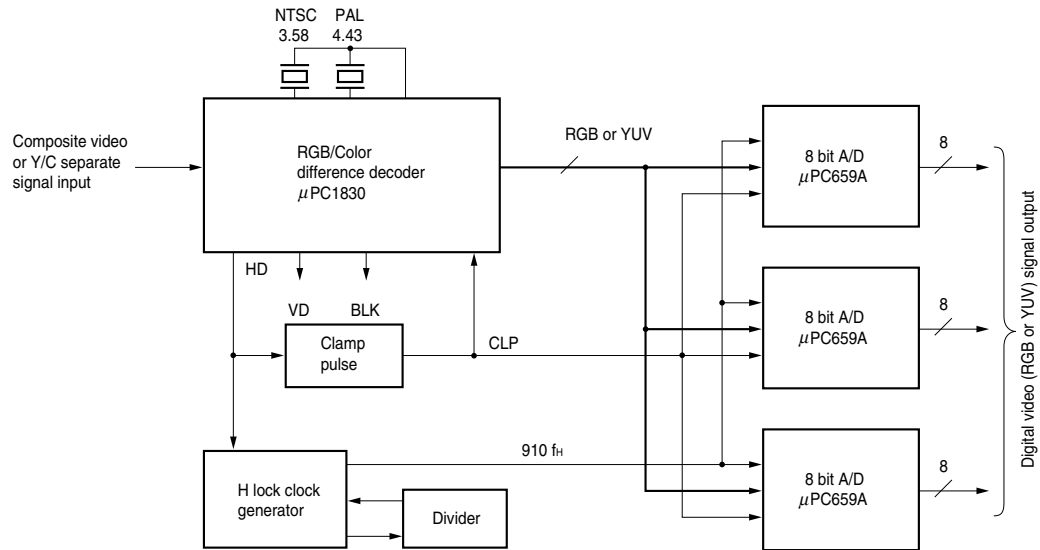


Digital Image IC

■ Analog Frontend IC

Part Number	Function	Package
μPC1830	5 V operation chroma decoder NTSC/PAL, 525/625 line, 50/60 Hz selectable, matrix circuit	• 42-pin plastic SSOP

■ Video Capture System Block Diagram



■ A/D Converter for Video Processing

Part Number	Resolution (bits)	Linearity (%FSR)	Sampling Time (MSPS)	Supply Voltage (V)	Data Format	Output Format	Package	Remarks
μPC659A	8	0.2	20	+5	Binary	8-bit parallel	• 24-pin plastic SOP	Parallel approximation Video processing

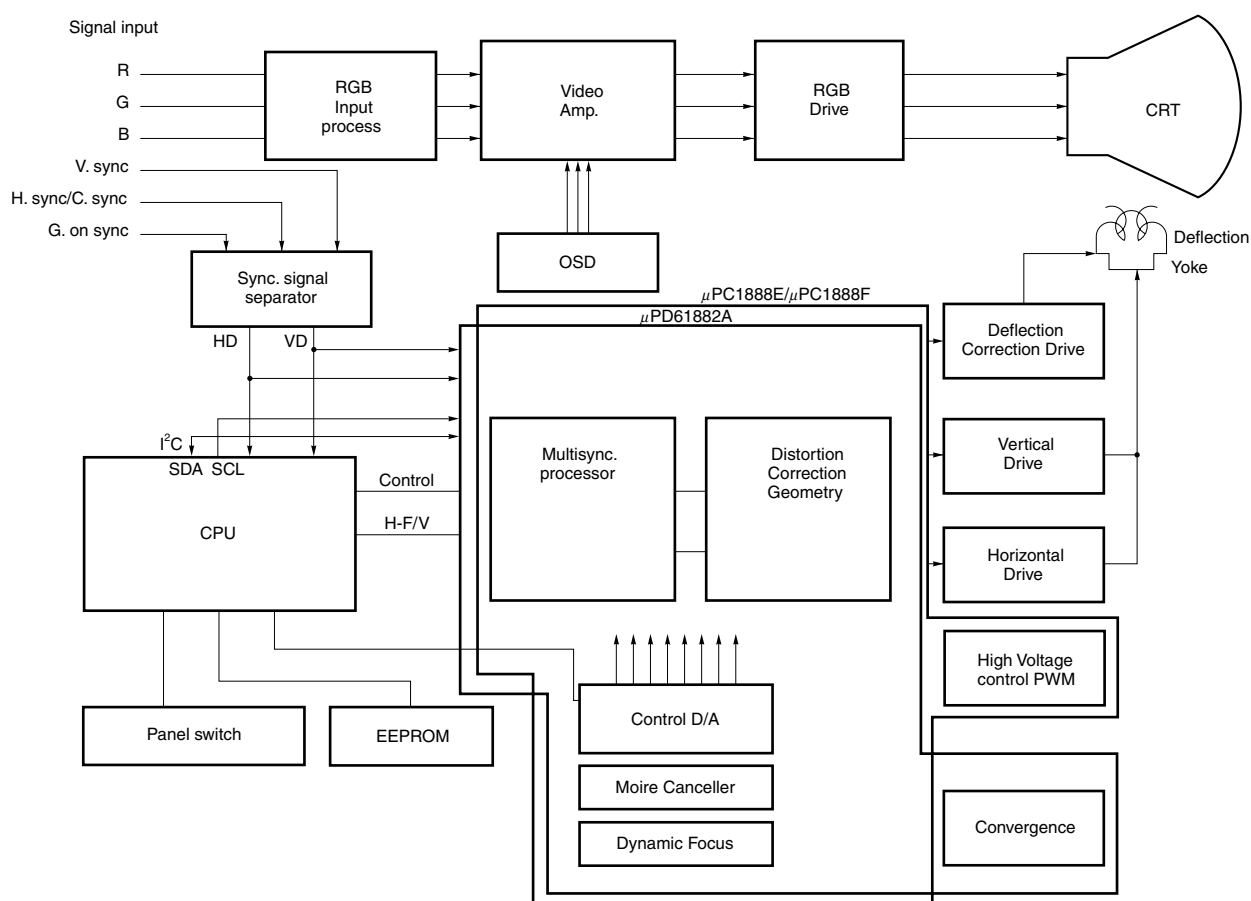
Multisync Monitor IC

■ Multisync Monitor IC

Part Number	Function	Package
μPC1888E	Horizontal vertical sync. processor, picture geometry processor (I ² C bus), dynamic focus only mix, EHT (horizontal and vertical), Target : Combine deflection type set	• 30-pin plastic SDIP
μPC1888F[☆]	Horizontal vertical sync. processor, picture geometry processor (I ² C bus), dynamic focus separate or mix, reference voltage output (5 V), Target : High voltage separate type set	• 30-pin plastic SDIP
μPD61882A	Horizontal vertical sync. processor, picture geometry processor (I ² C bus), convergence	• 64-pin plastic QFP

☆: Newly added product

■ Multisync Monitor System Block Diagram



Video Camera, Digital Still Camera IC

■ CCD Driver Circuit

Part Number	Function	Package
μPD16510	Area sensor vertical, VOD shutter driver, for low voltage logic	• 20-pin plastic SSOP
μPD16520	Area sensor vertical driver 10ch (3 state: 6, 2 state: 4), VOD shutter driver, for low voltage logic	• 38-pin plastic SSOP

On-screen Character Display IC

■ RGB Type

Part Number	μPD6461	μPD6462	μPD6467
Function			
Number of Character Types	256 (ROM)	128 (ROM)	512 (ROM)
Number of Display Characters	228 (12 lines × 24 columns)		336 (12 lines × 28 columns)
Character Configuration	12 (horizontal) × 18 (vertical)		
Character Color	Eight colors		
Character Size (Per Line)	× 1, × 2 (height and width at one time)		× 1, × 2, × 3, × 4 (height and width at one time)
Character Color Reverse	Black character/no fringed (per character)		Black character/no fringed White character/fringed
Background (Per Frame)	No background Blank background (eight colors) Filled background (eight colors)		
Fringed (Per Frame)	Two colors (black, white)		
Supply Voltage	2.7 to 5.5 V		2.0 to 3.6 V
Package	• 20-pin plastic SSOP • 24-pin plastic SOP	• 20-pin plastic SSOP	• 20-pin plastic SSOP

- Making ideally suited for camcoders (μPD6461, 6462, 6467)
- μPD6461 and μPD6462 are command compatible and pins compatible for 20-pin plastic SSOP package.
- μPD6467 has a blue background function and character mirror reverse function.
- μPD6467 has external dot clock frequency 2-divided function.

Clock IC

■ Clock IC

Part Number	I/O	Alarm	Supply Voltage (V)	Circuit Current (μ A)	Package
μ PD4990A	Serial	×	2.0 to 5.5	20	• 14-pin plastic DIP • 16-pin plastic SOP
μ PD4991A	4-bit parallel	○		14	• 18-pin plastic DIP • 20-pin plastic SOP
μ PD4992	8-bit parallel	×	2.4 to 5.5	6	• 20-pin plastic DIP • 20-pin plastic SOP

Rotary Encoder IC

■ Rotary Encoder IC

Part Number	Axis	Counter-bit	Supply Voltage (V)	Package
μPD4701A	2	12	5.0	• 24-pin plastic DIP • 24-pin plastic SOP
μPD4702	1	8		• 20-pin plastic DIP • 20-pin plastic SOP
μPD4704	1 (Expansion for μPD4702)			

Line Driver Receiver IC

■ Line Driver Receiver IC

Part Number	Driver	Receiver	Capacitor (μ F)	Supply Voltage (V)	Package
μ PD4721	2	2	0.33 to 4.7 (4 or 5 pcs)	3.3/5.0	• 20-pin plastic SSOP
μ PD4722	4	4	0.47 to 4.7 (4 or 5 pcs)		• 30-pin plastic SSOP
μ PD4723	3	3	0.33 to 4.7 (4 or 5 pcs)		
μ PD4724		5			
μ PD4726	4	7	1.0 to 4.7 (4 pcs)	5.0	• 36-pin plastic SSOP

General Purpose Linear IC

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Operational Amplifier

■ Low Noise

Part number	Number of circuits	V [±] (recommended value) (V) ^{Note 1}	V _{IO} (Max.) (mV)	I _{CC} (Max.) (mA)	SR (Typ.) (V/μs)	Features and Functions	Packages ^{Note 2}			Number of pins
							C	G2	HA	
μPC4556	2	±4 to ±16	±6	—	5.0	Wide band	○	○		8
μPC4557	2	±4 to ±16	±6	—	1.0	High output current	○			8
μPC4558	2	±4 to ±16	±6	—	1.0	Low noise	○	○		8
μPC4559	2	±4 to ±16	±6	—	2.0	Wide band	○			8
μPC4560	2	±4 to ±16	±6	—	2.8	High output current	○	○		8
μPC4570	2	±4 to ±16	±5	8.0	7.0	Super low noise, wide band	○	○	○	8 ^{Note 3}
μPC4572	2	±2 to ±7	±5	7.0	6.0	Super low noise, low voltage	○	○	○	8 ^{Note 3}
μPC4574	4	±4 to ±16	±5	12.0	6.0	Super low noise, wide band	○	○		14
μPC4741	4	±4 to ±16	±5	7.0	1.0	Low noise	○	○		14

■ Single Supply Voltage

Part number	Number of circuits	V [±] (recommended value) (V) ^{Note 1}	V _{IO} (Max.) (mV)	I _{CC} (Max.) (mA)	SR (Typ.) (V/μs)	Features and Functions	Packages ^{Note 2}			Number of pins
							C	G2	HA	
μPC324	4	+3 to +30	±7	2.0	0.3	Single supply voltage	○	○		14
μPC358	2	+3 to +30	±7	1.2	0.3	Single supply voltage	○	○	○	8 ^{Note 3}
μPC3403	4	+3 to +32	±7	7.0	0.8	High speed	○	○		14
μPC4742	2	+3 to +32	±5	5.5	7.0	High speed, wide band	○	○		8
μPC4744	4	+3 to +32	±5	11.0	7.0	High speed, wide band	○	○		14

■ J-FET Input

Part number	Number of circuits ^{Note 4}	V [±] (recommended value) (V) ^{Note 1}	V _{IO} (Max.) (mV)	I _{CC} (Max.) (mA)	SR (Typ.) (V/μs)	Features and Functions	Packages ^{Note 2}			Number of pins
							C	G2	HA	
μPC4061	1	±2 to ±16	±10	0.25	3.0	Micro-power	○	○		8
μPC4062	2	±2 to ±16	±10	0.5	3.0	Micro-power	○	○		8
μPC4064	4	±2 to ±16	±10	1.0	3.0	Micro-power	○	○		14
μPC4071	1	±5 to ±16	±10	2.7	13	Low noise	○	○		8
μPC4072	2	±5 to ±16	±10	5.0	13	Low noise	○	○	○	8 ^{Note 3}
μPC4074	4	±5 to ±16	±10	10.0	13	Low noise	○	○		14
μPC4081	1	±5 to ±16	±15	2.8	13	High speed	○	○		8
μPC4082	2	±5 to ±16	±15	5.6	13	High speed	○	○		8
μPC4084	4	±5 to ±16	±15	11.2	13	High speed	○			14
μPC4091	1	±5 to ±16	±2.5	3.4	15	High accuracy, high speed	○	○		8
μPC4092	2	±5 to ±16	±3	6.8	15	High accuracy, high speed	○	○		8
μPC4093	1	±5 to ±16	±2.5	3.4	25	High accuracy, high speed	○	○		8
μPC4094	2	±5 to ±16	±3	6.8	25	High accuracy, high speed	○	○		8

Notes 1. For product indicated by +/- voltage, single supply voltage operation is possible if the input/output voltage range is observed.

2. C, G2 or HA shows Package Type, as follows.

C : Plastic DIP

G2 : Plastic SOP

HA : 9-pin plastic slim SIP

3. HA has 9 pins.

4. Single type has an offset adjust pin.

Operational Amplifier

■ Micro-power

Part number	Number of circuits ^{Note 1}	V [±] (recommended value) (V) ^{Note 2}	V _{IO} (Max.) (mV)	I _{CC} (Max.) (mA)	SR (Typ.) (V/μs)	Features and Functions	Packages ^{Note 3}			Number of pins
							C	G2	HA	
μPC4250	1	±1 to ±16	±6	0.1	0 to 1.0	Wide supply voltage range	○	○		8

■ General Purpose

Part number	Number of circuits ^{Note 1}	V [±] (recommended value) (V) ^{Note 2}	V _{IO} (Max.) (mV)	I _{CC} (Max.) (mA)	SR (Typ.) (V/μs)	Features and Functions	Packages ^{Note 3}			Number of pins
							C	G2	HA	
μPC741	1	±7.5 to ±16	±6	2.8	0.5	Output short circuit protection	○	○		8
μPC1458	2	±7.5 to ±16	±6	5.6	0.5	Output short circuit protection	○	○		8

Notes 1. Single type has a offset adjust pin.

2. For product indicated by +/- voltage, single supply voltage operation is possible if the input/output voltage range is observed.

3. C, G2 or HA shows Package Type, as follows.

C : Plastic DIP

G2 : Plastic SOP

HA : 9-pin plastic slim SIP

Comparator

■ Comparator

Part number	Number of circuits	V [±] (recommended value) (V)	V _{IO} (Max.) (mV)	I ⁺ (Max.) (mA)	t _d (Typ.) (μs)	Features and Functions	Packages ^{Note 1}			Number of pins
							C	G2	HA	
μPC311	1	+5 to +32	±7.5	7.5	0.2	High speed	○	○		8
μPC319	2	+5 to +32	±8.0	12.5	0.08	High speed	○	○		14
μPC339	4	+2 to +32	±5.0	2.0	1.3	Single supply voltage	○	○		14
μPC393	2	+2 to +32	±5.0	1.0	1.3	Single supply voltage	○	○	○	8 ^{Note 2}

Notes 1. C, G2 or HA shows Package Type, as follows.

C : Plastic DIP

G2 : Plastic SOP

HA : 9-pin plastic slim SIP

2. HA has 9 pins.

Power Supply IC

■ Series Regulator

Type	Part number	Output Current (A)	Output voltage (V)																Absolute maximum ratings		Packages	Remarks
			1.8	2.5	2.6	3	3.3	4	5	6	7	7.8	8	9	10	12	15	18	Input voltage (V)	Total power dissipation (W) Note 1		
Positive voltage	μPC78L00 series ^{Note 2}	0.1							○	○	○		○		○	○	○		30 ^{Note 3}	0.7 2 ^{Note 4}	• TO-92 • SOT-89	3-terminal
	μPC29L00 series ^{Note 2}	0.1				○	○	○	○										16	0.7 2 ^{Note 4}	• TO-92 • SOT-89	Low dropout, 3-terminal
	μPC29M00 series ^{Note 2}	0.5				○				○	○		○	○	○	○			20	15 10 10	• MP-45G ^{Note 5} • MP-3 ^{Note 6} • MP-3Z ^{Note 7}	Low dropout, 3-terminal
	μPC29M00A series ^{Note 2☆}	0.5					○		○										20	15 10 10	• MP-45G ^{Note 5} • MP-3 ^{Note 6} • MP-3Z ^{Note 7}	Low dropout, 3-terminal
	μPC2900 series ^{Note 2}	1.0				○				○	○		○	○	○	○			20	15 10 10	• MP-45G ^{Note 5} • MP-3 ^{Note 6} • MP-3Z ^{Note 7}	Low dropout, 3-terminal
	μPC2918 [☆]	1.0	○																20	10 10	• MP-3 ^{Note 6} • MP-3Z ^{Note 7}	Low dropout, 3-terminal
	μPC2925 [☆]	1.0		○															20	10 10	• MP-3 ^{Note 6} • MP-3Z ^{Note 7}	Low dropout, 3-terminal
	μPC2926 [☆]	1.0			○														20	10 10	• MP-3 ^{Note 6} • MP-3Z ^{Note 7}	Low dropout, 3-terminal
	μPC2900A series ^{Note 2☆}	1.0					○		○										20	15 10 10	• MP-45G ^{Note 5} • MP-3 ^{Note 6} • MP-3Z ^{Note 7}	Low dropout, 3-terminal
	μPC24M00A series ^{Note 2}	0.5							○	○	○		○	○	○	○	○		36	15	• MP-45G ^{Note 5}	Low dropout, 3-terminal
	μPC2400A series ^{Note 2}	1.0							○	○	○		○	○	○	○	○		36	15	• MP-45G ^{Note 5}	Low dropout, 3-terminal
	μPC24A00 series ^{Note 2}	2.0							○							○	○		36	20	• MP-45G ^{Note 5}	Low dropout, 3-terminal
	μPC29S78 [☆]	0.1											○						20	1.2 1.2 0.48	• TO-126 (4-pin) • TO-126 (4-pin) Gull wing • 8-pin plastic SOP	Low dropout, with ON/OFF function
	μPC29S10 [☆]	0.1													○				20	0.48	• 8-pin plastic SOP	Low dropout, with ON/OFF function
	μPC3000 series ^{Note 2☆}	1.0	○	○															20	10 10	• MP-3Z ^{Note 7} (5-pin) • MP-3 ^{Note 6} (5-pin)	Low dropout, with ON/OFF function
	μPC305 [☆]	0.05	Adjustable output range: 4.5 to 30 V																40	0.44	• 8-pin plastic SOP	Adjustable output
	μPC317 [☆]	1.5	Adjustable output range: 1.3 to 30 V																40	15	• MP-45G ^{Note 5}	Adjustable output, 3-terminal
Negative voltage	μPC79L00 series ^{Note 2☆}	0.1							○				○			○	○		-30 ^{Note 8}	0.7	• TO-92	3-terminal
	μPC337 [☆]	1.5	Adjustable output range: -1.3 to 30 V																-40	15	• MP-45G ^{Note 5}	Adjustable output, 3-terminal

☆: Newly added product

Notes 1. Limited by internal circuit

2. It refers to the series name.

3. μPC78L10, μPC78L12 and μPC78L15 : 35 V

4. With 16 cm² × 0.7 mm ceramic substrate

5. TO-220 plastic insulated package

6. Similar TO-251

7. Similar TO-252

8. μPC79L12 and μPC79L15 : -35 V

Power Supply IC

■ Shunt Regulator

Part number	Output current (A)	Output voltage (V)	Absolute maximum ratings		Packages	Remarks
			Input voltage (V)	Total power dissipation (W)		
μPC1093	0.15	2.5 to 36	37	0.48	8-pin plastic SOP	
				0.7	TO-92	
				2 ^{Note 1}	SOT-89	
				0.51 ^{Note 2}	SC-74A	
μPC1943	0.05	1.26 to 24	25	1.6 ^{Note 1}	SOT-89	Low voltage
μPC1944	0.05	1.26 to 24	25	0.56	TO-92	Low voltage (μPC1093 pin compatible)
				0.385	8-pin plastic SOP	
				1.6 ^{Note 1}	SOT-89	
μPC1945	0.015	1.26 to 5	6	0.09	SC-74A	Low voltage

Notes 1. With $16 \text{ cm}^2 \times 0.7 \text{ mm}$ ceramic substrate

2. With $75 \text{ cm}^2 \times 0.7 \text{ mm}$ ceramic substrate

Power Supply IC

■ Switching Regulator Control Circuit

Part number	Input voltage range (V)	Absolute maximum ratings		Packages	Oscillation frequency (KHz)	Output circuit operation mode	Remarks
		Output current (mA)	Total power dissipation (W)				
μ PC494	7 to 40	250	0.78 ^{Note 1}	16-pin plastic SOP (9.53 mm (375))	1 to 300	Push-pull/Single selectable	General purpose
			0.65 ^{Note 1}	16-pin plastic SOP (7.26 mm (300))			
μ PC1094	11 to 24	1200 (peak)	0.55	14-pin plastic SOP	50 to 500	Totem pole circuit configuration Single mode	AC-DC primary control
μ PC1099	11.5 to 24	1200 (peak)	0.694	16-pin plastic SOP	50 to 500	Totem pole circuit configuration Single mode	AC-DC primary control
μ PC1100	3.6 to 40	25	0.694	16-pin plastic SOP	1 to 500	2 outputs (synchronous control possible). If one output is shorted, both outputs will be turned off	AC-DC primary control
μ PC1150	3.6 to 40	25	0.694	16-pin plastic SOP	1 to 500	2 outputs (synchronous control possible). If one output is shorted, only the output will be turned off	DC/DC converter
μ PC1905	12 to 30	1200 (peak)	0.694	16-pin plastic SOP	50 to 500	Totem pole circuit configuration Single mode	AC-DC primary control
μ PC1933	2.5 to 20	20	0.48	16-pin plastic SOP	20 to 800	Open drain, 1 output	DC/DC converter
μ PC1934	2.5 to 20	20	0.417	16-pin plastic SSOP	20 to 1000	Open drain, 2 outputs	DC/DC converter
			0.4	16-pin plastic TSSOP			
μ PC1935	2.5 to 20	20	0.4	16-pin plastic TSSOP	20 to 800	Open drain, 3 outputs	DC/DC converter
μ PC1909	7 to 24	1200 (peak)	1	16-pin plastic DIP	50 to 500	Totem pole circuit configuration Q ₁ /Q ₂ outputs	AC-DC primary control, ZCS ^{Note 2}
			0.694	16-pin plastic SOP			

Notes 1. With 25 cm² × 0.7 mm ceramic substrate.

2. It is necessary to obtain license from Vicor Corporation before using the μ PC1909 in an active-clamp type.

Functional Block

■ Functional Block

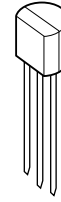
Function	Part number	Features	Package
Analog Multiplexer	μ PD5205	Single-pole 8 position mode/double-pole 4 position mode Supply Voltage: 44 V, ON Resistance: 270 Ω TYP.	• 24-pin plastic shrink DIP • 24-pin plastic SOP
Precision Timer	μ PC1555	CR Timer, Operating Temperature: -20 ~ +80°C Supply Voltage: 4.5 ~ 16 V, Free Running Frequency: 0.1 ~ 100 kHz	• 8-pin plastic DIP • 8-pin plastic SOP
	μ PD5555	CMOS OR Timer, CMOS Type of μ PC1555 Supply Voltage: 3 ~ 16 V, Free Running Frequency: 0.1 ~ 500 kHz	• 8-pin plastic DIP • 8-pin plastic SOP
	μ PD5556	CMOS CR Timer Dual Type of μ PD5555	• 14-pin plastic DIP • 14-pin plastic SOP

Transistor/Diode/Thyristor

Bipolar Transistor	338
Field Effect Transistor	362
• Small Signal FET	362
• Power MOS FET	365
Transistor with Internal Resistor	385
Transistor for Array	391
Transistor Array	393
Zener Diode.....	397
Noise Clipping Diode	399
Thyristor	401

Bipolar Transistor

Quick Reference by Package



TO-92

■ TO-92 Type

V_{CE0} (V) I_C (A)	up to 15	up to 30	up to 50	up to 70	up to 100	up to 150	up to 200	up to 250	up to 400
up to 20 m		2SC1674							
up to 50 m	2SA1206 ^{Note 1}					2SA988 2SA992 2SC1841 2SC1845			
up to 100 m			2SA733 2SA990 2SC945 2SC1842 2SC1843 AA1[] AA1[]		2SA675 ^{Note 2}		2SA1376 2SA1376A 2SC3478	2SA1544 2SC3478A	
up to 200 m	2SC2901 ^{Note 1}		2SC3622 ^{Note 3} (150 mA) 2SC3622A ^{Note 3} (150 mA)						
up to 500 m			2SC3615 ^{Note 3} (300 mA)	2SA953 2SC2002	2SA954 2SC2003				2SA1625
up to 1.0		2SA952 2SC2001 2SC3616 ^{Note 3} (25 V/ 700 mA) AB1[] (25 V/ 700 mA) AP1[] (25 V/ 700 mA)	2SB1116 2SD1616	AD1[] AD2[] ^{Note 4} AR1[] 2SB1116A (60 V) 2SD1616A (60 V) 2SD1701 ^{Note 4} (60 V)	2SD1698 (80 V)				
up to 2.0		2SD1513 (16 V/2.0 A) 2SB1068 (16 V/2.0 A) AQ1[] (20 V/2.0 A)							
up to 3.0		2SB1300 (16 V/3 A)							

 : Darlington transistor

Notes 1. High speed switching

2. V_{CES}

3. High h_{FE} transistor

4. Contains internal zener diode

Bipolar Transistor



SST

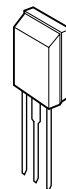
■ SST Type

V_{CE0} (V) I_C (A)	up to 15	up to 20	up to 30	up to 50	up to 120
up to 20 m		2SC2786	2SC2787		
up to 50 m	2SA1459 ^{Note 1}				2SC2784
up to 100 m				BA1[] BN1[]	
up to 200 m	2SC3732 ^{Note 1}			2SA1458 ^{Note 1} (40 V) 2SC3623 ^{Note 2} (150 mA) 2SC3623A ^{Note 2} (150 mA) 2SC3731 ^{Note 2} (40 V)	
up to 700 m		2SB810 2SD1020	BB1[] (25 V) BP1[] (25 V)		

Notes 1. High speed switching

2. High h_{FE} transistor

Bipolar Transistor



SP-8

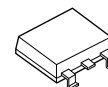
■ SP-8 Type

V_{CE0} (V) I_C (A)	up to 16	up to 25	up to 50	up to 80	up to 140	up to 160	up to 300	up to 400	up to 600
up to 50 m					2SA915 2SC1940	2SA916 2SC1941			
up to 200 m							2SC3209 2SC4000 (250 V/ 100 mA)		
up to 500 m					2SA1221 2SC2958	2SA1222 2SC2959			
up to 700 m			2SB605 2SD571 2SC2721						
up to 1.0		2SB564 2SD471	2SA1460 ^{Note 1} 2SB734 ^{Note 1} 2SC3733 ^{Note 1} 2SD774 ^{Note 2} 2SD1582 ^{Note 2}	2SB984 2SB1093 2SD1312 2SD1579 2SD1697 (800 mA) 2SD1700 ^{Note 3} (60 V/ 800 mA) 2SD1843 ^{Note 3} (60 V)					2SA1627
up to 2.0	2SB733 2SD773	2SD1581 ^{Note 2}	2SD2463 ^{Note 3} (31 V)	2SD1779 ^{Note 2} (60 V) 2SD1780 ^{Note 2} (60 V) CE1[] ^{Note 3} (60 V) CE2[] ^{Note 2} (60 V)				2SA1626	
up to 3.0		2SB1117			2SB1318 (100 V)				
up to 5.0		2SA1897 (20 V)							

 : Darlington transistor

- Notes**
1. High speed switching
 2. High h_{FE} transistor
 3. Internal zener diode

Bipolar Transistor

TO-251
(MP-3)TO-252
(MP-3Z)

■ TO-251 (MP-3), TO-252 (MP-3Z) Type

V_{CE0} (V) $I_{C(DC)}$ (A)	up to 20	up to 40	up to 60	up to 100	up to 150	up to 300	up to 400	up to 600
up to 0.5							2SA1400 2SC3588	
up to 1.0			2SB963 2SD1286					2SA1413 2SC3632
up to 2.0	2SD1583○	2SD992	2SD1164		2SB768 2SD1033	2SC2885 2SC2946	2SA1412 2SC3631	
up to 3.0		2SB962◎	2SD1584○ 2SB1261◎ 2SD1899◎					
up to 5.0			2SA1385◎ 2SC3518◎ 2SA1648◎ 2SC4332◎	2SA1647◎ 2SC4331◎			2SC4346	
up to 10	2SA1615◎	2SA1649◎						

□ : Darlington transistor, [: Complementary pair, ○ : Single High h_{FE} , ◎ : Low $V_{CE(sat)}$

The name of TO-252 (MP-3Z) is represented with the suffix “-Z” added to the standard part number.

TO-126
(MP-5)

■ TO-126 (MP-5) Type

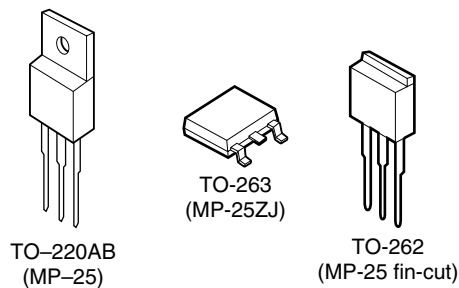
V_{CE0} (V) $I_{C(DC)}$ (A)	up to 45	up to 60	up to 80	up to 120	up to 160	up to 300	up to 400	up to 600
up to 0.1						2SA1546 2SC4001		
up to 0.5						2SC2688	2SA1156 2SC2752	
up to 1.0		2SD1630 ^{Note}		2SD415				2SA1486 2SC3840
up to 2.0	2SD1695 ^{Note}	2SB794 2SD985	2SB795 2SD986	2SC2690	2SC2690A			
up to 3.0	2SD794 2SB772◎ 2SD882◎	2SD794A 2SB1150 ^{Note} 2SD1693 ^{Note} 2SD1694○ 2SB1217◎ 2SD1818◎		2SB1149 2SD1692 2SA1714★ 2SC4342				
up to 5.0		2SB1151◎ 2SD1691◎						

□ : Darlington transistor, [: Complementary pair, ◎ : Low $V_{CE(sat)}$, ○ : Single High h_{FE}

★ : Newly added product

Note Internal zener diode between C-B

Bipolar Transistor



■ TO-220AB (MP-25) Type

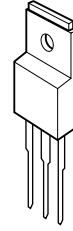
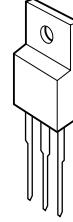
V_{CE0} (V) $I_{C(DC)}$ (A)	up to 40	up to 60	up to 80	up to 100	up to 150	up to 300	up to 400
up to 0.5						2SC1505	
up to 2.0		2SD1481 ☆ 2SB1669 ☆		2SA1008 2SC2331	2SB546A 2SD401A	2SA1009	2SA1009A 2SC2333
up to 5.0		2SA1069	2SA1069A	2SB601 2SD560 2SC2517			2SC2518
up to 7.0	2SA1129 2SC2654 ☆	2SB707	2SB708	2SA1010 2SC2334 2SA1645◎			2SC2335
up to 10				2SA1646◎			

□ : Darlington transistor, [: Complementary pair, ◎: Low $V_{CE(sat)}$

☆ : Newly added product

The names of TO-263 (MP-25ZJ) and TO-262 (MP-25 fin-cut) are represented with the suffix “-Z” and “-S” added to the standard part number, respectively

Bipolar Transistor

Isolated TO-220
(MP-45)Isolated TO-220
(MP-45F)

■ Isolated TO-220AB (MP-45F, MP-45) Type

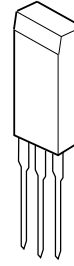
V_{CE0} (V) Package $I_{C(DC)}$ (A)	up to 60		up to 100		up to 300	up to 400
	MP-45	MP-45F	MP-45	MP-45F	MP-45	MP-45
up to 2.0			2SA1395 2SC3567		2SB1465 ☆	2SC3569
up to 3.0	2SB1094 2SD1585	2SB1453 2SD2164 ○				
up to 5.0	2SA1394 2SC4351 Note	2SA1741 ◎ 2SC4549 ◎	2SA1650 ◎	2SB1430 2SD2161	2SD1592	2SC3570
up to 6.0				2SD2165 ○		
up to 7.0	2SB1097 2SD1588	2SA1742 ◎ 2SC4550 ◎		2SC4553 ○		2SC3571
up to 8.0				2SB1431 2SD2162		
up to 10		2SA1743 ◎ 2SC4551 ◎	2SA1396 2SC3568 2SA1652 ◎ 2SC4336 ◎ 2SA1720	2SB1432 2SD2163		2SC3572
up to 15		2SA1744 ◎ 2SC4552 ◎		2SC4554 ○		

 : Darlington transistor, : Complementary pair, ◎: Low $V_{CE(sat)}$, ○ : Single High h_{FE}

☆ : Newly added product

Note Internal zener diode between C-B

Bipolar Transistor



MP-10

■ MP-10 Type

V_{CEO} (V) $I_{C(DC)}$ (A)	up to 60	up to 100
up to 2.5		2SC4814 ○
up to 5	2SA1843 ◎ 2SC4815 ◎	2SA1840 2SC4810 2SA1845 ◎
up to 7		2SC4813 ○
up to 8		2SA1841 2SC4811
up to 10		2SA1847 ◎

□ : Darlington transistor, [] : Complementary pair, ◎: Low $V_{CE(sat)}$, ○: Low $V_{CE(sat)}$ High h_{FE}



SC-59
(Mini mold)

■ SC-59 (Min Mold) Type

V_{CEO} (V) I_C (mA)	up to 15	up to 20	up to 30	up to 40	up to 50	up to 60	up to 80	up to 120	up to 200	up to 300
up to 20		2SC2223								2SD2383
up to 30				2SA1226						
up to 50	2SA1462		2SC1009A					2SA811A 2SC1622A	2SC1653 (130 V) 2SC1654 (160 V)	
up to 100					2SA812 2SC1623 FA1[] FN1[]				2SA1330 2SC3360	
up to 150					2SC3624 2SC3624A					
up to 200	2SC3735	2SC1621		2SA1461 2SC3734						
up to 300						2SB736 2SD780	2SB736A 2SD780A			
up to 500				2SA1464 2SC3739						
up to 700			2SB624 (-25 V) 2SD596 (25 V) FB1[] (25 V) FP1[] (-25 V)							

Bipolar Transistor

SC-62
(Power mini mold)

■ SC-62 (Power Mini Mold) Type

V_{CE0} (V) I_C (A)	up to 20	up to 25	up to 50	up to 60	up to 80	up to 100	up to 120	up to 140	up to 300
up to 50 m								2SC2780	
up to 200 m									2SC3554
up to 300 m			2SC3617		2SB800 2SD1001				
up to 0.7		2SC3618	2SB799 2SD1000			2SB805 2SD1006	2SB806 2SD1007		
up to 1.0		2SB798 2SD999	2SA1463 2SB1115 2SC3736 2SD1615 2SD1702	2SB1115A 2SF1615A HD1[] HD2[] HR1[]	2SB804 2SD1005 2SD1699				
up to 2.0	2SB1114 2SD1614 HQ1[]	2SD1950							
up to 3.0	2SB1628 (16 V)			2SB1572 2SD2403					
up to 5.0			2SB1571 (30 V) 2SD2402 (30 V)						

 : Darlington connection
SC-84
(MP-2)

■ SC-84 (MP-2) Type

V_{CE0} (V) I_C (A)	up to 60	up to 600
up to 1.0		2SA1871 2SC4942
up to 5.0	2SB1578 2SD2425	

Bipolar Transistor



SC-70
(SSP)

■ SC-70 (SSP) Type

V_{CE0} (V) I_C (mA)	up to 15	up to 20	up to 30	up to 40	up to 50	up to 120
up to 20		2SC4178				
up to 50	2SA1610		2SC4179			2SA1612 2SC4180
up to 100					2SA1611 2SC4177 GA1[] GN1[]	
up to 150					2SC4181	
up to 200	2SC4176	2SC4175				
up to 500			2SB1475 (-25 V) 2SD2228 (25 V)	2SA1608 2SC4173		

■ SC-75 (USM)

V_{CE0} (V) I_C (mA)	up to 50
up to 100	2SA1836 2SC4783



SC-75
(USM)

Bipolar Transistor

Quick Reference Table by Function/Application

■ Small Signal Transistor (1/2)

	TO-92	SP-8	SST	SC-70 (SSP)	SC-59 (Mini Mold)	SC-62 (Power Mini)
FM/FM RF RF/MIX/CON	2SC1674		2SC2786	2SC4178	2SC2223	
FM AM/FM/AM MIX/OSC/IF			2SC2787	2SC4179	2SC1009A	
Audio Frequency Amplification	2SA733			2SA1611	2SA812	
	2SA988			2SA1612	2SA811A	
	2SC945			2SC4177	2SC1623	
	2SC1841			2SC4180	2SC1622A	
	2SC3622/A		2SC3623/A	2SC4181	2SC3624/A	
Low Noise Amplification	2SA992					
	2SC1845		2SC2784			
Driver Output	2SA952		2SB810		2SB624	
	2SA953				2SB736	
	2SA954				2SB736A	2SB800
	2SA1376				2SA1330	
		2SB564				2SB798
		2SB605				2SB799
	2SB1068					2SB1114
	2SB1116					2SB1115
	2SB1116A					2SB1115A
	2SC2001		2SD1020		2SD596	
	2SC2002				2SD780	
	2SC2003				2SD780A	2SD1001
	2SC3478				2SC3360	
		2SC1940			2SC1653	2SC2780
		2SC1941			2SC1654	
		2SC3209				2SC3554
	2SC3615					2SC3617
	2SC3616					2SC3618
		2SD471				2SD999
		2SE571				2SD1000
	2SD1513					2SD1614
	2SD1616					2SD1615
	2SD1616A					2SD1615A
	2SD1698	2SD1697				2SD1699
	2SD1701	2SD1700				2SD1702
		2SD1581				2SD1950

Bipolar Transistor

■ Small Signal Transistor (2/2)

	TO-92	SP-8	SST	SC-70 (SSP)	SC-59 (Mini Mold)	SC-62 (Power Mini)
Switching	2SA1206		2SA1459	2SA1610	2SA1462	
				2SA1608	2SA1464	
		2SA1460				2SA1463
			2SA1458		2SA1461	
				2SC4173	2SC3739	
	2SC2901		2SC3732	2SC4176	2SC3735	
		2SC3733				2SC3736
			2SC3731		2SC3734	

Bipolar Transistor

■ Power Transistor (Low $V_{CE(sat)}$)

Charac- teristics V_{CE0} , $I_{C(DC)}$	SP-8	SC-84 (MP-2)	TO-251 (MP-3)	TO-126 (MP-5)	TO-220AB (MP-25)	MP-10	Isolated TO-220 (MP-45)	Isolated TO-220 (MP-45F)
16 V, 3 A		2SB1581						
20 V, 10 A	2SA1897 (5A)		2SA1615					
25 V, 3 A	2SB1117							
30 V, 3 A			2SB962	2SB772 2SD882				
30 V, 10 A			2SA1649					
60 V, 3 A			2SB1261 2SD1899	2SB1217 2SD1818				
60 V, 5 A		2SB1578 2SD2425	2SA1385 2SC3518	2SB1151 2SD1691		2SA1843 2SC4815		
			2SA1648					2SA1741 2SC4549
60 V, 7 A								2SA1742 2SC4550
60 V, 10 A								2SA1743 2SC4551
60 V, 15 A								2SA1744 2SC4552
100 V, 5 A			2SA1647 2SC4331			2SA1845	2SA1650	
100 V, 7 A					2SA1645			
100 V, 10 A					2SA1646	2SA1847	2SA1652 2SC4336	

■ Power Transistor (High h_{FE})

Charac- teristics V_{CE0} , $I_{C(DC)}$	SP-8	TO-251 (MP-3)	TO-126 (MP-5)	MP-10	Isolated TO-220 (MP-45)	Isolated TO-220 (MP-45F)
20 V, 2 A		2SD1583				
25 V, 2 A	2SD1581					
50 V, 1 A	2SD1582					
60 V, 3 A		2SD1584	2SD1694			2SD2164
100 V, 2.5 A				2SC4814 ^{Note}		
100 V, 6 A						2SD2165
100 V, 7.5 A				2SC4813 ^{Note}		2SC4553 ^{Note}
100 V, 15 A						2SC4554 ^{Note}

Note Low $V_{CE(sat)}$ & High h_{FE}

Bipolar Transistor

■ Power Transistor (Low Voltage, High Speed Switching)

Characteristics V_{CE0} , $I_{C(DC)}$	SP-8	TO-220AB (MP-25)	Isolated TO-220 (MP-45)
45 V, 1 A	$\left\{ \begin{array}{l} 2SA1460 \\ 2SC3733 \end{array} \right.$		
60 V, 5 A		2SA1069	2SA1394
100 V, 2 A		$\left\{ \begin{array}{l} 2SA1008 \\ 2SC2331 \end{array} \right.$	$\left\{ \begin{array}{l} 2SA1395 \\ 2SC3567 \end{array} \right.$
100 V, 5 A		2SC2517	
100 V, 7 A		$\left\{ \begin{array}{l} 2SA1010 \\ 2SC2334 \end{array} \right.$	
100 V, 10 A			$\left\{ \begin{array}{l} 2SA1396 \\ 2SC3568 \end{array} \right.$

$\left[\right.$: Complementary pair

■ Power Transistor (High Voltage, High Speed Switching)

Characteristics V_{CE0} , $I_{C(DC)}$	TO-251 (MP-3)	TO-126 (MP-5)	TO-220AB (MP-25)	Isolated TO-220 (MP-45)
200 V, 2 A	2SC2885 2SC2946 2SC2946(1)			
350 V, 2 A			2SA1009	
400 V, 0.5 A	$\left\{ \begin{array}{l} 2SA1400 \\ 2SC3588 \end{array} \right.$	$\left\{ \begin{array}{l} 2SA1156 \\ 2SC2752 \end{array} \right.$		
400 V, 2 A	$\left\{ \begin{array}{l} 2SA1412 \\ 2SC3631 \end{array} \right.$		2SA1009A 2SC2333	2SC3569
400 V, 5 A	2SC4346		2SC2518	2SC3570
400 V, 7 A				2SC3571
400 V, 10 A				2SC3572
600 V, 2 A	$\left\{ \begin{array}{l} 2SA1413 \\ 2SC3632 \end{array} \right.$	$\left\{ \begin{array}{l} 2SA1486 \\ 2SC3840 \end{array} \right.$		

$\left[\right.$: Complementary pair

Bipolar Transistor

■ Power Transistor (Audio Frequency Amplification)

Characteristics V_{CEO} , $I_{C(DC)}$	TO-251 (MP-3)	TO-126 (MP-5)	TO-220AB (MP-25)	Isolated TO-220 (MP-45)
45 V, 3 A		2SD794		
60 V, 3 A		2SD794A		[2SB1094 2SD1585
60 V, 7 A			2SB707	[2SB1097 2SD1588
80 V, 7 A			2SB708	
100 V, 0.8 A		2SD415		
150 V, 2 A	[2SB768 2SD1033		[2SB546A 2SD401A	

[: Complementary pair

■ Power Transistor (High Frequency Amplification)

Characteristics V_{CEO} , $I_{C(DC)}$	SP-8	TO-126 (MP-5)	TO-220AB (MP-25)
40 V, 7 A			2SA1129
120 V, 1.2 A		2SC2690	
160 V, 1.2 A		2SC2690A	
250 V, 0.1 A	2SC4000	[2SA1546 2SC4001	
300 V, 0.2 A		2SC2688	2SC1505

[: Complementary pair

Bipolar Transistor

■ Power Transistor (Darlington)

Charac- teristics V _{CEO} , I _{C(DC)}	SP-8	TO-251 (MP-3)	TO-126 (MP-5)	TO-220AB (MP-25)	MP-10	Isolated TO-220 (MP-45)	Isolated TO-220 (MP-45F)
31 V, 2 A	2SD2463 ^{Note}		2SD1695 ^{Note}				
60 V, 0.8 A	2SD1700 ^{Note}						
60 V, 1 A	2SD1843	{ 2SB963 2SD1286	2SD1630 ^{Note}				
60 V, 1.5 A		2SD1164	{ 2SB794 2SD985				
60 V, 3 A			{ 2SB1150 ^{Note} 2SD1693 ^{Note}				
60 V, 5 A						2SC4351 ◎	
80 V, 0.8 A	2SD1697						
80 V, 1.5 A	{ 2SB1093 2SD1579		{ 2SB795 2SD986				
100 V, 3 A			{ 2SB1149 2SD1692 2SC4342 ◎				
100 V, 5 A				{ 2SB601 2SD560	{ 2SA1840 ◎ 2SC4810 ◎		{ 2SB1430 2SD2161
100 V, 8 A					{ 2SA1841 ◎ 2SC4811 ◎		{ 2SB1431 2SD2162
100 V, 10 A						2SA1720 ◎	{ 2SB1432 2SD2163
300 V, 5 A						2SD1592	

{ : Complementary pair, ◎ : High speed darlington transistor

Note Internal zener diode between C-B

Bipolar Transistor

■ 2SA type (Polarity:PNP) (1/2)

Part Number	Mounting Type	Package	V _{CEO}	I _{C(DC)}	P _T	h _{FE}	
			Max.(V)	Max.(A)	Max.(W)	Min.	Max.
2SA675	Through-hole type	TO-92	80	0.1	0.25	50	300
2SA733	Through-hole type	TO-92	50	0.1	0.25	90	600
2SA811A	Surface mount type	SC-59 (Mini Mold)	120	0.05	0.2	135	900
2SA812	Surface mount type	SC-59 (Mini Mold)	50	0.1	0.2	90	600
2SA915	Through-hole type	SP-8	120	0.05	1	90	400
2SA916	Through-hole type	SP-8	160	0.05	1	90	400
2SA952	Through-hole type	TO-92	25	0.7	0.6	90	400
2SA953	Through-hole type	TO-92	60	0.3	0.6	90	400
2SA954	Through-hole type	TO-92	80	0.3	0.6	90	400
2SA988	Through-hole type	TO-92	120	0.05	0.5	200	800
2SA990	Through-hole type	TO-92	50	0.1	0.25	200	800
2SA992	Through-hole type	TO-92	120	0.05	0.5	200	800
2SA1008	Through-hole type	TO-220AB (MP-25) ^{Note}	100	2	15	40	200
2SA1009	Through-hole type	TO-220AB (MP-25) ^{Note}	350	2	15	20	200
2SA1009A	Through-hole type	TO-220AB (MP-25) ^{Note}	400	2	15	20	200
2SA1010	Through-hole type	TO-220AB (MP-25) ^{Note}	100	7	40	40	200
2SA1069	Through-hole type	TO-220AB (MP-25) ^{Note}	60	5	30	40	200
2SA1069A	Through-hole type	TO-220AB (MP-25) ^{Note}	80	5.0	30	40	200
2SA1129	Through-hole type	TO-220AB (MP-25) ^{Note}	30	7	40	40	200
2SA1156	Through-hole type	TO-126 (MP-5)	400	0.5	10	30	200
2SA1206	Through-hole type	TO-92	15	0.05	0.6	50	150
2SA1221	Through-hole type	SP-8	140	0.5	1	100	400
2SA1222	Through-hole type	SP-8	160	0.5	1	100	400
2SA1226	Surface mount type	SC-59 (Mini Mold)	40	0.03	0.2	40	180
2SA1330	Surface mount type	SC-59 (Mini Mold)	200	0.1	0.2	90	450
2SA1376	Through-hole type	TO-92	180	0.1	0.75	135	600
2SA1376A	Through-hole type	TO-92	200	0.1	0.75	135	600
2SA1385	Through-hole type	TO-251 (MP-3) /TO-252 (MP-3Z)	60	5	10	100	400
2SA1394	Through-hole type	Isolated TO-220 (MP-45)	60	5	25	40	200
2SA1395	Through-hole type	Isolated TO-220 (MP-45)	100	2	15	40	200
2SA1396	Through-hole type	Isolated TO-220 (MP-45)	100	10	30	40	200
2SA1400	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	400	0.5	10	30	200
2SA1412	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	400	2	10	40	120
2SA1413	Through-hole type / Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	600	1	10	30	120
2SA1458	Through-hole type	SST	40	0.2	0.25	75	300
2SA1459	Through-hole type	SST	15	0.05	0.25	50	150
2SA1460	Through-hole type	SP-8	45	1	1	60	200
2SA1461	Surface mount type	SC-59 (Mini Mold)	40	0.2	0.2	75	300

Note Please contact one of our sales representatives regarding the package availability of TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut).

Remark The minus sign is omitted from the values of V_{CEO} and I_{C(DC)}.

Bipolar Transistor

■ 2SA type (Polarity:PNP) (2/2)

Part Number	Mounting Type	Package	V _{CEO}	I _{C(DC)}	P _T	h _{FE}	
			Max.(V)	Max.(A)	Max.(W)	Min.	Max.
2SA1462	Surface mount type	SC-59 (Mini Mold)	15	0.05	0.2	50	150
2SA1463	Surface mount type	SC-62 (Power Mini Mold)	45	1	2	60	200
2SA1464	Surface mount type	SC-59 (Mini Mold)	40	0.5	0.2	75	300
2SA1486	Through-hole type	TO-126 (MP-5)	600	1	15	30	120
2SA1544	Through-hole type	TO-92	250	0.1	0.75	60	320
2SA1546	Through-hole type	TO-126 (MP-5)	250	0.1	7	60	320
2SA1608	Surface mount type	SC-70 (SSP)	40	0.5	0.15	75	300
2SA1610	Surface mount type	SC-70 (SSP)	15	0.05	0.15	50	150
2SA1611	Surface mount type	SC-70	50	0.1	0.15	90	600
2SA1612	Surface mount type	SC-70 (SSP)	120	0.05	0.15	135	900
2SA1615	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	20	10	15	200	600
2SA1625	Through-hole type	TO-92	400	0.5	0.75	40	200
2SA1626	Through-hole type	SP-8	400	2	1	40	120
2SA1627	Through-hole type	SP-8	600	1	1	30	120
2SA1645	Through-hole type/ Surface mount type	TO-220AB (MP-25) ^{Note} / TO-263 (MP-25ZJ)	100	7	35	100	400
2SA1646	Through-hole type/ Surface mount type	TO-220AB (MP-25) ^{Note} / TO-263 (MP-25ZJ)	100	10	40	100	400
2SA1647	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	100	5	18	100	400
2SA1648	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	60	5	18	100	400
2SA1649	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	30	10	15	100	400
2SA1650	Through-hole type	Isolated TO-220 (MP-45)	100	5	25	100	400
2SA1652	Through-hole type	Isolated TO-220 (MP-45)	100	10	25	100	400
2SA1714 [☆]	Through-hole type	TO-126 (MP-5)	100	3	12	2000	20000
2SA1720	Through-hole type	Isolated TO-220 (MP-45)	100	10	25	4000	20000
2SA1741	Through-hole type	Isolated TO-220 (MP-45F)	60	5	25	100	400
2SA1742	Through-hole type	Isolated TO-220 (MP-45F)	60	7	30	100	400
2SA1743	Through-hole type	Isolated TO-220 (MP-45F)	60	10	30	100	400
2SA1744	Through-hole type	Isolated TO-220 (MP-45F)	60	15	30	100	400
2SA1836	Surface mount type	SC-75 (USM)	50	0.1	0.2	90	600
2SA1840	Through-hole type	MP-10	100	5	1.8	2000	20000
2SA1841	Through-hole type	MP-10	100	8	1.8	4000	20000
2SA1843	Through-hole type	MP-10	60	5	1.8	100	400
2SA1845	Through-hole type	MP-10	100	5	1.8	100	400
2SA1847	Through-hole type	MP-10	100	10	1.8	100	400
2SA1871	Surface mount type	SC-84 (MP-2)	600	1	2	30	120
2SA1897	Through-hole type	SP-8	20	5	1	200	600

☆ : Newly added product

Note Please contact one of our sales representatives regarding the package availability of TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut).

Remark The minus sign is omitted from the values of V_{CEO} and I_{C(DC)}.

Bipolar Transistor

■ 2SB type (Polarity:PNP) (1/2)

Part Number	Mounting Type	Package	V _{CEO}	I _{C(DC)}	P _T	h _{FE}	
			Max.(V)	Max.(A)	Max.(W)	Min.	Max.
2SB546A	Through-hole type	TO-220AB (MP-25) ^{Note}	150	2	25	40	200
2SB564	Through-hole type	SP-8	25	1	1	90	400
2SB601	Through-hole type	TO-220AB (MP-25) ^{Note}	100	5	30	2000	15000
2SB605	Through-hole type	SP-8	50	0.7	1	90	400
2SB624	Surface mount type	SP-59 (Mini Mold)	25	0.7	0.2	110	400
2SB707	Through-hole type	TO-220AB (MP-25) ^{Note}	60	7	40	40	200
2SB708	Through-hole type	TO-220AB (MP-25) ^{Note}	80	7	40	40	200
2SB733	Through-hole type	SP-8	16	2	1	135	600
2SB734	Through-hole type	SP-8	50	1	1	135	600
2SB736	Surface mount type	SC-59 (Mini Mold)	60	0.3	0.2	110	400
2SB736A	Surface mount type	SC-59 (Mini Mold)	80	0.3	0.2	110	400
2SB768	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	150	2	20	40	200
2SB772	Through-hole type	TO-126 (MP-5)	30	3	10	60	400
2SB794	Through-hole type	TO-126 (MP-5)	60	1.5	10	2000	30000
2SB795	Through-hole type	TO-126 (MP-5)	80	1.5	10	2000	30000
2SB798	Surface mount type	SC-62 (Power Mini Mold)	25	1	2	90	400
2SB799	Surface mount type	SC-62 (Power Mini Mold)	50	0.7	2	90	400
2SB800	Surface mount type	SC-62 (Power Mini Mold)	80	0.3	2	90	400
2SB804	Surface mount type	SC-62 (Power Mini Mold)	80	1	2	90	400
2SB805	Surface mount type	SC-62 (Power Mini Mold)	100	0.7	2	90	400
2SB806	Surface mount type	SC-62 (Power Mini Mold)	120	0.7	2	90	400
2SB810	Through-hole type	SST	25	0.7	0.35	110	400
2SB962	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	30	3	10	60	400
2SB963	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	60	1	8	2000	30000
2SB984	Through-hole type	SP-8	80	1	1	135	400
2SB1068	Through-hole type	TO-92	16	2	0.75	135	650
2SB1093	Through-hole type	SP-8	80	1.5	1	2000	30000
2SB1094	Through-hole type	Isolated TO-220 (MP-45)	60	3	15	40	200
2SB1097	Through-hole type	Isolated TO-220 (MP-45)	60	7	30	40	200
2SB1114	Surface mount type	SC-62 (Power Mini Mold)	20	2	2	135	600
2SB1115	Surface mount type	SC-62 (Power Mini Mold)	50	1	2	135	600
2SB1115A	Surface mount type	SC-62 (Power Mini Mold)	60	1	2	135	400
2SB1116	Through-hole type	TO-92	50	1	0.75	135	600
2SB1116A	Through-hole type	TO-92	60	1	0.75	135	400
2SB1117	Through-hole type	SP-8	25	3	1	135	600
2SB1149	Through-hole type	TO-126 (MP-5)	100	3	15	2000	15000
2SB1150	Through-hole type	TO-126 (MP-5)	60	3	15	2000	15000
2SB1151	Through-hole type	TO-126 (MP-5)	60	5	20	100	400

Note Please contact one of our sales representatives regarding the package availability of TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut).

Remark The minus sign is omitted from the values of V_{CEO} and I_{C(DC)}.

Bipolar Transistor

■ 2SB type (Polarity:PNP) (2/2)

Part Number	Mounting Type	Package	V _{CEO}	I _{C(DC)}	P _T	h _{FE}	
			Max.(V)	Max.(A)	Max.(W)	Min.	Max.
2SB1217	Through-hole type	TO-126 (MP-5)	60	3	10	100	400
2SB1261	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	60	3	10	100	400
2SB1300	Through-hole type	TO-92	16	3	0.75	135	600
2SB1318	Through-hole type	SP-8	100	3	1	2000	15000
2SB1430	Through-hole type	Isolated TO-220 (MP-45F)	100	5	20	2000	20000
2SB1431	Through-hole type	Isolated TO-220 (MP-45F)	100	8	25	2000	15000
2SB1432	Through-hole type	Isolated TO-220 (MP-45F)	100	10	30	1000	30000
2SB1453	Through-hole type	Isolated TO-220 (MP-45F)	60	3	25	100	400
2SB1465 [☆]	Through-hole type	Isolated TO-220 (MP-45)	300	0.3	25	1500	30000
2SB1475	Surface mount type	SC-70 (SSP)	16	0.5	0.15	110	400
2SB1571	Surface mount type	SC-62 (Power Mini Mold)	30	5	2	100	400
2SB1572	Surface mount type	SC-62 (Power Mini Mold)	60	3	2	100	400
2SB1578	Surface mount type	SC-84 (MP-2)	60	5	2	100	400
2SB1581	Surface mount type	SC-84 (MP-2)	16	3	2	135	600
2SB1628	Surface mount type	SC-62 (Power Mini Mold)	16	3	2	140	560
2SB1669 [☆]	Through-hole type	TO-220AB (MP-25) ^{Note}	60	3	25	100	400

☆ : Newly added product

Note Please contact one of our sales representatives regarding the package availability of TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut).

Remark The minus sign is omitted from the values of V_{CEO} and I_{C(DC)}.

Bipolar Transistor

■ 2SC type (Polarity:NPN) (1/3)

Part Number	Mounting Type	Package	V _{CEO}	I _{C(DC)}	P _T	h _{FE}	
			Max.(V)	Max.(A)	Max.(W)	Min.	Max.
2SC945	Through-hole type	TO-92	50	0.1	0.25	90	600
2SC1009A	Surface mount type	SC-59 (Mini Mold)	30	0.05	0.2	60	180
2SC1505	Through-hole type	TO-220AB (MP-25) ^{Note}	300	0.2	15	40	200
2SC1621	Surface mount type	SC-59 (Mini Mold)	20	0.2	0.2	40	180
2SC1622A	Surface mount type	SC-59 (Mini Mold)	120	0.05	0.2	135	900
2SC1623	Surface mount type	SC-59 (Mini Mold)	50	0.1	0.2	90	600
2SC1653	Surface mount type	SC-59 (Mini Mold)	130	0.05	0.15	90	400
2SC1654	Surface mount type	SC-59 (Mini Mold)	160	0.05	0.15	90	400
2SC1674	Through-hole type	TO-92	20	0.02	0.25	40	180
2SC1841	Through-hole type	TO-92	120	0.05	0.5	200	1200
2SC1842	Through-hole type	TO-92	35	0.1	0.25	200	1200
2SC1843	Through-hole type	TO-92	50	0.1	0.25	200	800
2SC1845	Through-hole type	TO-92	120	0.05	0.5	200	1200
2SC1940	Through-hole type	SP-8	120	0.05	1	90	400
2SC1941	Through-hole type	SP-8	160	0.05	1	90	400
2SC2001	Through-hole type	TO-92	25	0.7	0.6	90	400
2SC2002	Through-hole type	TO-92	60	0.3	0.6	90	400
2SC2003	Through-hole type	TO-92	80	0.3	0.6	90	400
2SC2223	Surface mount type	SC-59 (Mini Mold)	20	0.02	0.15	40	180
2SC2331	Through-hole type	TO-220AB (MP-25) ^{Note}	100	2	15	40	200
2SC2333	Through-hole type	TO-220AB (MP-25) ^{Note}	400	2	15	20	80
2SC2334	Through-hole type	TO-220AB (MP-25) ^{Note}	100	7	40	40	200
2SC2335	Through-hole type/ Surface mount type	TO-220AB (MP-25) ^{Note} / TO-263 (MP-25ZJ)	400	7	40	20	80
2SC2517	Through-hole type	TO-220AB (MP-25) ^{Note}	100	5	30	40	200
2SC2518	Through-hole type	TO-220AB (MP-25) ^{Note}	400	5	40	20	80
2SC2654 ☆	Through-hole type	TO-220AB (MP-25) ^{Note}	40	7	40	40	320
2SC2688	Through-hole type	TO-126 (MP-5)	300	0.2	10	40	250
2SC2690	Through-hole type	TO-126 (MP-5)	120	1.2	20	60	320
2SC2690A	Through-hole type	TO-126 (MP-5)	160	1.2	20	60	320
2SC2721	Through-hole type	SP-8	60	0.7	1	90	400
2SC2752	Through-hole type	TO-126 (MP-5)	400	0.5	10	20	80
2SC2780	Surface mount type	SC-62 (Power Mini Mold)	140	0.05	2	90	400
2SC2784	Through-hole type	SST	120	0.05	0.3	200	1200
2SC2786	Through-hole type	SST	20	0.02	0.25	40	180
2SC2787	Through-hole type	SST	30	0.03	0.25	40	180
2SC2885	Through-hole type	TO-251 (MP-3)	200	2	15	20	160
2SC2901	Through-hole type	TO-92	15	0.2	0.6	40	200
2SC2946	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	200	2	15	20	160
2SC2958	Through-hole type	SP-8	140	0.5	1	100	400
2SC2959	Through-hole type	SP-8	160	0.5	1	100	400

☆ : Newly added product

Note Please contact one of our sales representatives regarding the package availability of TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut).

Bipolar Transistor

■ 2SC type (Polarity:NPN) (2/3)

Part Number	Mounting Type	Package	V _{CEO}	I _{C(DC)}	P _T	h _{FE}	
			Max.(V)	Max.(A)	Max.(W)	Min.	Max.
2SC3209	Through-hole type	SP-8	300	0.2	1	60	250
2SC3360	Surface mount type	SC-59 (Mini Mold)	200	0.1	0.2	90	400
2SC3478	Through-hole type	TO-92	180	0.1	0.75	135	600
2SC3478A	Through-hole type	TO-92	200	0.1	0.75	135	400
2SC3518	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	60	5	10	100	400
2SC3554	Surface mount type	SC-62 (Power Mini Mold)	300	0.2	2	60	250
2SC3567	Through-hole type	Isolated TO-220 (MP-45)	100	3	15	40	200
2SC3568	Through-hole type	Isolated TO-220 (MP-45)	100	10	30	40	200
2SC3569	Through-hole type	Isolated TO-220 (MP-45)	400	2	15	20	80
2SC3570	Through-hole type	Isolated TO-220 (MP-45)	400	5	25	20	80
2SC3571	Through-hole type	Isolated TO-220 (MP-45)	400	7	30	20	80
2SC3572	Through-hole type	Isolated TO-220 (MP-45)	400	10	30	15	80
2SC3588	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	400	0.5	10	20	80
2SC3615	Through-hole type	TO-92	50	0.3	0.75	800	3200
2SC3616	Through-hole type	TO-92	25	0.7	0.75	800	3200
2SC3617	Surface mount type	SC-62 (Power Mini Mold)	50	0.3	2	800	3200
2SC3618	Surface mount type	SC-62 (Power Mini Mold)	25	0.7	2	800	3200
2SC3622	Through-hole type	TO-92	50	0.15	0.25	1000	3200
2SC3622A	Through-hole type	TO-92	50	0.15	0.25	1000	3200
2SC3623	Through-hole type	SST	50	0.15	0.25	1000	3200
2SC3623A	Through-hole type	SST	50	0.15	0.25	1000	3200
2SC3624	Surface mount type	SC-59 (Mini Mold)	50	0.15	0.2	1000	3200
2SC3624A	Surface mount type	SC-59 (Mini Mold)	50	0.15	0.2	1000	3200
2SC3631	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	400	2	10	40	120
2SC3632	Through-hole type/ Surface mount type	TO-251 (MP-3) /TO-252 (MP-3Z)	600	1	10	30	120
2SC3731	Through-hole type	SST	40	0.2	0.25	75	300
2SC3732	Through-hole type	SST	15	0.2	0.25	40	200
2SC3733	Through-hole type	SP-8	45	1	1	60	200
2SC3734	Surface mount type	SC-59 (Mini Mold)	40	0.2	0.2	75	300
2SC3735	Surface mount type	SC-59 (Mini Mold)	15	0.2	0.2	40	200
2SC3736	Surface mount type	SC-62 (Power Mini Mold)	45	1	2	60	200
2SC3739	Surface mount type	SC-59 (Mini Mold)	40	0.5	0.2	75	300
2SC3840	Through-hole type	TO-126 (MP-5)	600	1	15	30	120
2SC4000	Through-hole type	SP-8	250	0.1	1	60	320
2SC4001	Through-hole type	TO-126 (MP-5)	250	0.1	7	60	320
2SC4173	Surface mount type	SC-70 (SSP)	40	0.5	0.15	75	300
2SC4175	Surface mount type	SC-70 (SSP)	20	0.2	0.15	40	180
2SC4176	Surface mount type	SC-70 (SSP)	15	0.2	0.15	40	200
2SC4177	Surface mount type	SC-70 (SSP)	50	0.1	0.15	90	600
2SC4178	Surface mount type	SC-70 (SSP)	20	0.02	0.15	40	180
2SC4179	Surface mount type	SC-70 (SSP)	30	0.05	0.15	60	180

Bipolar Transistor

■ 2SC type (Polarity:NPN) (3/3)

Part Number	Mounting Type	Package	V _{CEO}	I _{C(DC)}	P _T	h _{FE}	
			Max.(V)	Max.(A)	Max.(W)	Min.	Max.
2SC4180	Surface mount type	SC-70 (SSP)	120	0.05	0.15	135	900
2SC4181	Surface mount type	SC-70 (SSP)	50	0.15	0.15	1000	3200
2SC4331	Through-hole type	TO-251 (MP-3)	100	5	15	100	400
2SC4332	Through-hole type/ Surface mount type	TO-251 (MP-3)/TO-252 (MP-3Z)	60	5	15	100	400
2SC4336	Through-hole type	Isolated TO-220 (MP-45)	100	10	30	100	400
2SC4342	Through-hole type	TO-126 (MP-5)	100	3	12	2000	20000
2SC4346	Through-hole type	TO-251 (MP-3)	400	5	18	20	80
2SC4351	Through-hole type	Isolated TO-220 (MP-45)	60	5	20	2000	20000
2SC4549	Through-hole type	Isolated TO-220 (MP-45F)	60	5	25	100	400
2SC4550	Through-hole type	Isolated TO-220 (MP-45F)	60	7	30	100	400
2SC4551	Through-hole type	Isolated TO-220 (MP-45F)	60	10	30	100	400
2SC4552	Through-hole type	Isolated TO-220 (MP-45F)	60	15	30	100	400
2SC4553	Through-hole type	Isolated TO-220 (MP-45F)	100	7.5	30	450	2000
2SC4554	Through-hole type	Isolated TO-220 (MP-45F)	100	15	35	450	2000
2SC4783	Surface mount type	SC-75 (USM)	50	0.1	0.2	90	600
2SC4810	Through-hole type	MP-10	100	5	1.8	2000	20000
2SC4811	Through-hole type	MP-10	100	8	1.8	2000	20000
2SC4813	Through-hole type	MP-10	100	7.5	1.8	450	2000
2SC4814	Through-hole type	MP-10	100	2.5	1.8	300	1200
2SC4815	Through-hole type	MP-10	60	5	1.8	100	400
2SC4942	Surface mount type	SC-84 (MP-2)	600	1	2	30	120

Bipolar Transistor

■ 2SD type (Polarity:NPN) (1/2)

Part Number	Mounting Type	Package	V _{CEO}	I _{C(DC)}	P _T	h _{FE}	
			Max.(V)	Max.(A)	Max.(W)	Min.	Max.
2SD401A	Through-hole type	TO-220AB (MP-25) ^{Note}	150	2	25	40	200
2SD415	Through-hole type	TO-126 (MP-5)	100	0.8	10	40	320
2SD471	Through-hole type	SP-8	25	1	1	90	400
2SD560	Through-hole type	TO-220AB (MP-25) ^{Note}	100	5	30	2000	15000
2SD571	Through-hole type	SP-8	50	0.7	1	90	400
2SD596	Surface mount type	SC-59 (Mini Mold)	25	0.7	0.2	110	400
2SD773	Through-hole type	SP-8	16	2	1	135	600
2SD774	Through-hole type	SP-8	50	1	1	135	600
2SD780	Surface mount type	SC-59 (Mini Mold)	60	0.3	0.2	110	400
2SD780A	Surface mount type	SC-59 (Mini Mold)	80	0.3	0.2	110	400
2SD794	Through-hole type	TO-126 (MP-5)	45	3	10	60	320
2SD794A	Through-hole type	TO-126 (MP-5)	60	3	10	60	320
2SD882	Through-hole type	TO-126 (MP-5)	30	3	10	60	400
2SD985	Through-hole type	TO-126 (MP-5)	60	1.5	10	2000	30000
2SD986	Through-hole type	TO-126 (MP-5)	80	1.5	10	2000	30000
2SD992	Through-hole type/ Surface mount type	TO-251 (MP-3)/TO-252 (MP-3Z)	30	2	10	35	200
2SD999	Surface mount type	SC-62 (Power Mini Mold)	25	1	2	90	400
2SD1000	Surface mount type	SC-62 (Power Mini Mold)	50	0.7	2	90	400
2SD1001	Surface mount type	SC-62 (Power Mini Mold)	80	0.3	2	90	400
2SD1005	Surface mount type	SC-62 (Power Mini Mold)	80	1	2	90	400
2SD1006	Surface mount type	SC-62 (Power Mini Mold)	100	0.7	2	90	400
2SD1007	Surface mount type	SC-62 (Power Mini Mold)	120	0.7	2	90	400
2SD1020	Through-hole type	SST	25	0.7	0.35	110	400
2SD1033	Through-hole type/ Surface mount type	TO-251 (MP-3)/TO-252 (MP-3Z)	150	2	20	40	200
2SD1164	Through-hole type/ Surface mount type	TO-251 (MP-3)/TO-252 (MP-3Z)	60	1.5	10	2000	30000
2SD1286	Through-hole type/ Surface mount type	TO-251 (MP-3)/TO-252 (MP-3Z)	60	1	8	2000	30000
2SD1312	Through-hole type	SP-8	80	1	1	135	600
2SD1481 [☆]	Through-hole type	TO-220AB (MP-25) ^{Note}	60	2	15	2000	20000
2SD1513	Through-hole type	TO-92	16	2	0.75	135	650
2SD1579	Through-hole type	SP-8	80	1.5	1	2000	30000
2SD1581	Through-hole type	SP-8	25	2	1	800	3200
2SD1582	Through-hole type	SP-8	50	1	1	800	3200
2SD1583	Through-hole type/ Surface mount type	TO-251 (MP-3)/TO-252 (MP-3Z)	20	2	10	800	3200
2SD1584	Through-hole type/ Surface mount type	TO-251 (MP-3)/TO-252 (MP-3Z)	60	3	10	800	3200
2SD1585	Through-hole type	Isolated TO-220 (MP-45)	60	3	15	40	200
2SD1588	Through-hole type	Isolated TO-220 (MP-45)	60	7	30	40	200

☆ : Newly added product

Note Please contact one of our sales representatives regarding the package availability of TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut).

Bipolar Transistor

■ 2SD type (Polarity:NPN) (2/2)

Part Number	Mounting Type	Package	V _{CEO}	I _{C(DC)}	P _T	h _{FE}	
			Max.(V)	Max.(A)	Max.(W)	Min.	Max.
2SD1592	Through-hole type	Isolated TO-220 (MP-45)	300	5	30	400	3000
2SD1614	Surface mount type	SC-62 (Power Mini Mold)	20	2	2	135	600
2SD1615	Surface mount type	SC-62 (Power Mini Mold)	50	1	2	135	600
2SD1615A	Surface mount type	SC-62 (Power Mini Mold)	60	1	2	135	400
2SD1616	Through-hole type	TO-92	50	1	0.75	135	600
2SD1616A	Through-hole type	TO-92	60	1	0.75	135	400
2SD1630	Through-hole type	TO-126 (MP-5)	60	1	10	2000	30000
2SD1691	Through-hole type	TO-126 (MP-5)	60	5	20	100	400
2SD1692	Through-hole type	TO-126 (MP-5)	100	3	15	2000	20000
2SD1693	Through-hole type	TO-126 (MP-5)	60	3	15	2000	20000
2SD1694	Through-hole type	TO-126 (MP-5)	60	3	20	800	3200
2SD1695	Through-hole type	TO-126 (MP-5)	31	2	10	2000	30000
2SD1697	Through-hole type	SP-8	80	0.8	1	4000	50000
2SD1698	Through-hole type	TO-92	80	0.8	0.75	4000	50000
2SD1699	Surface mount type	SC-62 (Power Mini Mold)	80	0.8	2	4000	50000
2SD1700	Through-hole type	SP-8	60	0.8	1	4000	50000
2SD1701	Through-hole type	TO-92	60	0.8	0.75	4000	50000
2SD1702	Surface mount type	SC-62 (Power Mini Mold)	60	0.8	2	4000	50000
2SD1779	Through-hole type	SP-8	60	2	1	800	3200
2SD1780	Through-hole type	SP-8	60	2	1	800	3200
2SD1818	Through-hole type	TO-126 (MP-5)	10	3	10	100	400
2SD1843	Through-hole type	SP-8	60	1	1	2000	30000
2SD1899	Through-hole type/ Surface mount type	TO-251 (MP-3)/TO-252 (MP-3Z)	60	3	10	100	400
2SD1950	Surface mount type	SC-62 (Power Mini Mold)	25	2	2	800	3200
2SD2161	Through-hole type	Isolated TO-220 (MP-45F)	100	5	20	2000	20000
2SD2162	Through-hole type	Isolated TO-220 (MP-45F)	100	8	25	2000	15000
2SD2163	Through-hole type	Isolated TO-220 (MP-45F)	100	10	30	1000	30000
2SD2164	Through-hole type	Isolated TO-220 (MP-45F)	60	3	20	800	3200
2SD2165	Through-hole type	Isolated TO-220 (MP-45F)	100	6	30	800	3200
2SD2217	Through-hole type	Isolated TO-220 (MP-45)	300	0.3	25	1500	30000
2SD2228	Through-hole type	SC-70 (SSP)	16	0.5	0.15	110	600
2SD2230	Surface mount type	SC-59 (Mini Mold)	16	0.5	0.2	200	—
2SD2383	Surface mount type	SC-59 (Mini Mold)	300	0.02	0.2	100	250
2SD2402	Surface mount type	SC-62 (Power Mini Mold)	30	5	2	100	400
2SD2403	Surface mount type	SC-62 (Power Mini Mold)	60	3	2	100	400
2SD2425	Surface mount type	SC-84 (MP-2)	60	5	2	100	400
2SD2463	Through-hole type	SP-8	31	2	6	2000	30000

Field Effect Transistor

Small Signal FET

■ 2SK type (MOS type) (1/2)

Part Number	Package	Absolute Maximum Rating (T _A = 25°C)				Electrical Characteristics (T _A = 25°C)							Applications
		V _{DSS} (V)	I _D		P _r (W)	y _{fs} (S)			R _{DS(on)} (Ω)				
			DC (A)	Pulse (A)		V _{DS} (V)	I _D (A)	Min.	V _{GS} (V)	I _D (A)			
											Typ.	Max.	
2SK679A	TO-92	30	±0.5	±1.5	0.75	10	0.5	0.4	4	0.5	0.6	1.0	Switching
2SK680A	SC-62	30	±1.0	±2.0	2.0	10	0.5	0.4	4	0.5	0.6	1.0	
2SK681A	SP-8	30	±1.0	±2.0	1.0	10	0.5	0.4	4	0.5	0.6	1.0	
2SK1132	SST	50	0.1	0.2	0.25	5	0.02	0.02	4	0.02	16	50	
2SK1133	SC-59	50	0.1	0.2	0.2	5	0.02	0.02	4	0.02	16	50	
2SK1272	TO-92	60	±1.0	±2.0	0.75	10	0.5	0.4	4	0.5	0.31	1.0	
2SK1273	SC-62	60	±2.0	±4.0	2.0	10	0.5	0.4	4	0.5	0.31	1.0	
2SK1274	SP-8	60	±1.5	±3.0	1.0	10	0.5	0.4	4	0.5	0.31	1.0	
2SK1398	SST	50	0.1	0.2	0.25	3	0.01	0.02	2.5	0.01	22	40	
2SK1399	SC-59	50	0.1	0.2	0.2	3	0.01	0.02	2.5	0.01	22	40	
2SK1482	TO-92	30	±1.5	±3.0	0.75	10	0.5	0.4	4	0.5	0.19	0.8	
2SK1483	SC-62	30	±2.0	±4.0	2.0	10	0.5	0.4	4	0.5	0.19	0.8	
2SK1484	TO-92	100	±0.5	±1.0	0.75	10	0.5	0.4	4	0.5	0.6	1.2	
2SK1485	SC-62	100	±1.0	±2.0	2.0	10	0.5	0.4	4	0.5	0.6	1.2	
2SK1580	SC-70	16	0.1	0.2	0.15	3	0.01	0.02	2.5	0.001	9	15	
2SK1581	SC-59	16	0.2	0.4	0.2	3	0.01	0.02	2.5	0.001	3.2	5	
2SK1582	SC-59	30	0.2	0.4	0.2	5	0.01	0.02	4	0.01	2.2	5	
2SK1583	SC-62	16	±0.5	±1.0	2.0	5	0.3	0.4	2.5	0.3	1.2	2.0	
2SK1584	SC-62	30	±0.5	±1.0	2.0	5	0.5	0.35	4	0.3	1.2	2.0	
2SK1585	SC-62	16	±1.0	±2.0	2.0	5	0.5	0.4	2.5	0.5	0.8	1.2	
2SK1586	SC-62	30	±1.0	±2.0	2.0	5	0.5	0.4	4	0.5	0.3	1.0	
2SK1587	SC-62	16	±2.0	±4.0	2.0	5	1.0	0.4	2.5	0.5	0.5	0.8	
2SK1588	SC-62	16	±3.0	±6.0	2.0	3	1.0	0.4	2.5	1.0	0.25	0.5	
2SK1589	SC-59	100	0.1	0.2	0.2	5	0.01	0.02	4	0.01	19	30	
2SK1590	SC-59	60	±0.2	±0.4	0.2	5	0.01	0.02	4	0.01	3.2	6.0	
2SK1591	SC-59	100	±0.2	±0.4	0.2	5	0.01	0.4	4	0.01	5.8	8.0	
2SK1592	SC-62	60	±0.5	±1.0	2.0	10	0.5	0.4	4	0.3	1.6	2.5	
2SK1593	SC-62	100	±0.5	±1.0	2.0	10	0.5	0.4	4	0.3	4.0	6.0	
2SK1656	SST	30	±0.1	±0.2	0.25	3	0.01	0.02	2.5	0.01	25	45	
2SK1657	SC-59	30	±0.1	±0.2	0.2	3	0.01	0.02	2.5	0.01	25	45	
2SK1658	SC-70	30	±0.1	±0.2	0.15	3	0.01	0.02	2.5	0.01	25	45	
2SK1824	SC-75	30	±0.1	±0.2	0.2	3	0.01	0.02	2.5	0.001	7	13	
2SK1958	SC-70	16	±0.1	±0.2	0.15	3	0.01	0.02	1.5	0.001	20	50	
2SK1959	SC-62	16	±2.0	±4.0	2.0	3	1.0	1.0	1.5	0.05	0.8	3.2	
2SK1960	SC-62	16	±3.0	±6.0	2.0	3	1.5	2.0	1.5	0.1	0.35	0.8	

Field Effect Transistor

Small Signal FET

■ 2SK type (MOS type) (2/2)

Part Number	Package	Absolute Maximum Rating (T _A = 25°C)				Electrical Characteristics (T _A = 25°C)							Applications
		V _{DSS} (V)	I _D		P _T (W)	y _{fs} (S)			R _{DS(on)} (Ω)				
			DC (A)	Pulse (A)		V _{DS} (V)	I _D (A)	Min.	V _{GS} (V)	I _D (A)			
											Typ.	Max.	
2SK2053	SC-84	16	±5	±10	2.0	3	2.5	4	1.5	0.5	0.19	0.4	Switching
2SK2054	SC-84	60	±3	±6	2.0	10	1.5	2.0	4	1.5	0.18	0.25	
2SK2055	SC-84	100	±2	±4	2.0	10	1.0	2.0	4	1.0	0.28	0.45	
2SK2070	SP-8	100	±1	±2	1.0	10	1.0	2.0	4	1.0	0.28	0.45	
2SK2090	SC-70	50	±0.1	±0.2	0.15	3	0.01	0.02	2.5	0.01	20	40	
2SK2109	SC-62	60	±0.5	±1.0	2.0	10	0.3	0.4	4	0.3	0.55	1.0	
2SK2110	SC-62	100	±0.5	±1.0	2.0	10	0.3	0.4	4	0.3	0.95	1.5	
2SK2111	SC-62	60	±1.0	±2.0	2.0	10	0.5	0.4	4	0.5	0.32	0.6	
2SK2112	SC-62	100	±1.0	±2.0	2.0	10	0.5	0.4	4	0.5	0.58	1.2	
2SK2157	SC-84	30	±5	±10	2.0	10	2.5	2.0	4	2.5	0.09	0.15	
2SK2158	SC-59	50	±0.1	±0.2	0.2	3	0.01	0.02	1.5	0.001	32	50	
2SK2159	SC-62	60	±2	±4	2.0	10	1.0	0.4	1.5	0.1	0.55	0.7	
2SK2541	SST	50	±0.1	±0.2	0.25	3	0.01	0.02	1.5	0.001	32	50	
2SK2857	SC-62	60	±4	±16	2.0	10	1	1	4	1.5	0.15	0.22	
2SK2858	SC-70	30	±0.1	±0.4	0.15	3	0.01	0.02	2.5	0.001	8	15	
2SK3054	SC-70	50	±0.1	±0.2	0.15	3	0.01	0.02	2.5	0.01	22	40	
2SK3107	SC-75	30	±0.1	±0.4	0.2	3	0.01	0.02	2.5	0.001	8	15	
2SK3503	SC-75	16	±0.1	±0.2	0.2	3	0.01	0.02	1.5	0.001	30	50	

Field Effect Transistor

Small Signal FET

■ 2SJ type (MOS type)

Part Number	Package	Absolute Maximum Rating (T _A = 25°C)				Electrical Characteristics (T _A = 25°C)							Applications
		V _{DSS} (V)	I _D		P _r T _C = 25°C (W)	y _{fs} (S)			R _{DS(on)} (Ω)				
			DC (A)	Pulse (A)		V _{DS} (V)	I _D (A)	Min.	V _{GS} (V)	I _D (A)			
											Typ.	Max.	
2SJ165	SST	−50	±0.1	±0.2	0.25	−5	−0.02	0.03	−4	−0.02	18	50	Switching
2SJ166	SC-59	−50	±0.1	±0.2	0.2	−5	−0.02	0.03	−4	−0.02	18	50	
2SJ178	TO-92	−30	±1.0	±2.0	0.75	−10	−0.5	0.4	−4	−0.5	–	1.5	
2SJ179	SC-62	−30	±1.5	±3.0	2.0	−10	−0.5	0.4	−4	−0.5	–	1.5	
2SJ180	SP-8	−30	±1.0	±2.0	1.0	−10	−0.5	0.4	−4	−0.5	–	1.5	
2SJ184	SST	−50	±0.1	±0.2	0.25	−3	−0.01	0.02	−2.5	−0.001	25	40	
2SJ185	SC-59	−50	±0.1	±0.2	0.2	−3	−0.01	0.02	−2.5	−0.001	25	40	
2SJ196	TO-92	−60	±1.0	±2.0	0.75	−10	−0.5	0.4	−4	−0.5	0.9	1.5	
2SJ197	SC-62	−60	±1.5	±3.0	2.0	−10	−0.5	0.4	−4	−0.5	0.9	1.5	
2SJ198	TO-92	−100	±0.5	±1.0	0.75	−10	−0.5	0.4	−4	−0.5	1.5	2.5	
2SJ199	SC-62	−100	±1.0	±2.0	2.0	−10	−0.5	0.4	−4	−0.5	1.5	2.5	
2SJ202	SC-70	−16	±0.1	±0.2	0.15	−3	−0.01	0.02	−2.5	−0.001	70	100	
2SJ203	SC-59	−16	±0.2	±0.4	0.2	−3	−0.01	0.02	−2.5	−0.001	15	23	
2SJ204	SC-59	−30	±0.2	±0.4	0.2	−5	−0.01	0.02	−4	−0.01	8.5	13	
2SJ205	SC-62	−16	±0.5	±1.0	2.0	−3	−0.3	0.4	−2.5	−0.01	3.0	5.0	
2SJ206	SC-62	−30	±0.5	±1.0	2.0	−5	−0.3	0.4	−4.0	−0.3	2.0	4.0	
2SJ207	SC-62	−16	±1.0	±2.0	2.0	−3	−0.5	0.4	−2.5	−0.03	2.6	4.0	
2SJ208	SC-62	−16	±2.0	±4.0	2.0	−3	−1.0	0.4	−2.5	−0.03	1.6	3.0	
2SJ209	SC-59	−100	±0.1	±0.2	0.2	−5	−0.01	0.015	−4	−0.01	60	100	
2SJ210	SC-59	−60	±0.2	±0.4	0.2	−5	−0.01	0.02	−4	−0.01	10	15	
2SJ211	SC-59	−100	±0.2	±0.4	0.2	−5.0	−0.01	0.02	−4.0	−0.01	15	30	
2SJ212	SC-62	−60	±0.5	±1.0	2.0	−5.0	−0.3	0.4	−4.0	−0.3	1.5	4.0	
2SJ213	SC-62	−100	±0.5	±1.0	2.0	−5.0	−0.5	0.4	−4.0	−0.5	2.7	5.0	
2SJ243	SC-75	−30	±0.1	±0.2	0.2	−3	−0.01	0.02	−2.5	−0.0005	55	100	
2SJ353	SP-8	−60	±1.5	±3.0	1.0	−10	−1.0	1.0	−4	−0.8	0.58	0.68	
2SJ355	SC-62	−30	±2.0	±4.0	2.0	−10	−1.0	1.0	−4.0	−1.0	0.50	0.60	
2SJ356	SC-62	−60	±2.0	±4.0	2.0	−10	−1.0	1.0	−4	−1.0	0.65	0.95	
2SJ357	SC-84	−30	±3.0	±6.0	2.0	−10	−1.0	1.8	−4	−1.5	0.23	0.35	
2SJ358	SC-84	−60	±3.0	±6.0	2.0	−10	−1.0	1.8	−4	−1.5	0.29	0.40	
2SJ411	SP-8	−30	±5.0	±20.0	1.0	−10	−2.5	3.0	−4	−2.5	0.175	0.24	
2SJ460	SST	−50	±0.1	±0.2	0.25	−3	−0.01	0.012	−2.5	−0.003	46	100	
2SJ461	SC-59	−50	±0.1	±0.2	0.2	−3	−0.01	0.012	−2.5	−0.003	46	100	
2SJ462	SC-84	−12	±2.5	±5.0	2.0	−3	−1.0	1.5	−2.5	−0.5	0.195	0.290	
2SJ463A	SC-70	−30	±0.1	±0.4	0.15	−3	−0.01	0.02	−2.5	−0.001	23	60	
2SJ559	SC-75	−30	±0.1	±0.4	0.2	−3	−0.01	0.02	−2.5	−0.001	23	60	

Field Effect Transistor

Power MOS FET

■ N7-L Series/P7-L Series Quick Reference

DC Drain Current $I_{D(DC)}$ (A)	Drain to Source Voltage V_{DS} (V)		Package
	20	30	
up to 20		Δ 2SK3507 (39 m/70 m) [★] Δ 2SK3366 (21 m/33 m)	Δ : TO-251 (MP-3) $\bigcirc$: TO-220AB (MP-25)
up to 30		Δ 2SK3365 (14 m/21 m)	
up to 40	$\bigcirc$ 2SK3295 (18 m/27 m) $\bigcirc$ 2SK3296 (12 m/19 m)	Δ 2SK3367 (9 m/12 m) $\bigcirc$ 2SK3404 (14 m/21 m)	
up to 50	$\bigcirc$ 2SK3405 (9 m/4 m)	$\bigcirc$ 2SK3424 (11.5 m/17 m)	
up to 80	$\bigcirc$ 2SK3467 (6 m/10 m)		

() : $R_{DS(on)}$ Max. (Ω) (@ $V_{GS} = 10$ V/ $V_{GS} = 4.5$ V)

★ : Under development

DC Drain Current $I_{D(DC)}$ (A)	Drain to Source Voltage V_{DS} (V)			Package
	40	60	100	
up to 20		Δ 2SJ598 (130 m/190 m) ^{Note2} Δ 2SJ599 (75 m/111 m) ^{Note2} $\bigcirc$ 2SJ602 (73 m/107 m) ^{Note2} Δ 2SK3377 (44 m/78 m) ^{Note1}	Δ 2SK3484 (125 m/148 m) ^{Note2}	Δ : TO-251 (MP-3) $\bigcirc$: TO-220AB (MP-25) $\square$: TO-3P (MP-88)
up to 30		Δ 2SJ600 (50 m/79 m) ^{Note2} $\bigcirc$ 2SJ603 (48 m/75 m) ^{Note2} Δ 2SK3385 (28 m/45 m) ^{Note1}	$\bigcirc$ 2SK3481 (50 m/58 m) ^{Note2} Δ 2SK3483 (52 m/59 m) ^{Note2}	
up to 40		$\bigcirc$ 2SJ601 (31 m/46 m) ^{Note2} Δ 2SK3386 (15 m/36 m) ^{Note1} Δ 2SK3402 (15 m/22 m) ^{Note1} $\bigcirc$ 2SK3433 (26 m/41 m) ^{Note1}	Δ 2SK3482 (33 m/39 m) ^{Note2}	
up to 50		$\bigcirc$ 2SJ604 (30 m/43 m) ^{Note2} $\bigcirc$ 2SK3434 (20 m/31 m) ^{Note1}	$\bigcirc$ 2SK3480 (31 m/39 m) ^{Note2}	
up to 70		$\bigcirc$ 2SJ605 (20 m/31 m) ^{Note2} $\square$ 2SK3307 (9.5 m/14 m) ^{Note1}		
up to 80	$\bigcirc$ 2SK3430 (7.3 m/15 m) ^{Note1}	$\bigcirc$ 2SK3435 (14 m/21 m) ^{Note1} $\square$ 2SK3356 (8 m/12 m) ^{Note1} $\square$ 2SK3357 (5.8 m/8.8 m) ^{Note1}		
up to 90	$\bigcirc$ 2SK3431 (5.6 m/8.9 m) ^{Note1} $\bigcirc$ 2SK3432 (4 m/6.9 m) ^{Note1}	$\bigcirc$ 2SJ606 (15 m/23 m) ^{Note2} $\bigcirc$ 2SJ607 (11 m/16 m) ^{Note2} $\bigcirc$ 2SK3353 (9.5 m/14 m) ^{Note1} $\bigcirc$ 2SK3354 (8 m/12 m) ^{Note1} $\bigcirc$ 2SK3355 (5.8 m/8.8 m) ^{Note1}	$\bigcirc$ 2SK3479 (11 m/13 m) ^{Note2}	

Notes 1. () : $R_{DS(on)}$ Max. (Ω) (@ $V_{GS} = 10$ V/ $V_{GS} = 4$ V)2. () : $R_{DS(on)}$ Max. (Ω) (@ $V_{GS} = 10$ V/ $V_{GS} = 4.5$ V)

Field Effect Transistor

Power MOS FET

■ N6-L Series Quick Reference

DC Drain Current $I_{D(DC)}$ (A)	Drain to Source Voltage V_{DSS} (V)	Package
	60	
up to 20	$\triangle$ 2SK3224 (40 m/65 m) $\odot$ 2SK3204 (34 m/50 m)	$\triangle$: TO-251 (MP-3) $\bullet$: Isolated TO-220 (MP-45F) $\circ$: TO-220AB (MP-25) $\odot$: MP-10
up to 30	$\bullet$ 2SK3055 (34 m/50 m) $\bullet$ 2SK3053 (40 m/65 m)	
up to 40	$\triangle$ 2SK3225 (18 m/27 m) $\circ$ 2SK3056 (34 m/50 m)	
up to 50	$\bullet$ 2SK2057 (17 m/27 m) $\bullet$ 2SK3059 (13 m/20 m)	
up to 60	$\circ$ 2SK2058 (17 m/27 m)	
up to 70	$\circ$ 2SK3060 (13 m/20 m)	
	$\bullet$ 2SK3061 (8.5 m/12 m)	
	$\circ$ 2SK3062 (8.5 m/12 m)	
	$\circ$ 2SK2826 (6.5 m/10.5 m)	

() : $R_{DS(on)}$ Max. (Ω) (@ $V_{GS} = 10\text{ V}/V_{GS} = 4\text{ V}$)

■ N5-L Series/P5-L Series/N4-L Series Quick Reference

DC Drain Current $I_{D(DC)}$ (A)	Drain to Source Voltage V_{DS} (V)		Package
	60	100	
8.0	Δ 2SK2415 (0.1 /0.15)		Δ : TO-251 (MP-3) $\bullet$: Isolated TO-220 (MP-45F) $\circ$: TO-220AB (MP-25) $\odot$: MP-10 $\square$: TO-3P (MP-88)
10	$\odot$ 2SK2413 (70 m/95 m) Δ 2SK2414 (70 m/95 m)		
12	$\odot$ 2SJ581 (0.1/0.19) ^{Note}		
15	$\bullet$ 2SJ493 (0.1/0.19) ^{Note}	$\bullet$ 2SK2462 (0.14/0.17)	
20	$\bullet$ 2SK2412 (70 m/95 m) $\circ$ 2SJ492 (0.1/0.19) ^{Note} $\bullet$ 2SJ494 (50 m/88 m) ^{Note}	$\bullet$ 2SK2461 (80 m/0.1)	
25	$\bullet$ 2SK2723 (40 m/60 m) ^{Note}		
30	$\bullet$ 2SK2410 (40 m/60 m) $\bullet$ 2SJ495 (30 m/56m) ^{Note}		
35	$\bullet$ 2SK2724 (27 m/40 m) ^{Note}		
40	$\bullet$ 2SK2409 (27m/40 m) $\bullet$ 2SK2510 (20 m/30 m) ^{Note} $\square$ 2SK2511 (27 m/40 m) ^{Note}		
45	$\bullet$ 2SK2512 (15 m/23 m) ^{Note}		
50	$\bullet$ 2SK2498 (9 m/14 m) ^{Note}		
	$\square$ 2SK2514 (15 m/23 m) ^{Note} $\square$ 2SK2515 (9 m/14 m) ^{Note}		

() : $R_{DS(on)}$ Max. (Ω) (@ $V_{GS} = 10\text{ V}/V_{GS} = 4\text{ V}$)

Note N5-L/P5-L series

Field Effect Transistor

Power MOS FET

■ N3-L Series/P3-L Series Quick Reference

DC Drain Current $I_{D(PC)}$ (A)	Drain to Source Voltage V_{DS} (V)			Package
	30	60	100/[150]	
up to 4.0	△ 2SJ324 (0.25/0.52) △ 2SJ325 (0.11/0.24)	◇ 2SK1283 (0.18/0.24) △ 2SJ326 (0.37/0.68) △ 2SJ327 (0.17/0.34)	△ 2SK1284 (0.32/0.40) ◇ 2SK1285 (0.32/0.40)	◇ : TO-126 (MP-5) △ : TO-251 (MP-3) ● : Isolated TO-220 (MP-45F) ○ : TO-220AB (MP-25) ◎ : MP-10 □ : TO-3P (MP-88)
up to 10		◎ 2SK1850 (70 m/95 m)	◎ 2SK1852 (0.15/0.20)	
up to 15		◎ 2SK1851 (45 m/60 m) ● 2SJ303 (0.1/0.24) ● 2SJ329 (60 m/0.11)	◎ 2SK1853 (80 m/0.10) ● 2SK1288 (0.15/0.20) ● 2SK2131 (0.12/0.20)	
up to 20		○ 2SJ302 (0.1/0.24) ○ 2SJ328 (60 m/0.11) ● 2SJ330 (50 m/90 m)	● 2SK1292 (80 m/0.10)	
up to 30		□ 2SJ331 (30 m/55 m)		
up to 40		□ 2SK1123 (27 m/50 m)	□ 2SK1122 (50 m/70 m)	

() : $R_{DS(on)}$ Max. (Ω) (@ $V_{GS} = 10$ V/ $V_{GS} = 4$ V)

Field Effect Transistor

Power MOS FET

■ N7-L Series (Low Voltage N channel 7th generation Series)

Part Number	Package	Absolute Maximum Ratings			Electrical Characteristics		
		V _{DSS} (V)	I _{D(DC)} (A)	P _r @T _c = 25°C (W)	R _{DS(on)} Max. (Ω)		Q _G (nC)
					@V _{GS} = 10 V	@V _{GS} = 4 V	
2SK3507★	TO-251	30	22	20	39 m	70 m ^{Note}	8
2SK3366			20	30	21 m	33 m ^{Note}	15
2SK3365			30	36	14 m	21 m ^{Note}	25
2SK3367			36	40	9 m	12 m ^{Note}	49
2SK3377		60	20	30	44 m	78 m	17
2SK3385			30	36	28 m	45 m	30
2SK3386			34	40	21 m	36 m	39
2SK3402			36	40	15 m	22 m	61
2SK3482★		100	36	50	33 m	39 m ^{Note}	65
2SK3483★			28	40	52 m	59 m ^{Note}	42
2SK3484★			16	30	125 m	148 m ^{Note}	17
2SK3295	TO-220AB	20	35	35	18 m	27 m ^{Note}	16
2SK3296			35	40	12 m	19 m ^{Note}	30
2SK3405			48	50	9 m	14 m ^{Note}	34
2SK3467			80	76	6 m	9.5 m ^{Note}	55
2SK3404		30	40	40	14 m	21 m ^{Note}	25
2SK3424			48	50	11.5 m	17 m ^{Note}	34
2SK3430		40	80	84	7.3 m	15 m	50
2SK3431			83	100	5.6 m	8.9 m	110
2SK3432			83	100	4 m	6.9 m	140
2SK3433		60	40	47	26 m	41 m	30
2SK3434			48	56	20 m	31 m	40
2SK3435			80	84	14 m	21 m	60
2SK3353			82	95	9.5 m	14 m	90
2SK3354			83	100	8 m	12 m	106
2SK3355			83	100	5.8 m	8.8 m	170
2SK3479★		100	83	125	11 m	13 m ^{Note}	200
2SK3480★			50	84	31 m	36 m ^{Note}	65
2SK3481★			30	56	50 m	58 m ^{Note}	42
2SK3307	TO-3P	60	70	120	9.5 m	14 m	90
2SK3356			75	130	8 m	12 m	106
2SK3357			75	150	5.8 m	8.8 m	170

Note @V_{GS} = 4.5 V

★ : Under development

Remark TO-220AB package products are available in TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut) packages.

Field Effect Transistor

Power MOS FET

■ P7-L Series (Low Voltage P channel 7th generation Series)

Part Number	Package	Absolute Maximum Ratings			Electrical Characteristics		
		V _{BSS} (V)	I _{D(DC)} (A)	P _T @ T _C = 25°C (W)	R _{DS(on)} Max. (Ω)		Q _G (nC)
					@ V _{GS} = −10 V	@ V _{GS} = −4 V	
2SJ598	TO-251	−60	−12	25	130 m	190 m	15
2SJ599			−20	35	75 m	111 m	26
2SJ600			−25	45	50 m	79 m	38
2SJ601			−36	65	31 m	46 m	63
2SJ602	TO-220AB		−20	40	73 m	107 m	26
2SJ603			−25	50	48 m	75 m	38
2SJ604			−45	70	30 m	43 m	63
2SJ605			−63	100	20 m	31 m	87
2SJ606			−83	120	15 m	23 m	120
2SJ607			−83	160	11 m	16 m	188

Remark TO-220AB package products are available in TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut) packages.

■ N6-L Series (Low Voltage N channel 6th generation Series)

Part Number	Package	Absolute Maximum Ratings			Electrical Characteristics					
		V _{DSS} (V)	I _{D(DC)} (A)	P _T @ T _C = 25°C (W)	R _{DS(on)} @ V _{GS} = 10 V		R _{DS(on)} @ V _{GS} = 4 V		C _{iss} (pF)	C _{rss} (pF)
					Typ. (Ω)	Max. (Ω)	Typ. (Ω)	Max. (Ω)		
2SK3224	TO-251	60	20	25	24 m	40 m	33 m	60 m	790	100
2SK3204	MP-10		15	1.8 ^{Note}	25 m	34 m	35 m	50 m	940	120
2SK3053	Isolated TO-220		25	30	28 m	45 m	40 m	70 m	790	100
2SK3055	Isolated TO-220		30	25	24 m	34 m	35 m	50 m	920	120
2SK3056	TO-220AB		32	34	24 m	34 m	35 m	50 m	920	120
2SK3225	TO-251		34	40	13 m	18 m	18 m	27 m	2100	220
2SK3057	Isolated TO-220		45	30	12 m	17 m	17 m	27 m	2100	220
2SK3058	TO-220AB		55	58	12 m	17 m	19 m	27 m	2100	220
2SK3059	Isolated TO-220		50	30	11 m	13 m	16 m	20 m	2400	280
2SK3060	TO-220AB		70	70	11 m	13 m	16 m	20 m	2400	280
2SK3061	Isolated TO-220		70	35	6.3 m	8.5 m	8.2 m	12 m	5200	480
2SK3062	TO-220AB		70	100	6.3 m	8.5 m	8.2 m	12 m	5200	480
2SK2826	TO-220AB		70	100	5.5 m	6.5 m	7 m	9.7 m	7200	700

Note T_A = 25°C

Remark TO-220AB package products are available in TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut) packages.

Field Effect Transistor

Power MOS FET

■ N5-L Series (Low Voltage N channel 5th generation Series)

Part Number	Package	Absolute Maximum Ratings			Electrical Characteristics					
		V _{DS} (V)	I _{D(DC)} (A)	P _T @ T _C = 25°C (W)	R _{DS(on)} @ V _{GS} = 10 V		R _{DS(on)} @ V _{GS} = 4 V		C _{iss} (pF)	C _{rss} (pF)
					Typ. (Ω)	Max. (Ω)	Typ. (Ω)	Max. (Ω)		
2SK2723	Isolated TO-220	60	25	25	28 m	40 m	45 m	60 m	830	185
2SK2724	Isolated TO-220		35	30	20 m	27 m	33 m	40 m	1200	270
2SK2510	Isolated TO-220		40	35	16 m	20 m	24 m	30 m	1600	350
2SK2511	TO-3		40	80	22 m	27 m	32 m	40 m	1210	270
2SK2512	Isolated TO-220		45	35	11 m	15 m	16 m	23 m	2100	500
2SK2498	Isolated TO-220		50	35	7.3 m	9 m	11 m	14 m	3400	770
2SK2514	TO-3P		50	150	11 m	15 m	16 m	23 m	2100	500
2SK2515	TO-3P		50	150	7.3 m	9 m	11 m	14 m	3400	770

Remark TO-220AB package products are available in TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut) packages.

■ P5-L Series (Low Voltage P channel 5th generation Series)

Part Number	Package	Absolute Maximum Ratings			Electrical Characteristics					
		V _{DS} (V)	I _{D(DC)} (A)	P _T @ T _C = 25°C (W)	R _{DS(on)} @ V _{GS} = 10 V		R _{DS(on)} @ V _{GS} = 4 V		C _{iss} (pF)	C _{rss} (pF)
					Typ. (Ω)	Max. (Ω)	Typ. (Ω)	Max. (Ω)		
2SJ581	MP-10	-60	-12	1.8 ^{Note}	70 m	0.10	0.12	0.185	1210	180
2SJ492	TO-220AB		-20	70	70 m	0.10	0.12	0.185	1210	180
2SJ493	Isolated TO-220		-16	30	70 m	0.10	0.12	0.185	1210	180
2SJ494	Isolated TO-220		-20	35	39 m	50 m	61 m	88 m	2360	350
2SJ495	Isolated TO-220		-30	35	24 m	30 m	38 m	56 m	4120	580

Note T_A = 25°C

Remark TO-220AB package products are available in TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut) packages.

■ N4-L Series (Low Voltage N channel 4th generation Series)

Part Number	Package	Absolute Maximum Ratings			Electrical Characteristics					
		V _{DS} (V)	I _{D(DC)} (A)	P _T @ T _C = 25°C (W)	R _{DS(on)} @ V _{GS} = 10 V		R _{DS(on)} @ V _{GS} = 4 V		C _{iss} (pF)	C _{rss} (pF)
					Typ. (Ω)	Max. (Ω)	Typ. (Ω)	Max. (Ω)		
2SK2409	Isolated TO-220	60	40	35	21 m	27 m	30 m	40 m	1800	350
2SK2410	Isolated TO-220		30	35	28 m	40 m	40 m	60 m	1300	250
2SK2412	Isolated TO-220		15	30	53 m	70 m	70 m	0.10	700	150
2SK2413	MP-10		10	1.8 ^{Note}	53 m	70 m	70 m	0.10	700	150
2SK2414	TO-251		10	20	53 m	70 m	70 m	0.10	700	150
2SK2415	TO-251		8.0	20	70 m	0.10	0.11	0.15	440	85
2SK2461	Isolated TO-220	100	20	35	60 m	80 m	70 m	0.10	1510	140
2SK2462	Isolated TO-220		15	30	0.10	0.14	0.12	0.17	870	80

Note T_A = 25°C

Remark TO-220AB package products are available in TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut) packages.

Field Effect Transistor

Power MOS FET

■ P3-L Series (Low Voltage P channel 3rd generation Series)

Part Number	Package	Absolute Maximum Ratings			Electrical Characteristics					
		V _{DSS} (V)	I _{D(DC)} (A)	P _T @ T _C = 25°C (W)	R _{DS(on)} @ V _{GS} = 10 V		R _{DS(on)} @ V _{GS} = 4 V		C _{iss} (pF)	C _{rss} (pF)
					Typ. (Ω)	Max. (Ω)	Typ. (Ω)	Max. (Ω)		
2SJ324	TO-251	-30	-2.0	20	0.20	0.25	0.40	0.52	330	100
2SJ325	TO-251		-4.0	20	85 m	0.11	0.15	0.24	800	250
2SJ326	TO-251	-60	-2.0	20	0.28	0.37	0.50	0.68	320	75
2SJ327	TO-251		-4.0	20	0.13	0.17	0.22	0.34	750	165
2SJ303	Isolated TO-220		-14	35	75 m	0.1	0.17	0.24	1200	290
2SJ302	TO-220AB		-16	60	75 m	0.1	0.17	0.24	1200	290
2SJ328	TO-220AB		-20	75	48 m	60 m	85 m	0.11	2150	530
2SJ329	Isolated TO-220		-15	35	48 m	60 m	85 m	0.11	2150	530
2SJ330	Isolated TO-220		-20	35	38 m	50 m	65 m	90 m	2570	640
2SJ331	TO-3P		-30	150	25 m	30 m	40 m	55 m	4300	1110

Remark TO-220AB package products are available in TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut) packages.

■ N3-L Series (Low Voltage 3rd generation Series)

Part Number	Package	Absolute Maximum Ratings			Electrical Characteristics					
		V _{DSS} (V)	I _{D(DC)} (A)	P _T @ T _C = 25°C (W)	R _{DS(on)} @ V _{GS} = 10 V		R _{DS(on)} @ V _{GS} = 4 V		C _{iss} (pF)	C _{rss} (pF)
					Typ. (Ω)	Max. (Ω)	Typ. (Ω)	Max. (Ω)		
2SK1283	TO-126	60	3.0	20	0.15	0.18	0.18	0.24	500	40
2SK1850	MP-10		10	1.8 ^{Note}	55 m	70 m	80 m	95 m	1400	130
2SK1851	MP-10		15	1.8 ^{Note}	35 m	45 m	45 m	60 m	2200	180
2SK1123	TO-3P		40	100	22 m	27 m	30 m	50 m	3250	380
2SK1284	TO-251	100	3.0	20	0.26	0.32	0.32	0.40	500	20
2SK1285	TO-126		3.0	20	0.26	0.32	0.32	0.40	500	20
2SK1852	MP-10		10	1.8 ^{Note}	0.12	0.15	0.15	0.20	1400	50
2SK1853	MP-10		15	1.8 ^{Note}	70 m	80 m	80 m	0.10	2200	90
2SK1288	Isolated TO-220		15	30	0.12	0.15	0.15	0.20	1400	50
2SK1292	Isolated TO-220		20	35	70 m	80 m	80 m	0.10	2200	90
2SK1122	TO-3P		40	100	42 m	50 m	50 m	70 m	3300	200
2SK2131	Isolated TO-220		15	35	0.10	0.12	0.13	0.20	2300	140

Note T_A = 25°C

Remark TO-220AB package products are available in TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut) packages.

Field Effect Transistor

Power MOS FET

■ N5-H Series Quick Reference

DC Drain Current I _{D(DC)} (A)	Drain to Source Voltage V _{DSS} (V)				Package
	200/250 V	500 V	600 V	800/900 V	
2	■ μ PA1840 ☆ (0.5)		△ 2SK3113 (4.4) ● 2SK3221 (4.4)		△ : TO-251 (MP-3) ● : Isolated TO-220 (MP-45F) ○ : TO-220AB (MP-25) □ : TO-3P (MP-88) ■ : TSSOP (Single)
4			● 2SK3114 (2.2)		
5		● 2SK3306 (1.5) ○ 2SK3305 (1.5)	● 2SK3297 (1.6)	● 2SK3457 (2.2) ^{Note 1}	
5.5			○ 2SK3322 (2.2)		
6			● 2SK3115 (1.2)	□ 2SK3324 (2.8) ○ 2SK3458 (2.2) ^{Note 1}	
7	● 2SK3454 ☆ (0.63) ^{Note 2}			□ 2SK3304 (2.0)	
7.5			○ 2SK3116 (1.2) ● 2SK3298 (0.75)		
8	● 2SK3108 (0.4)				
10	○ 2SK3109 (0.4)	● 2SK3326 (0.85) ○ 2SK3325 (0.85)	○ 2SK3299 (0.75)		
12		● 2SK3455 (0.6) ○ 2SK3456 (0.6)			
14	● 2SK3110 (0.18)				
20	○ 2SK3111 (0.18) ○ 2SK3294 (0.16) ^{Note 2}				
25	○ 2SK3112 (0.11)				

() : R_{DS(on)} Max. (Ω) (@V_{GS} = 10 V)

☆ : Newly added product

Notes 1. 800 V

2. 250 V

Field Effect Transistor

Power MOS FET

■ N4-H Series/P4-H series Quick Reference

DC Drain Current $I_{D(DC)}$ (A)	Drain to Source Voltage V_{DS} (V)					Package
	180	250	450	500	[800]/900	
2.0					● 2SK2478 (7.5)	△ : TO-251 (MP-3) ● : Isolated TO-220 (MP-45F) ○ : TO-220AB (MP-25) ◎ : MP-10 □ : TO-3P (MP-88)
3.0					[● 2SK2476 (5.0)] ○ 2SK2479 (7.5) ● 2SK2480 (4.0)	
4.0	△ 2SK1954 (0.65) ◎ 2SK2132 (0.65)	● 2SJ448 (2.0)			○ 2SK2481 (4.0) ● 2SK2483 (2.8) (3.5 A)	
5.0					□ 2SK2482 (4.0) ○ 2SK2484 (2.8)	
6.0		● 2SJ449 (0.8)				
8.0					□ 2SK2487 (1.6)	
10			□ 2SK2361 (0.9)	□ 2SK2362 (1.0)	[□ 2SK2477 (1.0)] □ 2SK2488 (1.2)	
11		● 2SK2341 (0.26)				
15			□ 2SK2367 (0.5)	□ 2SK2368 (0.6)		
16		○ 2SK2133 (0.26)				
20			□ 2SK2369 (0.35)	□ 2SK2370 (0.4)		
25			□ 2SK2371 (0.25)	□ 2SK2372 (0.27)		

() : $R_{DS(on)}$ Max. (Ω) (@ $V_{GS} = 10$ V)

■ N3-H series Quick Reference

DC Drain Current I _{D(DC)} (A)	Drain to Source Voltage V _{DSS} (V)	Package
	250	
25	□ 2SK1491 (0.15)	□ : TO-3P (MP-88)
35	□ 2SK1492 (0.10)	

() : $R_{DS(on)}$ Max. (Ω) (@ $V_{GS} = 10$ V)

Field Effect Transistor

Power MOS FET

■ N5-H Series (High Voltage N channel 5th generation Series)

Part Number	Package	Absolute Maximum Ratings			Electrical Characteristics			
		V _{DSS} (V)	I _{D(DC)} (A)	P _T (W)	R _{DS(on)} @ V _{GS} = 10 V		C _{iss} (pF)	Q _G (nC)
					Typ. (Ω)	Max. (Ω)		
μPA1840 ☆	TSSOP (Single)	200	2.2	2	0.37	0.5	320	16
2SK3108	Isolated TO-220		8	25	0.33	0.4	400	15
2SK3109	TO-220AB		10	50	0.33	0.4	400	15
2SK3110	Isolated TO-220		14	35	0.13	0.18	1000	40
2SK3111	TO-220AB		20	65	0.13	0.18	1000	40
2SK3112	TO-220AB		25	70	0.08	0.11	1600	65
2SK3454 ☆	Isolated TO-220	250	7	30	0.5	0.63	400	18
2SK3294	TO-220AB		20	70	0.12	0.16	1600	65
2SK3305	TO-220AB	500	5	50	1.35	1.5	570	15
2SK3306	Isolated TO-220		5	30	1.35	1.5	570	15
2SK3326	Isolated TO-220		10	40	0.7	0.85	1200	23
2SK3325	TO-220AB		10	75	0.7	0.85	1200	23
2SK3455	Isolated TO-220		12	40	0.48	0.6	1500	30
2SK3456	TO-220AB		12	100	0.48	0.6	1500	30
2SK3113	TO-251	600	2	20	3.3	4.4	290	9
2SK3221	Isolated TO-220		2	25	3.3	4.4	290	9
2SK3114	Isolated TO-220		4	30	1.6	2.2	550	15
2SK3297	Isolated TO-220		5	35	1.28	1.6	690	24
2SK3322	TO-220AB		5.5	65	1.7	2.2	550	15
2SK3115	Isolated TO-220		6	35	0.9	1.2	1100	26
2SK3116	TO-220AB		7.5	70	0.9	1.2	1100	26
2SK3298	TO-220AB		7.5	40	0.6	0.75	1500	51
2SK3299	TO-220AB		10	70	0.6	0.75	1500	51
2SK3457	Isolated TO-220		5	40	1.8	2.2	990	21
2SK3458	TO-220AB	800	6	100	1.8	2.2	990	21
2SK3324	TO-3P	900	6	100	2.5	2.8	1000	34
2SK3304	TO-3P		7	120	1.6	2.0	1500	47

☆ : Newly added product

Remark TO-220AB package products are available in TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut) packages.

Field Effect Transistor

Power MOS FET

■ N4-H Series (High Voltage N channel 4th generation Series)

Part Number	Package	Absolute Maximum Ratings			Electrical Characteristics			
		V _{DS} (V)	I _D (DC) (A)	P _T (W)	R _{DS(on)} @ V _{GS} = 10 V		C _{iss} (pF)	Q _G (nC)
					Typ. (Ω)	Max. (Ω)		
2SK1954	TO-251	180	4.0	20	0.52	0.65	300	10
2SK2132	MP-10		4.0	1.8 ^{Note}	0.52	0.65	300	10
2SK2341	Isolated TO-220	250	11	35	0.21	0.26	1090	33
2SK2133	TO-220AB		16	75	0.21	0.26	1090	25
2SK2361	TO-3P	450	10	100	0.7	0.9	1050	26
2SK2367	TO-3P		15	120	0.4	0.5	1600	43
2SK2369	TO-3P		20	120	0.28	0.40	2400	65
2SK2371	TO-3P		25	160	0.20	0.25	3600	95
2SK2362	TO-3P	500	10	100	0.8	1.0	1050	26
2SK2368	TO-3P		15	120	0.5	0.6	1600	43
2SK2370	TO-3P		20	120	0.32	0.40	2400	65
2SK2372	TO-3P		25	160	0.22	0.27	3600	95
2SK2476	Isolated TO-220	800	3.0	40	3.4	5.0	590	20
2SK2477	TO-3P		10	150	0.65	1.0	2950	90
2SK2478	Isolated TO-220	900	2.0	30	5.0	7.5	485	17
2SK2479	TO-220AB		3.0	70	5.6	7.5	485	17
2SK2480	Isolated TO-220		3.0	35	3.2	4.0	900	30
2SK2481	TO-220AB		4.0	75	3.2	4.0	900	30
2SK2482	TO-3P		5.0	100	3.2	4.0	900	30
2SK2483	Isolated TO-220		3.5	40	2.2	2.8	1200	40
2SK2484	TO-220AB		5.0	75	2.2	2.8	1200	40
2SK2487	TO-3P		8.0	140	1.1	1.6	2100	65
2SK2488	TO-3P		10	160	1.0	1.2	2900	90

Note T_A = 25°C

Remark TO-220AB package products are available in TO-263 (MP-25ZJ) and TO-262 (MP-25 Fin-cut) packages.

Field Effect Transistor

Power MOS FET

■ P4-H Series (High Voltage P channel 4th generation Series)

Part number	Package	Absolute Maximum Ratings			Electrical Characteristics			
		V _{DSS} (V)	I _{D(DC)} (A)	P _T (W)	R _{DS(on)} @ V _{GS} = 10 V		C _{iss} (pF)	Q _G (nC)
					Typ. (Ω)	Max. (Ω)		
2SJ448	Isolated TO-220	-250	±4.0	30	1.5	2.0	470	15
2SJ449	Isolated TO-220		±6.0	35	0.55	0.8	1040	23.4

■ N3-H Series (High Voltage N channel 3rd generation Series)

Part Number	Package	Absolute Maximum Ratings			Electrical Characteristics			
		V _{DSS} (V)	I _{D(DC)} (A)	P _T (W)	R _{DS(on)} @ V _{GS} = 10 V		C _{iss} (pF)	Q _G (nC)
					Typ. (Ω)	Max. (Ω)		
2SK1491	TO-3P	250	25	120	0.12	0.15	1950	55
2SK1492	TO-3P		35	140	0.08	0.1	3000	80
2SK1271 ^{Note}	TO-3P	1400	5	240	3.5	4	1800	125

Note 2nd generation

Field Effect Transistor

Power MOS FET

■ 8-pin SOP Type Power MOS FET Series Quick Referenc (Package: Power SOP8)

4 V or 4.5 V Drive

On-Resistance $R_{DS(on)}$ Max. (m Ω) @ $V_{GS} = 10$ V	Drain to Source Voltage V_{DS} (V)			
	20	30	40	60
up to 600				μ PA1790 (Nch + Pch)
up to 250				μ PA1774 (Pch Dual) ★
up to 150				μ PA1759 (Nch Dual)
up to 90	μ PA1750 (Pch Dual)			
up to 50				μ PA1763 (Nch Dual)
up to 40		μ PA1717 (Pch Single) μ PA1755 (Nch Dual) μ PA1792 (Nch + Pch)		μ PA1764 (Nch Dual)
up to 30		μ PA1700A (Nch Single) μ PA1760 (Nch Dual) μ PA2751 (Nch Dual) ★ μ PA2752 (Nch Dual) ★ μ PA1705 (Nch Single) μ PA1720 (Nch Single) μ PA1722 (Nch Single)	μ PA1708 (Nch Single)	μ PA1728 (Nch Single)
up to 20		μ PA1707 (Nch Single) μ PA2750 (Nch Dual) ★ μ PA2751 (Nch Dual) ★ μ PA2753 (Nch Dual) ★ μ PA1703 (Nch Single) μ PA1721 (Nch Single) μ PA1716 (Pch Single) μ PA1731 (Pch Single) μ PA1772 (Pch Dual) ★★	μ PA1709 (Nch Single)	μ PA1727 (Nch Single)
up to 10		μ PA2700 (Nch Single) ★ μ PA2701 (Nch Single) ★ μ PA2702 (Nch Single) ★ μ PA1706 (Nch Single) μ PA1730 (Pch Single)		

★ : Under development, ☆ : Newly added product

2.5 V Drive

On-Resistance $R_{DS(on)}$ Max. (m Ω) @ $V_{GS} = 4$ V or 4.5 V	Drain to Source Voltage V_{DS} (V)	
	20	30
up to 40	μ PA1770 (Pch Dual)	
up to 30	μ PA1725 (Nch Single) μ PA1756 (Nch Dual) μ PA1757 (Nch Dual)	μ PA1701A (Nch Single) μ PA1758 (Nch Dual)
up to 20	μ PA1724 (Nch Single)	μ PA1704 (Nch Single) μ PA2754 (Nch Dual) ★★
up to 10	μ PA1726 (Nch Single) μ PA1723 (Nch Single)	

★ : Under development, ☆ : Newly added product

Field Effect Transistor

Power MOS FET

■ 8-pin SOP Type Power MOS FET (Package: Power SOP8) (1/3)

N channel Single

Part Number	Absolute Maximum Rating (T _A = 25°C)				Electrical Characteristics (T _A = 25°C)				
	V _{DSS} (V)	V _{ESS} (V)	I _{D(DC)} (A)	P _T (W)	R _{DS(on)} Max. (mΩ)			C _{iss} (pF) Typ.	Q _g (nC) Typ.
					@ V _{GS} = 10 V	@ V _{GS} = 4.5 V	@ V _{GS} = 2.5 V		
μPA1700A	30	20	7	2 ^{Note 1}	27	50 ^{Note 2}	—	820	20
μPA1701A		12	7		—	27 ^{Note 2}	40	1040	13.2
μPA1703		20	10		10.5	17 ^{Note 2}	—	2180	40
μPA1704		12	10		—	13 ^{Note 2}	16	2700	38
μPA1705		25	8		27	40	—	750	19
μPA1706		20	13		7.8	10	—	3000	56
μPA1707			10		13.5	18	—	1400	26
μPA2700★			17		5.5	7.5	—	2450	51
μPA2701★			14		7.5	12	—	1210	25
μPA2702★			13		9.5	15.5	—	905	19
μPA1708	40	25	7		24	40	—	730	20
μPA1709			9		12.5	20	—	1850	43
μPA1720	30	20	8		25	33	—	800	14
μPA1721			10		10.5	14	—	2200	39
μPA1722			9		21	29	—	980	20
μPA1723	20	12	13		—	6.7	8.7	3800	47
μPA1724			10		—	11	15	1850	18
μPA1725			7		—	21	30	950	9.6
μPA1726			12		—	9.1	12.5	2700	25
μPA1727	60	20	10		19	25	—	2400	45
μPA1728			9		27	34	—	1700	31

Notes 1. Mounted on ceramic substrate

★ : Under development

2. @ V_{GS} = 4 V

Field Effect Transistor

Power MOS FET

■ 8-pin SOP Type Power MOS FET (Package: Power SOP8) (2/3)

N channel Dual

Part Number	Absolute Maximum Rating (T _A = 25°C)				Electrical Characteristics (T _A = 25°C)				
	V _{DSS} (V)	V _{GSS} (V)	I _{D(DC)} (A)	P _T (W)	R _{DS(on)} Max. (mΩ)			C _{iss} (pF) Typ.	Q _G (nC) Typ.
					@ V _{GS} = 10 V	@ V _{GS} = 4.5 V	@ V _{GS} = 2.5 V		
μPA1755	30	20	7	2 ^{Note}	32	45	–	895	19
μPA1756	20	12	6		–	30	40	800	11
μPA1757			7		–	23	32	750	13
μPA1758	30	12	6		–	30	40	1100	15
μPA1759	60	20	5		160	300	–	186	8.6
μPA1760	30	20	8		26	36	–	760	14
μPA2750 [★]			9		13	18.5	–	985	21
μPA2751 [★]			8		13	18.5	–	985	21
μPA2752 [★]					20.5	32	–	440	9.4
					20.5	32	–	440	9.4
μPA2753 [★]				19.5	32	–	630	14.1	
μPA2754 ^{★☆}	30	12	11	2	–	14.5	20	1940	T.B.D.
μPA1763	60	20	4.5		47	66	–	870	20
μPA1764			7		36	46	–	1300	29

T.B.D. (To be determined.)

★ : Under development, ☆ : Newly added product

Note 2 circuits, Mounted on ceramic substrate

Field Effect Transistor

Power MOS FET

■ 8-pin SOP Type Power MOS FET (Package: Power SOP8) (3/3)

P-channel Single

Part Number	Absolute Maximum Rating (T _A = 25°C)				Electrical Characteristics (T _A = 25°C)				
	V _{DSS} (V)	V _{GSS} (V)	I _{D(DC)} (A)	P _T (W)	R _{DS(on)} Max. (mΩ)			C _{iss} (pF) Typ.	Q _G (nC) Typ.
					@V _{GS} = 10 V	@V _{GS} = 4.5 V	@V _{GS} = 2.5 V		
μPA1716	-30	-20	-8	2 ^{Note 1}	16	23	—	2100	40
μPA1717		-25	-6		33	59 ^{Note 2}	—	830	20
μPA1730		-20	-13		9.5	13.5	—	3800	70
μPA1731			-10		13	19.5	—	2600	46

Notes 1. Mounted on ceramic substrate

2. @V_{GS} = 4 V

P-channel Dual

Part number	Absolute Maximum Rating (T _A = 25°C)				Electrical Characteristics (T _A = 25°C)				
	V _{DSS} (V)	V _{GSS} (V)	I _{D(DC)} (A)	P _T (W)	R _{DS(on)} Max. (mΩ)			C _{iss} (pF) Typ.	Q _G (nC) Typ.
					@V _{GS} = 10 V	@V _{GS} = 4.5 V	@V _{GS} = 2.5 V		
μPA1750	-20	-20	-3.5	2 ^{Note 1}	90	180 ^{Note 2}	—	540	18
μPA1770		-12	-6		—	37	59	1300	11
μPA1772★☆☆	-30	-20	-8	2	20	29.5	—	1920	T.B.D.
μPA1774★	-60	-20	-5		250	340 ^{Note 2}	—	380	8

T.B.D (To be determined.)

★ : Under development, ☆ : Newly added product

Notes 1. 2 circuits, Mounted on ceramic substrate

2. @V_{GS} = 4 V

N+P channel

Part Number	Configuration	Absolute Maximum Rating (T _A = 25°C)				Electrical Characteristics (T _A = 25°C)			
		V _{DSS} (V)	V _{GSS} (V)	I _{D(DC)} (A)	P _T (W)	R _{DS(on)} Max. (mΩ)		C _{iss} (pF) Typ.	Q _G (nC) Typ.
						@V _{GS} = 10 V	@V _{GS} = 4.5 V		
μPA1790	Nch	60	±20	±1	2 ^{Note 1}	260	340 ^{Note 2}	180	8
	Pch	-60		±0.7		600	1100 ^{Note 2}	230	7.6
μPA1792	Nch	30		±6.8		26	36.0	760	14
	Pch	-30		±5.8		36	54	900	17

Notes 1. 2 circuits, Mounted on ceramic substrate

2. @V_{GS} = 4 V

Field Effect Transistor

Power MOS FET

■ 8-pin TSSOP Type Power MOS FET Series Quick Reference (Package: Power TSSOP8)

4 V or 4.5 V Drive

On-Resistance $R_{DS(on)Max.}(m\Omega)$ @ $V_{GS} = 10\text{ V}$	Drain to Source Voltage V_{DS} (V)			
	20	30	60	200
up to 500				$\mu\text{PA1840}^{\text{Note}}$ (Nch Single)
up to 110	μPA1851 (Pch Dual)			
up to 90		μPA1853 (Pch Dual)	μPA1857 (Nch Dual)	
up to 40		μPA1812 (Pch Single) μPA1890 (Nch+Pch)		
up to 30		μPA1800 (Nch Single) μPA1804 (Nch Single)		
up to 20		μPA1803 (Nch Single) μPA1814 (Pch Single)		

Note 10 V Drive

2.5 V Drive

On-Resistance $R_{DS(on)Max.}(m\Omega)$ @ $V_{GS} = 4\text{ V}$ or 4.5 V	Drain to Source Voltage V_{DS} (V)		
	12	20	30
up to 120	μPA1850 (Pch Dual)		
up to 80		μPA1811 (Pch Single)	
up to 60	μPA1810 (Pch Single) μPA1854 (Pch Dual)		
up to 50		μPA1856 (Pch Dual)	
up to 40		μPA1852 (Nch Dual)	
up to 30	μPA1813 (Pch Single)	μPA1801 (Nch Single) μPA1802 (Nch Single) μPA1855 (Nch Dual) $\mu\text{PA1870}^{\text{Note}}$ (Nch Dual) $\mu\text{PA1873}^{\text{Note}} \star \star$ (Nch Dual)	$\mu\text{PA1871}^{\text{Note}}$ (Nch Dual)
up to 20		μPA1815 (Pch Single) $\mu\text{PA1872}^{\text{Note}} \star \star$ (Nch Dual)	$\mu\text{PA1874}^{\text{Note}} \star \star$ (Nch Dual)

Note Drain Common

★ : Under development, ☆ : Newly added product

Field Effect Transistor

Power MOS FET

■ SC-95/SC-96 Type Power MOS FET Series Quick Reference (Package: SC-95/SC-96)

4 V or 4.5 V Drive

On-Resistance $R_{DS(on)Max. (m\Omega)}$ @ $V_{GS} = 10\text{ V}$	Drain to Source Voltage $V_{DSS} (V)$
	30
up to 200	2SK3408 ^{Note} (SC-96, Nch Single)
up to 160	2SJ557 (SC-96, Pch Single)
up to 100	2SK3105 (SC-96, Nch Single)
up to 60	μ PA1914 (SC-95, Pch Single)

Note $V_{DSS} = 43 \pm 5\text{ V}$

1.8 V or 2.5 V Drive

On-Resistance $R_{DS(on)Max. (m\Omega)}$ @ $V_{GS} = 4\text{ V or }4.5\text{ V}$	Drain to Source Voltage $V_{DSS} (V)$	
	12	20
up to 130	μ PA1950 ^{Note ★} (SC-95, Pch Dual) μ PA1951 ^{Note ★ ★} (SC-95, Pch Dual)	μ PA1911A ^{Note} (SC-95, Pch Single)
up to 80	μ PA1910 (SC-95, Pch Single)	
up to 60	2SJ621 ^{Note ★ ★} (SC-96, Pch Single)	μ PA1913 (SC-95, Pch Single) μ PA1915 (SC-95, Pch Single)
up to 50	μ PA1912 (SC-95, Pch Single)	
30 to 40	μ PA1916 ^{Note ★} (SC-95, Pch Single)	μ PA1900 (SC-95, Nch Single)

Note 1.8 V Drive

★ : Under development, ☆ : Newly added product

Field Effect Transistor

Power MOS FET

■ SC-95/SC-96 Type Power MOS FET Series

Part Number	PKG	Configuration	Absolute Maximum Rating (T _A = 25°C)				Electrical Characteristics (T _A = 25°C)					Applications
			V _{DSS} (V)	V _{GSS} (V)	I _{D(DC)} (A)	P _r ^{Note} (W)	R _{DS(on)} Max. (mΩ)					
							V _{GS} = 1.8 V	V _{GS} = 2.5 V	V _{GS} = 4 V	V _{GS} = 4.5 V	V _{GS} = 10 V	
2SK3105	SC-96	N-ch Single	30	±20	2.5	1.25	—	—	150	135	95	Power management
2SK3408	SC-96	N-ch Single	43±5	±20	1.0	1.25	—	—	260	250	195	Dynamic clamp
2SJ557	SC-96	P-ch Single	−30	−20/+5	−2.5	1.25	—	—	290	255	155	Power management
2SJ621 ^{★ ☆}	SC-96	P-ch Single	−12	±8	−35	1.25	140	80	—	57	—	
μPA1900	SC-95	N-ch Single	20	±12	5.5	2	—	45	38	35	—	
μPA1910	SC-95	P-ch Single	−12	−10/+5	−2.5	2	—	130	90	80	—	
μPA1912	SC-95	P-ch Single	−12	±10	−4.5	2	—	70	52	50	—	
μPA1911A	SC-95	P-ch Single	−20	±12	−2.5	2	—	190	120	115	—	
μPA1913	SC-95	P-ch Single	−20	±12	−4.5	2	—	100	74	65	—	Switching
μPA1914	SC-95	P-ch Single	−30	±20	−4.5	2	—	—	96	86	57	
μPA1915	SC-95	P-ch Single	−20	±12	−4.5	2	—	100	74	65	—	
μPA1916 [★]	SC-95	P-ch Single	−12	±8	−4.5	2	74	55	—	39	—	Power management
μPA1950 [★]	SC-95	P-ch Dual	−12	±8	−2.5	1.15	375	205	—	130	—	
μPA1951 ^{★ ☆}	SC-95	P-ch Dual	−12	±8	−2.5	1.15	220	130	—	90	—	

Note Mounted on FR-4 Board of 50 cm² × 1.6 mm, t ≤ 5 sec

★ : Under development, ☆ : Newly added product

Field Effect Transistor

Power MOS FET

■ 8-pin TSSOP Type Power MOS FET (Package: Power TSSOP8)

Part Number	Configuration	Absolute Maximum Rating (T _A = 25°C)				Electrical Characteristics (T _A = 25°C)				Applications
		V _{DSS} (V)	V _{GSS} (V)	I _{D(DC)} (A)	P _T ^{Note1} (W)	R _{DS(on)} Max. (mΩ)				
						V _{GS} = 2.5 V	V _{GS} = 4 V	V _{GS} = 4.5 V	V _{GS} = 10 V	
μPA1800	N-ch Single	30	±20	±5	2	—	45	39	27	Switching
μPA1801	N-ch Single	20	±8	±6	2	34	25	24	—	
μPA1802	N-ch Single	20	±12	±7	2	32	25	23	—	
μPA1803	N-ch Single	30	±20	±8	2	—	—	16	12	
μPA1804	N-ch Single	30	±20	±8	2	—	—	32	23	
μPA1810	P-ch Single	−12	−10/+5	±4	2	100	60	55	—	
μPA1811	P-ch Single	−20	−12/+5	±4	2	120	80	75	—	
μPA1812	P-ch Single	−30	−20/+5	±5	2	—	90	70	40	
μPA1813	P-ch Single	−12	−10/+5	±5	2	40	30	25	—	
μPA1814	P-ch Single	−30	±20	±7	2	—	27	24	16	
μPA1815	P-ch Single	−20	±12	±7	2	23	16	15	—	
μPA1840	N-ch Single	200	±20	±2.2	2	—	—	—	500	
μPA1850	P-ch Dual	−12	−10/+5	±2.5	2	200	130	115	—	
μPA1851	P-ch Dual	−20	−20/+5	±2.5	2	—	250	210	105	
μPA1852	N-ch Dual	20	±12	±5	2	60	45	40	—	
μPA1853	P-ch Dual	−30	−20/+5	±2.5	2	—	220	190	85	
μPA1854	P-ch Dual	−12	−10/+5	±2.5	2	105	70	60	—	
μPA1855	N-ch Dual	20	±12	±6	2	29	24	23	—	
μPA1856	P-ch Dual	−20	±12	±4.5	2	77	48	45	—	
μPA1857	N-ch Dual	60	±20	±3.5	1.7	—	95	86	67	
μPA1870 ^{Note2}	N-ch Dual	20	±12	±6	2	27	21	20	—	
μPA1871 ^{Note2}	N-ch Dual	30	±12	±6	2	38	27	26	—	
μPA1872 ^{Note2 ★ ☆}	N-ch Dual	20	±12	±10	2	18	135	13.0	—	
μPA1873 ^{Note2 ★ ☆}	N-ch Dual	20	±12	±6	2	29	24	23	—	
μPA1874 ^{Note2 ★ ☆}	N-ch Dual	30	±12	±8	2	25.5	19	17	—	
μPA1890	N-ch + P-ch	30	±20	±6	2	—	47	37	27	
		−30	±20	±5	2	—	64	56	37	

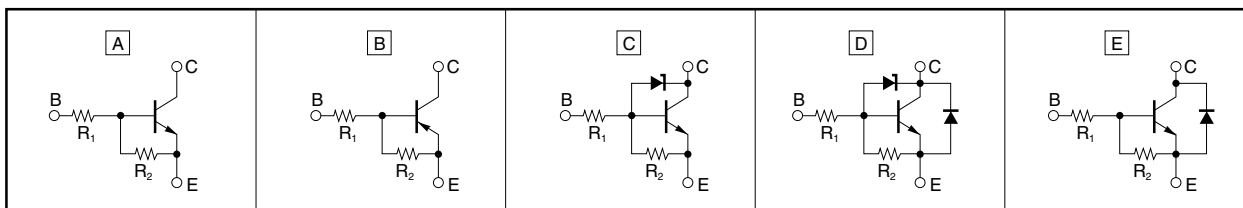
Notes 1. Mounted on ceramic substrate of 50 cm² × 1.1 mm

★ : Under development, ☆ : Newly added product

2. Drain Common

Transistor with Internal Resistor

Equivalent Circuit

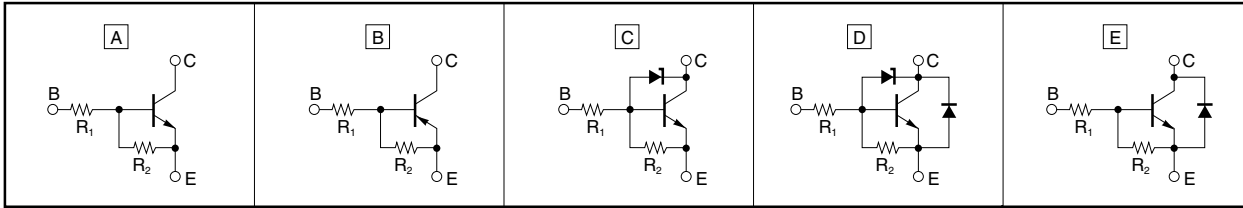


■ AA1[], AN1[], BA1[], BN1[] series (Package: TO-92, SST)

Part Number		Equivalent Circuit and Applications	Absolute Maximum Ratings (T _A = 25°C)						Electrical Characteristics (T _A = 25°C)				
TO-92	SST		V _{CB0} (V)	V _{CE0} (V)	V _{EB0} (V)	I _C (mA)	P _T (mW)	T _J (°C)	R ₁ (kΩ)	R ₂ (kΩ)	h _{FE}	V _{CE} (V)	I _C (mA)
AA1A4M	BA1A4M	Refer to equivalent circuit [A] Switching	60	50	10	100	250	150	10	10	35 to 100	5.0	5.0
AA1A4P	BA1A4P		60	50	5	100	250	150	10	47	35 to 340	5.0	5.0
AA1F4M	BA1F4M		60	50	10	100	250	150	22	22	60 to 195	5.0	5.0
AA1F4N	BA1F4N		60	50	5	100	250	150	22	47	85 to 340	5.0	5.0
AA1L4M	BA1L4M		60	50	10	100	250	150	47	47	85 to 340	5.0	5.0
AA1L4L	BA1L4L		60	50	15	100	250	150	47	22	60 to 195	5.0	5.0
AA1L3Z	BA1L3Z		60	50	5	100	250	150	4.7	—	135 to 600	5.0	5.0
AA1A4Z	BA1A4Z		60	50	5	100	250	150	10	—	135 to 600	5.0	5.0
AA1F4Z	BA1F4Z		60	50	5	100	250	150	22	—	135 to 600	5.0	5.0
AA1L4Z	BA1L4Z		60	50	5	100	250	150	47	—	135 to 600	5.0	5.0
AA1L3M	BA1L3M		60	50	10	100	250	150	4.7	4.7	20 to 80	5.0	5.0
AA1L3N	BA1L3N		60	50	5	100	250	150	4.7	10	35 to 100	5.0	5.0
AA1A3Q	BA1A3Q		60	50	5	100	250	150	1.0	10	35 to 100	5.0	5.0
AN1A4M	BN1A4M	Refer to equivalent circuit [B] Switching	−60	−50	−10	−100	250	150	10	10	35 to 100	−5.0	−5.0
AN1A4P	BN1A4P		−60	−50	−5	−100	250	150	10	47	85 to 340	−5.0	−5.0
AN1F4M	BN1F4M		−60	−50	−10	−100	250	150	22	22	60 to 195	−5.0	−5.0
AN1F4N	BN1F4N		−60	−50	−5	−100	250	150	22	47	85 to 340	−5.0	−5.0
AN1L4M	BN1L4M		−60	−50	−10	−100	250	150	47	47	85 to 340	−5.0	−5.0
AN1L4L	BN1L4L		−60	−50	−15	−100	250	150	47	22	60 to 195	−5.0	−5.0
AN1L3Z	BN1L3Z		−60	−50	−5	−100	250	150	4.7	—	135 to 600	−5.0	−5.0
AN1A4Z	BN1A4Z		−60	−50	−5	−100	250	150	10	—	135 to 600	−5.0	−5.0
AN1F4Z	BN1F4Z		−60	−50	−5	−100	250	150	22	—	135 to 600	−5.0	−5.0
AN1L4Z	BN1L4Z		−60	−50	−5	−100	250	150	47	—	135 to 600	−5.0	−5.0
AN1L3M	BN1L3M		−60	−50	−10	−100	250	150	4.7	4.7	20 to 80	−5.0	−5.0
AN1L3N	BN1L3N		−60	−50	−5	−100	250	150	4.7	10	35 to 100	−5.0	−5.0
AN1A3Q	BN1A3Q		−60	−50	−5	−100	250	150	1.0	10	35 to 100	−5.0	−5.0

Transistor with Internal Resistor

Equivalent Circuit



■ AB1[], AP1[], BB1[], BP1[] series (Package: TO-92, SST)

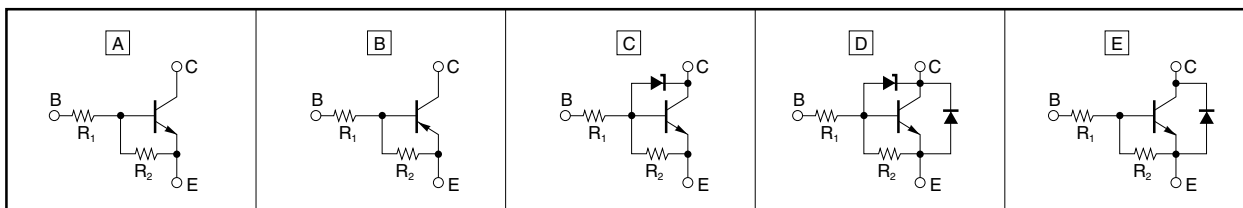
Part Number		Equivalent Circuit and Applications	Absolute Maximum Ratings (T _A = 25°C)							Electrical Characteristics (T _A = 25°C)				
TO-92	SST		V _{CBO} (V)	V _{CEO} (V)	V _{EBO} (V)	I _C (A)	P _T (mW)		T _J (°C)	R ₁ (kΩ)	R ₂ (kΩ)	h _{FE}	V _{CE} (V)	I _C (A)
							TO-92	SST						
AB1A4A	BB1A4A	Refer to equivalent circuit A	30	25	10	0.7	750	250	150	—	10	300 Min.	2.0	0.5
AB1L2Q	BB1L2Q		30	25	10	0.7	750	250	150	0.47	4.7	300 Min.	2.0	0.5
AB1A3M	BB1A3M		30	25	10	0.7	750	250	150	1.0	1.0	100 Min.	2.0	0.5
AB1F3P	BB1F3P		30	25	10	0.7	750	250	150	2.2	10	300 Min.	2.0	0.5
AB1J3P	BB1J3P		30	25	10	0.7	750	250	150	3.3	10	300 Min.	2.0	0.5
AB1L3N	BB1L3N		30	25	10	0.7	750	250	150	4.7	10	300 Min.	2.0	0.5
AB1A4M	BB1A4M		30	25	10	0.7	750	250	150	10	10	300 Min.	2.0	0.5
AP1A4A	BP1A4A	Refer to equivalent circuit B	–25	–25	–10	–0.7	750	250	150	—	10	100 Min.	–2.0	–0.5
AP1L2Q	BP1L2Q		–25	–25	–10	–0.7	750	250	150	0.47	4.7	100 Min.	–2.0	–0.5
AP1A3M	BP1A3M		–25	–25	–10	–0.7	750	250	150	1.0	1.0	100 Min.	–2.0	–0.5
AP1F3P	BP1F3P		–25	–25	–10	–0.7	750	250	150	2.2	10	100 Min.	–2.0	–0.5
AP1J3P	BP1J3P		–25	–25	–10	–0.7	750	250	150	3.3	10	100 Min.	–2.0	–0.5
AP1L3N	BP1L3N		–25	–25	–10	–0.7	750	250	150	4.7	10	100 Min.	–2.0	–0.5
AP1A4M	BP1A4M		–25	–25	–10	–0.7	750	250	150	10	10	100 Min.	–2.0	–0.5

■ AQ1[] series (Package: TO-92)

Part Number	Equivalent Circuit and Applications	Absolute Maximum Ratings (T _A = 25°C)						Electrical Characteristics (T _A = 25°C)				
		V _{CBO} (V)	V _{CEO} (V)	V _{EBO} (V)	I _C (A)	P _T (mW)	T _J (°C)	R ₁ (kΩ)	R ₂ (kΩ)	h _{FE}	V _{CE} (V)	I _C (A)
TO-92												
AQ1A4A	Refer to equivalent circuit 	-20	-20	-10	-2.0	750	150	—	10	150 Min.	-2.0	-1.0
AQ1F2Q		-20	-20	-10	-2.0	750	150	0.22	2.2	150 Min.	-2.0	-1.0
AQ1L2N		-20	-20	-10	-2.0	750	150	0.47	1.0	150 Min.	-2.0	-1.0
AQ1L2Q	Switching	-20	-20	-20	-10	750	150	0.47	4.7	150 Min.	-2.0	-1.0
AQ1A3M		-20	-20	-10	-2.0	750	150	1.0	1.0	150 Min.	-2.0	-1.0
AQ1F3M		-20	-20	-10	-2.0	750	150	2.2	2.2	150 Min.	-2.0	-1.0
AQ1F3P		-20	-20	-10	-2.0	750	150	4.7	10	150 Min.	-2.0	-1.0

Transistor with Internal Resistor

Equivalent Circuit



■ AD1[], AD2[], AR1[] series (Package: TO-92)

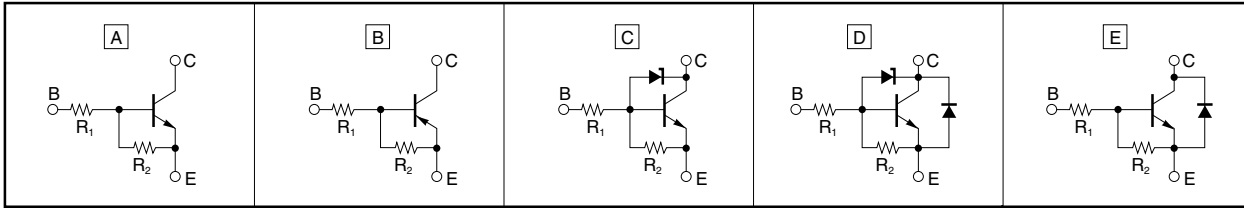
Part Number	Equivalent Circuit and Applications	Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$)						Electrical Characteristics ($T_A = 25^\circ\text{C}$)				
		V_{CB0} (V)	V_{CE0} (V)	V_{EB0} (V)	I_C (A)	P_T (mW)	T_J ($^\circ\text{C}$)	R_1 ($k\Omega$)	R_2 ($k\Omega$)	h_{FE}	V_{CE} (V)	I_C (A)
TO-92												
AD1A3M	Refer to equivalent circuit [A] Switching	80	60	10	1.0	750	150	1.0	1.0	200 Min.	2.0	0.5
AD1F3P		80	60	10	1.0	750	150	2.2	10	300 Min.	2.0	0.5
AD1L3N		80	60	10	1.0	750	150	4.7	10	300 Min.	2.0	0.5
AD1A4M		80	60	10	1.0	750	150	10	10	300 Min.	2.0	0.5
AD1L2Q		80	60	10	1.0	750	150	0.47	4.7	300 Min.	2.0	0.5
AD1F2Q		80	60	10	1.0	750	150	0.22	2.2	300 Min.	2.0	0.5
AD1A4A		80	60	10	1.0	750	150	—	10	300 Min.	2.0	0.5
AD2A3M	Refer to equivalent circuit [B] Switching	60 $\pm$ 10	60 $\pm$ 10	10	1.0	750	150	1.0	1.0	200 Min.	2.0	0.5
AD2F3P		60 $\pm$ 10	60 $\pm$ 10	10	1.0	750	150	2.2	10	300 Min.	2.0	0.5
AD2L3N		60 $\pm$ 10	60 $\pm$ 10	10	1.0	750	150	4.7	10	300 Min.	2.0	0.5
AD2A4M		60 $\pm$ 10	60 $\pm$ 10	10	1.0	750	150	10	10	300 Min.	2.0	0.5
AD2L2Q		60 $\pm$ 10	60 $\pm$ 10	10	1.0	750	150	0.47	4.7	300 Min.	2.0	0.5
AD2F2Q		60 $\pm$ 10	60 $\pm$ 10	10	1.0	750	150	0.22	2.2	300 Min.	2.0	0.5
AD2A4A		60 $\pm$ 10	60 $\pm$ 10	10	1.0	750	150	—	10	300 Min.	2.0	0.5
AR1A3M	Refer to equivalent circuit [C] Switching	−60	−60	−10	−1.0	750	150	1.0	1.0	100 Min.	−2.0	−0.5
AR1F3P		−60	−60	−10	−1.0	750	150	2.2	10	100 Min.	−2.0	−0.5
AR1L3N		−60	−60	−10	−1.0	750	150	4.7	10	100 Min.	−2.0	−0.5
AR1A4M		−60	−60	−10	−1.0	750	150	10	10	100 Min.	−2.0	−0.5
AR1L2Q		−60	−60	−10	−1.0	750	150	0.47	4.7	100 Min.	−2.0	−0.5
AR1F2Q		−60	−60	−10	−1.0	750	150	0.22	2.2	100 Min.	−2.0	−0.5
AR1A4A		−60	−60	−10	−1.0	750	150	—	10	100 Min.	−2.0	−0.5

■ CE1[], CE2[] series (Package: SP-8)

Part Number	Equivalent Circuit and Applications	Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$)						Electrical Characteristics ($T_A = 25^\circ\text{C}$)				
		V_{CB0} (V)	V_{CE0} (V)	V_{EB0} (V)	I_C (A)	P_T (W)	T_J ($^\circ\text{C}$)	R_1 ($k\Omega$)	R_2 ($k\Omega$)	h_{FE}	V_{CE} (V)	I_C (A)
SP-8												
CE1A3Q	Refer to [D]	60 $\pm$ 10	60 $\pm$ 10	15	± 2.0	1.0	150	1.0	10	1000 to 3000	5.0	1.0
CE1F3P		60 $\pm$ 10	60 $\pm$ 10	15	± 2.0	1.0	150	2.2	10	1000 to 3000	5.0	1.0
CE1N2R		60 $\pm$ 10	60 $\pm$ 10	15	± 2.0	1.0	150	0.68	10	1000 to 3000	5.0	1.0
CE2A3Q	Refer to [E]	60	60	15	± 2.0	1.0	150	1.0	10	1000 to 3000	5.0	1.0
CE2F3P		60	60	15	± 2.0	1.0	150	1.0	10	1000 to 3000	5.0	1.0

Transistor with Internal Resistor

Equivalent Circuit

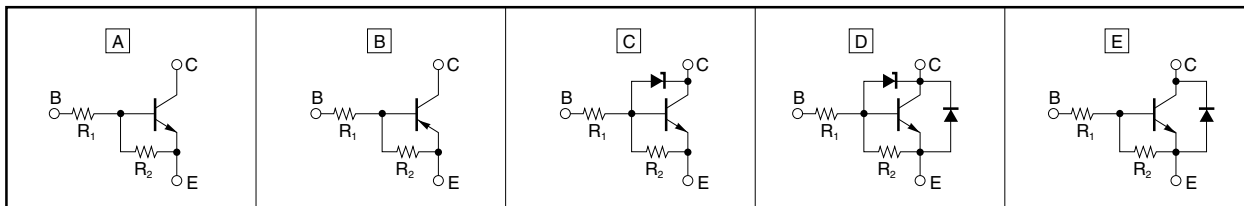


FA1[], FN1[], GA1[] GN1[] series (Package: SC-59, SC-70)

Part Number		Equivalent Circuit and Applications	Absolute Maximum Ratings (T _A = 25°C)						Electrical Characteristics (T _A = 25°C)				
			V _{CB0} (V)	V _{CE0} (V)	V _{EB0} (V)	I _C (mA)	P _T (mW)	T _J (°C)	R ₁ (kΩ)	R ₂ (kΩ)	h _{FE}	V _{CE} (V)	I _C (mA)
SC-59	SC-70												
FA1A4M	GA1A4M	Refer to equivalent circuit [A] Switching	60	50	10	100	200	150	10	10	35 to 100	5.0	5.0
FA1A4P	GA1A4P		(SC-59)	60	50	5	100	150	10	47	35 to 340	5.0	5.0
FA1F4M	GA1F4M		150	60	50	10	100	150	22	22	60 to 195	5.0	5.0
FA1F4N	GA1F4N		(SC-70)	60	50	5	100	150	22	47	85 to 340	5.0	5.0
FA1L4M	GA1L4M		150	60	50	10	100	150	47	47	85 to 340	5.0	5.0
FA1L4L	GA1L4L		(SC-70)	60	50	15	100	150	47	22	60 to 195	5.0	5.0
FA1L3Z	GA1L3Z		150	60	50	5	100	150	4.7	—	135 to 600	5.0	5.0
FA1A4Z	GA1A4Z		(SC-70)	60	50	5	100	150	10	—	135 to 600	5.0	5.0
FA1F4Z	GA1F4Z		150	60	50	5	100	150	22	—	135 to 600	5.0	5.0
FA1L4Z	GA1L4Z		(SC-70)	60	50	5	100	150	47	—	135 to 600	5.0	5.0
FA1L3M	GA1L3M		150	60	50	10	100	150	4.7	4.7	20 to 80	5.0	5.0
FA1L3N	GA1L3N		(SC-70)	60	50	5	100	150	4.7	10	35 to 100	5.0	5.0
FA1A3Q	GA1A3Q		150	60	50	5	100	150	1.0	10	35 to 100	5.0	5.0
FN1A4M	GN1A4M	Refer to equivalent circuit [B] Switching	−60	−50	−10	−100	200	150	10	10	35 to 100	−5.0	−5.0
FN1A4P	GN1A4P		(SC-59)	−60	−50	−5	−100	150	10	47	85 to 340	−5.0	−5.0
FN1F4M	GN1F4M		150	−60	−50	−10	−100	150	22	22	60 to 195	−5.0	−5.0
FN1F4N	GN1F4N		(SC-70)	−60	−50	−5	−100	150	22	47	85 to 340	−5.0	−5.0
FN1L4M	GN1L4M		150	−60	−50	−10	−100	150	47	47	85 to 340	−5.0	−5.0
FN1L4L	GN1L4L		(SC-70)	−60	−50	−15	−100	150	47	22	60 to 195	−5.0	−5.0
FN1L3Z	GN1L3Z		150	−60	−50	−5	−100	150	4.7	—	135 to 600	−5.0	−5.0
FN1A4Z	GN1A4Z		(SC-70)	−60	−50	−5	−100	150	10	—	135 to 600	−5.0	−5.0
FN1F4Z	GN1F4Z		150	−60	−50	−5	−100	150	22	—	135 to 600	−5.0	−5.0
FN1L4Z	GN1L4Z		(SC-70)	−60	−50	−5	−100	150	47	—	135 to 600	−5.0	−5.0
FN1L3M	GN1L3M		150	−60	−50	−10	−100	150	4.7	4.7	20 to 80	−5.0	−5.0
FN1L3N	GN1L3N		(SC-70)	−60	−50	−5	−100	150	4.7	10	35 to 100	−5.0	−5.0
FN1A3Q	GN1A3Q		150	−60	−50	−5	−100	150	1.0	10	35 to 100	−5.0	−5.0

Transistor with Internal Resistor

Equivalent Circuit

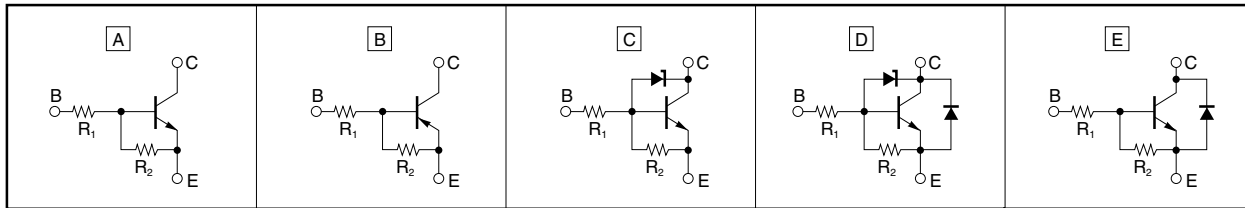


■ FB1[] series (Package: SC-59)

Part Number	Equivalent Circuit and Applications	Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$)						Electrical Characteristics ($T_A = 25^\circ\text{C}$)				
		V_{CB0} (V)	V_{CE0} (V)	V_{EB0} (V)	I_C (A)	P_T (mW)	T_J ($^\circ\text{C}$)	R_1 ($k\Omega$)	R_2 ($k\Omega$)	h_{FE}	V_{CE} (V)	I_C (A)
FB1A4A	Refer to equivalent circuit [A] Switching	30	25	10	0.7	200	150	—	10	300	2.0	0.5
FB1L2Q		30	25	10	0.7		150	0.47	4.7	300	2.0	0.5
FB1A3M		30	25	10	0.7		150	1.0	1.0	100	2.0	0.5
FB1F3P		30	25	10	0.7		150	2.2	10	300	2.0	0.5
FB1J3P		30	25	10	0.7		150	3.3	10	300	2.0	0.5
FB1L3N		30	25	10	0.7		150	4.7	10	300	2.0	0.5
FB1A4M		30	25	10	0.7		150	10	10	300	2.0	0.5
FP1A4A	Refer to equivalent circuit [B] Switching	−25	−25	−10	−0.7	200	150	—	10	100	−2.0	−0.5
FP1L2Q		−25	−25	−10	−0.7		150	0.47	4.7	100	−2.0	−0.5
FP1A3M		−25	−25	−10	−0.7		150	1.0	1.0	100	−2.0	−0.5
FP1F3P		−25	−25	−10	−0.7		150	2.2	10	100	−2.0	−0.5
FP1J3P		−25	−25	−10	−0.7		150	3.3	10	100	−2.0	−0.5
FP1L3N		−25	−25	−10	−0.7		150	4.7	10	100	−2.0	−0.5
FP1A4M		−25	−25	−10	−0.7		150	10	10	100	−2.0	−0.5

Transistor with Internal Resistor

Equivalent Circuit



■ HD1[], HD2[], HR1[] series (Package: SOT-89)

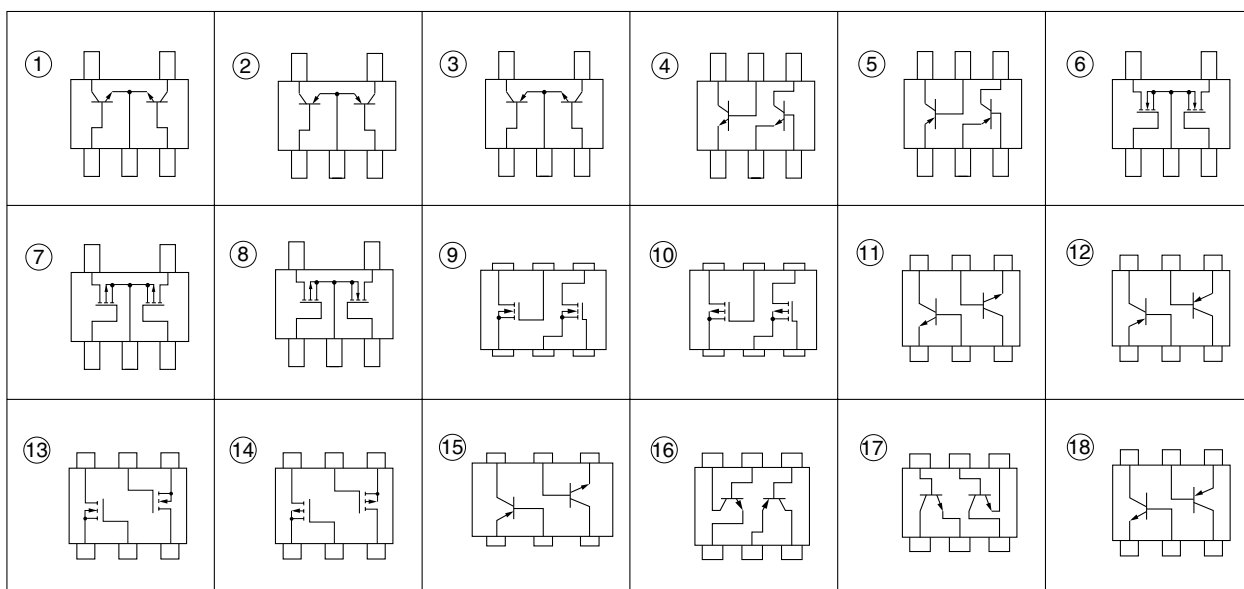
Part Number	Equivalent Circuit and Applications	Absolute Maximum Ratings (T _A = 25°C)						Electrical Characteristics (T _A = 25°C)				
		V _{CE0} (V)	V _{CE0} (V)	V _{EB0} (V)	I _C (A)	P _T (W)	T _J (°C)	R ₁ (kΩ)	R ₂ (kΩ)	h _{FE}	V _{CE} (V)	I _C (A)
HD1A3M	Refer to equivalent circuit [A]	80	60	10	1.0	2.0	150	1.0	1.0	200	2.0	0.5
HD1F3P		80	60	10	1.0		150	2.2	10	300	2.0	0.5
HD1L3N		80	60	10	1.0		150	4.7	10	300	2.0	0.5
HD1A4M	Switching	80	60	10	1.0	2.0	150	10	10	300	2.0	0.5
HD1L2Q		80	60	10	1.0		150	0.47	4.7	300	2.0	0.5
HD1F2Q		80	60	10	1.0		150	0.22	2.2	300	2.0	0.5
HD1A4A		80	60	10	1.0		150	—	10	300	2.0	0.5
HD2A3M	Refer to equivalent circuit [C]	60 ±10	60 ±10	10	1.0	2.0	150	1.0	1.0	200	2.0	0.5
HD2F3P		60 ±10	60 ±10	10	1.0		150	2.2	10	300	2.0	0.5
HD2L3N		60 ±10	60 ±10	10	1.0		150	4.7	10	300	2.0	0.5
HD2A4M	Switching	60 ±10	60 ±10	10	1.0	2.0	150	10	10	300	2.0	0.5
HD2L2Q		60 ±10	60 ±10	10	1.0		150	0.47	4.7	300	2.0	0.5
HD2F2Q		60 ±10	60 ±10	10	1.0		150	0.2	2.2	300	2.0	0.5
HD2A4A		60 ±10	60 ±10	10	1.0		150	—	10	300	2.0	0.5
HR1A3M	Refer to equivalent circuit [B]	−60	−60	−10	−1.0	2.0	150	1.0	1.0	100	−2.0	−0.5
HR1F3P		−60	−60	−10	−1.0		150	2.2	10	100	−2.0	−0.5
HR1L3N		−60	−60	−10	−1.0		150	4.7	10	100	−2.0	−0.5
HR1A4M	Switching	−60	−60	−10	−1.0	2.0	150	10	10	100	−2.0	−0.5
HR1L2Q		−60	−60	−10	−1.0		150	0.47	4.7	100	−2.0	−0.5
HR1F2Q		−60	−60	−10	−1.0		150	0.22	2.2	100	−2.0	−0.5
HR1A4A		−60	−60	−10	−1.0		150	—	10	100	−2.0	−0.5

■ HQ1[] series (Package: SOT-89)

Part Number	Equivalent Circuit and Applications	Absolute Maximum Ratings (T _A = 25°C)						Electrical Characteristics (T _A = 25°C)				
		V _{CE0} (V)	V _{CE0} (V)	V _{EB0} (V)	I _C (A)	P _T (W)	T _J (°C)	R ₁ (kΩ)	R ₂ (kΩ)	h _{FE}	V _{CE} (V)	I _C (A)
HQ1A4A	Refer to equivalent circuit [B]	−20	−20	−10	−2.0	2.0	150	—	10	150	−2.0	−1.0
HQ1F2Q		−20	−20	−10	−2.0		150	0.22	2.2	150	−2.0	−1.0
HO1L2N		−20	−20	−10	−2.0		150	0.47	1.0	150	−2.0	−1.0
HQ1L2Q	Switching	−20	−20	−10	−10	2.0	150	0.47	4.7	150	−2.0	−1.0
HQ1A3M		−20	−20	−10	−2.0		150	1.0	1.0	150	−2.0	−1.0
HQ1F3M		−20	−20	−10	−2.0		150	2.2	2.2	150	−2.0	−1.0
HQ1F3P		−20	−20	−10	−2.0		150	4.7	10	150	−2.0	−1.0

Transistor for Array

■ Equivalent Circuit



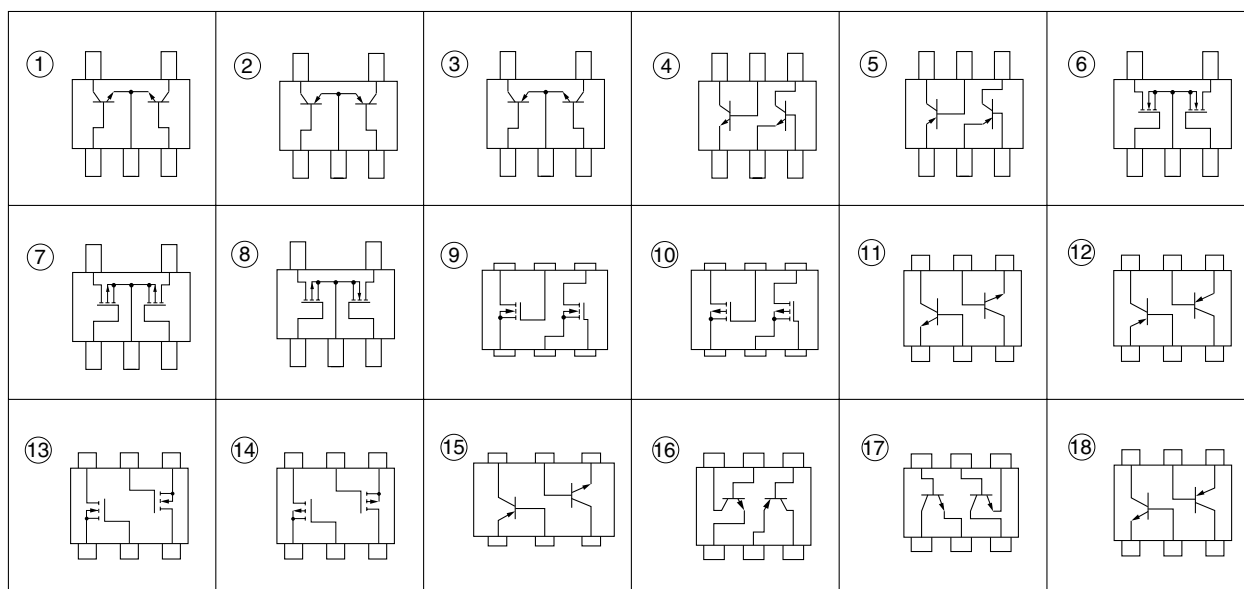
■ Bipolar Transistor

Part Number	Equivalent Circuit	V_{CE0} (V)	$I_{C(DC)}$ (mA)	P_r^{Note} (mW)	h_{FE}			Package
						V_{CE} (V)	I_C (mA)	
$\mu PA570T$	①	50	100	200	90 to 600	6	1	• 5-pin Super Mini-Mold SC-88A
$\mu PA571T$	②	-50	-100	200		-6	-1	
$\mu PA574T$	③	50/-50	100/-100	300		6/-6	1/-1	
$\mu PA670T$	⑪	50	100	200		6	1	• 6-pin Super Mini-Mold SC-88
$\mu PA671T$	⑫	-50	-100	200		-6	-1	
$\mu PA500T$	①	50	100	300		6	1	• 5-pin Mini-Mold SC-74A
$\mu PA501T$	②	-50	-100	300		-6	-1	
$\mu PA504T$	③	50/-50	100/-100	300		6/-6	1/-1	
$\mu PA600T$	④	50	100	300		6	1	• 6-pin Mini-Mold SC-74
$\mu PA601T$	⑤	-50	-100	300		-6	-1	
$\mu PA604T$	⑪	50	100	300		6	1	
$\mu PA605T$	⑫	-50	-100	300		-6	-1	
$\mu PA608T$	⑮	50 -16	100 -500	300	90 to 600 110 to 400	6 -1	1 -100	
$\mu PA609T$	⑯	40 -40	500 -500	300	75 to 300 75 to 300	1 -1	150 -150	
$\mu PA673T$	⑰	15	200	200	82 to 180	6	1	• 6-pin Super Mini-Mold SC-88
$\mu PA674T$	⑱	15 -15	200 -50	200	40 to 200 50 to 150	1 -1	10 -10	

Note Total

Transistor for Array

■ Equivalent Circuit



■ MOS FET

Part Number	Equivalent Circuit	V_{DS} (V)	$I_{C(DC)}$ (mA)	P_T^{Note} (mW)	$R_{DS(on)}$			Package
					Max. (Ω)	V_{GS} (V)	I_D (mA)	
$\mu PA572T$	⑥	30	100	200	13	2.5	10	• 5-pin Super Mini-Mold SC-88A
$\mu PA573T$	⑦	-30	-100	200	60	-2.5	-10	
$\mu PA502T$	⑥	50	100	300	30	4	10	
$\mu PA503T$	⑦	-50	-100	300	100	-4	-10	• 5-pin Mini-Mold SC-74A
$\mu PA505T$	⑧	50/-50	100/-100	300	30/100	4/-4	10/-10	
$\mu PA602T$	⑨	50	100	300	30	4	10	• 6-pin Mini-Mold SC-74
$\mu PA603T$	⑩	-50	-100	300	100	-4	-10	
$\mu PA606T$	⑬	50	100	300	30	4	10	
$\mu PA607T$	⑭	-50	-100	300	100	-4	-10	
$\mu PA610TA$	⑩	-30	-100	300	60	-2.5	-1	
$\mu PA611TA$	⑨	30	100	300	15	2.5	1	
$\mu PA672T$	⑬	50	100	200	40	2.5	10	• 6-pin Super Mini-Mold SC-88
$\mu PA675T^{\star}$	⑬	16	100	200	50	1.5	1	

Note Total

$\star$: Newly added product

Transistor Array

■ Signal transistor array Quick Reference (Monolithic)

I_o (mA) V_o (V)	500
50	μPA2987
60	μPA2001 μPA2002 μPA2003 μPA2004

■ Signal transistor array (Monolithic)

Part Number	Number of Circuits				Output Voltage V_o (V)	Output Current I_o (mA/Unit)	Surge Absorber Diode	Input Impedance	Active Level		Input/Output Relationship		Output Current Relationship		Remarks	Package
	5	6	7	8					"H"	"L"	Inverter Type	Non-inverter Type	Source Type	Sink Type		
μPA2001			○		60	500	○	—	○		○			○	Darlington	• 16-pin DIP • 16-pin SOP
μPA2002			○		60	500	○	7VZDi +10.5 k Ω	○		○			○	Darlington	
μPA2003			○		60	500	○	2.7 k Ω	○		○			○	Darlington	
μPA2004			○		60	500	○	10.5 k Ω	○		○			○	Darlington	
μPA2987			○		50	500	○	3 k Ω	○			○	○		Darlington output stage	• 16-pin SOP

Transistor Array

■ Power transistor array Quick Reference (Multi-chip, 4 circuits)

V _{CE0} (V)	I _C (DC) (A)		2.0	3.0	5.0
	Polarity				
30	NPN		μPA1478 ○		
	PNP				
60	NPN		μPA1428A ○	μPA1434 ●□	μPA1458 ○
	PNP				μPA1453 □
100	NPN		μPA1476 ○	μPA1436A	μPA1454 ●
	PNP			μPA1437	μPA1456

○ : with Zenner Diode □ : Low V_{CE} (sat) ● : Single High h_{FE}

■ Power transistor array (Multi-chip, 4 circuits)

Part Number	Number of Circuits	Collector-Emitter Voltage V _{CE} (V)	Collector Current I _C (A)	Surge Absorber Diode	Input Impedance	Output Current Relationship		Remarks	Package
						Source Type	Sink Type		
μPA1428A	4	60 ±10	±2.0	○	—		○	Darlington	• 10-pin SIP
μPA1434	4	60	3.0	—	—		○	High beta	
μPA1436A	4	100	±3.0	—	—		○	Darlington	
μPA1437	4	—100	±3.0	—	—	○		Darlington	
μPA1453	4	—60	5.0	—	—	○		Low V _{CE(sat)}	
μPA1454	4	100	5.0	—	—		○	High beta	
μPA1456	4	100	±5.0	—	—		○	Darlington	
μPA1458	4	60 ±10	±5.0	○	—		○	Darlington	
μPA1476	4	100 ±15	±2.0	○	—		○	Darlington	
μPA1478	4	31 ±4	±2.0	○	—		○	Darlington	

Transistor Array

■ Power MOS FET array Quick Reference (Multi-chip, 4 circuits)

V_{DS} (V) \ I_D (DC) (A)	2.0	3.0	5.0
30	• μ PA1520B (0.25)		• μ PA1550 (0.15)
60	• μ PA1522 (0.35) • μ PA1572B (0.8) • <u>μPA1523B</u> (1.3)	• μ PA1500B (0.24)	• μ PA1552B (0.24)
80	• μ PA1524 (1.0)		
100	• μ PA1526 (0.6) • μ PA1576 (1.5) • <u>μPA1527</u> (1.5)		• μ PA1556A (0.33)
120		• μ PA1501 (0.53) • μ PA1560 (0.165)	

(): $R_{DS(on)}$ Max. (@ $V_{GS} = 4V$) Underlined: P-channel

■ Power MOS FET array (Multi-chip, 4 circuits)

Part Number	Number of Circuits			V_{DS} (V)	I_D (A/Unit)	Surge Absorber Diode	4 V Driving	Active Level		Input/Output Relationship		Output Current Relationship		Package
	4	7	8					"H"	"L"	Inverter Type	Non-inverter Type	Source Type	Sink Type	
μ PA1500B	○			60	± 3	○	○	○		○			○	• 12-pin SIP
μ PA1501	○			120	± 3	○	○	○		○			○	
μ PA1520B	○			30	± 2	—	○	○		○			○	• 10-pin SIP
μ PA1522	○			60	± 2	—	○	○		○			○	
μ PA1523B	○			—60	∓ 2	—	○		○		○	○		
μ PA1524	○			80	± 2	—	○	○		○			○	
μ PA1526	○			100	± 2	—	○	○		○			○	
μ PA1527	○			—100	∓ 2	—	○		○		○	○		
μ PA1550	○			30	± 5	—	○	○		○			○	
μ PA1552B	○			60	± 5	—	○	○		○			○	
μ PA1556A	○			100	± 5	—	○	○		○			○	
μ PA1560	○			120	± 3		○	○		○			○	
μ PA1572B	○			60	± 2	—	○	○		○			○	
μ PA1576	○			100	± 2	—	○	○		○			○	

Transistor Array

■ Power MOS FET array Quick Reference (Monolithic)

I_D (DC) (A)	0.43	0.5	0.87
V_{DSS} (V)			
30	• μPA1601 (5.3 Ω, 7_{CH}) (DIP, SOP) • μPA1602 (5.3 Ω, 7_{CH}) (DIP, SOP)	• μPA1600 (4.0 Ω, 8_{CH}) (DIP, SOP)	• μPA1603 (1.3 Ω, 4_{CH}) (DIP, SOP) • μPA1604 (1.7 Ω, 4_{CH}) (DIP)

■ Power MOS FET array (Monolithic)

Part Number	Number of Circuits			V_{DSS} (V)	I_D (A/Unit)	Surge Absorber Diode	4 V Driving	Active Level		Input/Output Relationship		Output current Relationship		Package
	4	7	8					"H"	"L"	Inverter Type	Non-inverter Type	Source Type	Sink Type	
μ PA1600			○	30	0.5	—	○	○		○			○	• 20-pin DIP • 20-pin SOP
μ PA1601		○		30	0.43	—	○	○		○			○	• 16-pin DIP
μ PA1602		○		30	0.43	—	○		○		○		○	• 16-pin SOP
μ PA1603	○			30	0.87	○	○	○		○			○	• 16-pin DIP
μ PA1604	○			30	0.87	○	○		○		○		○	

Zener Diode

■ Zener Diode Quick Reference (1/2) (Surface-Mount Type)

V _Z (V)	P (W)							
Typ.	0.15		0.2				1.0	
2.0		RD2.0UM	RD2.0M	RD2.0MW	RD2.0S		RD2.0P	RD2.0FM
2.2		RD2.2UM	RD2.2M	RD2.2MW	RD2.2S		RD2.2P	RD2.2FM
2.4		RD2.4UM	RD2.4M	RD2.4MW	RD2.4S		RD2.4P	RD2.4FM
2.7		RD2.7UM	RD2.7M	RD2.7MW	RD2.7S		RD2.7P	RD2.7FM
3.0		RD3.0UM	RD3.0M	RD3.0MW	RD3.0S		RD3.0P	RD3.0FM
3.3		RD3.3UM	RD3.3M	RD3.3MW	RD3.3S		RD3.3P	RD3.3FM
3.6		RD3.6UM	RD3.6M	RD3.6MW	RD3.6S		RD3.6P	RD3.6FM
3.9		RD3.9UM	RD3.9M	RD3.9MW	RD3.9S		RD3.9P	RD3.9FM
4.3		RD4.3UM	RD4.3M	RD4.3MW	RD4.3S		RD4.3P	RD4.3FM
4.7	RD4.7UJ	RD4.7UM	RD4.7M	RD4.7MW	RD4.7S	RD4.7SL	RD4.7P	RD4.7FM
5.1	RD5.1UJ	RD5.1UM	RD5.1M	RD5.1MW	RD5.1S	RD5.1SL	RD5.1P	RD5.1FM
5.6	RD5.6UJ	RD5.6UM	RD5.6M	RD5.6MW	RD5.6S	RD5.6SL	RD5.6P	RD5.6FM
6.2	RD6.2UJ	RD6.2UM	RD6.2M	RD6.2MW	RD6.2S	RD6.2SL	RD6.2P	RD6.2FM
6.8	RD6.8UJ	RD6.8UM	RD6.8M	RD6.8MW	RD6.8S	RD6.8SL	RD6.8P	RD6.8FM
7.5	RD7.5UJ	RD7.5UM	RD7.5M	RD7.5MW	RD7.5S	RD7.5SL	RD7.5P	RD7.5FM
8.2	RD8.2UJ	RD8.2UM	RD8.2M	RD8.2MW	RD8.2S	RD8.2SL	RD8.2P	RD8.2FM
9.1	RD9.1UJ	RD9.1UM	RD9.1M	RD9.1MW	RD9.1S	RD9.1SL	RD9.1P	RD9.1FM
10	RD10UJ	RD10UM	RD10M	RD10MW	RD10S	RD10SL	RD10P	RD10FM
11	RD11UJ	RD11UM	RD11M	RD11MW	RD11S	RD11SL	RD11P	RD11FM
12	RD12UJ	RD12UM	RD12M	RD12MW	RD12S	RD12SL	RD12P	RD12FM
13	RD13UJ	RD13UM	RD13M	RD13MW	RD13S	RD13SL	RD13P	RD13FM
15	RD15UJ	RD15UM	RD15M	RD15MW	RD15S	RD15SL	RD15P	RD15FM
16	RD16UJ	RD16UM	RD16M	RD16MW	RD16S	RD16SL	RD16P	RD16FM
18	RD18UJ	RD18UM	RD18M	RD18MW	RD18S	RD18SL	RD18P	RD18FM
20	RD20UJ	RD20UM	RD20M	RD20MW	RD20S	RD20SL	RD20P	RD20FM
22	RD22UJ	RD22UM	RD22M	RD22MW	RD22S	RD22SL	RD22P	RD22FM
24	RD24UJ	RD24UM	RD24M	RD24MW	RD24S	RD24SL	RD24P	RD24FM
27	RD27UJ	RD27UM	RD27M	RD27MW	RD27S	RD27SL	RD27P	RD27FM
30	RD30UJ	RD30UM	RD30M	RD30MW	RD30S	RD30SL	RD30P	RD30FM
33	RD33UJ	RD33UM	RD33M	RD33MW	RD33S	RD33SL	RD33P	RD33FM
36	RD36UJ	RD36UM	RD36M	RD36MW	RD36S	RD36SL	RD36P	RD36FM
39	RD39UJ	RD39UM	RD39M	RD39MW	RD39S	RD39SL	RD39P	RD39FM
43			RD43M		RD43S		RD43P	RD43FM
47			RD47M		RD47S		RD47P	RD47FM
51					RD51S		RD51P	RD51FM
56					RD56S		RD56P	RD56FM
62					RD62S		RD62P	RD62FM
68					RD68S		RD68P	RD68FM
75					RD75S		RD75P	RD75FM
82					RD82S		RD82P	RD82FM
91					RD91S		RD91P	RD91FM
100					RD100S		RD100P	RD100FM
110					RD110S		RD110P	RD110FM
120					RD120S		RD120P	RD120FM
Package	SC-78 (USM)		SC-59 (Mini Mold)		SC-76 (SSP)		SC-62 (Power Mini Mold)	2-pin Power Mini Mold
	Low noise	General Purpose			General Purpose	Low noise		

Zener Diode

■ Zener Diode Quick Reference (2/2) (Through-Hole Type)

V _Z (V)	P (W)			
Typ.	0.4	0.4	0.5	1.0
2.0		RD2.0ES	RD2.0E	RD2.0F
2.2		RD2.2ES	RD2.2E	RD2.2F
2.4		RD2.4ES	RD2.4E	RD2.4F
2.7		RD2.7ES	RD2.7E	RD2.7F
3.0		RD3.0ES	RD3.0E	RD3.0F
3.3		RD3.3ES	RD3.3E	RD3.3F
3.6		RD3.6ES	RD3.6E	RD3.6F
3.9		RD3.9ES	RD3.9E	RD3.9F
4.3		RD4.3ES	RD4.3E	RD4.3F
4.7	RD4.7JS	RD4.7ES	RD4.7E	RD4.7F
5.1	RD5.1JS	RD5.1ES	RD5.1E	RD5.1F
5.6	RD5.6JS	RD5.6ES	RD5.6E	RD5.6F
6.2	RD6.2JS	RD6.2ES	RD6.2E	RD6.2F
6.8	RD6.8JS	RD6.8ES	RD6.8E	RD6.8F
7.5	RD7.5JS	RD7.5ES	RD7.5E	RD7.5F
8.2	RD8.2JS	RD8.2ES	RD8.2E	RD8.2F
9.1	RD9.1JS	RD9.1ES	RD9.1E	RD9.1F
10	RD10JS	RD10ES	RD10E	RD10F
11	RD11JS	RD11ES	RD11E	RD11F
12	RD12JS	RD12ES	RD12E	RD12F
13	RD13JS	RD13ES	RD13E	RD13F
15	RD15JS	RD15ES	RD15E	RD15F
16	RD16JS	RD16ES	RD16E	RD16F
18	RD18JS	RD18ES	RD18E	RD18F
20	RD20JS	RD20ES	RD20E	RD20F
22	RD22JS	RD22ES	RD22E	RD22F
24	RD24JS	RD24ES	RD24E	RD24F
27	RD27JS	RD27ES	RD27E	RD27F
30	RD30JS	RD30ES	RD30E	RD30F
33	RD33JS	RD33ES	RD33E	RD33F
36	RD36JS	RD36ES	RD36E	RD36F
39	RD39JS	RD39ES	RD39E	RD39F
43			RD43E	RD43F
47			RD47E	RD47F
51			RD51E	RD51F
56			RD56E	RD56F
62			RD62E	RD62F
68			RD68E	RD68F
75			RD75E	RD75F
82			RD82E	RD82F
91			RD91E	
100			RD100E	
110			RD110E	
120			RD120E	
Package	DO-34	DO-34	DO-35	DO-41

Noise Clipping Diode

■ Surface-Mount Type Quick Reference

V _{BR} (V)	P (W)						Application
Typ.	0.15	0.2					
3.3	NNCD3.3C	NNCD3.3D	NNCD3.3E	NNCD3.3F	NNCD3.3G		• E.S.D. absorber • Surge absorber
3.6	NNCD3.6C	NNCD3.6D	NNCD3.6E	NNCD3.6F	NNCD3.6G		
3.9	NNCD3.9C	NNCD3.9D	NNCD3.9E	NNCD3.9F	NNCD3.9G		
4.3	NNCD4.3C	NNCD4.3D	NNCD4.3E	NNCD4.3F	NNOD4.3G		
4.7	NNCD4.7C	NNCD4.7D	NNCD4.7E	NNCD4.7F	NNCD4.7G		
5.1	NNCD5.1C	NNCD5.1D	NNCD5.1E	NNCD5.1F	NNCD5.1G		
5.6	NNCD5.6C	NNCD5.6D	NNCD5.6E	NNCD5.6F	NNCD5.6G	NNCD5.6H [☆]	
6.2	NNCD6.2C	NNCD6.2D	NNCD6.2E	NNCD6.2F	NNCD6.2G		
6.8	NNCD6.8C	NNCD6.8D	NNCD6.8E	NNCD6.8F	NNCD6.8G	NNCD6.8H [☆]	
7.5	NNCD7.5C	NNCD7.5D	NNCD7.5E	NNCD7.5F	NNCD7.5G		
8.2	NNCD8.2C	NNCD8.2D	NNCD8.2E	NNCD8.2F			
9.1	NNCD9.1C	NNCD9.1D	NNCD9.1E	NNCD9.1F			
10	NNCD10C	NNCD10D	NNCD10E	NNCD10F			
11	NNCD11C	NNCD11D	NNCD11E	NNCD11F			
12	NNCD12C	NNCD12D	NNCD12E	NNCD12F			
27					NNCD27G		
Package	SC-78 (USM)	SC-76 (SSP)	SC-59 (Mini Mold)		SC-74A (Mini Mold)	SC-88A (SSP)	
			Single	Twin	Quad	Quad	

☆ : Newly added product

■ Surface-Mount Type (Low Capacitance) Quick Reference

V _{BR} (V)	P (W)		Application
Typ.	0.2		
5.6	NNCD5.6LG	NNCD5.6LH	• E.S.D. absorber
6.2	NNCD6.2LG	NNCD6.2LH	
6.8	NNCD6.8LG	NNCD6.8LH	
Package	SC-74A (Mini Mold)	SC-88A (SSP)	
	Quad		

■ Surface-Mount Type (Low Capacitance and High ESD Endurance Type) Quick Reference

V _{BR} (V)	P (W)		Application
Typ.	0.2		
5.6		NNCD5.6MG	• E.S.D. absorber
6.2	NNCD6.2MF	NNCD6.2MG	
6.8		NNCD6.8MG	
Package	SC-59 (Mini Mold)	SC-74A (Mini Mold)	
	Twin	Quad	

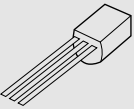
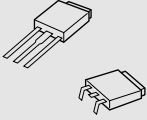
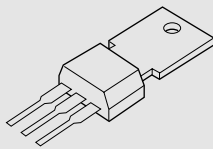
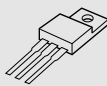
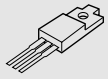
Noise Clipping Diode

■ Through Hole Type Quick Reference

V _{BR} (V)	P (W)		Application
Typ.	0.4	0.5	
3.3	NNCD3.3A	NNCD3.3B	• E.S.D. protection • Surge absorber
3.6	NNCD3.6A	NNCD3.6B	
3.9	NNCD3.9A	NNCD3.9B	
4.3	NNCD4.3A	NNCD4.3B	
4.7	NNCD4.7A	NNCD4.7B	
5.1	NNCD5.1 A	NNCD5.1B	
5.6	NNCD5.6A	NNCD5.6B	
6.2	NNCD6.2A	NNCD6.2B	
6.8	NNCD6.8A	NNCD6.8B	
7.5	NNCD7.5A	NNCD7.5B	
8.2	NNCD8.2A	NNCD8.2B	
9.1	NNCD9.1A	NNCD9.1B	
10	NNCD10A	NNCD10B	
11	NNCD11A	NNCD11B	
12	NNCD12A	NNCD12B	
Package	DO-34	DO-35	

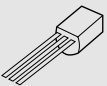
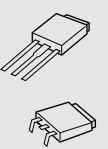
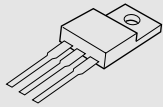
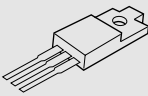
Thyristor

■ SCR

Package															
	SOT-89	TO-92	TO-251 (MP-3) TO-252 (MP-3Z)			TO-202AA				TO-220AB (MP-25)		Isolated TO-220 (MP-45)			
$I_{T(RMS)}$ (A)	0.47	0.47	4.7	8	12.6	4	4	4	4.7	8	12.6	8	12.6		
$I_{T(AV)}$ (A)	0.3	0.3	3	5	8	2	2	2.5	3	5	8	5	8		
I_{TSM} (A)	6	8	40	65	80	20	20	45	65	80	100	80	100		
T_J (°C)	125	125	125			125				125		125			
V_{DRM} V_{RRM} (V)	200	03P2J 03P2M	–	–	–	–	2S2M	–	–	–	8P2M	–	8P2SM		
	400	03P4J 03P4M	03P4MG	3P4J 3P4J-Z	5P4J 5P4J-Z	8P4J 8P4J-Z	2P4M	2S4M	2V5P4M	3P4MH	5P4M	8P4M	5P4SM	8P4SM	
	600	–	–	03P6MG	–	5P6J 5P6J-Z	–	2P6M	–	–	3P6MH	5P6M	–	5P6SM	–
I_{GT} (mA)	0.2	0.2	3-50 μ A		0.1	0.2	10	0.2	0.3	0.1	0.2	10	10	10	10
$t_{Q(TYP)}$ (μ s)	25	25	60	30	80	50	30	15 ^{Note}	80	80	50	100	50	100	

Note indicates Max.

■ TRIAC

Package																	
																	
Electrical Characteristics	SOT-89	TO-92	TO-251 (MP-3) TO-252 (MP-3Z)	TO-202AA	TO-220AB (MP-25)							Isolated TO-220 (MP-45)					
$I_{T(RMS)}$ (A)	1.0	0.8 1.0	3 5	3	5 8 10 12 16	30 50 80 80 100 150	3	5	8	10	12	16	30	50	80	80	100
$I_{TSM(50\text{ Hz})}$ (A)	7.0	7 9	30 50	30	50 80 80 100 150	30 50 80 80 100 150	30	50	80	80	100	150	30	50	80	80	100
T_j (°C)	125	125	125	125	125							125					
V_{DRM} V_{RRM} (V)	400	AC01DJM AC0V8DGM AC01DGM	AC03DJM AC03DJM-Z	AC05DJM AC05DJM-Z	AC03DGM AC05DGM AC08DGM AC10DGM AC12DGM AC16DGM	AC03DSM AC05DSM AC08DSM AC10DSM AC12DSM AC16DSM	AC03FSM AC05FSM AC08FSM AC10FSM AC12FSM AC16FSM	AC03FSM AC05FSM AC08FSM AC10FSM AC12FSM AC16FSM	AC03FSM AC05FSM AC08FSM AC10FSM AC12FSM AC16FSM	AC03FSM AC05FSM AC08FSM AC10FSM AC12FSM AC16FSM	AC03FSM AC05FSM AC08FSM AC10FSM AC12FSM AC16FSM	AC03FSM AC05FSM AC08FSM AC10FSM AC12FSM AC16FSM	AC03FSM AC05FSM AC08FSM AC10FSM AC12FSM AC16FSM	AC03FSM AC05FSM AC08FSM AC10FSM AC12FSM AC16FSM	AC03FSM AC05FSM AC08FSM AC10FSM AC12FSM AC16FSM	AC03FSM AC05FSM AC08FSM AC10FSM AC12FSM AC16FSM	AC03FSM AC05FSM AC08FSM AC10FSM AC12FSM AC16FSM
	600	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
I_{GT} (mA)	I	5	5	3	12	10	12	10	20	20	20	30	12	10	20	20	30
	II	10	10	5	–	–	–	–	–	–	–	–	–	–	–	–	–
	III	5	5	3	12	10	12	10	20	20	20	30	12	10	20	20	30
	IV	10	10	3	12	10	12	10	20	20	20	30	12	10	20	20	30
$(dv/dt)_c$ (V/ μ s)	Min.	0.5	1	0.5	5	5	5	5	10	10	10	10	5	5	10	10	10

[MEMO]

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