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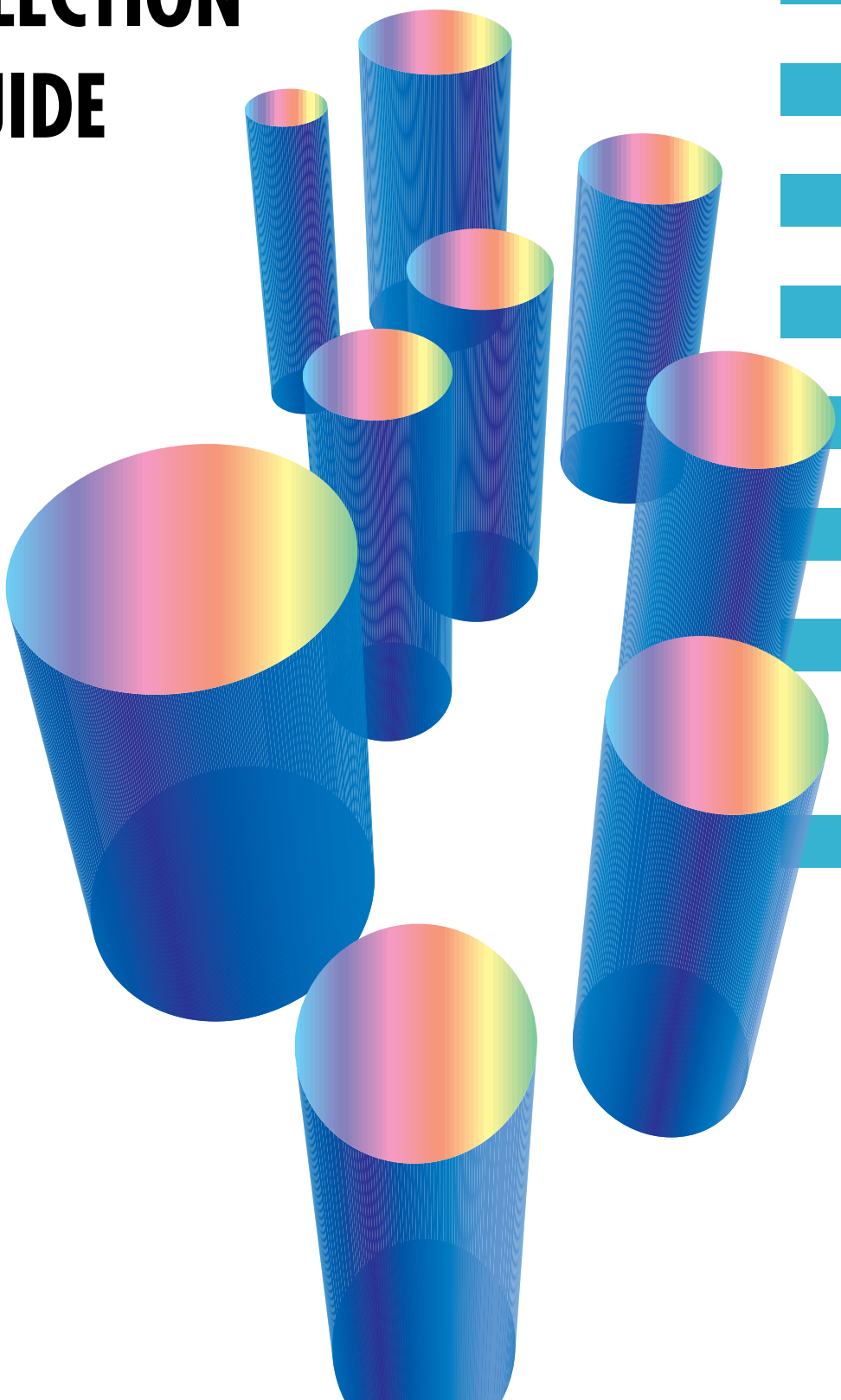
NEC MULTIMEDIA

NEC

SEMICONDUCTORS SELECTION GUIDE



April 1999

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The μPD754144, 754244, 754264, 75F4264, 789196AY, 789197AY, 78F9197AY, 789216AY, 789217AY, 78F9217AY, 780973, 78F0974, 780949, 78F0949 are manufactured and sold in accordance with the license agreement with CP8 Transac pertinent to the patent of microcomputers with on-chip EEPROM.

Note that this product can not be used for the IC card (SMART CARD).

Caution: The I^2C bus interface circuit is incorporated in the μPD17709 subseries, 17719 subseries, 178018A subseries, 178048 subseries, 178078 subseries, 178098 subseries, 780018AY subseries, 780024AY subseries, 780034AY subseries, 780058Y subseries, 780078Y subseries, 78018FY subseries, 780308Y subseries, 78054Y subseries, 78058FY subseries, 78064Y subseries, 780701Y subseries, 78078Y subseries, 780833Y subseries, 784038Y subseries, 784216Y subseries, 784218Y subseries, 784225Y subseries, 784928Y subseries, 789197AY subseries, 789217AY subseries, μPD17001, 17P001, 17003A, 17005, 17P005, 17010, 17P010, 703008Y, 70F3008Y, 703015Y, 703017Y, 70F3017Y, 703033Y, 70F3033Y, 70F3035Y, 78070AY, μPC1851B, 1853, 1854A, 1857A, 1884, μPD61882, 6221, 6222 and 72254Y.

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[MEMO]

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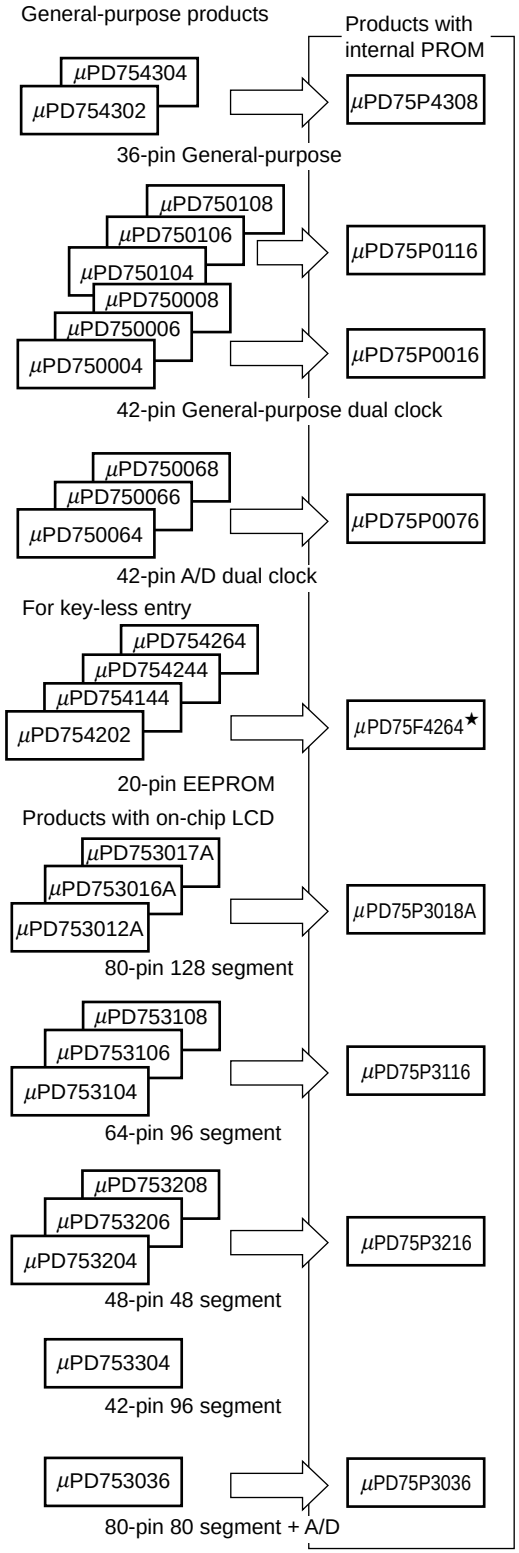
Microcomputer

1

4-Bit Single-Chip Microcontroller

75XL Series

■ 75XL Series Products Product Evolution



★ : Under development

4-Bit Single-Chip Microcontroller

75XL Series

■ **General-Purpose 42-pin (1/2)**

Part number		**μPD750004**		**μPD750006**	**μPD750008**	**μPD75P0016**
ROM (bytes)		4096 (Mask ROM)		6144 (Mask ROM)	8192 (Mask ROM)	16384 (One-time PROM)
RAM (× 4 bits)		512				
General-purpose register		(4-bit × 8) × 4 banks or (8-bit × 4) × 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)				
I/O port	CMOS input	34	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, 13 V withstand voltage Pull-up resistors can be incorporated by mask option		Can drive LED 13 V withstand voltage No on-chip pull-up resistors
Timer		4 channels		• 8-bit timer/event counter × 1 channel • Basic interval timer/watchdog timer × 1 channel • Watch timer × 1 channel • 8-bit 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				
Vectored interrupt		External: 3, Internal: 4				
Test input		External: 1, Internal: 1				
Clock output (PCL)		• 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 (BUZ)		• 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		V_{DD} = 2.2 to 5.5 V (V_{DD} = 1.8 to 5.5 V with external clock)				
Package		• 42-pin plastic shrink DIP (600 mil) • 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 (2/2)

Part number		**μPD750104**		**μPD750106**	**μPD750108**	**μPD75P0116**
ROM (bytes)		4096 (Mask ROM)		6144 (Mask ROM)	8192 (Mask ROM)	16384 (One-time PROM)
RAM (× 4 bits)		512				
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 2.0 MHz main system clock) • 4 μs, 8 μs, 16 μs, 64 μs (with RC 1.0 MHz main system clock) • 122 μs (with 32.768 kHz subsystem clock)				
Minimum instruction execution time		2 μs (V_{DD} = 1.8 to 5.5 V)				
I/O port	CMOS input	34	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, 13 V withstand voltage Pull-up resistors can be incorporated by mask option		Can drive LED 13 V withstand voltage No on-chip pull-up resistors
Timer		4 channels		• 8-bit timer/event counter × 1 channel • Basic interval timer/watchdog timer × 1 channel • Watch timer × 1 channel • 8-bit 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				
Vectored interrupt		External: 3, Internal: 4				
Test input		External: 1, Internal: 1				
Clock output (PCL)		Φ, 125 kHz, 62.5 kHz, 15.6 kHz (with 1.0 MHz main system clock)				
Buzzer output (BUZ)		• 2 kHz, 4 kHz, 32 kHz (with 32.768 kHz subsystem clock) • 0.49 kHz, 0.98 kHz, 7.81 kHz (with 1.0 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		V_{DD} = 1.8 to 5.5 V				
Package		• 42-pin plastic shrink DIP (600 mil) • 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		**μPD750064**		**μPD750066**	**μPD750068**	**μPD75P0076**
ROM (bytes)		4096 (Mask ROM)		6144 (Mask ROM)	8192 (Mask ROM)	16384 (One-time PROM)
RAM (× 4 bits)		512				
General-purpose register		(4-bit × 8) × 4 banks or (8-bit × 4) × 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)				
I/O port	CMOS input	32	12	On-chip pull-up resistors are connectable by software: 7 Also used for analog input pins: 4		
	CMOS I/O		12	Can drive LED On-chip pull-up resistors are connectable by software Also used for analog input pins: 4		
	N-ch open-drain I/O		8	Can drive LED, 13 V withstand voltage Pull-up resistors can be incorporated by mask option		Can drive LED 13 V withstand voltage No on-chip pull-up resistors
Timer		4 channels		• 8-bit timer/event counter: 2 channels (Usable as 16-bit timer/event counter) • Basic interval timer/watchdog timer: 1 channel • Watch timer: 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 × 8 channels				
Vectored interrupt		External: 3, Internal: 4				
Test input		External: 1, Internal: 1				
Clock output (PCL)		• 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 (BUZ)		• 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/oprations/increment and decrement/comparison				
Power supply voltage		V_{DD} = 1.8 to 5.5 V				
Package		• 42-pin plastic shrink DIP (600 mil, 1.778-mm pitch) • 42-pin plastic shrink SOP (375 mil, 0.8-mm pitch)				
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		**μPD754302**		**μPD754304**	**μPD75P4308**
ROM (bytes)		2048 (Mask ROM)		4096 (Mask ROM)	8192 (One-time PROM)
RAM (× 4 bits)		256			
General-purpose register		(4-bit × 8) × 4 banks or (8-bit × 4) × 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)			
I/O port	CMOS input	30	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, 13 V withstand voltage Pull-up resistors can be incorporated by mask option	Can drive LED 13 V withstand voltage No on-chip pull-up resistors
Timer		3 channels		8-bit timer/event counter × 2 channels (usable as 16-bit timer/event counter) Basic interval timer/watchdog timer × 1 channel	
Serial interface		Either of two modes can be used: • 3-wire serial I/O mode: MSB/LSB switchable • 2-wire serial I/O mode			
Vectored interrupt		External: 3, Internal: 4			
Test input		External: 1			
Clock output (PCL)		• 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		V_{DD} = 1.8 to 5.5 V			
Package		• 36-pin plastic shrink SOP (300 mil, 0.8-mm pitch)			
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

■ Keyless Entry

Part number			**μPD754202**	**μPD754144**	**μPD754244**	**μPD754264**	**μPD75F4264★**
ROM (bytes)			2048 (Mask ROM)	4096 (Mask ROM)			4096 (Flash memory)
RAM (× 4 bits)			128				
EEPROM™ (bytes)			—	16		32	
General-purpose register			(4-bit × 8) × 4 banks or (8-bit × 4) × 4 banks				
Instruction cycle			• 0.95 μs, 1.91 μs, 3.81 μs, 15.3 μs (with 4.19 MHz System clock) • 0.67 μs, 1.33 μs, 2.67 μs, 10.7 μs (with 6.0 MHz System clock)	• 4 μs, 8 μs, 16 μs, 64 μs (with 1 MHz system clock)	• 0.95 μs, 1.91 μs, 3.81 μs, 15.3 μs (with 4.19 MHz system clock) • 0.67 μs, 1.33 μs, 2.67 μs, 10.7 μs (with 6.0 MHz system clock)		
Minimum instruction execution time			• 0.67 μs (V_{DD} = 2.7 to 6.0 V) • 0.95 μs (V_{DD} = 1.8 to 6.0 V)	2 μs (V_{DD} = 1.8 to 6.0 V)	• 0.67 μs (V_{DD} = 2.7 to 6.0 V) • 0.95 μs (V_{DD} = 1.8 to 6.0 V)		
I/O port	CMOS input	13	4	Pull-up resistors can be incorporated by mask option			No on-chip pull-up resistors
	CMOS I/O		9	Can drive LED On-chip pull-up resistors are connectable by software			
Systrem clock oscillator			Crystal/ceramic oscillator	RC oscillator (external resistors and capacitors)	Crystal/ceramic oscillator		
Timer			4 channels	• 8-bit timer counter: 3 channels (Usable as 16-bit timer counter or remote controller signal carrier generator) • Basic interval timer/watchdog timer: 1 channel			
Programmable threshold port			—	4-bit resolution × 2		—	
A/D converter			—			8-bit resolution × 2	
Others			Key return reset function				
Vectored interrupt			External: 1, internal: 5				
Test input			External: 1				
Instruction set			• Bit data set/reset/test/boolean operations • 4-/8-bit data transfer/operations/increment and decrement/comparison				
Power supply voltage			V_{DD} = 1.8 to 6.0 V				
Package			• 20-pin plastic SOP (300 mil, 1.27-mm pitch) • 20-pin plastic shrink SOP (300 mil, 0.65-mm pitch)			20-pin plastic SOP (300 mil, 1.27-mm pitch)	
Development tools			Assembler, IE controller, device file, in-circuit emulator				
Applications			Keyless entries, data carriers				

★: Under development

4-Bit Single-Chip Microcontroller

75XL Series

■ LCD-Driver 80-pin

Part number		μPD753012A		μPD753016A	μPD753017A	μPD75P3018A
ROM (bytes)		12288 (Mask ROM)		16384 (Mask ROM)	24576 (Mask ROM)	32768 (One-time PROM)
RAM (× 4 bits)		1024				
General-purpose register		(4-bit × 8) × 4 banks or (8-bit × 4) × 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)				
I/O port	CMOS input	40	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 I/O		8	Also used for segment pins		
	N-ch open-drain I/O		8	Can drive LED, 13 V withstand voltage Pull-up resistors can be incorporated by mask option		Can drive LED 13 V withstand voltage No on-chip pull-up resistors
LCD controller/driver		• Number of segments selectable: 24/28/32 segments (switchable to CMOS 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 divider resistors for LCD drive can be incorporated by mask option				No on-chip voltage divider resistors for LCD drive
Timer		5 channels		• 8-bit timer/event counter: 3 channels (usable as 16-bit timer/event counter or remote-controller signal carrier generator) • 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				
Vectored interrupt		External: 3, Internal: 5				
Test input		External: 1, Internal: 1				
Clock output (PCL)		• 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 (BUZ)		• 2 kHz, 4 kHz, 32 kHz (with 4.19 MHz main system clock, or with 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		V_{DD} = 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, 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		μPD753104			μPD753106		μPD753108	μPD75P3116
ROM (bytes)		4096 (Mask ROM)			6144 (Mask ROM)		8192 (Mask ROM)	16384 (One-time PROM)
RAM (× 4 bits)		512						
General-purpose register		(4-bit × 8) × 4 banks or (8-bit × 4) × 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)						
I/O port	CMOS input	32	8	On-chip pull-up resistors are connectable by software: 7				
	CMOS I/O		12	Can drive LED On-chip pull-up resistors are connectable by software				
	CMOS I/O		8	Also used for segment pins				
	N-ch open-drain I/O		4	Can drive LED, 13 V withstand voltage Pull-up resistors can be incorporated by mask option				Can drive LED 13 V withstand voltage No on-chip pull-up resistors
LCD controller/driver		• Number of segments selectable: 16/20/24 segments (switchable to CMOS 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 divider resistors for LCD drive can be incorporated by mask option						No on-chip voltage divider resistors for LCD drive
Timer		5 channels		• 8-bit timer/event counter: 3 channels (usable as 16-bit timer/event counter or remote-controller signal carrier generator) • 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						
Vectored interrupt		External: 3, Internal: 5						
Test input		External: 1, Internal: 1						
Clock output (PCL)		• 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 (BUZ)		• 2 kHz, 4 kHz, 32 kHz (with 4.19 MHz main system clock, or with 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		V_{DD} = 1.8 to 5.5 V						
Package		• 64-pin plastic QFP (14 × 14 mm) • 64-pin plastic TQFP (12 × 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		μPD753204		μPD753206	μPD753208	μPD75P3216
ROM (bytes)		4096 (Mask ROM)		6144 (Mask ROM)	8192 (Mask ROM)	16384 (One-time PROM)
RAM (× 4 bits)		512				
General-purpose register		(4-bit × 8) × 4 banks or (8-bit × 4) × 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)				
I/O port	CMOS input	30	6	On-chip pull-up resistors are connectable by software: 5		
	CMOS I/O		12	Can drive LED On-chip pull-up resistors are connectable by software		
	CMOS I/O		8	Also used for segment pins On-chip pull-up resistors are connectable by software		
	N-ch open-drain I/O		4	Can drive LED, 13 V withstand voltage Pull-up resistors can be incorporated by mask option		Can drive LED 13 V withstand voltage No on-chip pull-up resistors
LCD controller/driver		• Number of segments selectable: 4/8/12 segments • 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 divider resistors for LCD drive can be incorporated by mask option				No on-chip voltage divider resistors for LCD drive
Timer		5 channels	• 8-bit timer/event counter × 1 channel • Basic interval timer/watchdog timer × 1 channel • Watch timer × 1 channel • 8-bit timer × 2 channels (usable as 16-bit timer or remote controller signal carrier generator)			
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				
Vectored interrupt		External: 2, Internal: 5				
Test input		External: 1, Internal: 1				
Clock output (PCL)		• 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 (BUZ)		• 2 kHz, 4 kHz, 32 kHz (with 4.19 MHz main system 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		V_{DD} = 1.8 to 5.5 V				
Package		48-pin plastic shrink SOP (375 mil, 0.65-mm pitch)				
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 42-pin

Part number		**μPD753304**		
ROM (bytes)		4096 (Mask ROM)		
RAM (× 4 bits)		256		
General-purpose register		(4-bit × 8) × 4 banks or (8-bit × 4) × 4 banks		
Instruction cycle		1.1 μs, 2.2 μs, 4.4 μs, 17.8 μs (with 3.6 MHz main system clock, RC oscillator)		
		85.1 μs (with 47 kHz subsystem clock, RC oscillator)		
Minimum instruction execution time		• 0.67 μs (V_{DD} = 4.5 to 5.5 V) • 0.8 μs (V_{DD} = 2.5 to 5.5 V)		
I/O port	CMOS I/O	12	8	On-chip pull-up resistors are connectable by software: 4
	CMOS I/O		4	Also used for segment pins
LCD controller/driver		• Number of segments selectable: 20/24 segments (switchable to CMOS I/O ports in multiples of 4 : 4) • 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)		
		On-chip voltage divider resistors for LCD drive		
Timer		3 channels		• 8-bit timer: 1 channel • Basic interval timer/watchdog timer: 1 channel • Watch timer: 1 channel
Vectored interrupt		External: 1, Internal: 2		
Test input		Internal: 1		
Clock output (PCL)		Φ, 3.6 MHz, 450 kHz, 225 kHz (with 3.6 MHz main system clock)		
Buzzer output (BUZ)		• 2.94 kHz, 5.88 kHz, 47 kHz (with 47 kHz subsystem clock) • 1.76 kHz, 3.52 kHz, 28.13 kHz (with 3.6 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		V_{DD} = 2.5 to 5.5 V		
Operating ambient temperature		T_A = –10 to +60°C		
Package		• 42-pin pellet/wafer • 42-pin ceramic shrink DIP (600 mil) (ES only)		
Development tools		Assembler, IE controller, device file, in-circuit emulator		
Applications		Small-size LCD displays, etc.		

4-Bit Single-Chip Microcontroller

75XL Series

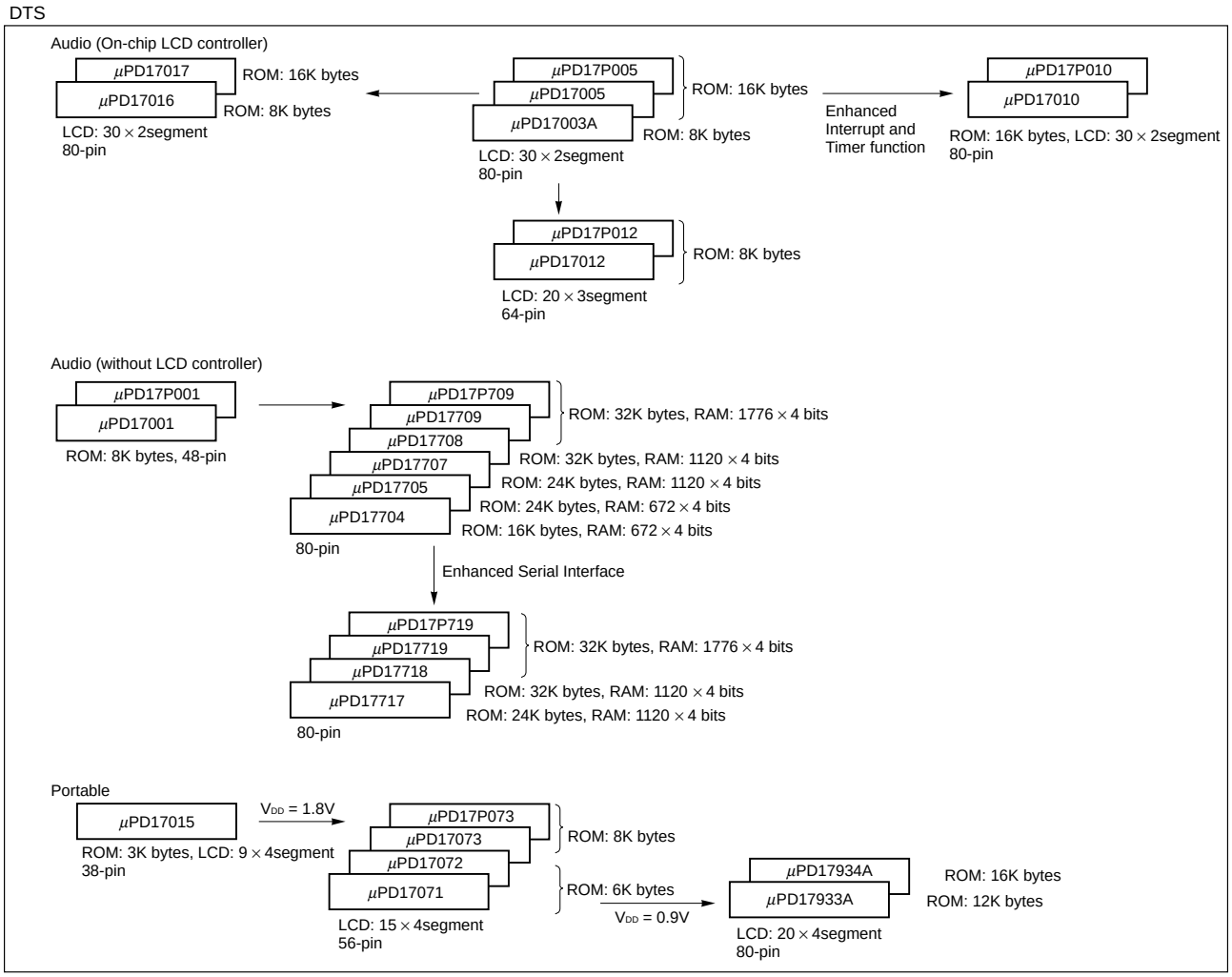
■ LCD-Driver 80-pin (A/D)

Part number		μPD753036			μPD75P3036
ROM (bytes)		16384 (Mask ROM)			16384 (One-time PROM)
RAM (× 4 bits)		768			
General-purpose register		(4-bit × 8) × 4 banks or (8-bit × 4) × 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)			
I/O port	CMOS input	44	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	
	Bit-port output		8	Also used for segment pins	
	N-ch open-drain I/O		8	Can drive LED 13 V withstand voltage Pull-up resistors can be incorporated by mask option	Can drive LED, 13 V withstand voltage No on-chip pull-up resistors
LCD controller/driver		• Number of segments selectable: 12/16/20 segments (switchable to bit-port output 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 divider resistors for LCD drive can be incorporated by mask option			No on-chip voltage divider resistors for LCD drive
Timer		5 channels	• 8-bit timer/event counter: 3 channels (Usable as 16-bit timer/event counter or remote controller signal carrier generator) • 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			
A/D converter		8-bit resolution × 8 channels			
Vectored interrupt		External: 3, Internal: 5			
Test input		External: 1, Internal: 1			
Clock output (PCL)		• 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 (BUZ)		• 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		V_{DD} = 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, IE controller, device file, in-circuit emulator			
Applications		Cordless telephones, AV equipment, home electric appliances, OA equipment, health equipment, meters, gas tables, etc.			

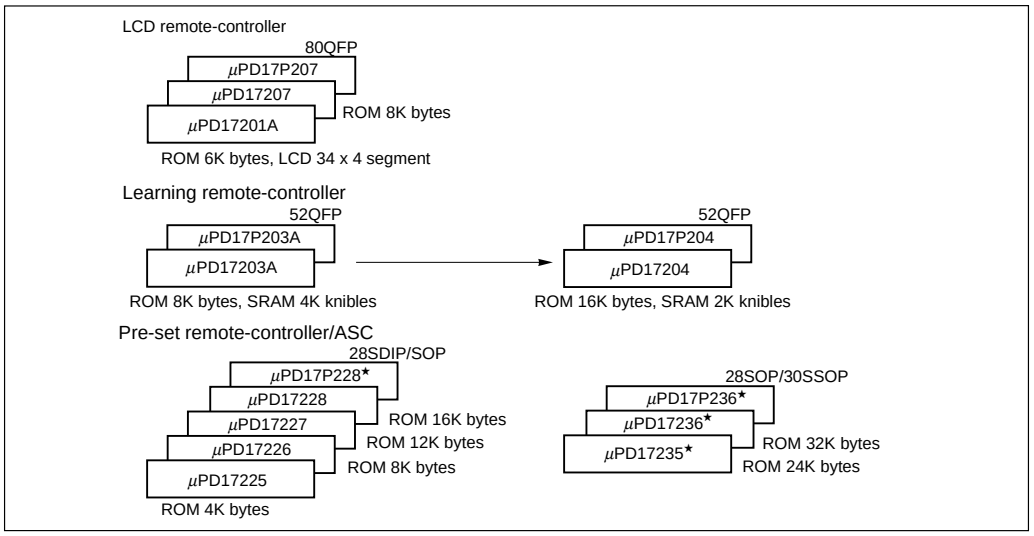
4-Bit Single-Chip Microcontroller

17K Series

■ 17K Series Product Evolution



★: Under development



★: Under development

4-Bit Single-Chip Microcontroller

17K Series

■ Audio (On-Chip LCD Controller)

Part number	**μPD17003A**	**μPD17005**	**μPD17010**	**μPD17016**	**μPD17017**	**μPD17012**
Main application	High-end tuner, automotive radio					
ROM size	3836 × 16 bits	7932 × 16 bits	7932 × 16 bits	3836 × 16 bits	7932 × 16 bits	4096 × 16 bits
RAM size	320 × 4 bits	432 × 4 bits	432 × 4 bits	320 × 4 bits	432 × 4 bits	316 × 4 bits
Display	On-chip LCD driver Segment signal: 30 Common signal: 2					On-chip LCD driver Segment signal: 20 Common signal: 3
Input port	8					
Output port	9 (+30)			9 (+8)		8 (+ 20)
I/O port	16					14
D/A converter	4			2		2
A/D converter	6			6		2
Modulo timer	—					1
Power supply voltage	+5 V ±10%					
Crystal	4.5 MHz					
PLL reference frequency	1, 1.25, 2.5, 3, 5, 6.25, 9, 10, 12.5, 25, 50, 100 kHz					
Applicable prescaler	On-chip (150 MHz)					On-chip (250 MHz)
Package	80-pin plastic QFP					64-pin plastic QFP
One-time PROM product	μPD17P005		μPD17P010	μPD17P005		μPD17P012
Development tools	Assembler, C-like compiler, device file, integrated debugger, in-circuit emulator					

4-Bit Single-Chip Microcontroller

17K Series

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

Subseries name	–	**μPD17709 Subseries**				
Part number	**μPD17001**	**μPD17704**	**μPD17705**	**μPD17707**	**μPD17708**	**μPD17709**
Main application	High-end tuner, automotive radio					
ROM size	3836 × 16 bits	8192 × 16 bits	12288 × 16 bits		16384 × 16 bits	
RAM size	224 × 4 bits	672 × 4 bits		1120 × 4 bits		1776 × 4 bits
Input port	8	12				
Output port	12	4				
I/O port	12	46				
D/A converter	4	3				
A/D converter	6	6				
Modulo timer	–	4 (Used also PWM: 1)				
Power supply voltage	+5 V ±10%					
Crystal	4.5 MHz					
PLL reference frequency	∗	1, 1.25, 2.5, 3, 5, 6.25, 9, 10, 12.5, 18, 20, 25, 50 kHz				
Applicable prescaler	On-chip (130 MHz)					
Package	48-pin plastic QFP	80-pin plastic QFP				
One-time PROM product	μPD17P001	μPD17P709				
Development tools	Assembler, C-like compiler, device file, integrated debugger, in-circuit emulator					

∗: 1, 1.25, 2.5, 3, 5, 6.25, 9, 10, 12.5, 25, 50, 100 kHz

4-Bit Single-Chip Microcontroller

17K Series

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

Subseries name	**μPD17719 Subseries**		
Part number	**μPD17717**	**μPD17718**	**μPD17719**
Main application	High-end tuner, automotive radio		
ROM size	12288 × 16 bits	16384 × 16 bits	
RAM size	1120 × 4 bits		1776 × 4 bits
Input port	12		
Output port	4		
I/O port	46		
D/A converter	3		
A/D converter	6		
Serial interface	2-wire/3-wire/SBI/I^2C bus (selectable): 1 channel 3-wire/UART (selectable): 1 channel		
Modulo timer	4 (Used also PWM: 1)		
Power supply voltage	+5 V ±10%		
Crystal	4.5 MHz		
PLL reference frequency	1, 1.25, 2.5, 3, 5, 6.25, 9, 10, 12.5, 18, 20, 25, 50 kHz		
Applicable prescaler	On-chip (130 MHz)		
Package	80-pin plastic QFP		
One-time PROM product	μPD17P719		
Development tools	Assembler, C-like compiler, device file, integrated debugger, in-circuit emulator		

4-Bit Single-Chip Microcontroller

17K Series

■ Portable

Part number	μPD17015	μPD17071	μPD17072	μPD17073	μPD17933A	μPD17934A
Main application	Portable radio					
ROM size	1528 × 16 bits	3072 × 16 bits		4096 × 16 bits	6144 × 16 bits	8192 × 16 bits
RAM size	97 × 4 bits	174 × 4 bits			448 × 4 bits	
Display	On-chip LCD driver Segment signal: 9 Common signal: 4	On-chip LCD driver Segment signal: 15 Common signal: 4			On-chip LCD driver Segment signal: 20 Common signal: 4	
Input port	3	4			11	
Output port	7	9			6	
I/O port	2	8			20	
A/D converter	—		2		3	
Power supply voltage	1.7 to 2.6 V (when PLL is stopped) 1.8 to 3.6 V (when PLL is operating)	1.8 to 3.6 V			0.9 to 1.8 V	
Crystal	75 kHz					
PLL reference frequency	1, 3, 5, 12.5 kHz	1, 3, 5, 6.25, 12.5, 25 kHz				
Applicable prescaler	On-chip (220 MHz)	On-chip (230 MHz)				
Package	38-pin plastic shrink SOP	56-pin plastic QFP	56-pin plastic QFP 64-pin plastic TQFP		80-pin plastic TQFP	
One-time PROM product	—	μPD17P073			—	
Development tools	Assembler, C-like compiler, device file, integrated debugger, in-circuit emulator					

4-Bit Single-Chip Microcontroller

17K Series

■ LCD Remote-Controller, Learning Remote-Controller

Part number	**μPD17201A**	**μPD17207**	**μPD17203A**	**μPD17204**
Main application	Infrared remote controller with LCD display		Infrared remote controller for learning	
ROM size	3072 × 16 bits	4096 × 16 bits	4096 × 16 bits	7936 × 16 bits
RAM size	336 × 4 bits		336 × 4 bits	
Static RAM	—	—	4096 × 4 bits	2048 × 4 bits
LCD controller/driver	136 segments maximum		None	
Carrier generator for infrared remote-controller signal	On-chip		On-chip	
Infrared remote-controller signal receiver preamplifier	None		On-chip	
I/O port	19		28	
External interrupt	1		1	
Analog input	A/D converter: 4 channels (8-bit resolution)		—	
Timer	2 channels		4 channel	
Serial interface	1 channel		1 channel	
Watchdog timer	On-chip ($\overline{\text{WDOUT}}$ output)		On-chip ($\overline{\text{WDOUT}}$ output)	
Dual clock	On-chip		On-chip	
Instruction execution time	4 μs at 4 MHz		4 μs at 4 MHz	
Power supply voltage	2.2 to 5.5 V		2.2 to 5.5 V	
Package	80-pin plastic QFP		52-pin plastic QFP	
One-time PROM product	μPD17P207	μPD17P207	μPD17P203A	μPD17P204
Development tools	Assembler, C-like compiler, device file, integrated debugger, in-circuit emulator			

4-Bit Single-Chip Microcontroller

17K Series

■ Pre-set Remote-Controller/ASC

Part number	**μPD17225**	**μPD17226**	**μPD17227**	**μPD17228**
Main application	Pre-set remote controller, toy, portable system			
ROM size	2048 × 16 bits	4096 × 16 bits	6144 × 16 bits	8192 × 16 bits
RAM size	111 × 4 bits		223 × 4 bits	
Carrier generator for infrared remote-controller signal	On-chip			
I/O port	CMOS input: 9 N-ch open-drain output: 8 CMOS I/O: 4			
External interrupt	1			
Timer	2 channels			
Watchdog timer	On-chip ($\overline{\text{WDOUT}}$ output)			
Low voltage detection circuit	On-chip ($\overline{\text{WDOUT}}$ output)			
P0C/P0D standby operation	The output level existing immediately before setting standby mode is maintained.			
Instruction execution time	High speed mode: 2 μs (at 8 MHz) Normal mode: 4 μs (at 8 MHz)			
Power supply voltage	2.2 to 3.6 V (4 μs, 2.0 to 3.6 V)			
Package	28-pin plastic SDIP, 28-pin plastic SOP, 30-pin plastic shrink SOP			
One-time PROM product	μPD17P228★			
Development tools	Assembler, C-like compiler, device file, integrated debugger, in-circuit emulator			

Part number	**μPD17235★**	**μPD17236★**
Main application	Pre-set remote controller, toy, portable system	
ROM size	12288 × 16 bits	16384 × 16 bits
RAM size	223 × 4 bits	
Carrier generator for infrared remote-controller signal	On-chip	
I/O port	CMOS input: 9 or 10 N-ch open-drain output: 8 or 9 CMOS I/O: 4	
External interrupt	1	
Timer	2 channels	
Watchdog timer	On-chip	
Low voltage detection circuit	On-chip	
P0C/P0D standby operation	The output level existing immediately before setting standby mode is maintained.	
Instruction execution time	High speed mode: 2 μs (at 8 MHz) Normal mode: 4 μs (at 8 MHz)	
Power supply voltage	2.2 to 3.6 V (4 μs, 2.0 to 3.6 V)	
Package	28-pin plastic SOP, 30-pin plastic shrink SOP	
One-time PROM product	μPD17P236★	
Development tools	Assembler, C-like compiler, device file, integrated debugger, in-circuit emulator	

★: Under development

4-Bit Single-Chip Microcontroller

μPD6133, 6604, 63 Series

■ Remote Controller (μPD6133 Series)

Part number	**μPD6133**	**μPD6134**	**μPD61P34B**
Main application	AV, household electric appliances		
ROM size	512 × 10 bits	1002 × 10 bits	
	Mask ROM		One time PROM
RAM size	32 × 4 bits		
Number of supported keys	32 (standard), 48 (when using key expansion pin), 96 (when expanded by diode)		
Operation clock frequency (f_X)	300 kHz to 1 MHz (ceramic oscillator)		
Instruction execution time	16 μs (at f_X = 500 kHz)		
Modulation carrier frequency	f_X, f_X/2, f_X/8, f_X/12, f_X/16, f_X/24, no carrier (high level)		
Timer	9-bit programmable timer		
POC circuit	Mask option		On-chip
Power supply voltage (V_{DD})	1.8 to 3.6 V, 2.2 to 3.6 V (when POC circuit is incorporated)		2.2 to 3.6 V
Package	20-pin plastic SOP, 20-pin plastic shrink SOP		
Development tools	Assembler		

■ Remote Controller (μPD6604 Series)

Part number	**μPD6604**	**μPD66P04B**
Main application	AV, household electric appliances	
ROM size	1002 × 10 bits	
	Mask ROM	One time PROM
RAM size	32 × 4 bits	
Number of supported keys	32 (standard), 48 (when using key expansion pin), 96 (when expanded by diode)	
Operation clock frequency (f_X)	300 kHz to 1 MHz (RC oscillator)	
Instruction execution time	16 μs (at f_X = 500 kHz)	
Modulation carrier frequency	f_X, f_X/2, f_X/8, f_X/12, f_X/16, f_X/24, no carrier (high level)	
Timer	9-bit programmable timer	
POC circuit	Mask option	On-chip
Power supply voltage (V_{DD})	1.8 to 3.6 V, 2.2 to 3.6 V (when POC circuit is incorporated)	2.2 to 3.6 V
Package	20-pin plastic SOP, 20-pin plastic shrink SOP	
Development tools	Assembler	

4-Bit Single-Chip Microcontroller

μPD6133, 6604, 63 Series

■ Remote Controller (μPD63 Series)

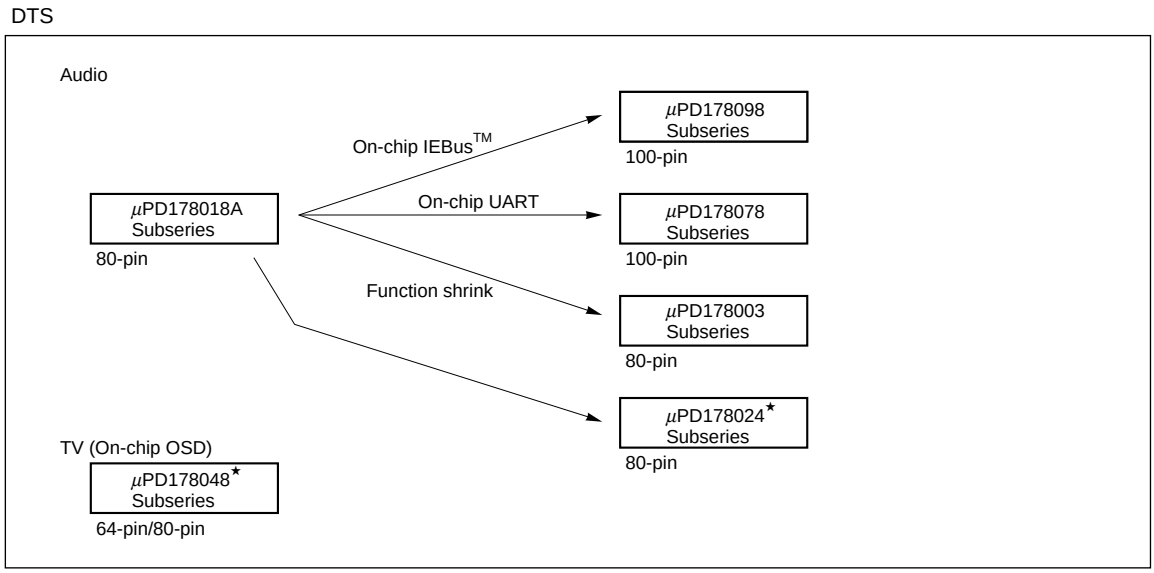
Part number	μPD62	μPD63A	μPD64	μPD6P4B	μPD65★
Main application	AV, household electric appliances				
ROM size	512 × 10 bits	768 × 10 bits	1002 × 10 bits		2026 × 10 bits
	Mask ROM			One time PROM	Mask ROM
RAM size	32 × 4 bits				
Number of supported keys	32 (standard), 48 (when using key expansion pin), 96 (when expanded by diode)				56 (standard)
Operation clock frequency (f_X)	2.4 MHz to 8 MHz (ceramic oscillator)				
Instruction execution time	16 μs (at f_X = 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 (high level)				
Timer	9-bit programmable timer				
POC circuit	Mask option			On-chip	Mask option
Power supply voltage (V_{DD})	1.8 to 3.6 V, 2.2 to 3.6 V (when POC circuit is incorporated)			2.2 to 3.6 V	
Package	20-pin plastic shrink SOP	20-pin plastic SOP	20-pin plastic SOP 20-pin plastic shrink SOP		20-pin plastic shrink SOP
Development tools	Assembler				

★: Under development

8-Bit Single-Chip Microcontroller

178K Series

■ 178K Series Product Evolution



★: Under development

■ Differences among the Subseries

Subseries name \ Function		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 (UART: 1 ch, I^2C: 1 ch)	80	4.5 V	–
	μPD178078							4 ch (UART: 1 ch, IEBus: 1 ch)			
	μPD178024	24K to 32K		–		6 ch		2 ch (I^2C: 1 ch)	62		
	μPD178018A	32K to 60K	3 ch				3 ch	2 ch (I^2C: 1 ch)			
	μPD178003	16K to 24K	2 ch		–		–	1 ch			
TV	**μPD178048**	48K to 60K	4 ch	–	1 ch	4 ch	–	3 ch (I^2C: 2 ch)	46	4.5 V	–

8-Bit Single-Chip Microcontroller

178K Series

■ Audio (μPD178003, 178018A Subseries)

Subseries name	μPD178003 Subseries		μPD178018A Subseries			
Part number	μPD178002	μPD178003	μPD178004A	μPD178006A	μPD178016A	μPD178018A
Main application	High-end tuner, automotive radio					
ROM size	16K bytes	24K bytes	32K bytes	48K bytes		60K bytes
RAM size	512 bytes		1K bytes		3K bytes	
Input port	1					
Output port	3					
I/O port	58					
D/A converter	–		3			
A/D converter	6					
Modulo timer	2		3 (Used also PWM: 1)			
Power supply voltage	+5 V ±10%					
Crystal	4.5 MHz					
PLL reference frequency	1, 3, 9, 10, 12.5, 25, 50 kHz		1, 3, 5, 9, 10, 25, 50 kHz			
Applicable prescaler	On-chip (160 MHz)					
Package	80-pin plastic QFP					
One-time PROM product	μPD178P018A					
Development tools	Assembler, C compioler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator					

■ Audio (μPD178024 Subseries)

Part number	μPD178023★	μPD178024★
Main application	High-end tuner, automotive radio	
ROM size	24K bytes	32K bytes
RAM size	1K bytes	
Input port	6	
Output port	3 (N-ch open drain)	
I/O port	53 (N-ch open drain: 2)	
Serial interface	I^2C bus: 1 channel 3-wire: 1 channel	
A/D converter	6	
Modulo timer	8 bits × 2 ch	
Power supply voltage	4.5 to 5.5 V (When PLL or A/D converter is operating) 3.5 to 5.5 V (When only CPU is operating)	
Crystal	4.5 MHz	
PLL reference frequency	1, 3, 9, 10, 12.5, 25, 50 kHz	
Applicable prescaler	On-chip (160 MHz)	
Package	80-pin plastic QFP (14 × 14 mm, 0.65 mm pitch) 80-pin plastic QFP (14 × 20 mm, 0.8 mm pitch)	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, device file, in-circuit emulator	

★: Under development

8-Bit Single-Chip Microcontroller

178K Series

■ Audio (μPD178098 Subseries)

Part number	**μPD178096**	**μPD178098**
Main application	High-end tuner, automotive radio	
ROM size	48K bytes	60K bytes
RAM size	2048 bytes	3072 bytes
Input port	8	
Output port	8 (N-ch open drain)	
I/O port	64 (N-ch open drain: 3)	
Serial interface	IEBus (mode 1 only): 1 channel 3-wire/2-wire/SBI/I²C bus (selectable): 1 channel 3-wire: 1 channel 3-wire (with function for automatic transmission and reception): 1 channel	
D/A converter	–	
A/D converter	8	
Modulo timer	16 bits × 1, 8 bits × 2	
Power supply voltage	+5 V ±10%	
Crystal	6.3 MHz	
PLL reference frequency	1, 3, 9, 10, 12.5, 25, 50 kHz	
Applicable prescaler	On-chip (160 MHz)	
Package	100-pin plastic QFP	
Flash memory product	μPD178F098	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, device file, in-circuit emulator	

■ Audio (μPD178078 Subseries)

Part number	**μPD178076**	**μPD178078**
Main application	High-end tuner, automotive radio	
ROM size	48K bytes	60K bytes
RAM size	2K bytes	3K bytes
Input port	8	
Output port	8 (N-ch open drain)	
I/O port	64 (N-ch open drain: 3)	
Serial interface	3-wire/2-wire/SBI/I²C bus (selectable): 1 channel 3-wire: 1 channel 3-wire (with function for automatic transmission and reception): 1 channel UART: 1 channel	
A/D converter	8-bit resolution × 8 channels	
Power supply voltage	+5 V ±10%	
Crystal	6.3 MHz, 4.5 MHz	
PLL reference frequency	1, 3, 9, 10, 12.5, 25, 50 kHz	
Applicable prescaler	On-chip (160 MHz)	
Package	100-pin plastic QFP	
Flash memory product	μPD178F098	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, device file, in-circuit emulator	

8-Bit Single-Chip Microcontroller

178K Series

■ TV (μPD178048 Subseries)

Part number	**μPD178046★**	**μPD178048★**
Main application	TV sets, CATV	
ROM size	48K bytes	60K bytes
RAM size	1K bytes	
Display	On-chip OSD Kind of character: 255 Display character: 12 lines × 24 columns Character type: 12 × 18 dot Character color: 8	
Input port	4	
Output port	5 (N-ch open drain)	
I/O port	37 (N-ch open drain: 4)	
Serial interface	I^2C bus: 2 channels 3-wire: 1 channel	
PWM	14-bit × 1 8-bit × 4	
A/D converter	8-bit resolution × 4 channels	
Power supply voltage	+5 V ±10%	
Crystal	5.0 MHz	
Package	64-pin plastic shrink DIP, 80-pin plastic TQFP	
Flash memory product	μPD178F048★	
Development tools	Assembler, C compiler, real-time OS, integrated debugger, device file, in-circuit emulator	

★: Under development

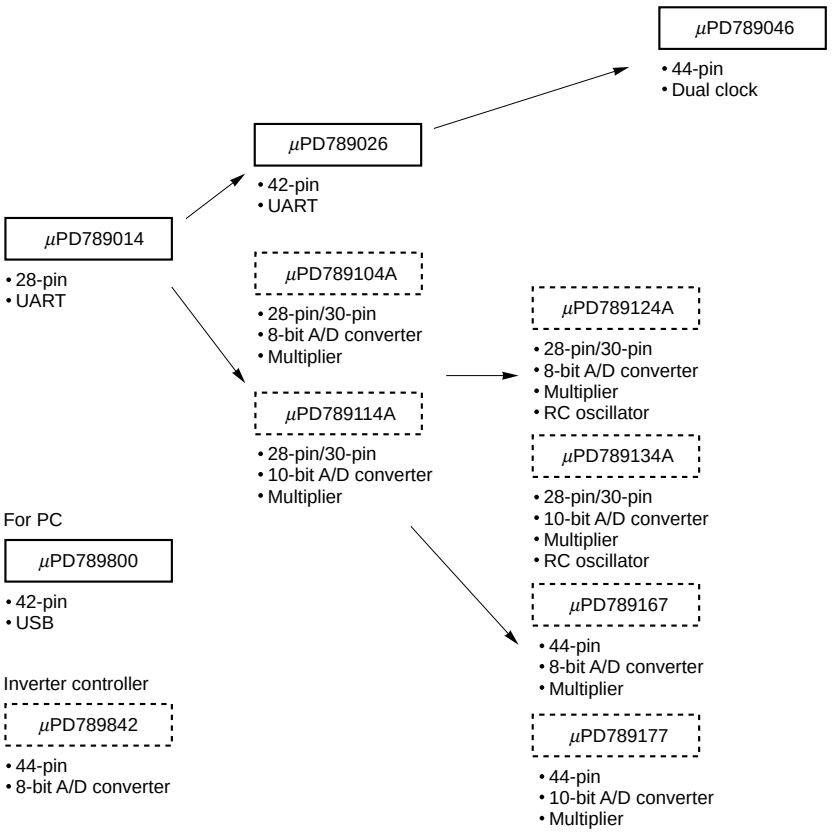
8-Bit Single-Chip Microcontroller

78K/0S Series

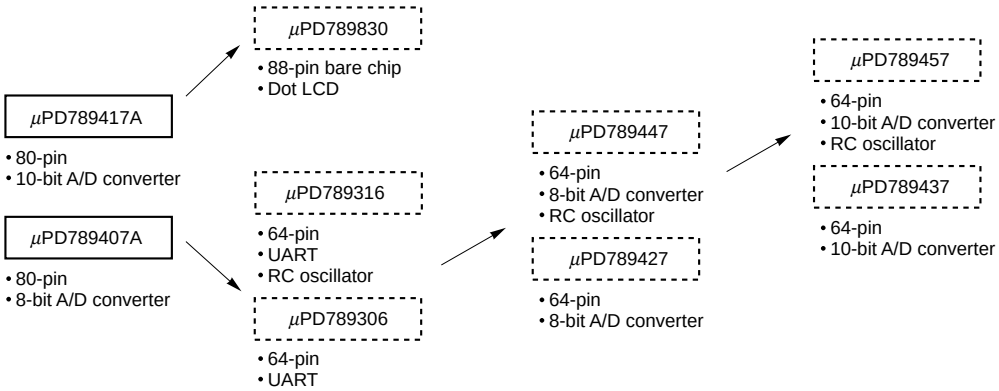
■ 78K/0S Series Product Evolution

Subseries names are shown inside frames.

Small-scale general purpose



LCD driver



Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Differences among the Subseries

Subseries name \ Function		ROM capacity	Timer				8-bit A/D	10-bit A/D	Serial interface	I/O	V_{DD} MIN. value	Remark
			8-bit	16-bit	Watch	WDT						
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		
Small-scale general-purpose + A/D	**μPD789177**	16K to 24K	3 ch	1 ch	1 ch	1 ch	–	8 ch	1 ch (UART: 1 ch)	31	1.8 V	–
	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	*	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	–				
	μPD789457	16K to 24K	2 ch				–	4 ch	2 ch (UART: 1 ch)	25	1.8 V	RC oscillation
	μPD789447						4 ch	–				
	μPD789437						–	4 ch				–
	μPD789427						4 ch	–				
	μPD789316	8K to 16K					–					RC oscillation
	μPD789306											–
	μPD789830	24K	1 ch							30	2.7 V	
For PC	**μPD789800**	8K	2 ch	1 ch	–	1 ch	–	–	2 ch (USB: 1 ch)	31	4.0 V	–

*: 10-bit timer 1 channel

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose (μPD789014 Subseries)

Part number			μPD789011	μPD789012	μPD78P9014
Number of basic instructions			48		
Minimum instruction execution time			0.4 μs (5.0 MHz)		
Instruction cycle			Selectable from 0.4 μs and 1.6 μs (5.0 MHz)		
Internal memory	ROM	Size (bytes)	2K	4K	8K (PROM)
	RAM	Size (bytes)	128		256
Address space			64K bytes		
Interrupt function		External	3		
		Internal	7		
I/O pin	CMOS I/O		22		
Timer			8-bit timer/event counter × 2 channels Watchdog timer × 1 channel		
Timer output			2		
Serial interface			3-wire/UART mode (selectable): 1 channel		
Standby function			STOP/HALT		
Operating power supply voltage range			V_{DD} = 1.8 to 5.5 V		
Package			• 28-pin plastic shrink DIP (400 mil) • 28-pin plastic SOP (375 mil)		
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications			Remote control, game machines, etc.		

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose (μPD789026 Subseries)

Part number			μPD789022	μPD789024	μPD789025	μPD789026	μPD78F9026A★
Number of basic instructions			48				
Minimum instruction execution time			0.4 μs (5.0 MHz)				
Instruction cycle			Selectable from 0.4 μs and 1.6 μs (5.0 MHz)				
Internal memory	ROM	Size (bytes)	4K	8K	12K	16K	16K (Flash memory)
	RAM	Size (bytes)	256		512		
Address space			64K bytes				
Interrupt function		External	4				
		Internal	6				
I/O pin	CMOS I/O		34				
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				
Standby function			STOP/HALT				
Operating power supply voltage range			V_{DD} = 1.8 to 5.5 V				
Package			• 42-pin plastic shrink DIP (600 mil) • 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			Compact household appliances, car accessories, air-conditioners, games, etc.				

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose (μPD789046 Subseries)

Part number			μPD789046	μPD78F9046★
Number of basic instructions			48	
Minimum instruction execution time			0.4 μs	
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs and 1.6 μs (5.0 MHz)	
	When subsystem clock is selected		122 μs (32.768 kHz)	
Internal memory	ROM	Size (bytes)	16K	16K (Flash memory)
	RAM	Size (bytes)	512	
Address space			64K bytes	
Interrupt function		External	4	
		Internal	8	
I/O pin	CMOS I/O		34	
Timer			16-bit timer counter × 1 channel 8-bit timer/event counter × 1 channel Watch timer × 1 channel Watchdog timer × 1 channel	
Timer output			2	
Serial interface			3-wire/UART mode (selectable): 1 channel	
Standby function			STOP/HALT	
Operating power supply voltage range			V_{DD} = 1.8 to 5.5 V	
Package			• 44-pin plastic QFP (10 × 10 mm, resin thickness 2.7 mm) • 44-pin plastic QFP (10 × 10 mm, resin thickness 1.4 mm)	
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications			Cordless phones, 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★
Number of basic instructions			48						
Minimum instruction execution time			0.4 μs (5.0 MHz)						
Instruction cycle			Selectable from 0.4 μs and 1.6 μs (5.0 MHz)						
System clock			Ceramic oscillator						
Internal memory	ROM	Size (bytes)	2K	4K	8K	2K	4K	8K	16K (Flash memory)
	RAM	Size (bytes)	256						
Address space			64K bytes						
Interrupt function		External	3						
		Internal	7						
Multiplier			8 × 8 = 16 bits						
I/O pin	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						
Operating power supply voltage range			V_{DD} = 1.8 to 5.5 V						
Package			• 28-pin plastic shrink DIP (400 mil) • 30-pin plastic shrink SOP (300 mil)						
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator						
Applications			Cleaners, washing machines, refrigerators, etc.						

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ Small-Scale General-Purpose + A/D (μPD789124A, 789134A Subseries)

Subseries name			μPD789124A Subseries			μPD789134A Subseries			
Part number			μPD789121A★	μPD789122A★	μPD789124A★	μPD789131A★	μPD789132A★	μPD789134A★	μPD78F9136A★
Number of basic instructions			48						
Minimum instruction execution time			0.5 μs (4.0 MHz)						
Instruction cycle			Selectable from 0.5 μs and 2.0 μs (4.0 MHz)						
System clock			RC oscillator						
Internal memory	ROM	Size (bytes)	2K	4K	8K	2K	4K	8K	16K (Flash memory)
	RAM	Size (bytes)	256						
Address space			64K bytes						
Interrupt function		External	3						
		Internal	7						
Multiplier			8 × 8 = 16 bits						
I/O pin	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 serial I/O mode/UART mode (selectable): 1 channel						
A/D converter			8-bit resolution × 4 channels			10-bit resolution × 4 channels			
Standby function			STOP/HALT						
Operating power supply voltage range			V_{DD} = 1.8 to 5.5 V						
Package			• 28-pin plastic shrink DIP (400 mil) • 30-pin plastic shrink SOP (300 mil)						
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator						
Applications			Battery chargers, etc.						

★: Under development

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★
Number of basic instructions			48				
Minimum instruction execution time			0.4 μs (5.0 MHz)				
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs and 1.6 μs (5.0 MHz)				
	When subsystem clock is selected		122 μs (32.768 kHz)				
System clock			Ceramic oscillator				
Internal memory	ROM	Size (bytes)	16K	24K	16K	24K	24K (Flash memory)
	RAM	Size (bytes)	512				
Address space			64K bytes				
Interrupt function		External	4				
		Internal	11				
Multiplier			8 × 8 =16 bits				
I/O pin	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 Watch timer × 1 channel Watchdog 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				
Operating power supply voltage range			V_{DD} = 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.				

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μPD789306, 789316 Subseries)

Subseries name			μPD789306 Subseries		μPD789316 Subseries	
Part number			μPD789304★	μPD789306★	μPD789314★	μPD789316★
Number of basic instructions			48			
Minimum instruction execution time			0.4 μs (5.0 MHz)		0.5 μs (4.0 MHz)	
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs and 1.6 μs (5.0 MHz)		Selectable from 0.5 μs and 2.0 μs (4.0 MHz)	
	When subsystem clock is selected		122 μs (32.768 kHz)			
Resonator	Main		Ceramic/crystal 1 to 5 MHz		RC oscillator 2 to 4 MHz	
	Sub		Crystal 32.768 kHz			
Internal memory	ROM	Size (bytes)	8K	16K	8K	16K
	RAM	Size (bytes)	256			
	LCD data RAM	Size (bytes)	20			
Address space			64K bytes			
Interrupt function		External	4			
		Internal	10			
I/O pin	CMOS input		4			
	CMOS I/O		17			
	N-ch open-drain I/O		4			
Timer			16-bit timer counter × 1 channel 8-bit timer counter × 1 channel 8-bit timer/event counter × 1 channel Watch timer × 1 channel Watchdog timer × 1 channel			
Timer output			3			
Serial interface			3-wire/UART mode (selectable): 1 channel 3-wire: 1 channel			
LCD controller/driver			Segment signal outputs: 20 maximum Common signal outputs: 4 maximum Bias: 1/3, on-chip booster			
Standby function			STOP/HALT			
Operating power supply voltage range			V_{DD} = 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 controller, etc.			

★: Under development

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★
Number of basic instructions			48						
Minimum instruction execution time			0.4 μs (5.0 MHz)						
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs and 1.6 μs (5.0 MHz)						
	When subsystem clock is selected		122 μs (32.768 kHz)						
Internal memory	ROM	Size (bytes)	12K	16K	24K	12K	16K	24K	32K (Flash memory)
	RAM	Size (bytes)	512						
	LCD data RAM	Size (bytes)	28						
Address space			64K bytes						
Interrupt function		External	5						
		Internal	12						
I/O pin	CMOS input		7						
	CMOS I/O		32						
	N-ch open-drain I/O		4						
Timer			16-bit timer counter × 1 channel 8-bit timer counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog 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			
LCD controller/driver			Segment signal outputs: 28 maximum Common signal outputs: 4 maximum Bias: 1/2 or 1/3 (switchable)						
Standby function			STOP/HALT						
Operating power supply voltage range			V_{DD} = 1.8 to 5.5 V						
Package			• 80-pin plastic QFP (14 × 14 mm) • 80-pin plastic TQFP (fine pitch) (12 × 12 mm, resin thickness 1.05 mm) • 80-pin plastic TQFP (fine pitch) (12 × 12 mm, resin thickness 1.0 mm)						
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator						
Applications			APS compact cameras, etc.						

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μPD789427, 789437 Subseries)

Subseries name			μPD789427 Subseries		μPD789437 Subseries		
Part number			μPD789426★	μPD789427★	μPD789436★	μPD789437★	μPD78F9437★
Number of basic instructions			48				
Minimum instruction execution time			0.4 μs (5.0 MHz)				
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs and 1.6 μs (5.0 MHz)				
	When subsystem clock is selected		122 μs (32.768 kHz)				
Resonator	Main		Ceramic/crystal 1 to 5 MHz				
	Sub		Crystal 32.768 kHz				
Internal memory	ROM	Size (bytes)	16K	24K	16K	24K	24K (Flash memory)
	RAM	Size (bytes)	512				
	LCD data RAM	Size (bytes)	20				
Address space			64K bytes				
Interrupt function		External	4				
		Internal	10				
I/O pin	CMOS input		4				
	CMOS I/O		17				
	N-ch open-drain I/O		4				
Timer			16-bit timer counter × 1 channel 8-bit timer counter × 1 channel 8-bit timer/event counter × 1 channel Watch timer × 1 channel Watchdog timer × 1 channel				
Timer output			3				
Serial interface			3-wire/UART mode (selectable): 1 channel 3-wire: 1 channel				
A/D converter			8-bit resolution × 4 channels		10-bit resolution × 4 channels		
LCD controller/driver			Segment signal outputs: 20 maximum Common signal outputs: 4 maximum Bias: 1/3, on-chip booster				
Standby function			STOP/HALT				
Operating power supply voltage range			V_{DD} = 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			Portable audio, etc.				

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μPD789447, 789457 Subseries)

Subseries name			μPD789447 Subseries		μPD789457 Subseries		
Part number			μPD789446★	μPD789447★	μPD789456★	μPD789457★	μPD78F9457★
Number of basic instructions			48				
Minimum instruction execution time			0.5 μs (4.0 MHz)				
Instruction cycle	When main system clock is selected		Selectable from 0.5 μs and 2.0 μs (4.0 MHz)				
	When subsystem clock is selected		122 μs (32.768 kHz)				
Resonator	Main		RC oscillator 2 to 4 MHz				
	Sub		Crystal 32.768 kHz				
Internal memory	ROM	Size (bytes)	16K	24K	16K	24K	24K (Flash memory)
	RAM	Size (bytes)	512				
	LCD data RAM	Size (bytes)	20				
Address space			64K bytes				
Interrupt function		External	4				
		Internal	10				
I/O pin	CMOS input		4				
	CMOS I/O		17				
	N-ch open-drain I/O		4				
Timer			16-bit timer counter × 1 channel 8-bit timer counter × 1 channel 8-bit timer/event counter × 1 channel Watch timer × 1 channel Watchdog timer × 1 channel				
Timer output			3				
Serial interface			3-wire/UART mode (selectable): 1 channel 3-wire: 1 channel				
A/D converter			8-bit resolution × 4 channels		10-bit resolution × 4 channels		
LCD controller/driver			Segment signal outputs: 20 maximum Common signal outputs: 4 maximum Bias: 1/3, on-chip booster				
Standby function			STOP/HALT				
Operating power supply voltage range			V_{DD} = 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			Portable audio, etc.				

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ LCD Driver (μPD789830 Subseries)

Part number			μPD789830★	μPD78F9831★
Number of basic instructions			48	
Minimum instruction execution time			0.4 μs	
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs and 1.6 μs (5.0 MHz)	
	When subsystem clock is selected		122 μs (32.768 kHz)	
Internal memory	ROM	Size (bytes)	24K	48K (Flash memory)
	RAM	Size (bytes)	1024	2048
	LCD data RAM	Size (bytes)	80	
Address space			64K bytes	
Interrupt function		External	3	5
		Internal	11	
I/O pin	CMOS I/O		30	38
Timer			16-bit timer counter × 1 channel 8-bit timer counter × 1 channel Watch timer × 1 channel Watchdog timer × 1 channel	
Timer output			2	
Serial interface			UART: 1 channel	
LCD controller/driver			Segment signal outputs: 40 maximum Common signal outputs: 16 maximum	
Standby function			STOP/HALT	
Operating power supply voltage range			V_{DD} = 2.7 to 5.5 V	
Delivery form			88-pin bare chip	100-pin plastic LQFP (14 × 14 mm)
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications			Card readers, etc.	

★: Under development

8-Bit Single-Chip Microcontroller

78K/0S Series

■ For PC (μPD789800 Subseries)

Part number			μPD789800	μPD78F9801
Number of basic instructions			48	
Minimum instruction execution time			0.33 μs (6.0 MHz)	
Instruction cycle			Selectable from 0.33 μs and 1.33 μs (6.0 MHz)	
Internal memory	ROM	Size (bytes)	8K	16K (Flash memory)
	RAM	Size (bytes)	256	
Address space			64K bytes	
Interrupt function		External	2	
		Internal	10	
I/O pin	CMOS I/O		31 (18 ports of the above CMOS I/O ports can be switched to N-ch open-drain I/O ports)	
Timer			8-bit timer × 1 channel 8-bit timer/event counter × 1 channel Watchdog timer × 1 channel	
Serial interface			USB (Universal Serial Bus): 1 channel 3-wire: 1 channel	
Regulator			Incorporated (V_{REG} = 3.3 ±0.3 V)	
Standby function			STOP/HALT	
Operating power supply voltage range			V_{DD} = 4.0 to 5.5 V	
Operating ambient temperature			T_A = –40 to +85°C (When the USB is not operating) T_A = 0 to 70°C (When the USB is operating)	
Package			• 42-pin plastic shrink DIP (600 mil) • 44-pin plastic QFP (10 × 10 mm, resin thickness 2.7 mm) • 44-pin plastic QFP (10 × 10 mm, resin thickness 1.4 mm)	
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

■ Inverter Controller (μPD789842 Subseries)

Part number			μPD789841★	μPD789842★	μPD78F9842★
Number of basic instructions			48		
Minimum instruction execution time			0.24 μs (8.38 MHz)		
Instruction cycle			Selectable from 0.24 μs and 0.96 μs (8.38 MHz)		
Internal memory	ROM	Size (bytes)	8K	16K	16K (Flash memory)
	RAM	Size (bytes)	256		
Address space			64K bytes		
Interrupt function		External	2		
		Internal	12		
Multiplier			10 × 10 = 20 bits		
I/O pin	CMOS input		8		
	CMOS I/O		22		
Timer			10-bit timer for inverter control × 1 channel 8-bit timer counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel		
Timer output			7 (Timer output: 1, inverter control output: 6)		
Serial interface			UART: 1 channel		
A/D converter			8 -bit resolution × 8 channels		
Standby function			STOP/HALT		
Operating power supply voltage range			V_{DD} = 4.0 to 5.5 V		
Package			• 44-pin plastic QFP (10 × 10 mm, resin thickness 2.7 mm) • 44-pin plastic QFP (10 × 10 mm, resin thickness 1.4 mm)		
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.		

★: Under development

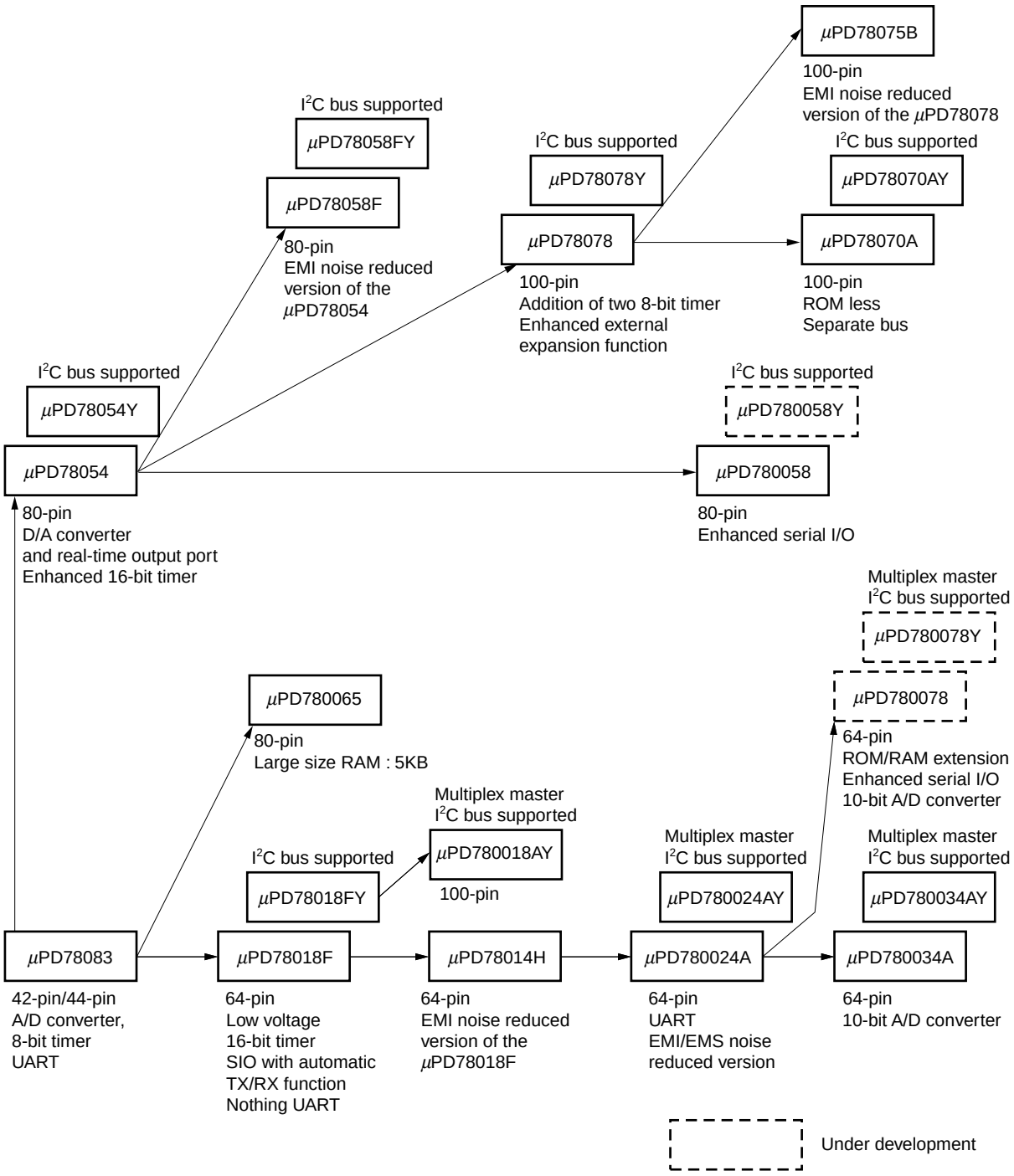
8-Bit Single-Chip Microcontroller

78K/0 Series

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

Subseries names are shown inside frames.

Controller series



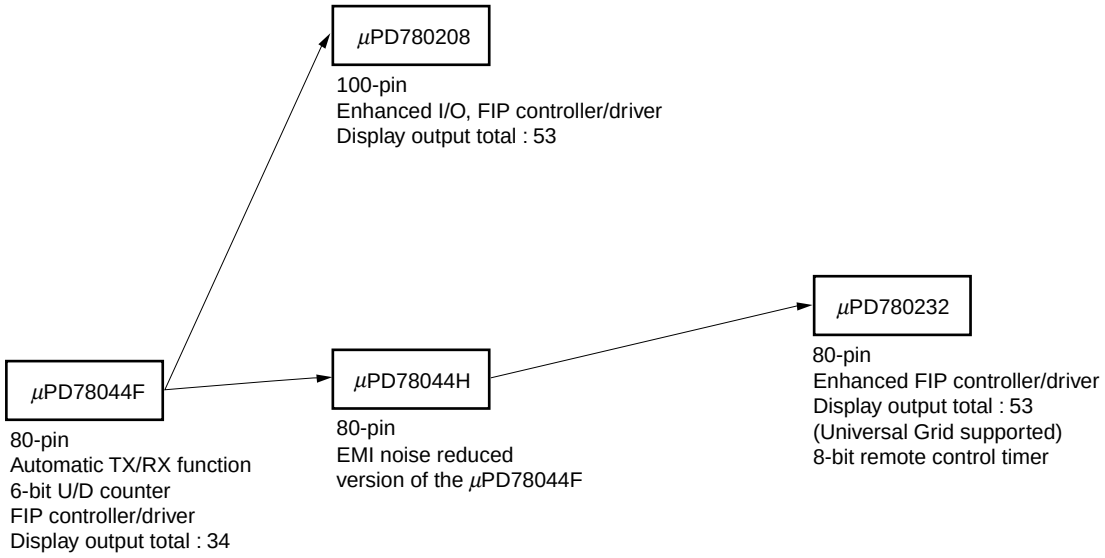
8-Bit Single-Chip Microcontroller

78K/0 Series

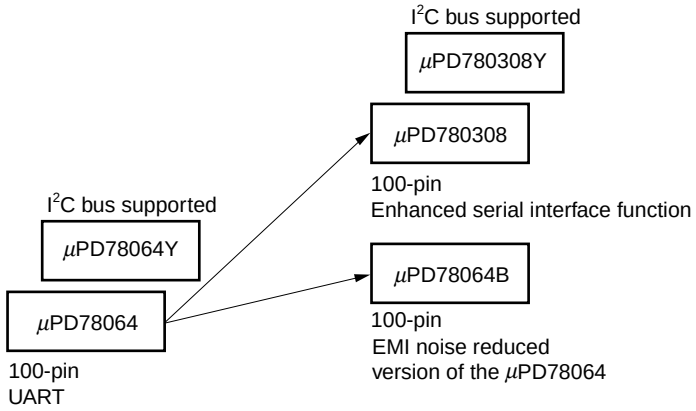
■ 78K/0 Series Product Evolution (2/3)

Subseries names are shown inside frames.

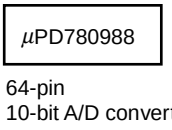
FIP™ drive series



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.

Call ID series

μPD780841
80-pin
Call ID decoder
Simple DTMF

Super low power consumption (meter controller) series

μPD780955
80-pin
Consumption current
When operating : 3.4 μA typical
When HALT : 1.1 μA typical

μPD780958
100-pin
Consumption current
When operating : 200 μA typical (1.0 MHz)
When operating : 4.5 μA typical 32.768 kHz)
When HALT : 2 μA typical 32.768 kHz)

Dashboard controller series

μPD780973
80-pin
Meter controller/driver

Bus controller series

μPD78098B
80-pin
IEBus controller

μPD780701Y
80-pin
(μPD780701Y : DCAN controller
μPD780702Y : IEBus controller
μPD78F0701Y : DCAN/IEBus controller)

μPD780833Y
80-pin
J1850 (CLASS2) controller

μPD780948
100-pin
DCAN controller

Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Differences among the Subseries (1/2)

Subseries name \ Function		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							
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											
	μPD78078Y									3 ch (UART: 1 ch, I^2C: 1 ch)			
	μPD78070A	–								3 ch (UART: 1 ch)	61	2.7 V	
	μPD78070AY									3 ch (UART: 1 ch, I^2C: 1 ch)			
	μPD780018AY	48K to 60K							–	3 ch (I^2C: 1 ch)	88		
	μPD780058	24K to 60K	2 ch						2 ch	3 ch (time-division UART: 1 ch)	68	1.8 V	
	μPD780058Y									3 ch (time-division UART: 1 ch, I^2C: 1 ch)			
	μPD78058F	48K to 60K								3 ch (UART: 1 ch)	69	2.7 V	
	μPD78058FY									3 ch (UART: 1 ch, I^2C: 1 ch)			
	μPD78054	16K to 60K								3 ch (UART: 1 ch)		2.0 V	
	μPD78054Y									3 ch (UART: 1 ch, I^2C: 1 ch)			
	μPD780065	40K to 48K							–	4 ch (UART: 1 ch)	60	2.7 V	
	μPD780078	48K to 60K		2 ch			–	8 ch		3 ch (UART: 2 ch)	52	1.8 V	
	μPD780078Y									4 ch (UART: 2 ch, I^2C: 1 ch)			
	μPD780034A	8K to 32K		1 ch						3 ch (UART: 1 ch, time-division 3-wire: 1 ch)	51		
	μPD780024A						8 ch	–					
	μPD780034AY						–	8 ch		3 ch (UART: 1 ch, I^2C: 1 ch)			
	μPD780024AY						8 ch	–					
	μPD78014H									2 ch	53		
	μPD78018F	8K to 60K											
	μPD78018FY												
	μPD78083	8K to 16K		–	–					1 ch (UART: 1 ch)	33		–
Inverter controller	**μPD780988**	16K to 60K	3 ch	*	–	1 ch	–	8 ch	–	3 ch (UART: 2 ch)	47	4.0 V	√

*: 16-bit timer 2 channels
10-bit timer 1 channel

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Differences among the Subseries (2/2)

Subseries name \ Function		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							
FIP driver	**μPD780208**	32K to 60K	2 ch	1 ch	1 ch	1 ch	8 ch	–	–	2 ch	74	2.7 V	–
	μPD780232	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	67	2.7 V	
	μPD78044F	16K to 40K								2 ch			
LCD driver	**μPD780308**	48K to 60K	2 ch	1 ch	1 ch	1 ch	8 ch	–	–	3 ch (time-division UART: 1 ch)	57	2.0 V	–
	μPD780308Y									3 ch (time-division UART: 1 ch, I^2C: 1 ch)			
	μPD78064B	32K								2 ch (UART: 1 ch)			
	μPD78064	16K to 32K											
	μPD78064Y									2 ch (UART: 1 ch, I^2C: 1 ch)			
For Call ID	**μPD780841**	24K to 32K	2 ch	–	1 ch	1 ch	2 ch	–	–	2 ch (UART: 1 ch)	58	2.7 V	–
On-chip bus controller	**μPD780948**	60K	2 ch	2 ch	1 ch	1 ch	8 ch	–	–	3 ch (UART: 1 ch)	79	4.0 V	√
	μPD78098B	40K to 60K		1 ch					2 ch		69	2.7 V	–
	μPD780701Y	60K	3 ch	2 ch			16 ch		–	4 ch (UART: 1 ch, I^2C: 1 ch)	67	3.5 V	
	μPD780833Y	60K	3 ch								65	4.5 V	
Meter controller	**μPD780958**	40K to 60K	4 ch	2 ch	–	1 ch	–	–	–	2 ch (UART: 1 ch)	69	2.7 V	–
	μPD780955	40K	6 ch	1 ch			1 ch			2 ch (UART: 2 ch)	50	2.2 V	
Dashboard controller	**μPD780973**	24K to 32K	3 ch	1 ch	1 ch	1 ch	5 ch	–	–	2 ch (UART: 1 ch)	56	4.5 V	–

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD78018F Subseries)

Part number			μPD78011F	μPD78012F	μPD78013F	μPD78014F	μPD78015F	μPD78016F	μPD78018F	μPD78P018F
Number of basic instructions			63							
Minimum instruction execution time			0.4 μs (10.0 MHz)							
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, and 6.4 μs (10.0 MHz)							
	When subsystem clock is selected		122 μs (32.768 kHz)							
Internal memory	ROM	Size (bytes)	8K	16K	24K	32K	40K	48K	60K	60K (PROM)
	RAM	Size (bytes)	544		1056		1568		2080	
Address space			64K bytes							
Interrupt function		External	4							
		Internal	10							
I/O pin	CMOS input		2							
	CMOS I/O		47							
	N-ch open-drain I/O		4							
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel							
Timer output			3 (PWM output: 1)							
Serial interface			3-wire/SBI/2-wire 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 × 8 channels							
Others			Clock output function Buzzer output function							
Standby function			STOP/HALT							
Operating power supply voltage range			1.8 to 5.5 V							
Package			• 64-pin plastic shrink DIP (750 mil) • 64-pin plastic QFP (14 × 14 mm, 0.8-mm pitch) • 64-pin plastic LQFP (12 × 12 mm, 0.65-mm pitch)							∗
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator							
Applications			VCRs, TVs, audio equipments, etc.							

∗: • 64-pin plastic shrink DIP (750 mil)
• 64-pin plastic QFP (14 × 14 mm, 0.8-mm pitch)
• 64-pin plastic LQFP (12 × 12 mm, 0.65-mm pitch)
• 64-pin ceramic shrink DIP with window (750 mil)
• 64-pin ceramic WQFN (14 × 14 mm)

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD78018FY Subseries)

Part number			μPD78011FY	μPD78012FY	μPD78013FY	μPD78014FY	μPD78015FY	μPD78016FY	μPD78018FY	μPD78P018FY
Number of basic instructions			63							
Minimum instruction execution time			0.4 μs (10.0 MHz)							
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, and 6.4 μs (10.0 MHz)							
	When subsystem clock is selected		122 μs (32.768 kHz)							
Internal memory	ROM	Size (bytes)	8K	16K	24K	32K	40K	48K	60K	60K (PROM)
	RAM	Size (bytes)	544		1056		1568		2080	
Address space			64K bytes							
Interrupt function		External	4							
		Internal	10							
I/O pin	CMOS input		2							
	CMOS I/O		47							
	N-ch open-drain I/O		4							
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel							
Timer output			3 (PWM output: 1)							
Serial interface			3-wire/2-wire/I²C 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 × 8 channels							
Others			Clock output function Buzzer output function							
Standby function			STOP/HALT							
Operating power supply voltage range			1.8 to 5.5 V							
Package			• 64-pin plastic shrink DIP (750 mil) • 64-pin plastic QFP (14 × 14 mm, 0.8-mm pitch) • 64-pin plastic LQFP (12 × 12 mm, 0.65-mm pitch) (except μPD78013FY, 78015FY, 78016FY)							*
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator							
Applications			VCRs, TVs, audio equipments, etc.							

*: • 64-pin plastic shrink DIP (750 mil)
• 64-pin plastic QFP (14 × 14 mm, 0.8-mm pitch)
• 64-pin plastic LQFP (12 × 12 mm, 0.65-mm pitch)
• 64-pin ceramic shrink DIP with window (750 mil)
• 64-pin ceramic WQFN (14 × 14 mm)

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD78014H Subseries)

Part number			μPD78011H	μPD78012H	μPD78013H	μPD78014H
Number of basic instructions			63			
Minimum instruction execution time			0.4 μs (10.0 MHz)			
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, and 6.4 μs (10.0 MHz)			
	When subsystem clock is selected		122 μs (32.768 kHz)			
Internal memory	ROM	Size (bytes)	8K	16K	24K	32K
	RAM	Size (bytes)	544		1056	
Address space			64K bytes			
Interrupt function		External	4			
		Internal	10			
I/O pin	CMOS input		2			
	CMOS I/O		47			
	N-ch open-drain I/O		4			
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel			
Timer output			3 (PWM output: 1)			
Serial interface			3-wire/SBI/2-wire 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 × 8 channels			
Others			Clock output function Buzzer output function			
Standby function			STOP/HALT			
Operating power supply voltage range			1.8 to 5.5 V			
Package			• 64-pin plastic shrink DIP (750 mil) • 64-pin plastic QFP (14 × 14 mm, 0.8-mm pitch) • 64-pin plastic LQFP (12 × 12 mm, 0.65-mm pitch)			
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 (μPD780024A, 780034A Subseries)

Part number			μPD780021A μPD780031A	μPD780022A μPD780032A	μPD780023A μPD780033A	μPD780024A μPD780034A	μPD78F0034A
Number of basic instructions			63				
Minimum instruction execution time			0.24 μs (8.38 MHz)				
Instruction cycle	When main system clock is selected		Selectable from 0.24 μs, 0.48 μs, 0.95 μs, 1.91 μs, and 3.81 μs (8.38 MHz)				
	When subsystem clock is selected		122 μs (32.768 kHz)				
Internal memory	ROM	Size (bytes)	8K	16K	24K	32K	32K (Flash memory)
	RAM	Size (bytes)	512		1024		
Address space			64K bytes				
Interrupt function		External	5				
		Internal	15				
I/O pin	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 Watch timer × 1 channel Watchdog 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 (μPD780021A, 780022A, 780023A, 780024A) 10-bit resolution × 8 channels (μPD780031A, 780032A, 780033A, 780034A, 78F0034A)				
Others			Clock output function Buzzer output function				
Standby function			STOP/HALT				
Operating power supply voltage range			1.8 to 5.5 V				
Package			• 64-pin plastic shirink DIP (750 mil) • 64-pin plastic QFP (14 × 14 mm, 0.8-mm pitch) • 64-pin plastic LQFP (12 × 12 mm, 0.65-mm pitch)				
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 (μPD780024AY, 780034AY Subseries)

Part number			μPD780021AY μPD780031AY	μPD780022AY μPD780032AY	μPD780023AY μPD780033AY	μPD780024AY μPD780034AY	μPD78F0034AY
Number of basic instructions			63				
Minimum instruction execution time			0.24 μs (8.38 MHz)				
Instruction cycle	When main system clock is selected		Selectable from 0.24 μs, 0.48 μs, 0.95 μs, 1.91 μs, and 3.81 μs (8.38 MHz)				
	When subsystem clock is selected		122 μs (32.768 kHz)				
Internal memory	ROM	Size (bytes)	8K	16K	24K	32K	32K (Flash memory)
	RAM	Size (bytes)	512		1024		
Address space			64K bytes				
Interrupt function		External	5				
		Internal	15				
I/O pin	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 Watch timer × 1 channel Watchdog timer × 1 channel				
Timer output			3 (PWM output: 2)				
Serial interface			3-wire: 1 channel UART: 1 channel I^2C bus (supporting multiplex master): 1 channel				
A/D converter			8-bit resolution × 8 channels (μPD780021AY, 780022AY, 780023AY, 780024AY) 10-bit resolution × 8 channels (μPD780031AY, 780032AY, 780033AY, 780034AY, 78F0034AY)				
Others			Clock output function Buzzer output function				
Standby function			STOP/HALT				
Operating power supply voltage range			1.8 to 5.5 V				
Package			• 64-pin plastic shirink DIP (750 mil) • 64-pin plastic QFP (14 × 14 mm, 0.8-mm pitch) • 64-pin plastic LQFP (12 × 12 mm, 0.65-mm pitch)				
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 (μPD780078, 780078Y Subseries)

Subseries name			μPD780078 Subseries			μPD780078Y Subseries		
Part number			μPD780076★	μPD780078★	μPD78F0078★	μPD780076Y★	μPD780078Y★	μPD78F0078Y★
Number of basic instructions			63					
Minimum instruction execution time			0.24 μs (8.38 MHz)					
Instruction cycle	When main system clock is selected		Selectable from 0.24 μs, 0.48 μs, 0.95 μs, 1.91 μs, and 3.81 μs (8.38 MHz)					
	When subsystem clock is selected		122 μs (32.768 kHz)					
Internal memory	ROM	Size (bytes)	48K	60K	60K (Flash memory)	48K	60K	60K (Flash memory)
	RAM	Size (bytes)	2048					
Address space			64K bytes					
Interrupt function		External	5					
		Internal	15					
I/O pin	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 Watch timer × 1 channel Watchdog timer × 1 channel					
Timer output			4 (PWM output: 2)					
Serial interface			3-wire/UART mode (selectable): 1 channel UART: 1 channel 3-wire: 1 channel			3-wire/UART mode (selectable): 1 channel UART: 1 channel 3-wire: 1 channel I²C bus (supporting multiplex master): 1 channel		
A/D converter			10-bit resolution × 8 channels					
Others			Clock output function Buzzer output function					
Standby function			STOP/HALT					
Operating power supply voltage range			V_{DD} = 1.8 to 5.5 V					
Package			• 64-pin plastic QFP (14 × 14 mm, 0.8-mm pitch) • 64-pin plastic LQFP (12 × 12 mm, 0.65-mm pitch)					
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator					
Applications			Telephones, AV equipment, automotive electronics, etc.					

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD780065 Subseries)

Part number			μPD780065	μPD78F0066★
Number of basic instructions			63	
Minimum instruction execution time			0.24 μs (8.38 MHz)	
Instruction cycle	When main system clock is selected		Selectable from 0.24 μs, 0.48 μs, 0.96 μs, 1.92 μs, 3.84 μs and 7.68 μs (8.38 MHz)	
	When subsystem clock is selected		122 μs (32.768 kHz)	
Internal memory	ROM	Size (bytes)	40K	48K (Flash memory)
	RAM	Size (bytes)	5K	
Address space			64K bytes	
Interrupt function		External	4	
		Internal	13	
I/O pin	CMOS I/O		53	
Timer			16-bit timer/event counter × 1 channel 8-bit timer × 2 channels Watch timer × 1 channel Watchdog timer × 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 × 8 channels	
Others			Clock output function Buzzer output function	
Standby function			STOP/HALT	
Operating power supply voltage range			V_{DD} = 2.7 to 5.5 V	
Package			80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch)	
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.	

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD78054 Subseries)

Part number			μPD78052	μPD78053	μPD78054	μPD78P054	μPD78055	μPD78056	μPD78058	μPD78P058
Number of basic instructions			63							
Minimum instruction execution time			0.4 μs (5.0 MHz)							
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, and 12.8 μs (5.0 MHz)							
	When subsystem clock is selected		122 μs (32.768 kHz)							
Internal memory	ROM	Size (bytes)	16K	24K	32K	32K (PROM)	40K	48K	60K	60K (PROM)
	RAM	Size (bytes)	544	1056					2080	
Address space			64K bytes							
Interrupt function		External	7							
		Internal	15							
I/O pin	CMOS input		2							
	CMOS I/O		63							
	N-ch open-drain I/O		4							
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel							
Timer output			3 (PWM output: 1)							
Serial interface			3-wire/SBI/2-wire 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							
A/D converter			8-bit resolution × 8 channels							
D/A converter			8-bit resolution × 2 channels							
Others			Clock output function Buzzer output function							
Standby function			STOP/HALT							
Operating power supply voltage range			2.0 to 6.0 V							
Package			• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch) • 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)			∗1	• 80-pin plastic QFP (14 × 14 mm) • 80-pin plastic TQFP (12 × 12 mm)			∗2
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.							

∗1: • 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch)
• 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)
• 80-pin ceramic WQFN (14 × 14 mm)

∗2: • 80-pin plastic QFP (14 × 14 mm)
• 80-pin ceramic WQFN (14 × 14 mm)

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD78054Y Subseries)

Part number			μPD78052Y	μPD78053Y	μPD78054Y	μPD78055Y	μPD78056Y	μPD78058Y	μPD78P058Y
Number of basic instructions			63						
Minimum instruction execution time			0.4 μs (5.0 MHz)						
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, and 12.8 μs (5.0 MHz)						
	When subsystem clock is selected		122 μs (32.768 kHz)						
Internal memory	ROM	Size (bytes)	16K	24K	32K	40K	48K	60K	60K (PROM)
	RAM	Size (bytes)	544	1056				2080	
Address space			64K bytes						
Interrupt function		External	7						
		Internal	15						
I/O pin	CMOS input		2						
	CMOS I/O		63						
	N-ch open-drain I/O		4						
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel						
Timer output			3 (PWM output: 1)						
Serial interface			3-wire/I²C bus/2-wire 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						
A/D converter			8-bit resolution × 8 channels						
D/A converter			8-bit resolution × 2 channels						
Others			Clock output function Buzzer output function						
Standby function			STOP/HALT						
Operating power supply voltage range			2.0 to 6.0 V						
Package			• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch) • 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)			• 80-pin plastic QFP (14 × 14 mm)		∗1	∗2
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.						

∗1: • 80-pin plastic QFP (14 × 14 mm)
• 80-pin plastic TQFP (12 × 12 mm)
∗2: • 80-pin plastic QFP (14 × 14 mm)
• 80-pin ceramic WQFN (14 × 14 mm)

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD78058F Subseries)

Part number			μPD78056F	μPD78058F	μPD78P058F
Number of basic instructions			63		
Minimum instruction execution time			0.4 μs (5.0 MHz)		
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, and 12.8 μs (5.0 MHz)		
	When subsystem clock is selected		122 μs (32.768 kHz)		
Internal memory	ROM	Size (bytes)	48K	60K	60K (PROM)
	RAM	Size (bytes)	1056	2080	
Address space			64K bytes		
Interrupt function		External	7		
		Internal	15		
I/O pin	CMOS input		2		
	CMOS I/O		63		
	N-ch open-drain I/O		4		
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel		
Timer output			3 (PWM output: 1)		
Serial interface			3-wire/SBI/2-wire 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		
A/D converter			8-bit resolution × 8 channels		
D/A converter			8-bit resolution × 2 channels		
Others			Clock output function Buzzer output function		
Standby function			STOP/HALT		
Operating power supply voltage range			2.7 to 6.0 V		
Package			• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch)	• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch) • 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)	• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch)
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications			Cellular phones, AV equipments, car stereo, cameras, PPCs, etc.		

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD78058FY Subseries)

Part number			μPD78056FY	μPD78058FY	μPD78P058FY
Number of basic instructions			63		
Minimum instruction execution time			0.4 μs (5.0 MHz)		
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, and 12.8 μs (5.0 MHz)		
	When subsystem clock is selected		122 μs (32.768 kHz)		
Internal memory	ROM	Size (bytes)	48K	60K	60K (PROM)
	RAM	Size (bytes)	1056	2080	
Address space			64K bytes		
Interrupt function		External	7		
		Internal	15		
I/O pin	CMOS input		2		
	CMOS I/O		63		
	N-ch open-drain I/O		4		
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel		
Timer output			3 (PWM output: 1)		
Serial interface			3-wire/I²C bus/2-wire 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		
A/D converter			8-bit resolution × 8 channels		
D/A converter			8-bit resolution × 2 channels		
Others			Clock output function Buzzer output function		
Standby function			STOP/HALT		
Operating power supply voltage range			2.7 to 6.0 V		
Package			• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch)	• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch) • 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)	• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch)
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications			Cellular phones, AV equipments, car stereo, cameras, PPCs, etc.		

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD780058 Subseries)

Part number			μPD780053	μPD780054	μPD780055	μPD780056	μPD780058	μPD78F0058★
Number of basic instructions			63					
Minimum instruction execution time			0.4 μs (5.0 MHz)					
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, and 12.8 μs (5.0 MHz)					
	When subsystem clock is selected		122 μs (32.768 kHz)					
Internal memory	ROM	Size (bytes)	24K	32K	40K	48K	60K	60K (Flash memory)
	RAM	Size (bytes)	1056				2080	
Address space			64K bytes					
Interrupt function		External	7					
		Internal	15					
I/O pin	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 Watch timer × 1 channel Watchdog timer × 1 channel					
Timer output			3 (PWM output: 1)					
Serial interface			3-wire/SBI/2-wire 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					
Others			Clock output function Buzzer output function					
Standby function			STOP/HALT					
Operating power supply voltage range			1.8 to 5.5 V					
Package			• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch) • 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)					
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.					

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD780058Y Subseries)

Part number			μPD780053Y★	μPD780054Y★	μPD780055Y★	μPD780056Y★	μPD780058Y★	μPD78F0058Y★
Number of basic instructions			63					
Minimum instruction execution time			0.4 μs (5.0 MHz)					
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, and 12.8 μs (5.0 MHz)					
	When subsystem clock is selected		122 μs (32.768 kHz)					
Internal memory	ROM	Size (bytes)	24K	32K	40K	48K	60K	60K (Flash memory)
	RAM	Size (bytes)	1056				2080	
Address space			64K bytes					
Interrupt function		External	7					
		Internal	15					
I/O pin	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 Watch timer × 1 channel Watchdog timer × 1 channel					
Timer output			3 (PWM output: 1)					
Serial interface			3-wire/I²C bus/2-wire 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					
Others			Clock output function Buzzer output function					
Standby function			STOP/HALT					
Operating power supply voltage range			1.8 to 5.5 V					
Package			• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch) • 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)					
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.					

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD780018AY Subseries)

Part number			μPD780016AY	μPD780018AY	μPD78P0018AY
Number of basic instructions			63		
Minimum instruction execution time			0.4 μs (5.0 MHz)		
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, and 6.4 μs (5.0 MHz)		
	When subsystem clock is selected		122 μs (32.768 kHz)		
Internal memory	ROM	Size (bytes)	48K	60K	60K (PROM)
	RAM	Size (bytes)	2080		
Address space			64K bytes		
Interrupt function		External	7		
		Internal	13		
I/O pin	CMOS input		9		
	CMOS I/O		79		
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 4 channels Watch timer × 1 channel Watchdog timer × 1 channel		
Timer output			5 (PWM output: 3)		
Serial interface			3-wire (with function for automatic transmission and reception of up to 32 bytes): 1 channel 3-wire (with time-division transmission function): 1 channel I^2C bus (supporting multiplex master): 1 channel		
A/D converter			8-bit resolution × 8 channels		
Others			Clock output function Buzzer output function		
Standby function			Main STOP/Sub STOP/HALT		
Operating power supply voltage range			2.7 to 5.5 V		
Package			• 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)		*
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications			Mini-component stereo systems, car stereos, etc.		

*: • 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)
• 100-pin ceramic WQFN (14 × 20 mm)

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD78075B, 78078 Subseries)

Subseries name			μPD78075B Subseries		μPD78078 Subseries		
Part number			μPD78074B	μPD78075B	μPD78076	μPD78078	μPD78P078
Number of basic instructions			63				
Minimum instruction execution time			0.4 μs (5.0 MHz)				
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, and 12.8 μs (5.0 MHz)				
	When subsystem clock is selected		122 μs (32.768 kHz)				
Internal memory	ROM	Size (bytes)	32K	40K	48K	60K	60K (PROM)
	RAM	Size (bytes)	1056		2080		
Address space			64K bytes				
Interrupt function		External	7				
		Internal	17				
I/O pin	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 Watch timer × 1 channel Watchdog timer × 1 channel				
Timer output			5 (PWM output: 3)				
Serial interface			3-wire/SBI/2-wire 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				
A/D converter			8-bit resolution × 8 channels				
D/A converter			8-bit resolution × 2 channels				
Others			Clock output function Buzzer output function				
Standby function			STOP/HALT				
Operating power supply voltage range			1.8 to 5.5 V				
Package			• 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch) • 100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)				*
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.				

*: • 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)
• 100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)
• 100-pin ceramic WQFN (14 × 20 mm)

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD78078Y Subseries)

Part number			μPD78076Y	μPD78078Y	μPD78P078Y
Number of basic instructions			63		
Minimum instruction execution time			0.4 μs (5.0 MHz)		
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, and 12.8 μs (5.0 MHz)		
	When subsystem clock is selected		122 μs (32.768 kHz)		
Internal memory	ROM	Size (bytes)	48K	60K	60K (PROM)
	RAM	Size (bytes)	2080		
Address space			64K bytes		
Interrupt function		External	7		
		Internal	17		
I/O pin	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 Watch timer × 1 channel Watchdog timer × 1 channel		
Timer output			5 (PWM output: 3)		
Serial interface			3-wire/2-wire/I²C 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 (selectable): 1 channel		
A/D converter			8-bit resolution × 8 channels		
D/A converter			8-bit resolution × 2 channels		
Others			Clock output function Buzzer output function		
Standby function			STOP/HALT		
Operating power supply voltage range			1.8 to 5.5 V		
Package			• 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch) • 100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)		∗
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications			VCRs, TVs, audio equipments, etc.		

∗: • 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)
• 100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)
• 100-pin ceramic WQFN (14 × 20 mm)

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD78070A, 78070AY)

Part number			μPD78070A	μPD78070AY
Number of basic instructions			63	
Minimum instruction execution time			0.4 μs (5.0 MHz)	
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, and 12.8 μs (5.0 MHz)	
	When subsystem clock is selected		122 μs (32.768 kHz)	
Internal memory	ROM	Size (bytes)	—	
	RAM	Size (bytes)	1056	
Address space			64K bytes	
Interrupt function		External	7	
		Internal	17	
I/O pin	CMOS input		2	
	CMOS I/O		51	
	N-ch open-drain I/O		8	
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 4 channels Watch timer × 1 channel Watchdog timer × 1 channel	
Timer output			5 (PWM output: 3)	
Serial interface			∗1	∗2
A/D converter			8-bit resolution × 8 channels	
D/A converter			8-bit resolution × 2 channels	
Others			Clock output function Buzzer output function	
Standby function			STOP/HALT	
Operating power supply voltage range			2.7 to 5.5 V	
Package			• 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch) • 100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)	
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications			CD-ROMs, printers, PPCs, etc.	

∗1: • 3-wire/SBI/2-wire 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

∗2: • 3-wire/2-wire/I^2C 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 (selectable): 1 channel

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Controller Series (μPD78083 Subseries)

Part number			μPD78081	μPD78082	μPD78P083
Number of basic instructions			63		
Minimum instruction execution time			0.4 μs (5.0 MHz)		
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs and 12.8 μs (5.0 MHz)		
Internal memory	ROM	Size (bytes)	8K	16K	24K (PROM)
	RAM	Size (bytes)	256	384	512
Address space			64K bytes		
Interrupt function		External	3		
		Internal	10		
I/O pin	CMOS input		1		
	CMOS I/O		32		
Timer			8-bit timer/event counter × 2 channels Watchdog timer × 1 channel		
Timer output			2 (PWM output: 2)		
Serial interface			3-wire/UART mode (selectable): 1 channel		
A/D converter			8-bit resolution × 8 channels		
Others			Clock output function Buzzer output function		
Standby function			STOP/HALT		
Operating power supply voltage range			1.8 to 5.5 V		
Package			• 42-pin plastic shrink DIP (600 mil) • 44-pin plastic QFP (10 × 10 mm, 0.8-mm pitch)		• 42-pin plastic shrink DIP (600 mil) • 44-pin plastic QFP (10 × 10 mm, 0.8-mm pitch) • 42-pin ceramic shrink DIP with window (600 mil)
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 entry, etc.		

8-Bit Single-Chip Microcontroller

78K/0 Series

■ FIP Drive Series (μPD78044F Subseries)

Part number			μPD78042F	μPD78043F	μPD78044F	μPD78045F	μPD78P048A
Number of basic instructions			63				
Minimum instruction execution time			0.4 μs (5.0 MHz)				
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, and 6.4 μs (5.0 MHz)				
	When subsystem clock is selected		122 μs (32.768 kHz)				
Internal memory	ROM	Size (bytes)	16K	24K	32K	40K	60K (PROM)
	RAM	Size (bytes)	624		1136		
Interrupt function		External	4				
		Internal	12				
I/O pin	CMOS input		2				
	CMOS I/O		27				
	N-ch open-drain I/O		5				
	P-ch open-drain I/O		16				
	P-ch open-drain output		18				
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel 6-bit up/down counter × 1 channel				
Timer output			3 (PWM output: 1)				
Serial interface			3-wire/SBI/2-wire 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 × 8 channels				
FIP controller/driver			Number of segments: 9 to 24 Number of digits: 2 to 16				
Others			Clock output function Buzzer output function				
Standby function			STOP/HALT				
Operating power supply voltage range			2.7 to 5.5 V				
Package			• 80-pin plastic QFP (14 × 20 mm, 0.8-mm pitch)				*
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications			VCRs, audio equipments, microwave ovens, etc.				

*: • 80-pin plastic QFP (14 × 20 mm, 0.8-mm pitch)
• 80-pin ceramic WQFN (14 × 20 mm)

8-Bit Single-Chip Microcontroller

78K/0 Series

■ FIP Drive Series (μPD78044H Subseries)

Part number			μPD78044H	μPD78045H	μPD78046H
Number of basic instructions			63		
Minimum instruction execution time			0.4 μs (5.0 MHz)		
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, and 6.4 μs (5.0 MHz)		
	When subsystem clock is selected		122 μs (32.768 kHz)		
Internal memory	ROM	Size (bytes)	32K	40K	48K
	RAM	Size (bytes)	1136		
Interrupt function		External	4		
		Internal	10		
I/O pin	CMOS input		2		
	CMOS I/O		19		
	N-ch open-drain I/O		13		
	P-ch open-drain I/O		16		
	P-ch open-drain output		18		
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel		
Timer output			3 (PWM output: 1)		
Serial interface			3-wire: 1 channel		
A/D converter			8-bit resolution × 8 channels		
FIP controller/driver			Number of segments: 9 to 24 Number of digits: 2 to 16		
Others			Clock output function Buzzer output function		
Standby function			STOP/HALT		
Operating power supply voltage range			2.7 to 5.5 V		
Package			• 80-pin plastic QFP (14 × 20 mm, 0.8-mm pitch)		
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications			Mini-component stereo systems, microwave ovens, ECRs, etc.		

8-Bit Single-Chip Microcontroller

78K/0 Series

■ FIP Drive Series (μPD780208 Subseries)

Part number			μPD780204	μPD780205	μPD780206	μPD780208	μPD78P0208
Number of basic instructions			63				
Minimum instruction execution time			0.4 μs (5.0 MHz)				
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, and 6.4 μs (5.0 MHz)				
	When subsystem clock is selected		122 μs (32.768 kHz)				
Internal memory	ROM	Size (bytes)	32K	40K	48K	60K	60K (PROM)
	RAM	Size (bytes)	1168		2192		
Interrupt function		External	4				
		Internal	12				
I/O pin	CMOS input		2				
	CMOS I/O		27				
	N-ch open-drain I/O		5				
	P-ch open-drain I/O		24				
	P-ch open-drain output		16				
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel				
Timer output			3 (PWM output: 1)				
Serial interface			3-wire/SBI/2-wire 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 × 8 channels				
FIP controller/driver			Number of segments: 9 to 40 Number of digits: 2 to 16				
Others			Clock output function Buzzer output function				
Standby function			STOP/HALT				
Operating power supply voltage range			2.7 to 5.5 V				
Package			• 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)				*
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications			VCRs, audio equipments, microwave ovens, etc.				

*: • 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)
• 100-pin ceramic WQFN (14 × 20 mm)

8-Bit Single-Chip Microcontroller

78K/0 Series

■ FIP Drive Series (μPD780232 Subseries)

Part number			μPD780232	μPD78F0233★
Number of basic instructions			63	
Minimum instruction execution time			0.4 μs (5.0 MHz)	
Instruction cycle			Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs and 6.4 μs (5.0 MHz)	
Internal memory	ROM	Size (bytes)	16K	24K (Flash memory)
	RAM	Size (bytes)	768	
Interrupt function		External	2	
		Internal	12	
I/O pin	CMOS I/O		11	
	P-ch open-drain I/O		29	
	P-ch open-drain output		24	
Timer			8-bit remote control timer × 1 channel 8-bit timer × 2 channels Watchdog timer × 1 channel	
Timer outupt			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 × 4 channels	
FIP controller/driver			Display outputs: 53	
Standby function			STOP/HALT	
Operating power supply voltage range			V_{DD} = 4.5 to 5.5 V	
Package			80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch)	
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 disc/mini disc players, audio amplifiers, etc.	

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ LCD Drive Series (μPD78064, 78064B Subseries)

Subseries name			μPD78064 Subseries				μPD78064B Subseries	
Part number			**μPD78062**	**μPD78063**	**μPD78064**	**μPD78P064**	**μPD78064B**	**μPD78P064B**
Number of basic instructions			63					
Minimum instruction execution time			0.4 μs (5.0 MHz)					
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, and 12.8 μs (5.0 MHz)					
	When subsystem clock is selected		122 μs (32.768 kHz)					
Internal memory	ROM	Size (bytes)	16K	24K	32K	32K (PROM)	32K	32K (PROM)
	RAM	Size (bytes)	532	1044				
Interrupt function		External	6					
		Internal	14					
I/O pin	CMOS input		2					
	CMOS I/O		55					
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel					
Timer output			3 (PWM output: 1)					
Serial interface			3-wire/SBI/2-wire mode (selectable): 1 channel 3-wire/UART mode (selectable): 1 channel					
A/D converter			8-bit resolution × 8 channels					
LCD controller/driver			Segment signal outputs: 40 maximum Common signal outputs: 4 maximum Bias: 1/2 or 1/3 (switchable)					
Others			Clock output function Buzzer output function					
Standby function			STOP/HALT					
Operating power supply voltage range			2.0 to 6.0 V					
Package			• 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch) • 100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)			*	• 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch) • 100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)	
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator					
Applications			Cellular phones, CD players, cameras, etc.					

*: • 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)
• 100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)
• 100-pin ceramic WQFN (14 × 20 mm)

8-Bit Single-Chip Microcontroller

78K/0 Series

■ LCD Drive Series (μPD78064Y Subseries)

Part number			μPD78062Y	μPD78063Y	μPD78064Y
Number of basic instructions			63		
Minimum instruction execution time			0.4 μs (5.0 MHz)		
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, and 12.8 μs (5.0 MHz)		
	When subsystem clock is selected		122 μs (32.768 kHz)		
Internal memory	ROM	Size (bytes)	16K	24K	32K
	RAM	Size (bytes)	532	1044	
Interrupt function		External	6		
		Internal	14		
I/O pin	CMOS input		2		
	CMOS I/O		55		
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel		
Timer output			3 (PWM output: 1)		
Serial interface			3-wire/2-wire/I²C bus mode (selectable): 1 channel 3-wire/UART mode (selectable): 1 channel		
A/D converter			8-bit resolution × 8 channels		
LCD controller/driver			Segment signal outputs: 40 maximum Common signal outputs: 4 maximum Bias: 1/2 or 1/3 (switchable)		
Others			Clock output function Buzzer output function		
Standby function			STOP/HALT		
Operating power supply voltage range			2.0 to 6.0 V		
Package			• 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch) • 100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)		
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 Drive Series (μPD780308, 780308Y Subseries)

Subseries name			μPD780308 Subseries			μPD780308Y Subseries		
Part number			μPD780306	μPD780308	μPD78P0308★	μPD780306Y	μPD780308Y	μPD78P0308Y★
Number of basic instructions			63					
Minimum instruction execution time			0.4 μs (5.0 MHz)					
Instruction cycle	When main system clock is selected		Selectable from 0.4 μs, 0.8 μs, 1.6 μs, 3.2 μs, 6.4 μs, and 12.8 μs (5.0 MHz)					
	When subsystem clock is selected		122 μs (32.768 kHz)					
Internal memory	ROM	Size (bytes)	48K	60K		48K	60K	60K (PROM)
	RAM	Size (bytes)	2068					
Address space			64K bytes					
Interrupt function		External	6					
		Internal	15					
I/O pin	CMOS input		2					
	CMOS I/O		55					
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel					
Timer output			3 (PWM output: 1)					
Serial interface			3-wire/SBI/2-wire mode (selectable): 1 channel 3-wire/UART mode (selectable): 1 channel 3-wire (with time-division transmission function): 1 channel			3-wire/I²C bus/2-wire 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					
LCD controller/driver			Segment signal outputs: 40 maximum Common signal outputs: 4 maximum Bias: 1/2 or 1/3 (switchable)					
Others			Clock output function Buzzer output function					
Standby function			STOP/HALT					
Operating power supply voltage range			2.0 to 5.5 V					
Package			• 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch) • 100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)		*	• 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch) • 100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)		*
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator					
Applications			Cellular phones, pagers, CD players, meters, etc.					

∗: • 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)
• 100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)
• 100-pin ceramic WQFN (14 × 20 mm)

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Inverter Controller Series (μPD780988 Subseries)

Part number			μPD780982★	μPD780983★	μPD780984★	μPD780986	μPD780988	μPD78F0988★
Number of basic instructions			63					
Minimum instruction execution time			0.24 μs (8.38 MHz)					
Instruction cycle			Selectable from 0.24 μs, 0.48 μs, 0.95 μs, 1.9 μs and 3.8 μs (8.38 MHz)					
Internal memory	ROM	Size (bytes)	16K	24K	32K	48K	60K	60K (Flash memory)
	RAM	Size (bytes)	1024			2048		
Address space			64K bytes					
Interrupt function		External	8					
		Internal	16					
I/O pin	CMOS input		8					
	CMOS I/O		39					
Timer			10-bit timer for inverter control × 1 channel 16-bit timer/event counter × 2 channels 8-bit timer/event counter × 3 channels Watchdog timer × 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 × 8 channels					
Others			Real-time output port					
Standby function			STOP/HALT					
Operating power supply voltage range			V_{DD} = 4.0 to 5.5 V					
Package			64-pin plastic shrink DIP (750 mil) 64-pin plastic QFP (14 × 14 mm, 0.8 mm pitch)					
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, washing machines, etc.					

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Call ID Series (μPD780841 Subseries)

Part number			μPD780840★	μPD780841★	μPD78F0841★
Number of basic instructions			63		
Instruction cycle	When main system clock is selected		0.56 μs (3.58 MHz)		
	When subsystem clock is selected		122 μs (32.768 kHz)		
Internal memory	ROM	Size (bytes)	24K	32K	32K (Flash memory)
	RAM	Size (bytes)	1024		
Address space			64K bytes		
Interrupt function		External	5		
		Internal	8		
I/O pin	CMOS input		2		
	CMOS I/O		55		
	N-ch open-drain I/O		4		
Timer			8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel		
Timer output			2 (PWM output: 2)		
Serial interface			3-wire: 1 channel 3-wire/UART mode (selectable): 1 channel		
A/D converter			8-bit resolution × 2 channels		
Others			Call ID decoder function Simple DTMF function		
Standby function			STOP/HALT		
Operating power supply voltage range			V_{DD} = 2.7 to 5.5 V		
Package			80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch)		
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications			Cordless phones, etc.		

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Super Low Power Consumption (Meter Controller) Series (μPD780955)

Part number			μPD780955★
Number of basic instructions			62
Minimum instruction execution time			52 μs (38.4 kHz)
Internal memory	ROM	Size (bytes)	40K
	RAM	Size (bytes)	1024
Address space			64K bytes
Interrupt function		External	7
		Internal	10
I/O pin	CMOS I/O		47
	N-ch open drain I/O		3
Timer			16-bit counter × 1 channel 8-bit timer/event counter × 1 channel 8-bit timer × 5 channels Watchdog timer × 1 channel
Timer output			1
Serial interface			UART: 2 channels
A/D converter			8-bit resolution × 1 channel
LCD controller			Segment signal outputs: 19 maximum Common signal outputs: 1 Static display mode only
Others			Quality grade: Special (μPD780955(A)) only (for high reliability electronic equipment)
Standby function			HALT
Operating power supply voltage range			V_{DD} = 2.2 to 3.5 V
Package			80-pin plastic QFP (14 × 20 mm, 0.8 mm pitch)
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator
Applications			Gas meters, etc.

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Super Low Power Consumption (Meter Controller) Series (μPD780958 Subseries)

Part number			μPD780957★	μPD780958★
Number of basic instructions			62	
Minimum instruction execution time			2 μs (1.0 MHz), 61 μs (32.768 kHz)	
Internal memory	ROM	Size (bytes)	48K	60K
	RAM	Size (bytes)	2048	
Address space			64K bytes	
Interrupt function		External	7	
		Internal	17	
I/O pin	CMOS I/O		66	
	N-ch open-drain I/O		3	
Timer			16-bit timer/event counter × 2 channels 8-bit timer × 4 channels Watchdog timer × 1 channel	
Timer output			1	
Serial interface			UART: 1 channel 3-wire: 1 channel	
LCD controller/driver			Segment signal outputs: 30 maximum Common signal outputs: 3 maximum Bias: static or 1/3 (switchable)	
Others			MR control function Sampling output function Quality grade: Special (μPD780957(A), μPD780958(A)) only (for high reliability electronic equipment)	
Standby function			HALT	
Operating power supply voltage range			V_{DD} = 2.2 to 3.5 V	
Package			100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch)	
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator	
Applications			Gas meters, etc.	

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Dashboard Controller Series (μPD780973 Subseries)

Part number			μPD780973★	μPD78F0974★
Number of basic instructions			63	
Minimum instruction execution time			0.24 μs (8.38 MHz)	
Instruction cycle			Selectable from 0.24 μs, 0.48 μs, 0.95 μs, 1.91 μs, and 3.81 μs (8.38 MHz)	
Internal memory	ROM	Size (bytes)	24K	32K (Flash memory)
	RAM	Size (bytes)	778	1034
	EEPROM	Size (bytes)	256	
Address space			64K bytes	
Interrupt function		External	3	
		Internal	18	
I/O pin	CMOS input		5	
	CMOS Output		16	
	CMOS I/O		35	
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 3 channels Watch timer × 1 channel Watchdog timer × 1 channel	
Timer output			2 (PWM output: 2)	
Serial interface			3-wire: 1 channel UART: 1 channel	
A/D converter			8-bit resolution × 5 channels	
LCD controller/driver			Segment signal outputs: 20 maximum Common signal outputs: 4 maximum Bias: 1/3	
Sound generator			Buzzer output signal with composed amplitude	
Meter controller/driver			4 meter control (Cross-coil or stepper motor)	
Others			Clock output function	
Standby function			STOP/HALT	
Operating power supply voltage range			4.5 to 5.5 V	
Package			80-pin plastic QFP (14 × 20 mm, 0.8-mm pitch)	
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 (μPD78098B Subseries)

Part number			μPD78095B	μPD78096B	μPD78098B	μPD78P098B
Number of basic instructions			63			
Minimum instruction execution time			0.4 μs (5.0 MHz)			
Instruction cycle	When main system clock is selected		Selectable from 0.5 μs, 1.0 μs, 2.0 μs, 4.0 μs, 8.0 μs, and 16.0 μs (6.0 MHz)			
	When subsystem clock is selected		122 μs (32.768 kHz)			
Internal memory	ROM	Size (bytes)	40K	48K	60K	60K (PROM)
	RAM	Size (bytes)	1056		3104	
Address space			64K bytes			
Interrupt function		External	7			
		Internal	16			
I/O pin	CMOS input		2			
	CMOS I/O		63			
	N-ch open-drain I/O		4			
Timer			16-bit timer/event counter × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel			
Timer output			3 (PWM output: 1)			
Serial interface			3-wire/SBI/2-wire 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			
A/D converter			8-bit resolution × 8 channels			
D/A converter			8-bit resolution × 2 channels			
IEBus controller			Effective transmission speed: 26 kbps maximum			
Others			Clock output function Buzzer output function			
Standby function			STOP/HALT			
Operating power supply voltage range			2.7 to 5.5 V			
Package			• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch)			∗
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator			
Applications			Car audios, CD changers, etc.			

∗: • 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch)
• 80-pin ceramic WQFN (14 × 14 mm)

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Bus Controller Series (μPD780948 Subseries)

Part number			μPD780948★	μPD780949★	μPD78F0948★	μPD78F0949★
Number of basic instructions			63			
Minimum instruction execution time			0.25 μs (8.0 MHz)			
Instruction cycle	When main system clock is selected		Selectable from 0.25 μs, 0.5 μs, 1 μs, 2 μs and 4 μs (8.0 MHz)			
	When subsystem clock is selected		122 μs (32.768 kHz)			
Internal memory	ROM	Size (bytes)	60K		60K (Flash memory)	
	Internal fast RAM	Size (bytes)	1024			
	Internal expansion RAM	Size (bytes)	1024			
	EEPROM	Size (bytes)	–	256	–	256
Address space			64K bytes			
Interrupt function		External	5			
		Internal	24			
I/O pin	CMOS input		8			
	CMOS I/O		71			
Timer			16-bit timer/event counter × 1 channel 16-bit timer × 1 channel 8-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel			
Timer output			4 (16-bit PWM output: 1, 8-bit PWM output: 2)			
Serial interface			3-wire: 1 channel 2-wire: 1 channel UART: 1 channel			
CAN controller			Conformed on CAN protocol Ver. 2.0 (part B), transmission speed: 500 kbps maximum			
A/D converter			8-bit resolution × 8 channels			
LCD controller/driver			Segment signal output: 40 maximum Common signal output: 4 maximum Bias: 1/3 bias			
Power fail detect function			Battery voltage detect function			
Sound generator			Buzzer output function (with composed amplitude)			
Standby function			STOP/HALT			
Operating power supply voltage range			V_{DD} = 4.0 to 5.5 V			
Package			100-pin plastic QFP (14 × 20 mm, 0.65 mm pitch)			
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator			
Applications			Control of automotive dashboard and electrical equipment in car body, etc.			

★: Under development

8-Bit Single-Chip Microcontroller

78K/0 Series

■ Bus Controller Series (μPD780701Y Subseries)

Part number			μPD780701Y★	μPD780702Y★	μPD78F0701Y★
Number of basic instructions			63		
Minimum instruction execution time			0.32 μs (6.29 MHz)		
Instruction cycle			Selectable from 0.32 μs, 0.64 μs, 1.27 μs, 2.54 μs, and 5.09 μs (6.29 MHz)		
Internal memory	ROM	Size (bytes)	60K		60K (Flash memory)
	RAM	Size (bytes)	3350		
Address space			64K bytes		
Interrupt function		External	8		
		Internal	21		
I/O pin	CMOS I/O		56		
	TTL input/CMOS output		8		
	N-ch open-drain I/O		3		
Timer			16-bit timer/event counter × 2 channels 8-bit timer/event counter × 3 channels Watch timer × 1 channel Watchdog timer × 1 channel		
Timer output			5 (PWM output: 3)		
Serial interface			3-wire: 2 channels UART: 1 channel I²C bus (supporting multiplex master): 1 channel		
A/D converter			8-bit resolution × 16 channels		
Power fail detect function			Battery voltage detect function		
Others			Clock output function Buzzer output function		
Bus controller			DCAN controller	IEBus controller	DCAN controller or IEBus controller
Standby function			STOP/HALT		
Operating power supply voltage range			V_{DD} = 3.5 to 5.5 V		
Package			80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch)		
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 (μPD780833Y Subseries)

Part number			μPD780831Y★	μPD780833Y★	μPD78F0833Y★
Number of basic instructions			63		
Minimum instruction execution time			0.48 μs (4.19 MHz)		
Instruction cycle			Selectable from 0.48 μs, 0.96 μs, 1.92 μs, 3.84 μs, and 7.68 μs (4.19 MHz)		
Internal memory	ROM	Size (bytes)	60K		60K (Flash memory)
	RAM	Size (bytes)	3104		
Address space			64K bytes		
Interrupt function		External	9		
		Internal	20		
I/O pin	CMOS I/O		54		
	TTL input/CMOS output		8		
	N-ch open-drain I/O		3		
Timer			16-bit timer/event counter × 2 channels Watch timer × 1 channel Watchdog timer × 1 channel	16-bit timer/event counter × 2 channels 8-bit timer/event counter × 3 channels Watch timer × 1 channel Watchdog timer × 1 channel	
Timer output			5 (PWM output: 3)		
Serial interface			3-wire: 2 channels UART: 1 channel I^2C bus (supporting multiplex master): 1 channel		
A/D converter			8-bit resolution × 8 channels × 2		
Others			Clock output function		
Bus controller			J1850 (CLASS2) bus interface		
Standby function			STOP/HALT		
Operating power supply voltage range			V_{DD} = 4.5 to 5.5 V		
Package			80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch)		
Development tools			Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications			Car audio systems, etc.		

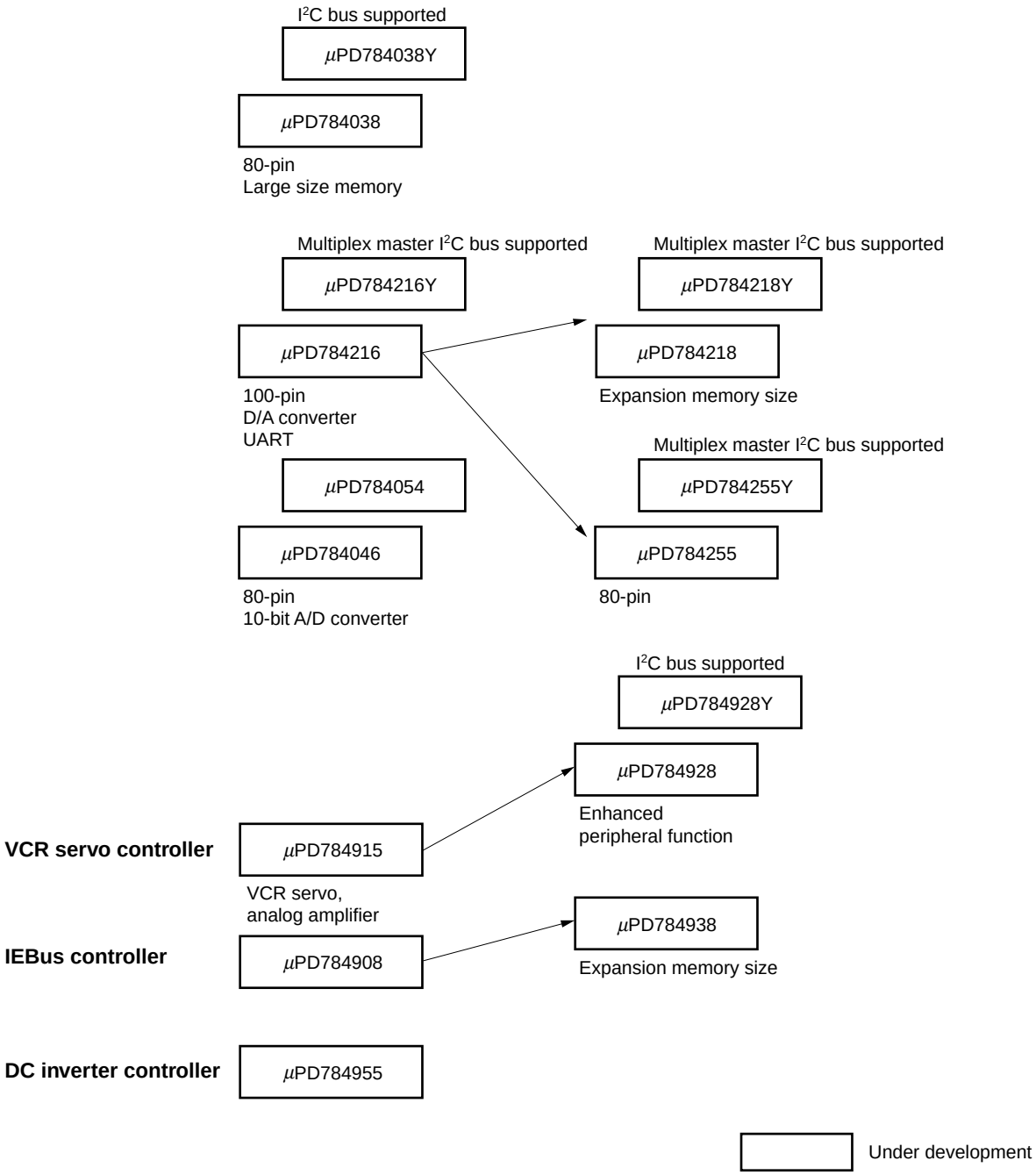
★: Under development

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

Subseries name \ Function		ROM capacity	Timer				8-bit A/D	10-bit A/D	8-bit D/A	Serial interface	I/O	V_{DD} MIN. value
			8-bit	16-bit	Watch	WDT						
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
	μPD784225Y									3 ch (UART: 2 ch, I^2C: 1 ch)		
	μPD784218	192K to 256K	6 ch							3 ch (UART: 2 ch)	86	2.2 V
	μPD784218Y									3 ch (UART: 2 ch, I^2C: 1 ch)		
	μPD784216	96K to 128K								3 ch (UART: 2 ch)		
	μPD784216Y									3 ch (UART: 2 ch, I^2C: 1 ch)		
	μPD784054	32K	–	3 ch	–		–	16 ch	–	2 ch (UART: 2 ch)	64	4.5 V
	μPD784046	32K to 64K		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^2C: 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^2C: 1 ch)		
	μPD784915	48K to 62K								2 ch	54	
On-chip IEBus controller	**μPD784938**	96K to 256K	–	4 ch	–	1 ch	8 ch	–	–	4 ch (UART: 2 ch)	80	4.0 V
	μPD784908	96K to 128K										
DC inverter controller	**μPD784955**	24K to 64K	2 ch	6 ch	–	1 ch	8 ch	–	–	2 ch (UART: 1 ch)	67	4.5 V

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μPD784038 Subseries)

Part number		μPD784031	μPD784035	μPD784036	μPD784037	μPD784038	μPD78P4038
Number of instructions		113					
Minimum instruction cycle		125 ns (32 MHz)					
Memory expansion function		Total of 1M bytes for both programs and data					
Internal memory	ROM size (bytes)	–	48K	64K	96K	128K	128K (PROM)
	RAM size (bytes)	2K			3.5K	4.25K	
Interrupt function		4-level programmable priority, macro service, vectored interrupt, context switching function					
	External source	7					
	Internal source	18					
	Number of interrupts supporting the use of a macro service	19					
	Type of macro service	4 types, 21 kinds					
I/O pin	Input	8					
	Output	4	0				
	I/O	34	56				
Timer/counter		16-bit timer/counter × 3 channels 16-bit timer × 1 channel					
Serial interface		UART/IOE (with on-chip baud rate generator): 2 channels CSI (3-wire/2wire mode): 1 channel					
A/D converter		8-bit resolution × 8 channels					
D/A converter		8-bit resolution × 2 channels					
PWM output		12-bit resolution × 2 channels					
Standby function		HALT/IDLE/STOP mode					
Pseudo-SRAM refresh function		Provided					
Feature		• Large internal memory • Wide operating voltage range (2.7 to 5.5 V) • System clock dividing function (1/2, 1/4, 1/8, 1/16)					
Package		80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch, 2.7-mm thick) 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch, 1.4-mm thick) 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)					*
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.					

*: • 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch, 2.7-mm thick)
• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch, 1.4-mm thick)
• 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)
• 80-pin ceramic WQFN (14 × 14 mm, 0.65-mm pitch)

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μPD784038Y Subseries)

Part number		μPD784031Y	μPD784035Y	μPD784036Y	μPD784037Y	μPD784038Y	μPD78P4038Y
Number of instructions		113					
Minimum instruction cycle		125 ns (32 MHz)					
Memory expansion function		Total of 1M bytes for both programs and data					
Internal memory	ROM size (bytes)	–	48K	64K	96K	128K	128K (PROM)
	RAM size (bytes)	2K			3.5K	4.25K	
Interrupt function		4-level programmable priority, macro service, vectored interrupt, context switching function					
	External source	8					
	Internal source	19					
	Number of interrupts supporting the use of a macro service	20					
	Type of macro service	4 types, 21 kinds					
I/O pin	Input	8					
	Output	4	0				
	I/O	34	56				
Timer/counter		16-bit timer/counter × 3 channels 16-bit timer × 1 channel					
Serial interface		UART/IOE (with on-chip baud rate generator): 2 channels CSI (3-wire/2wire/I²C bus mode): 1 channel					
A/D converter		8-bit resolution × 8 channels					
D/A converter		8-bit resolution × 2 channels					
PWM output		12-bit resolution × 2 channels					
Standby function		HALT/IDLE/STOP mode					
Pseudo-SRAM refresh function		Provided					
Feature		• Large internal memory • Wide operating voltage range (2.7 to 5.5 V) • System clock dividing function (1/2, 1/4, 1/8, 1/16)					
Package		80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch, 2.7-mm thick) 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch, 1.4-mm thick) 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)					*
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 equipment, etc.					

*: • 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch, 2.7-mm thick)
• 80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch, 1.4-mm thick)
• 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)
• 80-pin ceramic WQFN (14 × 14 mm, 0.65-mm pitch)

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μPD784046, 784054 Subseries)

Subseries name		μPD784046 Subseries			μPD784054 Subseries
Part number		μPD784044	μPD784046	μPD78F4046	μPD784054
Number of instructions		113			
Minimum instruction cycle		125 ns (32 MHz)			
Memory expansion function		Total of 1M bytes for both programs and data			
Internal memory	ROM size (bytes)	32K	64K	64K (flash memory)	32K
	RAM size (bytes)	1024	2048	2048	1024
Interrupt function		4-level programmable priority, macro service, vectored interrupt, context switching function			
	External source	8			
	Internal source	23			19
	Number of interrupts supporting the use of a macro service	25			21
	Type of macro service	7 types, 27 kinds			7 types, 23 kinds
I/O pin	Input	17			
	Output	0			
	I/O	48			47
Timer/counter		16-bit timer × 3 channels 16-bit timer/counter × 2 channels			16-bit timer × 3
Serial interface		UART/CSI × 2 channels			
A/D converter		10-bit resolution × 16 channels			
Standby function		HALT/IDLE/STOP mode			HALT/IDLE/STOP/standby invalidation mode
Feature		On-chip timer unit optimum for real-time control			
Package		80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch, 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 (μPD784216 Subseries)

Part number		μPD784214	μPD784215	μPD784216	μPD78F4216★
Number of instructions		113			
Minimum instruction cycle		160 ns (Main system clock 12.5 MHz)/61 μs (Subsystem clock 32.768 kHz)			
Memory expansion function		Total of 1M bytes for both programs and data			
Internal memory	ROM size (bytes)	96K	128K	128K	128K (Flash memory)
	RAM size (bytes)	3584	5120	8192	
Interrupt function		4-level programmable priority, macro service, vectored interrupt, context switching function			
	External source	9			
	Internal source	20			
	Number of interrupts supporting the use of a macro service	27			
	Type of macro service	4 types, 21kinds			
I/O pin	Input	8			
	I/O	72			
	N-ch open-drain I/O	6			
Timer/counter		16-bit timer/counter × 1 channel 8-bit timer/counter × 6 channels			
Real-time output port		4-bit × 2 ports or 8-bit × 1 port			
Serial interface		UART/IOE (with dedicated on-chip baud rate generator): 2 channels CSI (3-wire mode): 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 $f_{XX}/2^{10}$, $f_{XX}/2^{11}$, $f_{XX}/2^{12}$, $f_{XX}/2^{13}$			
Clock timer		1 channel			
Standby function		HALT/STOP/IDLE mode HALT/IDLE mode at Low power consumption mode (CPU operation using subsystem clock)			
Feature		• Large internal memory • Wide operation voltage range (Mask ROM version: 2.2 to 5.5 V, Flash memory version: 2.7 to 5.5 V) • Using peripheral functions of 78K/0 series			
Package		100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch) 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)			
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 equipment, etc.			

★: Under development

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μPD784216Y Subseries)

Part number		μPD784214Y	μPD784215Y	μPD784216Y	μPD78F4216Y★
Number of instructions		113			
Minimum instruction cycle		160 ns (Main system clock 12.5 MHz)/61 μs (Subsystem clock 32.768 kHz)			
Memory expansion function		Total of 1M bytes for both programs and data			
Internal memory	ROM size (bytes)	96K	128K	128K	128K (Flash memory)
	RAM size (bytes)	3584	5120	8192	
Interrupt function		4-level programmable priority, macro service, vectored interrupt, context switching function			
	External source	9			
	Internal source	20			
	Number of interrupts supporting the use of a macro service	27			
	Type of macro service	4 types, 21kinds			
I/O pin	Input	8			
	I/O	72			
	N-ch open-drain I/O	6			
Timer/counter		16-bit timer/counter × 1 channel 8-bit timer/counter × 6 channels			
Real-time output port		4-bit × 2 ports or 8-bit × 1 port			
Serial interface		UART/IOE (with dedicated on-chip baud rate generator): 2 channels CSI (3-wire/I^2C bus supporting multiplex master mode): 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 $f_{XX}/2^{10}$, $f_{XX}/2^{11}$, $f_{XX}/2^{12}$, $f_{XX}/2^{13}$			
Clock timer		1 channel			
Standby function		HALT/STOP/IDLE mode HALT/IDLE mode at Low power consumption mode (CPU operation using subsystem clock)			
Feature		• Large internal memory • Wide operation voltage range (Mask ROM version: 2.2 to 5.5 V, Flash memory version: 2.7 to 5.5 V) • Using peripheral functions of 78K/0 series			
Package		100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch) 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)			
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 equipment, etc.			

★: Under development

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μPD784218 Subseries)

Part number		μPD784217★	μPD784218	μPD78F4218
Number of instructions		113		
Minimum instruction cycle		160 ns (Main system clock 12.5 MHz)/61 μs (Subsystem clock 32.768 kHz)		
Memory expansion function		Total of 1M bytes for both programs and data		
Internal memory	ROM size (bytes)	192K	256K	256K (Flash memory)
	RAM size (bytes)	12800		
Interrupt function		4-level programmable priority, macro service, vectored interrupt, context switching function		
	External source	9		
	Internal source	20		
	Number of interrupts supporting the use of a macro service	27		
	Type of macro service	4 types, 21 kinds		
I/O pin	Input	8		
	I/O	72		
	N-ch open-drain I/O	6		
Timer/counter		16-bit timer/counter × 1 channel 8-bit timer/counter × 6 channels		
Real-time output port		4-bit × 2 ports or 8-bit × 1 port		
Serial interface		UART/IOE (with dedicated on-chip baud rate generator): 2 channels CSI (3-wire mode): 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 $f_{XX}/2^{10}$, $f_{XX}/2^{11}$, $f_{XX}/2^{12}$, $f_{XX}/2^{13}$		
Clock timer		1 channel		
Standby function		HALT/STOP/IDLE mode HALT/IDLE mode at Low power consumption mode (CPU operation using subsystem clock)		
Feature		• Large internal memory • Wide operation voltage range (Mask ROM version: 2.2 to 5.5 V, Flash memory version: 2.7 to 5.5 V) • Using peripheral functions of 78K/0 series		
Package		100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch) 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)		
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 equipment, etc.		

★: Under development

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μPD784218Y Subseries)

Part number		μPD784217Y★	μPD784218Y★	μPD78F4218Y★
Number of instructions		113		
Minimum instruction cycle		160 ns (Main system clock 12.5 MHz)/61 μs (Subsystem clock 32.768 kHz)		
Memory expansion function		Total of 1M bytes for both programs and data		
Internal memory	ROM size (bytes)	192K	256K	256K (Flash memory)
	RAM size (bytes)	12800		
Interrupt function		4-level programmable priority, macro service, vectored interrupt, context switching function		
	External source	9		
	Internal source	20		
	Number of interrupts supporting the use of a macro service	27		
	Type of macro service	4 types, 21 kinds		
I/O pin	Input	8		
	I/O	72		
	N-ch open-drain I/O	6		
Timer/counter		16-bit timer/counter × 1 channel 8-bit timer/counter × 6 channels		
Real-time output port		4-bit × 2 ports or 8-bit × 1 port		
Serial interface		UART/IOE (with dedicated on-chip baud rate generator): 2 channels CSI (3-wire/I^2C bus supporting multiplex master mode): 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 $f_{XX}/2^{10}$, $f_{XX}/2^{11}$, $f_{XX}/2^{12}$, $f_{XX}/2^{13}$		
Clock timer		1 channel		
Standby function		HALT/STOP/IDLE mode HALT/IDLE mode at Low power consumption mode (CPU operation using subsystem clock)		
Feature		• Large internal memory • Wide operation voltage range (Mask ROM version: 2.2 to 5.5 V, Flash memory version: 2.7 to 5.5 V) • Using peripheral functions of 78K/0 series		
Package		100-pin plastic LQFP (14 × 14 mm, 0.5-mm pitch) 100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)		
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 equipment, etc.		

★: Under development

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μPD784225 Subseries)

Part number		μPD784224★	μPD784225★	μPD78F4225★
Number of instructions		113		
Minimum instruction cycle		160 ns (Main system clock 12.5 MHz)/61 μs (Subsystem clock 32.768 kHz)		
Memory expansion function		Total of 1M bytes for both programs and data		
Internal memory	ROM size (bytes)	96K	128K	128K (Flash memory)
	RAM size (bytes)	3584	4352	
Interrupt function		4-level programmable priority, macro service, vectored interrupt, context switching function		
	External source	7		
	Internal source	18		
	Number of interrupts supporting the use of a macro service	23		
	Type of macro service	4 types, 21 kinds		
I/O pin	Input	8		
	I/O	59		
Timer/counter		16-bit timer/counter × 1 channel 8-bit timer/counter × 4 channels		
Real-time output port		4-bit × 2 ports or 8-bit × 1 port		
Serial interface		UART/IOE (with dedicated on-chip baud rate generator): 2 channels CSI (3-wire mode): 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 $f_{XX}/2^{10}$, $f_{XX}/2^{11}$, $f_{XX}/2^{12}$, $f_{XX}/2^{13}$		
Clock timer		1 channel		
Standby function		HALT/STOP/IDLE mode HALT/IDLE mode at Low power consumption mode (CPU operation using subsystem clock)		
Feature		• Large internal memory • Wide operation voltage range (1.8 to 5.5 V) • Using peripheral functions of 78K/0 series		
Package		80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch) 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)		
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.		

★: Under development

16-Bit Single-Chip Microcontroller

78K/IV Series

■ General-Purpose (μPD784225Y Subseries)

Part number		μPD784224Y★	μPD784225Y★	μPD78F4225Y★
Number of instructions		113		
Minimum instruction cycle		160 ns (Main system clock 12.5 MHz)/61 μs (Subsystem clock 32.768 kHz)		
Memory expansion function		Total of 1M bytes for both programs and data		
Internal memory	ROM size (bytes)	96K	128K	128K (Flash memory)
	RAM size (bytes)	3584	4352	
Interrupt function		4-level programmable priority, macro service, vectored interrupt, context switching function		
	External source	7		
	Internal source	18		
	Number of interrupts supporting the use of a macro service	23		
	Type of macro service	4 types, 21 kinds		
I/O pin	Input	8		
	I/O	59		
Timer/counter		16-bit timer/counter × 1 channel 8-bit timer/counter × 4 channels		
Real-time output port		4-bit × 2 ports or 8-bit × 1 port		
Serial interface		UART/IOE (with dedicated on-chip baud rate generator): 2 channels CSI (3-wire I^2C bus supporting multiplex master mode): 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 $f_{XX}/2^{10}$, $f_{XX}/2^{11}$, $f_{XX}/2^{12}$, $f_{XX}/2^{13}$		
Clock timer		1 channel		
Standby function		HALT/STOP/IDLE mode HALT/IDLE mode at Low power consumption mode (CPU operation using subsystem clock)		
Feature		• Large internal memory • Wide operation voltage range (1.8 to 5.5 V) • Using peripheral functions of 78K/0 series		
Package		80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch) 80-pin plastic TQFP (12 × 12 mm, 0.5-mm pitch)		
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.		

★: Under development

16-Bit Single-Chip Microcontroller

78K/IV Series

■ VCR Servo Controller (μPD784915 Subseries)

Part number		μPD784915, 784915A	μPD784915B	μPD784916A	μPD784916B	μPD78P4916
Number of instructions		113				
Minimum instruction cycle		250 ns (Internal clock: 8 MHz)				
Internal memory	ROM size (bytes)	48K		62K		62K (PROM)
	RAM size (bytes)	1280				2048
Interrupt function		4 levels (programmable), vectored interrupt, macro service, vectored interrupt, context switching function				
	External source	9 (including NMI)				
	Internal source	20 (including software interrupts)				
I/O pin	Input	8				
	Output	0				
	I/O	46				
Real-time output port		11 (including pseudo V sync, head amplifier switch, chroma-rotation outputs)				
Super timer unit	Timer/counter	22-bit FRC counter × 1 channel 16-bit timer × 6 channels (including 3 channels for general-purpose timers) 8-bit counter × 2 channels 5-bit UDC counter × 1 channel				
	Special circuit for VCR	V sync separator circuit, H sync separator circuit VISS detection circuit, wide aspect detection circuit Field identification circuit Head amplifier switch/chroma-rotation output circuit				
	PWM output	16-bit resolution × 3 channels (Carrier frequency: 62.5 kHz) 8-bit resolution × 3 channels (Carrier frequency: 62.5 kHz)				
Serial interface		Synchronous serial interface (3-wire): 2 channels (including 1 channel supporting BUSY/STRB control)				
A/D converter		8-bit resolution × 12 channels (Conversion time: 10 μs)				
Analog VCR circuits		CTL amplifier, RECCTL driver (with rewrite capability) CFG amplifier DFG amplifier, DPG comparator, DPFG separator circuit (3-value separator circuit) Reel FG comparator (2 channels) Csync comparator				
Standby function		HALT/STOP mode HALT mode for low power consumption				
Clock function		0.5-second measurement, low voltage operation (V_{DD} = 2.7 V) allowed				
Package		100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)				
Development tools		Assembler, C compiler, integrated debugger, system simulator, device file, in-circuit emulator				
Applications		VCRs, camcorder, integrated TV-VCR machines, etc.				

16-Bit Single-Chip Microcontroller

78K/IV Series

■ VCR Servo Controller (μPD784928 Subseries)

Part number		μPD784927	μPD784928	μPD78F4928★
Number of instructions		113		
Minimum instruction cycle		250 ns (Internal clock: 8 MHz)		
Internal memory	ROM size (bytes)	96K	128K	128K (Flash memory)
	RAM size (bytes)	2048	3584	
Interrupt function		4 levels (programmable), vectored interrupt, macro service, context switching function		
	External source	9 (including NMI)		
	Internal source	22 (including software interrupts)		
I/O pin	Input	20		
	Output	0		
	I/O	54		
Real-time output port		11 (including pseudo V sync, head amplifier switch, chroma-rotation outputs)		
Super timer unit	Timer/counter	22-bit FRC counter × 1 channel 16-bit timer × 6 channels (including 3 channels for general-purpose timers) 8-bit counter × 2 channels 5-bit UDC counter × 1 channel		
	Special circuit for VCR	V sync separator circuit, H sync separator circuit VISS detection circuit, wide aspect detection circuit Field identification circuit Head amplifier switch/chroma-rotation output circuit		
	PWM output	16-bit resolution × 3 channels (Carrier frequency: 62.5 kHz) 8-bit resolution × 3 channels (Carrier frequency: 62.5 kHz)		
Serial interface		Synchronous serial interface (3-wire): 2 channels (including 1 channel supporting BUSY/STRB control)		
A/D converter		8-bit resolution × 12 channels (Conversion time: 10 μs)		
Analog VCR circuits		CTL amplifier, RECCTL driver (with rewrite capability) CFG amplifier DFG amplifier, DPG amplifier, DPFG separator circuit (3-value separator circuit) Reel FG comparator (2 channels) Csync comparator		
Standby function		HALT/STOP mode Low power consumption mode/HALT mode for low power consumption		
Clock function		0.5-second measurement, low voltage operation (V_{DD} = 2.7 V) allowed		
Package		100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)		
Development tools		Assembler, C compiler, integrated debugger, system simulator, device file, in-circuit emulator		
Applications		VCRs, camcorder, integrated TV-VCR machines, etc.		

★: Under development

16-Bit Single-Chip Microcontroller

78K/IV Series

■ VCR Servo Controller (μPD784928Y Subseries)

Part number		μPD784927Y	μPD784928Y	μPD78F4928Y★
Number of instructions		113		
Minimum instruction cycle		250 ns (Internal clock: 8 MHz)		
Internal memory	ROM size (bytes)	96K	128K	128K (Flash memory)
	RAM size (bytes)	2048	3584	
Interrupt function		4 levels (programmable), vectored interrupt, macro service, context switching function		
	External source	9 (including NMI)		
	Internal source	23 (including software interrupts)		
I/O pin	Input	20		
	Output	0		
	I/O	54		
Real-time output port		11 (including pseudo V sync, head amplifier switch, chroma-rotation outputs)		
Super timer unit	Timer/counter	22-bit FRC counter × 1 channel 16-bit timer × 6 channels (including 3 channels for general-purpose timers) 8-bit counter × 2 channels 5-bit UDC counter × 1 channel		
	Special circuit for VCR	V sync separator circuit, H sync separator circuit VISS detection circuit, wide aspect detection circuit Field identification circuit Head amplifier switch/chroma-rotation output circuit		
	PWM output	16-bit resolution × 3 channels (Carrier frequency: 62.5 kHz) 8-bit resolution × 3 channels (Carrier frequency: 62.5 kHz)		
Serial interface		Synchronous serial interface (3-wire): 2 channels (including 1 channel supporting BUSY/STRB control) I^2C bus interface: 1 channel		
A/D converter		8-bit resolution × 12 channels (Conversion time: 10 μs)		
Analog VCR circuits		CTL amplifier, RECCTL driver (with rewrite capability) CFG amplifier DFG amplifier, DPG amplifier, DPFG separator circuit (3-value separator circuit) Reel FG comparator (2 channels) Csync comparator		
Standby function		HALT/STOP mode Low power consumption mode/HALT mode for low power consumption		
Clock function		0.5-second measurement, low voltage operation (V_{DD} = 2.7 V) allowed		
Package		100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)		
Development tools		Assembler, C compiler, integrated debugger, system simulator, device file, in-circuit emulator		
Applications		VCRs, camcorder, integrated TV-VCR machines, etc.		

★: Under development

16-Bit Single-Chip Microcontroller

78K/IV Series

■ IEBus Controller (μPD784908 Subseries)

Part number		μPD784907	μPD784908	μPD78P4908
Number of instructions		113		
Minimum instruction cycle		320 ns (6.29 MHz) 160 ns (12.58 MHz)		
Memory expansion function		Total of 1M bytes for both programs and data		
Internal memory	ROM size (bytes)	96K	128K	128K (PROM)
	RAM size (bytes)	3584	4352	
Interrupt function		4-level programmable priority, macro service, vectored interrupt, context switching function		
	External source	7		
	Internal source	20		
I/O pin	Input	8		
	I/O	72		
	LED direct drive output	24		
	Transistor direct drive	8		
	N-ch open-drain I/O	4		
Timer/counter		16-bit timer/counter × 4 channels		
Real-time output port		4-bit × 2 ports or 8-bit × 1 port		
IEBus controller		Incorporated (simple version)		
Serial interface		UART/IOE (3-wire): 2 channels CSI (3-wire): 2 channels		
A/D converter		8-bit resolution × 8 channels		
PWM output		12-bit resolution × 2 channels		
Clock output		Select of f_{XX}, $f_{XX}/2$, $f_{XX}/2^2$, $f_{XX}/2^3$, $f_{XX}/2^4$		
Watchdog timer		1 channel		
Standby function		HALT/STOP/IDLE mode		
Power supply voltage		V_{DD} = 4.0 to 5.5 V (Main clock: f_{XX} = 12.58 MHz, internal system clock = f_{XX}, f_{CYK} = 79 ns) V_{DD} = 3.5 to 5.5 V (Other than above, f_{CYK} = 159 ns)		V_{DD} = 4.5 to 5.5 V (Main clock: f_{XX} = 12.58 MHz, internal system clock = f_{XX}, f_{CYK} = 79 ns) V_{DD} = 4.0 to 5.5 V (Other than above, f_{CYK} = 159 ns)
Package		100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)		
Development tools		Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator		
Applications		Car audio, etc.		

16-Bit Single-Chip Microcontroller

78K/IV Series

■ IEBus Controller (μPD784938 Subseries)

Part number		μPD784935	μPD784936	μPD784937★	μPD784938★	μPD78F4938★
Number of instructions		113				
Minimum instruction cycle		320 ns (6.29 MHz) 160 ns (12.58 MHz)				
Memory expansion function		Total of 1M bytes for both programs and data				
Internal memory	ROM size (bytes)	96K	128K	192K	256K	256K (Flash memory)
	RAM size (bytes)	5120	6656	8192	10240	
Interrupt function		4-level programmable priority, macro service, vectored interrupt, context switching function				
	External source	7				
	Internal source	20				
I/O pin	Input	8				
	I/O	72				
	LED direct drive output	24				
	Transistor direct drive	8				
	N-ch open-drain I/O	4				
Timer/counter		16-bit timer/counter × 4 channels				
Real-time output port		4-bit × 2 ports or 8-bit × 1 port				
IEBus controller		Incorporated (simple version)				
Serial interface		UART/IOE (3-wire): 2 channels CSI (3-wire): 2 channels				
A/D converter		8-bit resolution × 8 channels				
PWM output		12-bit resolution × 2 channels				
Clock output		Select of f_{XX}, $f_{XX}/2$, $f_{XX}/2^2$, $f_{XX}/2^3$, $f_{XX}/2^4$				
Watchdog timer		1 channel				
Standby function		HALT/STOP/IDLE mode				
Package		100-pin plastic QFP (14 × 20 mm, 0.65-mm pitch)				
Development tools		Assembler, C compiler, real-time OS, integrated debugger, system simulator, device file, in-circuit emulator				
Applications		Car audio, etc.				

★: Under development

16-Bit Single-Chip Microcontroller

78K/IV Series

■ DC Inverter Controller (μPD784955 Subseries)

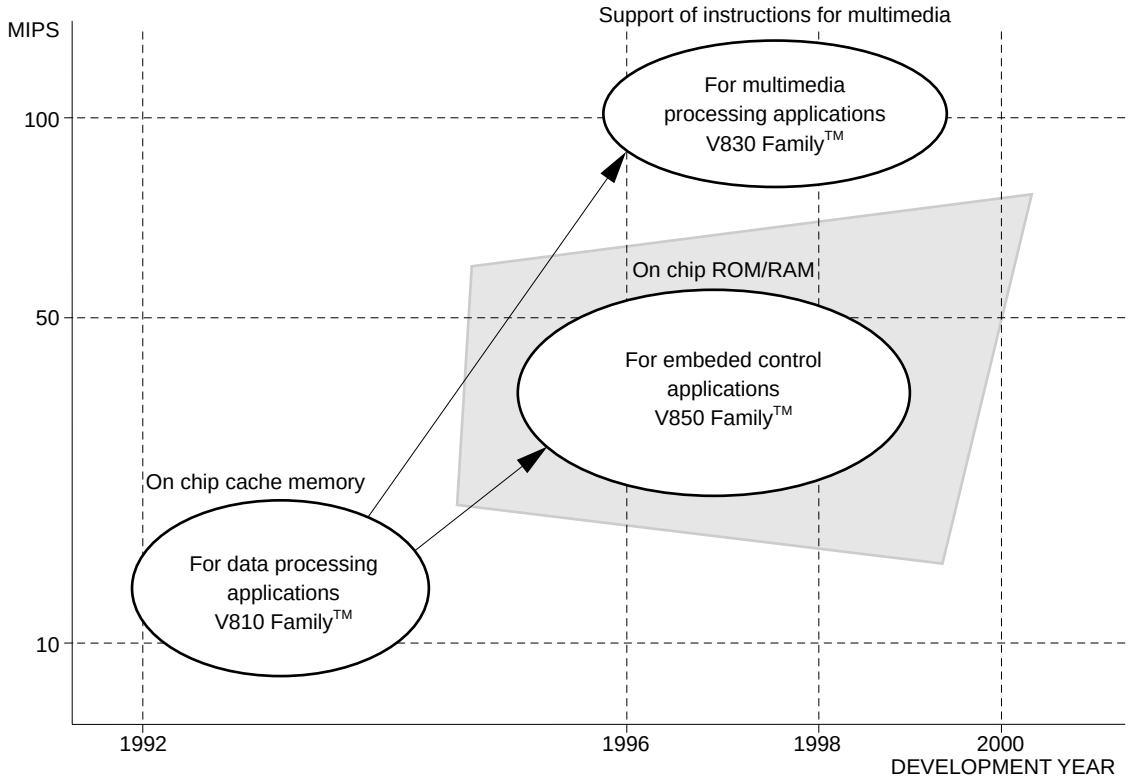
Part number		μPD784953★	μPD784955★	μPD78F4956★
Number of instructions		113		
Minimum instruction cycle		160 ns (Internal 12.5 MHz)		
Internal memory	ROM size (bytes)	24K	48K	64K (Flash memory)
	RAM size (bytes)	768	2048	
Interrupt function		4-level programmable priority, macro service, vectored interrupt, context switching function		
	External source	8 (Also internal source: 2)		
	Internal source	22		
I/O pin	Input	8		
	I/O	59		
	Pin with pull-up register	59		
	LED direct drive output	32		
Timer/counter		16-bit timer/counter × 6 channels 8-bit timer/counter × 2 channels		
Serial interface		Synchronous serial interface (3-wire): 1 channel UART: 1 channel		
A/D converter		8-bit resolution × 8 channels		
Watchdog timer		1 channel		
Standby function		HALT/STOP/IDLE mode		
Package		80-pin plastic QFP (14 × 14 mm, 0.65-mm pitch, 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 air-conditioners, etc.		

★: Under development

32-Bit Microprocessor

V800 Series™

■ **V800 Series Road Map**



32-Bit Microprocessor

V810 Family, V830 Family

Part number		**μPD70741**	**μPD705101**	**μPD705102★**
Alias		V821™	V831™	V832™
Performance		16 MIPS/25 MHz	118 MIPS/100 MHz	170 MIPS/143 MHz
Operating frequency		25 MHz	100 MHz	143 MHz
Operating voltage		4.5 to 5.5 V	3.0 to 3.6 V	2.3 to 2.7 V 3.0 to 3.6 V
Power consumption (max.)		500 mW (5 V25 MHz)	550 mW (3.3 V/100 MHz)	350 mW (2.5 V, 3.3 V/143 MHz)
Address bus		24-bit	24-bit	
Data bus		16-bit	16-/32-bit	
Address space		Internal: 4 G bytes External: 64M bytes (maximum)	Internal: 4 G bytes External: 128M bytes (maximum)	
Cache		Instruction cache: 1K bytes	Instruction cache: 4K bytes, Data cache: 4K bytes	
Internal RAM		—	Instruction RAM: 4K bytes, Data RAM: 4K bytes	
DSP		—	32 bits	
Peripheral I/O	Timer	2 channels	2 channels	
	Interrupt	External: 9, Internal: 11	External: 9, Internal: 11	
	Serial I/O	2 channels	2 channels	
	DMA	2 channels	4 channels	
	Memory interface	Fast page mode DRAM, SRAM, I/O, Page-ROM	EDO DRAM, SRAM, I/O, Page-ROM	SDRAM, SRAM, I/O, Page-ROM
Others		Watchdog timer	Debug controller	
Package		100-pin plastic QFP	160-pin plastic LQFP	
Development tools		Real-time OS	Real-time OS, task debugger, C compiler, system performance analyzer, device file	
Applications		Printers, facsimiles, word processors, game machines, car navigation, PDAs, etc.	Internet/intra-net systems, car navigation, color facsimile machines, high-performance TVs, etc.	Internet/intra-net systems, car nativation, color facsimile machines, digital still cameras, etc.

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V850E/MS1™

Part number		μPD703100/ μPD703100-A★	μPD703101/ μPD703101-A★	μPD703102/ μPD703102-A★	μPD70F3102/ μPD70F3102-A★
CPU core		V850E			
CPU performance (Dhrystone)		—	43 MIPS (33 MHz)		
On-chip ROM (bytes)		—	96K	128K	128K (Flash memory)
On-chip RAM (bytes)		4K			
External bus interface	Address bus	24-bit			
	Data bus	16-bit			
	Programmable wait	0 to 7			
Interrupt controller		External: 25, Internal: 47			
DSP	32 × 32 → 64	0.025 to 0.05 μs (40 MHz)	0.03 to 0.06 μs (33 MHz)		
	32 × 32 + 32 → 32	0.075 μs (40 MHz)	0.09 μs (33 MHz)		
	16 × 16 → 32	—			
	16 × 16 + 32 → 32	—			
Timer/counter (RPU)		16-bit × 8 channels			
Serial interface (SIO)	CSI	2 channels			
	CSI/I²C	—			
	CSI/UART	2 channels			
	UART	—			
	Dedicated baud rate generator	3 channels			
A/D converter		10-bit resolution × 8 channels			
DMA controller		4 channels			
Real-time output port		—			
Port	Input/output	114			
	Input	9			
Other peripheral function		Memory access control function (Direct connectable various memory)			
Power save function		HALT/IDLE/STOP			
Operating frequency		2 to 40 MHz	2 to 33 MHz		
Operating voltage		Internal unit: 3.3 V, A/D converter: 5 V/3.3 V, External pin: 5 V/3.3 V			
Power consumption (TYP.)		570 mW/ 360 mW (40 MHz)	470 mW/300 mW (33 MHz)		
Package		144-pin plastic LQFP (20 × 20 mm) 157-pin plastic FBGA (14 × 14 mm)*			
Development tools		Real-time OS, task debugger, C compiler, debugger, system performance analyzer, device file, in-circuit emulator			
Applications		Printers, facsimiles, PPCs, digital still cameras, video printers, DVD systems, etc.			

*: Except μPD703100, 703101, 703102, 70F3102

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SA1™

Part number		μPD703015/ μPD703015Y	μPD703017★/ μPD703017Y★	μPD70F3017★/ μPD70F3017Y★
CPU core		V850		
CPU performance (Dhrystone)		19 MIPS (17 MHz)		
On-chip ROM (bytes)		128K	256K	256K (Flash memory)
On-chip RAM (bytes)		4K	8K	
External bus interface	Address bus	22-bit		
	Data bus	16-bit		
	Programmable wait	0 to 3		
Interrupt controller		External: 8, Internal: 23		
DSP	32 × 32 → 64	—		
	32 × 32 + 32 → 32	—		
	16 × 16 → 32	0.059 to 0.118 μs (17 MHz)		
	16 × 16 + 32 → 32	0.177 μs (17 MHz)		
Timer/counter (RPU)		16-bit × 2 channels 8-bit × 4 channels (Cascade connection supported)		
Serial interface (SIO)	CSI	2 channels/1 channel	2 channels/1 channel	2 channels/1 channel
	CSI/I²C	0 channels/1 channel	0 channels/1 channel	0 channels/1 channel
	CSI/UART	1 channel		
	UART	1 channel		
	Dedicated baud rate generator	2 channels (UART only)		
A/D converter		10-bit resolution × 12 channels		
DMA controller		3 channels (internal RAM ←→ internal peripheral I/O)		
Real-time output port		8-bit × 1 or 4-bit × 2		
Port	Input/output	72		
	Input	13		
Other peripheral function		Watch timer: 1 channel Watchdog timer: 1 channel		
Power save function		HALT/IDLE/STOP		
Operating frequency		1 to 17 MHz (main clock, 3 V) 32.768 kHz (subclok)		
Operating voltage		2.7 to 3.6 V		
Power consumption (TYP.)		30 mW (main clock: 10 MHz, 3 V)		
Package		100-pin plastic LQFP (14 × 14 mm) 121-pin plastic FBGA (12 × 12 mm)		
Development tools		Real-time OS, task debugger, C compiler, debugger, system performance analyzer, device file, in-circuit emulator		
Applications		Portable equipment such as camcorders, PHS (Personal Handyphone System), digital still cameras, cellular phones, portable MDs, etc.		

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V850/SB1™, V850/SB2™

Part number		μPD703033★/ μPD703033Y★	μPD70F3033★/ μPD70F3033Y★	μPD70F3035★/ μPD70F3035Y★
Alias		V850/SB1™		V850/SB2™
CPU core		V850		
CPU performance (Dhrystone)		22 MIPS (20 MHz)		
On-chip ROM (bytes)		256K	256K (Flash memory)	
On-chip ROM (bytes)		16K		
External bus interface	Address bus	22-bit		
	Data bus	16-bit		
	Programmable wait	0 to 3		
Interrupt controller		External: 8, Internal: 30 (31 for Y products)		External: 8 Internal: 32 (33 for Y products)
DSP	32 × 32 → 64	—		
	32 × 32 + 32 → 32	—		
	16 × 16 → 32	0.050 to 0.100 μs (20 MHz)		
	16 × 16 + 32 → 32	0.150 μs (20 MHz)		
Timer/counter (RPU)		16-bit × 2 channels 8-bit × 6 channels (Cascade connection supported)		
Serial interface (SIO)	CSI	3 channels/1 channel	3 channels/1 channel	3 channels/1 channel
	CSI/I²C	0 channels/2 channels	0 channels/2 channels	0 channels/2 channels
	CSI/UART	2 channels		
	UART	—		
	Dedicated baud rate generator	3 channels		
A/D converter		10-bit resolution × 12 channels		
DMA controller		6 channels (internal RAM ←→ internal peripheral I/O)		
Real-time output port		8-bit × 1 or 4-bit × 2		
Port	Input/output	71		
	Input	12		
Other peripheral function		Watch timer: 1 channel Watchdog timer: 1 channel		Watch timer: 1 channel Watchdog timer: 1 channel IEBus (Simple version)
Power save function		HALT/IDLE/STOP		
Operating frequency		2 to 20 MHz (main clock) 32.768 kHz (subclock)		
Operating voltage		4.5 to 5.5 V		
Power consumption (TYP.)		40 mW (target value) (main clock: 5 V, 10 MHz)		
Package		100-pin plastic LQFP (14 × 14 mm) 100-pin plastic QFP (14 × 20 mm)		
Development tools		Real-time OS, task debugger, C compiler, debugger, system performance analyzer, device file, in-circuit emulator		
Applications		AV equipment such as car audio systems, TVs, and VCRs, and other applications		

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V854™

Part number		μPD703006	μPD703008	μPD703008Y	μPD70F3008★/ μPD70F3008Y★
CPU core		V850			
CPU performance (Dhrystone)		—	29 MIPS (25 MHz)	38 MIPS (33 MHz)	18 MIPS (16 MHz)
On-chip ROM (bytes)		—	128K		128K (Flash memory)
On-chip RAM (bytes)		4K			
External bus interface	Address bus	24-bit			
	Data bus	16-bit			
	Programmable wait	0 to 3			
Interrupt controller		External: 22, Internal: 31			
DSP	32 × 32 → 64	—			
	32 × 32 + 32 → 32	—			
	16 × 16 → 32	0.03 to 0.06 μs (33 MHz)	0.04 to 0.08 μs (25 MHz)	0.03 to 0.06 μs (33 MHz)	0.06 to 0.12 μs (16 MHz)
	16 × 16 + 32 → 32	0.09 μs (33 MHz)	0.12 μs (25 MHz)	0.09 μs (33 MHz)	0.18 μs (16 MHz)
Timer/counter (RPU)		24-bit × 2 channels 16-bit × 6 channels			
Serial interface (SIO)	CSI	3 channels	3 channels	2 channels	3 channes/2 channels
	CSI/I²C	0 channels	0 channels	1 channel	0 channels/1 channel
	CSI/UART	1 channel			
	UART	—			
	Dedicated baud rate generator	4 channels			
A/D converter		8-bit resolution × 16 channels			
DMA controller		—			
Real-time output port		8			
Port	Input/output	96			
	Input	16			
Other peripheral function		PWM: 4 channels (12 to 16-bit resolution)			
Power save function		HALT/IDLE/STOP			
Operating frequency		2 to 33 MHz (3.3 V)	2 to 25 MHz (3 V)	2 to 33 MHz (3.3 V)	2 to 16 MHz (3.3 V)
Operating voltage		3.0 to 3.6 V	2.7 to 3.6 V	3.0 to 3.6 V	3.1 to 3.6 V
Power consumption (TYP.)		195 mW (3.3 V, 33 MHz)	120 mW (3 V, 25 MHz)	195 mW (3.3 V, 33 MHz)	136 mW (3.3 V, 16 MHz)
Package		144-pin plastic LQFP (20 × 20 mm)			
Development tools		Real-time OS, task debugger, C compiler, debugger, simulator, system performance analyzer, device file, in-circuit emulator			
Applications		Low-voltage-operation equipment including camcorders, VCRs, cellular phones, PDAs, and digital still cameras			

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

■ V853™

Part number		μPD703003/ μPD703003A★	μPD703004A★	μPD70F3003	μPD70F3003A★	μPD703025A★	μPD70F3025A★
CPU core		V850					
CPU performance (Dhrystone)		38 MIPS (33 MHz)		29 MIPS (25 MHz)	38 MIPS (33 MHz)		
On-chip ROM (bytes)		128K	96K	128K (Flash memory)		256K	256K (Flash memory)
On-chip RAM (bytes)		4K				8K	
External bus interface	Address bus	20-bit					
	Data bus	16-bit					
	Programmable wait	0 to 3					
Interrupt controller		External: 17, Internal: 32					
DSP	32 × 32 → 64	—					
	32 × 32 + 32 → 32	—					
	16 × 16 → 32	0.03 to 0.06 μs (33 MHz)					
	16 × 16 + 32 → 32	0.09 μs (33 MHz)					
Timer/counter (RPU)		16 bit × 5 channels					
Serial interface (SIO)	CSI	2 channels					
	CSI/I²C	—					
	CSI/UART	2 channels					
	UART	—					
	Dedicated baud rate generator	3 channels					
A/D converter		10-bit resolution × 8 channels					
DMA controller		—					
Real-time output port		—					
Port	Input/output	67					
	Input	8					
Other peripheral function		PWM: 4 ch (8/9/10/12-bit resolution) D/A converter: 2 channels					
Power save function		HALT/IDLE/STOP					
Operating frequency		5 to 33 MHz (5 V)		5 to 25 MHz (5 V)	5 to 33 MHz (5 V)		
Operating voltage		4.5 to 5.5 V		4.75 to 5.25 V	4.5 to 5.5 V		
Power consumption (TYP.)		450 mW/365 mW (5 V, 33 MHz)	365 mW (5 V, 33 MHz)	385 mW (5 V, 25 MHz)	425 mW (5 V, 33 MHz)	450 mW (5 V, 33 MHz)	480 mW (5 V, 33 MHz)
Package		∗	100-pin plastic LQFP (14 × 14 mm)	100-pin plastic QFP (14 × 14 mm)	100-pin plastic LQFP (14 × 14 mm)		
Development tools		Real-time OS, task debegger, C compiler, debugger, 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, etc.					

∗: • 100-pin plastic QFP (14 × 14 mm)
• 100-pin plastic LQFP (14 × 14 mm)

★: Under development

32-Bit Single-Chip Microcontroller

V850 Family

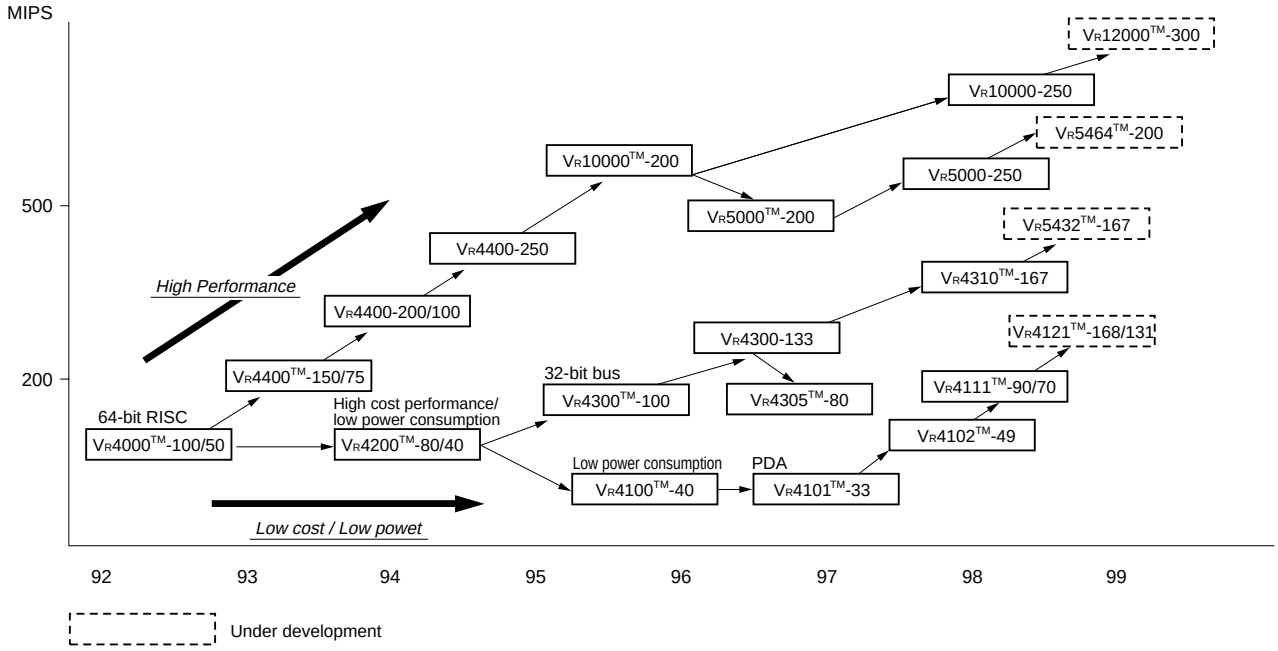
■ V852™

Part number		μPD703002	μPD70P3002
CPU core		V850	
CPU performance (Dhrystone)		29 MIPS (25 MHz)	
On-chip ROM (bytes)		90K	90K (PROM)
On-chip RAM (bytes)		3K	
External bus interface	Address bus	24-bit	
	Data bus	16-bit	
	Programmable wait	0 to 3	
Interrupt controller		External: 9, Internal: 16	
DSP	32 × 32 → 64	—	
	32 × 32 + 32 → 32	—	
	16 × 16 → 32	0.04 to 0.08 μs (25 MHz)	
	16 × 16 + 32 → 32	0.12 μs (25 MHz)	
Timer/counter (RPU)		16-bit × 2 channels	
Serial interface (SIO)	CSI	3 channels	
	CSI/I²C	—	
	CSI/UART	—	
	UART	1 channel	
	Dedicated baud rate generator	2 channels	
A/D converter		—	
DMA controller		—	
Real-time output port		—	
Port	Input/output	67	
	Input	1	
Other peripheral function		—	
Power save function		HALT/IDLE/STOP	
Operating frequency		3 to 25 MHz (5 V)	
Operating voltage		4.5 to 5.5 V	
Power consumption (TYP.)		250 mW (5 V, 25 MHz)	320 mW (5 V, 25 MHz)
Package		• 100-pin plastic QFP (14 × 14 mm) • 100-pin plastic LQFP (14 × 14 mm)	100-pin plastic QFP (14 × 14 mm)
Development tools		Real-time OS, task debugger, C compiler, debugger, simulator, system performance analyzer, device file, in-circuit emulator	
Applications		HDDs, PPCs, VCRs, motor control, robots, LBPs, printers, NC machine tools, digital phones, engine control, etc.	

64-Bit Microprocessor

VR Series™

■ VR Series Road Map



64-Bit Microprocessor

VR Series

■ VR Series Products (1/2)

Part number	μPD30121★		μPD30200		μPD30210	μPD30500
Alias	VR4121		VR4300	VR4305	VR4310	VR5000
Internal frequency	131 MHz	168 MHz	100 MHz 133 MHz	80 MHz	167 MHz	200 MHz 250 MHz
Operating voltage	External: 3.3 V Internal: 2.5 V		3.3 V			3.3 V
Cache size	Instruction: 16K bytes Data: 8K bytes		Instruction: 16K bytes Data: 8K bytes			Instruction: 32K bytes Data: 32K bytes
Performance	163 MIPS	208 MIPS	177 MIPS 80 SPECint92 60 SPECfp92	106 MIPS 48 SPECint92 36 SPECfp92	222 MIPS 100 SPECint92 75 SPECfp92	391 MIPS 6.8 SPECint95 6.8 SPECfp95
Features	CPU core: VR4120™ On-chip peripheral function ideal for PDAs High-speed processing by 168 MHz operation and 0.25 μm process rule Low power consumption design		Software compatible with VR4000 Series 32-bit external bus High-speed floating-point operation		Software compatible with VR4300 32-bit external bus High-speed floating-point operation	Two-way superscalar On-chip large primary cache On-chip secondary cache interface
Package	224-pin plastic FBGA		120-pin plastic QFP			272-pin plastic BGA 223-pin ceramic PGA
Applications	PDAs such as handheld PCs and palm-size PCs		Embedded equipment for LBP, and game machines			High-end embedded equipment for color LBPs, network routers, etc

★: Under development

■ VR Series Products (2/2)

Part number	μPD30540★	μPD30541★	μPD30700		μPD30710
Alias	VR5464	VR5432	VR10000		VR12000
Internal frequency	200 MHz	167 MHz	200 MHz	250 MHz	300 MHz
Operating voltage	External: 3.3 V, Internal: 2.5 V		3.3 V	2.6 V	2.6 V
Cache size	Instruction: 32K bytes Data: 32K bytes		Instruction: 32K bytes Data: 32K bytes		
Performance	309 MIPS 7 SPECint95 4 SPECfp95	258 MIPS 6.6 SPECint95 3.6 SPECfp95	9.0 SPECint95 19.0 SPECfp95	14 SPECint95 23 SPECfp95	16.8 SPECint95 27.8 SPECfp95
Features	Two-way superscalar On-chip large primary cache with line-lock function Hardware debugging function		Five-way superscalar On-chip FPU and MMU On-chip multiprocessor and secondary cache interface		
Package	272-pin plastic BGA	208-pin plastic QFP	599-pin ceramic LGA		
Applications	High-end embedded equipment for color LBPs and STB, etc.		Advanced WSs, servers		

★: Under development

Development Tools

75XL Series Software Tools

■ List of Software Tools

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

■ List of Device Files

Target device	Device file name	Target device	Device file name	Target device	Device file name
μPD750004 μPD750006 μPD750008	DF750008	μPD753036	DF753036	μPD754144 μPD754244	DF754244
μPD750104 μPD750106 μPD750108		μPD753104 μPD753106 μPD753108	DF753108	μPD754202	DF754202
μPD750064 μPD750066 μPD750068	DF750068	μPD753204 μPD753206 μPD753208	DF753208	μPD754264	DF754264
μPD753012A μPD753016A μPD753017A	DF753017	μPD753304	DF753304	μPD754302 μPD754304	DF754304

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		
μPD750004 μPD750006 μPD750008	42-pin SDIP (600 mil)	EP-75008CU-R	–
	44-pin QFP (10 × 10)	EP-75008GB-R	EV-9200G-44
μPD750104 μPD750106 μPD750108	42-pin SDIP (600 mil)	EP-75008CU-R	–
	44-pin QFP (10 × 10)	EP-75008GB-R	EV-9200G-44
μPD750064 μPD750066 μPD750068	42-pin SDIP (600 mil)	EP-750068CU-R	–
	42-pin SSOP (375 mil)	EP-750068GT-R	EV-9500GT-42
μPD753012A μPD753016A μPD753017A	80-pin QFP (14 × 14)	EP-753017GC-R	EV-9200GC-80
	80-PIN TQFP (12 × 12)	EP-753017GK-R	TGK-080SDW*
μPD753036	80-pin QFP (14 × 14)	EP-75336GC-R	EV-9200GC-80
	80-pin TQFP (12 × 12)	EP-75336GK-R	TGK-080SDW*
μPD753104 μPD753106 μPD753108	64-pin QFP (14 × 14)	EP-753108GC-R	EV-9200GC-64
	64-pin LQFP (12 × 12)	EP-753108GK-R	TGK-064SBW*
μPD753204 μPD753206 μPD753208	48-pin SSOP (375 mil)	EP-753208GT-R	EV-9500GT-48
μPD753304	42-pin SDIP (600 mil) (ES only)	EP-753304DU-R (ES only)	–
μPD754144	20-pin SOP (300 mil)	EP-754144GS-R	EV-9501GS-20
μPD754244	20-pin SSOP (300 mil)		EV-9500GS-20
μPD754264	20-pin SOP (300 mil)		EV-9501GS-20
μPD754202	20-pin SOP (300 mil)	EP-754144GS-R	EV-9501GS-20
	20-pin SSOP (300 mil)		EV-9500GS-20
μPD754302 μPD754304	36-pin SSOP (300 mil)	EP-754304GS-R	EV-9500GS-36

*: This is a product of Tokyo Eletech Corporation.

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	C-like compiler *emIC-17K*™
PC98-NX Series	Integrated debugger *SIMPLEHOST*™

■ List of Device Files

Target device	Device file name	Target device	Device file name	Target device	Device file name
μPD17001	AS17001	μPD17053	AS17053	μPD17933A	AS17934
μPD17003A	AS17003	μPD17062	AS17062	μPD17934A	
μPD17005	AS17005	μPD17068	AS17068	μPD17201A	AS17201
μPD17010	AS17010	μPD17071	AS17071	μPD17203A	AS17203
		μPD17072		μPD17204	AS17204
		μPD17073		μPD17207	AS17207
μPD17012	AS17012	μPD17704	AS17707	μPD17225	AS17225
		μPD17705		μPD17226	
		μPD17707		μPD17227	
μPD17015	AS17015	μPD17708		μPD17228	
		μPD17709		μPD17235★	AS17235★
		μPD17717		μPD17236★	
μPD17016	AS17016	μPD17718			
μPD17017		μPD17719			

★: Under development

Development Tools

17K Series Hardware Tools

■ Common Hardware Tools

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

*: This is a product of I.C Corporation.

■ List of Hardware Tools (1/2)

Target device		SE board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Device name	Package			
μPD17001	48-pin QFP	SE-17001	EP-17001GH	EV-9200GH-48
μPD17003A	80-pin QFP	SE-17010	EP-17003GF	EV-9200G-80
μPD17005	80-pin QFP	SE-17010	EP-17003GF	EV-9200G-80
μPD17010	80-pin QFP	SE-17010	EP-17003GF	EV-9200G-80
μPD17012	64-pin QFP	SE-17012	EP-17202GF	EV-9200G-64
μPD17015	38-pin SSOP	SE-17015	EP-17K38GT	EV-9500GT-38
μPD17016 μPD17017	80-pin QFP	SE-17010	EP-17003GF	EV-9200G-80
μPD17053	64-pin SDIP	SE-17053	EP-17052CW	–
μPD17062	48-pin SDIP	SE-17002	EP-17002CU	–
	64-pin QFP		EP-17002GC	EV-9200GC-64
μPD17068	100-pin QFP	SE-17008	EP-17068GF	EV-9200GF-100
μPD17071 μPD17072 μPD17073	56-pin QFP	SE-17072	EP-17K56GB -1 (Bend lead package) EP-17K56GB-2 (Inverted lead package)	TGB-056SBW*
	64-pin TQFP		EP-17K64GB	TGB-064SDP*

*: This is a product of Tokyo Eletech 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			
μPD17704 μPD17705 μPD17707 μPD17708 μPD17709 μPD17717 μPD17718 μPD17719	80-pin QFP	SE-17709	EP-17K80GC	EV-9200GC-80
μPD17933A μPD17934A	80-pin QFP	SE-17934	EP-17K80GK	TGB-080SDP*
μPD17201A	80-pin QFP (14 × 20)	SE-17207	EP-17201GF	EV-9200G-80
μPD17203A μPD17204	52-pin QFP (14 × 20)	SE-17204	EP-17203GC	EV-9200G-52
μPD17207	80-pin QFP (14 × 20)	SE-17207	EP-17201GF	EV-9200G-80
μPD17225 μPD17226 μPD17227 μPD17228	28-pin SDIP (400 mil)	SE-17225	EP-17K28CT	–
	28-pin SOP (375 mil)		EP-17K28GT	EV-9500GT-28
	30-pin SSOP (300 mil)		EP-17K30GS★	EV-9500GT-30
μPD17235★	28-pin SOP (375 mil)	SE-17235★	EP-17K28GT	EV-9500GT-28
μPD17236★	30-pin SSOP (300 mil)		EP-17K30GS★	EV-9500GT-30

*: This is a product of Tokyo Eletech Corporation.

★: Under development

Development Tools

μPD6133, 6604, 63 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

178K Series Software Tools

■ List of Device Files

Target device	Device file name	Target device	Device file name	Target device	Device file name
μPD178002	DF178018	μPD178023★	DF178134★	μPD178076★	DF178098
μPD178003		μPD178024★		μPD178078★	
μPD178004A		μPD178046★	DF178048★	μPD178096★	
μPD178006A		μPD178048★		μPD178098★	
μPD178016A					
μPD178018A					

★: 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

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

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

Tool name	Product name	
In-circuit emulator	IE-78K0-NS	
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
	IE-70000-PC-IF-C	for ISA bus of PC/AT and compatibles
	IE-70000-PCI-IF	for PCI bus
	IE-70000-CD-IF-A	for PCMCIA socket

★: Under development

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

Target device		Emulation board I/O board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Device name	Package			
μPD178002 μPD178003	80-pin QFP (14 × 14)	IE-178018-NS-EM1	NP-80GC∗1	EV-9200GC-80
μPD178004A μPD178006A μPD178016A μPD178018A	80-pin QFP (14 × 14)	IE-178018-NS-EM1	NP-80GC∗1	EV-9200GC-80
μPD178023★	80-pin QFP (14 × 20)	IE-178134-NS-EM1★	NP-80GF∗1	EV-9200G-80
μPD178024★	80-pin QFP (14 × 14)		NP-80GC∗1	EV-9200GC-80
μPD178046★	64-pin SDIP (750 mil)	IE-178048-NS-EM1★	NP-64CW∗1	–
μPD178048★	80-pin TQFP (12 × 12)		NP-80GK∗1	TGK-080SDW∗2
μPD178076★ μPD178078★	100-pin QFP (14 × 20)	IE-178098-NS-EM1	NP-100GF∗1	EV-9200GF-100
μPD178096★ μPD178098★	100-pin QFP (14 × 20)	IE-178098-NS-EM1	NP-100GF∗1	EV-9200GF-100

∗1: This is a product of Natio Densei Machida Mfg. Co., Ltd.
∗2: This ia a product of Tokyo Eletech Corporation.

★: Under development

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
	IE-70000-PC-IF-C	for ISA bus of PC/AT and compatibles
	IE-70000-PCI-IF	for PCI bus

■ 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/ Flexible board
Device name	Package			
μPD178002 μPD178003	80-pin QFP (14 × 14)	IE-178018-R-EM	EP-78230GC-R	EV-9200GC-80
μPD178004A μPD178006A μPD178016A μPD178018A	80-pin QFP (14 × 14)	IE-178018-R-EM	EP-78230GC-R	EV-9200GC-80
μPD178023★	80-pin QFP (14 × 20)	IE-178134-NS-EM1★	EP-78130GF-R	EV-9200G-80
μPD178024★	80-pin QFP (14 × 14)	IE-78K0-R-EX1	EP-78230GC-R	EV-9200GC-80
μPD178046★	64-pin SDIP (750 mil)	Not supported. Use IE-78K0-NS for these devices.		
μPD178048★	80-pin TQFP (12 × 12)			
μPD178076★	100-pin QFP (14 × 20)	IE-178098-NS-EM1 IE-78K0-R-EX1	EP-78064GF-R	EV-9200GF-100
μPD178078★				
μPD178096★	100-pin QFP (14 × 20)	IE-178098-NS-EM1 IE-78K0-R-EX1	EP-78064GF-R	EV-9200GF-100
μPD178098★				

★: Under development

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	Assembler package RA78K0S
	C compiler CC78K0S
	C library source file CC78K0S-L
	Integrated debugger ID78K0S-NS
	System simulator SM78K0S
	Embedded OS MX78K0S
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
μPD789014	DF789014	μPD789167★	DF789178
μPD789026	DF789026	μPD789177★	
μPD789046	DF789046	μPD789407A	DF789418
μPD789104A★	DF789134	μPD789417A	
μPD789114A★		μPD789800	DF789801
μPD789124A★		μPD789830★	DF789831
μPD789134A★		μPD789842★	DF789842

★: Under development

Development Tools

78K/0S Series Hardware Tools

■ Common Hardware Tools

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

■ List of Hardware Tools (1/2)

Target device		Emulation board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Subseries name	Package			
μPD789014	28-pin SDIP (400 mil)	IE-789014-NS-EM1	NP-28CT*	–
	28-pin SOP (375 mil)		NP-28GT*	AXS628119P* AXS662821*
μPD789026	42-pin SDIP (600 mil)	IE-789026-NS-EM1	NP-42CU*	–
	44-pin QFP (10 × 10)		NP-44GB*	EV-9200G-44
μPD789046	44-pin QFP (10 × 10)	IE-789046-NS-EM1	NP-44GB*	EV-9200G-44
μPD789104A★	28-pin SDIP (400 mil)	IE-789136-NS-EM1	NP-28CT*	–
	30-pin SSOP (300 mil)		NP-36GS*	NGS-30* (attached to NP-36GS*)
μPD789114A★	28-pin SDIP (400 mil)	IE-789136-NS-EM1	NP-28CT*	–
	30-pin SSOP (300 mil)		NP-36GS*	NGS-30* (attached to NP-36GS*)
μPD789124A★	28-pin SDIP (400 mil)	IE-789136-NS-EM1	NP-28CT*	–
	30-pin SSOP (300 mil)		NP-36GS*	NGS-30* (attached to NP-36GS*)

*: This is a product of Naito Densei Machida Mfg. Co., Ltd.

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Development Tools

78K/0S Series Hardware Tools

■ List of Hardware Tools (2/2)

Target device		Emulation board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Subseries name	Package			
μPD789134A★	28-pin SDIP (400 mil)	IE-789136-NS-EM1	NP-28CT∗1	–
	30-pin SSOP (300 mil)		NP-36GS∗1	NGS-30∗1 (attached to NP-36GS∗1)
μPD789167★	44-pin QFP (10 × 10)	IE-789177-NS-EM1★	NP-44GB∗1	EV-9200G-44
μPD789177★	44-pin QFP (10 × 10)	IE-789177-NS-EM1★	NP-44GB∗1	EV-9200G-44
μPD789407A	80-pin QFP (14 × 14)	IE-789418-NS-EM1	NP-80GC∗1	EV-9200GC-80
	80-pin TQFP (12 × 12)		NP-80GK∗1	TGK-080SDW∗2
μPD789417A	80-pin QFP (14 × 14)	IE-789418-NS-EM1	NP-80GC∗1	EV-9200GC-80
	80-pin TQFP (12 × 12)		NP-80GK∗1	TGK-080SDW∗2
μPD789800	42-pin SDIP (600 mil)	IE-789801-NS-EM1	NP-42CU∗1	–
	44-pin QFP (10 × 10)		NP-44GB∗1	EV-9200G-44
μPD789830★	88-pin bare chip	IE-789831-NS-EM1	–	–
μPD78F9831★	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD789842★	44-pin QFP (10 × 10)	IE-789840-NS-EM1	NP-44GB∗1	EV-9200G-44

∗1: This is a product of Naito Densei Machida Mfg. Co., Ltd.

∗2: This is a product of Tokyo Eletech Corporation.

★: Under development

Development Tools

78K/0 Series Software Tools

■ List of Software Tools

Host machine	Software tool name
PC-9800 Series IBM PC/AT and compatibles PC98-NX Series	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 RX78K/0
	Embedded OS MX78K0
EWS	Assembler package RA78K0
	C compiler CC78K0
	C library source file CC78K0-L
	Integrated debugger ID78K0

■ List of Device Files

Subseries name	Device file name	Subseries name	Device file name	Subseries name	Device file name
μPD78018F	DF78014	μPD78078	DF78078	μPD780232	DF780233
μPD78018FY		μPD78078Y		μPD780308	DF780308
μPD78014H		μPD78075B		μPD780308Y	(μSxxxxDF78064)
μPD78044F	DF78044	μPD78083	DF78083	μPD780701Y★	DF780701★
μPD78044H		μPD78098B	DF78098	μPD780833Y★	DF780831★
μPD78054	DF78054	μPD780018AY	DF780018	μPD780948★	DF780948★
μPD78054Y		μPD780024A	DF780024	μPD780955★	DF780955
μPD78058F	DF78054	μPD780024AY		μPD780958★	DF780958★
μPD78058FY		μPD780034A	DF780034	μPD780973★	DF780974
μPD78064	DF78064	μPD780034AY		μPD780988	DF780988
μPD78064Y		μPD780058	DF780058		
μPD78064B		μPD780058Y★			
μPD78070A	DF78078	μPD780065★	DF780066★		
μPD78070AY		μPD780208	DF780208		

★: Under development

Development Tools

78K/0 Series Hardware Tools

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

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

Tool name	Product name	
In-circuit emulator	IE-78K0-NS	
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
	IE-70000-PC-IF-C	for ISA bus of PC/AT and compatibles
	IE-70000-PCI-IF	for PCI bus
	IE-70000-CD-IF-A	for PCMCIA socket

★: Under development

■ List of Hardware Tools (When using IE-78K0-NS) (1/3)

Target device		Emulation board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Subseries name	Package	I/O board		
μPD78018F	64-pin SDIP (750 mil)	IE-78018-NS-EM1	NP-64CW∗1	–
	64-pin QFP (14 × 14)		NP-64GC∗1	EV-9200GC-64
	64-pin LQFP (12 × 12)		NP-64GK∗1	TGK-064SBW∗2
μPD78018FY	64-pin SDIP (750 mil)	IE-78018-NS-EM1	NP-64CW∗1	–
	64-pin QFP (14 × 14)		NP-64GC∗1	EV-9200GC-64
	64-pin LQFP (12 × 12)		NP-64GK∗1	TGK-064SBW∗2
μPD78014H	64-pin SDIP (750 mil)	IE-78018-NS-EM1	NP-64CW∗1	–
	64-pin QFP (14 × 14)		NP-64GC∗1	EV-9200GC-64
	64-pin LQFP (12 × 12)		NP-64GK∗1	TGK-064SBW∗2
μPD78044F	80-pin QFP (14 × 20)	IE-78048-NS-EM1	NP-80GF∗1	TGF-080RAW∗2
μPD78044H	80-pin QFP (14 × 20)	IE-78048-NS-EM1	NP-80GF∗1	TGF-080RAW∗2
μPD78054	80-pin QFP (14 × 14)	IE-780308-NS-EM1	NP-80GC∗1	EV-9200GC-80
	80-pin TQFP (12 × 12)	IE-780308-NS-EM1	NP-80GK∗1	TGK-080SDW∗2
μPD78054Y	80-pin QFP (14 × 14)	IE-780308-NS-EM1	NP-80GC∗1	EV-9200GC-80
	80-pin TQFP (12 × 12)	IE-780308-NS-EM1	NP-80GK∗1	TGK-080SDW∗2
μPD78058F	80-pin QFP (14 × 14)	IE-780308-NS-EM1	NP-80GC∗1	EV-9200GC-80
μPD78058FY	80-pin QFP (14 × 14)	IE-780308-NS-EM1	NP-80GC∗1	EV-9200GC-80

∗1: This is a product of Naito Densei 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) (2/3)

Target device		Emulation board I/O board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Subseries name	Package			
μPD78064	100-pin SDIP (14 × 20)	IE-780308-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD78064Y	100-pin QFP (14 × 20)	IE-780308-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD78064B	100-pin QFP (14 × 20)	IE-780308-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD78070A	100-pin QFP (14 × 20)	IE-78078-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD78070AY	100-pin QFP (14 × 20)	IE-78078-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD78078	100-pin QFP (14 × 20)	IE-78078-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD78078Y	100-pin QFP (14 × 20)	IE-78078-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD78075B	100-pin QFP (14 × 20)	IE-78078-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD78083	42-pin SDIP (600 mil)	IE-78078-NS-EM1	NP-42CU∗1	–
	44-pin QFP (10 × 10)		NP-44GB∗1	EV-9200G-44
μPD78098B	80-pin QFP (14 × 14)	Not supported. Use IE-78001-R-A for these devices.		
μPD780018AY	100-pin QFP (14 × 20)	IE-780018-NS-EM1	NP-100GF∗1	EV-9200GF-100
μPD780024A	64-pin SDIP (750 mil)	IE-780034-NS-EM1	NP-64CW∗1	–
	64-pin QFP (14 × 14)		NP-64GC∗1	EV-9200GC-64
	64-pin LQFP (12 × 12)		NP-64GK∗1	TGK-064SBW∗2
μPD780024AY	64-pin SDIP (750 mil)	IE-780034-NS-EM1	NP-64CW∗1	–
	64-pin QFP (14 × 14)		NP-64GC∗1	EV-9200GC-64
	64-pin LQFP (12 × 12)		NP-64GK∗1	TGK-064SBW∗2
μPD780034A	64-pin SDIP (750 mil)	IE-780034-NS-EM1	NP-64CW∗1	–
	64-pin QFP (14 × 14)		NP-64GC∗1	EV-9200GC-64
	64-pin LQFP (12 × 12)		NP-64GK∗1	TGK-064SBW∗2
μPD780034AY	64-pin SDIP (750 mil)	IE-780034-NS-EM1	NP-64CW∗1	–
	64-pin QFP (14 × 14)		NP-64GC∗1	EV-9200GC-64
	64-pin LQFP (12 × 12)		NP-64GK∗1	TGK-064SBW∗2

∗1: This is a product of Naito Densei 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) (3/3)

Target device		Emulation board I/O board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Subseries name	Package			
μPD780058	80-pin QFP (14 × 14)	IE-780308-NS-EM1	NP-80GC∗1	EV-9200GC-80
	80-pin TQFP (12 × 12)		NP-80GK∗1	TGK-080SDW∗2
μPD780058Y★	80-pin QFP (14 × 14)	IE-780308-NS-EM1	NP-80GC∗1	EV-9200GC-80
	80-pin TQFP (12 × 12)		NP-80GK∗1	TGK-080SDW∗2
μPD780065★	80-pin QFP (14 × 14)	IE-780066-NS-EM4★ IE-78K0-NS-P01	NP-80GC∗1	EV-9200GC-80
μPD780208	100-pin QFP (14 × 20)	IE-780208-NS-EM1	NP-100GF∗1	EV-9200GF-100
μPD780232	80-pin QFP (14 × 14)	IE-780233-NS-EM4★ IE-78K0-NS-P01	NP-80GC∗1	EV-9200GC-80
μPD780308	100-pin QFP (14 × 20)	IE-780308-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD780308Y	100-pin QFP (14 × 20)	IE-780308-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD780701Y★	80-pin QFP (14 × 14)	IE-780701-NS-EM1★	NP-80GC∗1	EV-9200GC-80
μPD780833Y★	80-pin QFP (14 × 14)	IE-780831-NS-EM4 IE-78K0-NS-P02	NP-80GC∗1	EV-9200GC-80
μPD780948★	100-pin QFP (14 × 20)	Not supported. Use IE-78001-R-A for these devices.		
μPD780955★	80-pin QFP (14 × 20)	We, NEC, will support each requirement for the development environment of this subseries' devices. Please contact an NEC sales representative.		
μPD780958★	100-pin LQFP (14 × 14)	IE-780958-NS-EM4★ IE-78K0-NS-P01	NP-100GC∗1	TGC-100SDW∗2
μPD780973★	80-pin QFP (14 × 20)	IE-780974-NS-EM1★	NP-80GF∗1	EV-9200G-80
μPD780988	64-pin SDIP (750 mil)	IE-780988-NS-EM4	NP-64CW∗1	–
	64-pin QFP (14 × 14)	IE-780K0-NS-P01	NP-64GC∗1	EV-9200GC-64

∗1: This is a product of Naito Densei Machida Mfg. Co., Ltd.

∗2: This is a product of Tokyo Eletech Corporation.

★: Under development

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
	IE-70000-PC-IF-C	for ISA bus of PC/AT and compatibles
	IE-70000-PCI-IF	for PCI bus

■ List of Hardware Tools (When using IE-78001-R-A) (1/3)

Target device		Emulation board I/O board Emulation probe conversion board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Subseries name	Package			
μPD78018F	64-pin SDIP (750 mil)	IE-78014-R-EM-A	EP-78240CW-R	–
	64-pin QFP (14 × 14)		EP-78240GC-R	EV-9200GC-64
	64-pin LQFP (12 × 12)		EP-78012GK-R	TGK-064SBW*
μPD78018FY	64-pin SDIP (750 mil)	IE-78014-R-EM-A	EP-78240CW-R	–
	64-pin QFP (14 × 14)		EP-78240GC-R	EV-9200GC-64
	64-pin LQFP (12 × 12)		EP-78012GK-R	TGK-064SBW*
μPD78014H	64-pin SDIP (750 mil)	IE-78014-R-EM-A	EP-78240CW-R	–
	64-pin QFP (14 × 14)		EP-78240GC-R	EV-9200GC-64
	64-pin LQFP (12 × 12)		EP-78012GK-R	TGK-064SBW*
μPD78044F	80-pin QFP (14 × 20)	IE-78044-R-EM	EP-78130GF-R	EV-9200G-80
μPD78044H	80-pin QFP (14 × 20)	IE-78044-R-EM	EP-78130GF-R	EV-9200G-80
μPD78054	80-pin QFP (14 × 14)	IE-780308-R-EM	EP-78230GC-R	EV-9200GC-80
	80-pin TQFP (12 × 12)		EP-78054GK-R	TGK-080SDW*
μPD78054Y	80-pin QFP (14 × 14)	IE-780308-R-EM	EP-78230GC-R	EV-9200GC-80
	80-pin TQFP (12 × 12)		EP-78054GK-R	TGK-080SDW*
μPD78058F	80-pin QFP (14 × 14)	IE-780308-R-EM	EP-78230GC-R	EV-9200GC-80
μPD78058FY	80-pin QFP (14 × 14)	IE-780308-R-EM	EP-78230GC-R	EV-9200GC-80
μPD78064	100-pin QFP (14 × 20)	IE-780308-R-EM	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)		EP-78064GC-R	TGC-100SDW*
μPD78064Y	100-pin QFP (14 × 20)	IE-780308-R-EM	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)		EP-78064GC-R	TGC-100SDW*
μPD78064B	100-pin QFP (14 × 20)	IE-780308-R-EM	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)		EP-78064GC-R	TGC-100SDW*

*: 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) (2/3)**

Target device		Emulation board I/O board Emulation probe conversion board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Subseries name	Package			
μPD78070A	100-pin QFP (14 × 20)	IE-78078-R-EM	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)		EP-78064GC-R	TGC-100SDW*
μPD78070AY	100-pin QFP (14 × 20)	IE-78078-R-EM	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)		EP-78064GC-R	TGC-100SDW*
μPD78078	100-pin QFP (14 × 20)	IE-78078-R-EM	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)		EP-78064GC-R	TGC-100SDW*
μPD78078Y	100-pin QFP (14 × 20)	IE-78078-R-EM	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)		EP-78064GC-R	TGC-100SDW*
μPD78075B	100-pin QFP (14 × 20)	IE-78078-R-EM	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)		EP-78064GC-R	TGC-100SDW*
μPD78083	42-pin SDIP (600 mil)	IE-78078-R-EM	EP-78083CU-R	–
	44-pin QFP (10 × 10)		EP-78083GB-R	EV-9200G-44
μPD78098B	80-pin QFP (14 × 14)	IE-780908-R-EM	EP-78230GC-R	EV-9200GC-80
μPD780018AY	100-pin QFP (14 × 20)	IE-780018-R-EM	EP-78064GF-R	EV-9200GF-100
μPD780024A	64-pin SDIP (750 mil)	IE-780034-NS-EM1	EP-78240CW-R	–
	64-pin QFP (14 × 14)	IE-78K0-R-EX1	EP-78240GC-R	EV-9200GC-64
	64-pin LQFP (14 × 14)		EP-78012GK-R	TGK-064SBW*
μPD780024AY	64-pin SDIP (750 mil)	IE-780034-NS-EM1	EP-78240CW-R	–
	64-pin QFP (14 × 14)	IE-78K0-R-EX1	EP-78240GC-R	EV-9200GC-64
	64-pin LQFP (12 × 12)		EP-78012GK-R	TGK-064SBW*
μPD780034A	64-pin SDIP (750 mil)	IE-780034-NS-EM1	EP-78240CW-R	–
	64-pin QFP (14 × 14)	IE-78K0-R-EX1	EP-78240GC-R	EV-9200GC-64
	64-pin LQFP (12 × 12)		EP-78012GK-R	TGK-064SBW*
μPD780034AY	64-pin SDIP (750 mil)	IE-780034-NS-EM1	EP-78240CW-R	–
	64-pin QFP (14 × 14)	IE-78K0-R-EX1	EP-78240GC-R	EV-9200GC-64
	64-pin LQFP (12 × 12)		EP-78012GK-R	TGK-064SBW*
μPD780058	80-pin QFP (14 × 14)	IE-780308-R-EM	EP-78230GC-R	EV-9200GC-80
	80-pin TQFP (12 × 12)		EP-78054GK-R	TGK-080SDW*
μPD780058Y★	80-pin QFP (14 × 14)	IE-780308-R-EM	EP-78230GC-R	EV-9200GC-80
	80-pin TQFP (12 × 12)		EP-78054GK-R	TGK-080SDW*

*: This is a product of Tokyo Eletech Corporation.

★: Under development

Development Tools

78K/0 Series Hardware Tools

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

Target device		Emulation board I/O board Emulation probe conversion board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Subseries name	Package			
μPD780065★	80-pin QFP (14 × 14)	IE-780066-NS-EM4★ IE-78K0-NS-P01 IE-78K0-R-EX1	EP-78230GC-R	EV-9200GC-80
μPD780208	100-pin QFP (14 × 20)	IE-780208-R-EM	EP-78064GF-R	EV-9200GF-100
μPD780232	80-pin QFP (14 × 14)	IE-780233-NS-EM4★ IE-78K0-NS-P01 IE-78K0-R-EX1	EP-78230GC-R	EV-9200GC-80
μPD780308	100-pin QFP (14 × 20)	IE-780308-R-EM	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)		EP-78064GC-R	TGC-100SDW*
μPD780308Y	100-pin QFP (14 × 20)	IE-780308-R-EM	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)		EP-78064GC-R	TGC-100SDW*
μPD780701Y★	80-pin QFP (14 × 14)	IE-780701-NS-EM1★ IE-78K0-R-EX1	EP-78230GC-R	EV-9200GC-80
μPD780833Y★	80-pin QFP (14 × 14)	IE-780831-NS-EM4 IE-78K0-NS-P02 IE-78K0-R-EX1	EP-78230GC-R	EV-9200GC-80
μPD780948★	100-pin QFP (14 × 20)	IE-780948-SL-EM1 IE-780948-SL-EM4	EP-100GF-SL	TQPACK100RB* or YQPACK100RB* + NQPACK100RB*
μPD780955★	80-pin QFP (14 × 20)	We, NEC, will support each requirement for the development environment of this subseries' devices. Please contact an NEC sales representative.		
μPD780958★	100-pin LQFP (14 × 14)	IE-780958-NS-EM4★ IE-78K0-NS-P01 IE-78K0-R-EX1	EP-78064GC-R	TGC-100SDW*
μPD780973★	80-pin QFP (14 × 20)	IE-780974-NS-EM1★ IE-78K0-R-EX1	EP-78130GF-R	EV-9200G-80
μPD780988	64-pin SDIP (750 mil)	IE-780988-NS-EM4 IE-78K0-NS-P01 IE-78K0-R-EX1	EP-78024CW-R	–
	64-pin QFP (14 × 14)		EP-78240GC-R	EV-9200GC-64

*: This is a product of Tokyo Eletech Corporation.

★: Under development

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	Assembler package RA78K4
	C compiler CC78K4
	C library source file CC78K4-L
	Integrated debugger ID78K4-NS
	Integrated debugger ID78K4
	System simulator SM78K4
	System performance analyzer AZ78K4
	Real-time OS RX78K4
	Embedded OS MX78K4
EWS	Assembler package RA78K4
	C compiler CC78K4
	C library source file CC78K4-L
	Integrated debugger ID78K4

■ List of Device Files

Subseries name	Device file name	Subseries name	Device file name	Subseries name	Device file name
μPD784038	DF784038	μPD784218	DF784218	μPD784928	DF784928
μPD784038Y		μPD784218Y		μPD784928Y	
μPD784046	DF784046	μPD784225★	DF784225	μPD784938★	DF784937★
μPD784054		μPD784225Y★		μPD784955★	DF784956
μPD784216	DF784218	μPD784908	DF784908		
μPD784216Y		μPD784915	DF784916		

★: Under development

Development Tools

78K/IV Series Hardware Tools

(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
	IE-70000-PC-IF-C	for ISA bus of PC/AT and compatibles
	IE-70000-PCI-IF	for PCI bus
	IE-70000-CD-IF-A	for PCMCIA socket

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

Target device		Emulation board	Emulation probe	Conversion socket/ Conversion adapter/ Flexible board
Subseries name	Package			
μPD784038	80-pin QFP (14 × 14)	IE-784038-NS-EM1	NP-80GC∗1	EV-9200GC-80
	80-pin TQFP (12 × 12)		NP-80GK∗1	TGK-080SDW∗2
μPD784038Y	80-pin QFP (14 × 14)	IE-784038-NS-EM1	NP-80GC∗1	EV-9200GC-80
	80-pin TQFP (12 × 12)		NP-80GK∗1	TGK-080SDW∗2
μPD784046	80-pin QFP (14 × 14)	IE-784046-NS-EM1	NP-80GC∗1	EV-9200GC-80
μPD784054	80-pin QFP (14 × 14)	IE-784046-NS-EM1	NP-80GC∗1	EV-9200GC-80
μPD784216	100-pin QFP (14 × 20)	IE-784225-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD784216Y	100-pin QFP (14 × 20)	IE-784225-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD784218	100-pin QFP (14 × 20)	IE-784225-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD784218Y	100-pin QFP (14 × 20)	IE-784225-NS-EM1	NP-100GF∗1	EV-9200GF-100
	100-pin LQFP (14 × 14)		NP-100GC∗1	TGC-100SDW∗2
μPD784225★	80-pin QFP (14 × 14)	IE-784225-NS-EM1	NP-80GC∗1	EV-9200GC-80
	80-pin TQFP (12 × 12)		NP-80GK∗1	TGK-080SDW∗2
μPD784225Y★	80-pin QFP (14 × 14)	IE-784225-NS-EM1	NP-80GC∗1	EV-9200GC-80
	80-pin TQFP (12 × 12)		NP-80GK∗1	TGK-080SDW∗2
μPD784908	100-pin QFP (14 × 20)	IE-784908-NS-EM1	NP-100GF∗1	EV-9200GF-100
μPD784915	100-pin QFP (14 × 20)	IE-784928-NS-EM1	EP-784928GF-NS	NEV-921GF-100
μPD784928	100-pin QFP (14 × 20)	IE-784928-NS-EM1	EP-784928GF-NS	NEV-921GF-100
μPD784928Y	100-pin QFP (14 × 20)	IE-784928-NS-EM1	EP-784928GF-NS	NEV-921GF-100
μPD784938★	100-pin QFP (14 × 20)	IE-784937-NS-EM1	NP-100GF∗1	EV-9200GF-100
μPD784955★	80-pin QFP (14 × 14)	IE-784956-NS-EM1	NP-80GC∗1	EV-9200GC-80

∗1: This is a product of Naito Densei Machida Mfg. Co., Ltd.

∗2: This is a product of Tokyo Eletech Corporation.

★: Under development

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
	IE-70000-PC-IF-C	for ISA bus of PC/AT and compatibles
	IE-70000-PCI-IF	for PCI bus
	IE-70000-CD-IF-A	for PCMCIA socket

■ 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/ Flexible board
Subseries name	Package			
μPD784038	80-pin QFP (14 × 14)	IE-784038-R-EM1	EP-78230GC-R	EV-9200GC-80
	80-pin TQFP (12 × 12)		EP-78054GK-R	TGK-080SDW*
μPD784038Y	80-pin QFP (14 × 14)	IE-784038-R-EM1	EP-78230GC-R	EV-9200GC-80
	80-pin TQFP (12 × 12)		EP-78054GK-R	TGK-080SDW*
μPD784046	80-pin QFP (14 × 14)	IE-784046-R-EM1	EP-78230GC-R	EV-9200GC-80
μPD784054	80-pin QFP (14 × 14)	IE-784046-R-EM1	EP-78230GC-R	EV-9200GC-80
μPD784216	100-pin QFP (14 × 20)	IE-784225-NS-EM1	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)	IE-78K4-R-EX3	EP-78064GC-R	TGC-100SDW*

*: 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/ Flexible board
Subseries name	Package			
μPD784216Y	100-pin QFP (14 × 20)	IE-784225-NS-EM1	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)	IE-78K4-R-EX3	EP-78064GC-R	TGC-100SDW*
μPD784218	100-pin QFP (14 × 20)	IE-784225-NS-EM1	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)	IE-78K4-R-EX3	EP-78064GC-R	TGC-100SDW*
μPD784218Y	100-pin QFP (14 × 20)	IE-784225-NS-EM1	EP-78064GF-R	EV-9200GF-100
	100-pin LQFP (14 × 14)	IE-78K4-R-EX3	EP-78064GC-R	TGC-100SDW*
μPD784225★	80-pin QFP (14 × 14)	IE-784225-NS-EM1	EP-78230GC-R	EV-9200GC-80
	80-pin TQFP (12 × 12)	IE-78K4-R-EX2	EP-78054GK-R	TGK-080SDW*
μPD784225Y★	80-pin QFP (14 × 14)	IE-784225-NS-EM1	EP-78230GC-R	EV-9200GC-80
	80-pin TQFP (12 × 12)	IE-78K4-R-EX2	EP-78054GK-R	TGK-080SDW*
μPD784908	100-pin QFP (14 × 20)	IE-784908-R-EM1	EP-784915GF-R	EV-9200GF-100
μPD784915	100-pin QFP (14 × 20)	IE-784928-NS-EM1 IE-78K4-R-EX3	EP-784928GF-NS	EV-9200GF-100
μPD784928	100-pin QFP (14 × 20)	IE-784928-NS-EM1 IE-78K4-R-EX3	EP-784928GF-NS	EV-9200GF-100
μPD784928Y	100-pin QFP (14 × 20)	IE-784928-NS-EM1 IE-78K4-R-EX3	EP-784928GF-NS	EV-9200GF-100
μPD784938★	100-pin QFP (14 × 20)	IE-784937-NS-EM1 IE-78K4-R-EX3	EP-78064GF-R	EV-9200GF-100
μPD784955★	80-pin QFP (14 × 14)	IE-784956-NS-EM1 IE-78K4-R-EX2	EP-784915GF-R	EV-9200GC-80

*: This is a product of Tokyo Eletech Corporation.

★: Under development

Development Tools

V810 Family Development Tools

■ List of Software Tools

Product name		Target device	Host machine
Real-time OS	RX732	V821	PC-9800 Series IBM PC/AT and compatibles SPARCstation™
File system	RX-FS732		PC-9800 Series SPARCstation

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

■ List of Hardware Tools

Product name	Target device	Part number	Remarks
In-circuit emulator	V821	IE-70741-BX	Conversion socket : TQPACK100SD* + TQSOCKET100SDW* (essential)
Interface board		IE-70000-98-IF-C	For PC-9800 Series
		IE-70000-PC-IF-C	For IBM PC/AT and compatibles
Expansion memory board		IE-70000-BX-MM2	Expands 2M bytes of the emulation memory
External logic probe		IE-70000-BX-EP	Consists of one GND and eight external inputs
Conversion adapter / Conversion socket		TQPACK100SD* TQSOCKET100SDW*	Probe included in the in-circuit emulator → 100-pin QFP

*: This is a product of Tokyo Eletech Corporation.

V830 Family Development Tools

■ List of Software Tools

Product name		Target device	Host machine
Real-time OS	RX830	V830 Family	PC-9800 Series IBM PC/AT and compatibles SPARCstation
Compiler	CA830	V830 V831	PC-9800 Series IBM PC/AT and compatibles SPARCstation
System performance analyzer	AZ830	V830 Family	PC-9800 Series IBM PC/AT and compatibles
Device file	DF705100	V830	PC-9800 Series IBM PC/AT and compatibles SPARCstation
	DF705101	V831	

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

Hardwre tools are not provided. Please contact an NEC sales representative about the development environment of the V830 Family.

Development Tools

V850 Family Software Tools

■ List of Software Tools

Product name		Target device	Host machine
Real-time OS	RX850	V850 Family	PC-9800 Series IBM PC/AT and compatibles SPARCstation
	RX850 pro		
Compiler	CA850		PC-9800 Series IBM PC/AT and compatibles SPARCstation
Debugger	ID850		PC-9800 Series IBM PC/AT and compatibles
Simulator	SM850		PC-9800 Series IBM PC/AT and compatibles
System performance analyzer	AZ850		PC-9800 Series IBM PC/AT and compatibles
Device file	DF703002	V852	PC-9800 Series IBM PC/AT and compatibles SPARCstation
	DF703003	V853	
	DF703008	V854	
	DF703017	V850/SA1	
	DF703037	V850/SB1 V850/SB2	
	DF703102	V850E/MS1	

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

Development Tools

V850 Family Hardware Tools

■ List of Hardware Tools (1/2)

Product name	Target device	Part number	Remarks
In-circuit emulator	V850E/MS1	IE-703102-MC	A PC interface cable, external logic probe, and conversion sockets∗1 are included
	V850/SA1, V850/SB1, V852, V853, V854	IE-703002-MC	
In-circuit emulator option board	V850/SA1	IE-703017-MC-EM1	NQPACK100SD∗2 is included
	V850/SB1, V850/SB2	IE-703037-MC-EM1★	Conversion socket not included (the V850/SB2 version is under development)
	V853	IE-703003-MC-EM1	NQPACK100SD∗2 is included
	V854	IE-703008-MC-EM1	NQPACK144SD∗2, YQPACK144SD∗2, HQPACK144SD∗2, and YQGUIDE∗2 are 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
Power supply unit	V850/SA1, V850/SB1, V850/SB2, V850E/MS1, V852, V853, V854	IE-70000-MC-PS-B	Power supply cable for AC100 to 240V is included
PC Interface board	V850/SA1, V850/SB1, V850/SB2, V850E/MS1, V852, V853, V854	IE-70000-98-IF-B or IE-70000-98-IF-C	For PC-9800 (C bus)∗3
		IE-70000-PC-IF-B or IE-70000-PC-IF-C	For IBM PC/AT and compatibles (ISA bus)∗3
		IE-70000-CD-IF-A	For PCMCIA socket∗4
		IE-70000-PCI-IF	For PCI bus∗4

★: Under development

∗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

∗2: This is a product of Tokyo Eletech Corporation.

∗3: Not available for PC98-NX Series.

∗4: Available for PC98-NX Series.

Development Tools

V850 Family Hardware Tools

■ List of Hardware Tools (2/2)

Product name	Target device	Part number	Remarks
Conversion adapter/ conversion socket	V850/SA1	CSPACK121A1312N02*	Conversion socket for 121-pin FPBGA
		CSICE121A1312N02*	Conversion adapter for 121-pin FPBGA CSPACK121A1312N02* is necessary when using this
	V850/SA1, V850/SB1, V850/SB2, V852, V853	NQPACK100SD*	Conversion socket for target board (for 100-pin QFP (0.5-mm pitch))
		YQPACK100SD*	Conversion socket for connection to an in-circuit emulator
		HQPACK100SD*	Cover of the socket for 100-pin QFP
		YQSOCKET100SDN*	Socket for spacer
		YQGUIDE*	Fixing screws
	V850/SB1, V850/SB2	NEXB-100SD/RB*	100-pin GC-GF conversion board
		NQPACK100RB*	Conversion socket for target board (for 100-pin QFP (14 × 20 mm, 0.65-mm pitch))
		YQPACK100RB*	Conversion socket for connection to an in-circuit emulator
		HQPACK100RB*	Cover of the socket for 100-pin QFP
		YQSOCKET100RBN*	Socket for spacer
		YQGUIDE*	Fixing screws
	V850E/MS1, V854	NQPACK144SD*	Conversion socket for target board (for 144-pin QFP (0.5-mm pitch))
		YQPACK144SD*	Conversion socket for connection to an in-circuit emulator
		HQPACK144SD*	Cover of the socket for 144-pin QFP
		YQSOCKET144SDN*	Socket for spacer
		YQGUIDE*	Fixing screws
	V850E/MS1	CSPACK157A1614N01*	Conversion socket for 157-pin FPBGA
		CSICE157A1614N01*	Conversion adapter for 157-pin FPBGA CSPACK157A1614N01* is necessary when using this
Expansion probe	V850/SA1, V850/SB1, V850/SB2, V852, V853	SC-100SDN*	Expansion probe for 100-pin QFP (0.5-mm pitch)
	V850E/MS1, V854	SC-144SDN*	Expansion probe for 144-pin QFP (0.5-mm pitch)

*: This is a product of Tokyo Eletech Corporation.

Development Tools

VR Series Development Tools

■ List of Software Tools

Product name	Target device	Host machine
Real-time OS RX4000	VR4100 Series™	PC-9800 Series
	VR4300 Series™	IBM PC/AT and compatibles

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

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

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 capable of high-speed data processing. The V800 Series and VR Series answer these requirements with powerful CPU performance complemented by middleware support based on multimedia performance.

■ The positioning of middleware

- **Software integration**
  - User programs
  - Middleware
    Human interface (speech recognition, handwritten character recognition, etc.)
    Internet
    Multimedia signal processing (JPEG, voice compression, moving picture processing)
    Communication (modem, mobile communications, etc.)
- **Hardware integration**
  CPU
  Memory
  Standard macro
  Dedicated macro
  Analog circuit
  User logic

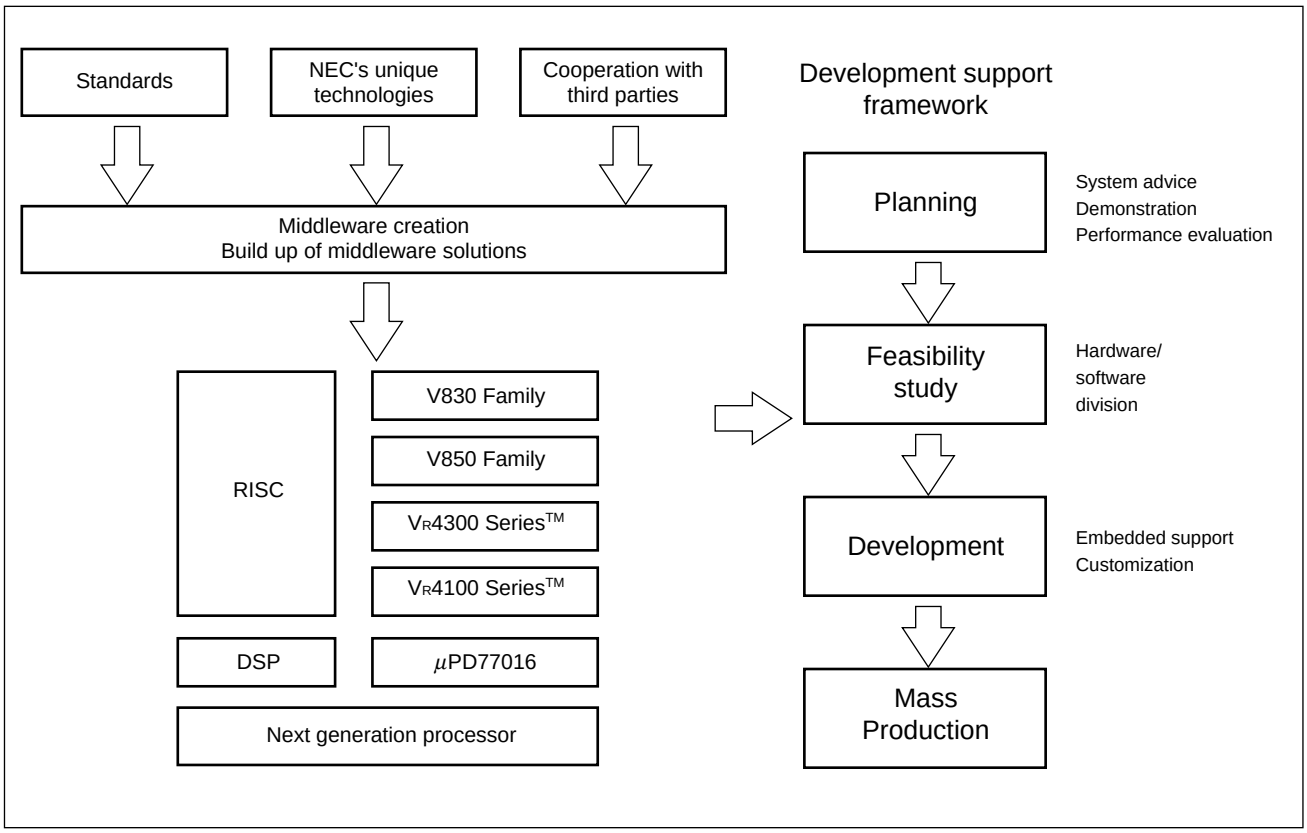
■ Features

- **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

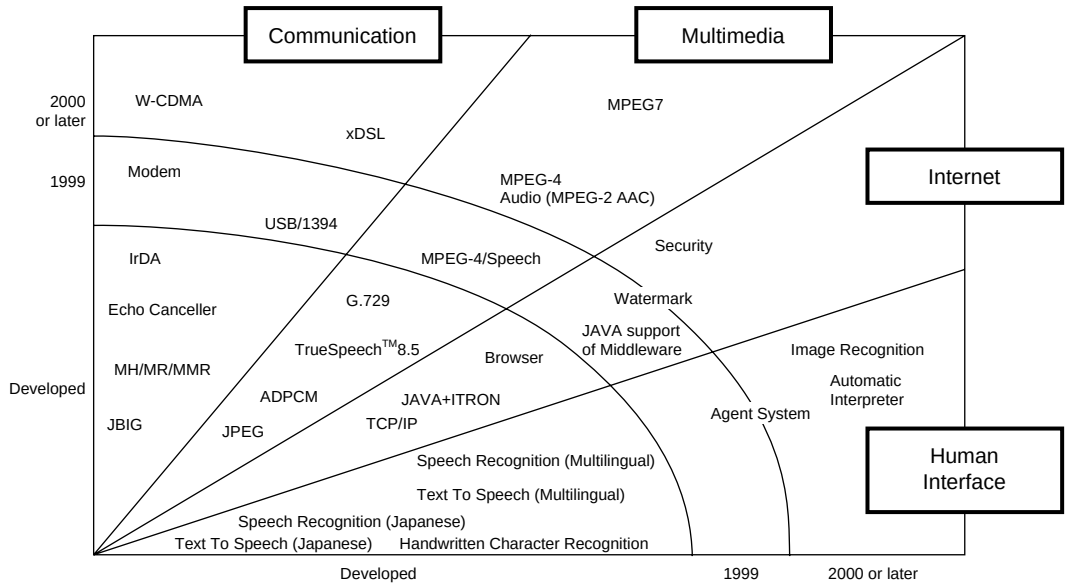
Middleware Development Framework

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 Products

Field	Middleware		V800 Series		VR Series
			V830 Family	V850 Family	
Image	MH/MR/MMR		◎	◎	◎
	JBIG		◎	◎	◎
	JPEG		◎	◎	◎
Speech	Text To Speech	Japanese	◎	◎	○
		Multilingual Version (TTS3000∗1)	◎	–	–
		English∗2	–	–	○
	TrueSpeech8.5		◎	–	◎
	G.726 (ADPCM)		Sample	◎	△
	G.729/AnnexA/B		–	–	△
	MPEG-4/Speech (CELP)		–	–	△
	Echo Canceller (for Hands-free operation)		◎	–	◎
Sound	MPEG-4 Audio (MPEG-2 AAC)		△	–	△
Recognition	Speech Recognition	Multilingual Version (ASR1600/C∗1)	◎	–	△
		English∗2	–	–	○
		Japanese (large vocabulary)	◎	–	○
	Handwritten Character Recognition		◎	◎	◎
Internet (Third party products)	Browser		◎	○	◎
	JAVA		◎	–	◎
	TCP/IP		◎	○	◎
Interface	IrDA protocol stack∗3		◎	◎	△

∗1: English/German/French/Italian/Dutch/Spanish (Jointly developed with L&H Inc.)

∗2: WindowsCE supported

∗3: This is a product of Okaya Systemware Co., Ltd.

Remark ◎: Developed, ○: Under Development, △: Under Planning

IC Memory

Dynamic RAM

■ Synchronous DRAM: SDR (Single Data Rate)

(1/3)

Density (bits)	Organization (words × bits × banks)	Part number	Speed grade	/CAS latency	Clock frequency (MHz)	Clock access time MAX. (ns)	Self refresh current MAX. (mA)	Supply voltage (V)	Refresh cycle (cycles /ms)	Interface level	Package	Remark
256M★	16M×4×4	**μPD45256441**	A75	3	133	5.4	2	3.3±0.3	8K/64	LVTTL	G5: 54-pin TSOP(II) (400 mil)	PC133 Compliant (3-3-3)
			A80	3	125	6						PC100 Compliant (2-2-2)
				2	100							
			A10	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10B	3	100							—
				2	67	8						
			A80L	3	125	6	1					PC100 Compliant (2-2-2)
				2	100							
			A10L	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10BL	3	100							—
				2	67	8						
	8M×8×4	**μPD45256841**	A75	3	133	5.4	2					PC133 Compliant (3-3-3)
			A80	3	125	6						PC100 Compliant (2-2-2)
				2	100							
			A10	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10B	3	100							—
				2	67	8						
			A80L	3	125	6	1					PC100 Compliant (2-2-2)
				2	100							
			A10L	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10BL	3	100							—
				2	67	8						
	4M×16×4	**μPD45256163**	A80	3	125	6	2					PC100 Compliant (2-2-2)
				2	100							
			A10	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10B	3	100							—
				2	67	8						
			A80L	3	125	6	1					PC100 Compliant (2-2-2)
				2	100							
			A10L	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10BL	3	100							—
				2	67	8						

★: Under development

Dynamic RAM

■ Synchronous DRAM: SDR (Single Data Rate)

(2/3)

Density (bits)	Organization (words × bits × banks)	Part number	Speed grade	/CAS latency	Clock frequency (MHz)	Clock access time MAX. (ns)	Self refresh current MAX. (mA)	Supply voltage (V)	Refresh cycle (cycles /ms)	Interface level	Package	Remark
128M	8M×4×4	**μPD45128441**	A75	3	133	5.4	2	3.3±0.3	4K/64	LVTTL	G5: 54-pin TSOP(II) (400 mil)	PC133 Compliant (3-3-3)
			A80	3	125	6						PC100 Compliant (2-2-2)
				2	100							
			A10	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10B	3	100							—
				2	67	8						
			A80L	3	125	6	0.8					PC100 Compliant (2-2-2)
				2	100							
			A10L	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10BL	3	100							—
				2	67	8						
	4M×8×4	**μPD45128841**	A75	3	133	5.4	2					PC133 Compliant (3-3-3)
			A80	3	125	6						PC100 Compliant (2-2-2)
				2	100							
			A10	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10B	3	100							—
				2	67	8						
			A80L	3	125	6	0.8					PC100 Compliant (2-2-2)
				2	100							
			A10L	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10BL	3	100							—
				2	67	8						
	2M×16×4	**μPD45128163**	A80	3	125	6	2					PC100 Compliant (2-2-2)
				2	100							
			A10	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10B	3	100							—
				2	67	8						
			A80L	3	125	6	0.8					PC100 Compliant (2-2-2)
				2	100							
			A10L	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10BL	3	100							—
				2	67	8						

Dynamic RAM

■ Synchronous DRAM: SDR (Single Data Rate)

(3/3)

Density (bits)	Organization (words × bits × banks)	Part number	Speed grade	/CAS latency	Clock frequency (MHz)	Clock access time MAX. (ns)	Self refresh current MAX. (mA)	Supply voltage (V)	Refresh cycle (cycles /ms)	Interface level	Package	Remark
64M	4M×4×4	**μPD4564441**	A75	3	133	5.4	1	3.3±0.3	4K/64	LVTTL	G5: 54-pin TSOP(II) (400 mil)	PC133 Compliant (3-3-3)
			A80	3	125	6						PC100 Compliant (2-2-2)
				2	100							
			A10	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10B	3	100							—
				2	67	8						
			A80L	3	125	6	0.4					PC100 Compliant (2-2-2)
				2	100							
			A10L	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10BL	3	100							—
				2	67	8						
	2M×8×4	**μPD4564841**	A75	3	133	5.4	1					PC133 Compliant (3-3-3)
			A80	3	125	6						PC100 Compliant (2-2-2)
				2	100							
			A10	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10B	3	100							—
				2	67	8						
			A80L	3	125	6	0.4					PC100 Compliant (2-2-2)
				2	100							
			A10L	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10BL	3	100							—
				2	67	8						
	1M×16×4	**μPD4564163**	A80	3	125	6	1					PC100 Compliant (2-2-2)
				2	100							
			A10	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10B	3	100							—
				2	67	8						
			A80L	3	125	6	0.4					PC100 Compliant (2-2-2)
				2	100							
			A10L	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10BL	3	100							—
				2	67	8						
	512K×32×4	**μPD4564323**	A80★	3	125	6	1				G5: 86-pin TSOP(II) (400 mil)	PC100 Compliant (2-2-2)
				2	100							
			A10★	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10B	3	100							—
				2	67	8						
			A80L★	3	125	6	0.4					PC100 Compliant (2-2-2)
				2	100							
			A10L★	3	100							PC100 Compliant (3-2-2)
				2	77	7						
			A10BL★	3	100							—
				2	67	8						

★: Under development

Dynamic RAM

■ Virtual Channel Synchronous DRAM:SDR (Single Data Rate)

Density (bits)	Organization (words × bits × banks)	Part number	Speed grade	Read latency	Clock frequency (MHz)	Clock access time MAX. (ns)	Supply voltage (V)	Refresh cycle (cycles /ms)	Interface level	Package	Remark
64M	8M×4×2	**μPD4565421**	A70★	2	143	5.4	3.3±0.3	4K/64	LVTTL	G5: 54-pin TSOP(II) (400 mil)	
			A75		133	5.4					
			A10		100	6					
			A15	1	67	12					
	4M×8×2	**μPD4565821**	A70★	2	143	5.4					
			A75		133	5.4					
			A10		100	6					
			A15	1	67	12					
	2M×16×2	**μPD4565161**	A70★	2	143	5.4					
			A75		133	5.4					
			A10		100	6					
			A15	1	67	12					

★: Under development

■ Synchronous DRAM: DDR (Double Data Rate)

Density (bits)	Organization (words × bits × banks)	Part number	Speed grade	/CAS latency	Clock frequency (MHz)	Self refresh current MAX. (mA)	Supply voltage (V)		Refresh cycle (cycles /ms)	Interface level	Package	Remark
							Vcc	VccQ				
128M	8M×4×4	**μPD45D128442**	C80★	2.5	133	2	2.5±0.125	2.5±0.125	4K/64	SSTL_2	G5: 66-pin TSOP(II) (400 mil)	
				2	125							
			C10	2.5	125							
				2	100							
			C12	2.5	100							
				2	83							
	4M×8×4	**μPD45D128842**	C80★	2.5	133							
				2	125							
			C10	2.5	125							
				2	100							
			C12	2.5	100							
				2	83							
	2M×16×4	**μPD45D128164**	C80★	2.5	133							
				2	125							
			C10	2.5	125							
				2	100							
			C12	2.5	100							
				2	83							

★: Under development

■ Direct Rambus™ DRAM

Density (bits)	Organization (words × bits × banks)	Part number	Clock frequency		Access time		Maximum supply current (mA)			Supply voltage (V)	Refresh cycle (cycles /ms)	Interface level	Package		Remark
								Refresh					Type	Pin configuration	
			Class	$1/t_{CYCLE}$ (MHz)	Class	t_{RAC} (ns)	Active	Auto	Self						
72M	256K×18×16	**μPD488385**	C80	400	40	40	TBD	TBD	TBD	2.5±0.13	8K/32	RSL	FB: 74-pin D^2BGA^{TM}	BF1:Normal	
					45	45									
			C60	300	53	53									
128M	256K×16×32	**μPD488448**	C80	400	40	40	TBD	TBD	TBD				FB: 62-pin D^2BGA	• Normal • Mirrored	
					45	45									
			C60	300	53	53									
144M	256K×18×32	**μPD488488**	C80	400	40	40	TBD	TBD	TBD				FB: 62-pin D^2BGA	• Normal • Mirrored	
					45	45									
			C60	300	53	53									

Dynamic RAM Module

■ 168-pin SDRAM DIMM (Dual In-line Memory Module): Unbuffered Type

Density (bytes)	Organization (words × bits)	Bank organi-zation	Part number	Speed grade	/CAS latency	Clock frequency (MHz)	Supply voltage (V)	Refresh cycle (cycles /ms)	Inter-face level	Mounted devices	Package height (mm/inch)	Remark
256M	32M×72	2	**MC-4532CC726**	A80	3	125	3.3±0.3	4K/64	LVTTL	μPD45128841G5 ×18 pcs.	34.93/1.375	PC100 Compliant (2-2-2)
					2	100						
				A10	3	100						PC100 Compliant (3-2-2)
					2	77						
	32M×64	2	**MC-4532CD646**	A80	3	125				μPD45128841G5 ×16 pcs.		PC100 Compliant (2-2-2)
					2	100						
				A10	3	100						PC100 Compliant (3-2-2)
					2	77						
128M	16M×72	2	**MC-4516CC726**	A80	3	125				μPD4564841G5 ×18 pcs.	34.93/1.375	PC100 Compliant (2-2-2)
					2	100						
				A10	3	100						PC100 Compliant (3-2-2)
					2	77						
		2	**MC-4516CC725**	A10B	3	100					33.02/1.30	—
					2	67						
	16M×64	2	**MC-4516CD646**	A80	3	125				μPD4564841G5 ×16 pcs.	34.93/1.375	PC100 Compliant (2-2-2)
					2	100						
				A10	3	100						PC100 Compliant (3-2-2)
					2	77						
		2	**MC-4516CD645**	A10B	3	100				μPD4564841G5 ×16 pcs.	33.02/1.30	—
					2	67						
64M	8M×72	1	**MC-458CA726**	A80	3	125				μPD4564841G5 ×9 pcs.	34.93/1.375	PC100 Compliant (2-2-2)
					2	100						
				A10	3	100						PC100 Compliant (3-2-2)
					2	77						
		1	**MC-458CA725**	A10B	3	100					31.75/1.25	—
					2	67						
	8M×64	1	**MC-458CB646**	A80	3	125				μPD4564841G5 ×8 pcs.	34.93/1.375	PC100 Compliant (2-2-2)
					2	100						
				A10	3	100						PC100 Compliant (3-2-2)
					2	77						
		1	**MC-458CB645**	A10B	3	100					31.75/1.25	—
					2	67						
32M	4M×72	1	**MC-454CA726**	A80	3	125				μPD4564163G5 ×5 pcs.	34.93/1.375	PC100 Compliant (2-2-2)
					2	100						
				A10	3	100						PC100 Compliant (3-2-2)
					2	77						
	4M×64	1	**MC-454CB646**	A10B	3	125				μPD4564163G5 ×4 pcs.	34.93/1.375	PC100 Compliant (2-2-2)
					2	100						
				A80	3	100						PC100 Compliant (3-2-2)
					2	77						
		1	**MC-454CB645**	A10B	3	100					29.21/1.15	—
					2	67						

Dynamic RAM Module

■ 168-pin SDRAM DIMM (Dual In-line Memory Module): Registered Type

Density (bytes)	Organization (words × bits)	Bank organi-zation	Part number	Speed grade	/CAS latency	Clock frequency (MHz)	Supply voltage (V)	Refresh cycle (cycles /ms)	Inter-face level	Mounted devices	Package height (mm/inch)	Remark
512M	64M×72	2	**MC-4564DC726**	A80	3	125	3.3±0.3	4K/64	LVTTL	μPD45128441G5 ×36 pcs.	43.18/1.70	PC100 Compliant (2-2-2)
					2	100						
				A10	3	100						PC100 Compliant (3-2-2)
					2	77						
256M	32M×72	1	**MC-4532DA727**	A75	3	133				μPD45128441G5 ×18 pcs.		PC133 Compliant (3-3-3)
			MC-4532DA726	A80	3	125						PC100 Compliant (2-2-2)
					2	100						
				A10	3	100						PC100 Compliant (3-2-2)
					2	77						
128M	16M×72	1	**MC-4516DA727**	A75	3	133				μPD4564441G5 ×18 pcs.		PC133 Compliant (3-3-3)
			MC-4516DA726	A80	3	125						PC100 Compliant (2-2-2)
					2	100						
				A10	3	100						PC100 Compliant (3-2-2)
					2	77						
64M	8M×72	1	**MC-458DA727**	A75	3	133				μPD4564841G5 ×9 pcs.	38.1/1.50	PC133 Compliant (3-3-3)
			MC-458DA726	A80	3	125						PC100 Compliant (2-2-2)
					2	100						
				A10	3	100						PC100 Compliant (3-2-2)
					2	77						
32M	4M×72	1	**MC-454DA726**	A80	3	125				μPD4564163G5 ×5 pcs.		PC100 Compliant (2-2-2)
					2	100						
				A10	3	100						PC100 Compliant (3-2-2)
					2	77						

Dynamic RAM Module

■ 144-pin SDRAM SO DIMM (Small Outline Dual In-line Memory Module)

Density (bytes)	Organization (words × bits)	Bank organi-zation	Part number	Speed grade	/CAS latency	Clock frequency (MHz)	Self refresh current (mA)	Supply voltage (V)	Refresh cycle (cycles /ms)	Inter-face level	Mounted devices	Package height (mm/inch)	Remark
128M	16M×64	1	**MC-4516CB64ES**	A10B	3	100	16	3.3±0.3	4K/64	LVTTL	μPD45128841G5 ×8 pcs.	26.67/1.05	—
					2	67							
				A10BL	3	100	6.4						
					2	67							
		2	**MC-4516CD64ES**	A10B	3	100	16				μPD45128163G5 ×8 pcs.		
					2	67							
				A10BL	3	100	6.4						
					2	67							
		2	**MC-4516CD641ES**	A80	3	125	16					31.75/1.25	PC100 Compliant (2-2-2), Rev.1.0
					2	100							
				A10	3	100							PC100 Compliant (3-2-2), Rev.1.0
					2	77							
64M	8M×64	1	**MC-458CB64LSA**	A10B	3	100	8				μPD4564841G5 ×8 pcs.	26.67/1.05	—
					2	67							
				A10BL	3	100	3.2						
					2	67							
		1	**MC-458CB641ES**	A80	3	125	4				μPD45128163G5 ×4 pcs.	25.4/1.0	PC100 Compliant (2-2-2), Rev.1.0
					2	100							
				A10	3	100							PC100 Compliant (3-2-2), Rev.1.0
					2	77							
		2	**MC-458CD64LS**	A10B	3	100	8				μPD4564163G5 ×8 pcs.	26.67/1.05	—
					2	67							
				A10BL	3	100	3.2						
					2	67							
		2	**MC-458CD641LS**	A80	3	125	8					31.75/1.25	PC100 Compliant (2-2-2), Rev.1.0
					2	100							
				A10	3	100	3.2						PC100 Compliant (3-2-2), Rev.1.0
					2	77							
32M	4M×64	1	**MC-454CB64LS**	A10B	3	100	4				μPD4564163G5 ×4 pcs.	25.4/1.00	—
					2	67							
				A10BL	3	100	2						
					2	67							
			MC-454CB641LS	A80	3	125	4						PC100 Compliant (2-2-2), Rev.0.7
					2	100							
				A10	3	100							PC100 Compliant (3-2-2), Rev.1.0
					2	77							

Dynamic RAM Module

■ 168-pin Virtual Channel SDRAM DIMM (Dual In-line Memory Module): Unbuffered Type

Density (bytes)	Organization (words × bits)	Bank organization	Part number	Speed grade	Read latency	Prefetch read latency	Clock frequency (MHz)	Supply voltage (V)	Refresh cycle (cycles /ms)	Interface level	Mounted devices	Package height (mm/inch)	Remark
128M	16M×64	2	**MC-45V16AD641**	A75	2	4	133	3.3±0.3	4K/64	LVTTL	μPD4565821G5 ×16 pcs.	34.93/1.375	
				A10			100						
				A15	1		66						
64M	8M×64	1	**MC-45V8AB641**	A75	2		133				μPD4565821G5 ×8 pcs.		
				A10			100						
				A15	1		66						

■ 144-pin Virtual Channel SDRAM SO DIMM (Small Outline Dual In-line Memory Module)

Density (bytes)	Organization (words × bits)	Bank organization	Part number	Speed grade	Read latency	Prefetch read latency	Clock frequency (MHz)	Supply voltage (V)	Refresh cycle (cycles /ms)	Interface level	Mounted devices	Package height (mm/inch)	Remark
64M★	8M×64	1	**MC-45V8AB641KS**	A75	2	4	133	3.3±0.3	4K/64	LVTTL	μPD4565821G5 ×8 pcs.	31.75/1.25	
				A10			100						
				A15	1		66						
		2	**MC-45V8AD641KS**	A75	2		133				μPD4565161G5 ×8 pcs.		
				A10			100						
				A15	1		66						

★: Under development

■ 184-pin Direct Rambus™ RIMM™

Density (bytes)	Organization (words × bits)	Bank organization	Part number	Class	Clock frequency $1/t_{CYCLE}$ (MHz)	Access time t_{RAC} (ns)	Supply voltage (V)	Interface level	Mounted devices	Remark
128M	64M × 18	16 × 16	**MC-4R128BKD8J**	840	400	40	2.5±0.13	RSL	μPD488385FB ×16 pcs.	With heat spreader
				845		45				
				653	300	53				
64M	32M × 18	16 × 8	**MC-4R64BKD8J**	840	400	40			μPD488385FB ×8 pcs.	With heat spreader
				845		45				
				653	300	53				
—	—	—	**MC-4RCNTYK**	—	—	—	—	—	—	**Note**

Note This module is the Direct Rambus RIMM continuity module which is designed to be inserted into any unused RIMM sockets in Direct Rambus systems. It continues the Rambus channel through unused RIMM connectors to terminate signals properly on motherboard, and has no active components mounted on it.

Static RAM

■ Low Power SRAM (Temperature range T_A = 0 to 70°C)

Density (bits)	Organization (words × bits)	Part number	Supply voltage (V)	Version	Class	Access time MAX. (ns)	Maximum supply current			Package
							Active (mA)	Standby (μA)	Data retention (μA)	
1M	128K × 8	**μPD431000A**	4.5 to 5.5	L	70	70	70	100	50	GW: 32-pin SOP (525 mil)
					85	85				
				LL	70	70	70	20	10	GW: 32-pin SOP (525 mil) 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)
					85	85	70	20	10	GW: 32-pin SOP (525 mil)
			3.0 to 5.5	A	10	100	35	13	10	GW: 32-pin SOP (525 mil)
						70 (V_{CC}=4.5 to 5.5)	70	20		GU: 32-pin TSOP(I) (8 × 13.4 mm)
					12	120	35	13		(Normal bent) (Reverse bent)
						70 (V_{CC}=4.5 to 5.5)	70	20		GZ: 32-pin TSOP(I) (8 × 20 mm)
			2.7 to 5.5	B	10	100	30	11	10	(Normal bent) (Reverse bent)
						70 (V_{CC}=4.5 to 5.5)	70	20		
					12	120	30	11		
						70 (V_{CC}=4.5 to 5.5)	70	20		
					15	150	30	11		
						70 (V_{CC}=4.5 to 5.5)	70	20		
256K	32K × 8	**μPD43257B**	4.5 to 5.5	L	70	70	45	50	20	GU: 28-pin SOP (450 mil)
					85	85				
				LL	70	70	45	15	7	
					85	85				
		μPD43256B	4.5 to 5.5	L	70	70	45	50	20	GU: 28-pin SOP (450 mil)
					85	85				
				LL	70	70	45	15	7	GU: 28-pin SOP (450 mil) GW: 28-pin TSOP(I) (8 × 13.4 mm) (Normal bent) (Reverse bent)
					85	85				
			3.0 to 5.5	A	85	85	45	15	7	
					10	100				
						85 (V_{CC}=4.5 to 5.5)				
					12	120				
						85 (V_{CC}=4.5 to 5.5)				
			2.7 to 5.5	B	10	100	20	10	7	
						85 (V_{CC}=4.5 to 5.5)	45	15		
					12	120	20	10		
						85 (V_{CC}=4.5 to 5.5)	45	15		
					15	150	20	10		
						85 (V_{CC}=4.5 to 5.5)	45	15		

Static RAM

■ Low Power SRAM (Extended Temperature T_A = –25 to +85°C)

Density (bits)	Organization (words × bits)	Part number	Supply voltage (V)	Version	Class	Access time MAX. (ns)	Maximum supply current			Package
							Active (mA)	Standby (μA)	Data retention (μA)	
4M	512K × 8	**μPD444010L-X**	2.7 to 3.6	B	70	70	40	7	7	GY: 48-pin TSOP(I) (12 × 18 mm) (Normal bent) (Reverse bent)
					85	85				
			2.2 to 3.6	C	10	100				
					12	120				
			1.8 to 3.6	D	12	120				
					15	150				
	256K × 16	**μPD444012L-X**	2.7 to 3.6	B	70	70	40	7	7	GY: 48-pin TSOP(I) (12 × 18 mm) (Normal bent) (Reverse bent)
					85	85				
			2.2 to 3.6	C	10	100				
					12	120				
			1.8 to 3.6	D	12	120				
					15	150				
2M	256K × 8	**μPD442000L-X**	2.7 to 3.6	B	85	85	35	2	2	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) F1: 36-pin FPBGA (10.5 × 6.5 mm)
					10	100				
			2.2 to 3.6	C	10	100	30			
					12	120				
					15	150				
			1.8 to 3.6	D	15	150	25			
					18	180				
1M	128K × 8	**μPD441000L-X**	2.7 to 3.6	B	70	70	25	2	2	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) F1: 36-pin FPBGA (6 × 6 mm)
					85	85				
					10	100				
			2.2 to 3.6	C	10	100				
					12	120				
			1.8 to 3.6	D	12	120				
					15	150				
		μPD431000A-X	4.5 to 5.5	—	70	70	70	50	20	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)
					85	85				
					10	100				
			3.0 to 5.5	A	10	100	35	26		
						70 (V_{CC}=4.5 to 5.5)	70	50		
					12	120	35	26		
						70 (V_{CC}=4.5 to 5.5)	70	50		
			2.7 to 5.5	B	10	100	30	22		
						70 (V_{CC}=4.5 to 5.5)	70	50		
					12	120	30	22		
						70 (V_{CC}=4.5 to 5.5)	70	50		
					15	150	30	22		
						70 (V_{CC}=4.5 to 5.5)	70	50		
256K	32K × 8	**μPD43256B-X**	4.5 to 5.5	—	70	70	45	50	20	GW: 28-pin TSOP(I) (8 × 13.4 mm) (Normal bent) (Reverse bent)
					85	85				
					10	100	40			
			3.0 to 5.5	A	85	85	45	50		
					10	100				
					12	120	40			
						100 (V_{CC}=4.5 to 5.5)				
			2.7 to 5.5	B	10	100	25	25		
					12	120	25	25		
						100 (V_{CC}=4.5 to 5.5)	40	50		
					15	150	25	25		
						100 (V_{CC}=4.5 to 5.5)	40	50		

Static RAM

■ CMOS Fast SRAM

Density (bits)	Organization (words × bits)	Part number	Class	Access time MAX. (ns)	Maximum supply current		Supply voltage (V)	Package	Remark
					Active (mA)	Standby (mA)			
4M	4M × 1	**μPD434001A**	15	15	140	10	5.0±0.5	LE: 32-pin SOJ (400 mil)	
			17	17	130				
			20	20	120				
		μPD434001AL	A15	15	130	5	3.3±0.3	LE: 32-pin SOJ (400 mil) G5: 32-pin TSOP (II) (400 mil)	
			A17	17	120				
			A20	20	110				
	1M × 4	**μPD434004A**	15	15	140	10	5.0±0.5	LE: 32-pin SOJ (400 mil)	
			17	17	130				
			20	20	120				
		μPD434004AL	A15	15	130	5	3.3±0.3	LE: 32-pin SOJ (400 mil)	
			A17	17	120				
			A20	20	110				
	512K × 8	**μPD434008A**	12	12	200	10	5.0±0.5	LE: 36-pin SOJ (400 mil)	
			15	15	170				
			17	17	160				
			20	20	150				
		μPD434008AL	A15	15	150	5	3.3±0.3	LE: 36-pin SOJ (400 mil)	
			A17	17	140				
			A20	20	130				
	256K × 16	**μPD434016A**	12	12	230	10	5.0±0.5	LE: 44-pin SOJ (400 mil) G5: 44-pin TSOP (II) (400 mil)	
			15	15	200				
			17	17	190				
			20	20	180				
		μPD434016AL	A15	15	190	5	3.3±0.3	LE: 44-pin SOJ (400 mil) G5: 44-pin TSOP (II) (400 mil)	
			A17	17	180				
			A20	20	170				

Static RAM

■ CMOS Synchronous Fast SRAM

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		
2M	64K × 36	**μPD432836AL**	A36	275	3.53	350	3.5	—	3.3±0.2	2.0	GF: 100-pin LQFP	Pipeline operation
			A37	267	3.65	350						
			A40	250	3.9	350						
			A44	225	4.34	350						
			A50	200	4.9	350						
			A55	183	5.3	335						
			A57	175	5.3	325						
			A60	167	5.3	290						
		μPD432836L	A40	250	3.9	350	3.5	3.5	3.3±0.2	2.0		
			A44	225	4.34	350						
			A50	200	4.9	350						
			A55	183	5.3	335						
			A57	175	5.3	325						
			A60	167	5.3	290						
	64K × 32	**μPD432232L**	A5	100	5.0	180	2	2	3.3+0.3/-0.2	3.0 or 2.5		
			A7	83	7.0							
			A8	66	8.0							
1M	32K × 32	**μPD431231L**	A7	83	7.0	130	5	1	3.3+0.3/-0.2	2.5	GF: 100-pin LQFP	Pipeline operation
			A8	66	8.0							
		μPD431632L	A6	150	4.6	220	20	20	3.3±0.165	3.3 or 2.5		Pipeline operation
			A7	133	5.0	200						
		μPD431532L	A8	100	8.5	200	5	5	3.3±0.165	3.3 or 2.5		Flow Through operation
			A9	100	9.0							
			A10	83	10.0							
			A12	66	12.0							
	32K × 36	**μPD431636L**	A6	150	4.6	220	20	20	3.3±0.165	3.3 or 2.5		Pipeline operation
			A7	133	5.0	200						
		μPD431536L	A8	100	8.5	200	5	5	3.3±0.165	3.3 or 2.5		Flow Through operation
			A9	100	9.0							
			A10	83	10.0							
			A12	66	12.0							

Static RAM

■ Bi-CMOS Synchronous Fast SRAM

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)				
4M	256K × 18	**μPD464318AL**	A4	250	2.0	550	55	3.3±0.15	HSTL	S1: 119-pin BGA	Single clock RR mode
			A44	225	2.3						
			A5	200	2.5						
		μPD464318L	A5	200	2.6	600	—	3.3±0.15	HSTL		Single clock RR mode
			A6	167	3.0						
			A65	154	3.5						
		μPD464518AL	A55	182	5.5	400	45	3.3±0.15	LVTTL		Single clock RL mode
			A6	166	6.0						
			A7	143	7.0						
		μPD464518L	A8	125	8.0	450	150	3.3±0.15	LVTTL		Single clock RL mode
	128K × 36	**μPD464336AL**	A4	250	2.0	750	55	3.3±0.15	HSTL		Single clock RR mode
			A44	225	2.3						
			A5	200	2.5						
		μPD464336L	A5	200	2.6	700	—	3.3±0.15	HSTL		Single clock RR mode
			A6	167	3.0						
			A65	154	3.5						
		μPD464536AL	A55	182	5.5	650	45	3.3±0.15	LVTTL		Single clock RL mode
			A6	166	6.0						
			A7	143	7.0						
		μPD464536L	A8	125	8.0	550	150	3.3±0.15	LVTTL		Single clock RL mode

Mask ROM

■ Mask ROM

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	**μPD23C128000L**	120	—	TBD	TBD	3.3±0.3	GY: 48-pin TSOP (I) (12 × 18 mm)
			140				3.0±0.3	(Normal bent) (Reverse bent)
		μPD23C128040L	120	TBD	TBD	TBD	3.3±0.3	GY: 48-pin TSOP (I) (12 × 18 mm)
			140				3.0±0.3	(Normal bent) (Reverse bent)
64M	4M × 16	**μPD23C64020**	120	—	70	—	5.0±0.5	CZ: 42-pin DIP (600 mil)
	8M × 8 or 4M × 16	**μPD23C64000AL**	90	—	45	30	3.3±0.3	GX: 44-pin SOP (600 mil)
			100	—	40	30	3.0±0.3	GY: 48-pin TSOP (I) (12 × 18 mm) (Normal bent) (Reverse bent)
		μPD23C64040AL	90	25	60	30	3.3±0.3	GX: 44-pin SOP (600 mil)
			100	30	55	30	3.0±0.3	GY: 48-pin TSOP (I) (12 × 18 mm) (Normal bent) (Reverse bent)
32M	4M × 8 or 2M × 16	**μPD23C32000A**	120	—	70	100	5.0±0.5	GX: 44-pin SOP (600 mil) GY: 48-pin TSOP (I) (12 × 18 mm) (Normal bent) (Reverse bent) G5: 44-pin TSOP (II) (400 mil)
	2M × 16	**μPD23C32020A**	120	—	70	100	5.0±0.5	CZ: 42-pin DIP (600 mil)
	4M × 8 or 2M × 16	**μPD23C32000L**	120	—	40	30	3.3±0.3	GX: 44-pin SOP (600 mil)
			140		35	30	3.0±0.3	GY: 48-pin TSOP (I) (12 × 18 mm) (Normal bent) (Reverse bent) G5: 44-pin TSOP (II) (400 mil)
		μPD23C32040L	140	40	60	30	3.3±0.3	GX: 44-pin SOP (600 mil) GY: 48-pin TSOP (I) (12 × 18 mm) (Normal bent) (Reverse bent) G5: 44-pin TSOP (II) (400 mil)
	2M × 16 or 1M × 32	**μPD23C32082L**	100	30	80	30	3.3±0.3	G7: 70-pin SSOP (500 mil)
24M	3M × 8 or 1.5M × 16	**μPD23C24000**	120	—	70	100	5.0±0.5	GX: 44-pin SOP (600 mil)
	1.5M × 16	**μPD23C24020**	120	—	70	100	5.0±0.5	CZ: 42-pin DIP (600 mil)
16M	2M × 8 or 1M × 16	**μPD23C16000AL**	85	—	45	30	3.3±0.3	GY: 48-pin TSOP (I) (12 × 18 mm)
			100		40		3.0±0.3	(Normal bent) (Reverse bent)
		μPD23C16040AL	85	30	60	30	3.3±0.3	G5: 44-pin TSOP (II) (400 mil)
			100	40	55		3.0±0.3	

■ Synchronous Mask ROM

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
32M	2M × 16 or 1M × 32	**μPD23C32202L**	66	5	2	10	150	3.3±0.3	LVTTL	G5: 86-pin TSOP (II) (400 mil)	
			50	4	1	15					
			33	3	1	25					

COMBO Memory

■ COMBO Memory

Part number	Function	Density (bits) Organization (words × bits)	Supply voltage (V)	Access time MAX. (ns)	Maximum supply current			Package
					Active (mA)	Standby (μA)	Data Retention (μA)	
μPD26401	SRAM	1M (128K × 8)	1.8 to 2.2	500	3.5	6.5	10	GU: 32-pin TSOP (I) (8 × 13.4 mm)
	+	+	2.2 to 2.7	375	5.5	8.0		(Normal bent) (Reverse bent)
	ROM	2M (256K × 8)	2.7 to 3.3	250	7.5	10.0		
μPD26411	SRAM	1M (128K × 8)	1.8 to 2.2	500	4.0	6.5	10	GZ: 32-pin TSOP (I) (8 × 20 mm)
	+	+	2.2 to 2.7	375	6.0	8.0		(Normal bent) (Reverse bent)
	ROM	2M (256K × 8)	2.7 to 3.3	250	10.0	10.0		

Flash Memory

■ Flash Memory

Density (bits)	Organization (words × bits)	Part number	Access time MAX. (ns)	Maximum supply current		Supply voltage (V)	Boot code Sector architecture	Package
				Active (mA)	Standby (μA)			
8M	1M × 8	**μPD29F008AL-X★**	90	12	5	2.7 to 3.6	top or bottom	GZ: 40-pin TSOP (I) (10 × 20 mm)
			100					(Normal bent) (Reverse bent)
			120	12	5	2.2 to 2.7		
			150					
	1M × 8 or 512K × 16	**μPD29F800AL-X★**	90	12	5	2.7 to 3.6	top or bottom	GZ: 48-pin TSOP (I) (12 × 20 mm)
			100					(Normal bent) (Reverse bent)
			120	12	5	2.2 to 2.7		
			150					

★: Under development

MCP (Flash Memory + SRAM)

■ MCP (Flash Memory and SRAM)

Part number	Function	Density (bits) Organization (words × bits)	Access time MAX. (ns)	Maximum supply current			Supply Voltage (V)	Boot code Sector architecture	Package
				Active (mA)	Standby (μA)	Data Retention (μA)			
MC-22100	Flash Memory	16M (2M × 8)	100	35	5	—	2.7 to 3.6	Top	F1-DE: 48-pin BGA (10 × 14 mm)
	SRAM	2M (256K × 8)			2	2		—	
MC-22101	Flash Memory	16M (2M × 8)			5	—		Bottom	
	SRAM	2M (256K × 8)			2	2		—	
MC-22102	Flash Memory	16M (1M × 16)			5	—		Top	
	SRAM	2M (256K × 8)			2	2		—	
MC-22103	Flash Memory	16M (1M × 16)			5	—		Bottom	
	SRAM	2M (256K × 8)			2	2		—	
MC-22104	Flash Memory	16M (2M × 8)			5	—		Top	
	SRAM	1M (128K × 8)			26	20		—	
MC-22105	Flash Memory	16M (2M × 8)			5	—		Bottom	
	SRAM	1M (128K × 8)			26	20		—	
MC-22106	Flash Memory	16M (1M × 16)			5	—		Top	
	SRAM	1M (128K × 8)			26	20		—	
MC-22107	Flash Memory	16M (1M × 16)			5	—		Bottom	
	SRAM	1M (128K × 8)			26	20		—	
MC-22000	Flash Memory	8M (1M × 8)			5	—		Top	F1-DB: 48-pin BGA (10 × 11 mm)
	SRAM	2M (256K × 8)			2	2		—	
MC-22001	Flash Memory	8M (1M × 8)			5	—		Bottom	
	SRAM	2M (256K × 8)			2	2		—	
MC-22002	Flash Memory	8M (1M × 8 or 512K × 16)			5	—		Top	
	SRAM	2M (256K × 8)			2	2		—	
MC-22003	Flash Memory	8M (1M × 8 or 512K × 16)			5	—		Bottom	
	SRAM	2M (256K × 8)			2	2		—	
MC-22004	Flash Memory	8M (1M × 8)			5	—		Top	
	SRAM	1M (128K × 8)			26	20		—	
MC-22005	Flash Memory	8M (1M × 8)			5	—		Bottom	
	SRAM	1M (128K × 8)			26	20		—	
MC-22006	Flash Memory	8M (1M × 8 or 512K × 16)			5	—		Top	
	SRAM	1M (128K × 8)			26	20		—	
MC-22007	Flash Memory	8M (1M × 8 or 512K × 16)			5	—		Bottom	
	SRAM	1M (128K × 8)			26	20		—	

Other

■ Line Buffer

Density (bits)	Organi-zation (words × bits)	Part number	Read/Write cycle time MIN. (ns)	Data hold period (ms)	Maximum supply current active (mA)	Supply voltage (V)	Package	Remark
80K	10096 × 8 5048 × 16	**μPD485506**	25/25 35/35	—	140	5.0±0.5	• 44-pin TSOP II	FAX, PPC Line buffer FIFO structure
40K	5048 × 8	**μPD485505**	25/25 35/35	—	80		• 24-pin SOP	

[MEMO]

Semi-Custom IC

NEC's ASICs

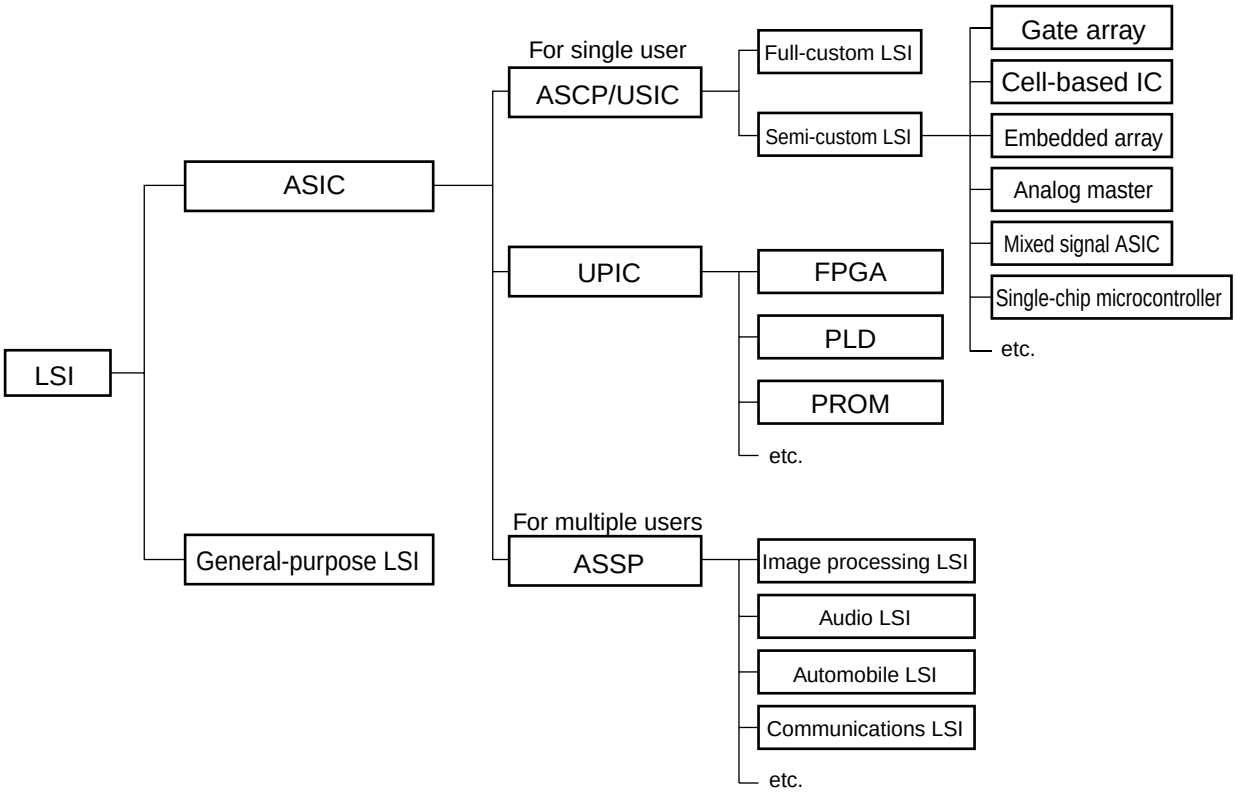
■ What Is ASICs ? (1/2)

LSIs are broadly classified into two types: general-purpose LSIs and Application-Specific ICs (ASICs).

The general-purpose LSIs are designed and supplied as standard products by the manufacturers. Because these LSIs are mass-produced, generally they are inexpensive and do not require much work or expense for development from the user even if each user uses only a small quantity of these LSIs. 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, the user's own unique functions cannot be provided.

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

Classification of ASICs



Remark 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 Is ASICs ? (2/2)

ASIC for single users (ASCP/USIC)

ASICs of this type are designed for a specific user and are used for security and to improve performance (such as increasing speed and lowering power consumption). On the other hand, the load 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 the users who have mastered LSI production technologies, and require a long development time and incur large costs. A contract for production with the manufacturer is made on the assumption of mass production of the application system. Usually, the LSIs developed in this way offer extremely high performance.

The word semi-custom LSI is used to differenciate from full-custom LSIs. With full-custom LSIs, all the development processes, from circuit design to photo mask, 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. Take gate arrays for example. A common photo mask is used for the diffusion process and only the photo mask for the wiring process is created according to the specifications of the user. This means an LSI can be developed in a shorter time.

ASIC for single user (UPIC)

FPGA, PLD, and PROM are collectively called UPIC. These are ASICs that can be developed by the user by using dedicated development tools for production runs as small as a single sample.

In particular, because the logical operations of FPGA and PLD are the same as those of gate arrays, these UPICs are highly useful as sample LSIs to evaluate the breadboard and circuit operations before the development of gate arrays. Compared with gate array products, the development cost 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 LSIs.

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 achieve these things. 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, as well as 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:

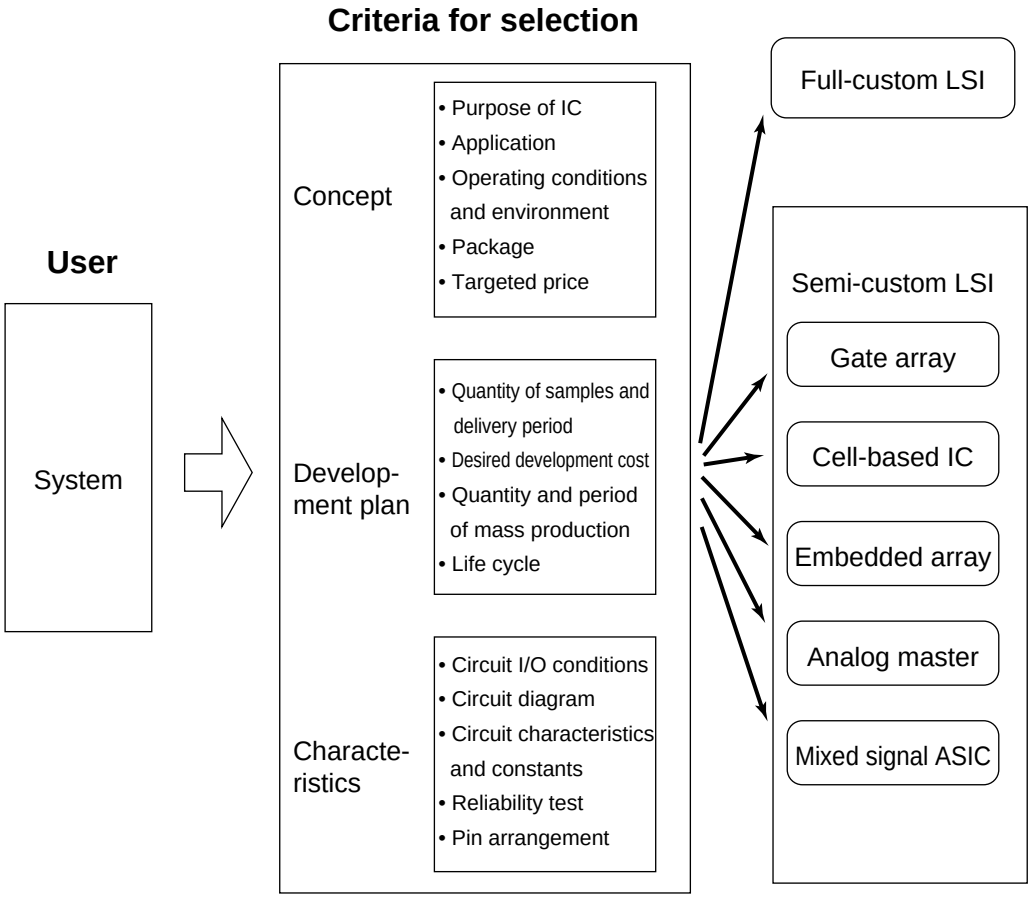
- Development investment
- Development period (delivery period)
- Quantity of production
- Necessary functions and performance
- Application

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

NEC's ASICs

■ Criteria for Selection (1/4)

Whether a full-custom or semi-custom LSI should be used, or whether ASSP or general-purpose LSI should be used depend on your concept, development plan, and the characteristics you require. By considering the items in the following diagram you can select the products that satisfy all your requirements. The subsequent sections 1 through 4 compare the major semi-custom products and full-custom products for your reference.



NEC's ASICs

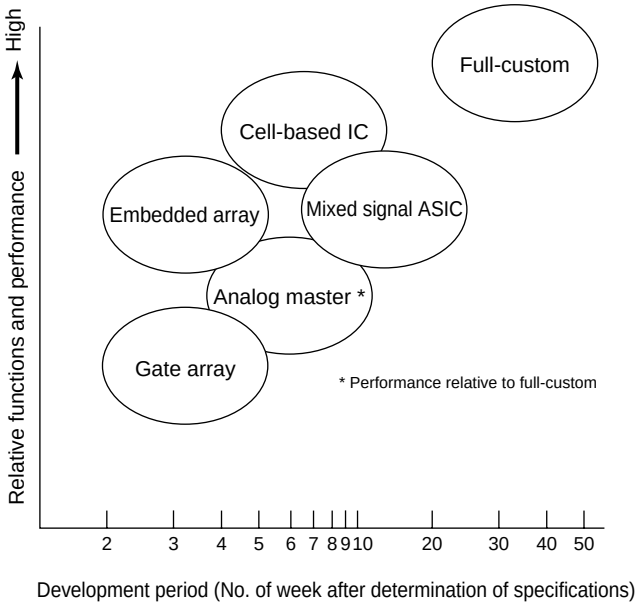
■ Criteria for Selection (2/4)

● 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 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

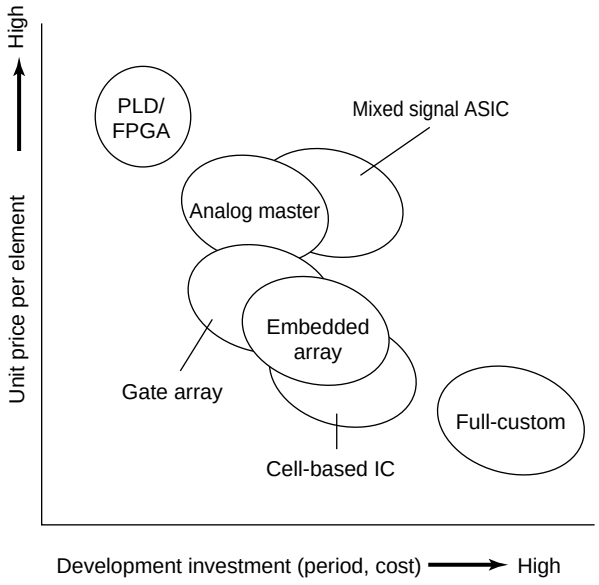
As shown in the figure on the right, there is an clear relationship between the development investment and unit cost.

PLD (Programmable Logic Device) and FPGA (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 the LSI 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 higher, 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)

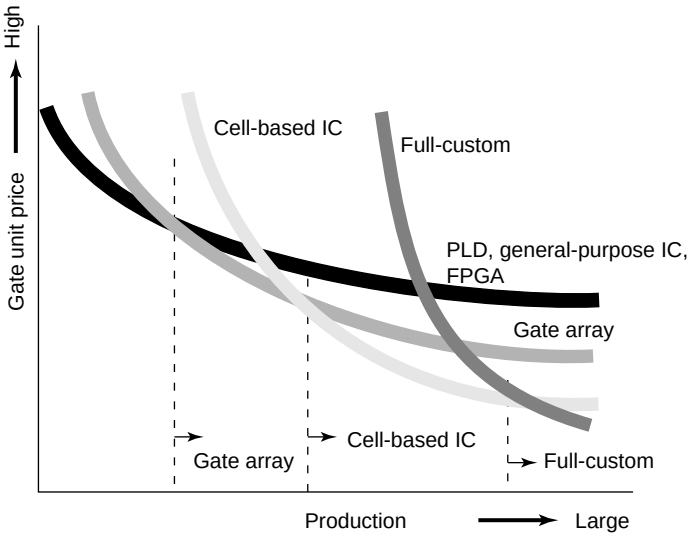
● Total Production and Gate Units (Guideline)

One of the indexes that indicate the price of an LSI is a gate unit price. The gate unit price of PLD 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.

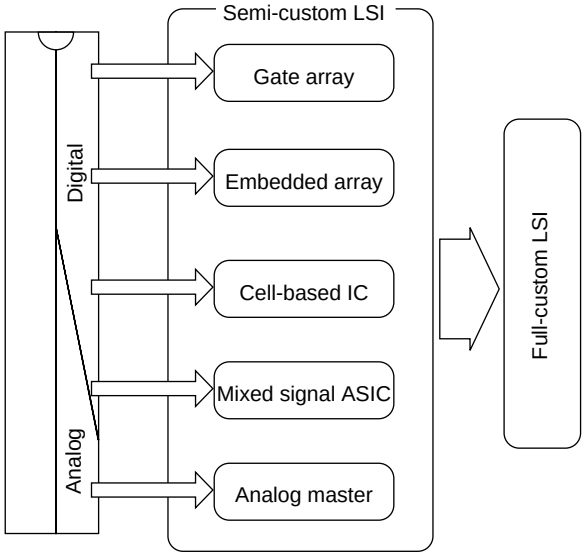


● Suitability for Different Types of Circuit

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 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

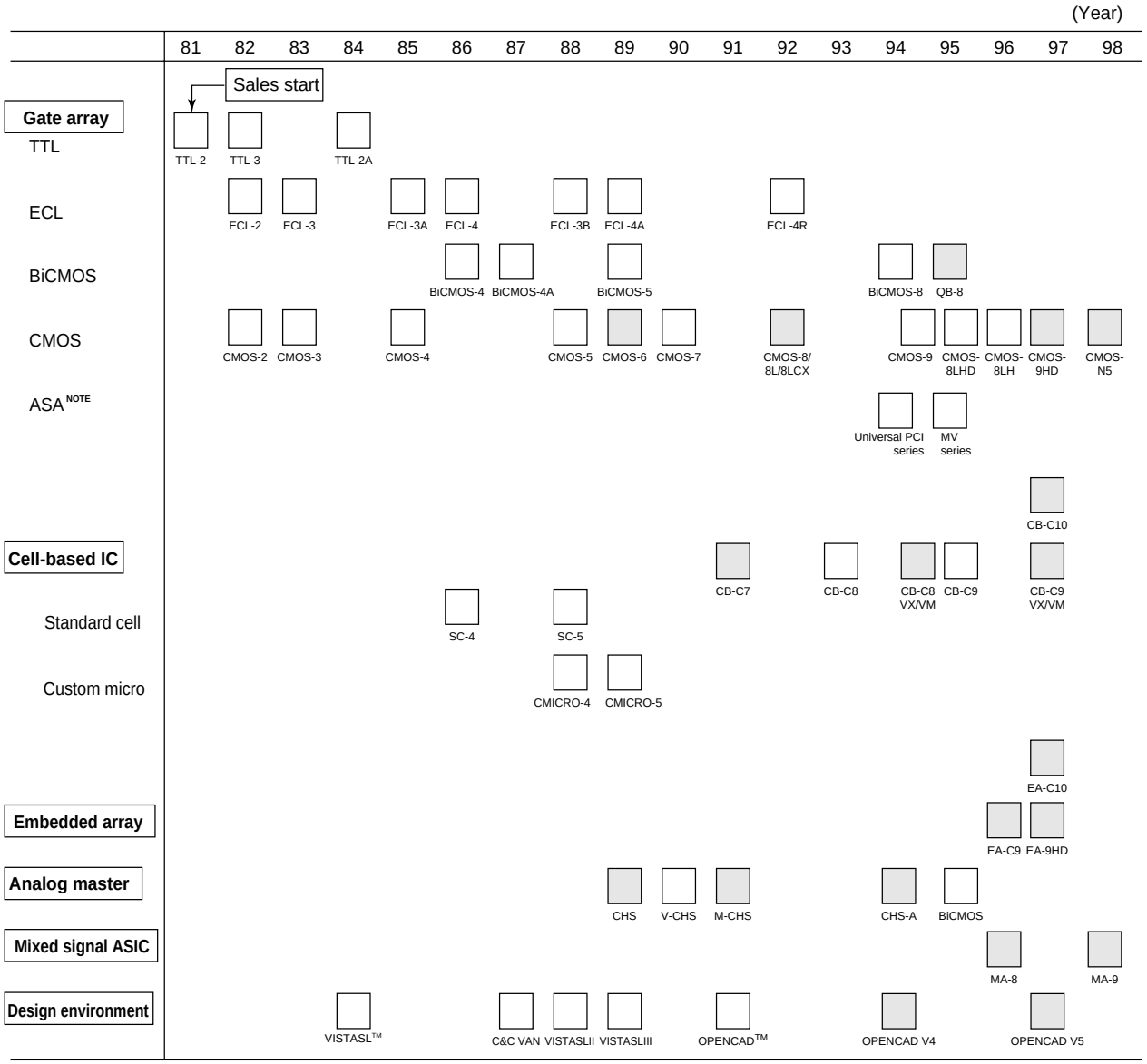
■ History of Development of ASIC

NEC developed device technology and basic software for its ASICs in the 1970's, and started sales of its ASICs from 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 1980's, the use of ASICs increasingly became widespread.

Today, users who have experience of development using gate arrays wish to develop using ASICs to acheive a 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 processes and technologies, and integrated CAD systems using original EWS and networking.

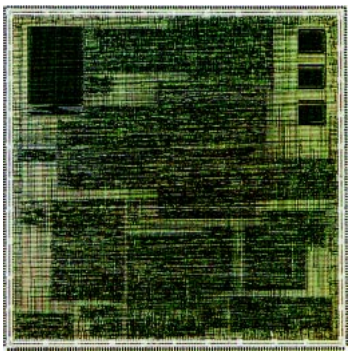


Note Application Specific Arrays
Remark □ : Maintenance parts

NEC's ASICs

■ NEC's ASIC Products (1/2)

● Gate array



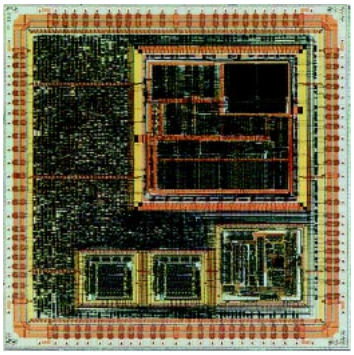
Gate arrays are semi-custom LSIs. Gates are laid out on master wafers in the form of an array. These gates are wired together to create the desired LSI.

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 you 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.

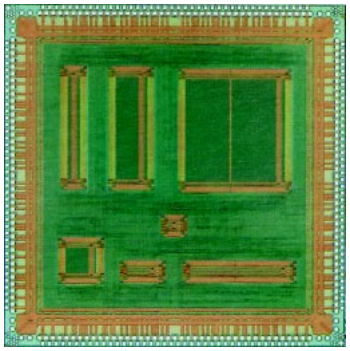
Cell-based ICs cannot only realize a density higher than gate arrays and embedded arrays, but also integrate high-performance macros. Therefore, they have increasingly grown in popularity recently as semi-custom LSIs for achieving systems-on-chip.

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

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.

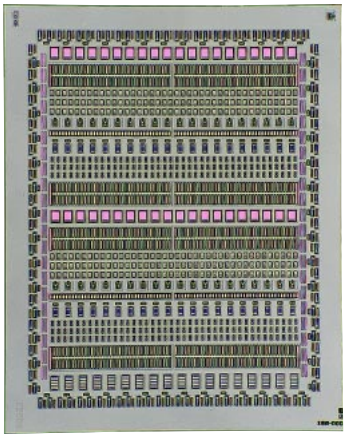
Because the wafer is produced in parallel with simulation, only the wiring process must be done after simulation has been completed. Consequently, the development period up to completion of a sample is as short as that of gate arrays.

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 cell-based ICs.

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

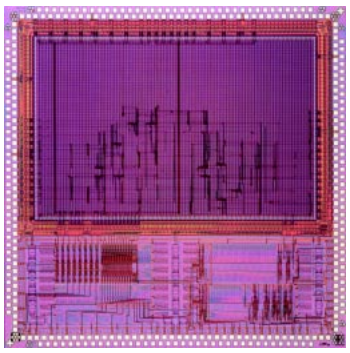
● Analog master



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 desiging the appropriate wiring in a similar way to when a gate array is used.

If you think it would be too difficult to create a full-custom analog circuit from the viewpoint of development period, cost, and the quantity 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 that high-performance analog circuits can be constructed.

0.25 μm ASIC

■ EA-C10 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-C10) (including analog circuit)

Family Name		EA-C10
Maximum density (total number of gates)		7 million gates
Supply voltage		2.5 V ± 0.2 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 μW/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 mA

0.25 μm ASIC

■ EA-C10 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	○	○			
V8×× CPU		○	○		
VR4××× 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

0.25 μm ASIC

■ EA-C10 Family

● Features (3/3)

Wide variety of macro libraries (2/2)

I/O buffer
LVCMOS/LVTTL
Slew rate buffer
3-state buffer
Open-drain buffer

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

High-speed I/O
GTL/GTL+ (Gunning Transceiver Logic)
PCI[Note 1] (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

RAM macro (gate array type)[Note 2]
High-speed 1-port RAM
High-speed 2-port RAM

Notes 1. Interface standard proposed by Intel.
2. RAM macro for gate array. Bit/word fixed.

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

0.25 μm ASIC

■ CB-C10 Family

● Features (1/3)

High-density, super high-speed, and low-power consumption cell-based IC using the most advanced 0.25 μm technology

In addition to featuring a high-density of 20 million gates (MAX.) and low-power consumption, high-speed internal gates, the EA-C10 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-C10
Maximum density (number of usable gates)		20M gates (15M gates)
Supply voltage		2.5 V ± 0.2 V
Delay time	Internal gate Note 1	93.4 ps
	Input buffer Note 2	31.5 ps
	Output buffer Note 3	1363 ps
Power consumption		0.04 μW/MHz/gate

Note 1. 2-input NAND power gate, fanout: 1, wiring length: 0 mm
2. Fanout: 2, wiring length: 0 mm
3. Load capacitance: 50 pF, I_{OL} = 12 mA

0.25 μm ASIC

■ CB-C10 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
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	○	○			
V8×× CPU		○	○		
V_R4××× 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

0.25 μm ASIC

■ CB-C10 Family

● Features (3/3)

Wide variety of macro libraries (2/2)

I/O buffer
LVCMOS/LVTTL
Slew rate buffer
3-state buffer
Open-drain buffer

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

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

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

Gate Array

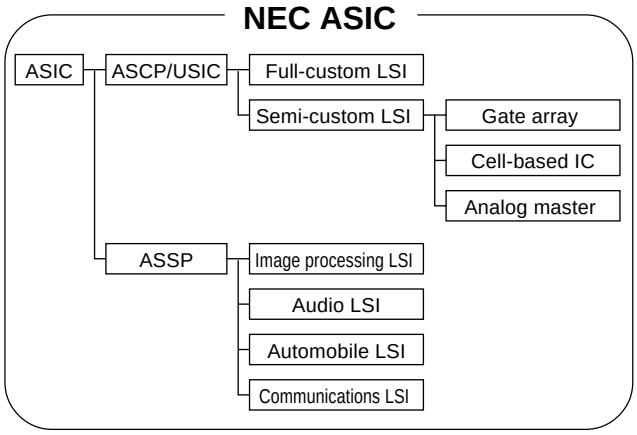
■ What Is a Gate Array ?

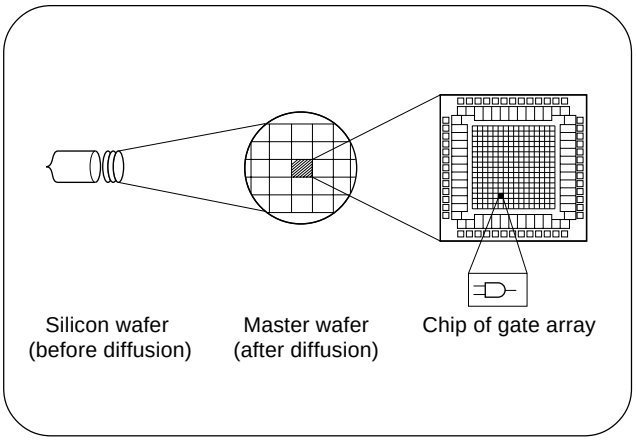
When producing LSIs, the diffusion process that forms elements such as transistors on a silicon wafer takes a long time. With gate arrays, manufacturers can supply wafers called master wafers whose diffusion process has been completed. On a master wafer, logic gates (basic cells) are arranged in the 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 the user produce product 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.

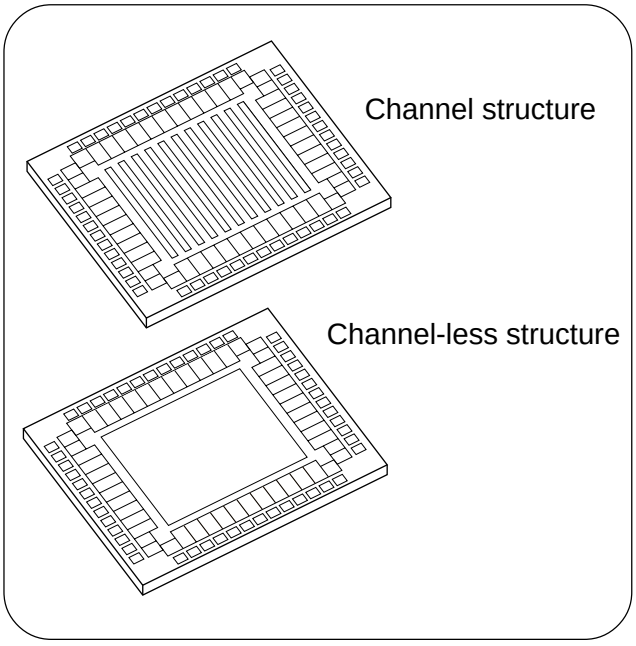
As the density of gate arrays has increased, a type called the channel-less gate array that can be used to integrate a large-scale system on a single chip has come into the spotlight.

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.





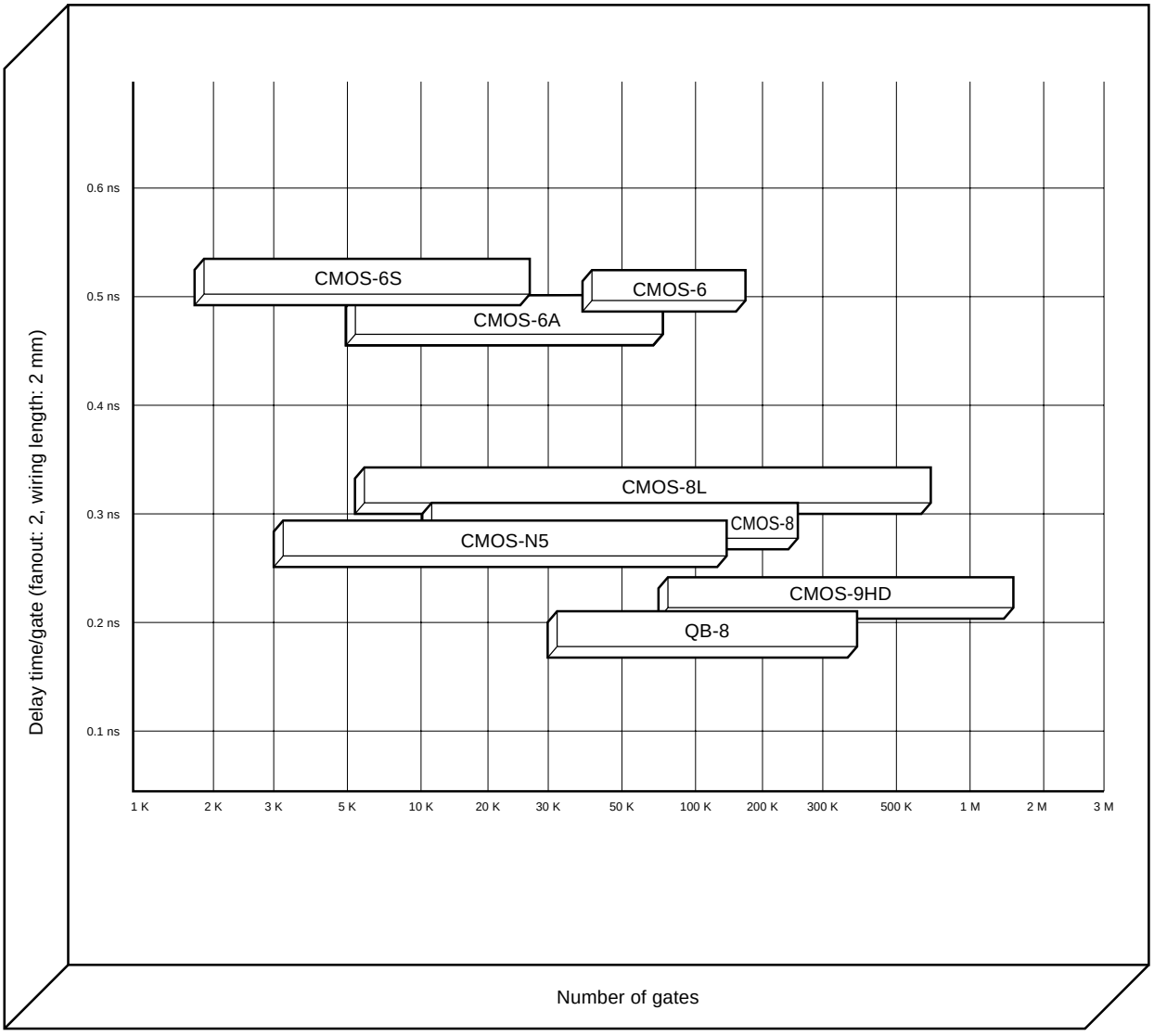


Gate Array

■ Product Line-Up

NEC offers 89 different gate array models (78 CMOS models, 11 BiCMOS 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 super computers.

Product Line-up



Channel-less CMOS : CMOS-N5, CMOS-9HD, CMOS-8, CMOS-8L, CMOS-6, CMOS-6A, CMOS-6S
BiCMOS : QB-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 : 7 families, 78 models

BiCMOS gate arrays : 1 families, 11 models

High density and high speed thanks to leading edge technology

The CMOS-9HD family employs a 0.35-μm CMOS technology, 3-layer wiring technology, and channel-less structure. As a result, a density of up to 1.6M gates (1.1M usable gates) and a speed of 107ps have been achieved, enabling large-scale system integration on a single chip.

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.

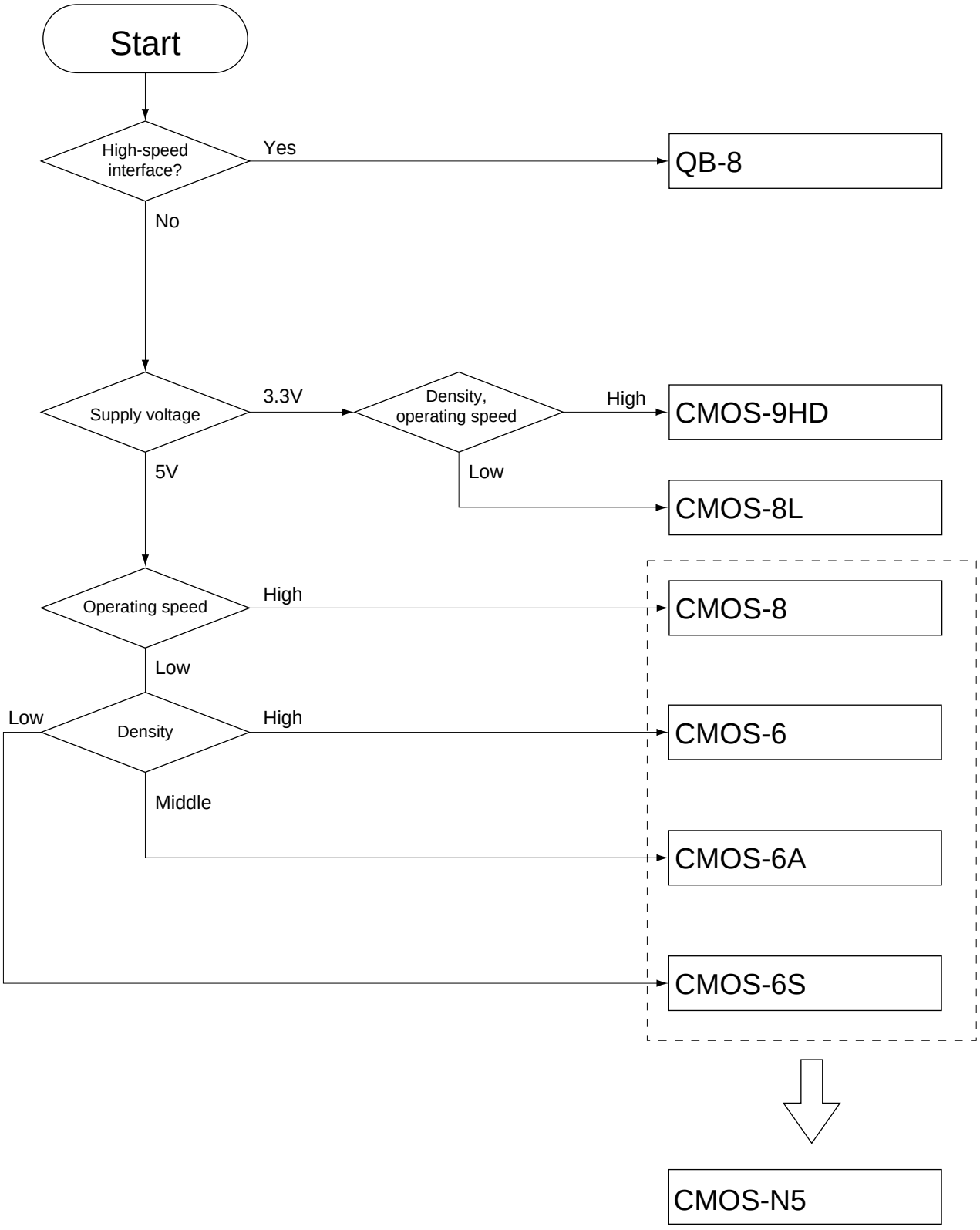
High-level gate arrays from many libraries

Because many library functions are available, its 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 designing period and improving the functionality of your systems.

Gate Array

■ Which Gate Arrays Is Best-Suited to Your System ?



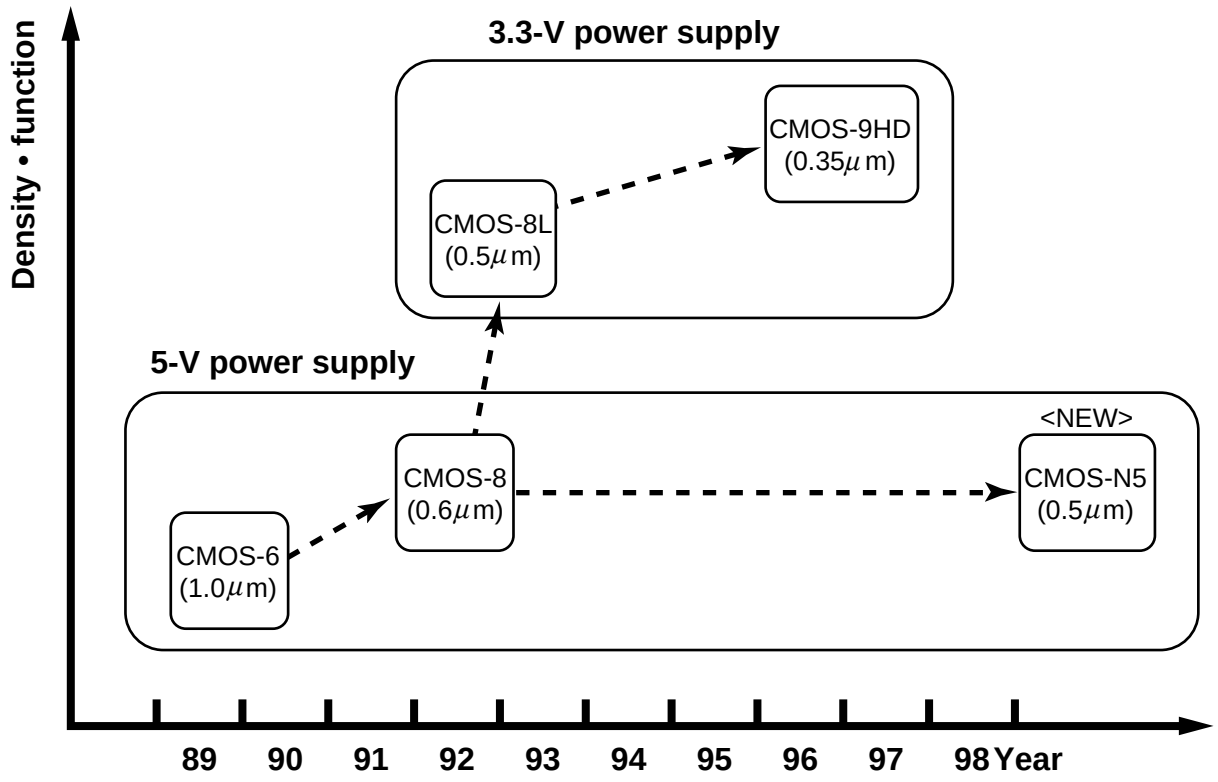
Gate Array

■ CMOS Gate Arrays

● Product Line-Up

NEC offer many types of CMOS gate arrays including the CMOS-6 family with a design rule of 1.0 μm and the CMOS-9HD family with a design rule of 0.35 μm.

These CMOS gate arrays have densities from 1.8K gates to 1.6M gates (78 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-6 Family

● **Available Models**

		μPD65658	μPD65664	μPD65672	μPD65676
Density	Number of integrated gates*	42240	72576	119232	177408
	Number of usable gates**	31680	54432	89424	133056
	Number of pads[Note]	236	304	384	464
Delay time	Internal gate	0.5 ns (fanout: 2, wiring length: 2 mm)			
	Power gate	0.4 ns (fanout: 2, wiring length: 2 mm)			
	Input buffer	1.0 ns (fanout: 2, wiring length: 2 mm)			
	Output buffer	2.0 ns (C_L = 15 pF)			
Output drive capability		I_{OL} = 4.5, 9.0, 13.5, 18.0, 24.0 mA			
Supply voltage		5 V			
Remark		* 2-input NAND conversion (1 cell = 1 gate) ** Cell utilization rate: 75 %			

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

■ CMOS-6A Family

● **Available Models**

		μPD65630	μPD65636	μPD65640	μPD65646	μPD65650	μPD65654	μPD65656	μPD65662
Density	Number of integrated gates*	5376	8000	11520	16240	21120	30720	40480	70272
	Number of usable gates**	3225	4800	6912	9744	12672	18432	24288	42163
	Number of pads[Note]	100	116	136	156	176	208	220	288
Delay time	Internal gate	0.5 ns (fanout: 2, wiring length: 2 mm)							
	Power gate	0.4 ns (fanout: 2, wiring length: 2 mm)							
	Input buffer	1.0 ns (fanout: 2, wiring length: 2 mm)							
	Output buffer	2.0 ns (C_L = 15 pF)							
Output drive capability		I_{OL} = 4.5, 9.0, 13.5, 18.0, 24.0 mA							
Supply voltage		5 V							
Remark		* 2-input NAND conversion (1 cell = 1 gate) ** Cell utilization rate: 60 %							

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

Gate Array

CMOS Gate Array

■ CMOS-6S Family

● Available Models

		μPD65611	μPD65621	μPD65625	μPD65643	μPD65653
Density	Internal gates*	1836	3484	5312	13416	25488
	Number of usable gates**	1101	2090	3187	8049	15292
	Number of pads[Note]	80	100	120	176	236
Delay time	Internal gate	0.5 ns (fanout: 2, wiring length: 2 mm)				
	Power gate	0.4 ns (fanout: 2, wiring length: 2 mm)				
	Input buffer	1.0 ns (fanout: 2, wiring length: 2 mm)				
	Output buffer	2.0 ns (C_L = 15 pF)				
Output drive capability		I_{OL} = 4.5, 9.0, 13.5, 18.0, 24.0 mA				
Supply voltage		5 V				
Remark		* 2-input NAND conversion (1 cell = 1 gate) ** Cell utilization rate: 60 %				

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

Gate Array

CMOS Gate Array

■ CMOS-6/6A/6S Family

● **Library**

I/O buffer
Function
Input buffer Output buffer Bidirectional buffer Low-noise buffer Fail-safe buffer Oscillation circuit

Function block
Function
Logic gate Buffer Inverter 3-state buffer Driver Delay Adder Decoder Multiplexer Latch Flip-flop Shift register Counter Others

Memory block
Function
High-speed single-port RAM High-speed dual-port RAM High-density single-port RAM Compiled RAM ROM

Mega macro
Function
DMA controller Serial interface unit Parallel interface unit Timer/counter Interrupt controller

● **Characteristics**

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V_{DD}	–0.5 to +6.5	V
Input/output voltage	V_I/V_O	–0.5 to V_{DD} + 0.5	V
Output current	I_O	40 Note1	mA
Output current	I_O	30 Note2	mA
Output current	I_O	20 Note3	mA
Output current	I_O	10 Note4	mA
Operating temperature	T_A	–40 to +85	˚C
Storage temperature	T_{stg}	–65 to +150	˚C

Recommended Operating Conditions

Parameter	Symbol	CMOS Level		TTL Level		Unit
		MIN.	MAX.	MIN.	MAX.	
Supply voltage	V_{DD}	4.5	5.5	4.75	5.25	V
High-level input voltage	V_{IH}	0.7 V_{DD}	V_{DD}	2.2	V_{DD}	V
Low-level input voltage	V_{IL}	0	0.3 V_{DD}	0	0.8	V
Input rise time	t_r	0	200	0	200	ns
Input fall time	t_f	0	200	0	200	ns
Positive trigger voltage	V_P	1.8	4.0	1.2	2.4	V
Negative trigger voltage	V_N	0.6	3.1	0.6	1.8	V
Hysteresis voltage	V_H	0.3	1.5	0.3	1.5	V

Notes
1. I_{OL} (MIN.) = 18.0 mA type
2. I_{OL} (MIN.) = 13.5 mA type
3. I_{OL} (MIN.) = 9.0 mA type
4. I_{OL} (MIN.) = 4.5 mA type

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}	V_I = V_{DD} or GND		0.1	280	μA
Off-state output leakage current		I_{OZ}	V_O = V_{DD} or GND			±10	μA
Output short-circuit current		I_{OS}	V_O = 0V			–250	mA
Input leakage current	Normal input	I_I	V_I = V_{DD} or GND		±10^{-5}	±10	μA
	with pull-up (50 kΩ)	I_I	V_I = GND	–45	–131	–320	μA
	with pull-up (5 kΩ)	I_I	V_I = GND	–0.35	–1.0	–2.2	mA
	with pull-down (50 kΩ)	I_I	V_I = V_{DD}	45	131	320	μA
High-level output voltage (CMOS)		V_{OH}	I_{OH} = 0mA	V_{DD} – 0.1			V
High-level output voltage (TTL)		V_{OH}	I_{OH} = 0mA	2.6			V
Low-level output voltage		V_{OL}	I_{OL} = 0mA			0.1	V

Remark The above values are under the recommended operating conditions shown above.
For the details of the DC characteristics when other supply voltage (3.0 V ± 10%) is used, refer to the **Design Manual**.

Gate Array

CMOS Gate Array

■ CMOS-8 Family

● **Available Models (2-layer wiring)**

		μPD65800	μPD65801	μPD65802	μPD65803
Density	Number of integrated gates*	11712	21504	32000	42688
	Number of usable gates**	7027	12902	19200	25612
	Number of pads[Note]	172	228	268	308
Delay time	Internal gate	0.29 ns (fanout: 2, wiring length: 2 mm)			
	Power gate	0.20 ns (fanout: 2, wiring length: 2 mm)			
	Input buffer	0.36 ns (fanout: 2, wiring length: 2 mm)			
	Output buffer	1.73 ns (C_L = 15 pF)			
Output drive capability		I_{OL} = 3.0, 6.0, 9.0, 12.0, 18.0, 24.0 mA			
Supply voltage		5 V ± 10% (CMOS level), 5 V ± 5% (TTL level)			
Remark		* 2-input NAND conversion ** Cell utilization rate: 60 %			

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

● **Available Models (3-layer wiring)**

		μPD65804	μPD65806	μPD65808	μPD65810	μPD65811	μPD65812	μPD65813
Density	Number of integrated gates*	42688	58752	82432	103680	138776	176720	233280
	Number of usable gates**	32016	44064	61824	77760	104082	132540	174960
	Number of pads[Note]	308	356	420	468	524	588	676
Delay time	Internal gate	0.29 ns (fanout: 2, wiring length: 2 mm)						
	Power gate	0.20 ns (fanout: 2, wiring length: 2 mm)						
	Input buffer	0.36 ns (fanout: 2, wiring length: 2 mm)						
	Output buffer	1.73 ns (C_L = 15 pF)						
Output drive capability		I_{OL} = 3.0, 6.0, 9.0, 12.0, 18.0, 24.0 mA						
Supply voltage		5 V ± 10% (CMOS level), 5 V ± 5 % (TTL level)						
Remark		* 2-input NAND conversion ** Cell utilization rate: 75 %						

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

Gate Array

CMOS Gate Array

■ CMOS-8 Family

● **Library**

I/O buffer	Function block	Memory block	Mega macro
Function	Function	Function	Function
Input buffer Output buffer Bidirectional buffer Low-noise buffer Fail-safe buffer PCI buffer GTL (under development) D-PLL (under development) Oscillation circuit	Logic gate Buffer Inverter 3-state buffer Clock driver Delay Adder Decoder Multiplexer Latch Flip-flop Shift register Counter Others	High-speed single-port RAM High-speed dual-port RAM High-density single-port RAM ROM	DMA controller Serial interface unit Parallel interface unit Timer/counter Interrupt controller

● **Characteristics**

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V_{DD}	–0.5 to +6.5	V
Input/output voltage	V_I/V_O	–0.5 to V_{DD} + 0.5	V
Output current	I_O	60[Note1]	mA
Output current	I_O	40[Note2]	mA
Output current	I_O	30[Note3]	mA
Output current	I_O	20[Note4]	mA
Output current	I_O	15[Note5]	mA
Output current	I_O	10[Note6]	mA
Operating temperature	T_A	–40 to +85	°C
Storage temperature	T_{stg}	–65 to +150	°C

Recommended Operating Conditions

Parameter	Symbol	CMOS Level		TTL Level		Unit
		MIN.	MAX.	MIN.	MAX.	
Supply voltage	V_{DD}	4.5	5.5	4.75	5.25	V
High-level input voltage	V_{IH}	0.7 V_{DD}	V_{DD}	2.2	V_{DD}	V
Low-level input voltage	V_{IL}	0	0.3 V_{DD}	0	0.8	V
Input rise time	t_r	0	200	0	200	ns
Input fall time	t_f	0	200	0	200	ns
Positive trigger voltage	V_P	1.8	4.0	1.2	2.4	V
Negative trigger voltage	V_N	0.6	3.1	0.6	1.8	V
Hysteresis voltage	V_H	0.3	1.5	0.3	1.5	V

Notes 1. I_{OL} (MIN.) = 24.0 mA type **4.** I_{OL} (MIN.) = 9.0 mA type
2. I_{OL} (MIN.) = 18.0 mA type **5.** I_{OL} (MIN.) = 6.0 mA type
3. I_{OL} (MIN.) = 12.0 mA type **6.** I_{OL} (MIN.) = 3.0 mA type

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}	$V_I = V_{DD}$ or GND		0.1	200	μA
Off-state output leakage current		I_{OZ}	$V_O = V_{DD}$ or GND			±10	μA
Output short-circuit current		I_{OS}	V_O = 0V			–250	mA
Input leakage current	Normal input	I_I	$V_I = V_{DD}$ or GND		±10^{-5}	±10	μA
	with pull-up (50 kΩ)	I_I	V_I = GND	–45	–131	–320	μA
	with pull-up (5 kΩ)	I_I	V_I = GND	–0.35	–1.0	–2.2	mA
	with pull-down (50 kΩ)	I_I	$V_I = V_{DD}$	45	131	320	μA
High-level output voltage (CMOS)		V_{OH}	I_{OH} = 0 mA	V_{DD} – 0.1			V
High-level output voltage (TTL)		V_{OH}	I_{OH} = 0 mA	2.6			V
Low-level output voltage		V_{OL}	I_{OL} = 0 mA			0.1	V

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

Gate Array

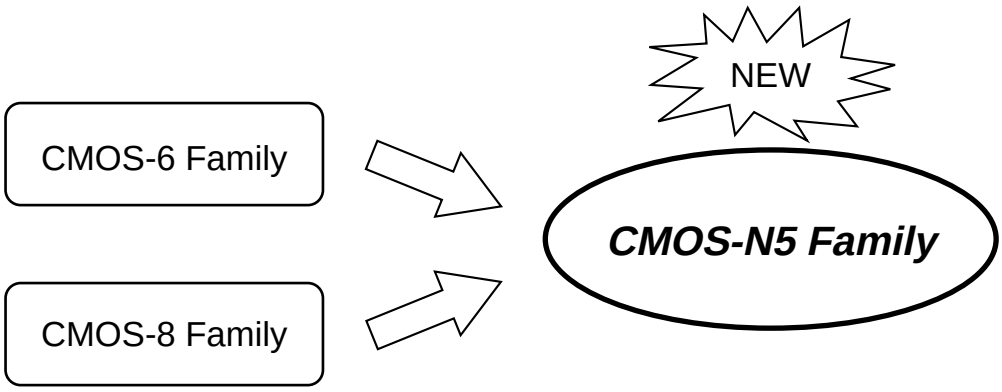
CMOS Gate Array

■ 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 thanks to higher integration by the adoption of 0.5 μm technology (2-layer wiring), and lowering the package assembly cost.



Integration

- 3K to 120K gates (number of integrated gates)
- 2K to 74K gates (number of usable gates)

High-speed operation (preliminary)

- t_{PD} = 0.2 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

Gate Array

CMOS Gate Array

■ CMOS-N5 Family

● **Available Models (Preliminary)**

		μPD65880	μPD65881	μPD65882	μPD65883	μPD65884	μPD65885	μPD65887	μPD65889	μPD65890	μPD65893
Density	Number of integrated gates*	3456	5880	13952	25344	33864	40768	56496	76000	99528	123384
	Number of usable gates**	2073	3528	8371	15206	20318	24460	33897	45600	59716	74030
	Number of pads[Note]	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		5 V ± 10 % (CMOS level)									
Remark		* 2-input NAND conversion ** Cell utilization rate: 60 %									

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

Gate Array

CMOS Gate Array

■ CMOS-8L Family

● Available Models (2-layer wiring)

		μPD65837	μPD65839	μPD65840	μPD65841	μPD65842	μPD65843	μPD65845	μPD65846
Density	Number of integrated gates*	4480	7904	10912	20832	30192	40592	52528	61904
	Number of usable gates**	2912	5137	6547	12499	18115	24355	31516	37142
	Number of pads[Note]	80	104	164	204	212	244	276	300
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} = 3, 6, 9, 12, 18, 24 mA							
Supply voltage		3.3 V ± 0.3 V							
Remark		* 2-input NAND conversion (1 cell = 1 gate) ** Cell utilization rate: 60 %							

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

		μPD65848	μPD65849	μPD65850	μPD65851	μPD65852	μPD65853	μPD65855	μPD65858
Density	Number of integrated gates*	81984	102272	120768	148256	202752	255744	342000	488720
	Number of usable gates**	49190	61363	72460	88953	121651	153446	205200	293232
	Number of pads[Note]	340	380	412	452	524	588	676	804
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} = 3, 6, 9, 12, 18, 24 mA							
Supply voltage		3.3 V ± 0.3 V							
Remark		* 2-input NAND conversion (1 cell = 1 gate) ** Cell utilization rate: 60 %							

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

Gate Array

CMOS Gate Array

■ CMOS-8L Family

● **Available Models (3-layer wiring)**

		μPD65860	μPD65861	μPD65862	μPD65863	μPD65865	μPD65866	μPD65868	μPD65869
Density	Number of integrated gates*	10912	20832	30192	40592	52528	61904	81984	102272
	Number of usable gates**	8184	15624	22644	30444	39396	46428	61488	76704
	Number of pads[Note]	164	204	212	244	276	300	340	380
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} = 3, 6, 9, 12, 18, 24 mA							
Supply voltage		3.3 V ± 0.3 V							
Remark		* 2-input NAND conversion (1 cell = 1 gate) ** Cell utilization rate: 75 %							

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

		μPD65870	μPD65871	μPD65872	μPD65873	μPD65875	μPD65878
Density	Number of integrated gates*	120768	148256	202752	255744	342000	488720
	Number of usable gates**	90576	111192	152064	191808	256500	366540
	Number of pads[Note]	412	452	524	588	676	804
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} = 3, 6, 9, 12, 18, 24 mA					
Supply voltage		3.3 V ± 0.3 V					
Remark		* 2-input NAND conversion (1 cell = 1 gate) ** Cell utilization rate: 75 %					

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

Gate Array

CMOS Gate Array

■ CMOS-8L Family

● **Library**

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

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[Note1]	mA
Output current	I_O	7[Note2]	mA
Output current	I_O	10[Note3]	mA
Output current	I_O	20[Note4]	mA
Output current	I_O	30[Note5]	mA
Output current	I_O	40[Note6]	mA
Output current	I_O	60[Note7]	mA
Output current	I_O	80[Note8]	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} = 3.3V ± 0.3V		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	μA
Off-state output leakage current		I_{OZ}				±18	μA
Output short-circuit current		I_{OS}				–250	mA
Input leakage current	Normal input	I_I	$V_I = V_{DD}$ or GND		$±10^{-5}$	±10	μA
	with pull-up (50 kΩ)	I_I	V_I = GND	–10	–40	–80	μA
	with pull-up (5 kΩ)	I_I	V_I = GND	–130	–350	–640	μA
	with pull-down (50 kΩ)	I_I	$V_I = V_{DD}$	30	65	130	μA
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

Remark 1. The above values are under the recommended operating conditions shown above. For details, refer to the **Design Manual**.
2. Blank indicates value is under study.

Gate Array

CMOS Gate Array

■ CMOS-9HD Family

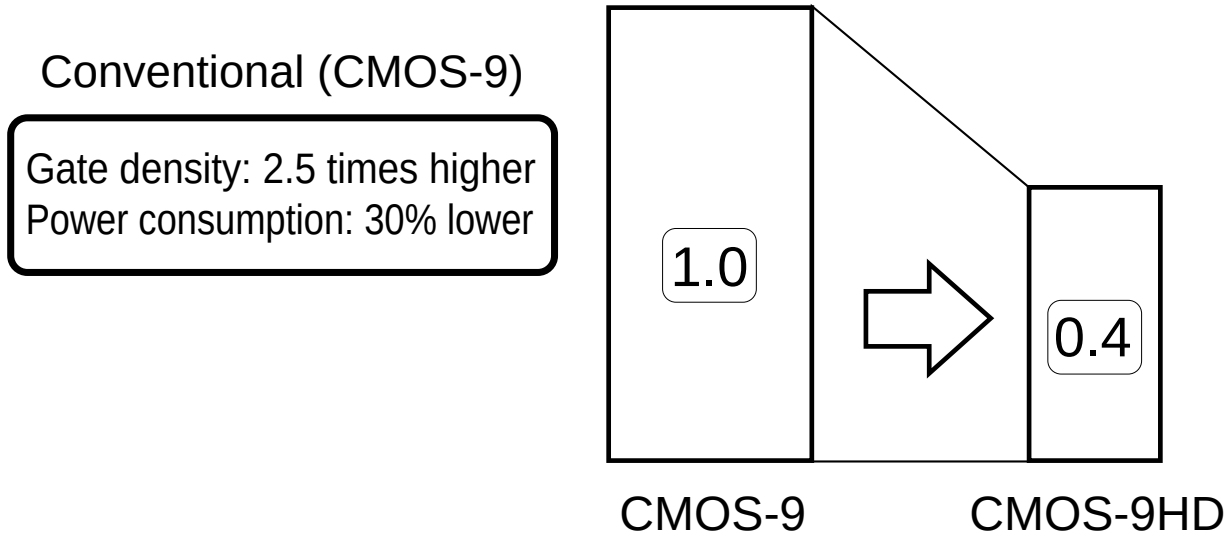
● Features

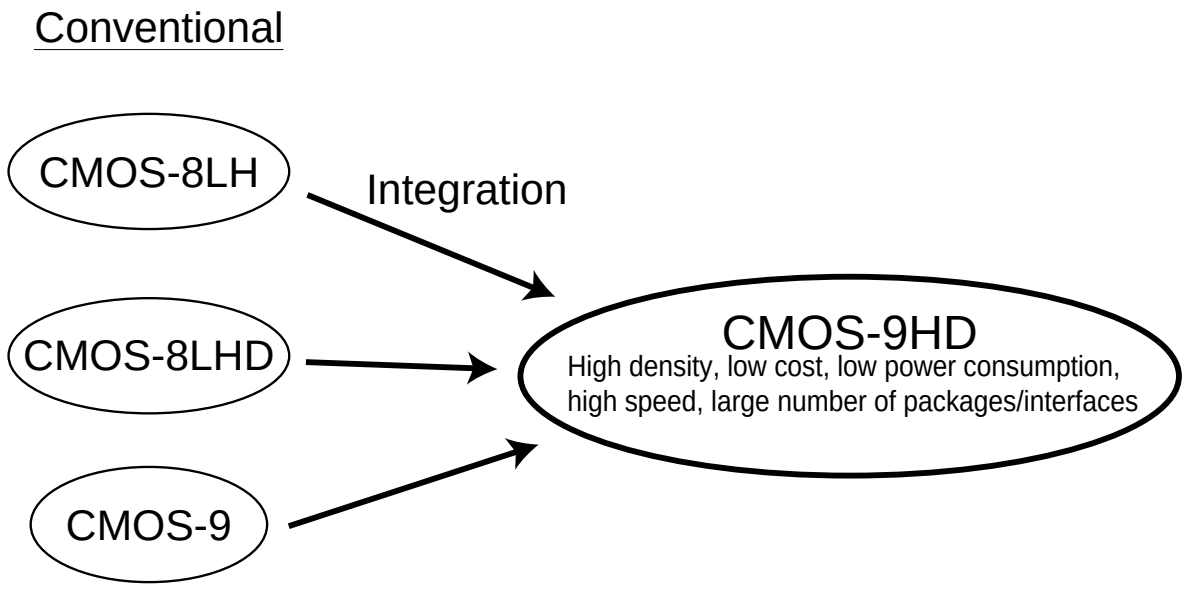
The CMOS-9HD family is a collection of channel-less gate arrays employing a 0.35-μm technology. This family consists of 10 masters with 75K to 1.6M gates.

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

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

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





Gate Array

CMOS Gate Array

■ CMOS-9HD Family

● **Available Models (3-layer wiring)**

		μPD65943	μPD65944	μPD65945	μPD65946	μPD65948	μPD65949	μPD65951	μPD65954	μPD65956	μPD65958
Density	Internal gates*	75740	100602	128338	202630	312684	437136	585390	835664	1096452	1615646
	Number of usable gates**	53018	70421	89836	141841	218878	305995	351234	501398	657871	969387
	Number of pads[Note]	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 V ± 0.3 V									
Remark		* 2-input NAND conversion ** Cell utilization rate: 70 % (60 % in the largest four masters)									

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

● **Library**

I/O buffer
Function
3 V Input buffer Output buffer Bidirectional buffer PCI buffer Low-noise buffer Fail-safe buffer 5 V (level shifter) Input buffer Output buffer Bidirectional buffer GTL (under development) D-PLL (under development)

Function block
Function
Logic gate Buffer Inverter 3-state buffer Clock driver Delay Adder Decoder Multiplexer Latch Flip-flop Shift register Counter Others

Memory block
Function
High-speed single-port RAM High-speed dual-port RAM

Mega macro (under development)
Function
DMA controller Serial interface unit Parallel interface unit Timer/counter Interrupt controller

Gate Array

CMOS Gate Array

■ CMOS-9HD Family

● Characteristics (1/5)

Absolute Maximum Ratings

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

Note Input current: Maximum value of current that can flow via input protection diode. Output current: 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 fail-		0		0.80	V
Positive trigger voltage	V_P	safe function	Schmitt input	1.50		2.70	V
Negative trigger voltage	V_N			0.60		1.40	V
Hysteresis voltage	V_H			1.10		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	V_P		Schmitt input	2.20		2.55	V
Negative trigger voltage	V_N			0.84		1.01	V
Hysteresis voltage	V_H			1.36		1.54	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]		0		10	ms
Input fall time	t_{fi}			0		10	ms

Note 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 lower 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 Note1						
μPD65943, 65944, 65945	I_{DDS}	$V_I = V_{DD}$ or GND		2.0	300	μA
μPD65946, 65948, 65949						
μPD65951, 65954, 65956	I_{DDS}	$V_O = V_{DD}$ or GND		0	400	μA
μPD65958	I_{DDS}	$V_O = V_{DD}$ or GND		4.0	800	μA
Off-state output leakage current Note2						
3-V 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 output	I_{OZ}	$V_O = V_{DD}$ or GND			±10	μA
Output sink current Note3 CMOS 5-V output	I_R	V_{PU} = 5.5 V R_{PU} = 2 kΩ V_O = 3.0 V			10	μA
Output short-circuit current Note4	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 kΩ)	I_I	V_I = GND	28	83	190	μA
With pull-up resistor (5 kΩ)	I_I	V_I = GND	280	700	1900	μA
With pull-down resistor (50 kΩ)	I_I	$V_I = V_{DD}$	28	83	190	μA
Pull-up resistor (50 kΩ) Note5	R_{PU}		18.9	39.8	107.1	kΩ
Pull-up resistor (5 kΩ) Note5	R_{PU}		1.9	4.7	10.7	kΩ
Pull-down resistor (50 kΩ) Note5	R_{PD}		18.9	39.8	107.1	kΩ

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 above figure 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 Note1							
3-V output type							
3.0-mA type	FO09	I_{OL}	V_{OL} = 0.4 V	3.00 Note2			mA
6.0-mA type	FO04	I_{OL}	V_{OL} = 0.4 V	6.00			mA
9.0-mA type	FO01	I_{OL}	V_{OL} = 0.4 V	9.00			mA
12.0-mA type	FO02	I_{OL}	V_{OL} = 0.4 V	12.00			mA
18.0-mA type	FO03	I_{OL}	V_{OL} = 0.4 V	18.00			mA
24.0-mA type	FO06	I_{OL}	V_{OL} = 0.4 V	24.00			mA
Low-level output current Note1							
TTL 5-V output							
1.0-mA type	FV0A	I_{OL}	V_{OL} = 0.4 V	1.00			mA
2.0-mA type	FV0B	I_{OL}	V_{OL} = 0.4 V	2.00			mA
3.0-mA type	FV09	I_{OL}	V_{OL} = 0.4 V	3.00			mA
6.0-mA type	FV04	I_{OL}	V_{OL} = 0.4 V	6.00			mA
9.0-mA type	FV01	I_{OL}	V_{OL} = 0.4 V	9.00			mA
12.0-mA type	FV02	I_{OL}	V_{OL} = 0.4 V	12.00			mA
18.0-mA type	FV03	I_{OL}	V_{OL} = 0.4 V	18.00			mA
24.0-mA type	FV06	I_{OL}	V_{OL} = 0.4 V	24.00			mA
Low-level output current Note1							
CMOS 5-V output							
3.0-mA type	FY09	I_{OL}	V_{OL} = 0.4 V	3.00			mA
6.0-mA type	FY04	I_{OL}	V_{OL} = 0.4 V	6.00			mA
9.0-mA type	FY01	I_{OL}	V_{OL} = 0.4 V	9.00			mA
12.0-mA type	FY02	I_{OL}	V_{OL} = 0.4 V	12.00			mA
18.0-mA type	FY03	I_{OL}	V_{OL} = 0.4 V	18.00			mA
24.0-mA type	FY06	I_{OL}	V_{OL} = 0.4 V	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-kΩ pull-up resistor

Remark The + and – symbols next to the current values in the above figure 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 (5/5)

DC Characteristics (3/3)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
High-level output current[Note]							
3-V output type							
3.0-mA type	FO09	I_{OH}	V_{OH} = 2.4 V	–3.00			mA
6.0-mA type	FO04	I_{OH}	V_{OH} = 2.4 V	–6.00			mA
9.0-mA type	FO01	I_{OH}	V_{OH} = 2.4 V	–9.00			mA
12.0-mA type	FO02	I_{OH}	V_{OH} = 2.4 V	–12.00			mA
18.0-mA type	FO03	I_{OH}	V_{OH} = 2.4 V	–18.00			mA
24.0-mA type	FO06	I_{OH}	V_{OH} = 2.4 V	–24.00			mA
High-level output current[Note]							
TTL 5-V output							
1.0-mA type	FV0A	I_{OH}	V_{OH} = 2.4 V	–1.00			mA
2.0-mA type	FV0B	I_{OH}	V_{OH} = 2.4 V	–1.00			mA
3.0-mA type	FV09	I_{OH}	V_{OH} = 2.4 V	–3.00			mA
6.0-mA type	FV04	I_{OH}	V_{OH} = 2.4 V	–3.00			mA
9.0-mA type	FV01	I_{OH}	V_{OH} = 2.4 V	–3.00			mA
12.0-mA type	FV02	I_{OH}	V_{OH} = 2.4 V	–3.00			mA
18.0-mA type	FV03	I_{OH}	V_{OH} = 2.4 V	–6.00			mA
24.0-mA type	FV06	I_{OH}	V_{OH} = 2.4 V	–6.00			mA
Low-level output current[Note]							
3-V output type		V_{OL}	I_{OL} = 0 mA				
3-V output type		V_{OL}	I_{OL} = 0 mA			0.1	V
(with 5-kΩ pull-up resistor)						0.2	V
TTL 5-V output		V_{OL}	I_{OL} = 0 mA			0.1	V
CMOS 5-V output		V_{OL}	I_{OL} = 0 mA			1	V
High-level output voltage							
3-V output type		V_{OH}	I_{OH} = 0 mA	V_{DD} – 0.1			V
TTL 5-V output		V_{OH}	I_{OH} = 0 mA	V_{DD} – 0.2			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 above figure 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

BiCMOS Gate Array

■ QB-8 Family

● Features

The QB-8 family is a collection of BiCMOS gate arrays that offer high speed, low power consumption, and high density, and a price comparable to CMOS devices through the use of an innovative of cell structure and technology, radicaly changing the image of conventional BiCMOS gate arrays.

These gate arrays help increase the speed and decrease the power consumption of many electronic systems such as office machines and communications equipment.

High-speed operation

- Internal gate
  t_{PD} = 107 ps (2-input NAND, fanout: 1, wiring length: 0 mm)
  t_{PD} = 191 ps (2-input NAND, fanout: 2, wiring length: 2 mm)
- Power gate
  t_{PD} = 142 ps (2-input NAND, fanout: 2, wiring length: 2 mm)

Super low power consumption

1.09 μW = (per gate, V_{DD} = 3.3 V at 1 MHz)

Function block

Compatible with CMOS-8L family

Many high-speed interfaces

Maximum operating output frequency

• LVTTL	100 MHz
• GTL	200 MHz
• PECL	250 MHz
• PCI	66 MHz
• HSTL	250 MHz
• LVDS	300 MHz

Gate Array

BiCMOS Gate Array

■ QB-8 Family

● Available Models

		μPD67821	μPD67822	μPD67823	μPD67824	μPD67825	μPD67826
Density	Number of integrated gates*	32832	44352	56800	69520	93184	123808
	Number of usable gates**	22982	31046	39760	48664	65229	86666
	Number of pads[Note]	180	204	228	240	284	324
Delay time	Internal gate	107 ps (fanout: 1, wiring length: 0 mm), 191 ps (fanout: 2, wiring length: 2 mm)					
	Power gate	142 ps (fanout: 2, wiring length: 2 mm)					
	Input buffer	289 ps (fanout: 2, wiring length: 2 mm)					
	Output buffer	1.64 ns (load: 15 pF, I_{OL} = 18 mA)					
Supply voltage		3.3V ± 0.3V					
Output drive capability		I_{OL} = 1, 2, 3, 6, 9, 12, 18, 24 mA					
I/O interface level		LVTTL, TTL, GTL, HSTL, PECL, PCI					
Remark		* 2-input NAND conversion **Cell utilization rate: 70 %					

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

		μPD67827	μPD67828	μPD67829	μPD67830	μPD67831
Density	Number of integrated gates*	136752	167280	234280	292896	381840
	Number of usable gates**	95726	117096	164024	205027	267288
	Number of pads[Note]	340	372	436	484	548
Delay time	Internal gate	107 ps (fanout: 1, wiring length: 0 mm), 191 ps (fanout: 2, wiring length: 2 mm)				
	Power gate	142 ps (fanout: 2, wiring length: 2 mm)				
	Input buffer	289 ps (fanout: 2, wiring length: 2 mm)				
	Output buffer	1.64 ns (load: 15 pF, I_{OL} = 18 mA)				
Supply voltage		3.3 V ± 0.3 V				
Output drive capability		I_{OL} = 1, 2, 3, 6, 9, 12, 18, 24 mA				
I/O interface level		LVTTL, TTL, GTL, HSTL, PECL, PCI				
Remark		* 2-input NAND conversion **Cell utilization rate: 70 %				

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

Gate Array

BiCMOS Gate Array

■ QB-8 Family

● Library

I/O buffer
Function
3 V Input buffer Output buffer Bidirectional buffer PCI buffer HSTL buffer Low-noise buffer Fail-safe buffer 5 V (level shifter) Input buffer GTL PECL LVDS

Function block
Function
Logic gate Buffer Inverter 3-state buffer Clock driver Delay Adder Decoder Multiplexer Latch Flip-flop Shift register Counter Others

Memory block
Function
High-speed single-port RAM High-speed dual-port RAM High-density single-port RAM High-density dual-port RAM

Mega macro (under development)
Function
DMA controller Serial interface unit Parallel interface unit Timer/counter Interrupt controller

Gate Array

BiCMOS Gate Array

■ QB-8 Family

● Characteristics (1/2)

Absolute Maximum Ratings

Parameter	Symbol	Condition	Rating	Unit
Supply voltage	V_{DD}		–0.5 to +4.6	V
Input voltage				
3-V input buffer	V_I	$V_I < V_{DD} + 0.5$ V	–0.5 to +4.6	V
3-V input buffer with fail-safe function	V_I	$V_I < V_{DD} + 0.5$ V	–0.5 to +4.6	V
5-V input buffer	V_I	$V_I < V_{DD} + 0.5$ V	–0.5 to +6.6	V
Output voltage				
3-V output buffer	V_O	$V_O < V_{DD} + 0.5$ V	–0.5 to +4.6	V
5-V output buffer	V_O	$V_O < V_{DD} + 3.0$ V	–0.5 to +6.6	V
Output current[Note]	I_O	I_{OL} = 1 mA(FV0A)	3	mA
		I_{OL} = 2 mA(FV0B)	7	mA
		I_{OL} = 3 mA (FO09,FV09,FW09)	10	mA
		I_{OL} = 6 mA (FO04,FV04,FW04)	20	mA
		I_{OL} = 9 mA (FO01)	30	mA
		I_{OL} = 12 mA (FO02)	40	mA
		I_{OL} = 18 mA (FO03)	60	mA
		I_{OL} = 24 mA (FO06)	80	mA
Operating temperature	T_A		–40 to +85	°C
Storage temperature	T_{stg}		–65 to +150	°C

Note Output current: 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.

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}	3-V interface	2.00		V_{DD}	V
Low-level input voltage	V_{IL}		0		0.80	V
Positive trigger voltage	V_P		1.50		2.70	V
Negative trigger voltage	V_N		0.60		1.40	V
Hysteresis voltage	V_H		1.10		1.50	V
High-level input voltage	V_{IH}	5-V interface	2.00		5.50	V
Low-level input voltage	V_{IL}		0		0.80	V
Positive trigger voltage	V_P		2.20		2.25	V
Negative trigger voltage	V_N		0.84		1.01	V
Hysteresis voltage	V_H		1.36		1.54	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]	0		10	ms
Input fall time	t_{fi}		0		10	ms

Note Do not use this for the clock.

Gate Array

BiCMOS Gate Array

■ QB-8 Family

● Characteristics (2/2)

DC Characteristics

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Static current consumption						
μPD67830,67831	I_{DDS}	$V_I = V_{DD}$ or GND		15	4800	μA
μPD67827,67828,67829				9	3000	μA
μPD67824,67825,67826				5	1500	μA
μPD67821,67822,67823				2	700	μA
Off-state output current						
3-V output	I_{OZ}	$V_O = V_{DD}$ or GND			±10	μA
5-V output	I_{OZ}	$V_O = V_{DD}$ or GND			±14	μA
Output sink current 5-V output	I_R	V_{PU} = 5.5 V R_{PU} = 2 kΩ V_O = 3.0 V			14	μA
Output short-circuit current	I_{OS}	V_O = GND			–250	mA
Input leakage current						
Normal input	I_I	$V_I = V_{DD}$ or GND			±10	μA
with pull-up resistor (50 kΩ)	I_I	V_I = GND	–30	–66	–144	μA
with pull-up resistor (5 kΩ)	I_I	V_I = GND	–300	–660	–1440	μA
with pull-down resistor (50 kΩ)	I_I	$V_I = V_{DD}$	30	66	144	μA
High-level output voltage						
3-V output	V_{OH}	I_{OH} = 0 mA	V_{DD} – 0.1			V
5-V output	V_{OH}	I_{OH} = 0 mA	V_{DD} – 0.2			V
Low-level output voltage						
3-V output	V_{OL}	I_{OL} = 0 mA			0.1	V
5-V output	V_{OL}	I_{OL} = 0 mA			0.1	V

Remarks 1. The above values are under the recommended operating conditions shown above. For details, refer to the **Design Manual**.

2. Blank indicates values are under study.

Cell-Based IC

■ Cell-Based IC Line-Up (1/2)

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

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

Many families available

Families are available for each technology.

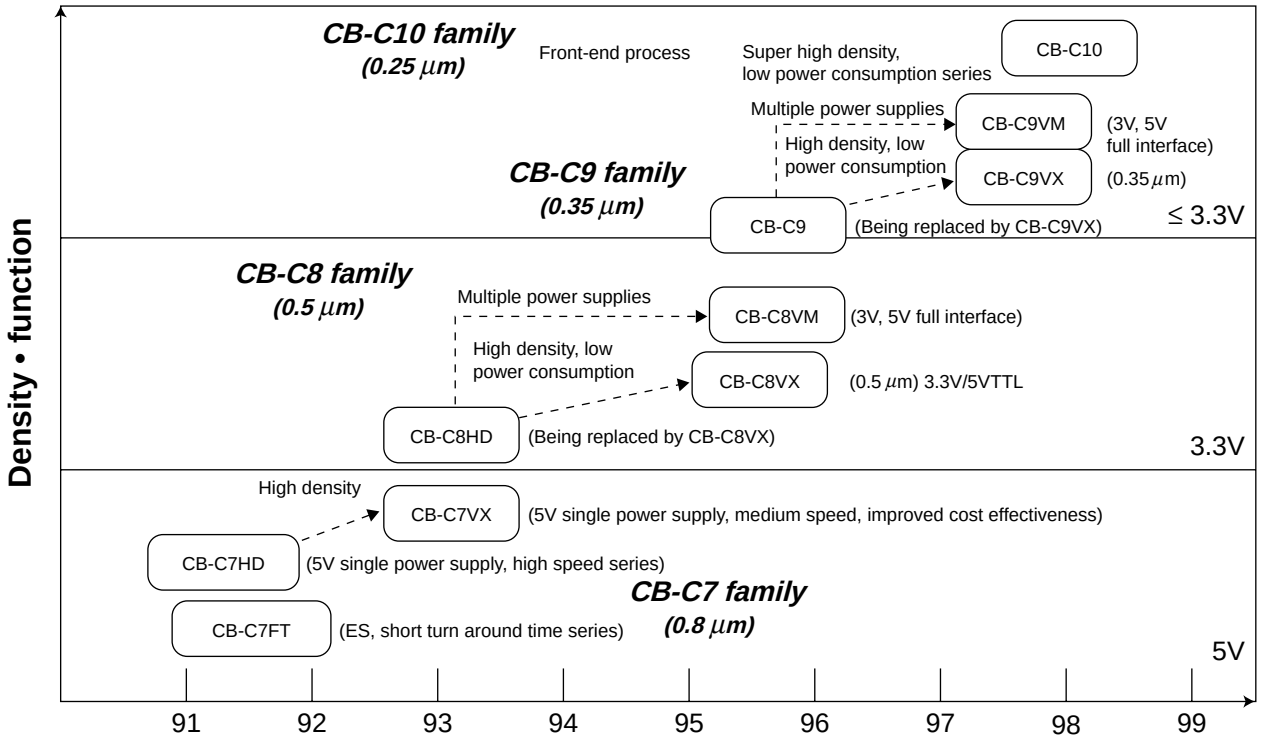
0.8μm CMOS family	:CB-C7 family (HD/FT/VX type)
0.5μm CMOS family	:CB-C8 family (VX/VM type)
0.35μm CMOS family	:CB-C9 family (VX/VM type)
0.25μm CMOS family	:CB-C10 family

The CB-C8 family VM type and CB-C9 family VM type can easily interface with 5-V and 3.3-V signals by using a buffer with level shifter in a system where 5 V and 3.3 V are used together.

The CB-C9 family VX type internally operates at 2.0 V and has a 3.3-V interface, and is ideal for portable systems where low power consumption is required, such as cellular telephones.

The CB-C10 family can internally operate at 2.5 V and have a 2.5 or 3.3 V interface to allow larger-scale systems with lower power consumption. (For details of the CB-C10 family, refer to the description in the section titled 0.25 μm ASIC in this pamphlet.)

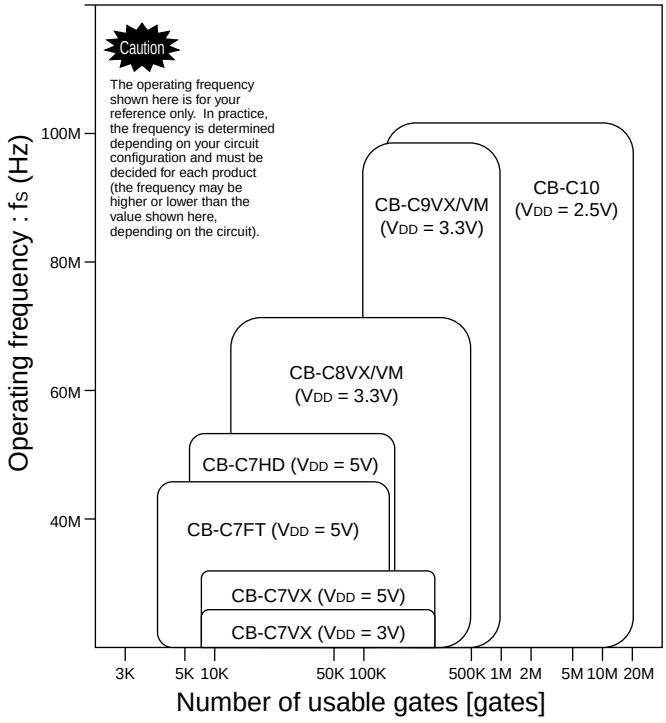
Series development of Cell-Based ICs



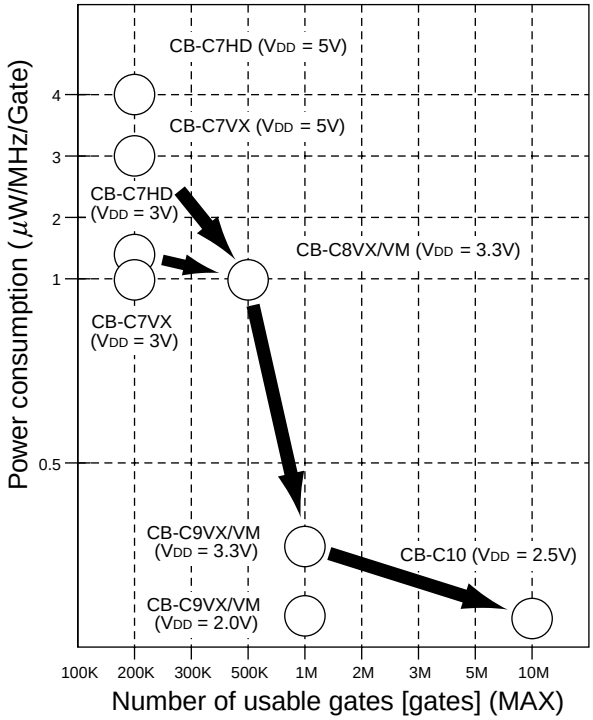
Cell-Based IC

■ Cell-Based IC Line-Up (2/2)

Comparison of performance of each series

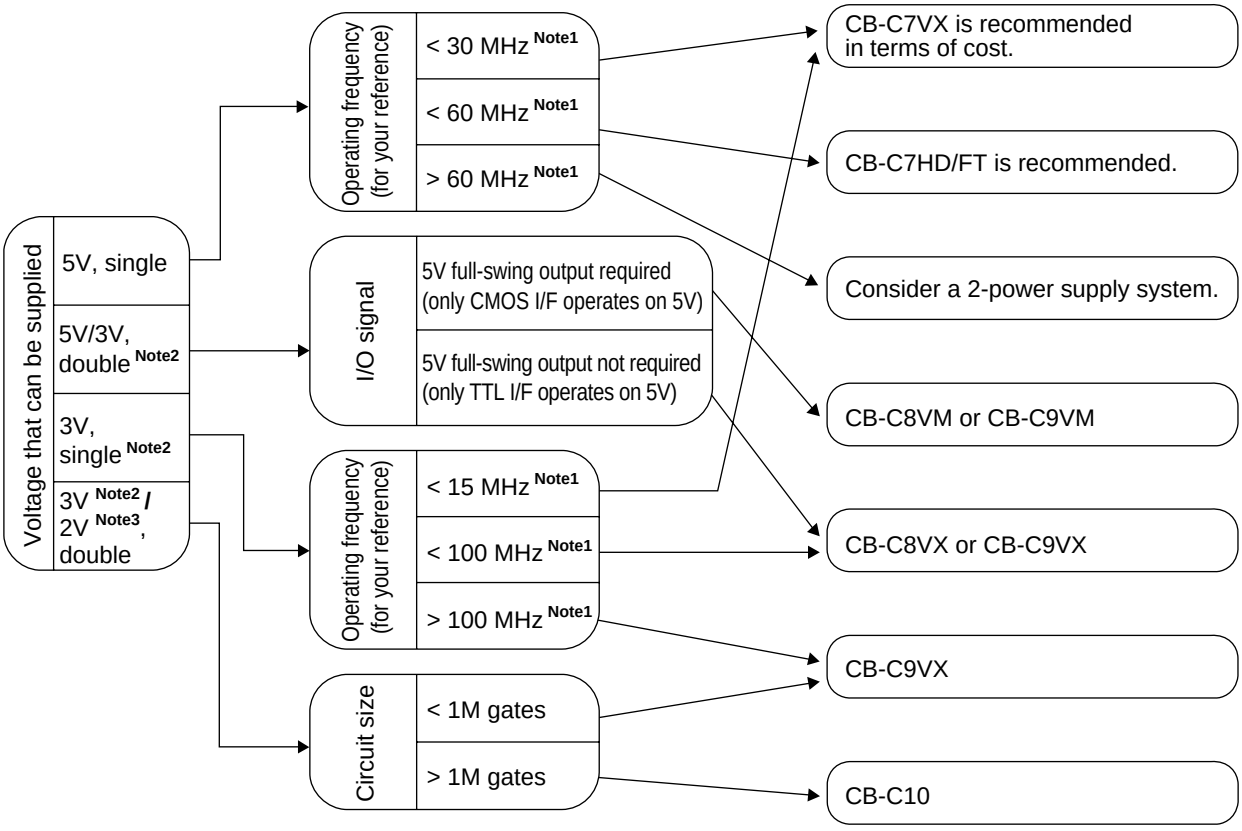


Transition of power consumption



Cell-Based IC

■ Guide to Selecting Cell-Based ICs



Notes 1. The values of the operating frequency shown above are for your reference only. In practice, the value of the operating frequency varies depending on your circuit configuration.

2. CB-C7, 3V: V_{DD} = 3.0 V ± 0.3 V
CB-C8VX/VM, CB-C9VX/VM, CB-C10: V_{DD} = 3.3 V ± 0.3 V

3. CB-C9VX, 2V: V_{DD} = 2.0 V ± 0.2 V
CB-C10: V_{DD} = 2.5 V ± 0.2 V

Many cores available

The need for system-on-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 the memory compiled method.

Cell-Based IC

■ CB-C7 Family

● Features

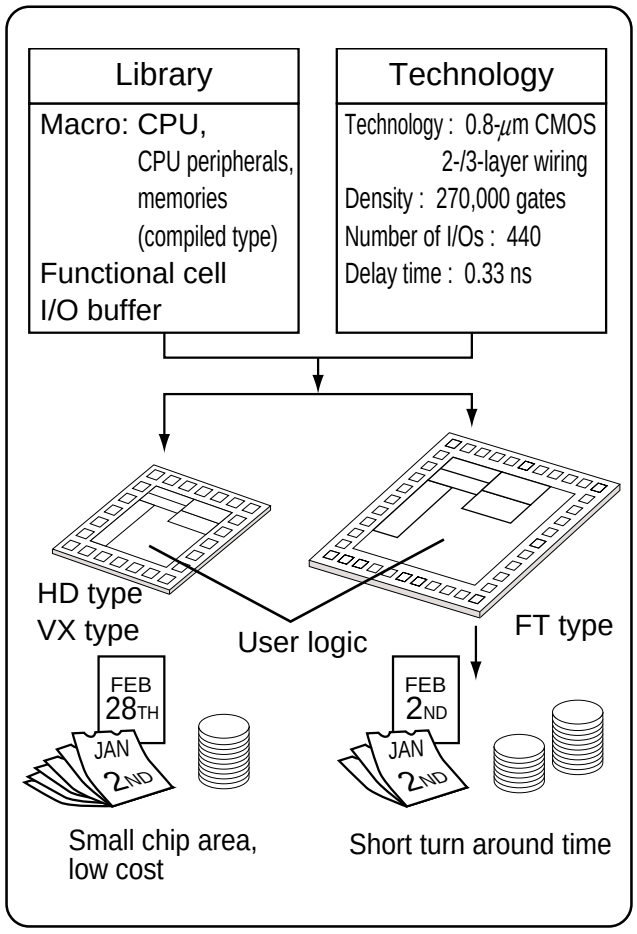
Three types available

FT type : Short turn around time realized by gate array method (substrate is developed first)

HD type : High speed and high density by employing dedicated cells

VX type [Note] : Super high density by employing dedicated cells and small transistors

Note The applications of the VX type are limited.

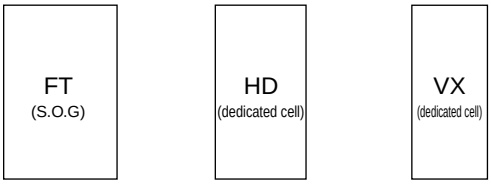


FT vs. HD vs. VX selection

- **Comparison of features of each type**

	FT	HD	VX
Turn around time	◎	0	0
Speed	0	◎	△
Density	△	0	◎
Power consumption	0	0	◎

- **Comparison of cell area (average of all blocks)**



1.2 : 1.0 : 0.8

Cell-Based IC

■ CB-C7 Family

● Product Outline

Type name		FT type/HD type/VX type			
Part number		μPD93000	μPD94000	μPD95100	μPD96100
CPU, peripherals		—		O	
Derivative models Note 1		—	O	—	O
Supply voltage		5 V ± 10 %, 3 V ± 10 %			
Interface level		CMOS, TTL compatible			
Number of usable gates Note 2		FT: 167K gates (MAX.)/HD: 223K gates (MAX.)/VX: 273K gates (MAX.)			
Delay time	Internal gate	FT,HD : 0.33ns Note 3/0.44ns(5V), 0.67ns Note 3/0.90ns(3V) [F/O=2,L=2mm] VX : 0.90ns Note 3/2.10ns(5V), 1.54ns Note 3/3.42ns(3V) [F/O=2,L=2mm]			
	Input buffer	FT,HD : 0.60 ns(5 V), 0.76 ns(3 V) [F/O = 2, L = 2 mm] VX : 1.25 ns(5 V), 2.18 ns(3 V) [F/O = 2, L = 2 mm]			
	Output buffer	FT,HD : 1.6 ns(5 V,I_{OL} = 8 mA), 3.0 ns(3 V,I_{OL} = 4.4 mA) [C_L = 15 pF] VX : 1.7 ns(5 V,I_{OL} = 8 mA), 3.0 ns(3 V,I_{OL} = 4.4 mA) [C_L = 15 pF]			
Power consumption (internal gate)		FT,HD : 3.90 μW/MHz/gate(5 V), 1.41 μW/MHz/gate(3 V) VX : 3.21 μW/MHz/gate(5 V), 1.17 μW/MHz/gate(3 V)			
Output drive capability		I_{OL} = 4,8,12,24,48 mA(5 V) I_{OL} = 2.2,4.4,6.6 mA(3 V)			

Notes 1. ROM code changeable. O: Derivative models available, —: No derivative models available
2. Number of gates if hard macro is not integrated (2-input NAND gate conversion)
3. Power gate

Cell-Based IC

■ CB-C8 Family VX/VM Type

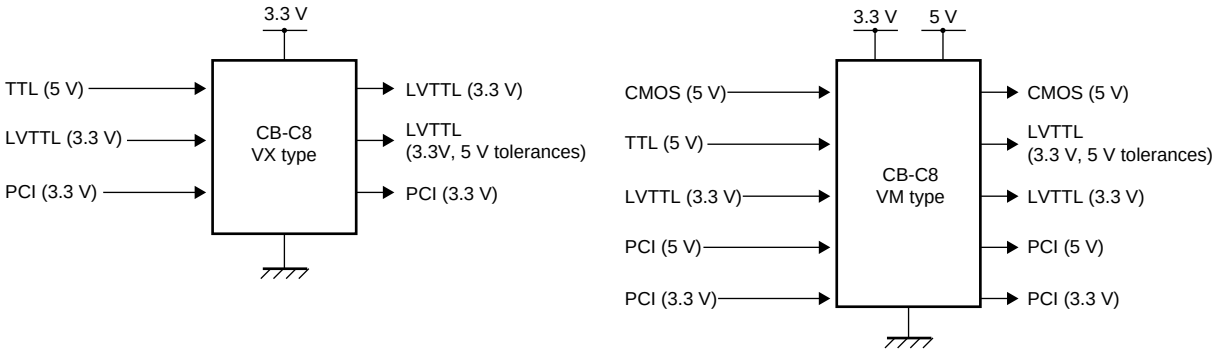
● Features

High-density, power-saving type and 2-power supply type available

VX type : Density 1.5 times (MAX.) higher and power consumption 20% lower than existing type

VM type : 2-power supply full-swing interface in system where 5-V and 3.3-V power sources are used together

Interface level



● Product Outline (VX/VM type)

Type name		VX type	VM type
Part number		μPD97000	μPD99000
Derivative models Note 1		O	O
Technology		0.5 μm rule CMOS (Ti silicide), aluminum 2-layer/3-layer wiring	
Supply voltage		3.3V ± 0.3V, single	Internal: 3.3 V ± 0.3 V I/O block: 5 V ± 10%, 3.3 V ± 0.3 V
Interface level		LVTTL (including 5 V tolerance)	5 V CMOS/TTL LVTTL (including 5 V tolerance)
Number of usable gates Note 2		1000K gates (MAX.)	
Delay time	Internal gate	0.16 ns Note 3/0.34 ns [F/O = 2, L = 1mm]	
	Input buffer	3.3-V LVTTL: 0.26 ns [F/O = 2, L = 1 mm] 5-V tolerant LVTTL: 0.33 ns [F/O = 2, L = 1 mm] 5-V full swing: 0.72 ns [F/O = 2, L = 1 mm]	
	Output buffer	3.3-V LVTTL: 1.24 ns (I_{OL} = 9 mA) [C_L = 15 pF] 5-V tolerant LVTTL: 1.88 ns (I_{OL} = 9 mA) [C_L = 15 pF] 5-V full swing: 2.30 ns (I_{OL} = 9 mA) [C_L = 15 pF]	
Power consumption (internal gate)		Standard block (F, L blocks): 1.04 μW/MHz/gate (3.3 V) Low power consumption block (Y block): 0.75 μW/MHz/gate (3.3 V)	
Output drive capability		I_{OL} = 3, 6, 9, 12, 18, 24 mA [for 3-V interface] I_{OL} = 1, 2, 3, 6. 9 mA [for 5-V interface (5 V tolerance)]	
		—	I_{OL} = 1, 2, 3, 6, 9, 12, 18 mA [for 5-V full swing]

Notes 1. ROM code changeable. O: Derivative models available

2. Number of gates if hard macro is not integrated [2-input NAND gate conversion]

3. 2 NAND power gate

Cell-Based IC

■ CB-C9 Family VX/VM Type

● Features

The CB-C9 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-C9 family VX/VM type

Multi-power supply

- Internal 2.0 V ⟷ External 3.3 V
- Internal 3.3 V ⟷ External 5 V

Many core libraries

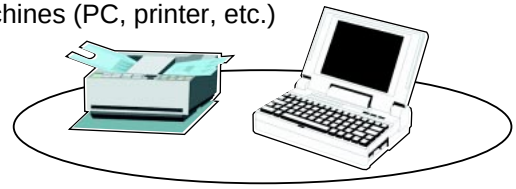
- V850 family™
- 78K/0
- V30MX™
- Z80™
- DSP (SPX)
- RTC
- UART + FIFO
- Parallel IO
- Timer
- PLL
- High-speed/high-density RAM
- High-speed ROM
- LINE BUFFER
- IrDA
- USB (SIE)
- JPEG
- PCI
- PCMCIA
- General-purpose A/D, D/A
- High-speed A/D, D/A

Interface buffer

- PCI
- GTL+
- HSTL
- SSTL
- Rambus™ IO
- USB

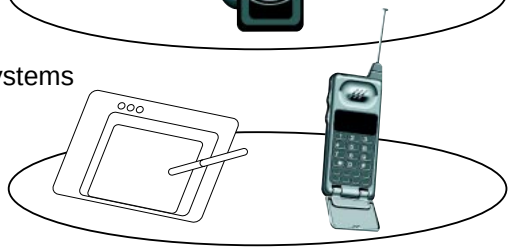
Remark The above cores and buffers include those still under development.

Office machines (PC, printer, etc.)

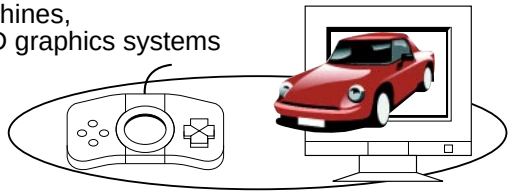


Audio/visual systems (DVC, DVD, etc.)

Portable systems



Game machines,
3D graphics systems



Cell-Based IC

■ CB-C9 Family VX/VM Type

● Product Outline (VX/VM type)

Type name		VX type		VM type	
Part Number		μPD822XX		μPD826XX	
Derivative models Note1		O			
Technology		0.35 μm rule CMOS, aluminum 2-layer/3-layer wiring			
Supply voltage I/O block		3.3 V ± 0.3 V		5.0 V ± 10 %	3.3 V ± 0.3 V
Supply voltage internal block		3.3 V ± 0.3 V	2.0 V ± 0.2 V	3.3 V ± 0.3 V	
Interface level		LVTTL, TTL, 5-V CMOS (VM Type only)			
Number of usable gates Note2		1.7-M usable gate		1.6-M usable gate	
Delay time	Internal gate Note3	114 ps	207 ps	114 ps	114 ps
	Input buffer Note4	169 ps	—	690 ps	169 ps
	Output buffer Note5	864 ps	—	2045 ps	864 ps
Power consumption (internal gate)		0.3 μW/MHz/gate	0.12 μW/MHz/gate	0.3 μW/MHz/gate	

Notes 1. ROM code changeable. O: Derivative models available
2. Number of gates if hard macro is not mounted (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

■ Library

● CPU core

	General-purpose model	CB-C7 (5 V)	CB-C7 (3 V)	CB-C8 (HD)	CB-C8 (VX/VM)	CB-C9 (VX/VM)
Z80	μPD70008A	O	O	O	O	O
V20HL™	μPD70108H	O	O	—	—	—
V30HL™	μPD70116H	O	O	—	—	—
V30MX		O	—	O	O	O
V30MT		—	—	—	O	△
V30MZ		—	—	—	—	O
V30MZC™		—	—	—	—	O
78K/0		—	—	—	—	O
V851™		—	—	—	—	O
V853™		—	—	—	—	O
V850E		—	—	—	—	△
V830 family™		—	—	—	—	
V_R series™		—	—	—	—	

Remark O : can be supported, △: under development, — : cannot be supported, blank : under study

● Features of V850E core

CPU performance (Dhrystone): 87 MIPS (at 66 MHz)

V850 RISC CPU adopting 5-stage pipeline method. The object coding efficiency of C compilation has been improved and the program size has been reduced using 2-byte length basic instructions and instructions compatible with high-level language.

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.

Cell-Based IC

■ Library

● Functional Outline of 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: 1clock Bit manipulation instruction Load/store instruction with long/short format Signed load instruction
Memory space		Program area: 64M bytes linear Data area: 4G byte linear (Internal ROM size: 0 to 1M bytes Internal RAM size: 4K/12K/28K/60K bytes) 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
Interrupt	**Non-maskable**	3
	Maskable	64 (8 priority levels can be specified.)
	Exception	1
DMA control function		4-channel configuration Transfer unit: 8 bits, 16bits, 32bits 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

● NPB Peripheral Macro for V850E Core

Function	Macro name	CB-C9 (VX/VM)
Prescaler	**PRS1**	△
PWM	**PWM**	△
16-bit timer/counter	**TMC**	△
16-bit interval timer	**TMD**	△
UART	**UART5**	△
Serial I/O	**SIO**	△

Remark △: Under development

Cell-Based IC

■ Library

● Features of V851 and V853 core

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

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

Linear address space of up to 4G bytes

Supports linear address space of up to 4G bytes as data area and up to 16M bytes as program area

Instruction set: Completely compatible with V85X series 32-bit single-chip microcontrollers

● Functional Outline of V851 Core

Item		Function
Internal memory	Mask ROM Note	48K, 64K, 96K, 128K, 256K
	RAM	4K, 8K, 16K, 24K
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
Interrupt	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 V853 Core

Item		Function
Internal memory	Mask ROM Note	48K, 64K, 96K, 128K, 256K
	RAM	4K, 8K, 16K, 24K
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
Interrupt	Non-maskable	1
	Maskable	31 (8 priority levels can be specified)
Real-time pulse unit		16-bit timer/event counter: 4 ch 16-bit interval timer: 1 ch
Serial interface		Asynchronous serial interface (UART) Clocked serial interface (CSI) UART/CSI: 2 ch CSI: 2 ch
PWM output		8/9/10/12-bit resolution PWM: 2 ch
Power save function		HALT, STOP, IDLE modes Clock output stop function

Note ROM may not be provided.

Cell-Based IC

■ Library

● Features of 78K/0 core

- Instruction set: Completely compatible with 78K/0 series 8-bit single-chip microcontrollers
- Many peripheral units such as timer, serial interface, and interrupt controller
- Software development environments available

● Functional Outline of 78K/0 Core

Item		Function
General-purpose register		8 bits × 32
Minimum instruction execution time		238.4 ns (at 8.38 MHz)
Instruction set		Multiplication/division (8 bits × 8 bits, 16 bits ÷ 8 bits) Bit manipulation instruction (set, reset, test, Boolean operation)
External bus interface		8-bit data bus (DIN/DOUT separated) 16-bit address bus
Interrupt	Maskable	Internal : 17 External : 12
Port		128 bits MAX. Input : 64 bits (8 bits × 8) Output : 64 bits (8 bits × 8)
Timer		16-bit timer/event counter: 1 ch 8-bit timer (PWM output): 2 chs Watch timer: 1 ch Watchdog timer: 1 ch
Serial interface		Asynchronous serial interface (UART): 2 chs Clocked serial interface (CSI): 2 chs I^2C bus interface: 2 chs
Standby function		HALT, STOP modes

Cell-Based IC

■ Library

● V851, V853, and 78K/0 core dedicated peripheral macros

Function	Macro Name	CB-C9 (VX/VM)
UART	UART	○
Serial I/O	SIO	○
16-bit timer	TM4	○
8/16-bit timer	TM5	○

Remark ○: can be supported

	UART	SIO(CSI)	TM4	TM5
Features	7/8-bit character length	3-wire synchronous serial	16-bit interval timer	8/16-bit timer/event counter
	1/2-bit stop bit length	Transfer clock		8-bit PWM output
	Parity bit spesification	External clock		External pulse output
	None/0/odd/even	fx/2		
	Baud rate generator	fx/8		
	IrDA mode	fx/32		

Dedicated external bus interface for V851, V853, or 78K/0 core is provided with each peripheral macro.
Each peripheral macro can be directly connected to each CPU core.

Cell-Based IC

■ Library

● Features of V30MX series

V30MX core

V30HL upward compatible

2-clock bus cycle realized by separating the address bus and data bus which are multiplexed in the V30HL.

V30MT core

Small and low-power model of V30MX

- Software compatible with V30HL and V30MX
- Low power consumption realized by deleting internal Hi-Z signal

V30MZ core

- Processing performance comparable to RISC thanks to internal pipeline processing
  35 MIPS (66 MHz, 0 wait)
- 1-clock bus cycle
- ICE conforming to N-Wire
- Software compatible with V30HL and V30MX
- 2.0 V supported for CB-C9VX/VM (f_{MAX} = 32 MHz)

V30MZC core

V30MZ with cache memory

- Cache memory capacity: 4K bytes
- 20 MIPS (50 MHz)
- Burst transfer mode supported

CPU core	V30MX	V30MT	V30MZ	V30MZC
Operating frequency	33 MHz	16 MHz	66 MHz	50 MHz
Performance (0 wait)	4.3 MIPS	2.6 MIPS	35 MIPS	20 MIPS
Current consumption	1.0 mA/MHz	0.8 mA/MHz	1.2 mA/MHz	T.B.D.
Bus cycle	2 clocks	2 clocks	1 clock	4 clocks (external) 1 clock between cache and CPU

Remark Specification for CB-C9VX/VM. However, V30MT only is for CB-C8VX/VM

Cell-Based IC

■ Library

● Peripheral macros

Function	General-purpose model	CB-C7 (5 V)	CB-C7 (3 V)	CB-C8 (VX/VM)	CB-C9 (VX/VM)
Serial I/O	μPD71051	O	O	O	O
Timer	μPD71054	O	O	O	O
Parallel I/O	μPD71055	O	O	O	—
Interrupt controller	μPD71059	O	O	O	O
DMAC (8 bits)	μPD71037	O	O	O	—
Watch	μPD4991AL	O	O	O	O
UART + FIFO	NS16550	O	—	O	O
FDC + DVFO	μPD72065B	△	—	△	△
IrDA1.1		—	—	O	O
SIE for USB1.1 full speed		—	—	—	O
USB function controller for printer		—	—	—	△
USB function controller for display				—	△
Line buffer for PPC (7.5 kW)		—	—	—	O

Remark O : can be supported, △: under development, — : cannot be supported, blank : under study

● Analog macros

Function	Performance	CB-C7	CB-C8 (VX/VM)	CB-C9 (VX/VM)
A/D	8 bits, 100 kHz	O	O	O
	10 bits, 100 kHz	—	—	O
	12 bits, 300 kHz	—	—	△
	8 bits, 50 MHz	—	—	△
	10 bits, 30 MHz	—	—	△
D/A	8 bits, 100 kHz (1 ch)	O	O	O
	10 bits, 100 kHz (1 ch)	—	—	O
	8 bits, 20 MHz (3 chs)	O	—	—
	8 bits, 30 MHz (3 chs)	—	O	O
	9 bits, 30 MHz (2 chs)	—	O	—
	10 bits, 30 MHz (3 chs)	—	—	O
	10 bits, 85 MHz (1 ch)	—	—	△
PLL	For multiplication	O	O	O
	For skew adjustment	—	—	O
Analog switch		O	O	O
Comparator		O		—

Remark O : can be supported, △: under development, — : cannot be supported, blank : under study

Cell-Based IC

■ Library

● Compiled macros

Function	Performance	CB-C7 (5 V)	CB-C7 (3 V)	CB-C8 (VX/VM)	CB-C9 (VX/VM)
Multiplier	Signed (32 × 32 MAX.)	O	O	—	
Register file (2 ports)	8K bits MAX.	O	O	O	△
Register file (3 ports)	8K bits MAX.	O	O	O	△
Low-power synchronous 1-port RAM	128K bits MAX.	O	O	O	—
High-density synchronous 1-port RAM	64K bits MAX.	—	—	—	O
High-density synchronous 2-port (R + W) RAM	32K bits MAX.	—	—	—	O
High-speed synchronous 1-port RAM	64K bits MAX.	O	—	—	O
High-speed synchronous 2-port (R/W + R) RAM	64K bits MAX.	—	—	O	O
Super high-speed synchronous 1-port RAM	16K bits MAX.	—	—	—	O
Low-power asynchronous 1-port ROM	512K bits MAX.	O	O	O	—
High-speed synchronous 1-port ROM	512K bits MAX.	—	—	—	O

Remark O: can be supported, △: under development, —: cannot be supported, blank : under study

Embedded Array

■ EA-C9HD Family

● Features (1/2)

High-density, super high-speed, and low-power consumption embedded array using the most advanced 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-C9/9VX)

The EA-C9HD family is a collection of embedded arrays employing a 0.35-μm technology.

This family consists of 10 masters with 76K to 1.6M gates.

The gate density of this family is about 2.5 times higher than that of the existing EA-C9 family 0.35-μm embedded arrays, thanks to improvement of the cell structure.

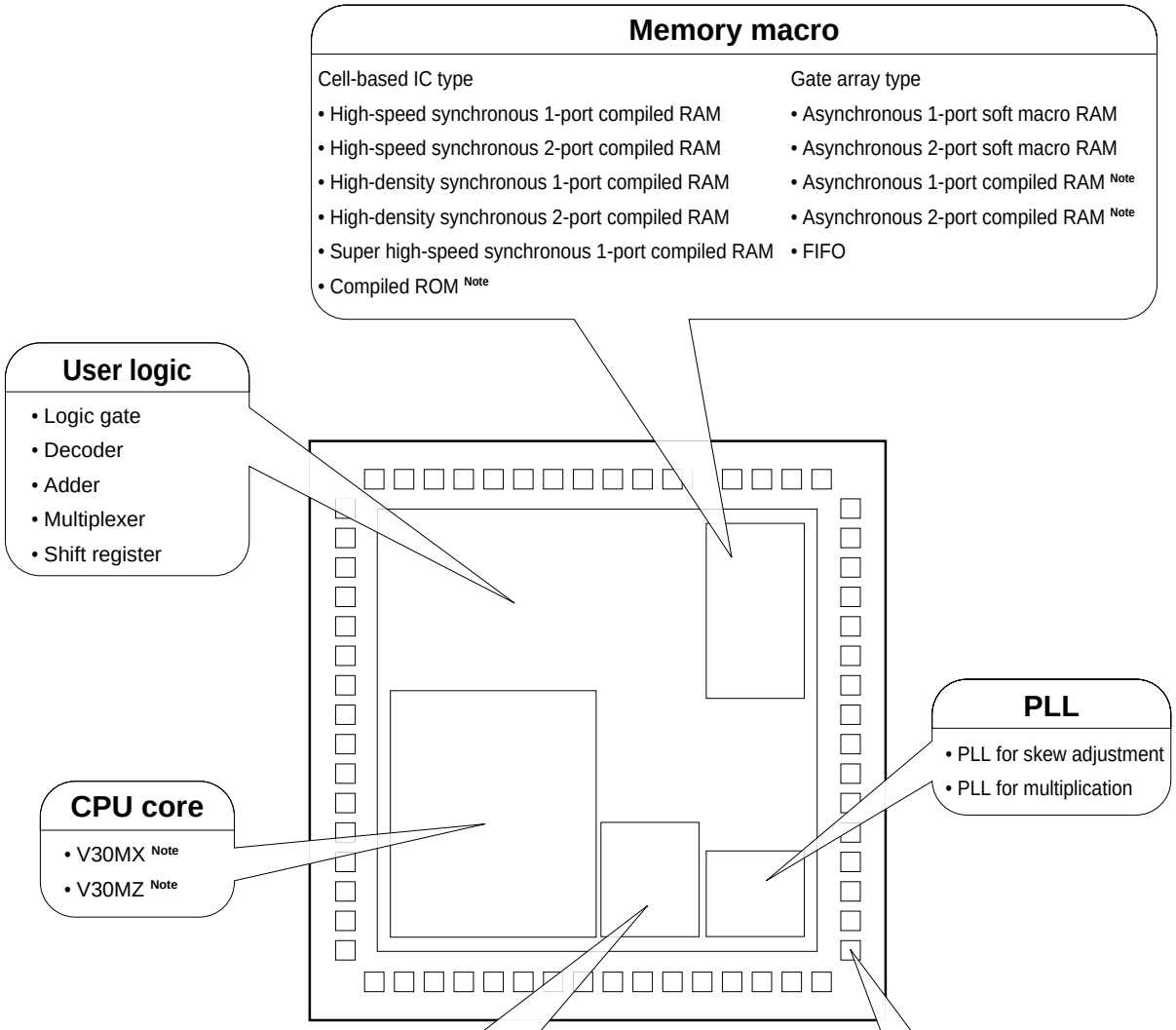
In addition, the power consumption is 40 % lower, and thanks to new I/O pad layout technology, this family offers a large number of pins in addition to the high density.

Embedded Array

■ EA-C9HD Family

● Features (2/2)

Wide variety of macro libraries



Note Macros under development or under study

Embedded Array

■ EA-C9HD Family

● Available Models (3-layer wiring)

		μPD65443	μPD65444	μPD65445	μPD65446	μPD65448	μPD65449	μPD65451	μPD65454	μPD65456	μPD65458
Density	Internal gates*	76720	103032	128872	207000	314104	440832	592020	840768	1104432	1626628
	Number of usable gates**	38360	51516	64436	103500	157052	220416	296010	420384	552216	813314
	Number of pads Note1	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		3.3V ± 0.3V									
Remark		*2-input NAND conversion, **Cell utilization rate: 50 to 70 % Note2									

Notes 1. Including the power supply and GND pins. The number of pins that can be actually used differs depending on the type of package.
2. Differs depending on the number of pin pairs and the occupation rate of the macro.

Analog Master

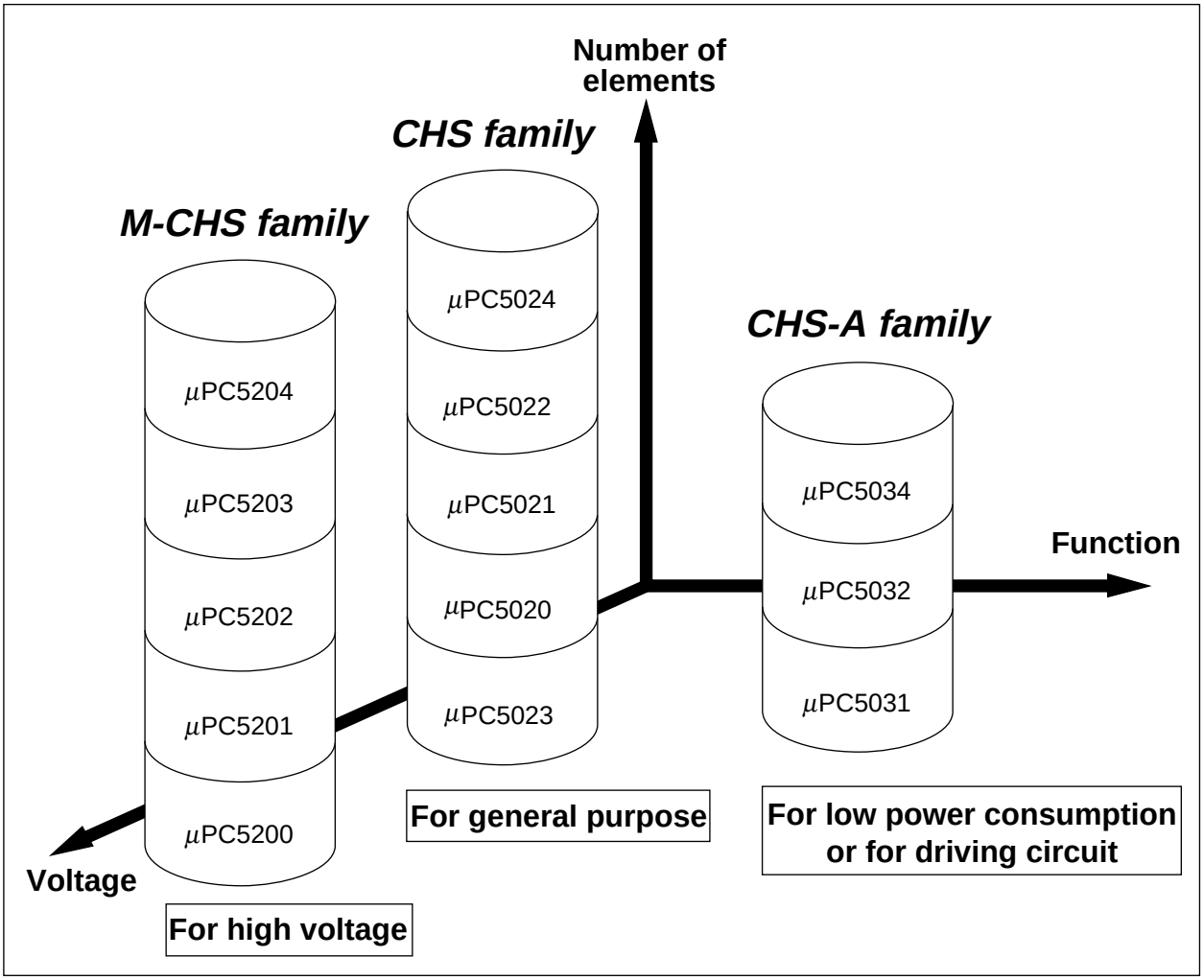
■ Analog Master Line-Up

NEC's analog master is classified into the following 3 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 (3 families 13 masters), user can find the optimum one to realize the user-desired analog LSI.

Line-up and features

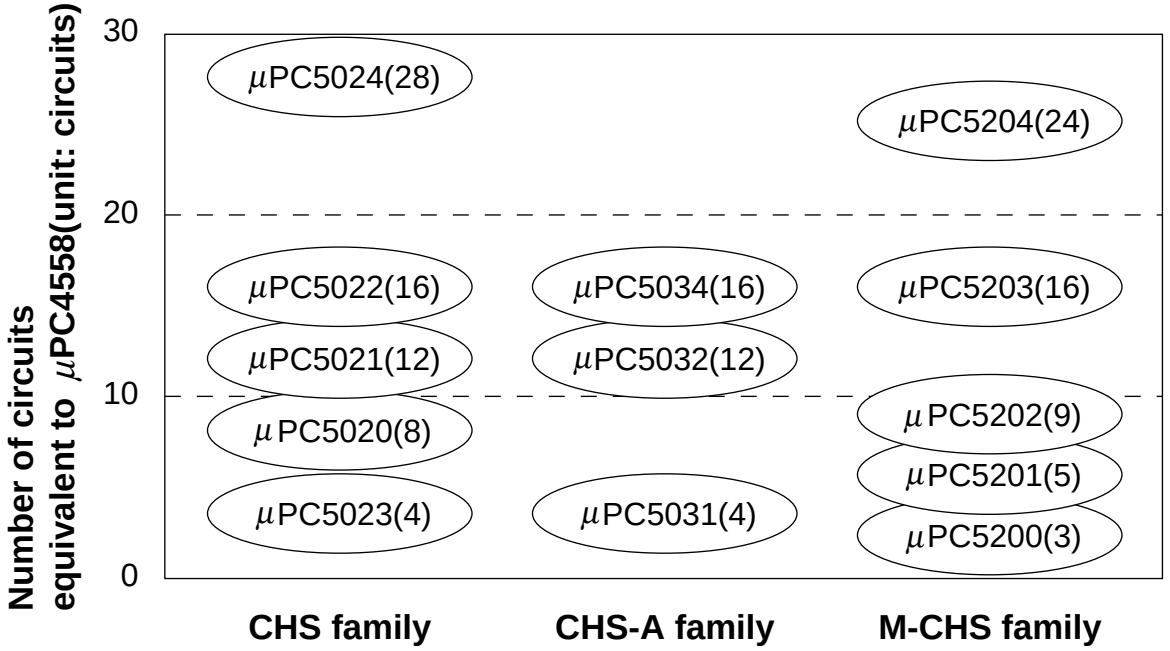


Analog Master

■ Circuit Scale of Each Family

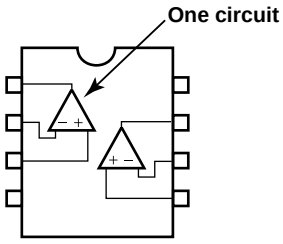
The scale of the circuit that can be integrated on the analog master differs depending on the model of each family.

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

Item \ 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 ≦ several 10 MHz					• Many pins • Internal driver • High resistance		
Part number	μPC5020	μPC5021	μPC5022	μPC5023	μPC5024	μPC5031	μPC5032	μPC5034
Total number of elements	1628	2328	3042	727	6152	576	1472	2252
NPN transistor[Note1]	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]		

Item \ Family Name	M-CHS Family				
Technology	High voltage bipolar				
Absolute maximum ratings	44 V				
Features	• High voltage: $V_{CC\ (MAX.)}$ = 44 V • f ≦ several MHz				
Part number	**μPC5200**	**μPC5201**	μPC5202	μPC5203	μPC5204
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				

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

Mixed Signal ASIC

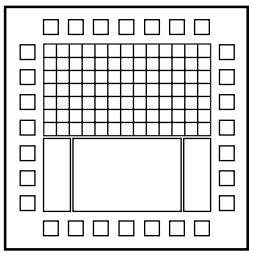
■ Mixed Signal ASIC Product Lines (1/2)

NEC offers mixed digital ASICs that employ the BiCMOS technology with a technology rule of 0.6 μm to 0.35 μm.

Furthermore, NEC supports the world's first analog IP cores through the use of a leading-edge 0.35-μm BiCMOS technology, applying its rich analog circuit design know-how.

An extensive line-up of products is available to answer the wide-ranging needs of users.

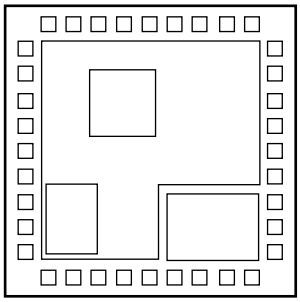
5-V power supply
for small-scale circuits



MA-8 family
(μPD680XX)

0.6-μm BiCMOS technology
Gate array
+ Analog master slice form

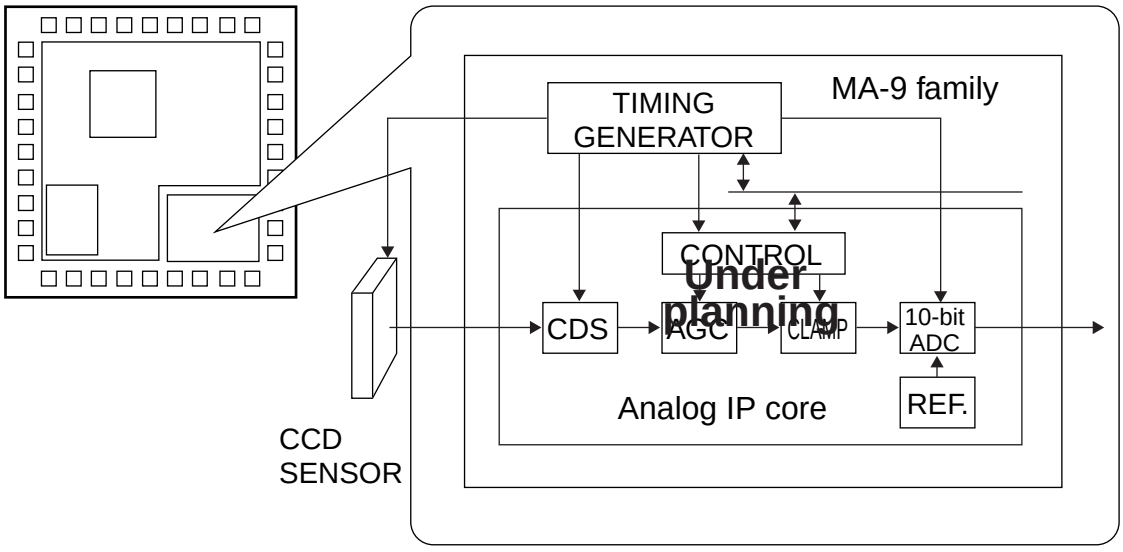
3.3-V power supply
for large-scale systems



MA-9 family
(μPD681XXX)

0.35-μm BiCMOS technology
Cell-based form

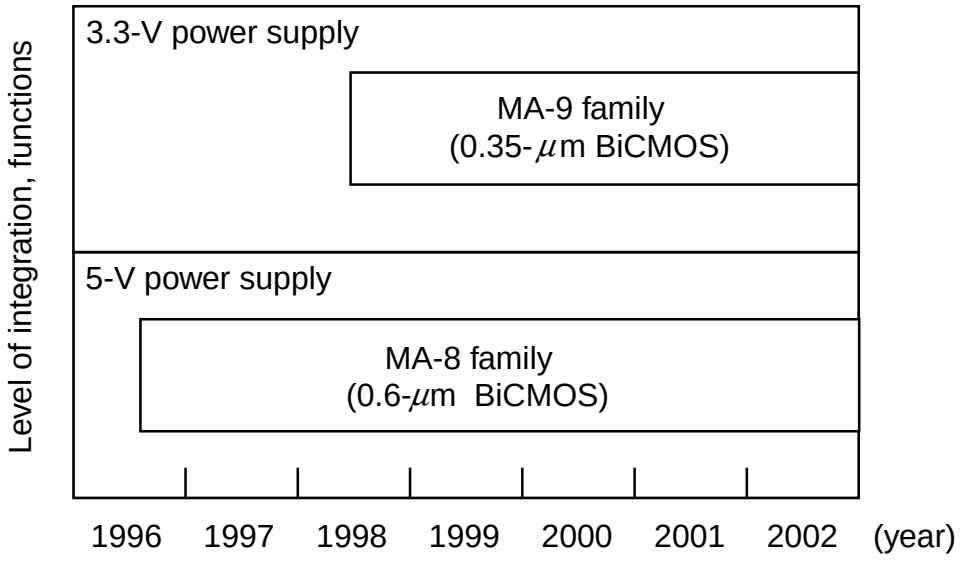
● MA-9 Family Analog IP Core



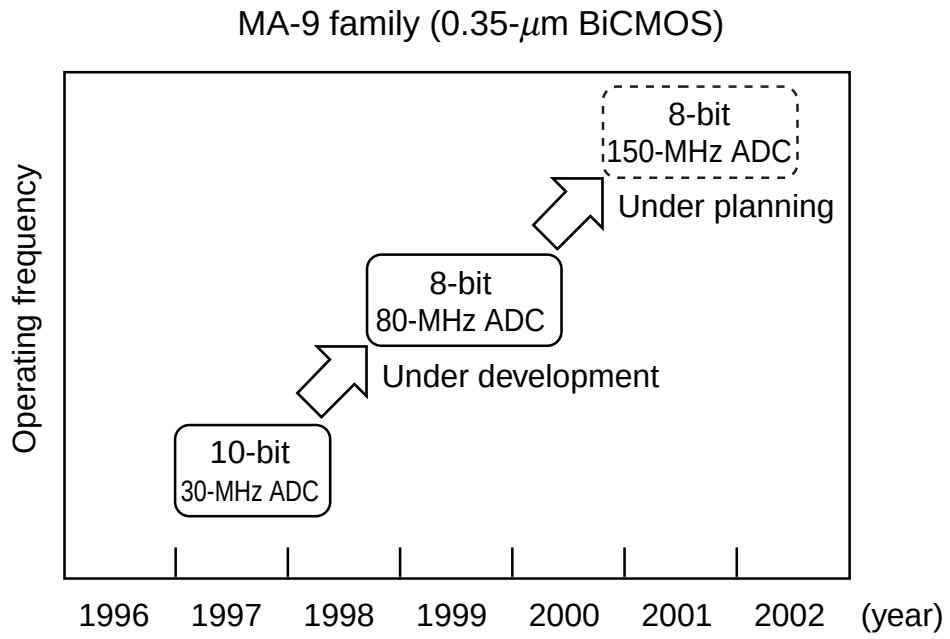
Mixed Signal ASIC

■ Mixed Signal ASIC Product Lines (2/2)

● Mixed Signal ASIC Family Evolution



● Mixed Signal ASIC Analog Core Evolution



Mixed Signal ASIC

■ MA-8 Family (0.6-μm Mixed Signal ASIC)

● Features

The MA-8 Family (μPD680××) consists of top-level mixed signal ASICs that employ the latest high-cost-performance BiCMOS technology.

This family achieves the integration of mixed digital/analog circuits on a single chip, which will be pivotal for the development of the multimedia market.

Support of digital/analog mixed circuits

By employing the latest BiCMOS technology, the MA-8 Family realizes the integration of 0.6-μm CMOS gate array and analog ASIC (analog master) on a single chip.

Analog block element configuration prioritizing circuit functions

Analog circuits that mix bipolar transistors and CMOS transistors can be created through the use of the BiCMOS technology:

High input impedance operational amplifiers
Sample and hold circuits
Analog switches, etc.

Simple design and short development time

The logic block can be easily developed with OPENCAD (NEC' s original CAE tool).

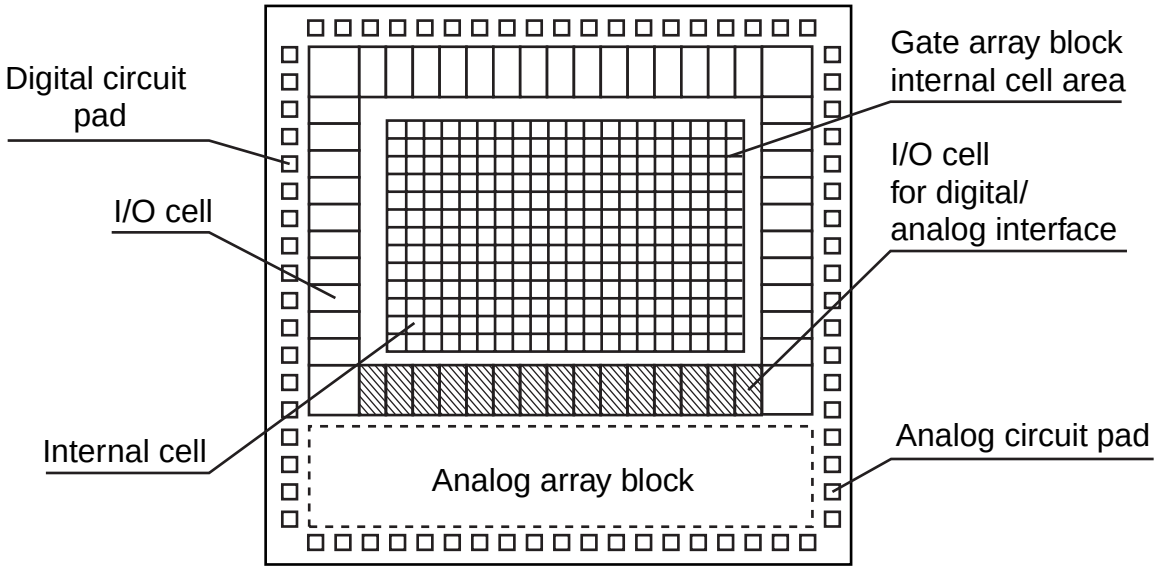
Furthermore, a short development time can be achieved, which is another advantage of ASICs.

Mixed Signal ASIC

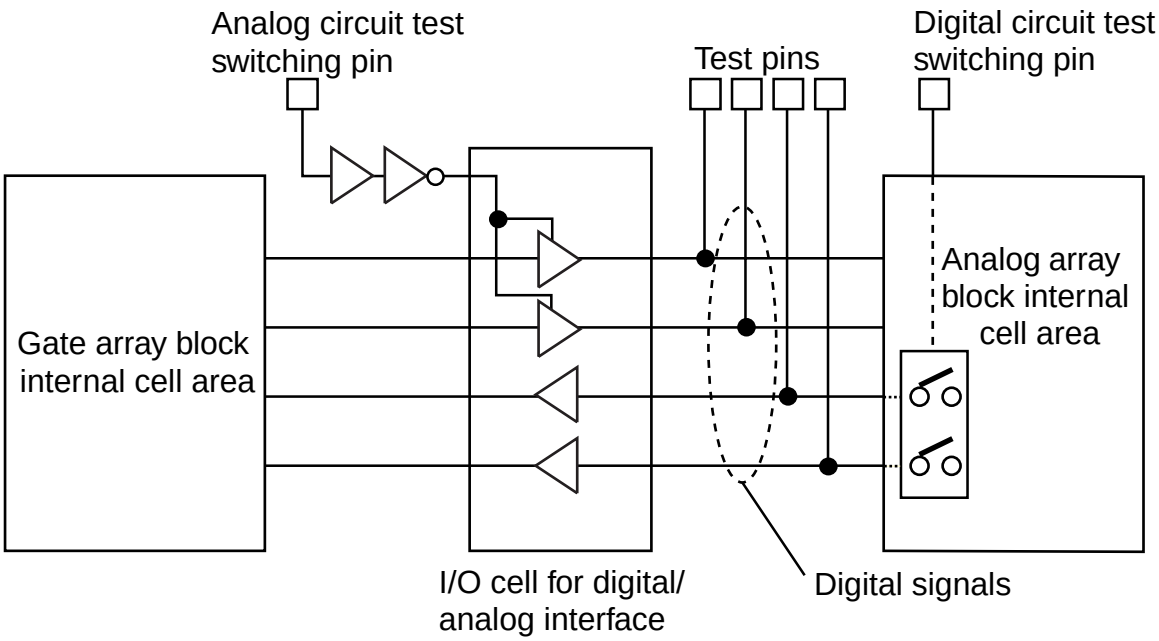
■ MA-8 Family (0.6-μm Mixed Signal ASIC)

● Chip Configuration

The MA-8 Family is mainly composed of a gate array block and an analog array block. The I/O cells for the digital/analog interface perform input/output of digital signals between the gate array block and the analog array block.



I/O Cells for Digital/Analog Interface



Mixed Signal ASIC

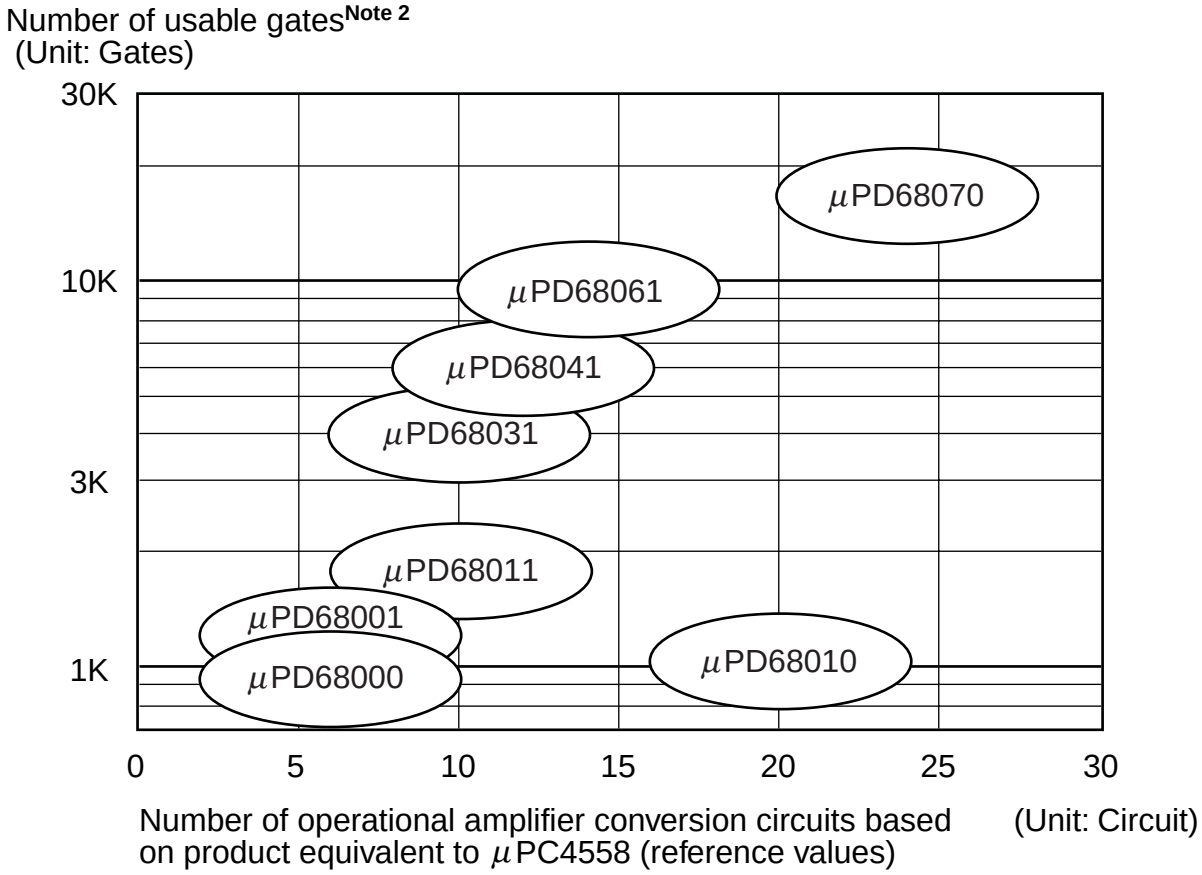
■ MA-8 Family (0.6-μm Mixed Signal ASIC)

● Master Size

The MA-8 Family offers eight masters, based on the gate array block size, the analog array block size, and whether the analog array block has MOS transistors.

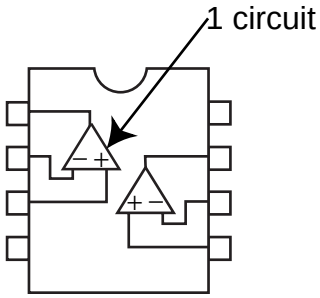
The figure below shows the master block size in terms of the number of usable gates and the number of circuits[Note 1] calculated as general-purpose operational amplifier circuits corresponding to the μPC4558.

MA-8 Family Master Sizes



Notes 1. The two operational amplifiers mounted on the package (8-pin DIP) of the μPC4558 general-purpose amplifier are each treated as one circuit.
Moreover, the numbers of conversion circuits indicated in the figure above are merely reference values for the case when only operational amplifiers are mounted on the analog array block, and operational amplifier peripheral circuits (such as feedback circuits) are not included.
In particular when selecting products, estimate the circuit scale considering their peripheral circuits.

2. Gate utilization rate: 60%



Remark The presence of analog MOS transistors and analog switches on the analog array block.
- Mounted : μPD68000, 68010, 68070
- Not mounted : μPD68001, 68011, 68031, 68041, 68061

Mixed Signal ASIC

■ MA-8 Family (0.6-μm Mixed Signal ASIC)

● Element List

Part Number		μPD68000	μPD68001	μPD68010	μPD68011	μPD68031	μPD68041	μPD68061	μPD68070
Technology		High-performance BiCMOS technology							
Maximum supply voltage		6.0 V (absolute maximum rating)							
Number of pads		68	68	108	84	96	108	128	168
Logic block									
Number of gates		1520	1520	1680	2880	6720	9520	16512	28320
Number of usable gates[Note]		912	912	1008	1728	4032	5712	9907	16992
Number of logic I/Os		23	23	31	32	44	53	68	88
Analog block									
Total number of elements		912	1264	4614	2016	2016	2304	2736	5017
NPN transistor	(Standard)	150	210	756	336	336	384	456	816
	(Large type)	25	35	126	56	56	64	76	136
PNP transistor (Lateral)		200	280	1008	448	448	512	608	1088
Polysilicon resistor	(1 kΩ)	150	210	756	336	336	384	456	816
	(5 kΩ)	300	420	1512	672	672	768	912	1632
Capacitor (5 pF)		25	35	126	56	56	64	76	136
P-ch MOS transistor		50	70	252	112	112	128	152	272
Analog SW		4	0	24	0	0	0	0	15
P-ch MOS transistor for analog		4	2	28	0	0	0	0	58
N-ch MOS transistor for analog		4	2	26	0	0	0	0	48
Digital/analog junction block									
Digital/analog I/F (Maximum)		14	14	36	14	14	14	14	24

Note Gate utilization rate: 60%

Remark The last digit in the part number of MA-8 Family products indicates the presence/absence of analog MOS transistors and analog switches in the analog array block, as follows:

Last digit = 0 ⟶ Mounted
Last digit = 1 ⟶ Not mounted

Mixed Signal ASIC

■ MA-8 Family (0.6-μm Mixed Signal ASIC)

● Basic Specifications

Logic Block

Product Name		μPD680XX
Technology		0.6-μm BiCMOS technology
Supply Voltage		5.0 V ± 0.5 V (I/O block, internal gates)
Maximum integration (logic only)		17K gates (usable)
Interface level		CMOS, TTL
Delay time	Internal gates[Note 1]	190 ps (TYP.)
	Input buffer[Note 2]	340 ps (TYP.)
	Output buffer[Note 3]	2.13 ns (TYP.)

Notes 1. Value assuming 2-input NAND power gate, fanout: 1, and wiring length: 0.6 mm/1 pin pair.
2. Value assuming fanout: 2, wiring length: 0.6 mm/1 pin pair.
3. Value assuming load capacitance: 15 pF, block name: FO01.

Analog Block

Product Name		μPD680XX
Technology		0.6-μm BiCMOS technology
Supply Voltage		5.0 V ± 0.5 V
Transistor	NPN type	f_T = 10 GHz, h_{FE} = 80 (all TYP.)
	PNP type (Lateral)	f_T = 10 MHz, h_{FE} = 70 (all TYP.)
	MOS	N-ch type, P-ch type for analog circuit
Polysilicon resistor[Note]		Absolute precision: ±20%, relative precision: ±2% (all MAX.)
Capacitor (MOS type)[Note]		Absolute precision: ±15%, relative precision: ±2% (all MAX.)

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-8 Family (0.6-μm Mixed Signal ASIC)

● Electrical Characteristics

Absolute Maximum Ratings

Item	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{DD},V_{CC}		–0.5 to +6.0	V
Input/output voltage (logic block)	V_I / V_O		–0.5 to V_{DD} + 0.5	V
Input current (logic block)	I_I		20	mA
Output current (logic block)	I_O	I_{OL} = 3 mA	10	mA
		I_{OL} = 6 mA	15	mA
		I_{OL} = 9 mA	20	mA
		I_{OL} = 12 mA	30	mA
		I_{OL} = 18 mA	40	mA
		I_{OL} = 24 mA	60	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 rating 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.

Mixed Signal ASIC

■ MA-9 Family (0.35-μm Mixed Signal ASIC) New Products

● Features

The MA-9 Family (μPD68155) consists of leading-edge mixed signal ASICs that aim for system-on-a-chip through the use of a leading-edge 0.35-μm BiCMOS technology pioneered by NEC.

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

Support of world's first analog IP core

NEC supports the world's first analog IP 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 an analog IP core, high-speed ADC and DAC and other analog cores, digital/analog mixed circuits, etc.

Leading-edge BiCMOS technology

High-speed digital circuits and high-accuracy, sophisticated analog circuits can now be realized on a single chip by employing NEC's leading-edge 0.35-μm 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.

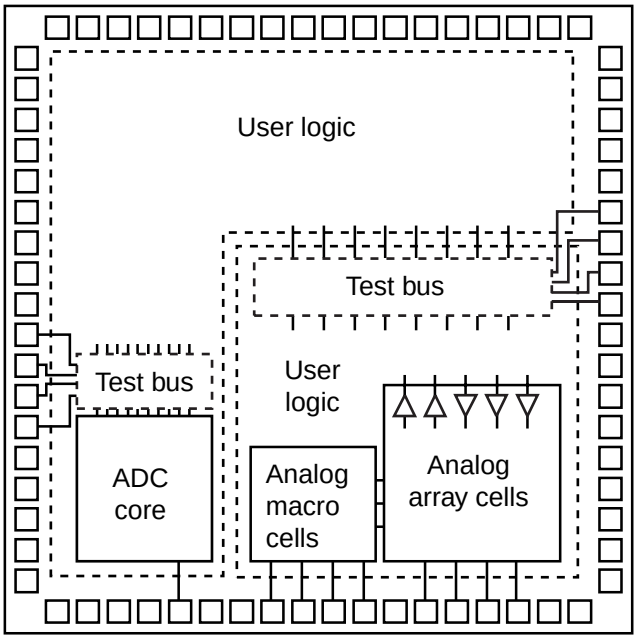
Moreover, for circuit blocks, for which analog characteristics particularly matter, NEC supports a development environment that enables the use of macro cells.

Mixed Signal ASIC

■ MA-9 Family (0.35-μm Mixed Signal ASIC) New Products

● Chip Configuration

The MA-9 Family features a digital/analog mixed circuit configured as a core (mixed signal core) as 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 (0.35-μm Mixed Signal ASIC) New Products

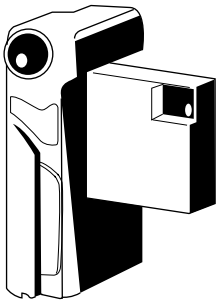
● Analog IP Cores (1/2)

The MA-9 Family combines NEC's rich analog circuit design technology and NEC's analog ASIC technology cultivated through its analog master products, supporting analog IP cores through the use of the world's first leading-edge BiCMOS technology.

In the area of digital/analog mixed circuits, NEC provides already custom designed analog circuits that require advanced circuit technology as IP 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.

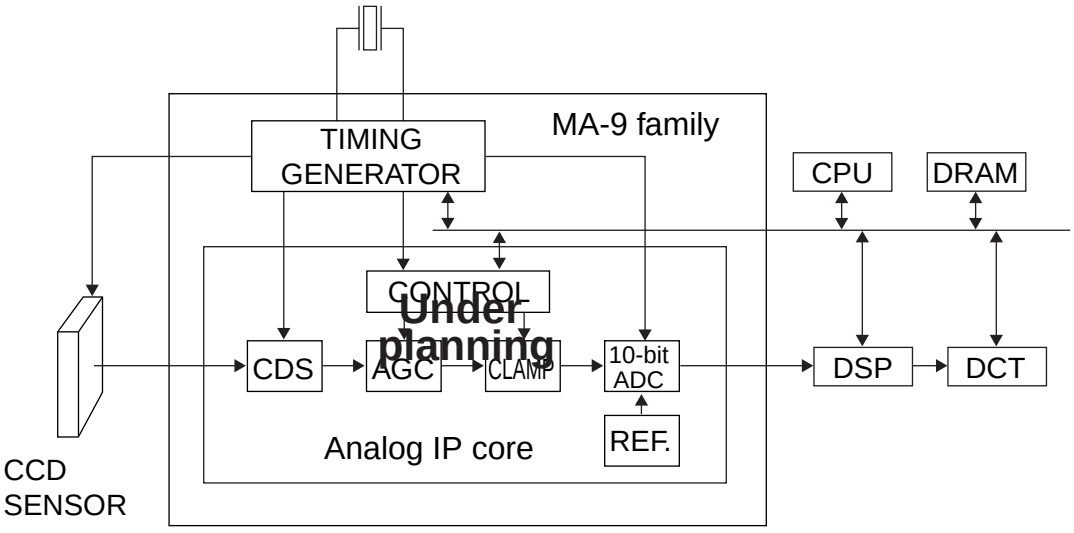


Under planning

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

Application Example (Digital Still Camera)



Mixed Signal ASIC

■ MA-9 Family (0.35-μm Mixed Signal ASIC) New Products

● Analog IP Cores (2/2)

High-Speed ADC Cores for Video

The MA-9 Family supports high-speed ADC cores as ASIC cores through the use of the world's most advanced 0.35-μm BiCMOS technology.

NEC has realized high-speed ADC, which is difficult to realize with a CMOS technology, through optimum design using CMOS transistors and bipolar transistors that can created only by employing the BiCMOS technology.

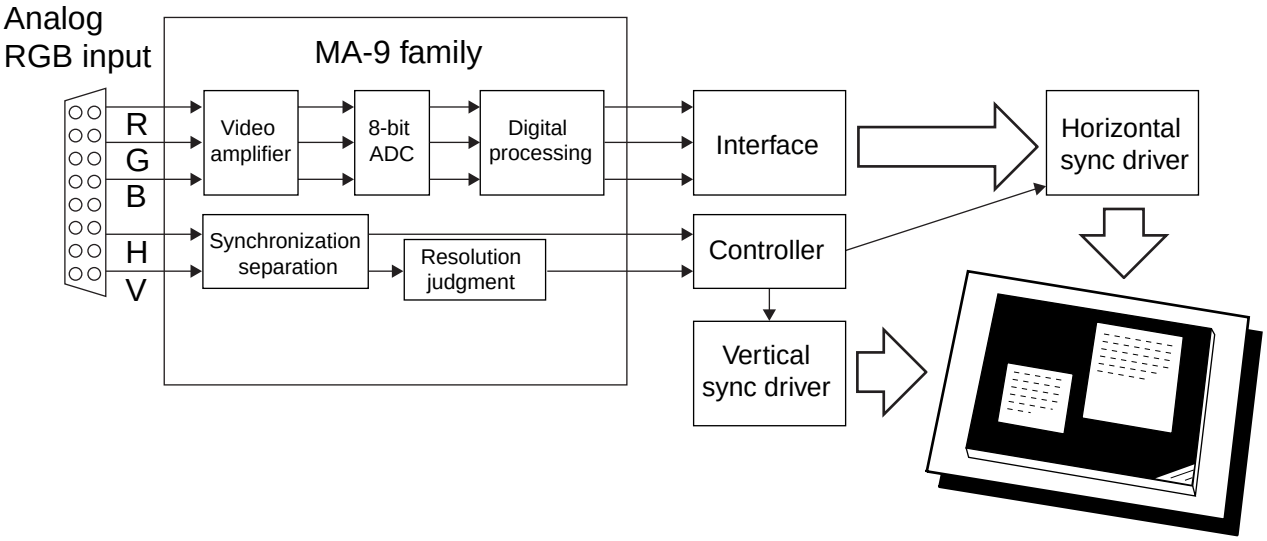
Moreover, by offering these ADCs as cores, NEC makes these products available for a wide range of applications.

For video	8-bit 80-MHz	**Under development**

Application Example (LDC 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 (0.35-μm Mixed Signal ASIC) New Products

● Analog Core

ADC Core

NEC provides both video and general-purpose ADC cores.

For video	10-bit 30 MHz	V_{DD} = 3.3 V (TYP) , I_{DD} = 60 mA (TYP)
		Differential linearity error : ±1.0 LSB (MAX) Integral linearity error : ±2.0 LSB (MAX) Analog input range : 0.8 to 1.8 V
	10-bit 15 MHz	V_{DD} = 3.3 V (TYP) , I_{DD} = 30 mA (TYP)
		Differential linearity error : ±1.0 LSB (MAX) Integral linearity error : ±2.0 LSB (MAX) Analog input range : 0.8 to 1.8 V
General-purpose	10-bit 100 kHz	V_{DD} = 3.3 V (TYP) , I_{DD} = 1.5 mA (TYP)
		Differential linearity error : ±1.0 LSB (MAX) Integral linearity error : ±2.0 LSB (MAX) Analog input range : 0.3 to 3.0 V
	8-bit 100 kHz	V_{DD} = 3.3 V (TYP) , I_{DD} = 0.6 mA (TYP)
		Differential linearity error : ±1.0 LSB (MAX) Integral linearity error : ±2.0 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 V (TYP) , I_{DD} = 7 mA (TYP)
		Differential linearity error : ±1.0 LSB (MAX) Integral linearity error : ±2.0 LSB (MAX) Analog output voltage : 1.2 to 2.2 V
	8-bit 30 MHz	V_{DD} = 3.3 V (TYP) , I_{DD} = 5 mA (TYP)
		Differential linearity error : ±0.5 LSB (MAX) Integral linearity error : ±1.5 LSB (MAX) Analog output voltage : 1.4 to 2.4 V
General-purpose	10-bit 100 kHz	V_{DD} = 3.3 V (TYP) , I_{DD} = 40 μA (TYP)
		Differential linearity error : ±1.0 LSB (MAX) Integral linearity error : ±1.0 LSB (MAX) Analog output voltage : 0 to 3.2 V
	8-bit 100 kHz	V_{DD} = 3.3 V (TYP) , I_{DD} = 20 μA (TYP)
		Differential linearity error : ±1.0 LSB (MAX) Integral linearity error : ±1.0 LSB (MAX) Analog output voltage : 0 to 3.2 V

Mixed Signal ASIC

■ MA-9 Family (0.35-μm Mixed Signal ASIC) New Products

● Basic Specifications

Logic Block

Product Name		μPD681XX
Technology		0.35-μm BiCMOS technology
Supply Voltage		3.3 V ±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		μPD681XX
Technology		0.35-μm BiCMOS technology
Supply Voltage		3.3 V ±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: ±20%, relative precision: ±2%
Capacitor (MIM type)[Note]		Absolute precision: ±20%, relative precision: ±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 (0.35-μm Mixed Signal ASIC) New Products

● Electrical Characteristics

Absolute Maximum Ratings

Item	Symbol	Conditions	Rating	Unit
Supply voltage	V_{DD}			
3.3-V			–0.5 to +4.6	V
I/O voltage	V_I/V_O			
LVTTL buffer		$V_I/V_O < V_{DD} + 0.5$ 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 rating 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.

[MEMO]

Particular Purpose IC

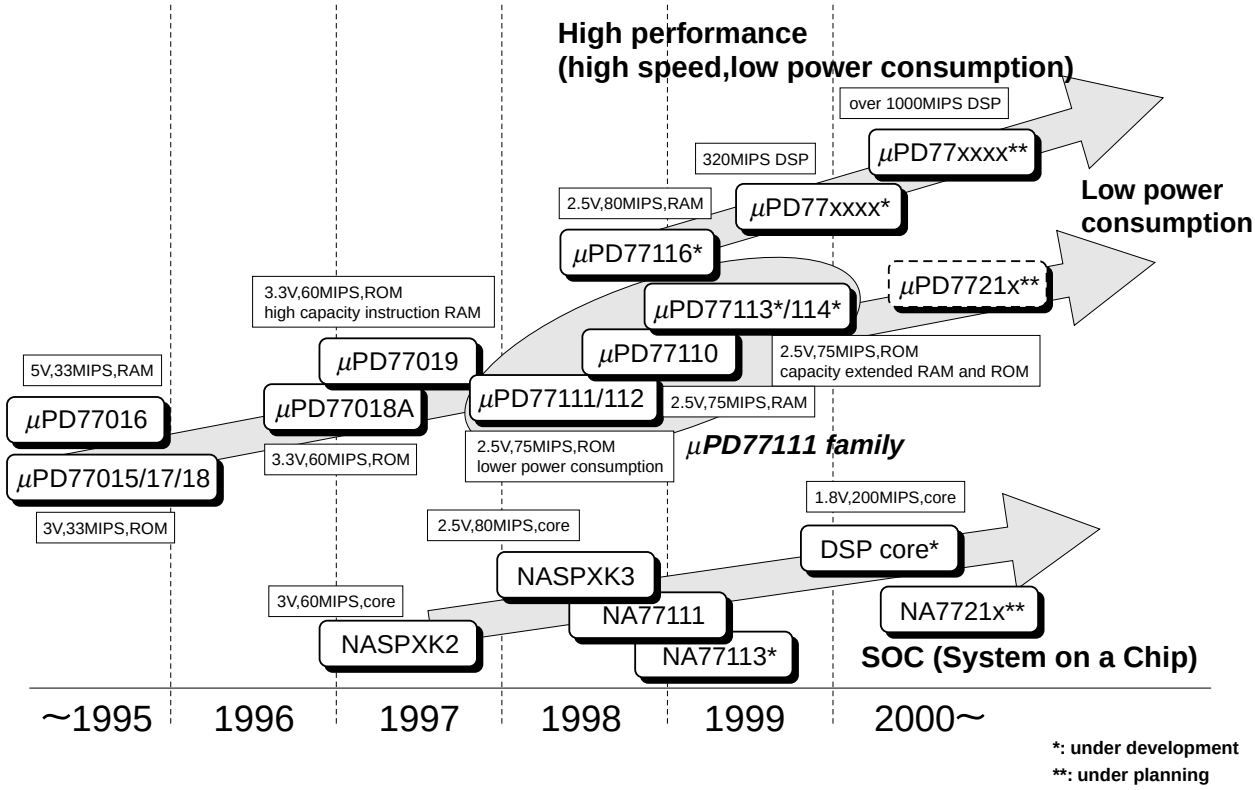
DSP

		μPD77016	μPD77018A	μPD77019	μPD77019-013
Instruction cycle (ns)		30	16.7	16.7	16.7
Data type		fixed point decimal	fixed point decimal	fixed point decimal	fixed point decimal
Multiplier precision (bits)		40 + 16 × 16 → 40	40 + 16 × 16 → 40	40 + 16 × 16 → 40	40 + 16 × 16 → 40
ALU precision (bits)		40	40	40	40
Internal memory (words × bits)	Program ROM	–	24K × 32	24K × 32	–
	Program RAM	1.5K × 32	256 × 32	4K × 32	4K × 32
	Data ROM	–	24K × 16	24K × 16	–
	Data RAM	4K × 16	6K × 16	6K × 16	6K × 16
External memory (words × bits)		48K × 32 (program) 96K × 16 (data)	32K × 16 (data)	32K × 16 (data)	32K × 16 (data)
Power supply		5.0 V	3.0 V	3.0 V	3.0 V
Power consumption (TYP.)		4.2 mA/MHz (@5.0 V)	1.0 mA/MHz (@3.0 V)	1.1 mA/MHz (@3.0 V)	1.1 mA/MHz (@3.0 V)
Package		• 160-pin QFP	• 100-pin TQFP • 116-pin FBGA	• 100-pin TQFP	• 100-pin TQFP

		μPD77110	μPD77111	μPD77112
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 × 16 → 40	40 + 16 × 16 → 40	40 + 16 × 16 → 40
ALU precision (bits)		40	40	40
Internal memory (words × bits)	Program ROM	–	32K × 32	32K × 32
	Program RAM	35.5K × 32	1K × 32	1K × 32
	Data ROM	–	32K × 16	32K × 16
	Data RAM	48K × 16	6K × 16	6K × 16
External memory (words × bits)		64K × 16 (data)	–	32K × 16 (data)
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 (@2.5 V)	0.4 mA/MHz (@2.0 V) 0.5 mA/MHz (@2.5 V)	0.4 mA/MHz (@2.0 V) 0.5 mA/MHz (@2.5 V)
Package		• 100-pin TQFP	• 80-pin TQFP • 80-pin FBGA	• 100-pin TQFP

DSP

■ DSP Development Plan



*: under development
**: under planning

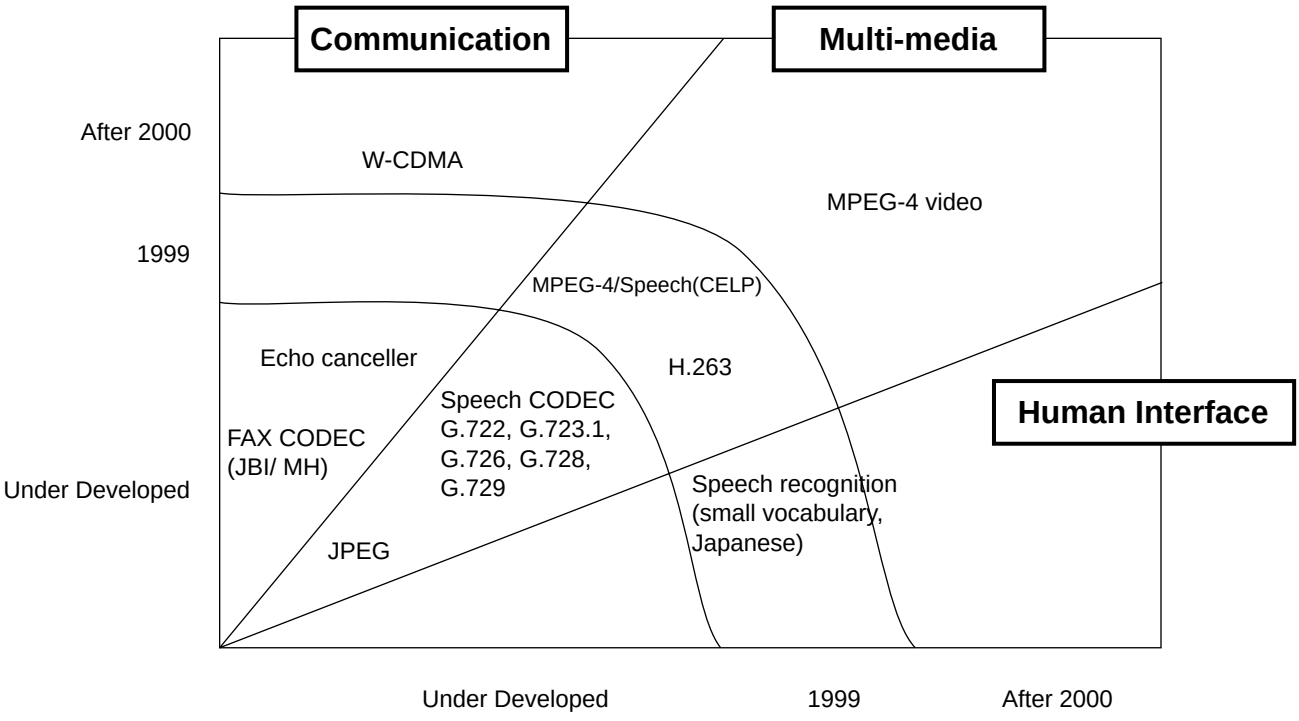
DSP

■ DSP Middleware

Field	Middleware		μPD77016 family
Image	JPEG		sample
	H.263		△
Speech	G.722		◎
	G.723.1		◎
	G.723.1 ANNEX A/C		◎
	G.726 (ADPCM)		◎
	G.728 (LDCELP)		◎
	G.729		◎
	G.729 ANNEX A/B		◎
	MPEG-4/Speech (CELP)		○
	Echo canceller (for hands-free operation)		◎
Recognition	Speech recognition (Japanese)	Small vocabulary	△
		1000 words	–

Remark ◎: Developed, ○: Under development, △: Under planning

■ DSP Middleware Development Plan



CCD Linear Image Sensor

■ Monochrome

Part number	**μPD3753**	**μPD3734A**	**μPD3739**
Pixel number	2088	2660	5000
Resolution (dpi/sheet)	200/B4	300/A4	400/A3
Pixel size (μm)	14 × 14	11 × 11	7 × 7
Sensitivity (TYP.) (V/lx•s)	90	70	9.0
Data rate (MAX.) (MHz)	2	5	40 (20 × 2)
Readout method	single-sided	dual-sided	
Output (ch)	1		2 (in or out of phase)
S/H circuit	–	○	–
Package	22-pin plastic DIP (400 mil)	22-pin plastic DIP (400 mil)	22-pin ceramic DIP (CERDIP) (400 mil)
Features	5 V power supply	Low image lag	μPD35H71A pin compatible

Light source of the Sensitivity: Daylight color fluorescent lamp

■ Color

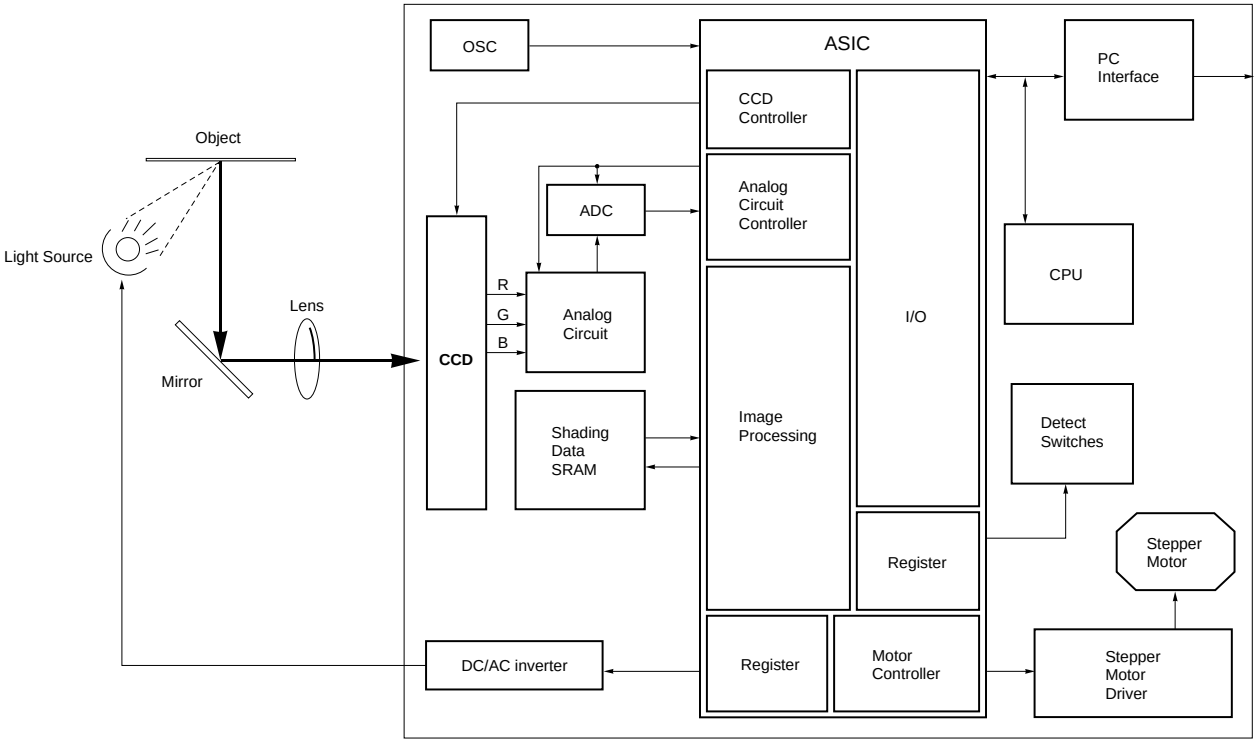
Part number		**μPD3794**	**μPD3797**	**μPD3799**
Pixel number		2700 × 3	5300 × 3	
Resolution (dpi/sheet)		300/A4	600/A4	
Pixel size (μm)		8 × 8	7 × 7	
Sensitivity (TYP.) (V/lx•s)	R	14.6	11.2	
	G	13.3	10.2	
	B	8.00	6.10	
Line spacing		4 (32 μm)	4 (28 μm)	
Data rate (MAX.) (MHz)		4	3	4
Readout method		single-sided		
Output (ch)		1	3	
Clamp pulse generator		○	–	○
Package		22-pin plastic DIP (400 mil)	32-pin plastic DIP (glass cap) (400 mil)	32-pin plastic DIP (plastic cap) (400 mil)
Features		On-chip multiplexer	On-chip S/H circuit	upgraded from μPD3797

Part number		**μPD3719**	**μPD3729**	**μPD3728**
Pixel number		10600 × 3	5000 × 3	7300 × 3
Resolution (dpi/sheet)		1200/A4	400/A3	600/A3
Pixel size (μm)		7 × 7	10 × 10	
Sensitivity (TYP.) (V/lx•s)	R	9.70	6.20	5.60
	G	8.80	5.40	5.10
	B	5.30	6.80	6.40
Line spacing		10 (70 μm)	4 (40 μm)	
Data rate (MAX.) (MHz)		2	30 (15 × 2)	40 (20 × 2)
Readout method		single-sided	dual-sided	
Output (ch)		3	6 (2-output/color (in phase))	
Clamp pulse generator		–		
Package		36-pin ceramic DIP (600 mil)	24-pin ceramic DIP (400 mil)	36-pin ceramic DIP (600 mil)
Features		V_{sat}: 4.0 V (MIN.), 15 V power supply, for professional color image scanners	High speed, for digital copiers	

Light source of the Sensitivity: 3200K halogen lamp + C-500S (infrared cut filter, t = 1 mm)

CCD Linear Image Sensor

■ CCD Linear Image Sensor System Block Diagram

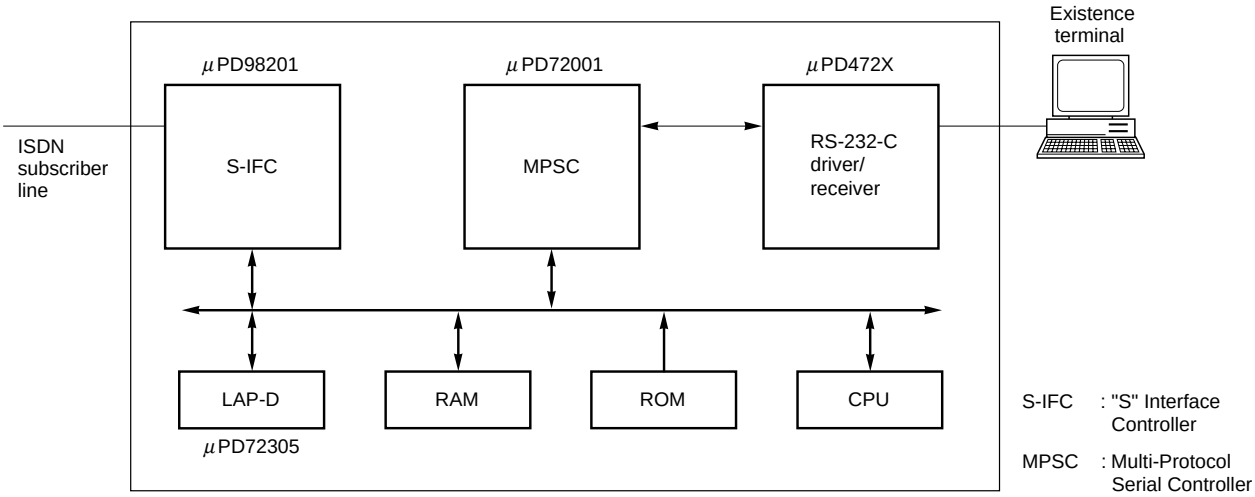


Communication IC

■ Communication LSI

Part number	Function	Features	Package
μPD72001-11	Multi-protocol serial controller	Allows communication in ASYNC, COP, and BOP mode (2 ch) μPD72001-11: 5 V Operation μPD72001-A8: 3.3 V Operation	• 40-pin DIP • 52-pin QFP • 52-pin QFJ • 44-pin TQFP
μPD72001-A8			• 40-pin DIP • 44-pin TQFP • 52-pin QFP
μPD72002-11	Multi-protocol serial controller	Allows communication in ASYNC, COP, and BOP mode (1 ch)	• 40-pin DIP • 44-pin QFP • 44-pin QFJ • 44-pin TQFP
μPD72103A	HDLC controller	HDLC frame control, link/separation are possible, internal DMA controller 8 Mbps operation	• 68-pin QFJ • 80-pin QFP
μPD72107	Packet communication control LSI (X.25 communication control)	Conforms ITU-T recommendation X.25 (LAP-B '84 ver)	• 64-pin shrink DIP • 68-pin QFJ • 80-pin QFP
μPD72305	LAP-D protocol processing LSI	Supports LAP-D protocol of ITU-T recommendation	• 64-pin shrink DIP • 68-pin QFJ • 80-pin QFP
μPD98201	S interface transceiver for NT or TE	4-wire full duplexed communication (basic access) Conforms to ITU-T recommendation I430	• 64-pin QFP
μPD98203	S interface transceiver for NT	Conforms to ITU-T recommendation I430	• 20-pin DIP
μPD6708	IE Bus™ controller/driver	Transmit data buffer: 4 bytes Receive data buffer: 20 bytes	• 16-pin SOP • 16-pin DIP
μPD72042A **μPD72042B**		Transmit data buffer: 33 bytes Receive data buffer: 40 bytes	• 16-pin SOP

■ ISDN Terminal Adapter

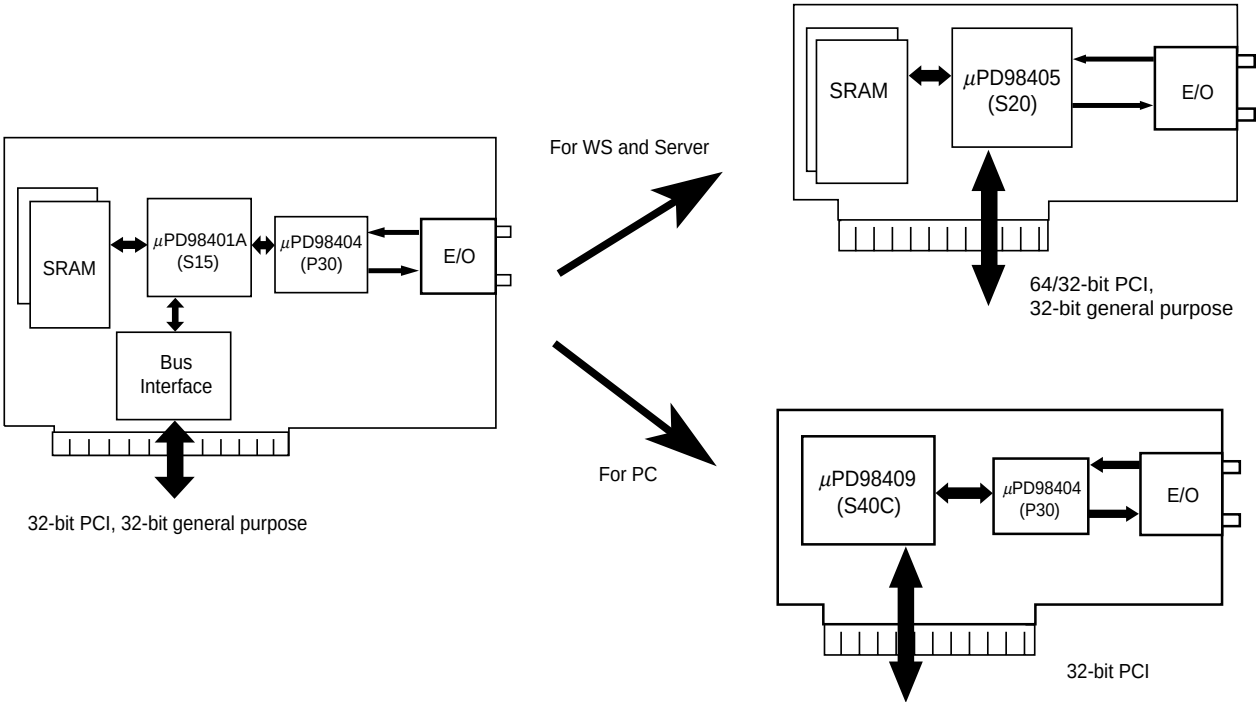


Communication IC

■ Chip Set for ATM

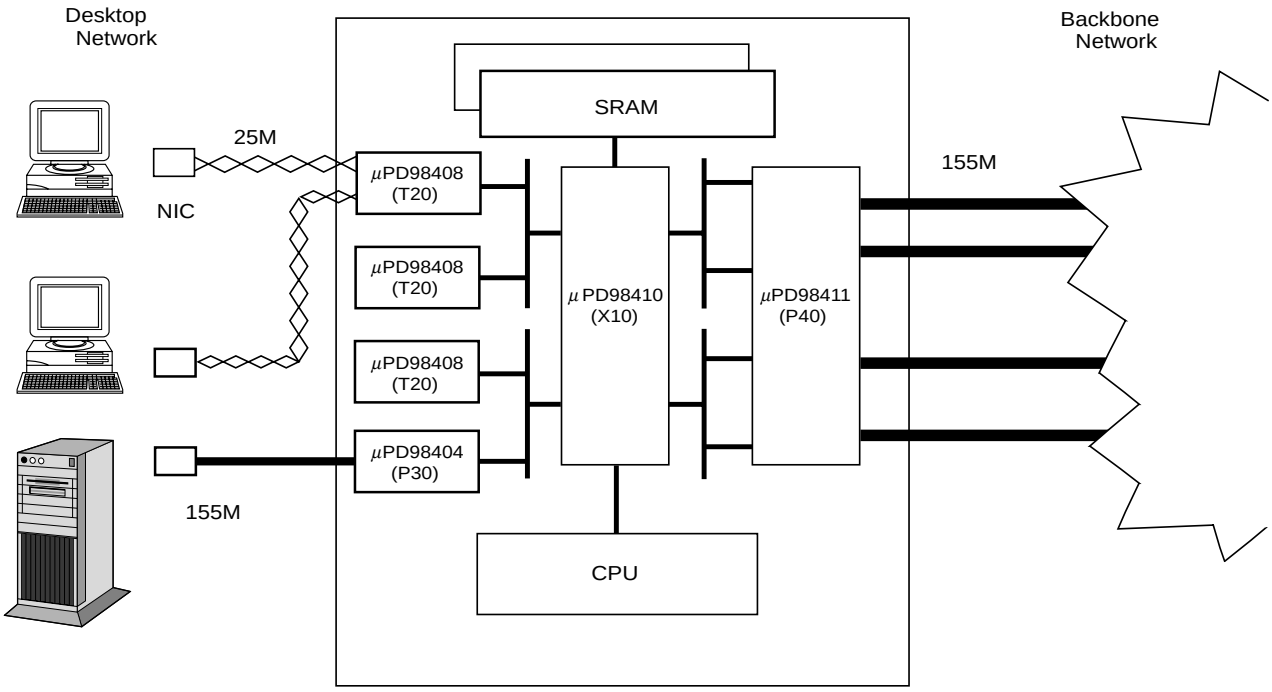
Part number	Function	Features	Package
μPD98401A	ATM SAR Chip	• Upward compatible with μPD98401 • Conforms to ATM Forum recommendations • Implements AAL-5 SAR sublayer and ATM layer functions	• 208-pin QFP (Fine Pitch)
μPD98404	ATM Advanced SONET Framer	• Supports TC sublayer in PHY layer • Implements SONET STS-3c/SDH STM-1 (155 Mbps) framer function • Integrated Clock recovery/Clock synthesis function • UTOPIA Level 2 interface	• 144-pin QFP (Fine Pitch)
μPD98405	ATM Integrated SAR controller	• SONET STS-3c/SDH STM-1 (155M bps), Framer and SAR controller with ABR function in a single-chip • Support both PCI bus and generic bus	• 304-pin QFP (Fine Pitch)
μPD98408	6 port 25M ATM PHY	• 25.6 Mbps ATM PHY (PMD & TC) function for 6 circuits • UTOPIA Level 2 interface	• 208-pin 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 QFP (Fine Pitch)
μPD98410	1.2 Gbps ATM Switch	• ATM switching function in a single-chip • 1.2 Gbps with non blocking • ABR traffic control	• 580-pin BGA
μPD98411	ATM QUAD SONET FRAMER	• Implements 4 ports SONET STS-3c/SDH-1 (155M bps) framer function on chip	• 240-pin QFP (Fine Pitch)

■ PCI Bus Supporting ATM-NIC



Communication IC

■ ATM Switch



■ Ethernet LSI

Part number	Function	Features	Package
μPD98421	High Speed Address Search Engine	• CAM (64-bit × 8K Entry) • Implements three search modes	• 240-pin QFP (Fine Pitch) • 240-pin FPBGA™
μPD98431	8-port 10/100 Mbps Ethernet Controller	• 8-port 10/100 Mbps Ethernet MAC • MII and 10 Mbps serial interface	• 352-pin BGA

■ Standard USB

Part number	Function	Features	Package
μPD72011	USB Hub Controller	• All USB HUB function in a single-chip • Compliance with USB Specification 1.0 • Supports Self-powered and Bus-powered • 4 or 5 down-port selectable	• 42-pin SDIP • 44-pin QFP
μPD72012		• Up-grade LSI of μPD72011 • Compliant with USB specification 1.1 • Built-in Mask-ROM for Generic HUB Descriptor Selectable to use Standard or User-Defined	• 42-pin SDIP • 44-pin QFP

Communication IC

■ LSI for IEEE1394

Part number	Function	Features	Package
μPD72850	IEEE1394 400M PHY	• Compliant with P1394a draft2.0 • Selectable for 1-port, 2-port, 3-port • Data Rate: 100/200/400 Mbps • Compliant with MD8405 (FFM)	• 80-pin TQFP
μPD72861	IEEE1394 OHCI Host Controller	• Compliant with Open HCI for IEEE1394-1995 1.0 • Compliant with P1394a draft2.0 • Data Rate: 100/200/400 Mbps • Supports PCI-Bus/Cardbus	• 100-pin TQFP
μPD72870/71★	IEEE1394 1-chip OHCI Host Controller	• Integrated OHCI LINK and .aPHY in a single chip 3-port: μPD72870, 1-port: μPD72871	• 160-pin LQFP • 192-pin FPBGA

★: Under development

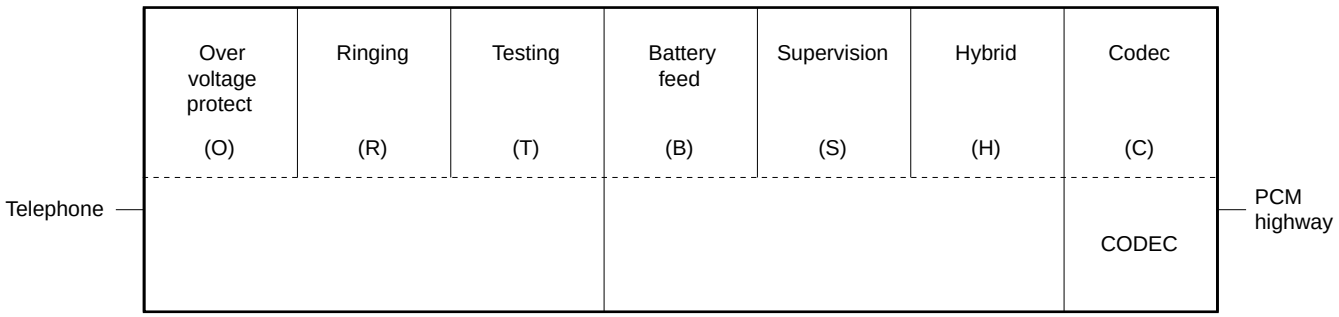
■ Power Switch for USB Application

Part number	Function	Internal circuit	Input voltage (V)	Circuit current (mA)	Output current (A)	Over current detect (A)	Package	Main application
μPD16855A	Pch High-side switch for USB (High active)	2	4.0 to 5.5	1.5	0.5	0.6 to 1.25	• 8-pin SOP (225 mil)	Note PC CRT monitor LCD monitor
μPD16855B	Pch High-side switch for USB (Low active)	2					• 8-pin DIP (300 mil) • 8-pin SOP (225 mil)	
μPD16855C	Pch High-side switch for USB (High active, instant switch off)	2					• 8-pin SOP (225 mil)	
μPD16855D	Pch High-side switch for USB (Low active, instant switch off)	2					• 8-pin SOP (225 mil)	
μPD16874★	Pch High-side switch for USB (Low active)	4		2.5			• 16-pin DIP (300 mil) • 16-pin SOP (300 mil)	CRT monitor LCD monitor
μPD16875★	Pch High-side switch for USB (Low active)	2		0.1			• 8-pin DiP (300 mil) • 8-pin SOP (225 mil)	Key board HUB BOX

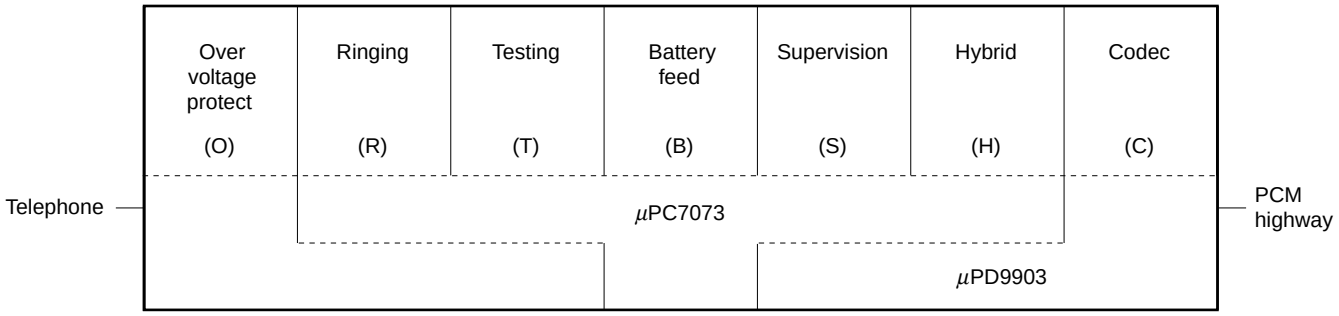
★: Under development

Communication IC

■ Analog Line Card LSI



CODEC (PCM CODEC)	**μPD9611**	programable control (DGS, power-down, A/μ-law), 4-ch PCM CODEC, Single 5 V power supply	• 48-pin SSOP



BS-SLIC	**μPC7073**	• 3 relay drivers	• 48-pin SSOP
Digital CODEC	**μPD9903**	• Terminal impedance and Hybrid balance network can be selected by combining μPC7073	• 48-pin SSOP

Mass Storage IC

Part number	Function	Features	Package
μPC2575	RF amplifier for 24X speed CD-ROM	RF amplifier, error amplifier for 24X speed CD-ROM	• 36-pin SSOP
μPC2576	RF amplifier for 32X speed CD-ROM	RF amplifier, error amplifier for 32X speed CD-ROM Supports CD-RW Lens error amplifier Supports voltage output type pickup Power management	• 38-pin SSOP
μPD63724A	1 chip CD-ROM controller	Digital Servo, Data Processor, CD-ROM Decoder, Host I/F on 1 chip Supports 24X speed operation Automatic adjustment function Wide capture range High speed CAV audio playback Supports PIO mode 4, DMA mode 2 (Enhanced IDE/ ATAPI) Power management Digital audio interface output	• 160-pin LQFP
μPD63725		Digital Servo, Data Processor, AudioDAC, CD-ROM Decoder, Host I/F, 1MbitSRAM on 1 chip Supports 32X speed operation Automatic adjustment function with μPC2576 Wide capture range by analog PLL High speed CAV audio playback Supports PIO mode 4, DMA mode 2 (Enhanced IDE/ ATAPI) Supports UltraDMA mode 2 Supports CD TEXT Power management	• 176-pin QFP

Global Positioning System IC

■ RF IC for GPS receiver

Type	Part number	Function (frequency unit: MHz)	V_{CC} (V)	I_{CC} (mA)	CG (dB)	Package
General purpose wideband separate IC	**μPC2756**	RF downconverter with osc. Tr	2.7 to 3.3	6	14	• 6-pin mini-mold • 6-pin super mini-mold
	μPC2753	IF downconverter with gain control amplifier	2.7 to 3.3	6.5	60 to 79	• 20-pin plastic SSOP (225 mil)
Clock frequency specific 1 chip IC	**μPB1005**	RF/IF downconverter + PLL synthesizer TCXO = 16.368/1stIF = 61.380/ 2ndIF = 4.092	2.7 to 3.3	45	72 to 92	• 36-pin plastic QFN

Typical performance. (T_A = +25°C, V_{CC} = 3.0 V)

Display IC

■ Fluorescent indicator panel (FIP) driver IC

Part number	Drives	Number of outputs	Withstand voltage (V)	Output current (mA)	Output type	Package	Main applications
μPD6320	Static	39	18	1	CMOS	• 52-pin QFP	Car stereo
μPD6321							
μPD6323	Static	21	25	5	Pch-O.D	• 28-pin DIP	Automotive
μPD6323B			40				
μPD6340	Dynamic	20	80	25	NPN+Nch	• 52-pin QFP	ECR, PPC
μPD6700	Static	47	18	1	CMOS	• 56-pin QFP	Car stereo
μPD16304	Dynamic	40	200	20	CMOS	• 80-pin QFP*	Graphic FIP module
μPD16306	Dynamic	64	80	50	CMOS	• 100-pin QFP	
μPD16306A	Dynamic	64	80	25	CMOS	• 100-pin QFP	
μPD16310	Dynamic	40	80	50	CMOS	• 80-pin QFP*	
μPD16326	Dynamic	32	130	20	CMOS	• 44-pin QFP	
μPD16326A	Dynamic	32	150	20	CMOS	• 44-pin QFP	

*: Three direction lead

■ Fluorescent indicator panel (FIP) controller/driver IC

Part number	Drives	Duty (Max.)	Number of outputs		Number of characters*	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	Segment	1/11	11	11	121 segments	5/35	• 44-pin QFP	VCR	
μPD16313	Segment	1/11	11	11	121 segments	5/35	• 44-pin QFP	VCR	Included key scan (μPD16312 mirror)
μPD16314	DOT character	1/24	80	24	24 × 2 characters	5/50	• 144-pin QFP	OA, FA	
μPD16315★	Segment	1/14	16	14	224 segments	5/35	• 44-pin QFP	VCR	Included key scan

*: At maximum duty

★: Under development

Display IC

■ Liquid crystal display (LCD) controller/driver IC

Part number	Drives	Duty (MAX.)	Number of outputs		Number of characters*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	4	240 segments	3.5 to 6/ 3.5 to 14	• 80-pin QFP	Car audio	
μPD16431A			56	4	224 segments	2.7 to 5.5/ 2.7 to 6.5	• 80-pin QFP		Included key scan
μPD16432B	DOT character	1/15			12 × 2 characters + 60 pictographs	2.7 to 5.5/12	• 100-pin QFP		
μPD16434		1/16	42	16	8 × 2 characters	2.7 to 5.5/12	• 80-pin QFP		
μPD16435 **μPD16435A**	Graphic	1/73	119	73	119 × 71 dots + 119 × 2 pictographs	2.7 to 5.5/10*2	• TCP		Included DC/DC Converter
μPD16435B							• CHIP		
μPD16670	DOT character	1/36	60	33	12 × 4 characters + 60 pictographs	2.7 to 3.6/12*2	• CHIP	Mobile phone	
μPD16675A	Graphic		128	34	128 × 32 dots + 128 × 2 pictographs	2.7 to 5.5/10*2		Pager	
μPD16676		1/16 1/32	61	16	61 × 16 dots	2.7 to 5.5/12			
μPD16680		1/53	100	53	100 × 51 dots + 100 × 2 pictographs	2.7 to 3.6/12*2		Mobile phone	Included DC/DC Converter
μPD16681		1/52	96	52	96 × 52 dots + 96 pictographs (8 × 4 Japanese Kanji character)	2.45 to 4.0/12*2			• Included DC/DC Converter • Included Japanese Kanji ROM
μPD16682		1/65	132	65	132 × 64 dots + 132 pictographs	2.4 to 5.5/12*2	• CHIP • TCP		Included DC/DC Converter

*1: At maximum duty

*2: Internal DC/DC Converter

Display IC

■ Liquid crystal display (LCD) driver IC

Part number	Drives	Number of outputs	Withstand voltage (V)	Logic voltage (V)	Package	Main applications
μPD6320	Static	39	18	5.0	• 52-pin QFP	Car stereo
μPD6321						
μPD16448A	TFT (source) Analog	240	5.0	3.3	• TCP	LCD-TV
μPD16780★		288/300	5.0	3.3/5.0		LCD-TV
μPD16633B	TFT (source) 64 gray scale	312	10.5	3.3		XGA
μPD16634A		300	8.5	3.3		SVGA
μPD16638A		300/309	8.5	3.3		SVGA/XGA
μPD16640A		300/309	3.3/5.0	3.3		SVGA/XGA
μPD16640B						
μPD16640C						
μPD16644		384	5.0	3.3		XGA
μPD16647★		402	3.3/5.0	3.3		SVGA
μPD16710		300/309	12.0	3.3		SVGA/XGA
μPD16715		384	13.5	3.3		XGA/SXGA
μPD16715A★						
μPD16732		384	8.5	3.3		XGA/SXGA
μPD16732A						
μPD16732B						
μPD16740	TFT (source) 256 gray scale	384	8.5	3.3		XGA/SXGA
μPD16750		384	8.5	3.3		XGA
μPD16650	TFT (gate)	120/128	40	3.3/5.0		–
μPD16652★		192/200	31	3.3		–
μPD16654		150/154	40	3.3		–
μPD16655		240	31	3.3		–
μPD16661A	STN (column) 4 gray scale	160	5	3.3		PDA (1/8 VGA to VGA)
μPD16666A	STN (row)	240	36	5.0		PDA (1/8 VGA to VGA)
μPD16662	STN (column) 4 gray scale	240	5	3.3		PDA (1/8 VGA to 1/2 VGA)
μPD16667	STN (row)	160	36	5.0		PDA (1/8 VGA to 1/2 VGA)
μPD16663	STN (column) 16 gray scale	240	5	3.3		PDA (1/8 VGA to 1/2 VGA)
μPD16664★	STN (column) 4 gray scale	208	5	3.3		PDA (144 × 128 to 416 × 320 dots)

★: Under development

■ Plasma display, EL display driver IC

Part number	Drives	Number of outputs	Withstand voltage (V)	Output current (mA)	Output type	Package
μPD16305	AC-PDP row	40	200	400	CMOS	• 80-pin QFP*
μPD16306B	AC-PDP/EL column	64	80	50		• 100-pin QFP
μPD16306A		64	80	25		• 100-pin QFP • 100-pin QFP
μPD16310	AC-PDP/EL	40	80	50		• 80-pin QFP*
μPD16327	AC-PDP column	64	100	40		• 100-pin QFP • 100-pin QFP
μPD16331		40	100	150		• 80-pin QFP • 80-pin QFP
μPD16334		96	80	50		• For COB
μPD16335		96	80	50		• For COB
μPD16337		64	150	40		• 100-pin QFP
μPD16364★		160	60	25		• TCP

*: Three direction lead

★: Under development

Display IC

■ Other driver IC

Part number	Number of outputs	Withstand voltage (V)	Output current (mA)	Output type	Package	Main applications
μPD6320 **μPD6321**	4 × 4	18	20	NPN+Nch	• 52-pin QFP	Car stereo (LED)
μPD6345	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 SOP	Camera, DSC
μPD16805		3 to 6	Up to 7.5	±1.0		
μPD16823		2.5 to 6	Up to 7.5	±0.5	• 20-pin SOP	
μPD16803	stepping motor driver	4 to 6	4 to 13.2	±0.38		FDD (2 aspects excitation)
μPD16808		4 to 6	4 to 13.2	±0.45		FDD (1-2 aspects excitation)
μPD16813		4 to 6		±0.31	• 16-pin SOP	FDD (2 aspects excitation)
μPD16814		4 to 6		±0.415		FDD (1-2 aspects excitation)
μPD16818		2.7 to 6		±0.38	• 20-pin SOP • 20-pin SSOP	FDD (2 aspects excitation)
μPD16833		2.5 to 5.5	2.7 to 5.5	±0.3	• 30-pin SSOP	camcorder 4 ch-H bridge
μPD16833A		2.5 to 5.5	2.7 to 5.5	±0.3	• 30-pin SSOP • 26-pin TSSOP	camcorder 4 ch-H bridge
μPD16835		2.7 to 5.5	4.8 to 11	±0.15	• 38-pin SSOP	camcorder microstep drive
μPD16836	3 aspects blush-less DC motor driver	4.5 to 5.5	10.8 to 13.2	±1.3 peak	• 24-pin SOP (375 mil)	CD-ROM PWM drive
μPD16837	stepping motor driver	4 to 6	10.8 to 13.2	±1.0 peak	• 30-pin SSOP (0.8 mm pitch)	CD-ROM/DVD actuator drive
μPD16853B	3 aspects blush-less DC motor driver	4.5 to 5.5		±1.9 peak		CD-ROM PWM drive
μPD16856	3 aspects blush-less DC motor driver	4.5 to 5.5	10.8 to 13.2	±2.0 peak		CD-ROM PWM drive
μPD16857	stepping motor driver	3.0 to 3.6	10.8 to 13.2	±1.0 peak	• 38-pin SSOP	DVD-RAM
μPD16858B **μPD16858C**	3 aspects blush-less DC motor driver	4.5 to 5.5		±1.5 peak	• 30-pin SSOP	CD-ROM PWM drive
μPD16877	stepping motor driver	2.5 to 5.5	2.7 to 5.5	±0.25	• 24-pin TSSOP	camcoder 4-ch-H bridge

■ Power MOS IC for Voltage Regulator

Part number	Function	Input voltage (V)	Output voltage (V)	Output current (mA)	Package	Main application
μPD16901	Step-up type DC/DC converter for PCMCIA	4.5 to 5.5	11.72 to 12.28	140	• 14-pin SOP	Note PC

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
μPD16855A	Pch High-side switch for USB (H-active)	2	4.0 to 5.5	1.5	0.5	0.6 to 1.25	• 8-pin SOP (225 mil)	Note PC CRT monitor LCD monitor
μPD16855B	Pch High-side switch for USB (L-active)	2					• 8-pin DIP (300 mil) • 8-pin SOP (225 mil)	
μPD16855C	Pch High-side switch for USB (H-active, instant switch off)	2					• 8-pin SOP (225 mil)	
μPD16855D	Pch High-side switch for USB (L-active, instant switch off)	2						
μPD16874★	Pch High-side switch for USB (L-active)	4		2.5			• 16-pin DIP (300 mil) 16-pin SOP (300 mil)	CRT monitor LCD monitor
μPD16875★	Pch High-side switch for USB (L-active)	2		0.1			• 8-pin DIP (225 mil) • 8-pin SOP (225 mil)	Key board HUB BOX

★: Under development

Image IC

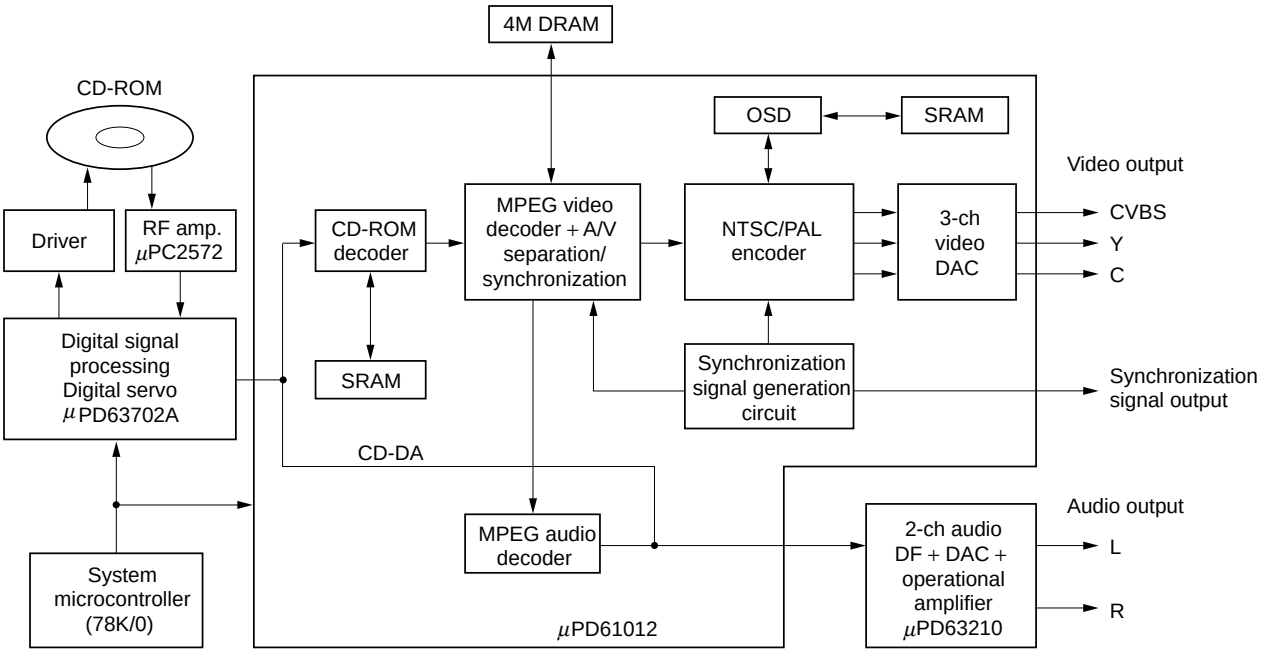
Part number	Function	Package
μPD72254Y★	Graphics LSI	• 208-pin QFP

★: Under development

MPEG IC

Part number	Function	Package
μPD61012	MPEG1 Audio/Video decoder for Video-CD	• 100-pin LQFP
μPD61030	Signal processing for STB, includes MPEG2 Audio/Video decoder, TS demultiplexer, Graphics and VR4110CPU	• 304-pin QFP

■ Video CD



Audio IC

■ Radio frequency amplification

Part number	Recommended operating voltage range (V)	Function					Recommended application	Package
		AM tuner	FM front end	FM IF amplification	FM detection	Other functions	Car radio	
μPC2533	7.5 to 8.5	●				Double super heterodyne DTS use	●	• 36-pin SOP

■ Pre-amplifier

Part number	Recommended operating voltage range (V)	Function				Recommended application		Package
		Play back amplifier	Recording amplifier	MIC amplifier	Other functions	Radio cassette recorder	Car radio	
μPC1228	6 to 16	●			Dual	●	●	• 8-pin SIP

■ Power amplifier

Part number	Recommended operating voltage range (V)	Electrical characteristics (typical value)			Function	Recommended application			Package
		P_O (W)	V_{CC} (V)	R_L (Ω)		Home stereo	Radio cassette recorder	Car radio	
μPC1316	3 to 16	1.2	9	8	Dual		●		• 14-pin DIPTAB
		0.5	6	8	Low pop noise				

■ 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 SOP
μPD6379 **μPD6379A**	4.5 to 5.5	16-bit D/A converter	●	●	●	• 8-pin SOP
μPD6379L **μPD6379AL**	3.0 to 5.5					
μPD63200	4.5 to 5.5	18-bit D/A converter	●	●	●	• 16-pin SOP
μPD63210	4.5 to 5.5	16-bit D/A converter with digital filter	●	●	●	• 28-pin SOP
μPD63210L	3.0 to 5.5					

■ Sound CODEC

Part number	Function	Features	Package
μPD63310	Sound codec	• ΔΣ 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 TQFP

Audio IC

■ Device kit for CD

Part number	Recommended operating voltage range (V)	Function	Recommended application			Package
			Home stereo	Portable	Car stereo	
μPC2572	4.5 to 5.5	RF amp, error amp, APC for CD player	●		●	• 38-pin SOP
μPD63702A	4.5 to 5.5	Digital servo, data processor, DAC for CD player	●		●	• 80-pin QFP
μPD63710	4.5 to 5.5	RF amp, servo, data processor, ATT, DAC for CD player	●		●	• 100-pin LQFP

■ Other functions

Part number	Recommended operating voltage range (V)	Function	Recommended application			Package
			Home stereo	Tape deck	Radio cassette recorder	
μPC1237	25 to 60	Stereo power amplifier protection circuit	●			• 8-pin SIP

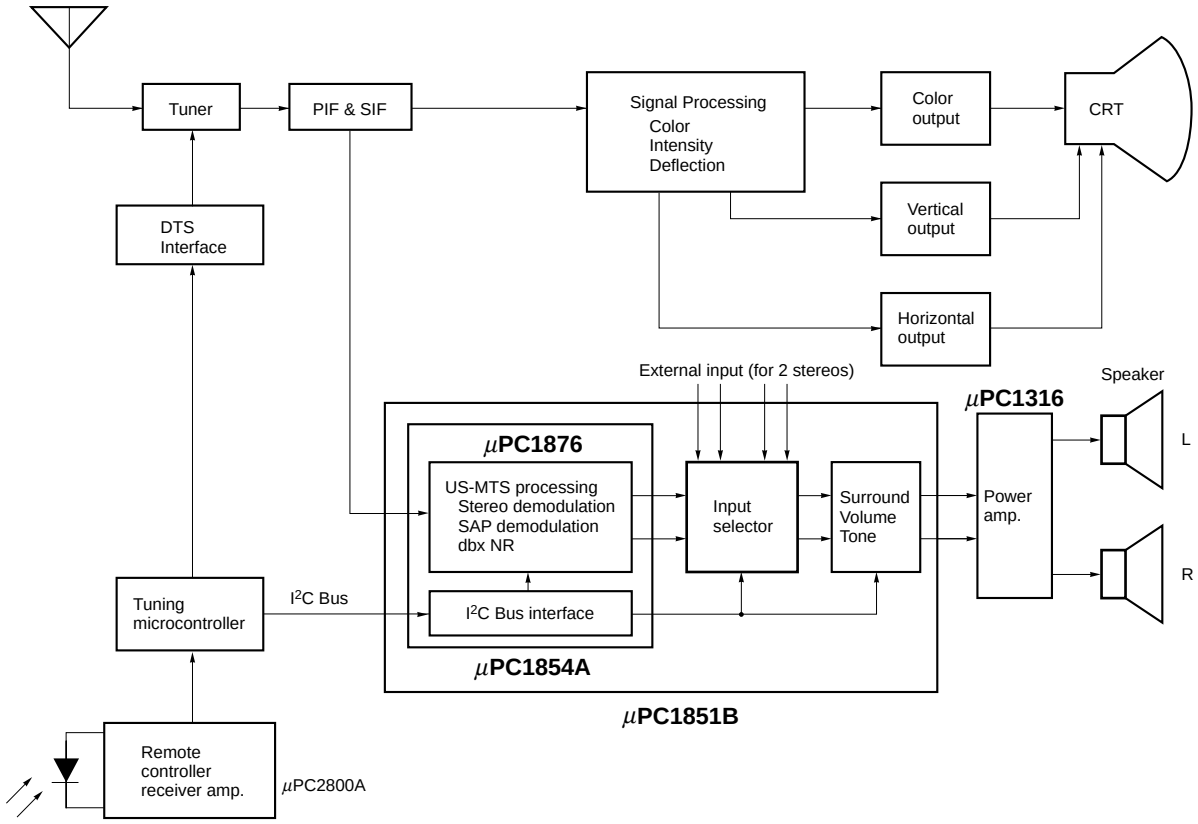
TV IC

■ US MTS Decoder

US MTS: Multi Television Sound for USA specifications

Part number	Function	Package
μPC1851B	I²C Bus, Input Selector (2 ch), dbx NR, SAP Decoder, Tone/Volume control	• 42-pin SDIP
μPC1876	dbx NR, SAP Decoder	• 42-pin SSOP
μPC1854A	I²C Bus, dbx NR, SAP Decoder, Normal Output	• 28-pin SDIP • 28-pin SOP

■ US MTS (TV) System Block Diagram



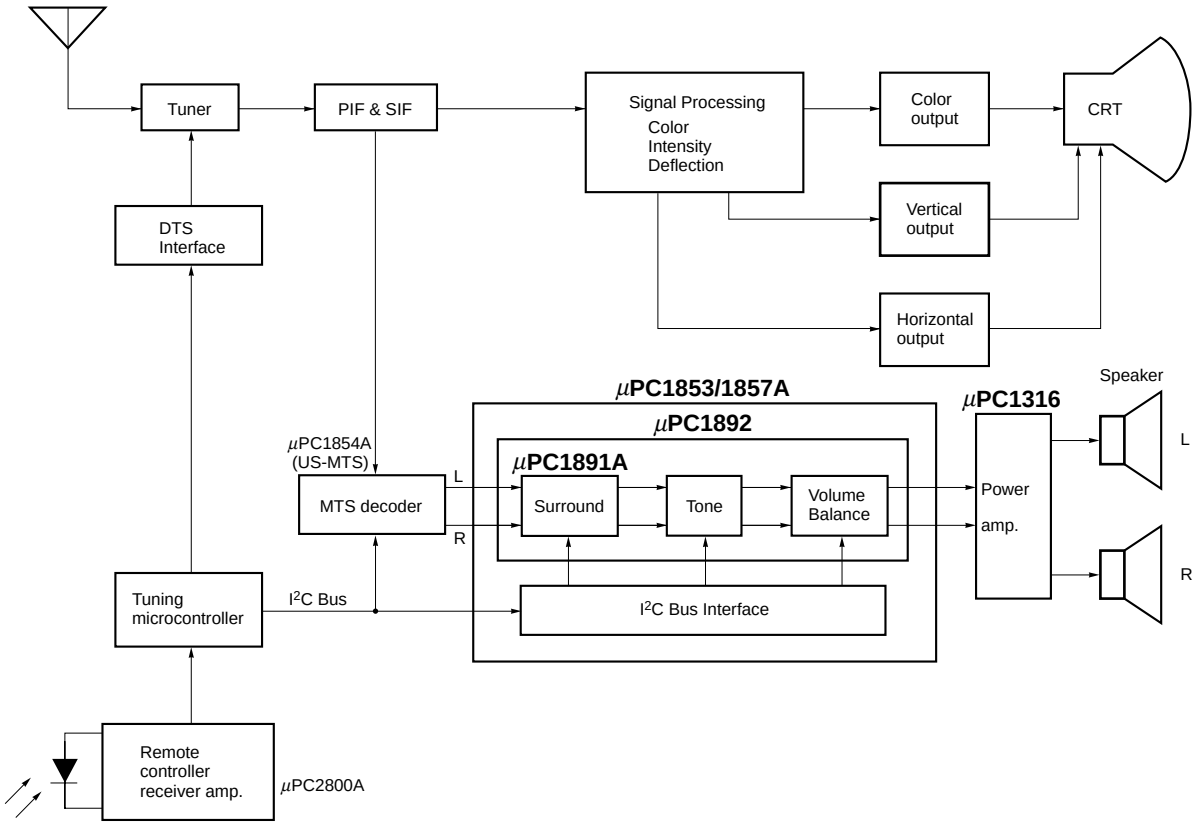
Remark DTS: Digital Tuning System
MTS: Multichannel Television Sound
PIF: Picture Intermediate Frequency
SIF: Sound Intermediate Frequency

TV IC

■ Matrix Surround

Part number	Function	Package
μPC1891A	Matrix Surround (Phase Shift)	• 20-pin DIP
μPC1892	Matrix Surround (Phase Shift), Tone/Balance/Volume, L + R output	• 30-pin SDIP
μPC1853	I²C bus, BASS boost, Matrix Surround, Tone/Balance/Volume, Audio output, L + R output	• 30-pin SDIP
μPC1857A	I²C bus, Matrix Surround, Tone/Balance/Volume, Mixer input	• 30-pin SDIP

■ Matrix Surround (TV) System Block Diagram



Remark DTS: Digital Tuning System
MTS: Multichannel Television Sound
PIF: Picture Intermediate Frequency
SIF: Sound Intermediate Frequency

TV IC

■ Digital Satellite Broadcasting

Part number	Function	Package
μPD61511	A/D Converter, QPSK demodulation, Viterbi decoder, Reed-Solomon error correction	• 100-pin QFP
μPC2781	AGC amplifier + Quadrature demodulator	• 20-pin SSOP
μPC2782	L band frequency down converter + IF-AGC amplifier	• 20-pin SSOP
μPC2795	L band frequency down converter	• 8-pin SSOP (175 mil)
μPC3205	AGC amplifier + Quadrature demodulator	• 20-pin SSOP

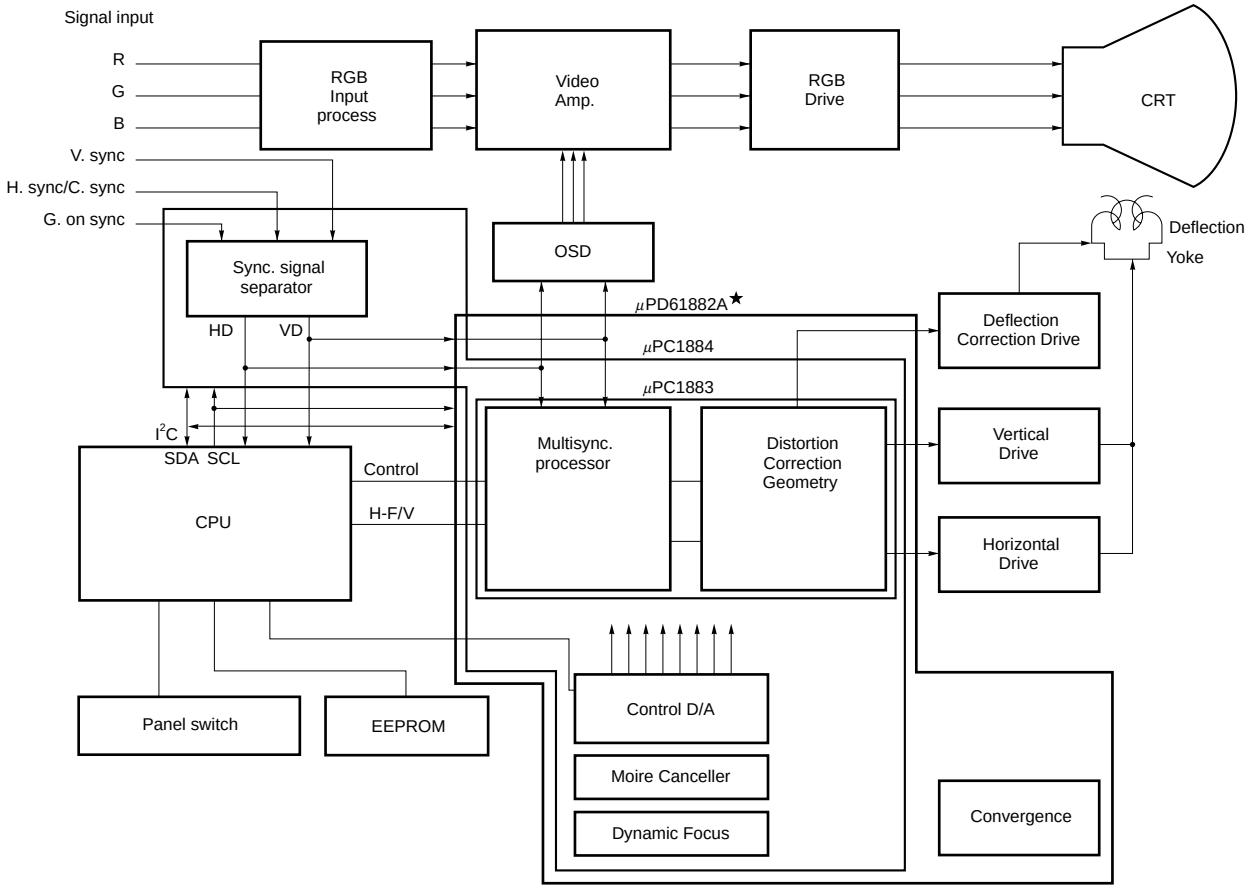
■ Digital CATV

Part number	Function	Package
μPC2798GR	QAM IF down converter (AGC amplifier + MIX/OSC + Video amplifier)	• 20-pin SSOP
μPC3206GR	50 dB AGC amplifier + Video amplifier	• 20-pin SSOP
μPC3211GR	AGC amplifier for Return-pass	• 20-pin SSOP

Multisync Monitor IC

Part number	Function	Package
μPC1883	Horizontal Vertical sync. processor, Picture geometry processor	• 30-pin SDIP
μPC1884	Horizontal Vertical sync. processor, Picture geometry processor (I^2C bus)	• 30-pin SDIP
μPD61882A★	Horizontal Vertical sync. processor, Picture geometry processor (I^2C bus)	• 64-pin QFP

★: Under development



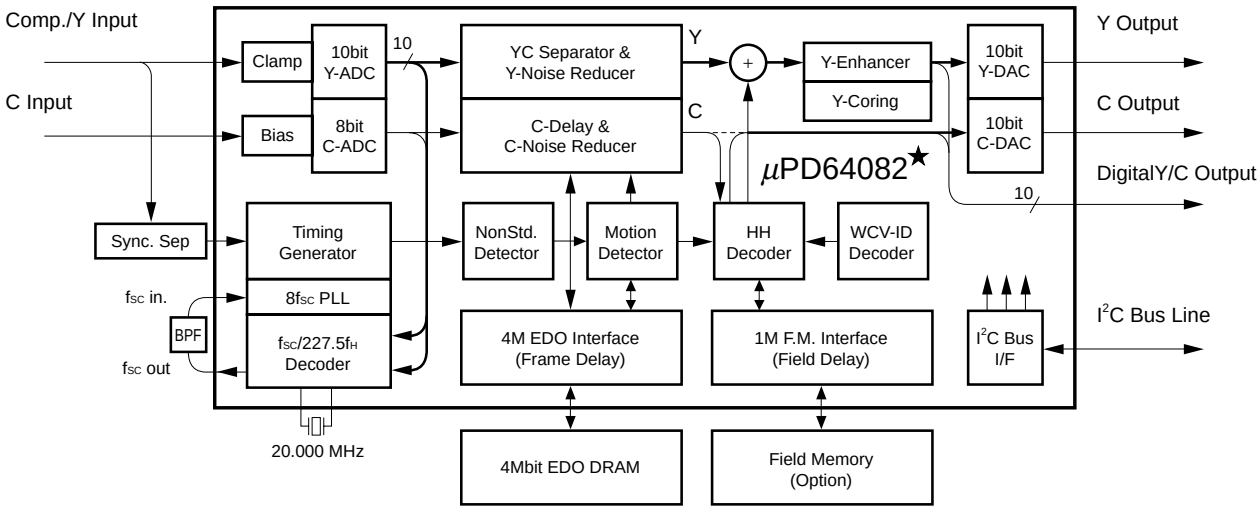
★: Under development

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 QFP

★: Under development



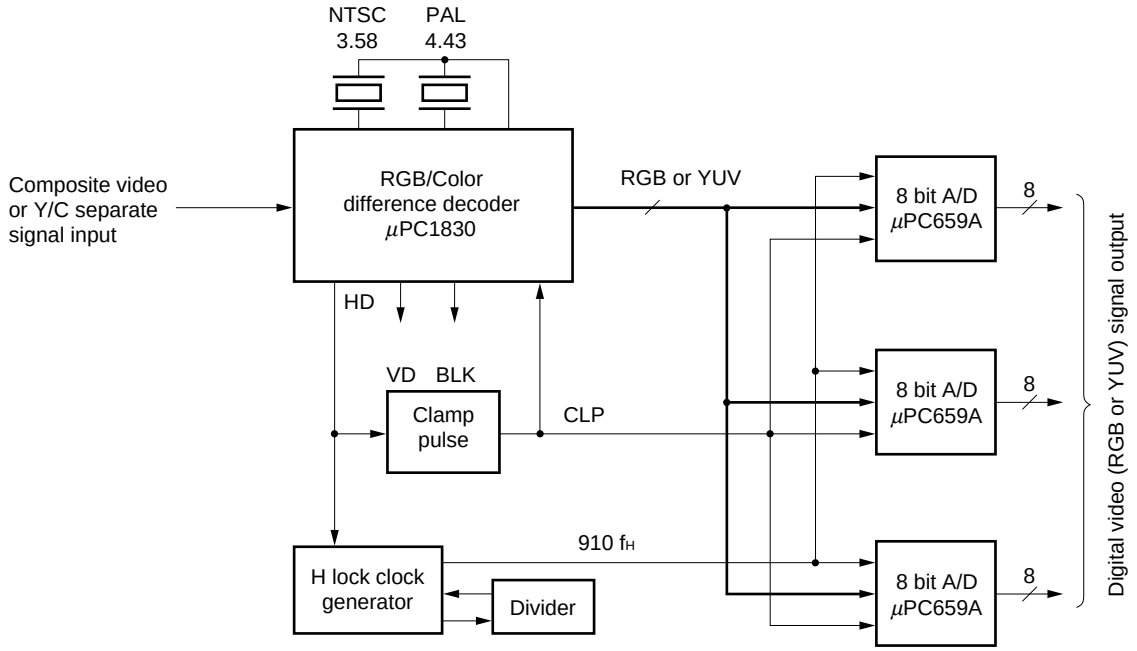
★: Under development

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 SOP

■ Video capture system block diagram



On-Screen Character Display IC

■ Video type

Function \ Part number	μPD6464A	μPD6465
Number of character types	128 (ROM)	256 (ROM)
Number of display characters	288 (12 lines × 24 digits)	
Character configuration	12 × 18	
Character color	Single (white, the luminance level of a character can be set in 2 stages.)	
Character size	1 dot/1H, 2H (per line)	
Internal video signal color	White/Black/Blue/Green	
Background	None/Fringed/Squared/Solid (per field)	
Applicable video signal mode	NTSC/PAL/PAL-M/SECAM	
Supply Voltage	4.5 to 5.5 V	
Package	• 24-pin SDIP (300 mil) • 24-pin SOP (375 mil)	

• μPD6464A adapts PAL-N.

■ RGB type

Function \ Part number	μPD6461	μPD6462	μPD6466
Number of character types	256 (ROM)	128 (ROM)	512 (ROM)
Number of display characters	288 (12 lines × 24 digits)		
Character configuration	12 × 18		
Character color	8 colors		
Character size (per line)	1 dot/1H, 2H		1 dot/1H, 2H, 3H, 4H
Character color reverse (per character)	Black character/No friged		Black character/No friged White character/Friged
Background (per frame)	None Square (8 colors) Solid (8 colors)		
Fringed (per frame)	Two colors (Black, White)		
Supply voltage	2.7 to 5.5 V		
Package	• 20-pin SSOP (300 mil) • 24-pin SOP (375 mil)	• 20-pin SSOP (300 mil)	• 20-pin SSOP (300 mil) • 24-pin SOP (375 mil)

• Making ideally suited for camcoders (μPD6461, μPD6462)
• μPD6461 and μPD6462 are commands conpertible and pins conpertible for 20-pin SSOP package.
• μPD6466 has a blue background and character mirror reverse function.

Video Camera IC

■ CCD driver circuit

Part number	Function	Package
μPD16501	Area sensor vertical drive interface	• 16-pin SOP (300 mil)
μPD16502	Area sensor vertical drive interface	• 20-pin SOP (300 mil)
μPD16510	Area sensor vertical, VOD shutter driver, for low voltage logic	• 22-pin SSOP (225 mil)
μPD16520★	Area sensor vertical driver 10ch (3 state: 6, 2 state: 4), VOD shutter driver, for low voltage logic	• 38-pin SSOP (300 mil)

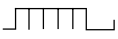
★: Under development

Remote Control IC

■ Infrared remote control preamplifiers IC

Part number	Supply voltage	Features	Package	Remarks
μPC2800A	5 V ± 10%	Internal high trap circuit	• 8-pin SOP	Active low type

■ Infrared remote control IC

Part number	**μPD6121G-001**	**μPD6122G-001**
Operating voltage range	2.0 to 3.3 V	
Operation clock (f_{OSC})	400 to 500 kHz ceramic oscillator	
Transmission format	Leader | Custom code 16-bit | Data code 8-bit | Data code 8-bit	
Modulation mode	P.P.M. 0 ····  1···  38 kHz • carrier modulation(f_{OSC} = 455 kHz)	
Custom code	16-bit set*	
Data code	32 × 2	64 × 2
Number of keys	32	64
Package	• 20-pin SOP	• 24-pin SOP

∗: All codes except code “00FFH” are managed by NEC.

Clock IC

Part number	I/O	Alarm	Supply voltage (V)	Circuit Current (μA)	Package
μPD4990A	Serial	×	2.0 to 5.5	20	• 14-pin DIP • 16-pin SOP
μPD4991A	4-bit · Parallel	○		14	• 18-pin DIP • 20-pin SOP
μPD4992	8-bit · Parallel	×	2.4 to 5.5	6	• 20-pin DIP • 20-pin SOP

Rotary Encoder IC

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

A/D Converter IC

■ 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 SOP	Parallel approximation Video processing

D/A Converter IC

■ D/A Converter

Part number	Resolution (bits)	Linearity (%FSR)	Settling time (μs)	Supply voltage (V)	Input format	Output format	Package	Remarks
μPD6325 **μPD6335**	6 (4 circuits)	Monotonicity	200	+5 to +15 +5	Binary	Voltage output	• 16-pin DIP • 16-pin SOP	Serial input, CMOS
μPD6326 **μPD6336**	6 (8 circuits)	Monotonicity	200	+5 to +15 +5	Binary	Voltage output	• 16-pin DIP	Serial input, CMOS
μPD6221	8 (8 circuits)	0.31	100	+5	Binary	Voltage output	• 20-pin DIP • 20-pin SOP	I²C-bus compatible Internal Output CMOS' Buffer
μPD6222	8 (12 circuits)	0.31	100	+5	Binary	Voltage output	• 24-pin SDIP • 24-pin SOP	I²C-bus compatible Internal Output CMOS' Buffer

■ D/A Converter for Video processing

Part number	Resolution (bits)	Linearity (%FSR)	Sampling rate (MSPS)	Supply voltage (V)	Input format	Output format	Package	Remarks
μPC667	10	0.1	60	+5	Binary	Voltage output	• 30-pin SDIP	Parallel input Video processing

Line Driver Receiver IC

Part number	Driver	Receiver	Capacitor (μF)	Supply voltage (V)	Package
μPD4711B	2	2	1.0 to 4.7 (4 pcs)	5.0	• 20-pin DIP • 20-pin SOP
μPD4712C	4	4	4.7 to 47 (4 pcs)		• 28-pin DIP • 28-pin SOP
μPD4712D	4	4			
μPD4713A	3	3			• 24-pin DIP • 24-pin SOP
μPD4714A	3	5			• 28-pin DIP • 28-pin SOP
μPD4715A	5	3			
μPD4721	2	2	0.33 to 4.7 (4 or 5 pcs)	3.3/5.0	• 20-pin SSOP
μPD4722	4	4	0.47 to 4.7 (4 or 5 pcs)		• 30-pin SSOP
μPD4723	3	3	0.33 to 4.7 (4 or 5 pcs)		
μPD4724	3	5			
μPD4726	4	7	1.0 to 4.7 (4 pcs)	5.0	• 36-pin SSOP

[MEMO]

General Purpose Linear IC

Operational Amplifier

Part number		Number of circuits*1	$V^{\pm}$ (recommended value) (V)*2	V_{IO} (MAX.) (mV)	I_{CC} (MAX.) (mA)	SR (TYP.) (V/μs)	Features and Functions	Packages*3			Number of pins
Communication/ industry use	General use							C	G2	HA	
μPC151	**μPC741**	1	±7.5 to ±16	±6	2.8	0.5	General purpose	◯	◯		8
μPC251	**μPC1458**	1	±7.5 to ±16	±6	5.6	0.5	General purpose	◯	◯		8
μPC258	**μPC4558**	2	±4 to ±16	±6	–	1.0	Low noise	◯	◯		8
μPC259	**μPC4560**	2	±4 to ±16	±6	–	2.8	Low noise, high output current	◯	◯		8
μPC451	**μPC324**	4	+3 to +30	±7	2.0	0.3	Single supply voltage	◯	◯		14
μPC452	**μPC3403**	4	+3 to +32	±7	7.0	0.8	Single supply voltage, high speed	◯	◯		14
μPC458	**μPC4741**	4	±4 to ±16	±5	7.0	1.0	Low noise	◯	◯		14
μPC801	**μPC4081**	1	±5 to ±16	±15	2.8	13	J-FET input	◯	◯		8
μPC802	**μPC4250**	1	±1 to ±16	±6	0.1	0 to 1.0	Micro-power	◯	◯		8
μPC803	**μPC4082**	2	±5 to ±16	±15	5.6	13	J-FET input	◯	◯		8
μPC804	**μPC4084**	4	±5 to ±16	±15	11.2	13	J-FET input	◯			14
μPC811	**μPC4091**	1	±5 to ±16	±2.5	3.4	15	High accuracy, J-FET input	◯	◯		8
μPC812	**μPC4092**	2	±5 to ±16	±3	6.8	15	High accuracy, J-FET input	◯	◯		8
μPC813	**μPC4093**	1	±5 to ±16	±2.5	3.4	25	High accuracy, high speed, J-FET input	◯	◯		8
μPC814	**μPC4094**	2	±5 to ±16	±3	6.8	25	High accuracy, high speed, J-FET input	◯	◯		8
μPC815	–	1	±3 to ±20	±0.06	4.6	1.6	Super high accuracy	◯			8
μPC816	–	1	±3 to ±20	±0.06	4.6	7.6	Super high accuracy	◯			8
μPC821	**μPC4071**	1	±5 to ±16	±10	2.7	13	Low noise, J-FET input	◯	◯		8
μPC822	**μPC4072**	2	±5 to ±16	±10	5.0	13	Low noise, J-FET input	◯	◯	◯	8*4
μPC824	**μPC4074**	4	±5 to ±16	±10	10.0	13	Low noise, J-FET input	◯	◯		14
μPC831	**μPC4061**	1	±2 to ±16	±10	0.25	3.0	Micro-power, J-FET input	◯	◯		8
μPC832	**μPC4062**	2	±2 to ±16	±10	0.5	3.0	Micro-power, J-FET input	◯	◯		8
μPC834	**μPC4064**	4	±2 to ±16	±10	1.0	3.0	Micro-power, J-FET input	◯	◯		14
μPC842	**μPC4742**	2	+3 to +32	±5	5.5	7.0	Single supply voltage, high speed, wide band	◯	◯		8
μPC844	**μPC4744**	4	+3 to +32	±5	11.0	7.0	Single supply voltage, high speed, wide band	◯	◯		14
μPC1251	**μPC358**	2	+3 to +30	±7	1.2	0.3	Single supply voltatge	◯	◯	◯	8*4
–	**μPC4556**	2	±4 to ±16	±6	–	5.0	Low noise, wide band	◯	◯		8
–	**μPC4557**	2	±4 to ±16	±6	–	1.0	Low noise, high output current	◯			8
–	**μPC4559**	2	±4 to ±16	±6	–	2.0	Low noise, wide band	◯			8
–	**μPC4570**	2	±4 to ±16	±5	8.0	7.0	Super low noise, wide band	◯	◯	◯	8*4
–	**μPC4572**	2	±2 to ±7	±5	7.0	6.0	Super low noise, low voltage	◯	◯	◯	8*4
–	**μPC4574**	4	±4 to ±16	±5	12.0	6.0	Super low noise, wide band	◯	◯		14

∗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 (300 mil)

G2 : Plastic SOP (225 mil)

HA : 9-pin plastic slim SIP

∗4 : HA has 9 pins.

Comparator

Part number		Number of circuits	$V^{\pm}$ (recommended value) (V)	V_{IO} (MAX.) (mV)	I^{+} (MAX.) (mA)	t_d (TYP.) (μs)	Features and Functions	Packages*1			Number of pins
Communication/ industry use	General use							C	G2	HA	
μPC177	**μPC339**	4	+2 to +32	±5.0	2.0	1.3	Single supply voltage	○	○		14
μPC271	**μPC311**	1	+5 to +32	±7.5	7.5	0.2	High speed	○	○		8
μPC272	**μPC319**	2	+5 to +32	±8.0	12.5	0.08	High speed	○	○		14
μPC277	**μPC393**	2	+2 to +32	±5.0	1.0	1.3	Single supply voltage	○	○	○	8*2

*1: C, G2 or HA shows Package Type, as follows.
C : Plastic DIP (300 mil)
G2 : Plastic SOP (225 mil)
HA : 9-pin plastic slim SIP
*2: HA has 9 pins.

Fixed Output Voltage, 3-Terminal Regulator

Type	Part number	Output current (A)	Output voltage (V)													Absolute maximum ratings		Package	Remarks
			3	3.3	4	5	6	7	8	9	9.3	10	12	15	18	24	Input voltage (V)	Total power dissipation (W)*1		
Positive voltage output	**μPC78L00**	0.1				○	○	○	○								30	0.7/2*3	• TO-92 • TO-243	
												○	○	○			35			
	μPC78N00	0.3				○			○			○	○	○	○		35	12.5	• TO-126	
																○	40			
	μPC78M00A	0.5				○	○	○	○	○		○	○	○	○		35	15	• MP-45*2	Improved version of μPC78M00
																○	40			
	μPC7800A	1.0				○			○		○		○	○	○		35	15	• MP-45*2	Improved version of μPC7800
																○	40			
	μPC29L00	0.1	○	○	○	○											16	0.7/2*3	• TO-92 • TO-243	Low dropout voltage type
	μPC29M00	0.5	○	○		○	○	○	○	○		○	○				20	1.0/2.0*4 15	• TO-251 • TO-252 • MP-45*2	Low dropout voltage type
	μPC2900	1.0	○	○		○	○	○	○	○		○	○				20	1.0/2.0*4 15	• TO-251 • TO-252 • MP-45*2	Low dropout voltage type
	μPC24A00	2.0				○							○	○			36	20	• MP-45*2	Low dropout voltage type
	μPC24M00A	0.5				○	○	○	○	○		○	○	○	○		36	15	• MP-45*2	Low dropout voltage type
	μPC2400A	1.0				○	○	○	○	○		○	○	○	○		36	15	• MP-45*2	Low dropout voltage type
Negative voltage output	**μPC79L00**	0.1				○			○								–30	0.7	• TO-92	
													○	○			–35			
	μPC79N00	0.3				○			○				○	○	○		–35	12.5	• TO-126	
																○	–40			
	μPC79M00	0.5				○			○				○	○	○		–35	15	• MP-45*2	
																○	–40			
	μPC7900A	1.0				○			○				○	○	○		–35	15	• MP-45*2	Improved version of μPC7900
																○	–40			

*1: Limited by internal circuit
*2: TO-220 Plastic insulated package
*3: With 16 $cm^2 \times 0.7$ mm ceramic substrate
*4: With 7.5 $cm^2 \times 0.7$ mm ceramic substrate

Variable Output Voltage Regulator

Type	Part number	Output current (A)	Output voltage range (V)	Absolute maximum ratings		Package	Remarks
				Input voltage (V)	Total power dissipation (W)		
Positive voltage output	**μPC305**	0.05	4.5 to 30	40	0.35, 0.44	• 8-pin DIP • 8-pin SOP	
	μPC317	1.5	1.3 to 30	40	15*1	• MP-45*2	3-pin regulator
	μPC1093	0.15	2.5 to 36	37	0.48, 0.7, 2*3, 0.2	• 8-pin SOP • TO-92 • TO-243 • 5-pin mini mold	Shunt regulator
	μPC1943	0.05	1.26 to 24	25	1.6*3	• TO-243	Shunt regulator for Low Voltage
	μPC1944	0.05	1.26 to 24	25	0.385, 0.56, 1.6*3	• 8-pin SOP • TO-92 • TO-243	Shunt regulator for Low Voltage
	μPC1945★	0.015	0.4 to 9	12	0.41*4	• 5-pin mini mold	Shunt regulator for Low Voltage
Negative voltage output	**μPC337**	1.5	–1.3 to –30	–40	15*1	• MP-45*2	3-pin regulator

∗1 : Limited by internal circuit

∗2 : TO-220 Plastic insulated package

∗3 : When mounted on 16 cm^2 (0.7 mm thick) ceramic board

∗4 : When mounted on 75 mm^2 (0.7 mm thick) ceramic board

★: Under development

Regulator with System Reset

Type	Part number	Output current (A)	Output voltage (V)	Reset start voltage (V)	Reset output logic		Absolute maximum ratings		Package	Remarks
					Active low	Active high	Input voltage (V)	Total power dissipation (W)		
Positive voltage output	**μPC2251**	0.1	3	2.85	◯		12	1.2*	• TO-126 (4-pin)	Low dropout type
	μPC2253	0.1	5	2.85	◯		12	1.2*	• TO-126 (4-pin)	Low dropout type
	μPC2255	0.1	5	4.75	◯		12	1.2*	• TO-126 (4-pin)	Low dropout type
	μPC2260	0.5	5	4.85	◯		35	20*	• TO-220 (5-pin)	Low dropout type

∗: Limited by internal circuit

Regulator with ON/OFF Function

Part number	Output current (A)	Output voltage (V)	ON/OFF voltage (V)		Absolute maximum ratings		Package
			Output ON	Output OFF	Input voltage (V)	Total power dissipation (W)	
μPC29S78	0.1	7.8	2.0	0.8	20	1.2*	• TO-126 (4-pin) • TO-126 Gullwing (4-pin)
μPC29S10	0.1	10	2.0	0.8	20	0.48*	• 8-pin SOP

∗: Limited by internal circuit

High Precision Reference Voltage

Part number	Input voltage range (V)	Output voltage (V)	Output current (mA)	Total power dissipation (mW)	Output voltage vs. temperature (ppm/°C)	Package
μPC1060	4.5 to 40	2.5 ±0.025	10	350, 500	40	• 8-pin DIP

Switching Regulator Control Circuit

Part number	Input voltage range (V)	Absolute maximum ratings		Package	Output circuit operation mode	Applications
		Output current (mA)	Total power dissipation (W)			
μPC494	7 to 40	250	1, 0.78∗2, 0.65∗2	• 16-pin DIP • 16-pin SOP∗1 (375 mil/ 300 mil)	Push-pull/single selectable	General purpose
μPC1094	11 to 24	1200 (peak)	0.57, 0.55	• 14-pin DIP • 14-pin SOP	Totem pole circuit configuration Single mode	Can operate up to 500 kHz General purpose
μPC1099	11.5 to 24	1200 (peak)	1, 0.694	• 16-pin DIP • 16-pin SOP	Totem pole circuit configuration Single mode	Can operate up to 500 kHz General purpose
μPC1905	12 to 30	1200 (peak)	1, 0.694	• 16-pin DIP • 16-pin SOP	Totem pole circuit configuration Single mode	Can operate up to 500 kHz General purpose
μPC1909★	7 to 24	1200 (peak)	1, 0.694	• 16-pin DIP • 16-pin SOP	Totem pole circuit configuration Q, $\overline{Q}$ output	Can operate up to 500 kHz ZCS, Half bridge
μPC1100	3.6 to 40	25	1, 0.694	• 16-pin DIP • 16-pin SOP	2 outputs (synchronous control possible) If one output is shorted, both outputs will be turned OFF.	DC/DC converter
μPC1150	3.6 to 40	25	1, 0.694	• 16-pin DIP • 16-pin SOP	2 outputs (synchronous control possible) If one output is shorted, only the output will be turned OFF.	DC/DC converter
μPC1933	2.5 to 20	21	0.48	• 8-pin SOP	Open drain 1 output	DC/DC converter
μPC1934	2.5 to 20	21	0.4, 0.417	• 16-pin SSOP • 16-pin T-SSOP	Open drain 2 outputs	DC/DC converter
μPC1935	2.5 to 20	21	0.417	• 16-pin T-SSOP	Open drain 3 outputs	DC/DC converter
μPC16902★	5.2 to 25	1000 (peak)	0.625	• 30-pin SSOP	High side: necessary drivers Low side: push-pull drivers	5 V, 3.3 V Synchronous rectifier controller

∗1 : μPC494G is 375 mil. μPC494GS is 300 mil.

∗2 : When mounted on 5 × 5 cm² (1.6 mm thick) glass epoxy board.

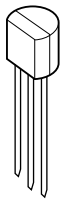
★: Under development

Functional Block

Function	Part number	Features	Package
Analog Multiplexer	**μPD5205**	Single-pole 8 position mode/double-pole 4 position mode Supply Voltage: 44 V, ON Resistance: 270 Ω TYP.	• 24-pin shrink DIP • 24-pin SOP
Precision Timer	**μPC1555**	CR Timer, Operating Temperature: –20 ~ +80°C Supply Voltage: 4.5 ~ 16 V, Free Running Frequency: 0.1 ~ 100 kHz	• 8-pin DIP • 8-pin SOP
	μPD5555	CMOS CR Timer, CMOS Type of μPC1555 Supply Voltage: 3 ~ 16 V, Free Running Frequency: 0.1 ~ 500 kHz	• 8-pin DIP • 8-pin SOP
	μPD5556	CMOS CR Timer Dual Type of μPD5555	• 14-pin DIP • 14-pin SOP

Transistor/Diode/Thyristor

Quick Reference by Package



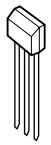
TO–92

■ TO-92 Type Transistor

V_{CEO} (V) / I_C (A)	~15	~30	~50	~70	~100	~150	~200	~250	~400
~20 m		2SC1674							
~50 m	2SA1206**					2SA988 2SA992 2SC1841 2SC1845			
~100 m			2SA733 2SA990 2SC945 2SC1842 2SC1843 AA1[ ] AN1[ ]		2SA675[1)]		2SA1376 2SA1376A 2SC3478 2SC3478A	2SA1544	
~200 m	2SC2901**		2SC3622* (150 mA) 2SC3622A* (150 mA)						
~500 m			2SC3615* (300 mA)	2SA953 2SC2002	2SA954 2SC2003				2SA1625
~1.0		2SA952 2SC2001 2SC3616* (25 V/ 700 mA) AB1[ ] (25 V/ 700 mA) AP1[ ] (25 V/ 700 mA)	2SB1116 2SD1616	AD1[ ] AD2[ ]*** AR1[ ] 2SB1116A (60 V) 2SD1616A (60 V)*** 2SD1701 (60 V)	2SD1698 (80 V)				
~2.0		2SD1513 (16 V/2.0 A) 2SB1068 (16 V/2.0 A) AQ1[ ] (20 V/2.0 A)							
~3.0		2SB1300 (16 V/3 A)							

1) V_{CES} ☐ : Darlington transistor, ∗: High h_{FE} transistor, ∗∗: High speed switching, ∗∗∗: Contains internal zener diode

Quick Reference by Package



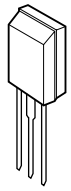
SST

■ SST Type Transistor

I_C (A) \ V_{CEO} (V)	~15	~20	~30	~50	~120
~20 m	2SC2786		2SC2787		
~50 m	2SA1459**				2SC2784
~100 m				2SA1175 2SC2785 2SC3623* BA1[ ] BN1[ ]	
~200 m	2SC3732**			2SA1458** (40 V) 2SC3623A* (150 mA) 2SC3731** (40 V)	
~700 m		2SB810 2SD1020	BB1[ ] (25 V) BP1[ ] (25 V)		

*: High h_{FE} transistor, **: High speed switching

Quick Reference by Package



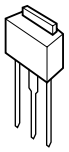
SP–8

■ SP-8 Type Transistor

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

□: Darlington transistor, *: High h_{FE} transistor, **: High speed switching, ***: Internal zener diode

Quick Reference by Package

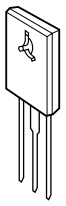


MP–3

■ MP-3 Type Transistor

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

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



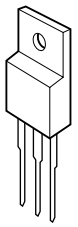
MP–5
(TO–126)

■ MP-5 (TO-126) Type Transistor

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

▭ : Darlington transistor, (: Complementary pair, ∗: Internal zener diode between C-B, ◎: Low $V_{CE(sat)}$,
○ : Single Hight h_{FE}

Quick Reference by Package

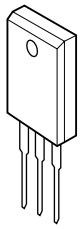


MP–25
(TO–220)

■ MP-25 (TO-220) Type Transistor

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

▭ : Darlington transistor, (: Complementary pair, ∗: Internal zener diode between C-B, ◎: Low $V_{CE(sat)}$



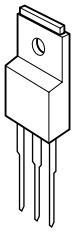
MP–40

■ MP-40 Type Transistor

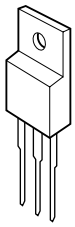
V_{CEO} (V) / $I_{C(DC)}$ (A)	~60	~100	~400
~5.0	2SD1392∗	2SD1308	
~7.0	2SC4305		2SC3158
~8.0		2SD1309	
~10		2SA1261 2SC3157 2SC4350	2SC3159

▭ : Darlington transistor, (: Complementary pair, ∗: Internal zener diode between C-B

Quick Reference by Package



MP–45
(MP-25 Insulated type)



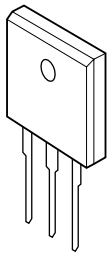
MP–45F
(MP-25 Insulated type)

■ MP-45, MP-45F (TO-220 Insulated Type) Transistor

V_{CEO} (V) / Package / $I_{C(DC)}$ (A)	~60		~100		~300	~400
	MP-45	MP-45F	MP-45	MP-45F	MP-45	MP-45
~2.0			2SA1395 2SC3567			2SC3569
~3.0	2SB1094 2SD1585 2SD1593 ○	2SB1453 2SD2164 ○				
~5.0	2SA1394 2SA1441 ◎ 2SC3691 ◎ 2SC4351*	2SA1741 ◎ 2SC4549 ◎	2SB1098 2SD1589 2SA1650 ◎	2SB1430 2SD2161	2SD1592	2SC3570
~6.0			2SD1594 ○	2SD2165 ○		
~7.0	2SB1097 2SD1588 2SA1442 ◎ 2SC3692 ◎	2SA1742 ◎ 2SC4550 ◎	2SC4062 ○	2SC4553 ○		2SC3571
~8.0			2SB1099 2SD1590	2SB1431 2SD2162		
~10	2SA1443 ◎ 2SC3693 ◎	2SA1743 ◎ 2SC4551 ◎	2SA1396 2SC3568 2SA1652 ◎ 2SC4336 ◎ 2SA1720 2SB1100 2SD1591	2SB1432 2SD2163		2SC3572
~15	2SA1444 ◎ 2SC3694	2SA1744 ◎ 2SC4552 ◎	2SC4063 ○	2SC4554 ○		

▭ : Darlington transistor, (: Complementary pair, * : Internal zener diode between C-B, ◎ : Low $V_{CE(sat)}$,
○ : Single High h_{FE}

Quick Reference by Package

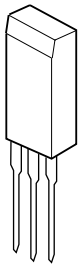


MP–80

■ MP-80 Type Transistor

V_{CEO} (V) / $I_{C(DC)}$ (A)	~100	~400
~5.0	2SC2908	
~1.0	2SB897 2SD1210	2SC2749
~15	2SC2750 2SD1296	2SC2751

□: Darlington transistor, ∗: MP-88



MP–10

■ MP-10 Type Transistor

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

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

Quick Reference by Package

Mini mold
SC-59

■ Mini-Mold Transistor

V_{CEO} (V) / I_C (mA)	~15	~20	~30	~40	~50	~60	~80	~120	~200	~300
~20		2SC2223								2SD2383
~30				2SA1226						
~50	2SA1462		2SC1009A					2SA811A 2SA1247 2SC1622A 2SC3115	2SC1653 (130 V) 2SC1654 (160 V)	
~100					2SA812 2SC1623 FA1[ ] FN1[ ]				2SA1330 2SC3360	
~150					2SC3624 2SC3624A					
~200	2SC3735	2SC1621		2SA1461 2SC3734						
~300						2SB736 2SD780	2SB736A 2SD780A			
~500				2SA1464 2SC3739						
~700			2SB624 (–25 V) 2SD596 (25 V) FB1[ ] (25 V) FP1[ ] (–25 V)							

Quick Reference by Package

Power mini mold
SC-62

■ Power Mini-Mold Transistor

V_{CEO} (V) / I_C (A)	~20	~25	~50	~60	~80	~100	~120	~140	~300
~50 m								2SA1173 2SC2780	
~200 m									2SC3554
~300 m			2SC3617		2SB800 2SD1001				
~0.7		2SC3618	2SB799 2SD1000			2SB805 2SD1006	2SB806 2SD1007		
~1.0		2SB798 2SD999	2SA1463 2SB1115 2SC3736 2SD1615 2SD1702	2SB1115A 2SD1615A HD1[ ] HD2[ ] HR1[ ]	2SB804 2SD1005 2SD1699				
~2.0	2SB1114 2SD1614 HQ1[ ]	2SD1950							
~3.0	2SB1628			2SB1572 2SD2403					
~5.0			2SB1571 2SD2402						

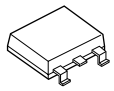
: Darlington connection

MP-2
SC-84

■ MP-2 Type Transistor

V_{CEO} (V) / I_C (A)	~60	~600
~1.0		2SA1871 2SC4942
~5.0	2SB1578 2SD2425	

Quick Reference by Package



MP-3

■ MP-3 Type (SC-63) Transistor

V_{CEO} (V) / I_C (A)	~20	~30	~45	~60	~200	~400	~600
~0.5						2SA1400-Z 2SC3588-Z	
~1.0				2SB963-Z 2SD1286-Z			2SA1413-Z 2SC3632-Z
~2.0	2SD1583-Z			2SD1164-Z (1.5 A)	2SB768 (150 V) 2SD1033 (150 V) 2SC2946(1)	2SA1412-Z 2SC3631-Z	
~3.0		2SB962-Z		2SB1261-Z 2SD1584-Z 2SD1899-Z			
~5.0				2SA1385-Z 2SC3518-Z			
~10	2SA1615-Z						

: Darlington connection

Small mini mold
SC-70

■ Small Mini-Mold Transistor

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

■ Ultra Small Mini-Mold Transistor

V_{CEO} (V) / I_C (mA)	~50
~100	2SA1836 2SC4783

Ultra small mini mold

Quick Reference Table by Function/Application

Small Signal Transistor

■ **Small Signal Transistor (1/2)**

	TO-92	SP-8	SST	SMALL MINI MOLD	MINI MOLD	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		2SA1175	2SA1611	2SA812	
					(2SA812)	
	2SA988			2SA1612	2SA811A	
	2SC945		2SC2785	2SC4177	2SC1623	
					(2SC1623)	
	2SC1841				2SC1622A	
	2SC3622/A		2SC3623/A	2SC4181	2SC3624/A	
Low Noise Amplification	2SA992		2SA1174		2SA1247	
	2SC1845		2SC2784		2SC3115	
Driver Output	2SA952		2SB810		2SB624	
	2SA953				2SB736	
	2SA954				2SB736A	2SB800
	2SA1376				2SA1330	
		2SB564	2SB811			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
		2SD571				2SD1000
	2SD1513					2SD1614
	2SD1616					2SD1615
	2SD1616A					2SD1615A
	2SD1698	2SD1697				2SD1699
	2SD1701	2SD1700				2SD1702
		2SD1581				2SD1950

Quick Reference Table by Function/Application

Small Signal Transistor

■ **Small Signal Transistor (2/2)**

	TO-92	SP-8	SST	SMALL MINI MOLD	MINI MOLD	POWER MINI
Switching	2SA1206		2SA1459	2SA1610	2SA1462	
				2SA1608	2SA1464	
		2SA1460				2SA1463
			2SA1458		2SA1461	
				2SC4173	2SC3739	
	2SC2901		2SC3732	2SC4176	2SC3735	
		2SC3733				2SC3736
			2SC3731		2SC3734	

Quick Reference Table by Function/Application

Power Transistor

■ Low $V_{CE(sat)}$ Transistor

Characteristics V_{CEO}, $I_{C(DC)}$	SP-8	MP-2	MP-3	MP-5 (TO-126)	MP-25	MP-10	MP-45	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				2SA1441 2SC3691	2SA1741 2SC4549
60 V, 7 A							2SA1442 2SC3692	2SA1742 2SC4550
60 V, 10 A							2SA1443 2SC3693	2SA1743 2SC4551
60 V, 15 A							2SA1444 2SC3694	2SA1744 2SC4552
100 V, 5 A			2SA1647 2SC4331			2SA1845	2SA1650	
100 V, 7 A					2SA1645			
100 V, 10 A						2SA1847	2SA1652 2SC4336	

■ High h_{FE} Transistor

Characteristics V_{CEO}, $I_{C(DC)}$	SP-8	MP-3	MP-5 (TO-126)	MP-10	MP-45	MP-45F
20 V, 2 A		2SD1583				
25 V, 2 A	2SD1581					
50 V, 1 A	2SD1582					
60 V, 3 A		2SD1584	2SD1694		2SD1593	2SD2164
100 V, 2.5 A				2SC4814*		
100 V, 6 A					2SD1594	2SD2165
100 V, 7.5 A				2SC4813*	2SC4062	2SC4553*
100 V, 15 A					2SC4063	2SC4554*

*: Low VCE(sat) & High hFE

Quick Reference Table by Function/Application

Power Transistor

■ Low Voltage, High Speed Switching Transistor

Characteristics V_{CEO}, $I_{C(DC)}$	SP-8	MP-25	MP-45	MP-80
45 V, 1 A	2SA1460 2SC3733			
60 V, 5 A		2SA1069	2SA1394	
100 V, 2 A		2SA1008 2SC2331	2SA1395 2SC3567	
100 V, 5 A		2SC2517		
100 V, 7 A		2SA1010 2SC2334		
100 V, 10			2SA1396 2SC3568	
100 V, 15 A				2SC2750

■ High Voltage, High Speed Switching Transistor

Characteristics V_{CEO}, $I_{C(DC)}$	MP-3	MP-5 (TO-126)	MP-25 (TO-220)	MP-40	MP-45	MP-80
200 V, 2 A	2SC2885 2SC2946 2SC2946(1)					
350 V, 2 A			2SA1009			
400 V, 0.5 A	2SA1400 2SC3588	2SA1156 2SC2752				
400 V, 2 A	2SC3631		2SA1009A 2SC2333		2SC3569	
400 V, 5 A	2SC4346		2SC2518		2SC3570	
400 V, 7 A				2SC3158	2SC3571	
400 V, 10 A				2SC3159	2SC3572	2SC2749
400 V, 15 A						2SC2751
600 V, 2 A	2SA1413 2SC3632	2SA1486 2SC3840				

Quick Reference Table by Function/Application

Power Transistor

■ Audio Frequency Amplification Transistor

Characteristics V_{CEO}, $I_{C(DC)}$	MP-3	MP-5 (TO-126)	MP-25 (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, 0.8 A		2SD414		
80 V, 7 A			2SB708	
100 V, 0.8 A		2SD415		
150 V, 2 A	2SB768 2SD1033		2SB546A 2SD401A	

■ High Frequency Amplification Transistor

Characteristics V_{CEO}, $I_{C(DC)}$	SP-8	MP-5 (TO-126)	MP-25 (TO-220)
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	2SC2802	2SC2688	2SC1505

Quick Reference Table by Function/Application

Power Transistor

■ Darlington Transistor

Characteristics V_{CEO}, $I_{C(DC)}$	SP-8	MP-3	MP-5 (TO-126)	MP-25 (TO-220)	MP-10	MP-40	MP-45	MP-45F	MP-80
31 V, 2 A	2SD2463*		2SD1695*						
60 V, 0.8 A	2SD1700*								
60 V, 1 A	2SD1843	2SB963 2SD1286	2SD1630*						
60 V, 1.5 A		2SD1164	2SB794 2SD985						
60 V, 3 A			2SB1150* 2SD1693*						
60 V, 5 A						2SD1392*	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	2SD1308	2SB1098◎ 2SD1589◎	2SB1430 2SD2161	
100 V, 8 A					2SA1841 2SC4811	2SD1309	2SB1099 2SD1590	2SB1431 2SD2162	
100 V, 10 A							2SA1720◎ 2SB1100 2SD1591	2SB1432 2SD2163	2SB897 2SD1210
100 V, 15 A									2SD1296
100 V, 25 A									2SD1297
300 V, 5 A							2SD1592		

◎: High speed darlington transistor, *: Internal zener diode between C-B

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_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.	
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	1.0	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	0.03	4	0.02	30	50	
2SK1133	SC-59	50	0.1	0.2	0.2	5	0.02	0.03	4	0.02	30	50	
2SK1272	TO-92	60	±1.0	±2.0	0.75	10	0.5	0.4	4	0.5	—	1.0	
2SK1273	SC-62	60	±2.0	±4.0	2.0	10	0.5	0.4	4	0.5	—	1.0	
2SK1274	SP-8	60	±1.5	±3.0	1.0	10	0.5	0.4	4	0.5	—	1.0	
2SK1398	SST	50	0.1	0.2	0.25	3	0.01	0.02	2.5	0.005	20	40	
2SK1399	SC-59	50	0.1	0.2	0.2	3	0.01	0.02	2.5	0.005	20	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	0.62	1.2	
2SK1485	SC-62	100	±1.0	±2.0	2.0	10	0.5	0.4	4	0.5	0.62	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	0.3	0.4	2.5	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	—	1.0	
2SK1587	SC-62	16	±2.0	±4.0	2.0	5	1.0	0.4	2.5	1.0	0.55	0.8	
2SK1588	SC-62	16	±3.0	±6.0	2.0	3	1.0	0.4	2.5	1.0	0.34	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	
2SK1591	SC-59	100	0.2	0.4	0.2	5	0.01	0.02	4	0.01	5.8	8	
2SK1592	SC-62	60	±0.5	±1.0	2.0	10	0.5	0.4	4	0.5	1.6	2.5	
2SK1593	SC-62	100	±0.5	±1.0	2.0	10	0.5	0.4	4	0.5	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	3-pin ultra super mini	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	30	50	
2SK1959	SC-62	16	±2.0	±4.0	2.0	3	1.0	1.0	1.5	0.05	0.08	0.8	
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	MP-2	16	±5	±10	2.0	3	2.5	0.4	1.5	0.5	0.2	0.4	Switching
2SK2054	MP-2	60	±3	±6	2.0	10	1.5	2.0	4	1.5	0.18	0.25	
2SK2055	MP-2	100	±2	±4	2.0	10	1.0	2.0	4	1.0	0.28	0.45	
2SK2070	SP-8	100	±1	±2	2.0	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	1.5	
2SK2110	SC-62	100	±0.5	±1.0	2.0	10	0.3	0.4	4	0.3	0.90	2.0	
2SK2111	SC-62	60	±1.0	±2.0	2.0	10	0.5	0.4	4	0.5	0.35	1.0	
2SK2112	SC-62	100	±1.0	±2.0	2.0	10	0.5	0.4	4	0.5	0.67	1.5	
2SK2157	MP-2	30	±5	±10	2.0	10	2.5	2.0	4	2.5	0.08	0.15	
2SK2158	SC-59	50	0.1	0.2	0.2	3	0.01	0.02	1.5	0.001	21	50	
2SK2159	SC-62	60	±2	±4	2.0	10	1.0	0.4	1.5	0.1	0.26	0.7	
2SK2541	SST	50	±0.1	±0.2	0.2	3	0.01	0.02	1.5	0.001	21	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	10	15	

★: Under development

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_T 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	22	50	Switching
2SJ166	SC-59	−50	∓0.1	∓0.2	0.2	−5	−0.02	0.03	−4	−0.02	22	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	−5	−0.02	0.02	−2.5	−0.05	25	40	
2SJ185	SC-59	−50	∓0.1	∓0.2	0.2	−5	−0.02	0.02	−2.5	−0.05	25	40	
2SJ196	TO-92	−60	∓1.0	∓2.0	0.75	−10	−0.5	0.4	−4	−0.5	0.89	1.5	
2SJ197	SC-62	−60	∓1.5	∓3.0	2.0	−10	−0.5	0.4	−4	−0.5	0.89	1.5	
2SJ198	TO-92	−100	∓0.5	∓1.0	0.75	−10	−0.5	0.4	−4	−0.5	1.7	2.0	
2SJ199	SC-62	−100	∓1.0	∓2.0	2.0	−10	−0.5	0.4	−4	−0.5	1.7	2.0	
2SJ202	SC-70	−16	∓0.1	∓0.2	0.15	−3	−0.01	0.02	−2.5	−0.001	—	60	
2SJ203	SC-59	−16	∓0.2	∓0.4	0.2	−3	−0.01	0.02	−2.5	−0.001	16	20	
2SJ204	SC-59	−30	∓0.2	∓0.4	0.2	−3	−0.01	0.02	−2.5	−0.001	8.8	15	
2SJ205	SC-62	−16	∓0.5	∓1.0	2.0	−5	−0.3	0.4	−2.5	−0.3	2.2	5.0	
2SJ206	SC-62	−30	∓0.5	∓1.0	2.0	−5	−0.3	0.4	−2.5	−0.3	2.8	3.0	
2SJ207	SC-62	−16	∓1.0	∓2.0	2.0	−5	−0.5	0.4	−2.5	−0.5	1.5	2.0	
2SJ208	SC-62	−16	∓2.0	∓4.0	2.0	−5	−1.0	0.4	−2.5	−1.0	0.6	1.5	
2SJ209	SC-59	−100	∓0.1	∓0.2	0.2	−5	−0.01	0.02	−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	−0.01	0.02	−4	−0.01	18	30	
2SJ212	SC-62	−60	∓0.5	∓1.0	2.0	−10	−0.5	0.4	−4	−0.5	1.8	4.0	
2SJ213	SC-62	−100	∓0.5	∓1.0	2.0	−10	−0.5	0.4	−4	−0.5	2.7	5.0	
2SJ243	3-pin ultra super mini	−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	1.0	−4	−0.8	0.58	0.68	
2SJ355	SC-62	30	2	4	2.0	−10	−1	1.0	4.0	1.0	0.50	0.60	
2SJ356	SC-62	60	2	4	2.0	−10	−1	1.0	4.0	1.0	0.65	0.95	
2SJ357	MP-2	30	3	6	2.0	−10	−1	1.8	4.0	1.5	0.23	0.35	
2SJ358	MP-2	60	3	6	2.0	−10	−1	1.8	4.0	1.5	0.29	0.40	
2SJ411	SP-8	−30	∓5	∓20	1.0	−10	−2.5	3.0	−4	−2.5	0.096	0.24	
2SJ460	SST	−50	∓0.1	∓0.2	0.25	−3	−0.01	0.01	−2.5	−0.003	75	100	
2SJ461	SC-59	−50	∓0.1	∓0.2	0.2	−3	−0.01	0.01	−2.5	−0.003	75	100	
2SJ462	MP-2	−12	∓2.5	∓5.0	2.0	−3	−1	1.5	−2.5	−0.5	0.23	0.3	
2SJ463A	SC-70	−30	∓0.1	∓0.4	0.15	−3	−0.01	0.02	−2.5	−0.001	23	60	

Field Effect Transistor

Power MOS FET

■ N6-L series Product Map

DC drain current $I_{D(DC)}$ (A)	Drain to source voltage V_{DSS} (V)		Package
	30	60	
to 20	△ 2SK2981 (27 m/40 m)*		△ : TO-251 (MP-3) ● : Isolated TO-220 (MP-45F) ○ : TO-220AB (MP-25)
to 30	△ 2SK2982 (12.5 m/16.5 m)* ○ 2SK2983 (20 m/27 m)*	● 2SK3055 (34 m/50 m)	
to 40	○ 2SK2984 (10 m/13 m)*	○ 2SK3056 (34 m/50 m)	
to 50		● 2SK2057 (17 m/27 m) ● 2SK3059 (13 m/20 m)	
to 60		○ 2SK2058 (17 m/27 m)	
to 70		○ 2SK3060 (13 m/20 m) ● 2SK3061 (8.5 m/12 m) ○ 2SK3062 (8.5 m/12 m) ○ 2SK2826 (6.5 m/10.5 m)	

( ): $R_{DS(on)\ MAX}$ (Ω) (@V_{GS} = 10 V/V_{GS} = 4 V)
* : (@V_{GS} = 10 V/V_{GS} = 4.5 V)

■ N5-L series/P5-L series/N4-L series Product Map

DC drain current $I_{D(DC)}$ (A)	Drain to source voltage V_{DSS} (V)			Package
	30	60	100	
8.0		△ 2SK2415 (0.1/0.15)		△ : TO-251 (MP-3) ● : Isolated TO-220 (MP-45F) ○ : TO-220AB (MP-25) ◎ : MP-10 ⧈ : TO-3P (MP-88)
10		◎ 2SK2413 (70 m/95 m) △ 2SK2414 (70 m/95 m)		
15			● 2SK2462 (0.14/0.17)	
20		● 2SK2412 (70 m/95 m) ○ 2SJ492 (0.1/0.19)* ● 2SJ494 (50 m/88 m)*	● 2SK2461 (80 m/0.1)	
25		● 2SK2723 (40 m/60 m)*		
30		● 2SK2410 (40 m/60 m) ○ 2SK2411 (40 m/60 m) ● 2SJ495 (30 m/56m)*		
35	○ 2SK2941 (20 m/33 m)*	● 2SK2724 (27 m/40 m)*		
40		● 2SK2409 (27m/40 m) ● 2SK2510 (20 m/30 m)* ⧈ 2SK2511 (27 m/40 m)*		
45		● 2SK2512 (15 m/23 m)* ○ 2SK2513 (15 m/23 m)*		
50		● 2SK2498 (9 m/14 m)* ○ 2SK2499 (9 m/14 m)* ⧈ 2SK2514 (15 m/23 m)* ⧈ 2SK2515 (9 m/14 m)*		

( ): $R_{DS(on)\ MAX}$ (Ω) (@V_{GS} = 10 V/V_{GS} = 4 V)
* : N5-L series

Field Effect Transistor

Power MOS FET

■ N3-L series/P3-L series Product Map

DC drain current $I_{D(DC)}$ (A)	Drain to source voltage V_{DSS} (V)			Package
	30	60	100/[150]	
~ 4.0	△ 2SJ324 (0.25/0.52) △ 2SJ325 (0.11/0.24)	△ 2SK1282 (0.18/0.24) ◇ 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)
~ 8.0		◎ 2SK1748 (0.11/0.16)		
~ 10		◎ 2SK1850 (70 m/95 m)	◎ 2SK1852 (0.15/0.20)	
~ 15		2SK1851 (45 m/60 m) ● 2SK1286 (70 m/95 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)]	
~ 20	● 2SK1594 (50 m/80 m)	○ 2SK1287 (70 m/95 m) ○ 2SJ302 (0.1/0.24) ○ 2SJ328 (60 m/0.11) ● 2SJ330 (50 m/90 m)	○ 2SK1289 (0.15/0.20) ● 2SK1292 (80 m/0.10)	
~ 25		● 2SK1290 (45 m/60 m)		
~ 30		▣ 2SJ331 (30 m/55 m)	○ 2SK1293 (80 m/0.10) ● 2SK1295 (50 m/70 m)	
~ 40	● 2SK1596 (20 m/30 m)	● 2SK1294 (27 m/50 m) ▣ 2SK1123 (27 m/50 m)	▣ 2SK1122 (50 m/70 m)	
~ 50		▣ 2SK1749 (18 m/25 m)		

( ): $R_{DS(on)\ MAX}$ (Ω) (@V_{GS} = 10 V/V_{GS} = 4 V)

Field Effect Transistor

Power MOS FET

■ N6-L Series (Low Voltage N channel 6th generation Series)

Part number	Package	Absolute maximum ratings			Electrical characteristics					
					$R_{DS(on)}$ @V_{GS} = 10 V		$R_{DS(on)}$ @V_{GS} = 4 V			
		V_{DSS} (V)	$I_{D(DC)}$ (A)	P_T @T_C = 25 °C (W)	TYP. (Ω)	MAX. (Ω)	TYP. (Ω)	MAX. (Ω)	C_{iss} (pF)	C_{rss} (pF)
2SK2981	TO-251	30	20	20	20 m	27 m	30 m	40 m*	860	160
2SK2982	TO-251		30	20	9.8 m	12.5 m	13.2 m	16.5 m*	2290	440
2SK2983	TO-220AB		30	50	13 m	20 m	18 m	27 m*	1200	250
2SK2984	TO-220AB		40	60	6.5 m	10 m	8.5 m	13 m*	2600	500
2SK3053	Isolated TO-220	60	25	25	29 m	45 m	46 m	70 m	790	100
2SK3055	Isolated TO-220		30	25	28 m	34 m	42 m	50 m	990	90
2SK3056	TO-220AB		32	34	28 m	34 m	42 m	50 m	990	90
2SK3057	Isolated TO-220		45	30	14 m	17 m	21 m	27 m	2040	190
2SK3058	TO-220AB		55	58	14 m	17 m	21 m	27 m	2040	190
2SK3059	Isolated TO-220		50	30	11 m	13 m	16 m	20 m	2550	250
2SK3060	TO-220AB		70	70	11 m	13 m	16 m	20 m	2550	250
2SK3061	Isolated TO-220		70	35	6.3 m	8.5 m	9.8 m	12 m	5020	460
2SK3062	TO-220AB		70	100	6.3 m	8.5 m	9.8 m	12 m	5020	460
2SK2826	TO-220AB		70	100	5.5 m	6.5 m	7 m	10.5 m	7260	660

*: V_{GS} = 4.5 V

■ N5-L Series (Low Voltage N channel 5th generation Series)

Part number	Package	Absolute maximum ratings			Electrical characteristics					
					$R_{DS(on)}$ @V_{GS} = 10 V		$R_{DS(on)}$ @V_{GS} = 4 V			
		V_{DSS} (V)	$I_{D(DC)}$ (A)	P_T @T_C = 25 °C (W)	TYP. (Ω)	MAX. (Ω)	TYP. (Ω)	MAX. (Ω)	C_{iss} (pF)	C_{rss} (pF)
2SK2941	TO-220AB	30	35	60	14 m	20 m	22 m	33 m	1250	460
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-3P		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
2SK2513	TO-220AB		45	75	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
2SK2499	TO-220AB		50	75	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

Field Effect Transistor

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■ P5-L Series (Low Voltage P channel 5th generation Series)

Part number	Package	Absolute maximum ratings			Electrical characteristics					
					$R_{DS(on)}$ @V_{GS} = 10 V		$R_{DS(on)}$ @V_{GS} = 4 V			
		V_{DSS} (V)	$I_{D(DC)}$ (A)	P_T @T_C = 25 °C (W)	TYP. (Ω)	MAX. (Ω)	TYP. (Ω)	MAX. (Ω)	C_{iss} (pF)	C_{rss} (pF)
2SJ492	TO-220AB	–60	–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

■ N4-L Series (Low Voltage N channel 4th generation Series)

Part number	Package	Absolute maximum ratings			Electrical characteristics					
					$R_{DS(on)}$ @V_{GS} = 10 V		$R_{DS(on)}$ @V_{GS} = 4 V			
		V_{DSS} (V)	$I_{D(DC)}$ (A)	P_T @T_C = 25 °C (W)	TYP. (Ω)	MAX. (Ω)	TYP. (Ω)	MAX. (Ω)	C_{iss} (pF)	C_{rss} (pF)
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
2SK2411	TO-220AB		30	75	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*	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

*: T_A = 25°C

■ P3-L Series (Low Voltage P channel 3rd generation Series)

Part number	Package	Absolute maximum ratings			Electrical characteristics					
					$R_{DS(on)}$ @V_{GS} = 10 V		$R_{DS(on)}$ @V_{GS} = 4 V			
		V_{DSS} (V)	$I_{D(DC)}$ (A)	P_T @T_C = 25 °C (W)	TYP. (Ω)	MAX. (Ω)	TYP. (Ω)	MAX. (Ω)	C_{iss} (pF)	C_{rss} (pF)
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

Field Effect Transistor

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■ N3-L Series (Low Voltage 3rd generation Series)

Part number	Package	Absolute maximum ratings			Electrical characteristics					
					$R_{DS(on)}$ @V_{GS} = 10 V		$R_{DS(on)}$ @V_{GS} = 4 V			
		V_{DSS} (V)	$I_{D(DC)}$ (A)	P_T @T_C = 25 °C (W)	TYP. (Ω)	MAX. (Ω)	TYP. (Ω)	MAX. (Ω)	C_{iss} (pF)	C_{rss} (pF)
2SK1594	Isolated TO-220	30	20	30	37 m	50 m	50 m	80 m	1300	280
2SK1596	Isolated TO-220		40	35	14 m	20 m	20 m	30 m	3400	960
2SK1282	TO-251	60	3.0	20	0.15	0.18	0.18	0.24	500	40
2SK1283	TO-126		3.0	20	0.15	0.18	0.18	0.24	500	40
2SK1748	TO-251		8.0	20	80 m	0.11	0.11	0.16	850	350
2SK1850	MP-10		10	1.8*	55 m	70 m	80 m	95 m	1400	130
2SK1851	MP-10		15	1.8*	35 m	45 m	45 m	60 m	2200	180
2SK1286	Isolated TO-220		15	30	55 m	70 m	80 m	95 m	1400	130
2SK1287	TO-251		20	60	55 m	70 m	80 m	95 m	1400	130
2SK1290	Isolated TO-220		25	35	35 m	45 m	45 m	60 m	2200	180
2SK1294	Isolated TO-220		40	35	22 m	27 m	30 m	50 m	3250	380
2SK1123	TO-3P		40	100	22 m	27 m	30 m	50 m	3250	380
2SK1749	TO-3P		50	150	16 m	18 m	22 m	25 m	5400	620
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*	0.12	0.15	0.15	0.20	1400	50
2SK1853	MP-10		15	1.8*	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
2SK1289	TO-220AB		20	60	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
2SK1293	TO-220AB		30	75	70 m	80 m	80 m	0.10	2200	90
2SK1295	Isolated TO-220		30	35	42 m	50 m	50 m	70 m	3300	200
2SK1122	TO-3P		40	100	42 m	50 m	50 m	70 m	3300	200
2SK2131	Isolated TO-220	150	15	35	0.10	0.12	0.13	0.20	2300	140

*: T_A = 25°C

Field Effect Transistor

Power MOS FET

■ N5-H series Product Map

( ): $R_{DS(on)\ MAX}$ (Ω) (@V_{GS} = 10 V)

DC drain current $I_{D(DC)}$ (A)	Drain to source voltage V_{DSS} (V)				Package
	200/250 V	400/500 V	600 V	900 V	
2			△ 2SK3113 (4.4) ● 2SK3221 (4.4)		△: TO-251 (MP-3) ●: Isolated TO-220 (MP-45F) ○: TO-220AB (MP-25) □: TO-3P (MP-88)
4			● 2SK3114 (2.2)		
5		● 2SK3306 (1.5)★ ○ 2SK3305 (1.5)★	● 2SK3297 (1.6)★		
6			● 2SK3115 (1.2)	□ 2SK3304 (2.0)★	
7					
7.5			○ 2SK3116 (1.2) ● 2SK3298 (0.75)★		
8	● 2SK3108 (0.4)				
10	○ 2SK3109 (0.4)		○ 2SK3299 (0.75)★		
14	● 2SK3110 (0.18)				
20	○ 2SK3111 (0.18) ○ 2SK3294 (0.12)∗1★		□ 2SK3300 (0.4)★		
25	○ 2SK3112 (0.11)★				

∗1: 250 V ∗2: 450 V

★: Under development

■ N4-H series/P4-H series Product Map

DC drain current $I_{D(DC)}$ (A)	Drain to source voltage V_{DSS} (V)						Package
	[180]/200	250	450	500	600	[800]/900	
2.0					● 2SK1953 (5.0) △ 2SK2040 (5.0)	● 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)			● 2SK2137 (2.4)	○ 2SK2481 (4.0) ● 2SK2483 (2.8) (3.5 A)	
4.5			● 2SK2353 (1.4)	● 2SK2354 (1.5)			
5.0			○ 2SK2355 (1.4)	○ 2SK2356 (1.5)	○ 2SK2138 (2.4) ● 2SK2139 (1.5)	⧈ 2SK2482 (4.0) ○ 2SK2484 (2.8)	
6.0		● 2SJ449 (0.8)	● 2SK2357 (0.9)	● 2SK2358 (1.0)	● 2SK2141 (1.1)	⧈ 2SK2485 (2.8)	
7.0			○ 2SK2359 (0.9)	○ 2SK2360 (1.0)	○ 2SK2140 (1.5)	⧈ 2SK2486 (2.0)	
8.0			● 2SK2363 (0.5)	● 2SK2364 (0.6)		⧈ 2SK2487 (1.6)	
10			⧈ 2SK2361 (0.9) ○ 2SK2365 (0.5)	⧈ 2SK2362 (1.0) ○ 2SK2366 (0.6)		[⧈ 2SK2477 (1.0)] ⧈ 2SK2488 (1.2)	
11		● 2SK2341 (0.26)					
13	○ 2SK2134 (0.4)						
14	● 2SK2135 (0.18)						
15			⧈ 2SK2367 (0.5)	⧈ 2SK2368 (0.6)			
16		○ 2SK2133 (0.26)					
20	○ 2SK2136 (0.18)		⧈ 2SK2369 (0.35)	⧈ 2SK2370 (0.4)			
25			⧈ 2SK2371 (0.25)	⧈ 2SK2372 (0.27)			

( ): $R_{DS(on)\ MAX}$ (Ω) (@V_{GS} = 10 V)

Field Effect Transistor

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■ N3-H series Product Map

DC drain current $I_{D(DC)}$ (A)	Drain to source voltage V_{DSS} (V)					Package
	250	450	500	600	900	
2.0				● 2SK1758 (4.2)	● 2SK1994 (7.5)	△: TO-251 (MP-3) ●: Isolated TO-220 (MP-45F) ○: TO-220AB (MP-25) ⧈: TO-3P (MP-88)
2.5		● 2SK1988 (2.8)	● 2SK1989 (3.0)			
3.0		○ 2SK1493 (2.8)	○ 2SK1494 (3.0)		○ 2SK1793 (7.5) ● 2SK1995 (4.0)	
3.5					● 2SK2275 (2.8)	
4.0					○ 2SK1501 (4.0)	
4.5		● 2SK1990 (1.4)	● 2SK1991 (1.5)			
5.0		○ 2SK1750 (1.4)	○ 2SK1751 (1.5)		⧈ 2SK1760 (4.0)	
6.0		● 2SK1992 (0.9)	● 2SK1993 (1.0)		⧈ 2SK1794 (2.8)	
7.0		○ 2SK1495 (0.9)	○ 2SK1496 (1.0)		⧈ 2SK1502 (2.0)	
8.0			● 2SK2234 (0.6)		⧈ 2SK1795 (1.6)	
10		⧈ 2SK1752 (0.9)	⧈ 2SK1753 (1.0)		⧈ 2SK1796 (1.2)	
12		⧈ 2SK1784 (0.6)	⧈ 2SK1785 (0.7)			
15		⧈ 2SK1756 (0.5)	⧈ 2SK1757 (0.6)			
20		⧈ 2SK1497 (0.35)	⧈ 2SK1498 (0.4)			
25	⧈ 2SK1491 (0.15)	⧈ 2SK1499 (0.25)	⧈ 2SK1500 (0.27)			
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)		
2SK3108	Isolated TO-220	200	8	25	0.33	0.4	400	15
2SK3109	TO-220AB	200	10	50	0.33	0.4	400	15
2SK3110	Isolated TO-220	200	14	35	0.13	0.18	1000	40
2SK3111	TO-220AB	200	20	65	0.13	0.18	1000	40
2SK3112	TO-220AB	200	25	70	0.08	0.11	1600	65
2SK3294★	TO-220AB	250	20	70	0.12	0.16	1600	65
2SK3305★	TO-220AB	500	5	50	1.35	1.5	570	20
2SK3306★	Isolated TO-220	500	5	30	1.35	1.5	570	20
2SK3113	TO-251	600	2	20	3.3	4.4	290	9
2SK3221	Isolated TO-220	600	2	25	3.3	4.4	290	9
2SK3114	Isolated TO-220	600	4	30	1.6	2.2	550	15
2SK3297★	Isolated TO-220	600	5	35	1.28	1.6	690	24
2SK3115	Isolated TO-220	600	6	35	0.9	1.2	1100	26
2SK3116	TO-220AB	600	7.5	70	0.9	1.2	1100	26
2SK3298★	TO-220AB	600	7.5	40	0.6	0.75	1500	51
2SK3299★	TO-220AB	600	10	70	0.6	0.75	1500	51
2SK3300★	TO-3P	600	20	150	0.32	0.4	3300	80
2SK3304★	TO-3P	900	7	120	1.6	2.0	1500	50

★: Under development

Field Effect Transistor

Power MOS FET

■ **N4-H Series (High Voltage N channel 4th generation Series) (1/2)**

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)		
2SK1954	TO-251	180	4.0	20	0.52	0.65	300	10
2SK2132	MP-10		4.0	1.8*	0.52	0.65	300	10
2SK2134	TO-220AB	200	13	70	0.32	0.40	540	15
2SK2135	Isolated TO-220		14	35	0.14	0.18	1100	30
2SK2136	TO-220AB		20	75	0.14	0.18	1100	30
2SK2341	Isolated TO-220	250	11	35	0.21	0.26	1090	33
2SK2133	TO-220AB		16	75	0.21	0.26	1090	25
2SK2353	Isolated TO-220	450	4.5	30	1.0	1.4	670	20
2SK2355	TO-220AB		5.0	50	1.0	1.4	670	20
2SK2357	Isolated TO-220		6.0	35	0.7	0.9	1050	27
2SK2359	TO-220AB		7.0	75	0.7	0.9	1050	27
2SK2361	TO-3P		10	100	0.7	0.9	1050	26
2SK2363	Isolated TO-220		8.0	35	0.4	0.5	1600	42
2SK2365	TO-220AB		10	75	0.4	0.5	1600	42
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
2SK2354	Isolated TO-220	500	4.5	30	1.1	1.5	670	20
2SK2356	TO-220AB		5.0	50	1.1	1.5	670	20
2SK2358	Isolated TO-220		6.0	35	0.8	1.0	1050	27
2SK2360	TO-220AB		7.0	75	0.8	1.0	1050	27
2SK2362	TO-3P		10	100	0.8	1.0	1050	26
2SK2364	Isolated TO-220		8.0	35	0.5	0.6	1600	42
2SK2366	TO-220AB		10	75	0.5	0.6	1600	42
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
2SK1953	Isolated TO-220	600	2.0	25	4.2	5.0	275	12
2SK2040	TO-251		2.0	20	4.2	5.0	275	12
2SK2137	Isolated TO-220		4.0	30	2.0	2.4	550	20
2SK2138	TO-220AB		5.0	70	2.0	2.4	550	20
2SK2139	Isolated TO-220		5.0	35	1.25	1.5	930	30
2SK2141	Isolated TO-220		6.0	40	0.9	1.1	1150	40
2SK2140	TO-220AB		7.0	75	1.25	1.5	930	30
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

*: T_A = 25°C

Field Effect Transistor

Power MOS FET

■ N4-H Series (High Voltage N channel 4th generation Series) (2/2)

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)		
2SK2482	TO-3P	900	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
2SK2485	TO-3P		6.0	100	2.2	2.8	1200	40
2SK2486	TO-3P		7.0	120	1.4	2.0	1830	55
2SK2487	TO-3P		8.0	140	1.1	1.6	2100	65
2SK2488	TO-3P		10	160	1.0	1.2	2900	90

■ 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	–250	∓6.0	35	0.55	0.8	1040	23.4

Field Effect Transistor

Power MOS FET

■ 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	250	35	140	0.08	0.1	3000	80
2SK1988	Isolated TO-220	450	2.5	30	2.2	2.8	350	12
2SK1493	TO-220AB	450	3	50	2.2	2.8	350	12
2SK1990	Isolated TO-220	450	4.5	30	1.1	1.4	610	22
2SK1750	TO-220AB	450	5	50	1.1	1.4	610	22
2SK1992	Isolated TO-220	450	6	35	0.7	0.9	1060	36
2SK1495	TO-220AB	450	7	70	0.7	0.9	1060	36
2SK1752	TO-3P	450	10	100	0.7	0.9	1060	36
2SK1784	TO-3P	450	12	100	0.5	0.6	1330	46
2SK1756	TO-3P	450	15	120	0.4	0.5	1500	50
2SK1497	TO-3P	450	20	120	0.28	0.35	2460	85
2SK1499	TO-3P	450	25	160	0.2	0.25	3300	115
2SK1989	Isolated TO-220	500	2.5	30	2.4	3	350	12
2SK1494	TO-220AB	500	3	50	2.4	3	350	12
2SK1991	Isolated TO-220	500	4.5	30	1.2	1.5	610	22
2SK1751	TO-220AB	500	5	50	1.2	1.5	610	22
2SK1993	Isolated TO-220	500	6	35	0.8	1	1060	36
2SK1496	TO-220AB	500	7	70	0.8	1	1500	57
2SK2234	Isolated TO-220	500	8	40	0.5	0.6	1060	36
2SK1753	TO-3P	500	10	100	0.8	1	1060	36
2SK1785	TO-3P	500	12	100	0.6	0.7	1330	46
2SK1757	TO-3P	500	15	120	0.5	0.6	1500	50
2SK1498	TO-3P	500	20	120	0.32	0.4	2460	85
2SK1500	TO-3P	500	25	160	0.22	0.27	3300	115
2SK1758	Isolated TO-220	600	2	30	2.8	4.2	360	17
2SK1994	Isolated TO-220	900	2	30	5.5	7.5	430	15.5
2SK1793	TO-220AB	900	3	75	5.5	7.5	430	19
2SK1995	Isolated TO-220	900	3	35	3	4	790	28
2SK2275	Isolated TO-220	900	3.5	35	2.2	2.8	1000	42
2SK1501	TO-220AB	900	4	70	2.8	4	790	33
2SK1760	TO-3P	900	5	100	3.1	4	790	34
2SK1794	TO-3P	900	6	100	2.4	2.8	1000	42
2SK1502	TO-3P	900	7	120	1.7	2	1550	80
2SK1795	TO-3P	900	8	140	1.3	1.6	1740	66
2SK1796	TO-3P	900	10	150	1	1.2	2500	90
2SK1271*	TO-3P	1400	5	240	3.5	4	1800	125

*: 2nd Generation

Field Effect Transistor

Power MOS FET

■ 8-pin SOP Type Power MOS FET

On-Resistance R_{DS} (on) (mΩ) (TYP.) @V_{GS} = 10 V	Drain to source voltage V_{DSS} (V)		
	20	30	60
up to 600			μPA1790 (Nch + Pch)
up to 150			μPA1759 (Nch Dual)
up to 90		μPA1750 (P-ch Dual)	
up to 70		μPA1710 (P-ch Single) μPA1710A (P-ch Single) μPA1754 (N-ch Dual)	
up to 50		μPA1713 (P-ch Single)	
up to 40	μPA1752 (N-ch Dual)*1	μPA1711 (P-ch Single)	
up to 30	μPA1753 (N-ch Dual)*1 μPA1756 (N-ch Dual)*1	μPA1751 (N-ch Dual) μPA1714 (P-ch Single) μPA1755 (N-ch Dual) μPA1758 (N-ch Dual)*1	
up to 20	μPA1701 (N-ch Single)*1 μPA1701A (N-ch Single) μPA1757 (N-ch Dual)*1	μPA1700 (N-ch Single) μPA1700A (N-ch Single) μPA1712 (P-ch Single) μPA1716 (P-ch Single) μPA1705 (N-ch Single)*2	
up to 10		μPA1702 (N-ch Single) μPA1703 (N-ch Single) μPA1704 (N-ch Single) μPA1706 (N-ch Single) μPA1707 (N-ch Single) μPA1715 (P-ch Single)	

∗1: 2.5 V drive is possible. Otherwise 4 V drive is possible. ∗2: 4.5 V drive

Field Effect Transistor

Power MOS FET

■ Power SOP8 series

Part number	Configuration	Absolute maximum rating (T_A = 25 °C)				Electrical characteristics (T_A = 25 °C)				Applications
		V_{DSS} (V)	I_D		P_T T_C = 25 °C (W)	$R_{DS(on)}$ (Ω)				
			DC (A)	Pulse (A)		V_{GS} (V)	I_D (A)	TYP.	MAX.	
μPA1700	N-ch Single	30	±7	±28	2.0*1	4	3.5	0.040	0.050	Switching
μPA1700A	N-ch Single	30	±7	±28	2.0*1	4	3.5	0.028	0.05	
μPA1701	N-ch Single	20	±7	±28	2.0*1	2.5	3.5	0.03	0.04	
μPA1701A	N-ch Single	20	±7	±28	2.0*1	2.5	3.5	0.026	0.04	
μPA1702	N-ch Single	30	±8	±32	2.0*1	4	4	0.018	0.025	
μPA1703	N-ch Single	30	±10	±40	2.0*1	4	5.0	0.012	0.017	
μPA1704	N-ch Single	30	±10	±40	2.0*1	2.5	5.0	0.0125	0.016	
μPA1705	N-ch Single	30	±7	±28	2.0*1	4.5	3.5	0.031	0.04	
μPA1706	N-ch Single	30	±13	±52	2.0*1	4	7.0	0.008	0.012	
μPA1707	N-ch Single	30	±10	±40	2.0*1	4	5.0	0.014	0.021	
μPA1710	P-ch Single	−30	∓5	∓20	2.0*1	−4	−2.5	0.11	0.16	
μPA1710A	P-ch Single	−30	∓5	∓20	2.0*1	−4	−2.0	0.091	0.16	
μPA1711	P-ch Single	−30	∓7	∓28	2.0*1	−4	−3.5	0.049	0.07	
μPA1712	P-ch Single	−30	∓8	∓32	2.0*1	−4	−4.0	0.027	0.048	
μPA1713	P-ch Single	30	∓5	∓20	2.0*1	−4	2.5	0.10	0.16	
μPA1714	P-ch Single	−30	∓7	∓28	2.0*1	−4	3.5	0.049	0.07	
μPA1715	P-ch Single	−30	∓11	∓44	2.0*1	−4.5	−6.0	0.011	0.016	
μPA1716	P-ch Single	−30	∓8	∓32	2.0*1	−4.5	−4	0.017	0.023	
μPA1750	P-ch Dual	−30	∓3.5	∓14	2.0*2	−4	−1.8	0.125	0.18	
μPA1751	N-ch Dual	30	±5	±20	2.0*2	4	2.5	0.044	0.064	
μPA1752	N-ch Dual	20	±5	±20	2.0*2	2.5	2.5	0.042	0.061	
μPA1753	N-ch Dual	20	±6	±24	2.0*2	2.5	3.0	0.028	0.04	
μPA1754	N-ch Dual	30	±7	±28	2.0*2	4	3.5	0.029	0.053	
μPA1755	N-ch Dual	−30	±7	±28	2.0*2	4.5	3.5	0.028	0.045	
μPA1756	N-ch Dual	30	±6	±24	2.0*2	2.5	3.0	0.028	0.04	
μPA1757	N-ch Dual	20	±7	±28	2.0*2	2.5	3.5	0.022	0.032	
μPA1758	N-ch Dual	30	±6	±24	2.0*2	2.5	3.0	0.026	0.04	
μPA1759	N-ch Dual	60	±5	±20	2.0*2	10	2.5	0.11	0.15	
μPA1790	N-ch + P-ch	60/−60	±1.0/±0.7	±4.0/±2.8	1.0*2	10	0.5/0.35	0.12/0.44	0.26/0.6	

*1: T_A = 25°C, Mounted on ceramic substrate of 1200 mm² × 0.7 mm

*2: T_A = 25°C, 2 circuits, Mounted on ceramic substrate of 2000 mm² × 1.1 mm

Field Effect Transistor

Power MOS FET

■ 8-pin TSSOP Type Power MOS FET

On-Resistance $R_{DS(on)}$ (mΩ) (MAX.) @V_{GS} = 4.5 V	Drain to source voltage V_{DSS} (V)		
	12	20	30
~210		μPA1851 (P-ch Dual)	
~190			μPA1853 (P-ch Dual)
~115	μPA1850 (P-ch Dual)		
~75		μPA1811 (P-ch Single)	μPA1812 (P-ch Single)
~60	μPA1854 (P-ch Dual) μPA1810 (P-ch Single)		
~40		μPA1852 (N-ch Dual)	μPA1800 (N-ch Single)
~30			μPA1814 (P-ch Single)★
~25	μPA1813 (P-ch Single)	μPA1801 (N-ch Single) μPA1855 (N-ch Dual)★ μPA1802 (N-ch Single) μPA1815 (P-ch Single)★	μPA1803 (N-ch Single)★

★: Under development

■ 8-pin TSSOP Type Power MOS FET

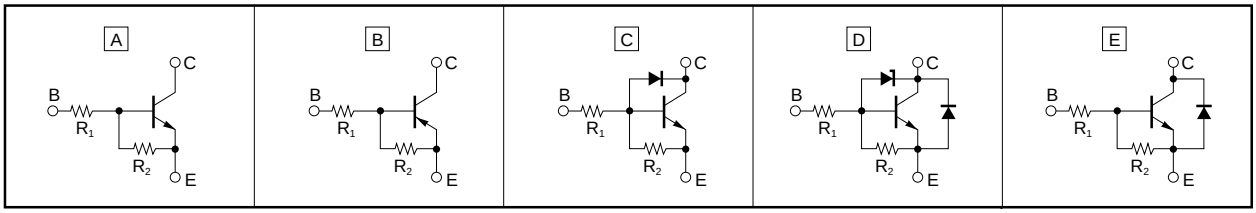
Part number	Configuration	Absolute maximum rating (T_A = 25 °C)				Electrical characteristics (T_A = 25 °C)				Applications
		V_{DSS} (V)	V_{GSS} (V)	$I_{D(DC)}$ (A)	P_T* (W)	$R_{DS(on)}$ (mΩ) MAX.				
						V_{GS} = 2.5 V	V_{GS} = 4 V	V_{GS} = 4.5 V	V_{GS} = 10 V	
μPA1800	N-ch Single	30	±20	±5	2	–	45	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	±7	2	–	–	16	21	
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/+5	±7	2	–	–	30	19	
μPA1815★	P-ch Single	–20	–12/+3	±7	2	30	23	22	–	
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	–	

*: Mounted on ceramic substrate of 50 cm^2 × 1.1 mm

★: Under development

Transistor with Internal Resistor

■ Equivalent circuit



■ AA1[ ], AN1[ ], BA1[ ], BN1[ ] series (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 (mA)	P_T (mW)	T_j (°C)	R_1 (kΩ)	R_2 (kΩ)	h_{FE}	V_{CE} (V)	I_C (mA)	Remarks
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	–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

■ AB1[ ], AP1[ ], BB1[ ], BP1[ ] series (TO-92, SST)

Part number		Equivalent circuit and applications	Absolute maximum ratings (T_A = 25 °C)							Electrical characteristics (T_A = 25 °C)					
			V_{CBO}	V_{CEO}	V_{EBO}	I_C	P_T (mW)		T_j	R_1	R_2	h_{FE}	V_{CE}	I_C	Re-
TO-92	SST		(V)	(V)	(V)	(A)	TO-92	SST	(°C)	(kΩ)	(kΩ)		(V)	(A)	marks
AB1A4A	**BB1A4A**	Refer to equivalent circuit A Switching	30	25	10	0.7	750	250	150	–	10	300 ~	2.0	0.5	
AB1L2Q	**BB1L2Q**		30	25	10	0.7	750	250	150	0.47	4.7	300 ~	2.0	0.5	
AB1A3M	**BB1A3M**		30	25	10	0.7	750	250	150	1.0	1.0	100 ~	2.0	0.5	
AB1F3P	**BB1F3P**		30	25	10	0.7	750	250	150	2.2	10	300 ~	2.0	0.5	
AB1J3P	**BB1J3P**		30	25	10	0.7	750	250	150	3.3	10	300 ~	2.0	0.5	
AB1L3N	**BB1L3N**		30	25	10	0.7	750	250	150	4.7	10	300 ~	2.0	0.5	
AB1A4M	**BB1A4M**		30	25	10	0.7	750	250	150	10	10	300 ~	2.0	0.5	
AP1A4A	**BP1A4A**	Refer to equivalent circuit B Switching	–25	–25	–10	–0.7	750	250	150	–	10	100 ~	–2.0	–0.5	
AP1L2Q	**BP1L2Q**		–25	–25	–10	–0.7	750	250	150	0.47	4.7	100 ~	–2.0	–0.5	
AP1A3M	**BP1A3M**		–25	–25	–10	–0.7	750	250	150	1.0	1.0	100 ~	–2.0	–0.5	
AP1F3P	**BP1F3P**		–25	–25	–10	–0.7	750	250	150	2.2	10	100 ~	–2.0	–0.5	
AP1J3P	**BP1J3P**		–25	–25	–10	–0.7	750	250	150	3.3	10	100 ~	–2.0	–0.5	
AP1L3N	**BP1L3N**		–25	–25	–10	–0.7	750	250	150	4.7	10	100 ~	–2.0	–0.5	
AP1A4M	**BP1A4M**		–25	–25	–10	–0.7	750	250	150	10	10	100 ~	–2.0	–0.5	

■ AQ1[ ] series (TO-92)

Part number	Equivalent circuit and applications	Absolute maximum ratings (T_A = 25 °C)						Electrical characteristics (T_A = 25 °C)					
		V_{CBO}	V_{CEO}	V_{EBO}	I_C	P_T	T_j	R_1	R_2	h_{FE}	V_{CE}	I_C	Remarks
TO-92		(V)	(V)	(V)	(A)	(mW)	(°C)	(kΩ)	(kΩ)		(V)	(A)	
AQ1A4A	Refer to equivalent circuit B Switching	–20	–20	–10	–2.0	750	150	–	10	150 ~	–2.0	–1.0	
AQ1F2Q		–20	–20	–10	–2.0	750	150	0.22	2.2	150 ~	–2.0	–1.0	
AQ1L2N		–20	–20	–10	–2.0	750	150	0.47	1.0	150 ~	–2.0	–1.0	
AQ1L2Q		–20	–20	–20	–10	750	150	0.47	4.7	150 ~	–2.0	–1.0	
AQ1A3M		–20	–20	–10	–2.0	750	150	1.0	1.0	150 ~	–2.0	–1.0	
AQ1F3M		–20	–20	–10	–2.0	750	150	2.2	2.2	150 ~	–2.0	–1.0	
AQ1F3P		–20	–20	–10	–2.0	750	150	4.7	10	150 ~	–2.0	–1.0	

Transistor with Internal Resistor

■ AD1[ ], AD2[ ], AR1[ ] series (TO-92)

Part number	Equivalent circuit and applications	Absolute maximum ratings (T_A = 25 °C)						Electrical characteristics (T_A = 25 °C)					
TO-92		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)	Remarks
AD1A3M	Refer to equivalent circuit A Switching	80	60	10	1.0	750	150	1.0	1.0	200 ~	2.0	0.5	
AD1F3P		80	60	10	1.0	750	150	2.2	10	300 ~	2.0	0.5	
AD1L3N		80	60	10	1.0	750	150	4.7	10	300 ~	2.0	0.5	
AD1A4M		80	60	10	1.0	750	150	10	10	300 ~	2.0	0.5	
AD1L2Q		80	60	10	1.0	750	150	0.47	4.7	300 ~	2.0	0.5	
AD1F2Q		80	60	10	1.0	750	150	0.22	2.2	300 ~	2.0	0.5	
AD1A4A		80	60	10	1.0	750	150	–	10	300 ~	2.0	0.5	
AD2A3M	Refer to equivalent circuit C Switching	60 ±10	60 ±10	10	1.0	750	150	1.0	1.0	200 ~	2.0	0.5	
AD2F3P		60 ±10	60 ±10	10	1.0	750	150	2.2	10	300 ~	2.0	0.5	
AD2L3N		60 ±10	60 ±10	10	1.0	750	150	4.7	10	300 ~	2.0	0.5	
AD2A4M		60 ±10	60 ±10	10	1.0	750	150	10	10	300 ~	2.0	0.5	
AD2L2Q		60 ±10	60 ±10	10	1.0	750	150	0.47	4.7	300 ~	2.0	0.5	
AD2F2Q		60 ±10	60 ±10	10	1.0	750	150	0.22	2.2	300 ~	2.0	0.5	
AD2A4A		60 ±10	60 ±10	10	1.0	750	150	–	10	300 ~	2.0	0.5	
AR1A3M	Refer to equivalent circuit B Switching	–60	–60	–10	–1.0	750	150	1.0	1.0	100 ~	–2.0	–0.5	
AR1F3P		–60	–60	–10	–1.0	750	150	2.2	10	100 ~	–2.0	–0.5	
AR1L3N		–60	–60	–10	–1.0	750	150	4.7	10	100 ~	–2.0	–0.5	
AR1A4M		–60	–60	–10	–1.0	750	150	10	10	100 ~	–2.0	–0.5	
AR1L2Q		–60	–60	–10	–1.0	750	150	0.47	4.7	100 ~	–2.0	–0.5	
AR1F2Q		–60	–60	–10	–1.0	750	150	0.22	2.2	100 ~	–2.0	–0.5	
AR1A4A		–60	–60	–10	–1.0	750	150	–	10	100 ~	–2.0	–0.5	

■ CE1[ ], CE2[ ] series (SP-8)

Part number	Equivalent circuit and applications	Absolute maximum ratings (T_A = 25 °C)						Electrical characteristics (T_A = 25 °C)				
SP-8		V_{CBO} (V)	V_{CEO} (V)	V_{EBO} (V)	I_C (A)	P_T (W)	T_j (°C)	R_1 (kΩ)	R_2 (kΩ)	h_{FE}	V_{CE} (V)	I_C (A)
CE1A3Q	Refer to D	60 ±10	60 ±10	15	±2.0	1.0	150	1.0	10	1000 to 3000	5.0	1.0
CE1F3P		60 ±10	60 ±10	15	±2.0	1.0	150	2.2	10	1000 to 3000	5.0	1.0
CE1N2R		60 ±10	60 ±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

■ FA1[ ], FN1[ ], GA1[ ], GN1[ ] series (SC-59, SC-70)

Part number		Equivalent circuit and applications	Absolute maximum ratings (T_A = 25 °C)						Electrical characteristics (T_A = 25 °C)					
SC-59	SC-70		V_{CBO} (V)	V_{CEO} (V)	V_{EBO} (V)	I_C (mA)	P_T (mW)	T_j (°C)	R_1 (kΩ)	R_2 (kΩ)	h_{FE}	V_{CE} (V)	I_C (mA)	Remarks
FA1A4M	**GA1A4M**	Refer to equivalent circuit A Switching	60	50	10	100	200 (SC-59) 150 (SC-70)	150	10	10	35 to 100	5.0	5.0	
FA1A4P	**GA1A4P**		60	50	5	100		150	10	47	35 to 340	5.0	5.0	
FA1F4M	**GA1F4M**		60	50	10	100		150	22	22	60 to 195	5.0	5.0	
FA1F4N	**GA1F4N**		60	50	5	100		150	22	47	85 to 340	5.0	5.0	
FA1L4M	**GA1L4M**		60	50	10	100		150	47	47	85 to 340	5.0	5.0	
FA1L4L	**GA1L4L**		60	50	15	100		150	47	22	60 to 195	5.0	5.0	
FA1L3Z	**GA1L3Z**		60	50	5	100		150	4.7	–	135 to 600	5.0	5.0	
FA1A4Z	**GA1A4Z**		60	50	5	100		150	10	–	135 to 600	5.0	5.0	
FA1F4Z	**GA1F4Z**		60	50	5	100		150	22	–	135 to 600	5.0	5.0	
FA1L4Z	**GA1L4Z**		60	50	5	100		150	47	–	135 to 600	5.0	5.0	
FA1L3M	**GA1L3M**		60	50	10	100		150	4.7	4.7	20 to 80	5.0	5.0	
FA1L3N	**GA1L3N**		60	50	5	100		150	4.7	10	35 to 100	5.0	5.0	
FA1A3Q	**GA1A3Q**		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 (SC-59) 150 (SC-70)	150	10	10	35 to 100	–5.0	–5.0	
FN1A4P	**GN1A4P**		–60	–50	–5	–100		150	10	47	85 to 340	–5.0	–5.0	
FN1F4M	**GN1F4M**		–60	–50	–10	–100		150	22	22	60 to 195	–5.0	–5.0	
FN1F4N	**GN1F4N**		–60	–50	–5	–100		150	22	47	85 to 340	–5.0	–5.0	
FN1L4M	**GN1L4M**		–60	–50	–10	–100		150	47	47	85 to 340	–5.0	–5.0	
FN1L4L	**GN1L4L**		–60	–50	–15	–100		150	47	22	60 to 195	–5.0	–5.0	
FN1L3Z	**GN1L3Z**		–60	–50	–5	–100		150	4.7	–	135 to 600	–5.0	–5.0	
FN1A4Z	**GN1A4Z**		–60	–50	–5	–100		150	10	–	135 to 600	–5.0	–5.0	
FN1F4Z	**GN1F4Z**		–60	–50	–5	–100		150	22	–	135 to 600	–5.0	–5.0	
FN1L4Z	**GN1L4Z**		–60	–50	–5	–100		150	47	–	135 to 600	–5.0	–5.0	
FN1L3M	**GN1L3M**		–60	–50	–10	–100		150	4.7	4.7	20 to 80	–5.0	–5.0	
FN1L3N	**GN1L3N**		–60	–50	–5	–100		150	4.7	10	35 to 100	–5.0	–5.0	
FN1A3Q	**GN1A3Q**		–60	–50	–5	–100		150	1.0	10	35 to 100	–5.0	–5.0	

■ FB1[ ] series (SC-59)

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)	Remarks
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

■ HD1[ ], HD2[ ], HR1[ ] series (SOT-89)

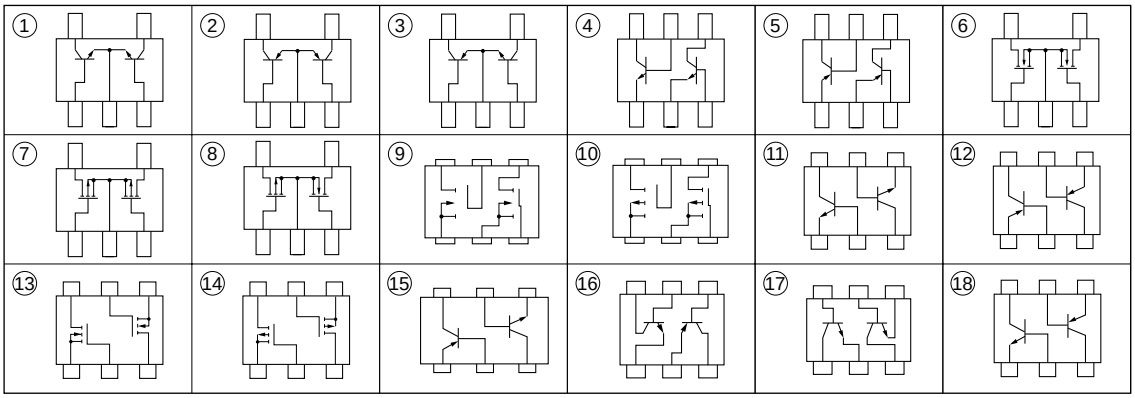
Part number	Equivalent circuit and applications	Absolute maximum ratings (T_A = 25 °C)						Electrical characteristics (T_A = 25 °C)					
		V_{CBO} (V)	V_{CEO} (V)	V_{EBO} (V)	I_C (A)	P_T (mW)	T_j (°C)	R_1 (kΩ)	R_2 (kΩ)	h_{FE}	V_{CE} (V)	I_C (A)	Remarks
HD1A3M	Refer to equivalent circuit A Switching	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		80	60	10	1.0		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	5.0	
HD1A4A		80	60	10	1.0		150	–	10	300	2.0	0.5	
HD2A3M	Refer to equivalent circuit C Switching	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		60±10	60±10	10	1.0		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 Switching	–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		–60	–60	–10	–1.0		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 (SOT-89)

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)	Remarks
HQ1A4A	Refer to equivalent circuit B Switching	–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	
HQ1L2N		–20	–20	–10	–2.0		150	0.47	1.0	150	–2.0	–1.0	
HQ1L2Q		–20	–20	–20	–10		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_{CEO} (V)	$I_{C(DC)}$ (mA)	P_T* (mW)	h_{FE}	V_{CE} (V)	I_C (mA)	Package
μPA570T	①	50	100	200	90 to 600	6	1	• 5-pin Super Mini-Mold SC-88A
μPA571T	②	−50	−100	200		−6	−1	
μPA574T	③	50/−50	100/−100	300		6/−6	1/−1	
μPA670T	⑪	50	100	200		6	1	• 6-pin Super Mini-Mold SC-88
μPA671T	⑫	−50	−100	200		−6	−1	
μPA500T	①	50	100	300		6	1	• 5-pin Mini-Mold SC-74A
μPA501T	②	−50	−100	300		−6	−1	
μPA504T	③	50/−50	100/−100	300		6/−6	1/−1	
μPA600T	④	50	100	300		6	1	• 6-pin Mini-Mold SC-74
μPA601T	⑤	−50	−100	300		−6	−1	
μPA604T	⑪	50	100	300		6	1	
μPA605T	⑫	−50	−100	300		−6	−1	
μPA608T	⑮	50 −16	100 −500	300	90 to 600 110 to 400	6 −1	1 −100	
μPA609T	⑯	40 −40	500 −500	300	75 to 300 75 to 300	1 −1	150 −150	
μPA673T	⑰	15	200	200	82 to 180	6	1	• 6-pin Super Mini-Mold SC-88
μPA674T	⑱	15 −15	200 −50	200	40 to 200 50 to 150	1 −1	10 −10	

*: Total

■ MOS FET

Part number	Equivalent circuit	V_{DSS} (V)	$I_{D(DC)}$ (mA)	P_T* (mW)	$R_{DS\ (on)}$ (Ω) MAX	V_{GS} (V)	I_D (mA)	Package
μPA572T	⑥	30	100	200	13	2.5	10	• 5-pin Super Mini-Mold SC-88A
μPA573T	⑦	−30	−100	200	60	−2.5	−10	
μPA502T	⑥	50	100	300	30	4	10	
μPA503T	⑦	−50	−100	300	100	−4	−10	• 5-pin Mini-Mold SC-74A
μPA505T	⑧	50/−50	100/−100	300	30/100	4/−4	10/−10	
μPA602T	⑨	50	100	300	30	4	10	• 6-pin Mini-Mold SC-74
μPA603T	⑩	−50	−100	300	100	−4	−10	
μPA606T	⑬	50	100	300	30	4	10	
μPA607T	⑭	−50	−100	300	100	−4	−10	
μPA610TA	⑩	−30	−100	300	60	−2.5	−1	
μPA611TA	⑨	30	100	300	15	2.5	1	
μPA672T	⑬	50	100	200	40	2.5	10	• 6-pin Super Mini-Mold SC-88

*: Total

Transistor Array

■ Signal transistor array Product Map (Monolithic)

I_O (mA) / V_O (V)	500
50	μPA2981 μPA2982 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	Ative level		Input/output relationship		Output current relationship		Remarks	Number of pins
	5	6	7	8					"H"	"L"	Inverter type	Non-iverter type	Source type	Sink type		
μPA80C, GR			○		60	50	–	20 kΩ		○	○		○		Darlington	16
μPA81C			○		45	400*2	–	20 kΩ	○		○			○	FIP driver	18
μPA2001C, GR			○		60	500	○	–	○		○			○	Darlington	16
μPA2002C, GR			○		60	500	○	7VZDi +10.5 kΩ	○		○			○	Darlington	16
μPA2003C, GR			○		60	500	○	2.7 kΩ	○		○			○	Darlington	16
μPA2004C, GR			○		60	500	○	10.5 kΩ	○		○			○	Darlington	16
μPA2981C				○	50	500	○	3 kΩ	○			○	○		Darlington output stage	18
μPA2982C				○	50	500	○	8.5 kΩ	○			○	○		Darlington output stage	18
μPA2987C			○		50	500	○	3 kΩ	○			○	○		Darlington output stage	16

*1: PW ≦ 30 ms, duty cycle ≦ 10% (7 circuits operation)
*2: PW ≦ 10 ms, duty cycle ≦ 10% (7 circuits operation)

■ Power transistor array Product Map (Multi-chip, 4 circuits)

V_{CEO} (V) / $I_{C\ (DC)}$ (A) Polarity	2.0	3.0	5.0
30 NPN	μPA1478H ○		
30 PNP			
60 NPN	μPA1428AH ○	μPA1434H ●	μPA1458H ○
60 PNP			μPA1453H ☆
100 NPN	μPA1476H ○	μPA1436AH	μPA1454H ● μPA1456H
100 PNP		μPA1437H	

○: 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	Number of pins
						Source type	Sink type		
μPA1428AH	4	60 ±10	±2.0	○	–		○	Darlington	10
μPA1434H	4	60	3.0	–	–		○	High beta	10
μPA1436AH	4	100	±3.0	–	–		○	Darlington	10
μPA1437H	4	–100	∓3.0	–	–	○		Darlington	10
μPA1453H	4	–60	5.0	–	–	○		Low $V_{CE(sat)}$	10
μPA1454H	4	100	5.0	–	–		○	High beta	10
μPA1456H	4	100	±5.0	–	–		○	Darlington	10
μPA1458H	4	60 ±10	±5.0	○	–		○	Darlington	10
μPA1476H	4	100 ±15	±2.0	○	–		○	Darlington	10
μPA1478H	4	31 ±4	±2.0	○	–		○	Darlington	10

Transistor Array

■ Power MOS FET array Product Map (Multi-chip, 4 circuits)

$I_{D(DC)}$ (A) / V_{DSS} (V)	2.0	3.0	5.0
30	• μPA1520BH (0.25)		• μPA1550H (0.15)
60	• μPA1522H (0.35) • μPA1572BH (0.8) • μPA1523BH (1.3)	• μPA1500BH (0.24)	• μPA1552BH (0.24)
80	• μPA1524H (1.0)		
100	• μPA1526H (0.6) • μPA1576H (1.5) • μPA1527H (1.5)		• μPA1556AH (0.33)
120		• μPA1501H (0.53) • μPA1560H (0.165)	

( ): $R_{DS(on)}$ (@V_{GS} = 4 V) [Ω MAX.] Underlined: P-channel

■ Power MOS FET array (Multi-chip, 4 circuits)

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		Number of pins
	4	7	8					"H"	"L"	Inverter type	Non-inverter type	Source type	Sink type	
μPA1500BH	○			60	±3	○	○	○		○			○	12
μPA1501H	○			120	±3	○	○	○		○			○	12
μPA1520BH	○			30	±2	–	○	○		○			○	10
μPA1522H	○			60	±2	–	○	○		○			○	10
μPA1523BH	○			−60	∓2	–	○		○		○	○		10
μPA1524H	○			80	±2	–	○	○		○			○	10
μPA1526H	○			100	±2	–	○	○		○			○	10
μPA1527H	○			−100	∓2	–	○		○		○	○		10
μPA1550H	○			30	±5	–	○	○		○			○	10
μPA1552BH	○			60	±5	–	○	○		○			○	10
μPA1556AH	○			100	±5	–	○	○		○			○	10
μPA1572BH	○			60	±2	–	○	○		○			○	10
μPA1576H	○			100	±2	–	○	○		○			○	10
μPA1560H	○			120	±3		○	○		○			○	10

■ Power MOS FET array Product Map (Monolithic)

$I_{D(DC)}$ (A) / V_{DSS} (V)	0.43	0.5	0.87
30	• μPA1601 (5.3 Ω, 7CH) (DIP, SOP) • μPA1602 (5.3 Ω, 7CH) (DIP, SOP)	• μPA1600 (4.0 Ω, 8CH) (DIP, SOP)	• μPA1603 (1.3 Ω, 4CH) (DIP, SOP)

■ 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		Number of pins
	4	7	8					"H"	"L"	Inverter type	Non-inverter type	Source type	Sink type	
μPA1600CX/GS			○	30	0.5	–	○	○		○			○	20
μPA1601CX/GS		○		30	0.43	–	○	○		○			○	16
μPA1602CX/GS		○		30	0.43	–	○		○		○		○	16
μPA1603CX	○			30	0.87	○	○	○		○			○	16
μPA1604CX	○			30	0.87	○	○		○		○		○	16

Zener Diode

■ Zener Diode Quick Reference (1/2) (Surface-Mount Type)

Vz (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	RD3.9FM
3.9		RD3.9UM	RD3.9M	RD3.9MW	RD3.9S		RD3.9P	RD4.3FM
4.3		RD4.3UM	RD4.3M	RD4.3MW	RD4.3S		RD4.3P	RD4.7FM
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	2-pin ultra mini-mold		Mini-mold (SC·59)		2-pin super mini-mold		Power mini-mold (SC·62)	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	NNCD4.3G	
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	
6.2	NNCD6.2C	NNCD6.2D	NNCD6.2E	NNCD6.2F	NNCD6.2G	
6.8	NNCD6.8C	NNCD6.8D	NNCD6.8E	NNCD6.8F	NNCD6.8G	
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	2-pin ultra mini-mold	2-pin super mini-mold	3-pin mini-mold (SC-59)		5-pin mini-mold (SC-74A quarto)	
			Single	Twin		

■ 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	5-pin mini-mold (SC-74A quad)	5-pin super mini-mold (SC-88A 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	3-pin mini-mold (SC-59 twin)	5-pin mini-mold (SC-74A quad)	

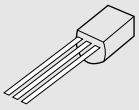
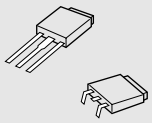
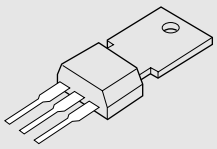
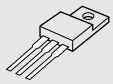
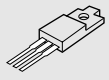
Noise Clipping Diode

■ 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	NNCD5.1A	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	

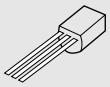
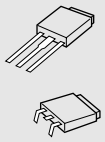
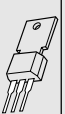
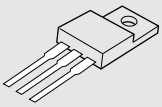
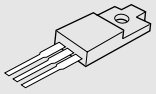
Thyristor

■ SCR

Electrical characteristics \ Package														 MP–25		 MP–45C	
		SOT-89	TO-92			MP-3			TO-202AA					TO-220AB		TO-220-like insulated type	
$I_{T(RMS)}$ (A)		0.47	0.47			4.7	8	12.6	4	4	4	4.7	4.7	8	12.6	8	12.6
$I_{T(AV)}$ (A)		0.3	0.3			3	5	8	2	2	2.5	3	3	5	8	5	8
I_{TSM} (A)		6	8			40	65	80	20	20	45	65	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	03P4MF*1	03P4MG	3P4J 3P4J-Z	5P4J 5P4J-Z	8P4J 8P4J-Z	2P4M	2S4M	2V5P4M	3P4MH	3S4M	5P4M	8P4M	5P4SM	8P4SM
	500	03P5J	–	–	03P5MG	–	–	–	2P5M	–	–	3P5MH	–	5P5M	–	–	–
	600	–	–	–	03P6MG	–	5P6J 5P6J-Z	–	2P6M	–	–	3P6MH	–	5P6M	–	5P6SM	–
I_{GT} (mA)		0.2	0.2	100 μA	3-50 μA	0.1	0.2	10	0.2	0.3	0.1	0.2	30	10	10	10	10
tq (TYP.) (μs)		25	25	40	60	30	80	50	30	15*2	80	80	5*2	50	100	50	100

*1: V_{RRM} = 5 V
*2: indicates MAX.

■ TRIAC

Electrical characteristics \ Package								 MP–25						 MP–45C					
		SOT-89	TO-92		MP-3		TO-202AA	TO-220AB						TO-220AB-like insulated type					
$I_{T(RMS)}$ (A)		1.0	0.8	1.0	3	5	3	5	8	10	12	16		3	5	8	10	12	16
$I_{TSM(50\ Hz)}$ (A)		7.0	7	9	30	50	30	50	80	80	100	150		30	50	80	80	100	150
T_j (°C)		125	125		125		125	125						125					
V_{DRM} V_{RRM} (V)	400	AC01DJM	AC0V 8DGM	AC01 DGM	AC03 DJM AC03 DJM-Z	AC05 DJM AC05 DJM-Z	AC03 DGM	AC05 DGM	AC08 DGM	AC10 DGM	AC12 DGM	AC16 DGM		AC03 DSM	AC05 DSM	AC08 DSM	AC10 DSM	AC12 DSM	AC16 DSM
	500	–	–	–	–	–	AC03 EGM	AC05 EGM	AC08 EGM	AC10 EGM	AC12 EGM	AC16 EGM		–	AC05 ESM	AC08 ESM	AC10 ESM	AC12 ESM	–
	600	–	–	–	AC03 FJM AC03 FJM-Z	AC05 FJM AC05 FJM-Z	AC03 FGM	AC05 FGM	AC08 FGM	AC10 FGM	AC12 FGM	AC16 FGM		AC03 FSM	AC05 FSM	AC08 FSM	AC10 FSM	AC12 FSM	AC16 FSM
I_{GT} (mA)	I	5	5	3	12	10	12	10	20	20	20	30		12	10	20	20	20	30
	II	10	10	5	–	–	–	–	–	–	–	–		–	–	–	–	–	–
	III	5	5	3	12	10	12	10	20	20	20	30		12	10	20	20	20	30
	IV	10	10	3	12	10	12	10	20	20	20	30		12	10	20	20	20	30
$(dv/dt)_C$ (V/μs)	MIN.	0.5	1	0.5	5	5	5	5	10	10	10	10		5	5	10	10	10	10

[MEMO]

RF and Microwave Devices

IC

■ AGC AMP. (μPC××××, μPG××××)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPC8119T	Mobile Comm.	3	11	100–1920	G_P (MAX.)=12.5dB, GCR=50dB, $P_{o(1dB)}$=3dBm@f=950MHz	6-pin minimold
μPC8120T	Mobile Comm.	3	11	100-1920	G_P(MAX.)=13dB, GCR=50dB, $P_{o(1dB)}$=3.5dBm@f=950MHz	
μPC8130TA	Mobile Comm.	3	11	800–1500	G_P(MAX.)=12.5dB, GCR=50dB, $P_{o(1dB)}$=5dBm@f=950MHz	
μPC8131TA	Mobile Comm.	3	11	800–1500	G_P(MAX.)=12dB, GCR=45dB, $P_{o(1dB)}$=5dBm@f=950MHz	
μPG175TA	Mobile Comm.	3	20	925–960	G_P=30dB, GCR=35dB, P_o=8dBm	6-pin minimold
μPC2723T	BS Tuner, Mobile Comm.	5	15	1100	G_P=13dB, NF=11dB, P_o=–2dBm@f=500MHz	
μPC3206GR	CATV Tuner, Video Amp.	5	34.5	100 or less	GCR=50dB(MIN.), G_P(MAX.)=38.5dB(@AGC block)	20-pin SSOP
μPC3211GR	CATV Tuner	9	38	5–100	GCR=55dB, IM_2=44dBc, IM_3=57dBc	

■ IQ Modulator/Demodulator (μPC××××)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPC8101GR	Mobile Comm. IQ Modulator	3	15	150	LOL=–49dBc, ImR=37.5dBc, P_o=–11dBm	20-pin SSOP
μPC8104GR	Mobile Comm. IQ Modulator	3	28	900–2000	LOL=–40dBc, ImR=–40dBc, P_o=–13.5dBm	
μPC8105GR	Mobile Comm. IQ Modulator	3	16	400	LOL=–40dBc, ImR=–40dBc, P_o=–18.5dBm	16-pin SSOP
μPC8110GR	Mobile Comm. IQ Modulator	3	24	900	LOL=–35dBc, ImR=–40dBc, P_o=–10dBm	20-pin SSOP
μPC8125GR	Mobile Comm. IQ Modulator	3	36	1800–2000	LOL=–37dBc, ImR=–35dBc, P_{RFout}=–9dBm	
μPC8126GR	Mobile Comm. IQ Modulator	3	35	915-960	LOL=–35dBc, ImR=–40dBc, P_{RFout}=–9dBm	
μPC8126K	Mobile Comm. IQ Modulator	3	35	889-960	LOL=–35dBc, ImR=–40dBc, P_{RFout}=–9dBm	28-pin QFN
μPC8129GR	Mobile Comm. IQ Modulator	3	28	800–1900	LOL=–40dBc, ImR=–30dBc, P_{RFout}=–5dBm	20–pin SSOP
μPC8139GR-7JH	PHS Transceiver	3	32.5	1800-2000	LOL=–40dBc, ImR=–40dBc, $P_{TX•MIXout}$=–13dBm	30-pin TSSOP
μPC8158K	Mobile Comm. IQ Modulator	3	28	800-1500	LOL=–40dBc, ImR=–40dBc, P_{RFout}=–11.5dBm	28-pin QFN
μPC2766GR/GS	BS Tuner IQ Demodulator	5	60	DC–1000	$\Delta\phi \leqq \pm 1.5°$, $\Delta V \leqq \pm 0.5$dB	20-pin SSOP/SOP
μPC2781GR	BS Tuner IQ Demodulator	5	70	440–520	$\Delta\phi \leqq \pm 2°$, $\Delta V \leqq \pm 0.5$dB	20-pin SSOP
μPC3205GR	BS Tuner IQ Demodulator	5	65	440–520	$\Delta\phi \leqq \pm 2°$, $\Delta V \leqq \pm 0.5$dB	

■ Up Converter (μPC××××)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPC8100GR	Mobile Comm. Up/Down	3	15	800–900	CG(UP)=20.5dB, CG(DOWN)=18dB	20-pin SSOP
μPC8106T	Mobile Comm.	3	9	400–2000	CG=7dB, $P_{o(sat)}$=–4dBm@f_{RFOUT}=1900MHz	6-pin minimold
μPC8106TB	Mobile Comm.	3	9	400–2000	CG=7dB, $P_{o(sat)}$=–4dBm@f_{RFOUT}=1900MHz	6-pin super minimold
μPC8109T	Mobile Comm.	3	5	400–2000	CG=5dB, $P_{o(sat)}$=–7.5dBm@f_{RFOUT}=1900MHz	6-pin minimold
μPC8109TB	Mobile Comm.	3	5	400–2000	CG=4dB, $P_{o(sat)}$=–7.5dBm@f_{RFOUT}=1900MHz	6-pin super minimold
μPC8163TB	Mobile Comm.	3	16.5	800–2000	CG=9dB, $P_{o(sat)}$=0.5dBm OIP_3 =9.5dBm@f=830MHz	
μPC2799GR	CATV Tuner	5	60	250–850	GCR=14.5dB, $P_{o(sat)}$=6dBm (@V_{AGC}=5V)	20-pin SSOP

IC

■ Prescaler (μPB××××, μPG××××)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPB1502GR	Mobile Comm. 1.7GHz 64/65, 128/129	3	6.7	500–1700	64/65, 128/129, V_o=0.8V_{p-p}	8-pin SOP
μPB1502GR(1)	Mobile Comm. 2.0GHz 64/65, 128/129	3	6.7	500–2000	64/65, 128/129, V_o=0.8V_{p-p}	
μPB1504GR	Mobile Comm. 1.1GHz 64/65, 128/129	3	2.47@64/65 2.24@128/129	500–1100	64/65, 128/129, V_o=0.9V_{p-p}	
μPB1509GV	Mobile Comm. 1GHz, ÷2, ÷4, ÷8	3	5	500–1000@1/8	1/2, 1/4, 1/8 V_o=0.3V_{p-p}	8-pin SSOP
μPB1505GR	BS Tuner 3GHz, ÷64, ÷128, ÷256	5	14	500–3000	1/256, 1/128, 1/64, V_o=1.6V_{p-p}	8-pin SOP
μPB1506GV	BS Tuner 3GHz, ÷64, ÷128, ÷256	5	19	500–3000	1/256, 1/128, 1/64, V_o=1.6V_{p-p}	8–pin SSOP
μPB1507GV	BS Tuner 3GHz, ÷64, ÷128, ÷256	5	19	500–3000	1/256, 1/128, 1/64, V_o=1.6V_{p-p}	
μPB1508GV	BS Tuner 3GHz, ÷2	5	12	500–3000	1/2, P_o=–7dBm	
μPB1510GV	BS Tuner 3GHz, ÷4	5	14	500–3000	1/4, P_o=–7dBm	
μPG501B	Microwave Comm. 5GHz, ÷4	10	70	1300–5000	1/4 Static, P_{in}=10dBm, P_o=2dBm	K-12, 8-pin ceramic
μPG502B	Microwave Comm. 5GHz, ÷2	10	100	1000–5000	1/2 Static, P_{in}=10dBm, P_o=2dBm	
μPG503B	Microwave Comm. 9GHz, ÷4	3.8, –2.2	80	4000–8000	1/2 Dynamic, P_{in}=10dBm, P_o=2dBm	
μPG504B	Microwave Comm. 9GHz, ÷2	3.8, –2.2	55	2500–8000	1/2 Dynamic, P_{in}=10dBm, P_o=–1dBm	
μPG506B	Microwave Comm. 14GHz, ÷8	3.8, –2.2	105	8200–13200	1/8 Dynamic, P_{in}=6dBm, P_o=1dBm	
μPG508B	Microwave Comm. 13GHz, ÷4	3.8, –2.2	100	8500–12200	1/4 Dynamic, P_{in}=6dBm, P_o=1dBm	

IC

■ Down Converter (μPC××××) (1/2)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPC2721GR/GV	General Purpose L–Band	5	38	900–2000	G_P=21dB, NF=9–11dB, Emitter follower Output	8-pin SOP/SSOP
μPC2722GR/GV	General Purpose L–Band	5	28	900–2000	G_P=18dB, NF=9–11dB, Open Collector Output	
μPC2795GV	General Purpose L–Band	5	35	950–2150	CG=11dB, NF=13.5dB@f=950MHz	8-pin SSOP
μPC1694GR	General Purpose 1GHz	5	40	55–1000	CG=18dB, NF=12.5–13.5dB, $P_{o(sat)}$=10dBm	14-pin SOP
μPC2757T	Mobile Comm.	3	5.6	100–2000	CG=15dB, NF=10dB@f=800MHz	6-pin minimold
μPC2757TB	Mobile Comm.	3	5.6	100–2000	CG=15dB, NF=10dB@f=800MHz	6-pin super minimold
μPC2758T	Mobile Comm.	3	11	100–2000	CG=19dB, NF=9dB@f=800MHz	6-pin minimold
μPC2758TB	Mobile Comm.	3	11	100–2000	CG=19dB, NF=9dB@f=800MHz	6-pin super minimold
μPC8001	Mobile Comm.	3	2.1	470	f_{out}=455kHz, $RSSI_{out}$=0.79–2.75V	14-pin SSOP
μPC8002	Mobile Comm.	3	1.7	250	f_{out}=10.7MHz, $RSSI_{out}$=1.08–2.68V	20-pin SSOP
μPC8112T	Mobile Comm.	3	8.5	800–2000	CG=13dB, NF=11.2dB@f_{RFin}=1900MHz	6-pin minimold
μPC8112TB	Mobile Comm.	3	8.5	800–2000	CG=13dB, $P_{o(sat)}$=–3dBm@f_{RFin}=1900MHz	6-pin super minimold
μPC8100GR	Mobile Comm. Up/Down	3	15	800–900	CG(UP)=20.5dB, CG(DOWN)=18dB	20-pin SSOP
μPC2743GS	TV/VCR Tuner UHF/VHF	9	47@VHF 49@UHF	55–890	CG=20/23dB, NF=13/12dB, (VHF/UHF)	20-pin SOP
μPC2744GS	TV/VCR Tuner UHF/VHF	9	47@VHF 49@UHF	55–890	CG=25/31dB, NF=11/10dB, (VHF/UHF)	
μPC2775GR/GS	TV/VCR Tuner UHF/VHF	9	35@VHF 36@UHF	55–890	CG=22/28dB, NF=10/10dB, (VHF/UHF)	20-pin SSOP/SOP
μPC2794GS	TV/VCR Tuner UHF/VHF	9	48@VHF 50@UHF	55–890	CG=23/32dB, NF=11/10dB, (VHF/UHF)	20-pin SOP
μPC2797GR	TV/VCR Tuner UHF/VHF	9	38	55–890	CG=22/28dB, NF=11/10dB, (VHF/UHF)	20-pin SSOP
μPC3200GS	TV/VCR Tuner UHF/VHF	9	38	55–890	CG=22/28dB, NF=11/10dB, (VHF/UHF)	20-pin SOP
μPC3202GR	TV/VCR Tuner UHF/VHF	5	41	55–800	CG=25/29dB, NF=10.5/10dB, (VHF/UHF)	20-pin SSOP
μPC3207GR	TV/VCR Tuner UHF/VHF	9	38	55–890	CG=22/28dB, NF=11/10dB, (VHF/UHF)	
μPC1686G	TV/VCR Tuner VHF	5	38	55–500	CG=19.5dB, NF=11dB, $P_{o(sat)}$=10dBm@f=200MHz	8-pin SOP
μPC1686GV	TV/VCR Tuner VHF	5	38	55–500	CG=19.5dB, NF=11dB, $P_{o(sat)}$=10dBm@f=200MHz	8-pin SSOP
μPC1687G	TV/VCR Tuner UHF	5	38	500–900	CG=26dB, NF=9dB, $P_{o(sat)}$=10dBm@f=500MHz	8-pin SOP
μPC1687GV	TV/VCR Tuner UHF	5	38	500–900	CG=26dB, NF=9dB, $P_{o(sat)}$=10dBm@f=500MHz	8-pin SSOP
μPC2731GS	BS Tuner AGC	5	69	900–2000	CG=14.5dB, NF=12dB@f=900MHz	20-pin SOP
μPC2734GR	BS Tuner	5	40	900–2100	CG=12dB, NF=10dB, f_{in}=480MHz@f=900MHz	20-pin SSOP
μPC2782GR	BS Tuner AGC	5	66	900–2100	CG=10dB, NF=11dB@f=900MHz	
μPC2798GR	CATV Tuner Video Amp.	5	35.5	30–250	GCR=32dB, V_o=3V_{p-p}(@R_L=1kΩ)	
μPC2753GR	GPS	3	6.9	DC–400	CG=38dB, NF=12dB	
μPC2756T	GPS	3	6	100–2000	CG=14dB, NF=10dB, P_o=–8dBm@f=900MHz	6-pin minimold
μPC2756TB	GPS	3	6	100–2000	CG=14dB, NF=10dB, P_o=–8dBm@f=900MHz	6-pin super minimold

IC

■ Down Converter (μPC××××) (2/2)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPC2768GR	Keyless Entry	3	6.8	DC-450	CG=36dB, NF=12dB@f=450MHz	20-pin SSOP
μPC8116GR	Keyless Entry	3	4.1	100–500	G_{MIX}=11dB, $RSSI_{sen}$=–95dBm	
μPC8103T	Pager	1.05	1	150–330	CG=15.5dB@f_{RFin}=280MHz	6-pin minimold
μPC8108T	Pager	1.05	1.5	150–930	CG=15dB@f_{RFin}=930MHz	

■ PLL Synthesizer (μPB××××)

Part Number	Functions	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPB1005K	PLL Synthesizer +Down Converters	GPS	3	45	1575.42	f_{2ndIF}=4.092MHz, f_{TCXOin}=16.368MHz	36-pin QFN

■ Switch (μPG××××)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPG132G	Mobile Comm. SPDT	0, +3	0.05	100–2500	L_{INS}=0.6dB, ISL=22dB, $P_{in(1dB)}$=30dBm	8-pin SSOP
μPG133G	Mobile Comm. SPDT	0, –3	0.05	100–2500	L_{INS}=0.6dB, ISL=25dB, $P_{in(1dB)}$=25dBm	
μPG137GV	Mobile Comm. SPDT	0, +3	0.005	100–2500	L_{INS}=0.55dB, ISL=25dB, $P_{in(1dB)}$=32dBm MIN.@f=1GHz	
μPG138GV	Mobile Comm. SPDT	0, –3	0.005	100–2500	L_{INS}=0.55dB, ISL=30dB, $P_{in(1dB)}$=32dBm MIN.@f=1GHz	
μPG139GV	Mobile Comm. DPDT	V_{CONT}= 3.6V/0V, V_{DD}=3V	0.015	100–2500	TXL_{INS}=0.7dB, TXISL=15.5dB, $TXP_{in(1dB)}$=34dBm@f=1GHz	8-pin SOP
μPG152TA	Mobile Comm. SPDT	0, +3	0.005	100–2500	L_{INS}=0.6dB, ISL=22dB, $P_{in(1dB)}$=30dBm@f=2GHz	6-pin minimold
μPG153TB	Mobile Comm. SPDT	V_{CONT}= 3.0V/0V	0.02	100–2500	L_{INS}=0.7dB, ISL=13dB, $P_{in(1dB)}$=33dBm@f=2GHz	6-pin super minimold
μPG154TB	Mobile Comm. SPDT	V_{CONT}= 3.0V/0V, V_{DD}=3V	0.002	100–2500	L_{INS}=0.65dB, ISL=21dB, $P_{in(1dB)}$=30dBm@f=2GHz	
μPG155TB	Mobile Comm. SPDT	V_{CONT}= 3.0V/0V	0.02	100–2500	L_{INS}=0.75dB, ISL=16dB, $P_{in(1dB)}$=34dBm@f=2GHz	

IC

■ Wide Band AMP. (μPC××××, μPG××××) (1/2)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPC1652G	General Purpose	5	20	1200	G_P=18dB, NF=5.5dB, P_o=+5dBm@f=500MHz	8-pin SOP
μPC1658G	General Purpose	10	9–18	1000	G_P=31dB, NF=1.5dB	
μPC1663	General Purpose Video Amp.	6	13	200	BW=700MHz, A_{vd}=320 Gain determined by external resister. Input noise 3μ Vr.m.s.	8-pin SOP/SSOP
μPC1675G	General Purpose	5	17	1900	G_P=12dB, NF=5.5dB, P_o=+4dBm@f=500MHz	4-pin super small package
μPC1676G	General Purpose	5	19	1200	G_P=22dB, NF=4.5dB, P_o=+5dBm @f=500MHz	
μPC1678G	General Purpose Medium Output	5	49	2000	G_P=23dB, NF=6dB, P_o=+17.5dBm @f=500MHz	8-pin SOP
μPC1678GV	General Purpose Medium Output	5	49	2000	G_P=23dB, NF=6dB, P_o=+17.5dBm @f=500MHz	8-pin SSOP
μPC1679G	General Purpose Medium Output	5	40	1800	G_P=21.5dB, NF=6dB, P_o=+15.5dBm@f=500MHz	8-pin SOP
μPC1688G	General Purpose	5	19	1100	G_P=21dB, NF=4dB, P_o=+4dBm @f=500MHz	4-pin super small package
μPC2708T	General Purpose Medium Output	5	26	2900	G_P=15dB, NF=6.5dB, P_o=+10dBm @f=1GHz	6-pin minimold
μPC2708TB	General Purpose Medium Output	5	26	2900	G_P=15dB, NF=6.5dB, P_o=+10dBm @f=1GHz	6-pin super minimold
μPC2709T	General Purpose Medium Output	5	25	2300	G_P=23dB, NF=5dB, P_o=+11.5dBm@f=1GHz	6-pin minimold
μPC2709TB	General Purpose Medium Output	5	25	2300	G_P=23dB, NF=5dB, P_o=+11.5dBm@f=1GHz	6-pin super minimold
μPC2710T	General Purpose Medium Output	5	22	1000	G_P=33dB, NF=3.5dB, P_o=+13.5dBm@f=500MHz	6-pin minimold
μPC2710TB	General Purpose	5	22	1000	G_P=33dB, NF=3.5dB, P_o=+13.5dBm@f=500MHz	6-pin super minimold
μPC2711T	General Purpose	5	12	2900	G_P=13dB, NF=5dB, P_o=+1dBm@f=1GHz	6-pin minimold
μPC2711TB	General Purpose	5	12	2900	G_P=13dB, NF=5dB, P_o=+1dBm@f=1GHz	6-pin super minimold
μPC2712T	General Purpose	5	12	2600	G_P=20dB, NF=4.5dB, P_o=+3dBm@f=1GHz	6-pin minimold
μPC2712TB	General Purpose	5	12	2600	G_P=20dB, NF=4.5dB, P_o=+3dBm@f=1GHz	6-pin super minimold
μPC2713T	General Purpose	5	12	1200	G_P=29dB, NF=3.2dB, P_o=+7dBm@f=500MHz	6-pin minimold
μPC2714T	General Purpose	3.4	4.5	1800	G_P=11.5dB, NF=5dB, P_o=–7dBm@f=500MHz	
μPC2715T	General Purpose	3.4	4.5	1200	G_P=19dB, NF=4.5dB, P_o=–6dBm@f=500MHz	
μPC2726T	General Purpose Differential Amp.	5	11.5	1600	G_P=15dB, NF=4.5dB, P_o=–2dBm@f=400MHz	
μPC3210TB	General Purpose	5	15	2300	G_P=20dB, NF=3.4dB, P_o=+3.5dBm@f=1.5GHz	6-pin super minimold
μPG100B	General Purpose	±5	45	50–3000	NF=2.7dB, G_P=16dB, $P_{o(1dB)}$=6dBm	T-31, 8-pin ceramic
μPG101B	General Purpose	8, –5	100	50–3000	NF=5dB, G_P=14dB, $P_{o(1dB)}$=18dBm	
μPG103B	General Purpose	±5	55	50–3000	NF=4.5dB, G_P=10dB, $P_{o(1dB)}$=9dBm	
μPG110B	General Purpose	8	135	2000–8000	G_P=15dB, $P_{o(1dB)}$=14dBm	4-pin ceramic

IC

■ Wide Band AMP. (μPC××××, μPG××××) (2/2)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPC2745T	Mobile Comm.	3	7.5	2700	G_P=12dB, NF=6dB, P_o=–1dBm@f=500MHz	6-pin minimold
μPC2745TB	Mobile Comm.	3	7.5	2700	G_P=12dB, NF=6dB, P_o=–1dBm@f=500MHz	6-pin super minimold
μPC2746T	Mobile Comm.	3	7.5	1500	G_P=19dB, NF=4dB, P_o=0dBm@f=500MHz	6-pin minimold
μPC2746TB	Mobile Comm.	3	7.5	1500	G_P=19dB, NF=4dB, P_o=0dBm@f=500MHz	6-pin super minimold
μPC2747T	Mobile Comm.	3	5	1800	G_P=12dB, NF=3.3dB, P_o=–7dBm@f=900MHz	6-pin minimold
μPC2747TB	Mobile Comm.	3	5	1800	G_P=12dB, NF=3.3dB, P_o=–7dBm@f=900MHz	6-pin super minimold
μPC2748T	Mobile Comm.	3	6	200–1500	G_P=19dB, NF=2.8dB, P_o=–3.5dBm@f=900MHz	6-pin minimold
μPC2748TB	Mobile Comm.	3	6	200–1500	G_P=19dB, NF=2.8dB, P_o=–3.5dBm@f=900MHz	6-pin super minimold
μPC2749T	Mobile Comm.	3	6	2900	G_P=16dB, NF=4dB, P_o=–6dBm@f=1900MHz	6-pin minimold
μPC2749TB	Mobile Comm.	3	6	2900	G_P=16dB, NF=4dB, P_o=–6dBm@f=1900MHz	6-pin super minimold
μPC2762T	Mobile Comm. Medium Output	3	26.5	2900	G_P=13dB, NF=6.5dB, P_o=+8dBm@f=900MHz	6-pin minimold
μPC2762TB	Mobile Comm. Medium Output	3	26.5	2900	G_P=13dB, NF=6.5dB, P_o=+8dBm@f=900MHz	6-pin super minimold
μPC2763T	Mobile Comm. Medium Output	3	27	2700	G_P=20dB, NF=5.5dB, P_o=+9.5dBm@f=900MHz	6-pin minimold
μPC2763TB	Mobile Comm. Medium Output	3	27	2700	G_P=20dB, NF=5.5dB, P_o=+9.5dBm@f=900MHz	6-pin super minimold
μPC2771T	Mobile Comm. Medium Output	3	36	2200	G_P=21dB, NF=6dB, P_o=+12.5dBm@f=900MHz	6-pin minimold
μPC2771TB	Mobile Comm. Medium Output	3	36	2200	G_P=21dB, NF=6dB, P_o=+12.5dBm@f=900MHz	6-pin super minimold
μPC8128TB	Mobile Comm. Buff Amp.	2.4–3.3	2.8	100–1900	G_P=12.5dB, ISL=39dB, $P_{o(1dB)}$=–4dBm, NF=6.0dB, I_{CC}=2.8mA@f=1000MHz	
μPC8151TB	Mobile Comm. Buff Amp.	2.4–3.3	4.2	100–1900	G_P=12.5dB, ISL=38dB, $P_{o(1dB)}$=+2.5dBm, NF=6.0dB, I_{CC}=4.2mA@f=1000MHz	
μPC8152TB	Mobile Comm. Buff Amp.	2.4–3.3	5.6	100–1900	G_P=23dB, ISL=40dB, $P_{o(1dB)}$=–4.5dBm, NF=3.5dB, I_{CC}=5.6mA@f=1000MHz	
μPG170TB	Mobile Comm.	3.6	30	800–1500	GL=11dB, $P_{o(1dB)}$=14.5dBm	
μPC2776T	BS Converter Medium Output	5	25	2700	G_P=23dB, NF=6dB, P_o=+6.5dBm@f=1GHz	6-pin minimold
μPC2776TB	BS Converter Medium Output	5	25	2700	G_P=23dB, NF=6dB, P_o=+6.5dBm@f=1GHz	6-pin super minimold
μPC2791TB	BS Converter	5	17	1900	G_P=12dB, NF=5.5dB, P_o=+4dBm@f=500MHz	
μPC2792TB	BS Converter	5	19	1200	G_P=20dB, NF=3.5dB, P_o=+5dBm@f=500MHz	
μPC8102T	Pager	1	0.5	150–330	G_P=14.7dB, NF=4.0dB@f=280MHz	6-pin minimold

IC

■ Driver AMP. (μPG××××)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPG173TA	Mobile Comm.	2.8	25	800–1000	P_o =9dBm, G_P=27dB MIN. f=889–960MHz	6-pin minimold
μPG174TA	Mobile Comm.	3	30	1400–2000	P_o =10dBm, G_P=32dB MIN. f=1429–1453MHz	
μPG175TA	Mobile Comm.	3	20	925–960	G_P=30dB, GCR=35dB, P_o =8dBm	

■ Power AMP. (μPG××××, MC-××××)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPG171GV	Mobile Comm.	3, –2	160	1895–1918	G_P=20dB, P_o=21dBm, P_{adj}=–60dBc	8-pin SSOP
MC-7712	CATV	24	240	50–750	NF=7.0dB, GL=18.5dB	7-pin special package
MC-7716	CATV	24	240	50–750	NF=6.5dB, GL=22.0dB	
MC-7722	CATV	24	395	50–750	NF=7.0dB, GL=18.5dB	
MC-7726	CATV	24	395	50–750	NF=6.5dB, GL=22.0dB	
MC-7852	CATV	24	240	50–860	NF=7.0dB, GL=18.0dB	
MC-7856	CATV	24	240	50–860	NF=7.0dB, GL=21.5dB	
MC-7862	CATV	24	395	50–860	NF=7.0dB, GL=18.5dB	
MC-7866	CATV	24	395	50–860	NF=6.5dB, GL=21.5dB	

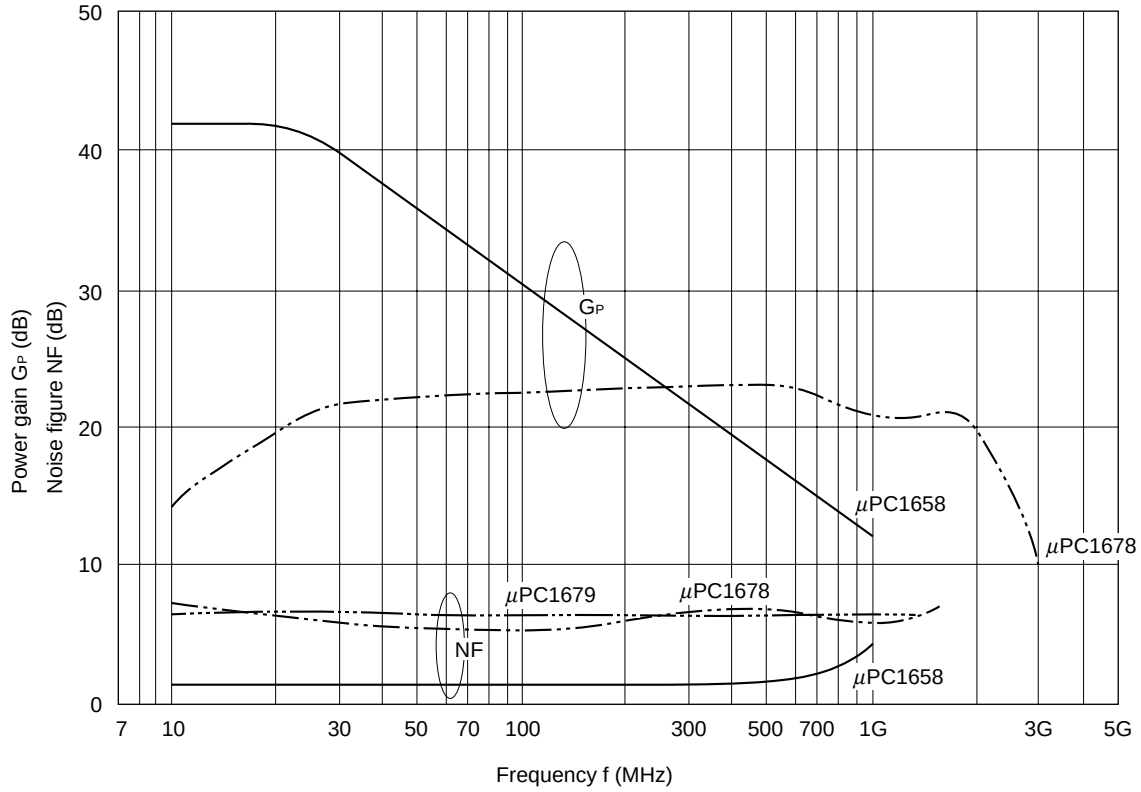
■ Transistor Array (μPA×××)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPA101	General Pupose	3	0.001	9000	f_T=9GHz	14-pin ceramic, 8-pin miniflat
μPA102	General Pupose	3	0.001	9000	f_T=9GHz	
μPA103	General Pupose	3	0.001	9000	f_T=9GHz	
μPA104	General Pupose	3	0.001	9000	f_T=9GHz	

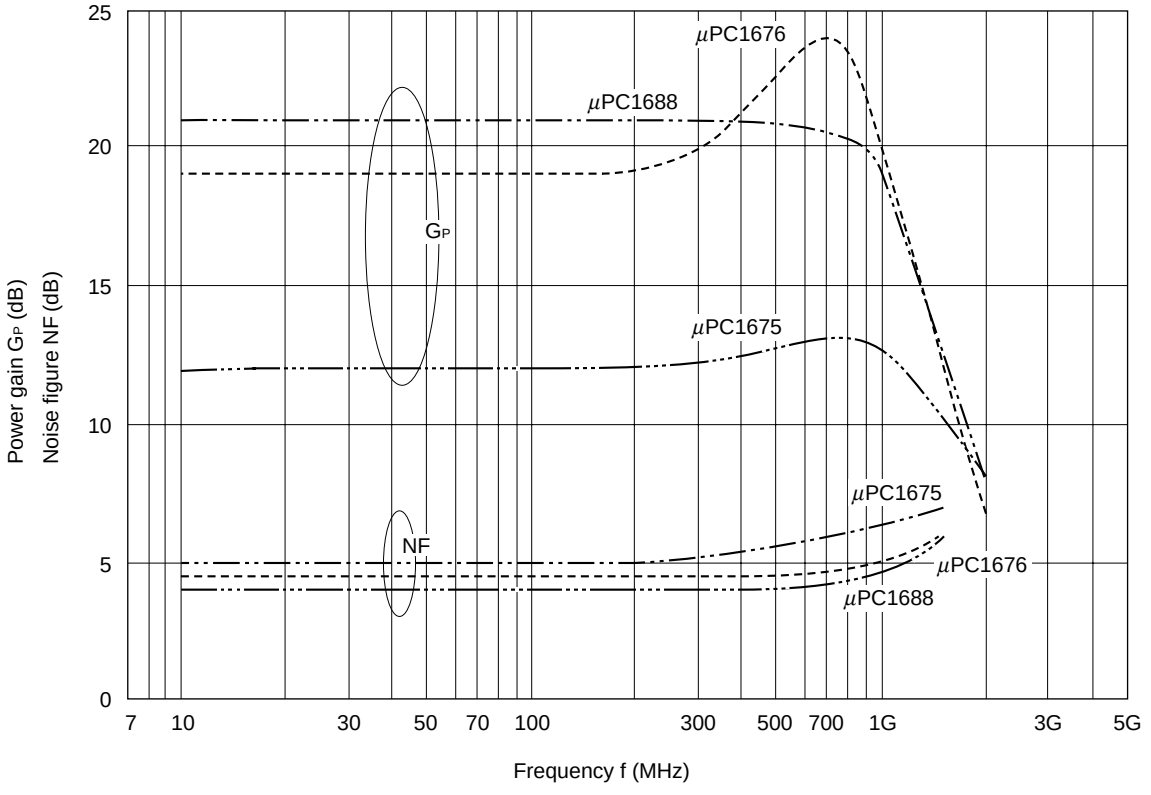
IC

■ Typical Characteristics

• POWER GAIN, NOISE FIGURE vs. FREQUENCY (1/4)



• POWER GAIN, NOISE FIGURE vs. FREQUENCY (2/4)



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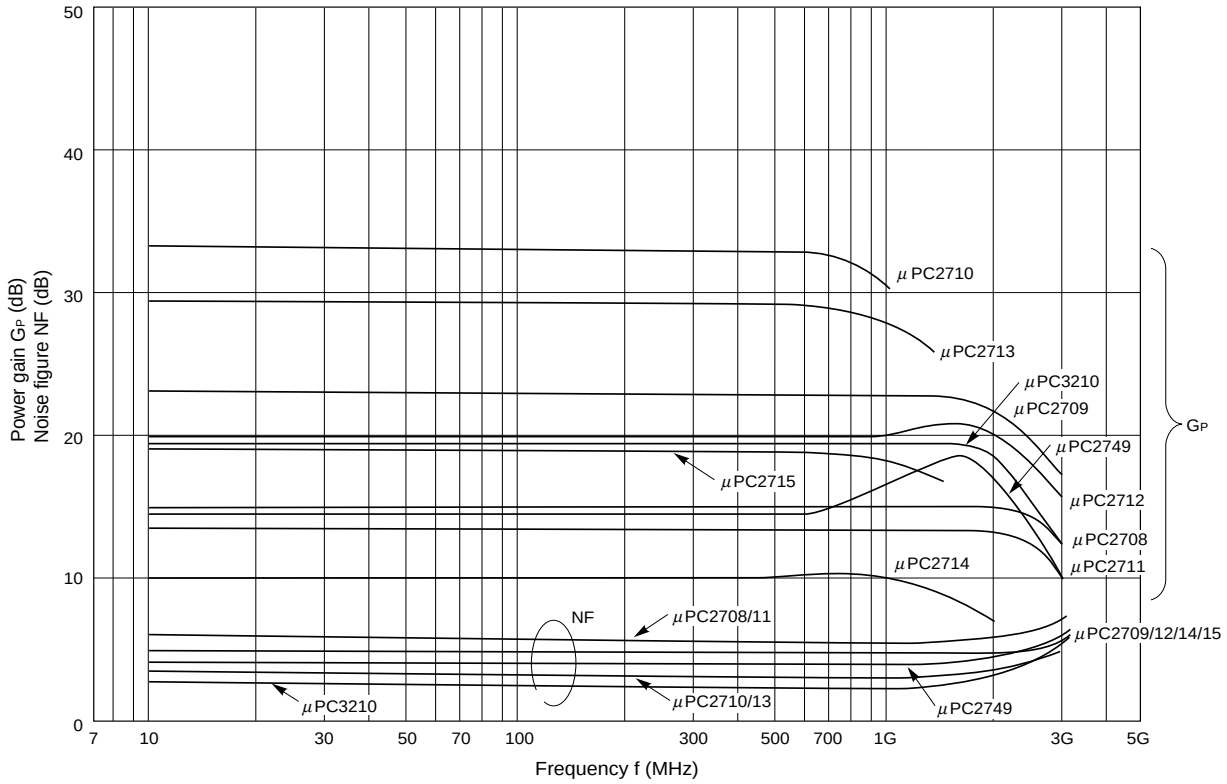
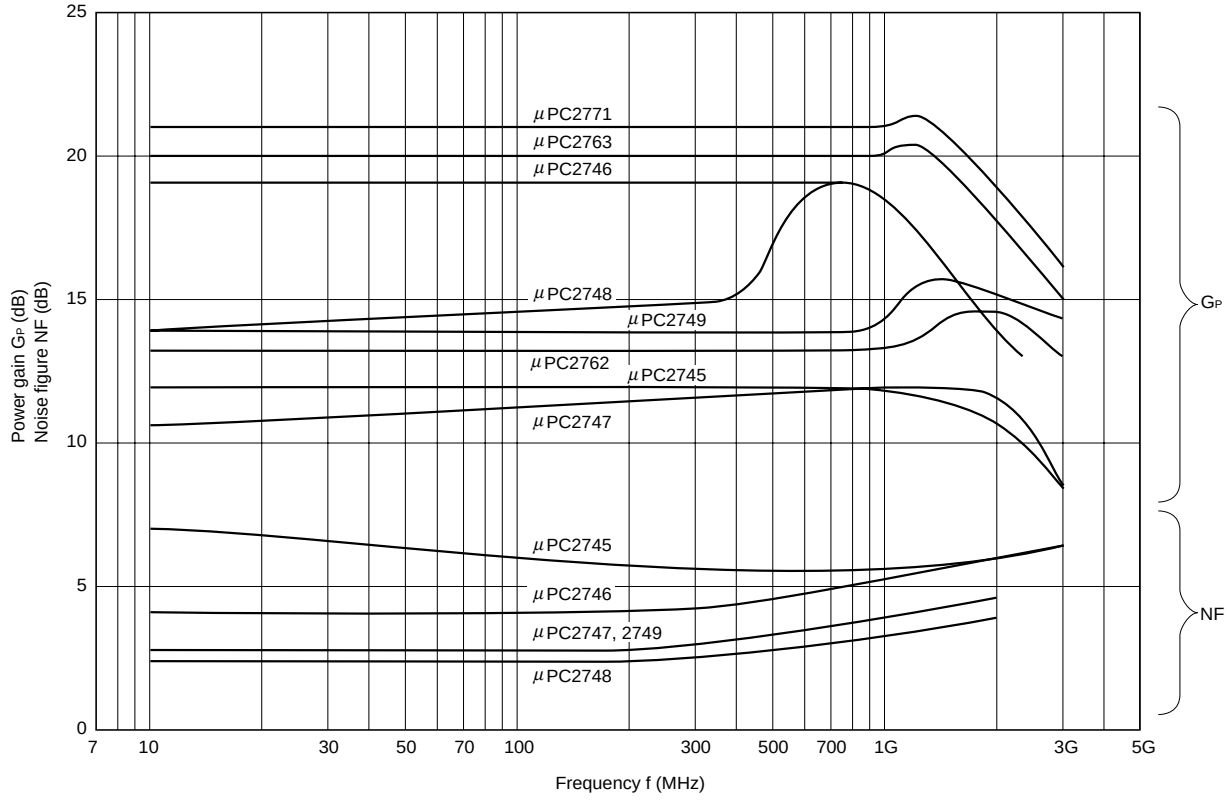
■ Typical Characteristics

• POWER GAIN, NOISE FIGURE vs. FREQUENCY (3/4)



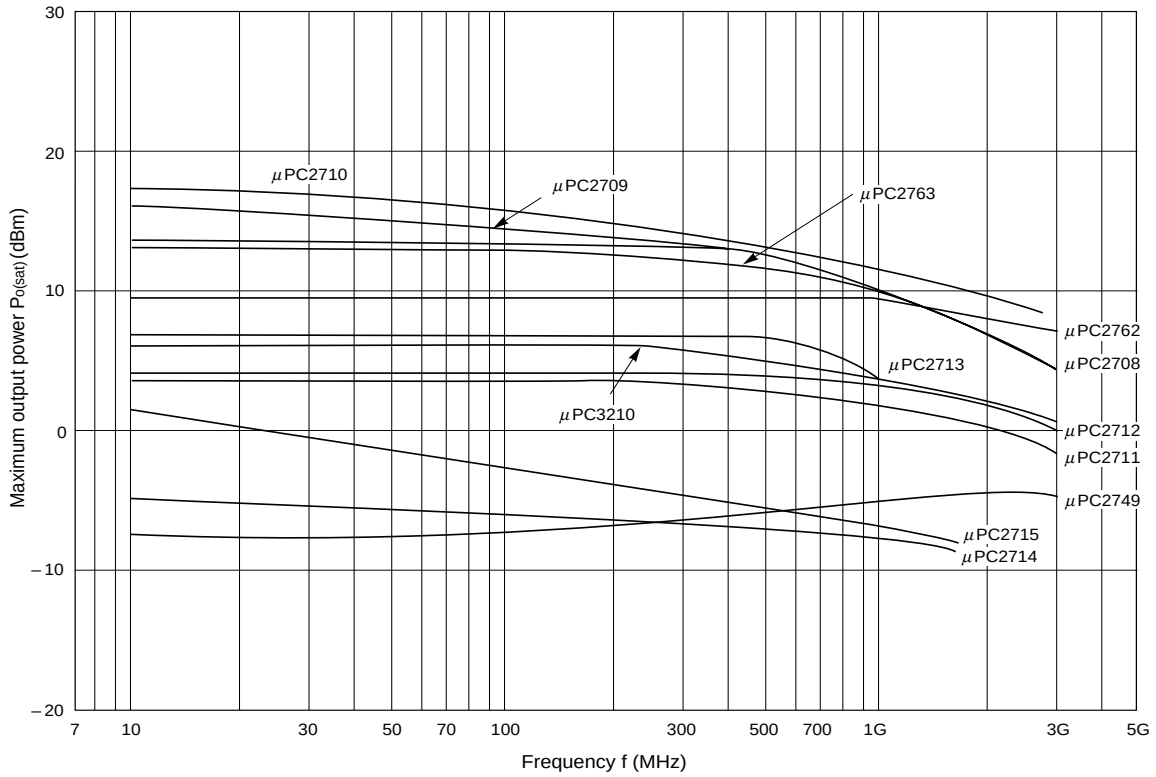
• POWER GAIN, NOISE FIGURE vs. FREQUENCY (4/4)



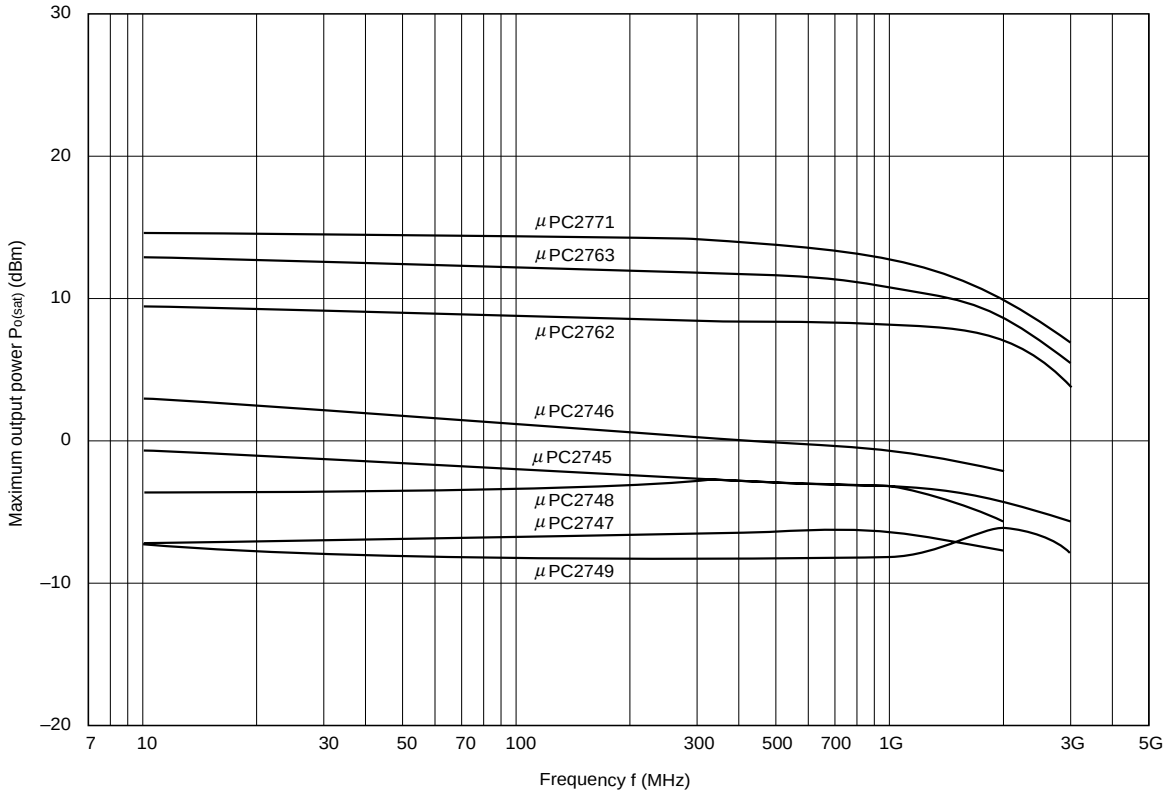
IC

■ Typical Characteristics

• MAXIMUM OUTPUT POWER vs. FREQUENCY (1/2)



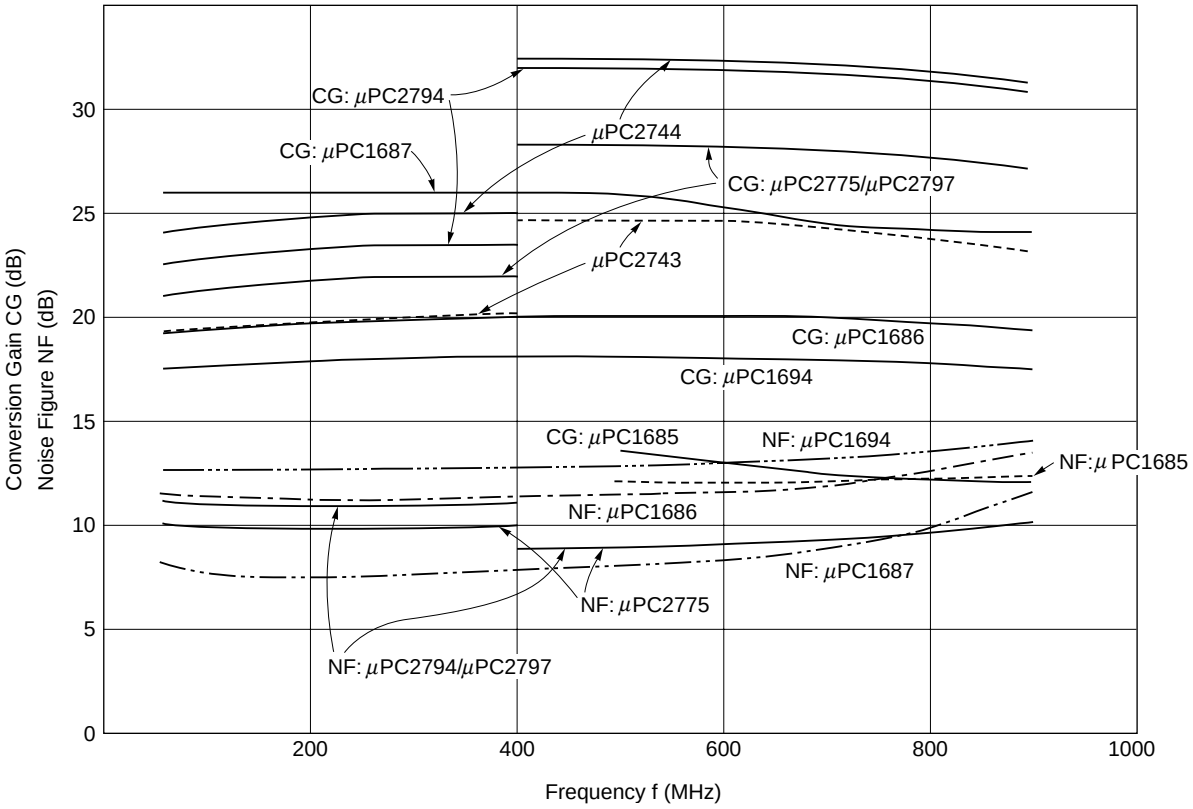
• MAXIMUM OUTPUT POWER vs. FREQUENCY (2/2)



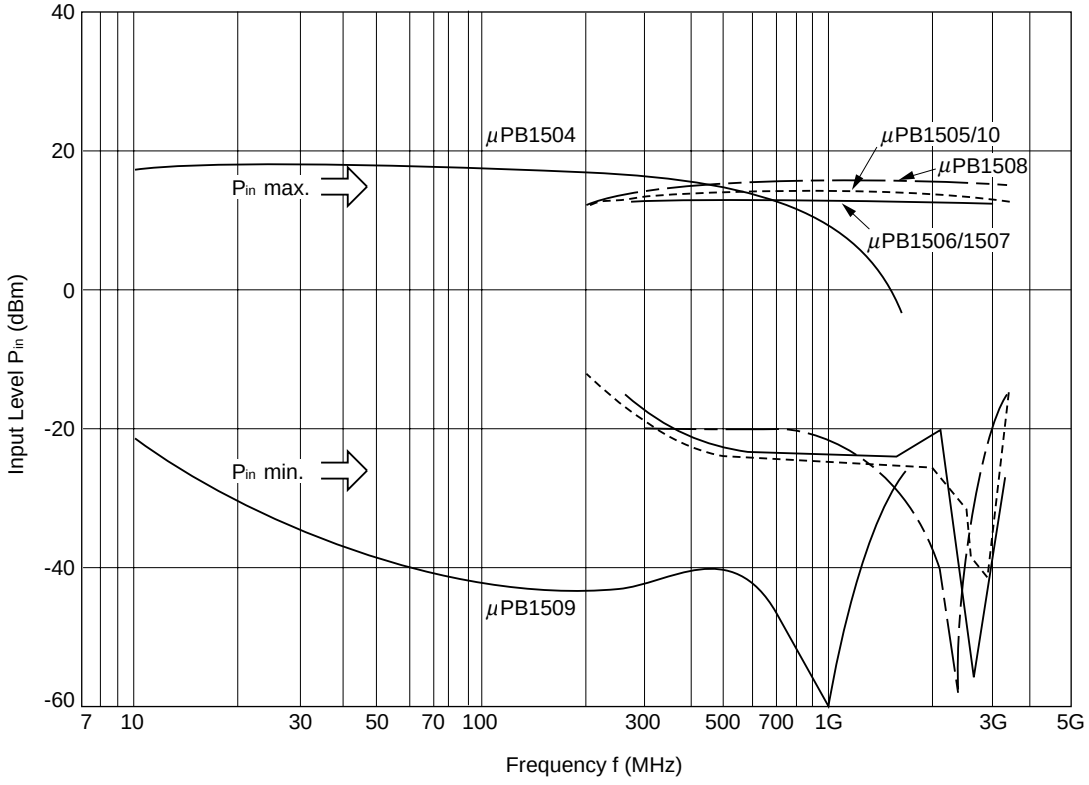
IC

■ Typical Characteristics

• CONVERSION GAIN, NOISE FIGURE vs. FREQUENCY



• INPUT LEVEL vs. FREQUENCY



Discrete

■ Dual Gate MES/MOS FET

• Dual Gate MES FET

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
3SK177 (NE25139)	TV/VCR Tuner	5	10	900	NF=1.1dB	4-pin minimold
3SK206 (NE25339)	TV/VCR Tuner	5	10	900	NF=1.1dB	
3SK299 (NE25118)	TV/VCR Tuner	5	10	900	NF=1.1dB	4-pin super minimold

• Dual Gate MOS FET

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
3SK131 (NE92939)	TV/VCR Tuner	10	10	200	NF=1.3dB	4-pin minimold
3SK134B (NE92739)	TV/VCR Tuner	10	10	900	NF=2.1dB	
3SK135A	TV/VCR Tuner	10	10	900	NF=2.7dB	
3SK176A	TV/VCR Tuner	6	3	470	NF=2.0dB	
3SK222 (NE92039)	TV/VCR Tuner	6	10	200	NF=1.2dB	
3SK223 (NE92239)	TV/VCR Tuner	6	10	470	NF=2.2dB	
3SK224 (NE92439)	TV/VCR Tuner	6	10	900	NF=1.8dB	
3SK230 (NE93039)	TV/VCR Tuner	6	10	470	NF=2.2dB	
3SK231 (NE93139)	TV/VCR Tuner	6	10	900	NF=2.0dB	
3SK252 (NE93239)	TV/VCR Tuner	3.5	7	470	NF=2.0dB	
3SK253 (NE93339)	TV/VCR Tuner	3.5	7	900	NF=1.8dB	
3SK254 (NE93218)	TV/VCR Tuner	3.5	7	470	NF=2.0dB	4-pin super minimold
3SK255 (NE93318)	TV/VCR Tuner	3.5	7	900	NF=1.8dB	

Discrete

■ Low Noise BIP. TR. (2SC, NE) (1/2)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
2SC1927 (NE73440B)	General Purpose	10	10	–	2 × 2SC1275	40(Ceramic)
2SC2148 (NE73435)	General Purpose	10	3	500	NF=2.1dB	μ–X
2SC2149 (NE02135)	General Purpose	10	20	2000	NF=2.6dB	
2SC2351 (NE02133)	General Purpose	10	5	1000	NF=1.5dB	3-pin minimold
2SC2954	General Purpose	10	30	500	NF=2.4dB	Power minimold
2SC3355 (NE85632)	General Purpose	10	7	1000	NF=1.1dB	TO-92
2SC3356 (NE85633)	General Purpose	10	7	1000	NF=1.1dB	3-pin minimold
2SC3357 (NE85634)	General Purpose	10	7	1000	NF=1.1dB	Power minimold
2SC3545 (NE94433)	General Purpose	10	–5	31.9	Cc·rbb'=4ps	3-pin minimold
2SC3582 (NE68132)	General Purpose	8	7	1000	NF=1.2dB	TO-92
2SC3583 (NE68133)	General Purpose	8	7	1000	NF=1.2dB	3-pin minimold
2SC3585 (NE68033)	General Purpose	6	5	2000	NF=1.8dB	
2SC3587 (NE68035)	General Purpose	6	5	2000	NF=1.7dB	μ–X
2SC3603 (NE85635)	General Purpose	10	7	2000	NF=2.1dB	
2SC3604 (NE68135)	General Purpose	8	7	2000	NF=1.6dB	
2SC3663	General Purpose	1	0.25	1000	NF=3.0dB	3-pin minimold
2SC3809 (NE85641)	General Purpose	10	20	–	2 × 2SC3603	41(Ceramic)
2SC3810 (NE68141)	General Purpose	8	20	–	2 × 2SC3604	
2SC3841	General Purpose	10	–5	31.9	Cc·rbb'=4ps	3-pin minimold
2SC4092 (NE02139E)	General Purpose	10	5	1000	NF=1.5dB	4-pin minimold
2SC4093 (NE85639E)	General Purpose	10	7	1000	NF=1.1dB	
2SC4094 (NE68139E)	General Purpose	8	7	1000	NF=1.2dB	
2SC4095 (NE68039E)	General Purpose	6	5	2000	NF=1.8dB	
2SC4182	General Purpose	3	–5	31.9	Cc·rbb'=9ps	3-pin super minimold
2SC4183 (NE58030)	General Purpose	5	2	900	NF=3.0dB	
2SC4184	General Purpose	3	–5	31.9	Cc·rbb'=3.5ps	
2SC4185 (NE73430)	General Purpose	10	5	1000	f_T=2GHz	
2SC4186	General Purpose	10	–5	31.9	Cc·rbb'=5ps (MAX.)	
2SC4187 (NE68330)	General Purpose	1	0.25	1000	NF=3.0dB	
2SC4225	General Purpose	3	5	1000	NF=1.5dB	
2SC4226 (NE85630)	General Purpose	3	7	1000	NF=1.2dB	
2SC4227 (NE68130)	General Purpose	3	7	1000	NF=1.4dB	
2SC4228 (NE68030)	General Purpose	3	5	2000	NF=1.9dB	
2SC4536 (NE46134)	General Purpose	10	50	500	NF=2.5dB	Power minimold
2SC4568 (NE58133)	General Purpose	10	5	1000	$\|S_{21e}\|^2$=5.0dB (MIN.)	3-pin minimold
2SC4569 (NE58233)	General Purpose	5	5	1000	$\|S_{21e}\|^2$=5.0dB (MIN.)	
2SC4570 (NE58130)	General Purpose	5	5	1000	$\|S_{21e}\|^2$=5.0dB (MIN.)	4-pin minimold
2SC4571 (NE58230)	General Purpose	5	5	1000	$\|S_{21e}\|^2$=5.0dB (MIN.)	
2SC4703 (NE46234)	General Purpose	5	50	1000	NF=2.3dB	Power minimold
2SC4885 (NE61030)	General Purpose	5	5	1000	NF=3.0dB	4-pin minimold
2SC4954 (NE68433)	General Purpose	3	3	2000	NF=2.5dB	
2SC4955 (NE68533)	General Purpose	3	3	2000	NF=1.5dB	
2SC4956 (NE68439E)	General Purpose	3	3	2000	NF=2.5dB	
2SC4957 (NE68539E)	General Purpose	3	3	2000	NF=1.5dB	
2SC4958 (NE68430)	General Purpose	3	3	2000	NF=2.5dB	
2SC4959 (NE68530)	General Purpose	3	3	2000	NF=1.5dB	
2SC5004 (NE58219)	General Purpose	5	5	1000	$\|S_{21e}\|^2$=5.0dB (MIN.)	3-pin ultra super minimold
2SC5005 (NE58119)	General Purpose	5	5	1000	$\|S_{21e}\|^2$=5.0dB (MIN.)	
2SC5006 (NE85619)	General Purpose	3	7	1000	NF=1.2dB	
2SC5007 (NE68119)	General Purpose	3	7	1000	NF=1.4dB	
2SC5008 (NE68019)	General Purpose	3	5	2000	NF=1.9dB	
2SC5009 (NE68419)	General Purpose	3	3	2000	NF=2.5dB	
2SC5010 (NE68519)	General Purpose	3	3	2000	NF=1.5dB	

Discrete

■ Low Noise BIP. TR. (2SC, NE) (2/2)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
2SC5011 (NE85618)	General Purpose	10	7	1000	NF=1.1dB	4-pin super minimold
2SC5012 (NE68118)	General Purpose	8	7	1000	NF=1.2dB	
2SC5013 (NE68018)	General Purpose	6	5	2000	NF=1.8dB	
2SC5014 (NE68418)	General Purpose	3	3	2000	NF=2.5dB	
2SC5015 (NE68518)	General Purpose	3	3	2000	NF=1.5dB	
2SC5177 (NE68633)	General Purpose	1	3	2000	NF=1.5dB	3-pin minimold
2SC5178 (NE68639)	General Purpose	1	3	2000	NF=1.5dB	4-pin minimold
2SC5179 (NE68630)	General Purpose	1	3	2000	NF=1.5dB	3-pin super minimold
2SC5180 (NE68618)	General Purpose	1	3	2000	NF=1.5dB	4-pin super minimold
2SC5181 (NE68619)	General Purpose	1	3	2000	NF=1.5dB	3-pin ultra super minimold
2SC5182 (NE68733)	General Purpose	1	3	2000	NF=1.3dB	3-pin minimold
2SC5183 (NE68739)	General Purpose	1	3	2000	NF=1.3dB	4-pin minimold
2SC5184 (NE68730)	General Purpose	1	3	2000	NF=1.3dB	3-pin super minimold
2SC5185 (NE68718)	General Purpose	1	3	2000	NF=1.3dB	4-pin super minimold
2SC5186 (NE68719)	General Purpose	1	3	2000	NF=1.3dB	3-pin ultra super minimold
2SC5191 (NE68833)	General Purpose	3	7	2000	NF=1.5dB	3-pin minimold
2SC5192 (NE68839)	General Purpose	3	7	2000	NF=1.5dB	4-pin minimold
2SC5193 (NE68830)	General Purpose	3	7	2000	NF=1.5dB	3-pin super minimold
2SC5194 (NE68818)	General Purpose	3	7	2000	NF=1.5dB	4-pin super minimold
2SC5195 (NE68819)	General Purpose	3	7	2000	NF=1.5dB	3-pin ultra super minimold
2SC5336	General Purpose	10	20	1000	$\|S_{21e}\|^2$=12dB (TYP.)	4-pin power minimold
2SC5337	General Purpose	10	50	1000	$\|S_{21e}\|^2$=7.0dB (MIN.)	
2SC5338	General Purpose	5	50	1000	$\|S_{21e}\|^2$=8.5dB (MIN.)	
2SC5369 (NE696M01)	General Purpose	3	3	2000	NF=1.3dB	6-pin super minimold
2SC5408	Mobile Comm. LNA PA-Driver	2	1	2000	NF=1.1dB	
2SC5409	Mobile Comm. LNA PA-Driver	2	3	2000	NF=1.1dB	
2SC5431	Mobile Comm. VCO	5	5	1000	$\|S_{21e}\|^2$=5.0dB (MIN.)	3-pin thin-type ultra super minimold
2SC5432	Mobile Comm. VCO	3	7	1000	NF=1.4dB	
2SC5433	Mobile Comm. VCO	3	7	1000	NF=1.4dB	
2SC5434	Mobile Comm. VCO	3	5	2000	NF=1.9dB	
2SC5435	Mobile Comm. VCO	3	3	2000	NF=1.5dB	
2SC5436	Mobile Comm. VCO	2	3	2000	NF=1.4dB	
2SC5437	Mobile Comm. VCO	1	3	2000	NF=1.9dB	
2SC5454	BS Tuner Buff Amp.	3	5	2000	NF=1.5dB	4-pin minimold
2SC5455	BS Tuner Buff Amp.	3	7	2000	NF=1.5dB	
2SC5507	LNA, VCO	2	2	2000	NF=1.2dB	4-pin thin-type super minimold
2SC5508	LNA, VCO	2	5	2000	NF=1.1dB	
2SC5509	Buff Amp.	2	10	2000	NF=1.2dB	

Discrete

■ Twin TR. (μPA×××)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
μPA800T	General Purpose	1	3	2000	NF=1.9dB	6-pin super minimold
μPA801T	General Purpose	3	7	1000	NF=1.2dB	
μPA801TC	General Purpose	3	7	1000	NF=1.2dB	6-pin thin-type ultra super minimold
μPA802T	General Purpose	3	7	1000	NF=1.4dB	6-pin super minimold
μPA803T	General Purpose	5	5	1000	$\|S_{21e}\|^2$=5.0dB (MIN.)	
μPA804T	General Purpose	5	5	1000	$\|S_{21e}\|^2$=5.0dB (MIN.)	
μPA804TC	General Purpose	5	5	1000	$\|S_{21e}\|^2$=5.0dB (MIN.)	6-pin thin-type ultra super minimold
μPA805T	General Purpose	3	3	2000	NF=2.5dB	6-pin super minimold
μPA806T	General Purpose	3	3	2000	NF=1.5dB	
μPA807T	General Purpose	2	3	2000	NF=1.5dB	
μPA808T	General Purpose	2	3	2000	NF=1.3dB	
μPA809T	General Purpose	1	3	2000	NF=1.7dB	
μPA810T	General Purpose	3	7	1000	NF=1.2dB	
μPA810TC	General Purpose	3	7	1000	NF=1.2dB	6-pin thin-type ultra super minimold
μPA811T	General Purpose	3	5	2000	NF=1.9dB	6-pin super minimold
μPA812T	General Purpose	3	7	1000	NF=1.4dB	
μPA813T	General Purpose	5	5	1000	$\|S_{21e}\|^2$=5.0dB (MIN.)	
μPA814T	General Purpose	3	7	2000	NF=1.5dB	
μPA814TC	General Purpose	3	7	2000	NF=1.5dB	6-pin thin-type ultra super minimold
μPA821TC	Mobile Comm. VCO	3	7	1000	NF=1.2dB	
μPA821TF	Mobile Comm. VCO	3	7	1000	NF=1.2dB	6-pin thin-type super minimold
μPA826TC	Mobile Comm. VCO	3	3	2000	NF=1.5dB	6-pin thin-type ultra super minimold
μPA826TF	Mobile Comm. VCO	3	3	2000	NF=1.5dB	6-pin thin-type super minimold
μPA827TF	Mobile Comm. VCO	2	3	2000	NF=1.5dB	
μPA828TF	Mobile Comm. VCO	2	3	2000	NF=1.3dB	
μPA831TC	Mobile Comm. VCO	Q1:3, Q2:3	Q1:7, Q2:7	Q1:1000, Q2:1000	Q1:NF=1.2dB Q2:NF=1.4dB	6-pin thin-type super minimold
μPA831TF	Mobile Comm. VCO	Q1:3, Q2:3	Q1:7, Q2:7	Q1:1000, Q2:1000	Q1:NF=1.2dB Q2:NF=1.4dB	6-pin thin-type super minimold
μPA832TF	Mobile Comm. VCO	Q1:3, Q2:3	Q1:7, Q2:3	Q1:1000, Q2:2000	Q1:NF=1.2dB Q2:NF=1.5dB	
μPA833TF	Mobile Comm. VCO	Q1:1, Q2:3	Q1:3, Q2:3	Q1:2000, Q2:2000	Q1:NF=1.7dB Q2:NF=1.5dB	
μPA834TF	Mobile Comm. VCO	Q1:3, Q2:3	Q1:7, Q2:7	Q1:1000, Q2:1000	Q1:NF=1.4dB Q2:NF=1.2dB	
μPA835TC	Mobile Comm. VCO	Q1:3, Q2:3	Q1:3, Q2:7	Q1:2000, Q2:1000	Q1:NF=1.5dB Q2:NF=1.2dB	6-pin thin-type ultra super minimold
μPA835TF	Mobile Comm. VCO	Q1:3, Q2:3	Q1:3, Q2:7	Q1:2000, Q2:1000	Q1:NF=1.5dB Q2:NF=1.2dB	6-pin thin-type super minimold
μPA836TC	Mobile Comm. VCO	Q1:3, Q2:1	Q1:3, Q2:3	Q1:2000, Q2:2000	Q1:NF=1.5dB Q2:NF=1.7dB	6-pin thin-type ultra super minimold
μPA836TF	Mobile Comm. VCO	Q1:3, Q2:1	Q1:3, Q2:3	Q1:2000, Q2:2000	Q1:NF=1.5dB Q2:NF=1.7dB	6-pin thin-type super minimold
μPA840TC	Mobile Comm. VCO	Q1:3, Q2:3	Q1:3, Q2:7	Q1:2000, Q2:1000	Q1:NF=1.5dB Q2:NF=1.4dB	6-pin thin-type ultra super minimold

Discrete

■ Low Noise GaAs/HJ FET (NE) (1/2)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
NE674	General Purpose GaAs FET	3	10	4000–12000	NF=1.4dB, G_a=10dB@f=12GHz	Chip, 83B
NE71300	General Purpose GaAs FET	3	10	12000	NF=1.6dB	Chip
NE71383B	General Purpose GaAs FET	3	10	12000	NF=1.6dB	83B
NE76118	General Purpose GaAs FET	3	10	2000	NF=0.8dB	18
NE23383B	General Purpose HJ-FET	2	10	4000–12000	NF=0.35dB, G_a=15dB@f=4GHz	83B
NE24200	General Purpose HJ-FET	2	10	12000	NF=0.6dB	Chip
NE24283B	General Purpose HJ-FET	2	10	4000–18000	NF=0.6dB, G_a=11dB@f=12GHz	83B
NE27200	General Purpose HJ-FET	2	10	12000	NF=0.45dB	Chip
NE32500	General Purpose HJ-FET	2	10	12000	NF=0.45dB	
NE32900	General Purpose HJ-FET	2	10	4000–18000	NF=0.35dB, G_a=13dB@f=12GHz	
NE34018	Mobile Comm. HJ-FET	2	5	800–3000	NF=0.6dB, G_a=16dB, G_s=18dB@f=2GHz	18
NE38018	Mobile Comm. HJ-FET	2	5	800–3000	NF=0.55dB, G_a=14.5dB, G_s=16dB@f=2GHz	
NE72118	BS Converter OSC Stage GaAs FET	3	30	4000–12000	G_s=5.5dB, $P_{o(1dB)}$=13.5dBm@=12GHz	
NE721S01	BS Converter OSC Stage GaAs FET	3	30	12000	G_s=7dB	S01
NE72218	BS Converter OSC Stage GaAs FET	3	30	4000–12000	G_s=4.5dB, $P_{o(1dB)}$=15.0dBm@=12GHz	18
NE76000	BS Converter GaAs FET	3	10	12000	NF=1.6dB	Chip
NE76038	BS Converter GaAs FET	3	10	12000	NF=1.7dB	38
NE76083A	BS Converter GaAs FET	3	10	12000	NF=1.6dB	83A
NE76084	BS Converter GaAs FET	3	10	12000	NF=1.6dB	84
NE76184A	BS Converter GaAs FET	3	10	4000	NF=0.8dB, G_a=12dB	84A
NE32484A	BS Converter HJ-FET	2	10	12000	NF=0.6dB, G_a=11.0dB	
NE32584C	BS Converter HJ-FET	2	10	12000	NF=0.45dB, G_a=12.5dB	84C
NE325S01	BS Converter HJ-FET	2	10	12000	NF=0.45dB, G_a=12.5dB	S01
NE329S01	BS Converter HJ-FET	2	10	4000–18000	NF=0.35dB, G_a=13.0dB@f=12GHz	
NE3210S01	BS Converter HJ-FET	2	10	4000–18000	NF=0.35dB, G_a=13.5dB@f=12GHz	
NE33284A	BS Converter HJ-FET	2	10	4000	NF=0.35dB, G_a=15.0dB	84A
NE334S01	BS Converter HJ-FET	2	15	4000	NF=0.25dB, G_a=16.0dB	S01

Discrete

■ Low Noise GaAs/HJ FET (NE) (2/2)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
NE42484A	BS Converter HJ-FET	2	10	12000	NF=0.8dB, G_a=10.5dB	84A
NE42484C	BS Converter HJ-FET	2	10	12000	NF=0.7dB, G_a=12.0dB	84C
NE425S01	BS Converter HJ-FET	2	10	12000	NF=0.6dB, G_a=12.0dB	S01
NE428M01	BS Converter HJ-FET	2	10	4000–12000	NF=0.9dB, G_a=8.5dB@f=12GHz	M01
NE429M01	BS Converter HJ-FET	2	10	4000–12000	NF=0.9dB, G_a=10dB@f=12GHz	
NE4210M01	BS Converter HJ-FET	2	10	4000–12000	NF=0.8dB, G_a=11dB@f=12GHz	
NE434S01	BS Converter HJ-FET	2	15	4000	NF=0.35dB, G_a=15.5dB	S01

Discrete

■ Power TR./FET (2SC, NE, NEL, NEM, NES, NEZ) (1/3)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
2SC5288 (NE68939)	General Purpose Medium Po. Bip. Tr.	3.6	Iq=1	1900	$P_{in(1dB)}$=24dBm (class AB)	4-pin minimold
2SC5289 (NE69039)	General Purpose Medium Po. Bip. Tr.	3.6	Iq=1	1900	$P_{in(1dB)}$=27dBm (class AB)	
NE850R599A	C-Band Po. Amp. Power GaAs FET	10	100	2000–10000	$P_{o(1dB)}$=25.5dBm	99
NE8500199	C-Band Po. Amp. Power GaAs FET	10	200	2000–10000	$P_{o(1dB)}$=28.5dBm	
NE8500295-4	C-Band Po. Amp. Power GaAs FET	10	450	3500–5500	$P_{o(1dB)}$=33.8dBm	95
NE8500295-6	C-Band Po. Amp. Power GaAs FET	10	450	5500–7500	$P_{o(1dB)}$=33.8dBm	
NE8500295-8	C-Band Po. Amp. Power GaAs FET	10	450	7500–8500	$P_{o(1dB)}$=33.5dBm	
NEZ3642-15D	C-Band Po. Amp. Power GaAs FET	10	≦6000	3600–4200	$P_{o(1dB)}$=42.5dBm	T-65
NEZ3642-15DD	C-Band Po. Amp. Power GaAs FET	10	≦6000	3600–4200	$P_{o(1dB)}$=42.5dBm	
NEZ3642-4D	C-Band Po. Amp. Power GaAs FET	10	≦1500	3600–4200	$P_{o(1dB)}$=36.5dBm	T-61
NEZ3642-8D	C-Band Po. Amp. Power GaAs FET	10	≦3000	3600–4200	$P_{o(1dB)}$=39.5dBm	
NEZ3642-8DD	C-Band Po. Amp. Power GaAs FET	10	≦3000	3600–4200	$P_{o(1dB)}$=39.5dBm	
NEZ4450-15D	C-Band Po. Amp. Power GaAs FET	10	≦6000	4400–5000	$P_{o(1dB)}$=42.5dBm	T-65
NEZ4450-15DD	C-Band Po. Amp. Power GaAs FET	10	≦6000	4400–5000	$P_{o(1dB)}$=42.5dBm	
NEZ4450-4D	C-Band Po. Amp. Power GaAs FET	10	≦1500	4400–5000	$P_{o(1dB)}$=36.5dBm	T-61
NEZ4450-4DD	C-Band Po. Amp. Power GaAs FET	10	≦1500	4400–5000	$P_{o(1dB)}$=36.5dBm	
NEZ4450-8D	C-Band Po. Amp. Power GaAs FET	10	≦3000	4400–5000	$P_{o(1dB)}$=39.5dBm	
NEZ4450-8DD	C-Band Po. Amp. Power GaAs FET	10	≦3000	4400–5000	$P_{o(1dB)}$=39.5dBm	
NEZ5964-15D	C-Band Po. Amp. Power GaAs FET	10	≦6000	5900–6450	$P_{o(1dB)}$=42.5dBm	T-65
NEZ5964-15DD	C-Band Po. Amp. Power GaAs FET	10	≦6000	5900–6450	$P_{o(1dB)}$=42.5dBm	
NEZ5964-4D	C-Band Po. Amp. Power GaAs FET	10	≦1500	5900–6450	$P_{o(1dB)}$=36.5dBm	T-61
NEZ5964-4DD	C-Band Po. Amp. Power GaAs FET	10	≦1500	5900–6450	$P_{o(1dB)}$=36.5dBm	
NEZ5964-8D	C-Band Po. Amp. Power GaAs FET	10	≦3000	5900–6450	$P_{o(1dB)}$=39.5dBm	
NEZ5964-8DD	C-Band Po. Amp. Power GaAs FET	10	≦3000	5900–6450	$P_{o(1dB)}$=39.5dBm	
NEZ6472-15D	C-Band Po. Amp. Power GaAs FET	10	≦6000	6400–7200	$P_{o(1dB)}$=42.5dBm	T-65
NEZ6472-15DD	C-Band Po. Amp. Power GaAs FET	10	≦6000	6400–7200	$P_{o(1dB)}$=42.5dBm	

Discrete

■ Power TR./FET (2SC, NE, NEL, NEM, NES, NEZ) (2/3)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
NEZ6472-4D	C-Band Po. Amp. Power GaAs FET	10	≦1500	6400–7200	$P_{o(1dB)}$=36.5dBm	T-61
NEZ6472-4DD	C-Band Po. Amp. Power GaAs FET	10	≦1500	6400–7200	$P_{o(1dB)}$=36.5dBm	
NEZ6472-8D	C-Band Po. Amp. Power GaAs FET	10	≦3000	6400–7200	$P_{o(1dB)}$=39.5dBm	
NEZ6472-8DD	C-Band Po. Amp. Power GaAs FET	10	≦3000	6400–7200	$P_{o(1dB)}$=39.5dBm	
NEZ7177-4D	C-Band Po. Amp. Power GaAs FET	10	≦1500	7100–7700	$P_{o(1dB)}$=36.5dBm	
NEZ7177-4DD	C-Band Po. Amp. Power GaAs FET	10	≦1500	7100–7700	$P_{o(1dB)}$=36.5dBm	
NEZ7177-8D	C-Band Po. Amp. Power GaAs FET	10	≦3000	7100–7700	$P_{o(1dB)}$=39.5dBm	
NEZ7177-8DD	C-Band Po. Amp. Power GaAs FET	10	≦3000	7100–7700	$P_{o(1dB)}$=39.5dBm	
NEZ7785-15D	C-Band Po. Amp. Power GaAs FET	10	≦6000	7700–8500	$P_{o(1dB)}$=42.5dBm	T-65
NEZ7785-4D	C-Band Po. Amp. Power GaAs FET	10	≦1500	7700–8500	$P_{o(1dB)}$=36.5dBm	T-61
NEZ7785-4DD	C-Band Po. Amp. Power GaAs FET	10	≦1500	7700–8500	$P_{o(1dB)}$=36.5dBm	
NEZ7785-8D	C-Band Po. Amp. Power GaAs FET	10	≦3000	7700–8500	$P_{o(1dB)}$=39.5dBm	
NEZ7785-8DD	C-Band Po. Amp. Power GaAs FET	10	≦3000	7700–8500	$P_{o(1dB)}$=39.5dBm	
NE1280100	K-Band Medium Po. Amp. Power GaAs FET	5	60	18700	P_{out}=21.5dBm	Chip
NE1280200	K-Band Medium Po. Amp. Power GaAs FET	5	120	18700	P_{out}=24.5dBm	
NE1280400	K-Band Medium Po. Amp. Power GaAs FET	5	240	18700	P_{out}=27.5dBm	
NEZ1414-2E	Ku-Band Po. Amp. Power GaAs FET	9	700	14000–14500	$P_{o(1dB)}$=34.0dBm	T-78
NEZ1414-3E	Ku-Band Po. Amp. Power GaAs FET	10	700	14000–14500	$P_{o(1dB)}$=34.0dBm	
NEZ1414-4E	Ku-Band Po. Amp. Power GaAs FET	9	1000	14000–14500	P_o=37.5dBm	
NEZ1414-5E	Ku-Band Po. Amp. Power GaAs FET	10	1500	14000–14500	$P_{o(1dB)}$=37.0dBm	
NEZ1414-8E	Ku-Band Po. Amp. Power GaAs FET	9	2800	14000–14500	P_o=39.5dBm	T-61
2SC3817 (NEL150181-12)	L-Band Po. Amp. Power Bip. Tr.	13.5	Iq=3	1550	P_{out}=30dBm (Class AB)	81 (Ceramic)
NEL2001	L-Band Po. Amp. Power Bip. Tr.	24	Iq=20	1970	$P_{in(1dB)}$=2.5W (Class AB)	01
NEL2004	L-Band Po. Amp. Power Bip. Tr.	24	Iq=40	1970	$P_{in(1dB)}$=7W (Class AB)	F02
NEL2012	L-Band Po. Amp. Power Bip. Tr.	24	Iq=75	1970	$P_{in(1dB)}$=16W (Class AB)	
NEL2012F03-24	L-Band Po. Amp. Power Bip. Tr.	24	Iq=75	1970	$P_{in(1dB)}$=16W	F03
NEL2035	L-Band Po. Amp. Power Bip. Tr.	24	Iq=100	1970	$P_{in(1dB)}$=33W (Class AB)	

Discrete

■ Power TR./FET (2SC, NE, NEL, NEM, NES, NEZ) (3/3)

Part Number	Applications	Supply Voltage (V)	Supply Current (mA)	Operating Frequency (MHz)	Performances	Package
NE650R279A	L, S-Band Po. Amp. Power GaAs FET	6	50	800–2500	$P_{o(1dB)}$=23dBm, GL=16dB, ηadd=45%@f=1.9GHz	79A
NE650R479A	L, S-Band Po. Amp. Power GaAs FET	6	100	800–2500	$P_{o(1dB)}$=26dBm, GL=14dB, ηadd=45%@f=1.9GHz	
NE6500379A	L, S-Band Po. Amp. Power GaAs FET	6	500	800–2500	$P_{o(1dB)}$=35dBm, GL=10dB, ηadd=50%@f=1.9GHz	
NE6500496	L, S-Band Po. Amp. Power GaAs FET	10	≦400	2300	$P_{o(1dB)}$=36dBm	96
NE6501077	L, S-Band Po. Amp. Power GaAs FET	10	≦1000	2300	$P_{o(1dB)}$=39.5dBm	77
NE651R479A	L-Band Po. Amp. Power GaAs HJ-FET	3.5	230	800–2500	P_o=27dBm, GL=12dB, ηadd=60%@f=1.9GHz	79A
NE6510179A	L-Band Po. Amp. Power GaAs HJ-FET	3.5	200	800–2500	P_o=32.5dBm, GL=10dB, ηadd=58%@f=1.9GHz	
NE6510379A	L-Band Po. Amp. Power GaAs HJ-FET	3.5	760	800–2500	P_o=32.5dBm, GL=8dB, ηadd=52%@f=1.9GHz	
NES1417B-30	L-Band Po. Amp. Power GaAs FET	10	1000	1500	P_o=45dBm	T-79
NES1821B-30	L-Band Po. Amp. Power GaAs FET	10	1000	1900	P_o=45dBm	
NES1821P-30	L, S-Band Po. Amp. Power GaAs FET	10	4000	1800-2300	P_o=45dBm, GL=13dB, ηD=40%@f=1.96GHz	T-86
NES1821P-50	L, S-Band Po. Amp. Power GaAs FET	10	2000	1800-2200	P_o=47dBm, GL=10.5dB, ηD=52%@f=1.96GHz	
NES1823P-100	L, S-Band Po. Amp. Power GaAs FET	10	6000	1800-2300	P_o=50dBm, GL=11dB, ηD=50%@f=2.2GHz	T-92
NES2527B-30	S-Band Po. Amp. Power GaAs FET	10	6000	2500-2700	$P_{o(1dB)}$=45.0dBm	T-79
2SC2586 (NE050214E-12)	UHF Po. Amp. Power Bip. Tr.	12.6	–	500	P_{out}=32dBm (Class C)	CAN
2SC2762 (NE050214-12)	UHF Po. Amp. Power Bip. Tr.	12.6	–	500	P_{out}=31.5dBm (Class C)	
2SC3218-M (NEM085068-28)	UHF Po. Amp. Power Bip. Tr.	28	Iq=2×150	860	P_{out}=47.2dBm (Class AB)	68 (Ceramic)
2SC3286-M (NEM0214068-28)	VHF Po. Amp. Power Bip. Tr.	28	Iq=2×500	230	P_{out}=51.4dBm (Class AB)	Ceramic
NEM0899F06-30	UHF Po. Amp. Power Bip. Tr.	30	Iq=2×150	860	P_{out}=100W	F06
NEM0995F06-30	UHF Po. Amp. Power Bip. Tr.	30	Iq=2×200	960	P_{out}=90W	
2SK2597 (NEM0995F01-30)	UHF Po. Amp. Power MOS FET	30	Iq=2×200	960	P_o=90W	F01
NEZ1011-2E	X-Band Po. Amp. Power GaAs FET	9	700	10700–11700	$P_{o(1dB)}$=34.5dBm	T-78
NEZ1011-3E	X-Band Po. Amp. Power GaAs FET	10	700	10700–11700	$P_{o(1dB)}$=34.0dBm	
NEZ1011-4E	X-Band Po. Amp. Power GaAs FET	9	1000	10700–11700	P_o=36.5dBm, GL=8.0dB@f=10.7–11.7GHz	
NEZ1011-5E	X-Band Po. Amp. Power GaAs FET	10	1500	10700–11700	$P_{o(1dB)}$=37.0dBm	
NEZ1011-8E	X-Band Po. Amp. Power GaAs FET	9	2000	10700–11700	P_o=40.5dBm	T-61
NE960R275	X, Ku-Band Po. Amp. Power GaAs FET	9	90	8000–16000	$P_{o(1dB)}$=25.0dBm	75
NE960R575	X, Ku-Band Po. Amp. Power GaAs FET	9	180	8000–16000	$P_{o(1dB)}$=27.5dBm	

Discrete

■ Cross-reference Table

• Dual Gate MES FET

Remarks	4-pin minimold	4-pin super minimold
W_g = 400 μm	**3SK177**	**3SK299**
W_g = 800 μm	**3SK206**	

• Dual Gate MOS FET

Applications		4-pin minimold	4-pin super minimold
VHF Band (to 200 MHz)		**3SK131**	**3SK242**
		3SK222	**3SK246**
CATV Band (to 470 MHz)		**3SK223**	**3SK243**
		3SK230	
		3SK252	**3SK254**
UHF Band (to 900 MHz)	λ/4 matching	**3SK135A**	
		3SK224	**3SK244**
		3SK231	
		3SK253	**3SK255**
	λ/2 matching	**3SK134B**	**3SK245**

Remark: Devices listed in the same row are the same chip.
Example: 3SK131, 3SK242

• Dual Gate MES/MOS FET, Low Noise BIP. TR. (for TV tuner)

Applications		BIP. TR.		Dual Gate FET	
		Minimold (3-pin)	Small minimold (3-pin)	Minimold (4-pin)	Super minimold (4-pin)
VHF band	RF			**3SK131** **3SK222** **3SK223** **3SK230** **3SK252**	**3SK254**
	MIX	**2SC3545**	**2SC4182** **2SC4184**	**3SK131**	**3SK242**
	OSC	**2SC3545**	**2SC4182** **2SC4184**		
UHF band	RF (λ/4)		**2SC4183**	**3SK135A** **3SK224** **3SK231** **3SK253**	**3SK255**
	RF (λ/2)			**3SK134B**	
	RF (GaAs FET)			**3SK177** **3SK206**	
	MIX	**2SC3545** **2SC3841**	**2SC4183** **2SC4185** **2SC4184** **2SC4186**		
	OSC	**2SC3545** **2SC3841**	**2SC4182** **2SC4184** **2SC4185**		

Discrete

■ Cross-reference Table

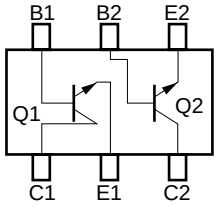
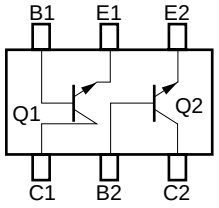
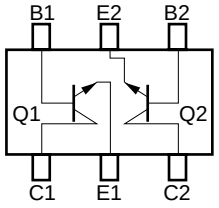
• Low Noise BIP. TR. (1/2)

Applications	Part Number						Electrical Characteristics	
	TO-92	Minimold		Super minimold		Ultra super minimold	f_T (GHz)	NF (dB)
		3-pin	4-pin	3-pin	4-pin	3-pin		
Pre Amp.	**2SC3355**	**2SC3356**	**2SC4093**	**2SC4228**	**2SC5013**	**2SC5008**	7 (20 mA)	1.1 (1 GHz)
	2SC2570A	**2SC2351**	**2SC4092**				5 (20 mA)	1.5 (1 GHz)
Buffer Amp.				**2SC4185**			2 (5 mA)	3 (0.5 GHz)
	2SC2570A	**2SC2351**	**2SC4092**				5 (20 mA)	1.5 (1 GHz)
1st IF Amp.	**2SC3355**	**2SC3356**	**2SC4093**	**2SC4226**	**2SC5011**	**2SC5006**	7 (20 mA)	1.1 (1 GHz)
	2SC2570A	**2SC2351**	**2SC4092**				5 (20 mA)	1.5 (1 GHz)
1st and 2nd OSC		**2SC3545**		**2SC4184**			1.8 (5 mA)	
				2SC4185			2 (5 mA)	
		2SC4568		**2SC4570**		**2SC5005**	5.5 (5 mA)	
		2SC4569		**2SC4571**		**2SC5004**	5 (5 mA)	
2nd IF Amp.				**2SC4185**			2 (5 mA)	

• Low Noise BIP. TR. (2/2)

Frequency (MHz)	NF (dB)		
	2.5	3.5	4.0
500	———	**2SC2148**	———
2000	**2SC3604**	**2SC3603**	**2SC2149**
4000	**2SC3587**	———	———

• Twin TR.

for pager	for VCO	for Mobile Communications	for VCO
			

Same Chip						Different Chip		
Part Number	2SC No. (×2)	Part Number	2SC No. (×2)	Part Number	2SC No. (×2)	Part Number	2SC No. (×2)	
							Q1	Q2
μPA800T, TF	2SC5008	**μPA811T**	2SC5008					
μPA801T,TC,TF	2SC5006	**μPA810T,TC,TF**	2SC5006	**μPA821TC, TF**	2SC5006	**μPA831TC, TF**	2SC5006	2SC5007
μPA802T	2SC5007	**μPA812T**	2SC5007	**μPA822TF**	2SC5007	**μPA832TF**	2SC5006	2SC5010
μPA803T	2SC5005	**μPA813T**	2SC5005			**μPA833TF**	2SC5195	2SC5010
μPA804T,TC,TF	2SC5004					**μPA834TF**	2SC5007	2SC5006
μPA805T	2SC5009					**μPA835TC, TF**	2SC5010	2SC5006
μPA806T	2SC5010			**μPA826TC, TF**	2SC5010	**μPA836TC, TF**	2SC5010	2SC5195
μPA807T	2SC5181			**μPA827TF**	2SC5181	**μPA837TF**	2SC5181	2SC5195
μPA808T	2SC5186			**μPA828TF**	2SC5186	**μPA838TF**	2SC5195	2SC5186
μPA809T, TF	2SC5195	**μPA814T,TC,TF**	2SC5195	**μPA829TF**	2SC5195	**μPA839TF**	2SC5008	2SC5006
						μPA840TC	2SC5010	2SC5007

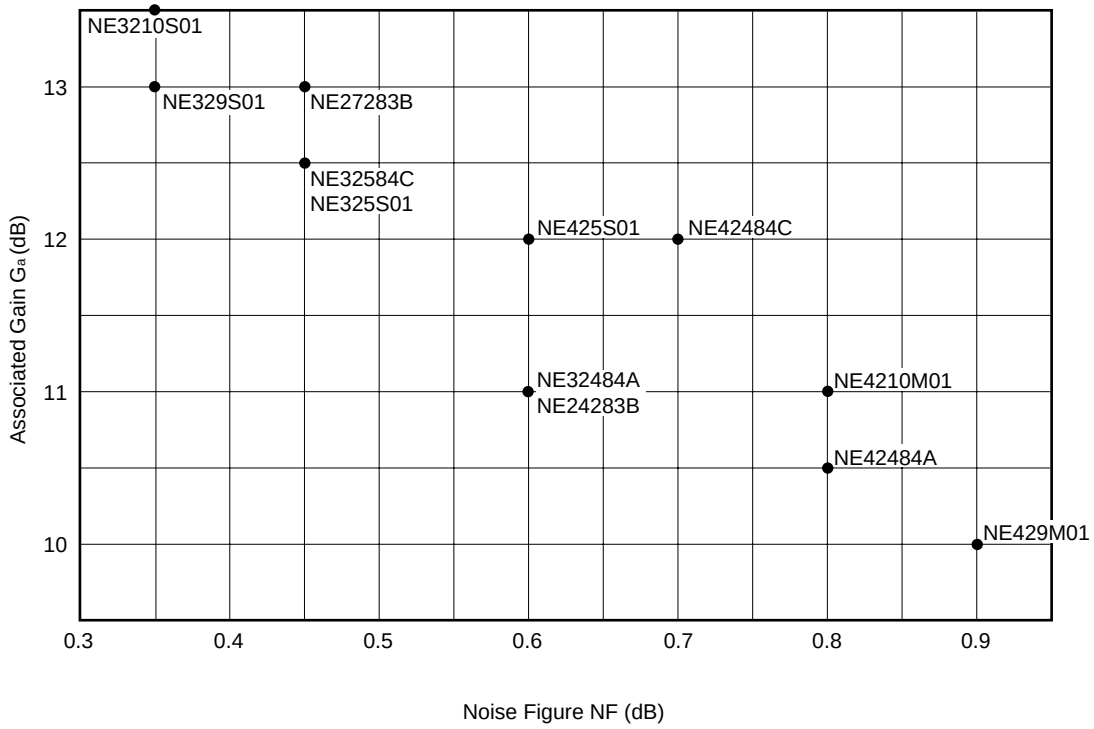
Package size T : 2.0 × 1.25 × 0.9 (mm)
TC: 1.5 × 1.1 × 0.55 (mm)
TF: 2.0 × 1.25 × 0.6 (mm)

Discrete

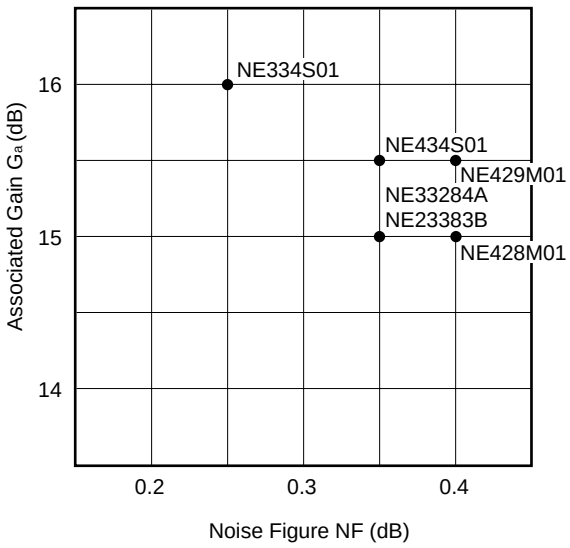
■ Cross-reference Table

• Low Noise GaAs/HJ FET

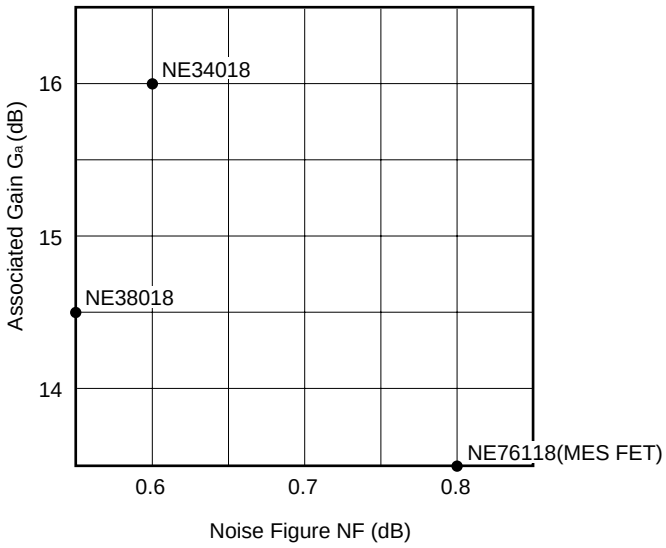
ASSOCIATED GAIN vs. NOISE FIGURE @ f = 12 GHz



ASSOCIATED GAIN vs. NOISE FIGURE @ f = 4 GHz



ASSOCIATED GAIN vs. NOISE FIGURE @ f = 2 GHz

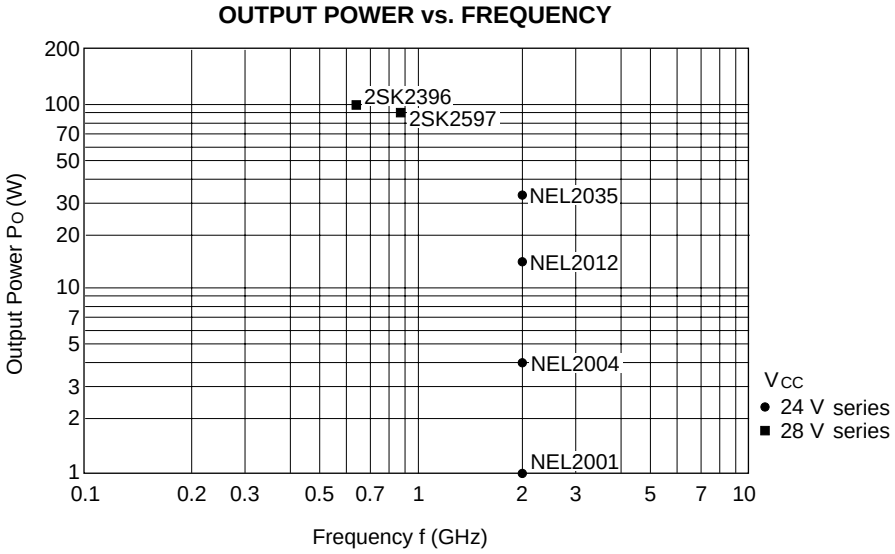


● : In mass production

Discrete

■ Cross-reference Table

• Power TR. (for mobile and portable radio station)



• Power TR. (for fixed radio station)

Frequency	Output Power
	10 W or higher
800 MHz or higher	**2SK2396**
900 MHz or higher	**2SK2597**
1900 MHz or higher	**NEL2000 SERIES**

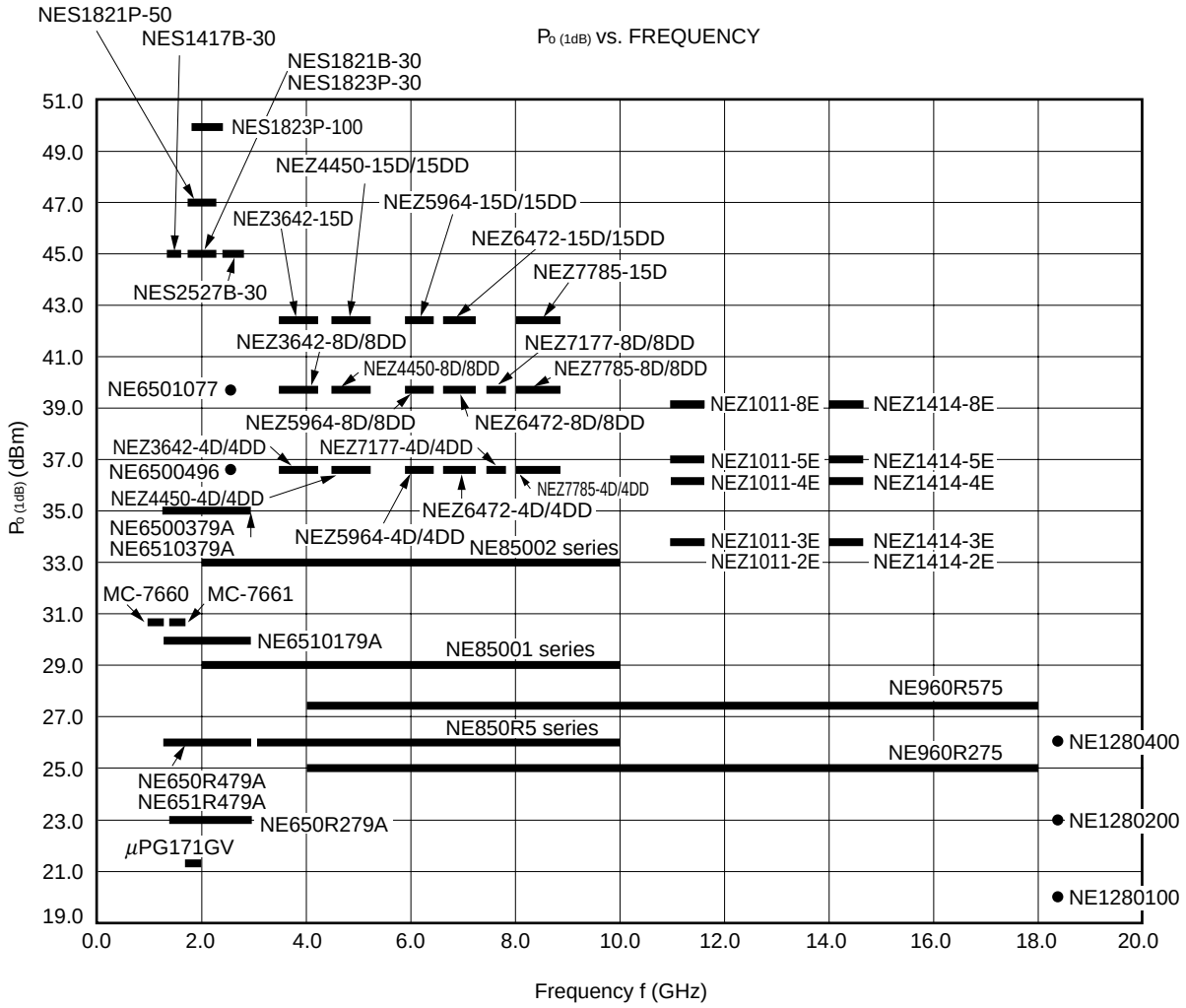
• Power TR. (for mobile and portable radio station)

Frequency	Output Power	
	0.1 W or higher	1 W or higher
1000 MHz or higher	**2SC5288** **2SC5289**	——

Discrete

■ Cross-reference Table

• Power FET



Discrete

■ Cross-reference Table

• Silicon Microwave Single Transistor

Package / f_T (GHz)	μ-X	TO-92	Power MM (3-pin)	New Power MM (4-pin)	3-pin MM	3-pin SMM	4-pin MM	4-pin SMM	3-pin USMM (1608)	3-pin Thin USMM (1408)	6-pin SMM High Gain	4-pin SMM (R type)
1.0					2SC2758	2SC4183						
1.1					2SC2757	2SC4182						
2.0					2SC2759	2SC4185						
					2SC3545	2SC4184						
2.8	2SC2148											
4.0		2SC2408A	2SC2954									
					2SC3841	2SC4186						
					2SC3663	2SC4187	2SC4091					
4.5	2SC2149				2SC2351	2SC4225	2SC4092					
5.0		2SC2570A										
					2SC4569	2SC4571			2SC5004	2SC5431		
5.3			2SC4536	2SC5337								
5.5					2SC4568	2SC4570			2SC5005			
6.0			2SC4703	2SC5338								
7.0	2SC3603	2SC3355	2SC3357	2SC5336	2SC3356	2SC4226	2SC4093	2SC5011	2SC5006	2SC5432		
8.5	2SC3604	2SC3582			2SC3583	2SC4227	2SC4094	2SC5012	2SC5007	2SC5433		
10.0*1	2SC3587				2SC3585	2SC4228	2SC4095	2SC5013	2SC5008	2SC5434		
					2SC5191	2SC5193	2SC5192	2SC5194	2SC5195	2SC5437		
11.0							2SC5455					
12.0*2					2SC4954	2SC4958	2SC4956	2SC5014	2SC5009			
					2SC4955	2SC4959	2SC4957	2SC5015	2SC5010	2SC5435		
14.0*2											2SC5369	
							2SC5454					
15.5*2					2SC5177	2SC5179	2SC5178	2SC5180	2SC5181			
					2SC5182	2SC5184	2SC5183	2SC5185	2SC5186	2SC5436		
16.0											2SC5409 (2SC5533*3)	
17.0											2SC5408	2SC5509
25.0												2SC5507
												2SC5508

*1: Lower stage: Low operation voltage and low phase noise type.
*2: Upper stage: Low power dissipation type. Lower stage: Low noise figure type.
*3: 2SC5533 is a thin type of 2SC5409.

Discrete

■ Cross-reference Table

• NE Part No.-EIAJ No.

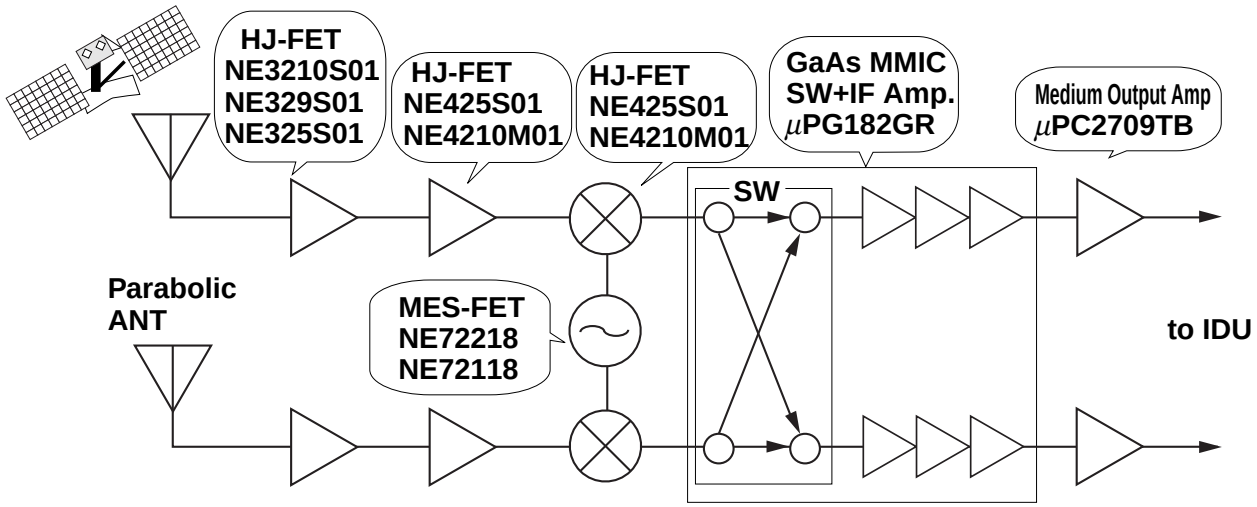
NE Part No.	EIAJ* No.
NE73416	2SC1733
NE73440A	2SC1926
NE73440B	2SC1927
NE73435	2SC2148
NE02135	2SC2149
NE02133	2SC2351
NE050214E-12	2SC2586
NE050214-12	2SC2762
NEM085068-28	2SC3218-M
NEM0214068-28	2SC3286-M
NE85632	2SC3355
NE85633	2SC3356
NE85634	2SC3357
NE94433	2SC3545
NE68132	2SC3582
NE68133	2SC3583
NE68033	2SC3585
NE68035	2SC3587
NE85635	2SC3603
NE68135	2SC3604
NE85641	2SC3809
NE68141	2SC3810
NEL150181-12	2SC3817
NE02139E	2SC4092
NE85639E	2SC4093
NE68139	2SC4094
NE68039	2SC4095
NE58030	2SC4183
NE73430	2SC4185
NE68330	2SC4187
NE85630	2SC4226
NE68130	2SC4227
NE68030	2SC4228
NE46134	2SC4536
NE58133	2SC4568
NE58233	2SC4569
NE58130	2SC4570
NE58230	2SC4571
NE46234	2SC4703
NE61030	2SC4885
NE68433	2SC4954
NE68533	2SC4955
NE68439E	2SC4956
NE68539E	2SC4957
NE68430	2SC4958
NE68530	2SC4959
NE58219	2SC5004
NE58119	2SC5005

NE Part No.	EIAJ* No.
NE85619	2SC5006
NE68119	2SC5007
NE68019	2SC5008
NE68419	2SC5009
NE68519	2SC5010
NE85618	2SC5011
NE68118	2SC5012
NE68018	2SC5013
NE68418	2SC5014
NE68518	2SC5015
NE68633	2SC5177
NE68639	2SC5178
NE68630	2SC5179
NE68618	2SC5180
NE68619	2SC5181
NE68733	2SC5182
NE68739	2SC5183
NE68730	2SC5184
NE68718	2SC5185
NE68719	2SC5186
NE68833	2SC5191
NE68839	2SC5192
NE68830	2SC5193
NE68818	2SC5194
NE68819	2SC5195
NE68939	2SC5288
NE69039	2SC5289
NE696M01	2SC5369
NEM0995F01-30	2SC2597
NE92939	3SK131
NE92739	3SK134B
NE25139	3SK177
NE25339	3SK206
NE92039	3SK222
NE92239	3SK223
NE92439	3SK224
NE93039	3SK230
NE93139	3SK231
NE92918	3SK242
NE92218	3SK243
NE92418	3SK244
NE92718	3SK245
NE92018	3SK246
NE93239	3SK252
NE93339	3SK253
NE93318	3SK255
NE25118	3SK299

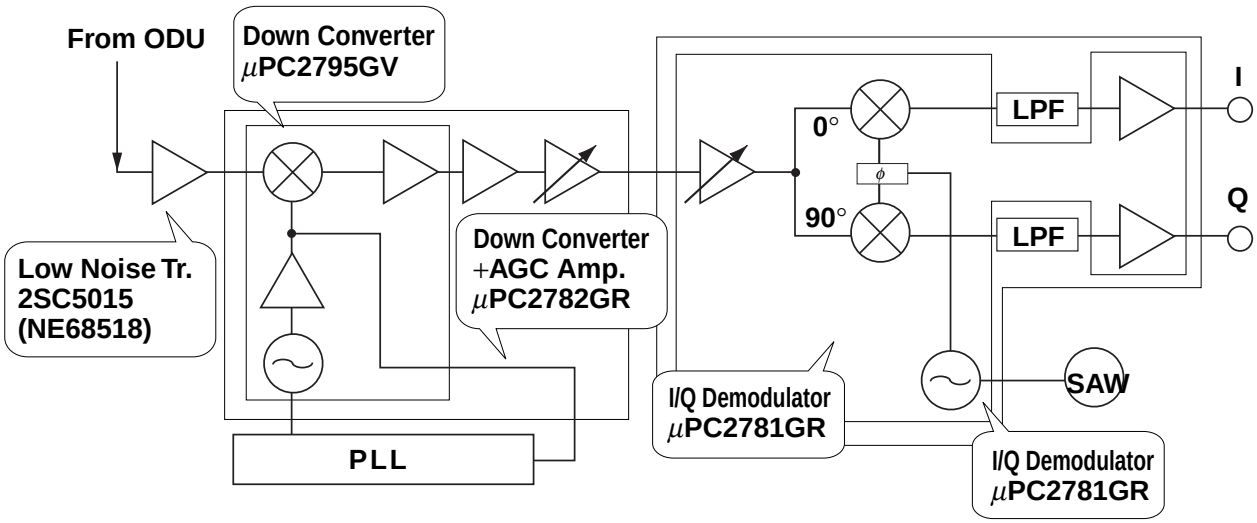
* : EIAJ = Electronics Industry Association Japan

Application

■ **Digital DBS (1/2)**

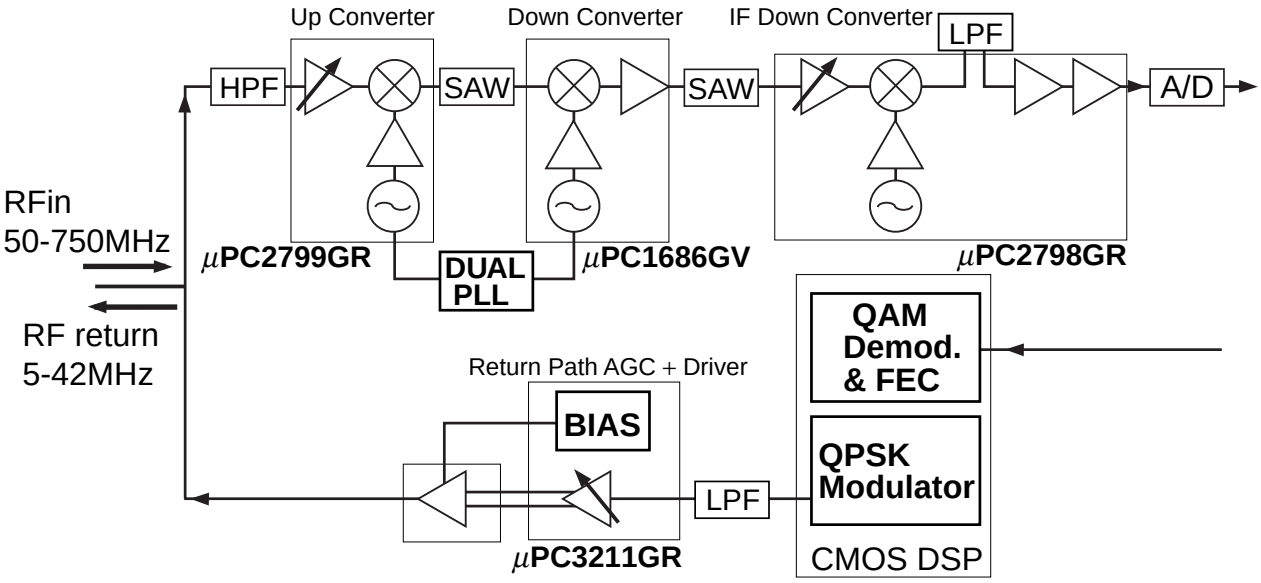


■ **Digital DBS (2/2)**



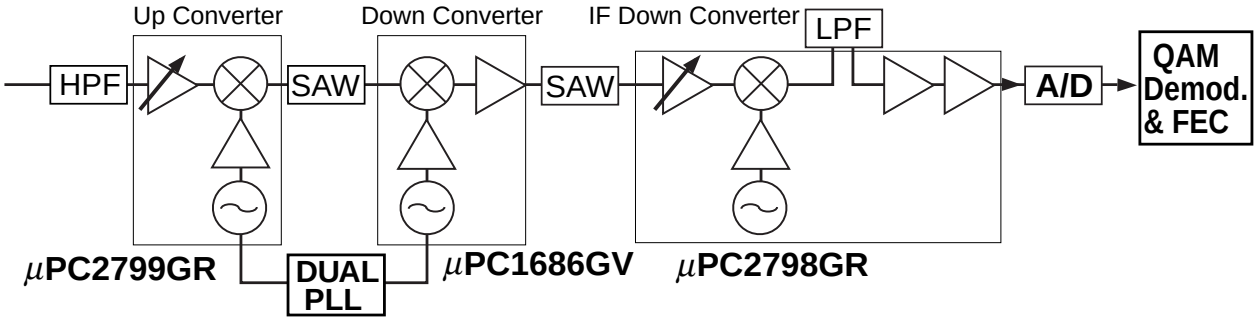
Application

■ **Transceiver Block for Digital Cable Modem/CATV Set-top-box**

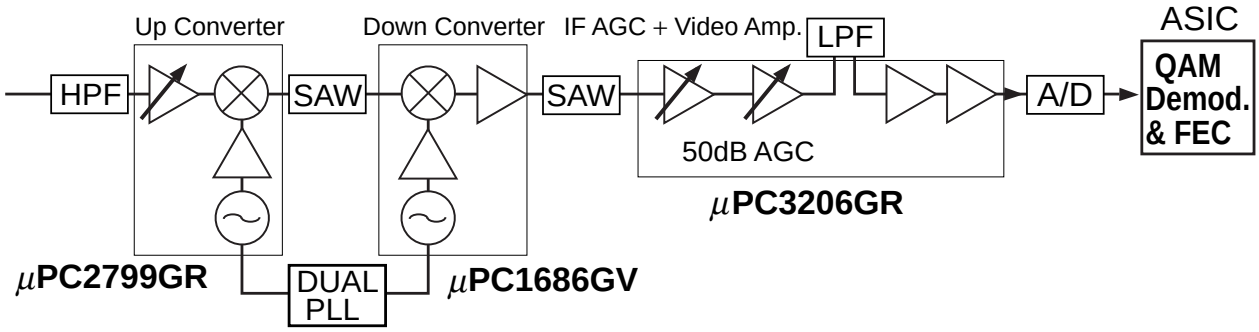


Application

■ **Receiver Block for Digital Cable Modem/CATV Set-top-box (1/2)**

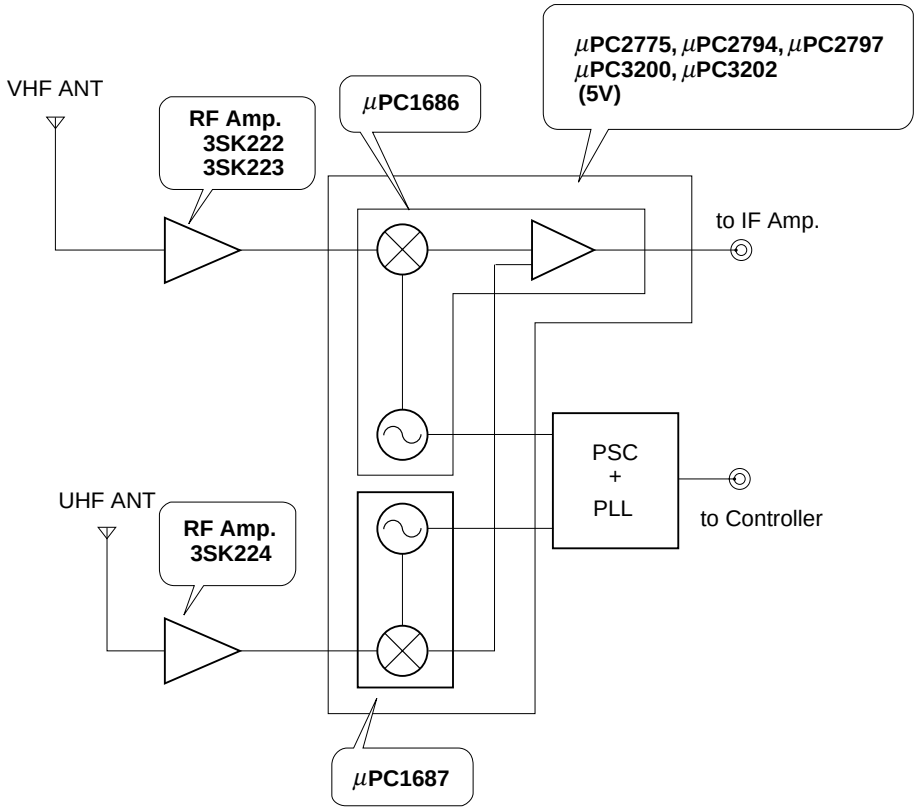


■ **Receiver Block for Digital Cable Modem/CATV Set-top-box (2/2)**

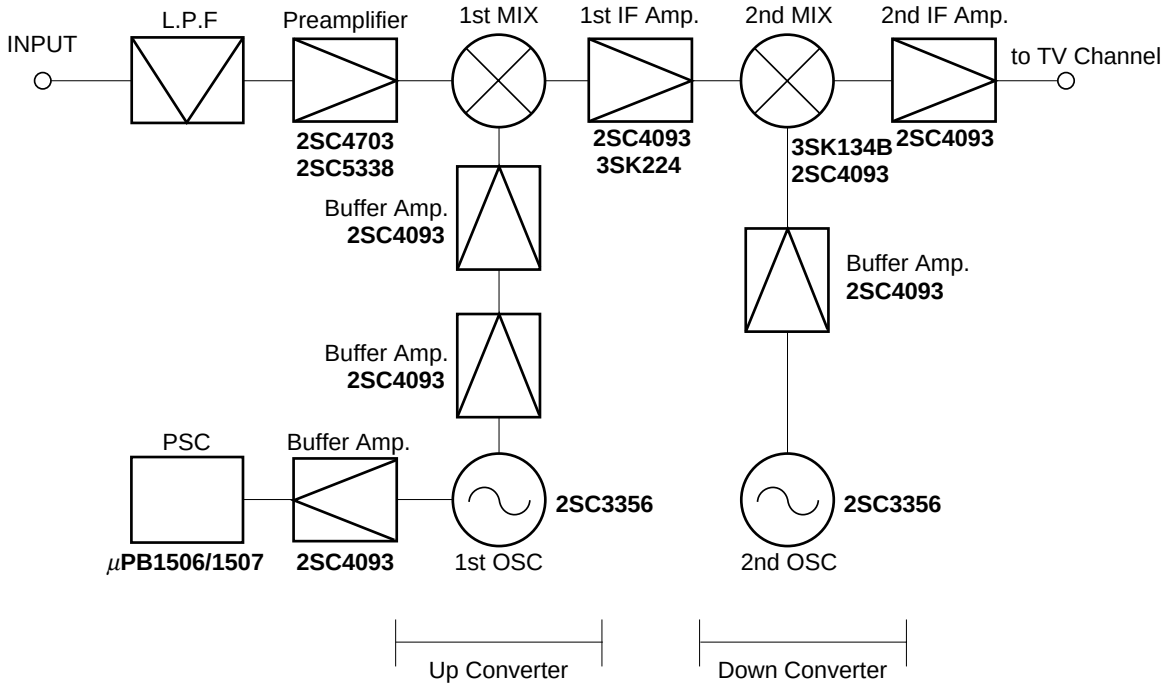


Application

■ Terrestrial TV



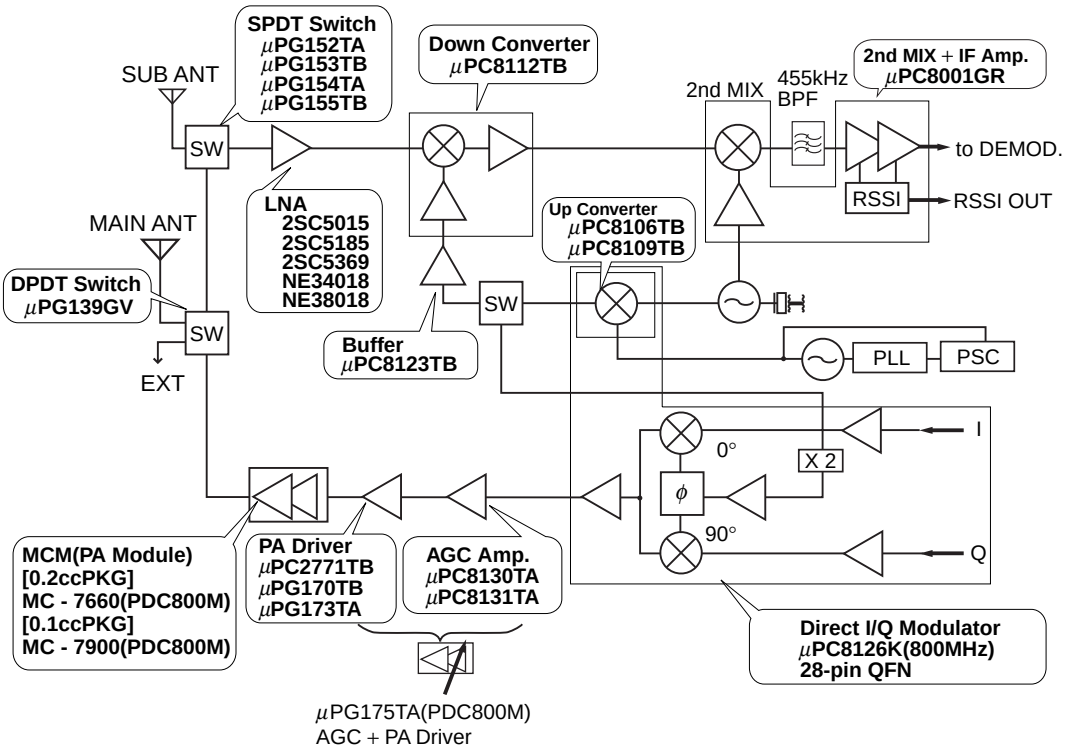
■ Block for Digital Cable Modem/CATV Converter



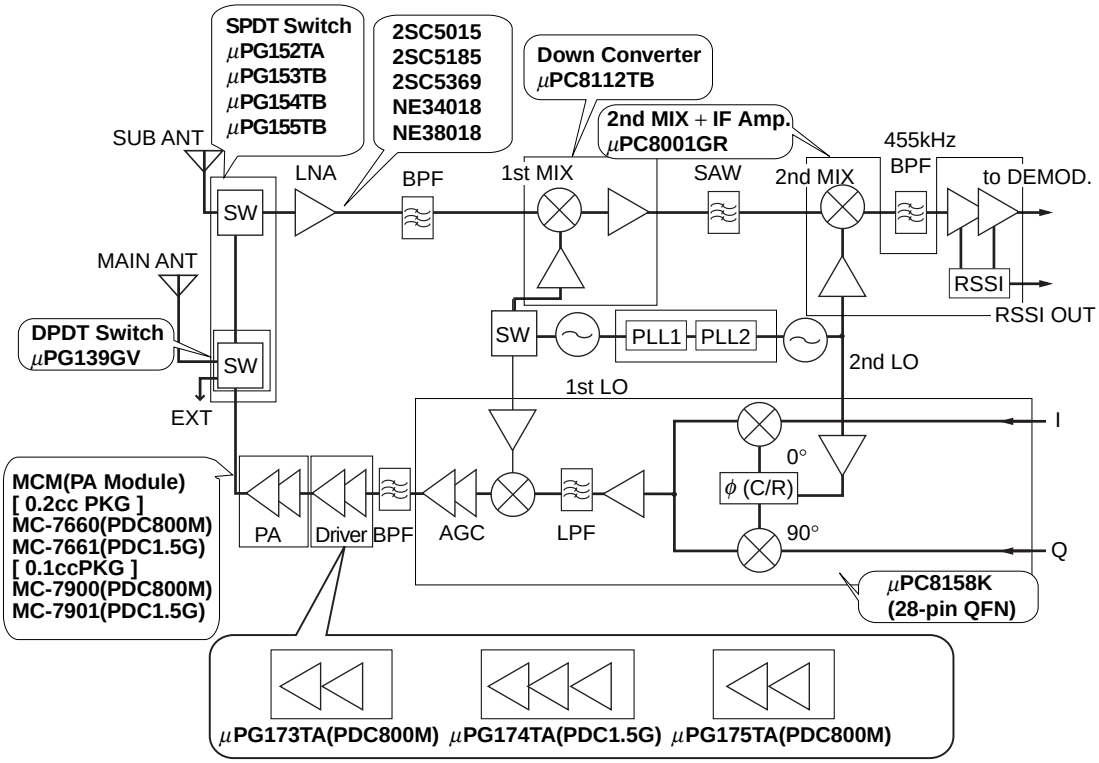
Application

■ PDC (RF Modulation System)

PDC 800M Direct Modulation System

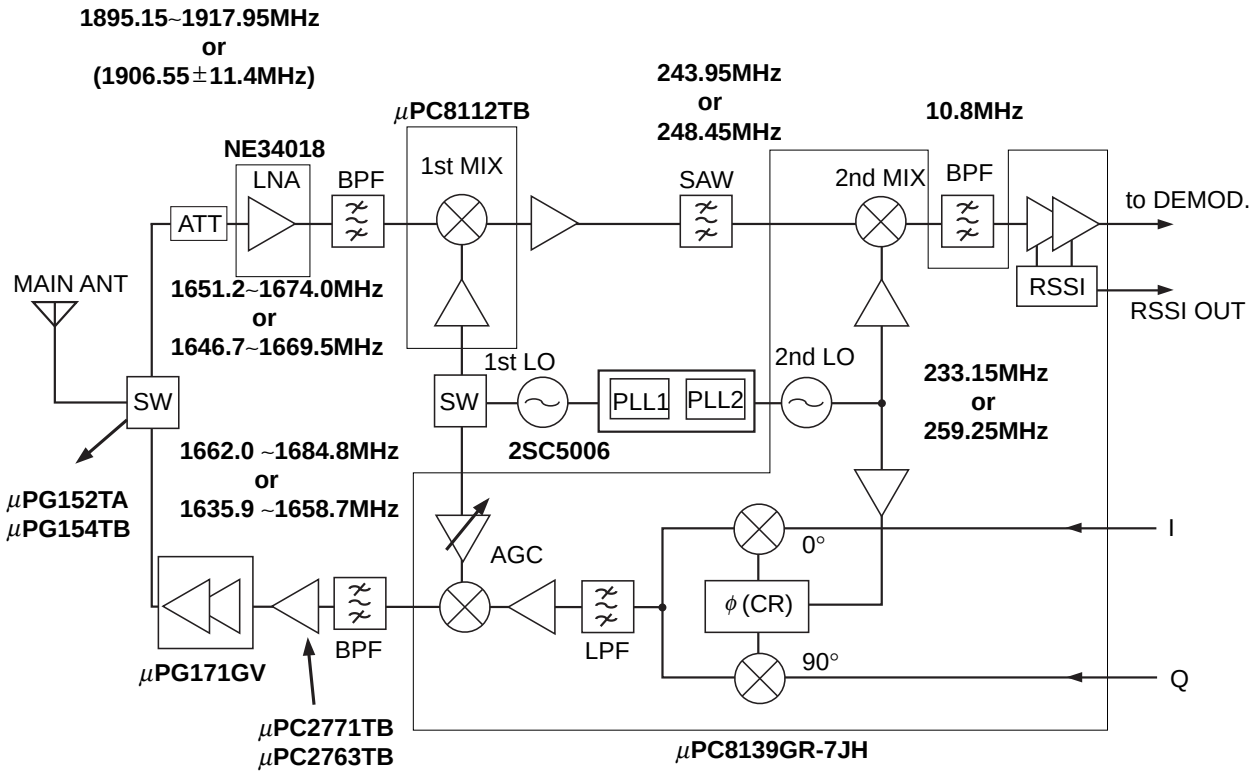


■ PDC (IF Modulation System)

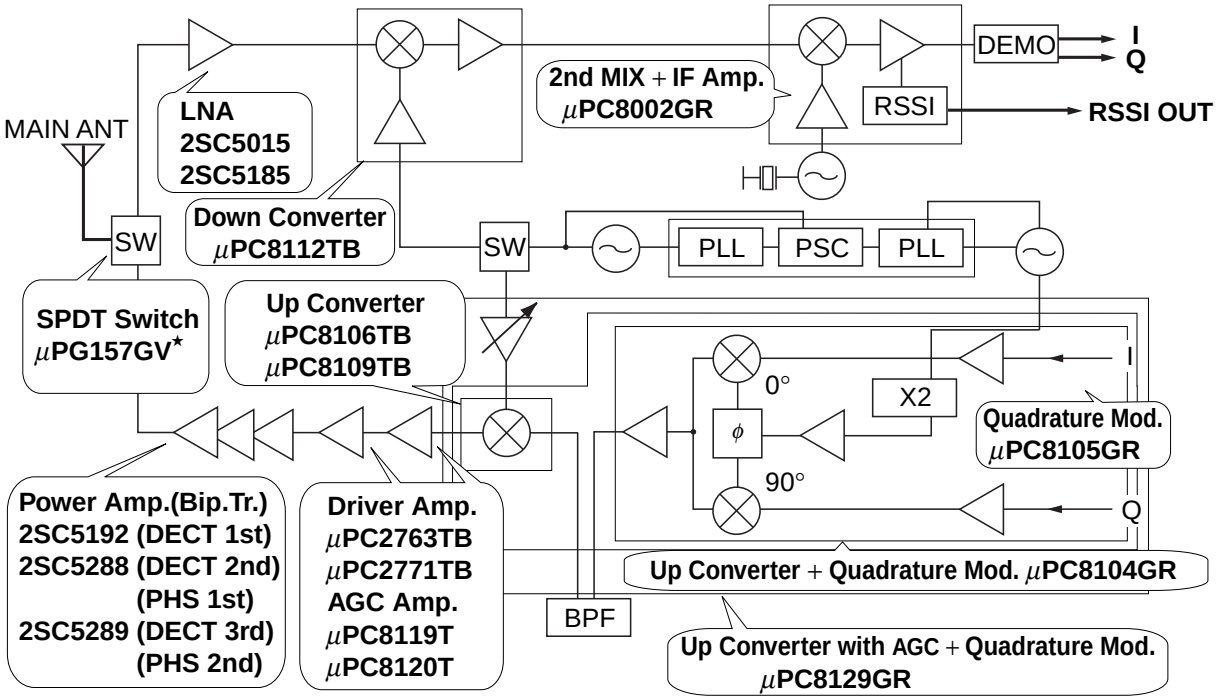


Application

■ PHS



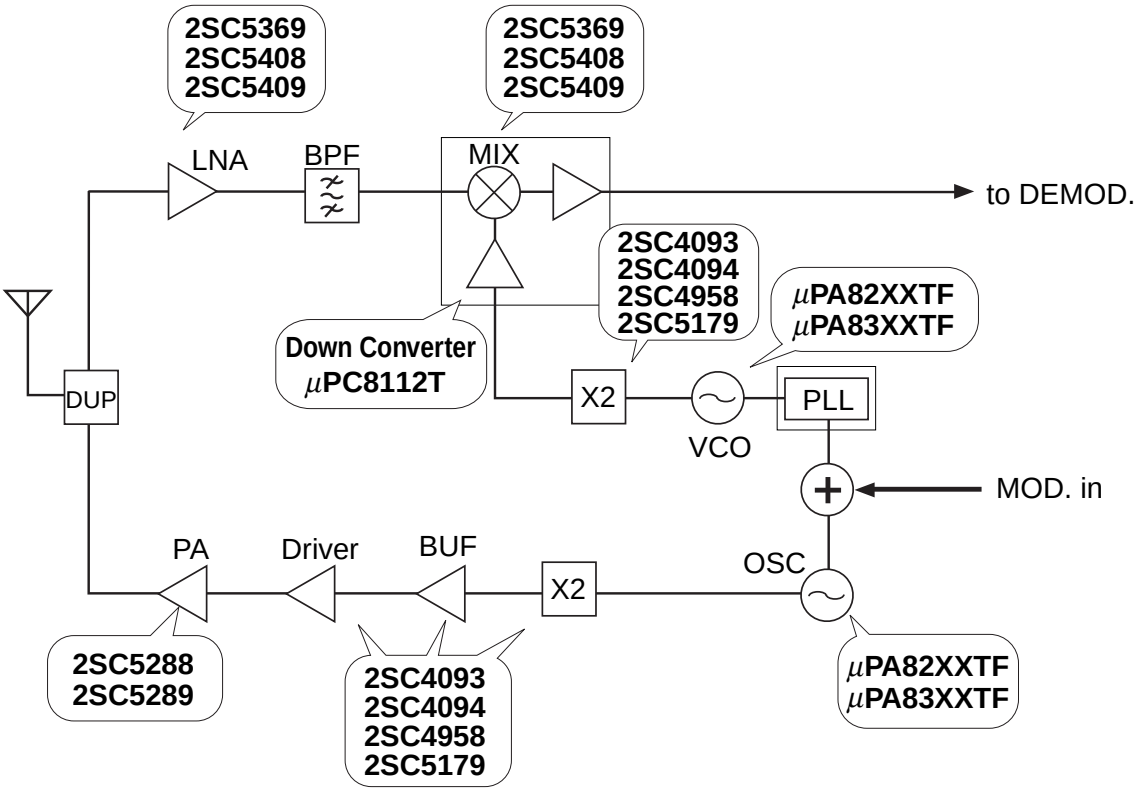
■ GSM (IF Modulation System)



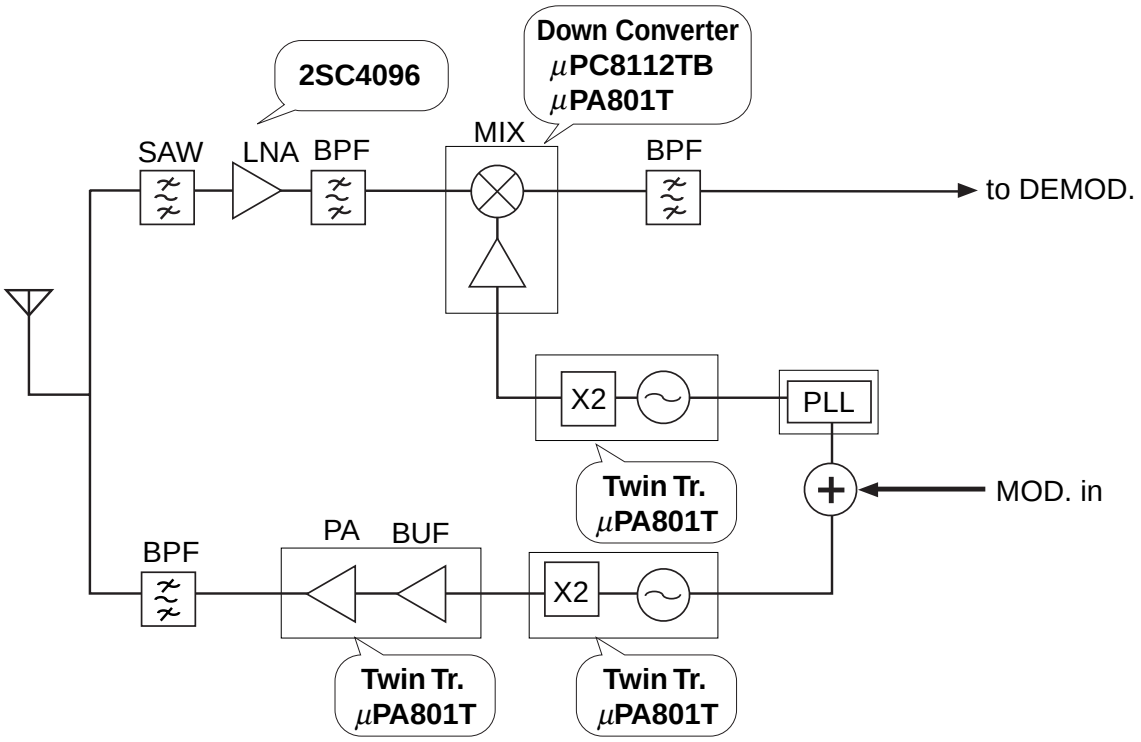
★: Under development

Application

■ **900 MHz Cordless Phone (1/2)**



■ **900 MHz Cordless Phone (2/2)**



[MEMO]

Optical Device

Photocoupler

Tr. Output Type

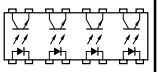
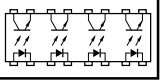
■ Standard Type (Single Tr.) (1/2)

Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics		Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CEO} (V)	I_C (mA)	CTR (%)	t_r, t_f (μs) TYP.	
PS2501-1	High isolation voltage High V_{CEO} UL approved	5 k	80	80	50	80 to 600	3, 5 (R_L = 100 Ω)	4-pin DIP
PS2501-2								8-pin DIP
PS2501-4								16-pin DIP
PS2511-1	High isolation voltage UL approved		50			100 to 300		4-pin DIP
PS2511-2						80 to 400		8-pin DIP
PS2511-4								16-pin DIP
PS2561-1	High isolation voltage UL, VDE (Option), CSA, BSI, SEMKO,		80					4-pin DIP
PS2561-2	FIMKO, NEMKO, DEMKO approved							8-pin DIP
PS2571-1	High isolation voltage UL, CSA, BSI, SEMKO, FIMKO, NEMKO,		50			100 to 300		4-pin DIP
PS2571-4	DEMKO approved					80 to 400		16-pin DIP
PS2581L1 PS2581L2	High isolation voltage Outer creepage distance: 8 mm UL, VDE (Standard), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMKO approved		80			80 to 400		4-pin DIP
PS2601	High isolation voltage High V_{CEO} UL approved					80 to 600		6-pin DIP
PS2602								6-pin DIP

Photocoupler

Tr. Output Type

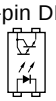
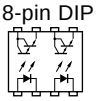
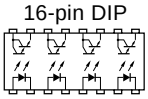
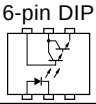
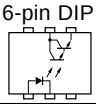
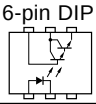
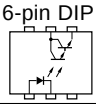
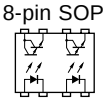
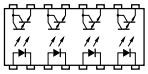
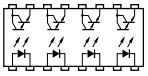
■ **Standard Type (Single Tr.) (2/2)**

Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics		Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CEO} (V)	I_C (mA)	CTR (%)	t_r, t_f (μs) TYP.	
PS2651	High isolation voltage UL, VDE (Option), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMKO approved	5 k	80	80	50	50 to 400	3, 5 (R_L = 100 Ω)	6-pin DIP 
PS2652								6-pin DIP 
PS2701-1	UL, VDE (Option), BSI approved	3.75 k	50	40	80	50 to 300	3, 5 (R_L = 100 Ω)	4-pin SOP 
PS2701-2								8-pin SOP 
PS2701-4								16-pin SOP 
PS2801-1	Pin pitch: 1.27 mm UL, BSI approved	2.5 k	50	80	50	80 to 600	3, 5 (R_L = 100 Ω)	4-pin Small SOP 
PS2801-4	Pin pitch: 1.27 mm UL, VDE (Option), BSI approved							16-pin Small SOP 

Photocoupler

Tr. Output Type

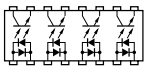
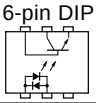
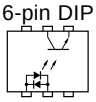
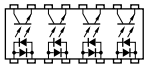
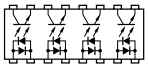
■ Standard Type (Darlington Tr.)

Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics		Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CEO} (V)	I_C (mA)	CTR (%)	t_r, t_f (μs) TYP.	
PS2502-1	High isolation voltage High CTR UL approved	5 k	80	40	200	200 or above	100, 100 (R_L = 100 Ω)	4-pin DIP 
PS2502-2					160			8-pin DIP 
PS2502-4								16-pin DIP 
PS2562-1	High isolation voltage UL, VDE (Option), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMKO approved				200			4-pin DIP 
PS2562-2					160			8-pin DIP 
PS2603	High isolation voltage High CTR UL approved				200			6-pin DIP 
PS2604								6-pin DIP 
PS2653	High isolation voltage High CTR UL, VDE (Option), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMKO approved							6-pin DIP 
PS2654								6-pin DIP 
PS2702-1	High CTR UL, VDE (Option), BSI approved	3.75 k	50	40	200	200 or above	200, 200 (R_L = 100 Ω)	4-pin SOP 
PS2702-2					160			8-pin SOP 
PS2702-4								16-pin SOP 
PS2802-1	Pin pitch: 1.27 mm UL, BSI approved	2.5 k	50	40	90	200 or above	200, 200 (R_L = 100 Ω)	4-pin Small SOP 
PS2802-4	Pin pitch: 1.27 mm UL, VDE (Option), BSI approved				100			16-pin Small SOP 

Photocoupler

Tr. Output Type

■ AC Input Type (Single Tr.)

Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics		Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CEO} (V)	I_C (mA)	CTR (%)	t_r, t_f (μs) TYP.	
PS2505-1	High isolation voltage AC input High V_{CEO}	5 k	±80	80	50	80 to 600	3, 5 (R_L = 100 Ω)	4-pin DIP 
PS2505-2	UL approved							8-pin DIP 
PS2505-4								16-pin DIP 
PS2565-1	High isolation voltage AC input UL, VDE (Option), CSA,					80 to 400		4-pin DIP 
PS2565-2	BSI, SEMKO, FIMKO, NEMKO, DEMKO approved							8-pin DIP 
PS2605	High isolation voltage AC input High V_{CEO}					80 to 600		6-pin DIP 
PS2606	UL approved							6-pin DIP 
PS2705-1	AC input UL, VDE (Option), BSI approved	3.75 k	±50	40	80	50 to 300	3, 5 (R_L = 100 Ω)	4-pin SOP 
PS2705-2								8-pin SOP 
PS2705-4								16-pin SOP 
PS2805-1	Pin pitch: 1.27 mm AC input UL, BSI approved	2.5 k	±50	80	50	80 to 600	3, 5 (R_L = 100 Ω)	4-pin Small SOP 
PS2805-4	Pin pitch: 1.27 mm AC input UL, VDE (Option), BSI approved							16-pin Small SOP 

Photocoupler

Tr. Output Type

■ AC Input Type (Darlington Tr.)

Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics		Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CEO} (V)	I_C (mA)	CTR (%)	t_r, t_f (μs) TYP.	
PS2506-1	High isolation voltage AC input High CTR	5 k	±80	40	200	200 or above	100, 100 (R_L = 100 Ω)	4-pin DIP
PS2506-2	UL approved				160			8-pin DIP
PS2506-4								16-pin DIP
PS2566-1	High isolation voltage AC input UL, VDE (Option), CSA,				200			4-pin DIP
PS2566-2	BSI, SEMKO, FIMKO, NEMKO, DEMKO approved				160			8-pin DIP
PS2607	High isolation voltage AC input High CTR				200			6-pin DIP
PS2608	UL approved							6-pin DIP
PS2706-1	High CTR AC input UL, VDE (Option),	3.75 k	±50	40	200	200 or above	200, 200 (R_L = 100 Ω)	4-pin SOP
PS2706-2	BSI approved				160			8-pin SOP
PS2706-4								16-pin SOP
PS2806-1	Pin pitch: 1.27 mm AC input UL, BSI approved	2.5 k	±50	40	90	200 or above	200, 200 (R_L = 100 Ω)	4-pin Small SOP
PS2806-4	Pin pitch: 1.27 mm AC input UL, VDE (Option), BSI approved				100			16-pin Small SOP

Photocoupler

Tr. Output Type

■ Low Input Current Type (Single Tr.)

Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics		Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CEO} (V)	I_C (mA)	CTR (%)	t_r, t_f (μs) TYP.	
PS2503-1	High isolation voltage High-speed UL approved	5 k	80	40	30	100 to 400	20, 30 (R_L = 10 kΩ)	4-pin DIP
PS2503-2								8-pin DIP
PS2503-4								16-pin DIP
PS2703-1	High V_{CEO} (120 V) UL, VDE (Option), BSI approved	3.75 k	50	120	30	50 to 400	10, 10 (R_L = 1 kΩ)	4-pin SOP
PS2703-2								8-pin SOP
PS2703-4								16-pin SOP
PS2707-1	AC input High V_{CEO} (120 V) UL, VDE (Option), BSI approved		±50					4-pin SOP
PS2707-2								8-pin SOP
PS2707-4								16-pin SOP

Photocoupler

Tr. Output Type

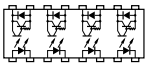
■ High Collector to Emitter Voltage Type (1/2)

Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics		Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CEO} (V)	I_C (mA)	CTR (%)	t_r, t_f (μs) TYP.	
PS2532-1	High isolation voltage High V_{CEO} (300 V) Darlington Tr.	5 k	80	300	150	1500 to 6500	100, 100 (R_L = 100 Ω)	4-pin DIP
PS2532-2	UL, VDE, (Option), BSI, SEMKO, FIMKO, NEMKO, DEMKO							8-pin DIP
PS2532-4	approved							16-pin DIP
PS2533-1	High isolation voltage High V_{CEO} (350 V) Darlington Tr.			350				4-pin DIP
PS2533-2	UL, VDE (Option), BSI, SEMKO, FIMKO, NEMKO, DEMKO approved							8-pin DIP
PS2533-4								16-pin DIP
PS2633	High isolation voltage High V_{CEO} (300 V) High CTR			300		1000 to 15000		6-pin DIP
PS2634	Darlington Tr. UL approved							6-pin DIP
PS2732-1	High isolation voltage Darlington Tr. High V_{CEO} (300 V)	2.5 k	50	300	150	1500 or above	100, 100 (R_L = 100 Ω)	4-pin SOP
PS2732-2	UL, VDE (Option), BSI approved							8-pin SOP
PS2732-4								16-pin SOP
PS2733-1	High isolation voltage Darlington Tr. High V_{CEO} (350 V)			350				4-pin SOP
PS2733-2	UL, VDE (Option), BSI approved							8-pin SOP
PS2733-4								16-pin SOP

Photocoupler

Tr. Output Type

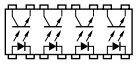
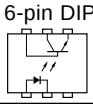
■ High Collector to Emitter Voltage Type (2/2)

Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics		Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CEO} (V)	I_C (mA)	CTR (%)	t_r, t_f (μs) TYP.	
PS2832-1	Pin pitch: 1.27 mm Darlington Tr. High V_{CEO} (300 V) UL approved	2.5 k	50	300	120	400 or above	100, 100 (R_L = 100 Ω)	4-pin Small SOP 
PS2832-4	Pin pitch: 1.27 mm Darlington Tr. High V_{CEO} (300 V) UL, BSI approved							16-pin Small SOP 

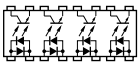
Photocoupler

Tr. Output Type

■ Large Input Current Type (DC Input, Single Tr.)

Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics		Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CEO} (V)	I_C (mA)	CTR (%)	t_r, t_f (μs) TYP.	
PS2521-1	High isolation voltage Large input current UL approved	5 k	150	80	50	20 to 80	3, 5 (R_L = 100 Ω)	4-pin DIP 
PS2521-2								8-pin DIP 
PS2521-4								16-pin DIP 
PS2621	High isolation voltage Large input current UL approved					20 to 50		6-pin DIP 
PS2622								6-pin DIP 

■ Large Input Current Type (AC Input, Single Tr.)

Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics		Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CEO} (V)	I_C (mA)	CTR (%)	t_r, t_f (μs) TYP.	
PS2525-1	High isolation voltage Large input current AC input	5 k	±150	80	50	20 to 80	3, 5 (R_L = 100 Ω)	4-pin DIP 
PS2525-2	UL approved							8-pin DIP 
PS2525-4								16-pin DIP 
PS2625	High isolation voltage Large input current AC input					20 to 50		6-pin DIP 
PS2626	UL approved							6-pin DIP 

Photocoupler

IC Output Type

■ High-Speed Type 1Mbps (Analog Output)

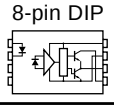
Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics			Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CC} (V)	I_O (mA)	CTR (%)	t_{PHL} (μs) MAX.	t_{PLH} (μs) MAX.	
PS8601	8-pin base connection UL, VDE (Option), BSI approved	5 k	25	35	8	15 or above	0.8 (R_L = 1.9 kΩ)	0.8 (R_L = 1.9 kΩ)	8-pin DIP 
PS8602	8 pins High CMR (2 kV/μs) UL, VDE (Option), BSI approved								8-pin DIP 
PS8701	5 pins High CMR (10 kV/μs) UL, VDE (Option) approved	2.5 k	25	35	8	15 to 35	0.8 (R_L = 2.2 kΩ)	1.2 (R_L = 2.2 kΩ)	5-pin SOP 

■ High-Speed Type 10Mbps (Digital Output)

Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics		Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CC} (V)	I_O (mA)	I_{FLH} (mA) MAX.	t_{PLH}, t_{PHL} (ns) MAX.	
PS9601	Ultra high-speed type UL approved	5 k	30	7	50	5.0	75	8-pin DIP 
PS9701	Ultra high-speed type UL, VDE (option) approved	2.5 k	30	7	50	5.0	75	5-pin SOP 
PS9611★	Ultra high-speed type High CMR (10 kV/μs TYP.)	5 k	30	7	13	6.0	75	8-pin DIP 
PS9711★		2.5 k	30	7	13	6.0	75	5-pin SOP 

★: Under development

■ High-Power Type (Inverter)

Part Number	Features	Absolute Maximum Ratings				Electrical Characteristics		Packages
		BV (Vr.m.s.)	I_F (mA)	V_{CC} (V)	I_{O1}/I_{O2} (A)	CM_H, CM_L (kV/μs)	t_{PLH}, t_{PHL} (μs) MAX.	
PS9634	Inverter circuit UL approved	5 k	30	18	0.5/ 0.8	1.0	5.0	8-pin DIP 

Photocoupler

■ Safety Standards Approval List (Made in Japan, as of January 1999) (1/2)

Part Number	Safety Standards								
	UL		VDE	CSA	BSI	SEMKO	FIMKO	NEMKO	DEMKO
	UL1577 E72422(S)		VDE0884	CL 9073 × 0030, CA 101391	EN 60065 /IEC 65, EN 60950 /IEC 950	EN 60065 /IEC 60065, EN 60950 /IEC 60950	EN 60065 /IEC 65, EN 60950 /IEC 950	EN 60065 /IEC 65, EN 60950 /IEC 950	EN 60065 /IEC 60665, EN 60950 /IEC 950
	Single protection	Double protection							
PS2501-1, -2, -4	●	●							
PS2502-1, -2, -4	●	●							
PS2503-1, -2, -4	●								
PS2505-1, -2, -4	●	●							
PS2506-1, -2, -4	●	●							
PS2511-1, -2, -4	●								
PS2521-1, -2, -4	●								
PS2525-1, -2, -4	●								
PS2532-1, -2, -4	●		●		●	●	●	●	●
PS2533-1, -2, -4	●		●		●	●	●	●	●
PS2561-1, -2	●	●	●	●	●	●	●	●	●
PS2562-1, -2	●	●	●	●	●	●	●	●	●
PS2565-1, -2	●	●	●	●	●	●	●	●	●
PS2566-1, -2	●	●	●	●	●	●	●	●	●
PS2571-1, -4	●		△	●	●	●	●	●	●
PS2581L1, L2	●	●	●	●	●	●	●	●	●
PS2601	●								
PS2602	●								
PS2603	●								
PS2604	●								
PS2605	●								
PS2606	●								
PS2607	●								
PS2608	●								
PS2621	●								
PS2622	●								
PS2625	●								
PS2626	●								

Remark ●: Approved △: Awaiting approval

Photocoupler

■ Safety Standards Approval List (Made in Japan, as of January 1999) (2/2)

Part Number	Safety Standards								
	UL		VDE	CSA	BSI	SEMKO	FIMKO	NEMKO	DEMKO
	UL1577 E72422(S)		VDE0884	CL 9073 × 0030, CA 101391	EN 60065 /IEC 65, EN 60950 /IEC 950	EN 60065 /IEC 60065, EN 60950 /IEC 60950	EN 60065 /IEC 65, EN 60950 /IEC 950	EN 60065 /IEC 65, EN 60950 /IEC 950	EN 60065 /IEC 60665, EN 60950 /IEC 950
	Single protection	Double protection							
PS2633	●								
PS2634	●								
PS2651	●		●	●	●	●	●	●	●
PS2652	●		●	●	●	●	●	●	●
PS2653	●		●	●	●	●	●	●	●
PS2654	●		●	●	●	●	●	●	●
PS2701-1, -2, -4	●		●		●				
PS2702-1, -2, -4	●		●		●				
PS2703-1, -2, -4	●		●		●				
PS2705-1, -2, -4	●		●		●				
PS2706-1, -2, -4	●		●		●				
PS2707-1, -2, -4	●		●		●				
PS2732-1, -2, -4	●		●		●				
PS2733-1, -2, -4	●		●		●				
PS2801-1	●				●				
PS2802-1	●				●				
PS2805-1	●				●				
PS2806-1	●				●				
PS2801-4	●		●		●				
PS2802-4	●		●		●				
PS2805-4	●		●		●				
PS2806-4	●		●		●				
PS2832-1	●								
PS2832-4	●				●				
PS8601	●		●		●				
PS8602	●		●		●				
PS8701	●		●						
PS9601	●								
PS9634	●								
PS9701	●		●						

Remark ●: Approved

Photocoupler

■ Safety Standards Approval List (Made in Taiwan, as of January 1999)

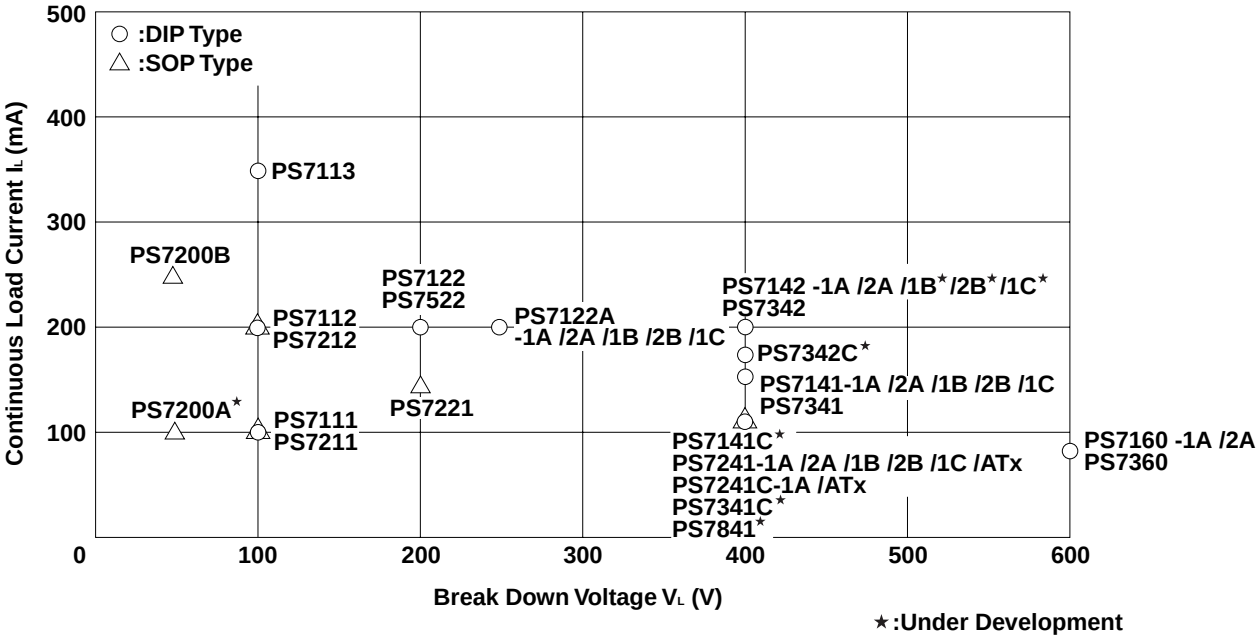
Part Number	Safety Standards								
	UL		VDE	CSA	BSI	SEMKO	FIMKO	NEMKO	DEMKO
	UL1577 E72422(S)		VDE0884	CL 9073 × 0030, CA 101391	EN 60065 /IEC 65, EN 60950 /IEC 950	EN 60065 /IEC 60065, EN 60950 /IEC 60950	EN 60065 /IEC 65, EN 60950 /IEC 950	EN 60065 /IEC 65, EN 60950 /IEC 950	EN 60065 /IEC 60665, EN 60950 /IEC 950
	Single protection	Double protection							
PS2501-1, -2, -4	●								
PS2502-1, -2, -4	●								
PS2503-1, -2, -4	●								
PS2505-1, -2, -4	●								
PS2506-1, -2, -4	●								
PS2521-1, -2, -4	●								
PS2525-1, -2, -4	●								
PS2532-1, -2, -4	●		●		●				
PS2533-1, -2, -4	●		●		●				
PS2561-1, -2	●	●	●			●	●	●	●
PS2562-1, -2	●	●	●			●	●	●	●
PS2565-1, -2	●	●	●			●	●	●	●
PS2566-1, -2	●	●	●			●	●	●	●

Remark ●: Approved

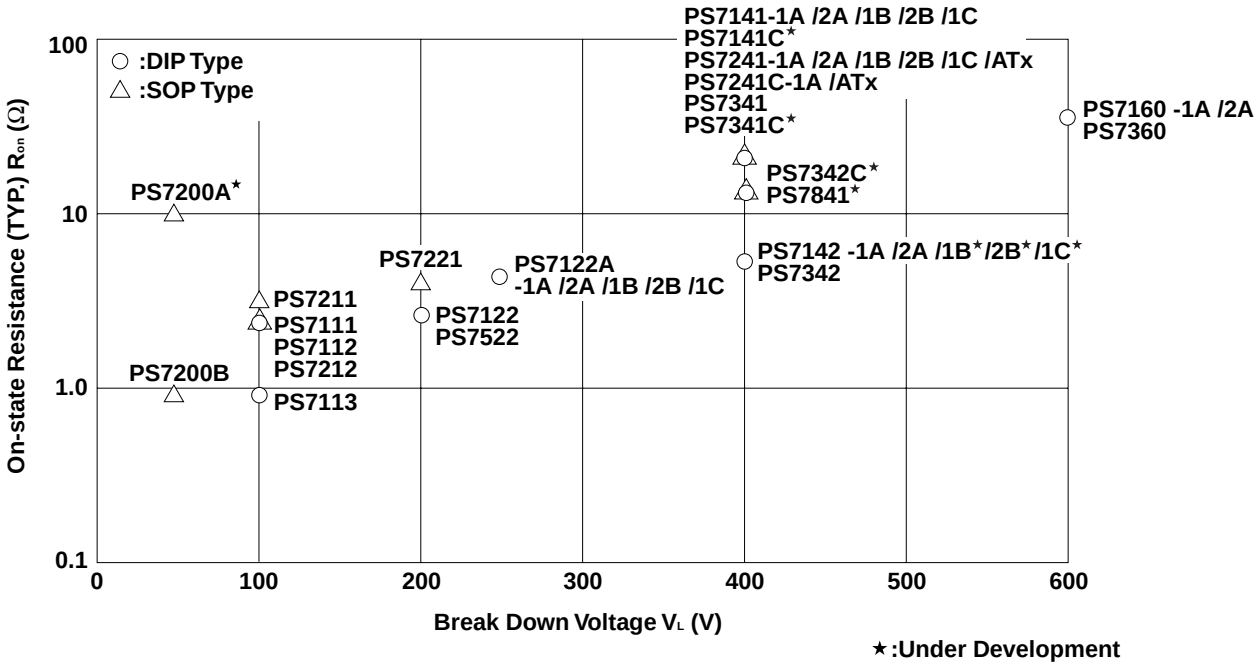
OCMOS FET™ (Opto-Coupled MOS FET Relay)

■ OCMOS FET Product Map

- **Continuous Load Current vs. Break Down Voltage**



- **On-state Resistance vs. Break Down Voltage**



OCMOS FET (Opto-Coupled MOS FET Relay)

■ Standard Type

Part Number	Features	Output Type	Absolute Maximum Ratings					Electrical Characteristics						Packages
								Diode		MOSFET	Coupled			
			V_L (V)	I_L (mA)	BV (Vr.m.s.)	T_A (°C)	T_{stg} (°C)	V_F (V) MAX.	I_R (μA) MAX.	I_{Loff} (μA) MAX.	R_{on} (Ω) TYP.	t_{on} (ms) MAX.	t_{off} (ms) MAX.	
PS7111-2A	Standard DIP, Normally open	2a	100	100	1.5 k	–40 to +80	–40 to +100	1.4	5	1	3.0	0.4	0.2	8-pin DIP
PS7112-1A		1a	100	200							3.0	0.4	0.2	6-pin DIP
PS7113-1A		1a	100	350							0.9	3.0	0.2	6-pin DIP
PS7113-2A		2a	100	350							0.9	3.0	0.2	8-pin DIP
PS7122-1A		1a	200	200							3.0	2.0	0.2	6-pin DIP
PS7122-2A		2a	200	200							3.0	2.0	0.2	8-pin DIP
PS7122A-1A		1a	250	200							4.5	1.5	0.2	6-pin DIP
PS7122A-2A		2a	250	200							4.5	1.5	0.2	8-pin DIP
PS7141-1A		1a	400	150							20.0	1.0	0.2	6-pin DIP
PS7141-2A		2a	400	150							20.0	1.0	0.2	8-pin DIP
PS7142-1A		1a	400	200							6.0	5.0	0.2	6-pin DIP
PS7142-2A		2a	400	200							7.5	2.0	0.2	8-pin DIP
PS7160-1A		1a	600	90							42.0	1.5	0.2	6-pin DIP
PS7160-2A		2a	600	90							42.0	1.5	0.2	8-pin DIP
PS7211-2A	Standard SOP, Normally open	2a	100	100	1.5 k	–40 to +80	–40 to +100	1.4	5	1	3.4	1.0	0.2	8-pin SOP
PS7212-1A		1a	100	200							3.0	1.0	0.2	4-pin SOP
PS7221-2A		2a	200	150							4.0	1.5	0.2	8-pin SOP
PS7241-1A		1a	400	120							18.0	2.0	0.2	4-pin SOP
PS7241-2A		2a	400	120							21.0	1.0	0.2	8-pin SOP
PS7200A-1A★	Low CxR type	1a	40	100	1.5 k	–40 to +80	–40 to +100	1.4	5	0.1	9.3	0.5	0.2	4-pin SOP
PS7200B-1A		1a	40	250							0.8	1.0	0.2	4-pin SOP
PS7122A-1B	Standard, Normally close	1b	250	200	1.5 k	–40 to +80	–40 to +100	1.4	5	1	4.5	0.2	1.5	6-pin DIP
PS7122A-2B		2b	250	200							4.5	0.2	1.5	8-pin DIP
PS7141-1B		1b	400	150							24.0	0.2	1.0	6-pin DIP
PS7141-2B		2b	400	150							24.0	0.2	1.0	8-pin DIP
PS7142-1B★		1b	400	200							7.0	0.2	5.0	6-pin DIP
PS7142-2B★		2b	400	200							7.0	0.2	5.0	8-pin DIP
PS7241-1B		1b	400	120							24.0	0.2	2.0	4-pin SOP
PS7241-2B		2b	400	120							21.0	0.2	1.0	8-pin SOP
PS7122A-1C	Standard, Transfer	1a+1b	250	200	1.5 k	–40 to +80	–40 to +100	1.4	5	1	4.5	1.5 (N.O.) 0.2 (N.C.)	0.2 (N.O.) 1.5 (N.C.)	8-pin DIP
PS7141-1C		1a+1b	400	150							20.0 (N.O.) 24.0 (N.C.)	1.0 (N.O.) 0.2 (N.C.)	0.2 (N.O.) 1.0 (N.C.)	8-pin DIP
PS7142-1C★		1a+1b	400	200							8.0 (N.O.) 7.0 (N.C.)	2.0 (N.O.) 0.2 (N.C.)	0.2 (N.O.) 2.0 (N.C.)	8-pin DIP
PS7241-1C		1a+1b	400	120							21.0	1.0 (N.O.) 0.2 (N.C.)	0.2 (N.O.) 1.0 (N.C.)	8-pin SOP

★: Under development

OCMOS FET (Opto-Coupled MOS FET Relay)

■ High Isolation Voltage Type

Part Number	Features	Output Type	Absolute Maximum Ratings					Electrical Characteristics						Packages
								Diode		MOSFET	Coupled			
			V_L (V)	I_L (mA)	BV (Vr.m.s.)	T_A (°C)	T_{stg} (°C)	V_F (V) MAX.	I_R (μA) MAX.	I_{Loff} (μA) MAX.	R_{on} (Ω) TYP.	t_{on} (ms) MAX.	t_{off} (ms) MAX.	
PS7341-1A	High isolation voltage	1a	400	150	3.75 k	–40 to +85	–40 to +125	1.4	5	1	20.0	1.0	0.2	6-pin DIP
PS7342-1A			400	200							6.0	2.5	0.2	
PS7360-1A			600	90							41.0	2.0	0.2	

■ Slow Speed Type

Part Number	Features	Output Type	Absolute Maximum Ratings					Electrical Characteristics						Packages
								Diode		MOSFET	Coupled			
			V_L (V)	I_L (mA)	BV (Vr.m.s.)	T_A (°C)	T_{stg} (°C)	V_F (V) MAX.	I_R (μA) MAX.	I_{Loff} (μA) MAX.	R_{on} (Ω) TYP.	t_{on} (ms) MAX.	t_{off} (ms) MAX.	
PS7522-1A	Slow speed	1a	200	200	1.5 k	–40 to +80	–40 to +100	1.4	5	1	3.0	12.0	6.5	6-pin DIP
PS7522-2A		2a	200	200	1.5 k	–40 to +80	–40 to +100	1.4	5	1	3.0	12.0	6.5	8-pin DIP

■ Hybrid (Multi Function) Type

Part Number	Features	BV (Vr.m.s.)	OCMOS FET (1a type)			Photocoupler		Diode Bridge		Darlington Tr.			Packages
			V_L (V)	I_L (mA)	R_{on} (Ω) TYP.	V_{CEO} (V)	CTR (%)	V_R (V) MAX.	V_F (V) MAX.	V_{CEO} (V)	I_C (mA)	h_{FE}	
PS7241-AT1*1	DC Input	1.5 k	400	120	20.0	40	50 to 400	–	–	–	–	–	8-pin SOP
PS7241-AT5*1	AC Input												
PS7841-A15★, *2	for DAA		400	120	16	40	50 to 400	100	1.2	40	120	10000 to 30000	16-pin SOP Lead pitch: 1.27 mm

★: Under development

*1: Solid state relays containing a GaAs LED on light emitting side (input side) and MOSFET's (+Photo transistor) on output side.

*2: The PS7841-A15 is a solid state relay for optical DAA (Data Access Arrangement) containing a diode bridge, MOS FET, photocoupler, Darlington transistor and LED.

OCMOS FET (Opto-Coupled MOS FET Relay)

■ Current Limit Type

• Standard Type

Part Number	Output Type	Absolute Maximum Ratings					Electrical Characteristics							Packages
							Diode		MOSFET	Coupled				
		V_L (V)	I_L (mA)	BV (Vr.m.s.)	T_A (°C)	T_{stg} (°C)	V_F (V) MAX.	I_R (μA) MAX.	I_{Loff} (μA) MAX.	R_{on} (Ω) TYP.	t_{on} (ms) MAX.	t_{off} (ms) MAX.	I_{LMT} (mA)	
PS7141C-2A★	2a	400	120	1.5 k	–40 to +80	–40 to +100	1.4	5	1	26.0	1.0	1.0	170 to 250 mA/ch	8-pin DIP
PS7241C-1A	1a	400	120	1.5 k	–40 to +80	–40 to +100	1.4	5	1	28.0	2.0	0.2	125 to 180	4-pin SOP

★: Under development

• High Isolation Voltage Type

Part Number	Output Type	Absolute Maximum Ratings					Electrical Characteristics							Packages
							Diode		MOSFET	Coupled				
		V_L (V)	I_L (mA)	BV (Vr.m.s.)	T_A (°C)	T_{stg} (°C)	V_F (V) MAX.	I_R (μA) MAX.	I_{Loff} (μA) MAX.	R_{on} (Ω) TYP.	t_{on} (ms) MAX.	t_{off} (ms) MAX.	I_{LMT} (mA)	
PS7341C-1A★	1a	400	120	3.75 k	–40 to +85	–40 to +125	1.4	5	1	27.0	1.0	1.0	125 to 250	6-pin DIP
PS7342C-1A★		400	170							12.0	5.0	1.0	175 to 370	

★: Under development

• Hybrid (Multi Function) Type

Part Number	Features	BV (Vr.m.s.)	OCMOS FET (1a type)				Photocoupler		Packages
			V_L (V)	I_L (mA)	R_{on} (Ω) TYP.	I_{LMT} (mA)	V_{CEO} (V)	CTR (%)	
PS7241C-AT1*	DC Input	1.5 k	400	120	28.0	125 to 180	40	50 to 400	8-pin SOP
PS7241C-AT5*	AC Input								

*: Solid state relays containing a GaAs LED on light emitting side (input side) and MOSFET's (+Photo transistor) on output side.

OCMOS FET (Opto-Coupled MOS FET Relay)

■ Safety Standards Approval List (as of January 1999)

Part Number	Safety Standards		
	UL	VDE	BSI
	UL1577	VDE0884	BS415 BS7002
PS7111-2A	●	△	●
PS7112-1A	●	△	●
PS7113-1A	●	△	●
PS7113-2A	●	△	●
PS7122-1A	●	△	●
PS7122-2A	●	△	●
PS7122A-1A	△	△	△
PS7122A-1B	△	△	△
PS7122A-1C	△	△	△
PS7122A-2A	△	△	△
PS7122A-2B	△	△	△
PS7141-1A	●	△	●
PS7141-1B	●	△	●
PS7141-1C	●	△	●
PS7141-2A	●	△	●
PS7141-2B	●	△	●
PS7141C-2A★	△	△	△
PS7142-1A	●	△	●
PS7142-2A	●	△	●
PS7142-1B★	△	△	△
PS7142-2B★	△	△	△
PS7142-1C★	△	△	△
PS7160-1A	●	△	●
PS7160-2A	●	△	●
PS7200A-1A★	△	△	●
PS7200B-1A	△	△	●
PS7211-2A	●	△	●
PS7212-1A	△	△	△
PS7221-2A	●	△	●
PS7241-1A	●	△	●
PS7241-1B	●	△	●
PS7241-1C	△	△	●
PS7241-2A	△	△	●
PS7241-2B	△	△	●
PS7241-AT1	●	△	●
PS7241-AT5	●	△	●
PS7241C-1A	●	△	△
PS7241C-AT1	△	△	△
PS7241C-AT5	△	△	△
PS7341-1A	●	△	●
PS7341C-1A★	●	△	△
PS7342-1A	●	△	●
PS7342C-1A★	●	△	△
PS7360-1A	●	△	●
PS7522-1A	●	△	●
PS7522-2A	●	△	●
PS7841-A15★	△	△	△

★: Under development

Remark ●: Approved △: Awaiting approval

Infrared Transceivers

■ Infrared Transceivers

Part Number	IrDA Ver.	Absolute Maximum Ratings (T_A = 25 °C)		Electro-Optical Characteristics (T_A = 25 °C)					Remarks
		T_A (°C)	T_{stg} (°C)	V_{CC} (V)	I_{LED} (mA) TYP.	I_{EH} (mW/Sr) TYP.	I_{CC} (A) TYP.	Data Rate (bps)	
NL1000★	1.0	0 to +70	–25 to +85	3.3	150	80	150 μ	2.4 k to 115.2 k	Standard: with Shield Case
NL1100	1.1	0 to +70	–25 to +85	5.0	300	160	4.0 m	A Port: 2.4 k to 115.2 k B Port: 0.576 M to 4.0 M	Option: Shield Case

★: Under development

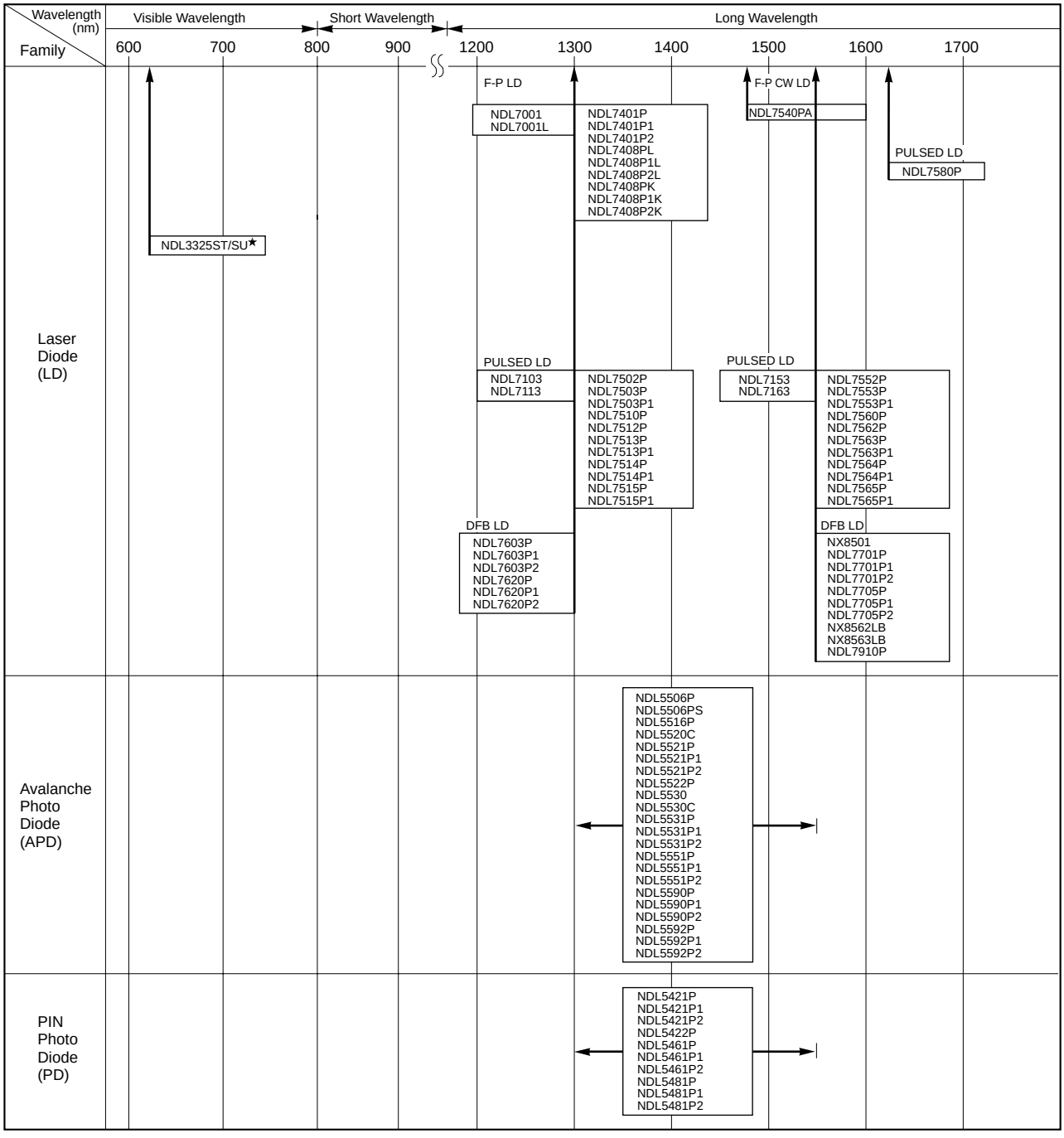
Plastic Fiber Link

■ Plastic Fiber Link

Part Number	Absolute Maximum Ratings (T_C = 25 °C)		Electro-Optical Characteristics (T_C = 25 °C)		
	V_{CC} (V)	T_C (°C)	Transmission Speed (Mbps)	Transmission Distance (m) @ SI-POF	Transmission Distance (m) @ SI-HPCF
NL2100	–0.5 to +7.0	0 to +70	1 to 156	50	100
NL2110	–0.5 to +7.0	0 to +70	1 to 250	50	100

Visible Lasers/Fiberoptic Devices

■ Visible Lasers/Fiberoptic Devices Product Map



⟶ : Mark wavelength or operating range

★: Under development

Modules are available with FC-PC or SC-PC connector.

Visible Lasers

■ Visible Lasers

Part Number	Peak Wavelength	Absolute Maximum Ratings (T_C = 25 °C)			Electro-Optical Characteristics (T_C = 25 °C)					Applications
	λ_p (nm)	P_o (mW)	T_C (°C)	T_{stg} (°C)	I_{th} (mA)	I_{op} (mA)	P_o (mW)	$\theta_\perp$ (deg.)	$\theta_{//}$ (deg.)	
NDL3325ST/SU★	650	8	–20 to +80	–40 to +85	30	40	5	30	8	for DVD

★: Under development

Fiberoptic Devices

■ Lasers (Digital)

- **Digital Optical Fiber Communications FP-LD**

Part Number	Absolute Maximum Ratings			Electro-Optical Characteristics (T_C = 25 °C)						Package
	I_F (mA)	T_C (°C)	T_{stg} (°C)	I_{th} (mA)	I_{op} (mA)	P_o/P_f (mW)	λ_C (nm)	σ* (nm)	t_r/t_f (ns)	
				TYP.	TYP.	MIN.	TYP.	TYP.	MAX.	
NDL7001	–	–40 to +85	–55 to +125	10	I_{th}+12	5	1310	1.0	0.5/0.5	CAN
NDL7001L	–	–40 to +85	–55 to +125	10	I_{th}+15	5	1310	1.0	0.5/0.5	CAN with lens
NDL7401P Series	I_{th}+50	–40 to +85	–40 to +85	10	I_{th}+15	2.0	1310	1.3	0.5/0.5	Coaxial
NDL7408PL Series	I_{th}+50	–40 to +85	–40 to +85	10	I_{th}+15	0.2	1310	1.3	0.5/0.5	Coaxial
NDL7408PK Series	I_{th}+50	–40 to +85	–40 to +85	10	I_{th}+20	1.0	1310	1.3	0.5/0.5	Coaxial

∗: RMS (–20 dB)

- **Digital Optical Fiber Communications DFB-LD**

Part Number	Absolute Maximum Ratings			Electro-Optical Characteristics (T_C = 25 °C)				Package
	I_F (mA)	T_C (°C)	T_{stg} (°C)	I_{th} (mA)	P_o/P_f (mW)	λ_p (nm)	t_r/t_f (ns)	
				TYP.	MIN.	TYP.	MAX.	
NDL7603P Series	150	–40 to +85	–40 to +85	15	2	1310	0.5/0.5	Coaxial
NDL7620P Series	150	0 to +70	–40 to +85	45∗1	2	1310	0.04/0.1∗2	Coaxial
NX8501 Series	200	0 to +65	–40 to +85	20	2	1510	0.5/0.5	Coaxial
NDL7701P Series	150	–20 to +85	–40 to +85	15	2	1550	0.5/0.5	Coaxial
NDL7705P Series	I_{th}+50	–40 to +85	–40 to +85	15	2	1550	0.5/0.5	Coaxial
NX8562LB	300	–20 to +65	–40 to +85	20	20	1550∗3	–	Butterfly
NX8563LB Series	300	–20 to +65	–40 to +85	20	10	ITU-T∗4	–	Butterfly
NDL7910P (EA Modulator integrated type)	150	–20 to +70	–40 to +85	7	0.5	1550∗3	0.125/0.125	Butterfly

∗1: MAX.

∗2: TYP.

∗3: Wavelength selectable for ITU-T standards upon request.

∗4: Wavelength selectable for ITU-T standards.

Fiberoptic Devices

■ Pump Laser

• EDFA Pumping Applications FP-LD

Part Number	Absolute Maximum Ratings			Electro-Optical Characteristics (T_C = 25 °C)						Package
	I_F (mA)	T_C (°C)	T_{stg} (°C)	I_{th} (mA)	I_{op} (mA)	P_f (mW)	λ_C (nm)	σ* (nm)	t_r/t_f (ns)	
				TYP.	TYP.	TYP.	TYP.	MAX.	MAX.	
NDL7540PA	600	–20 to +65	–40 to +85	40	500	110	1480	8	–	Butterfly

*: RMS (–20 dB)

■ Pulsed Lasers for OTDR

• OTDR Applications FP-LD

Part Number	Absolute Maximum Ratings			Electro-Optical Characteristics (T_C = 25 °C)						Package
	I_F*1 (mA)	T_C (°C)	T_{stg} (°C)	I_{th} (mA)	I_{op}*1 (mA)	P_o/P_f*1 (mW)	λ_C*1 (nm)	σ*2 (nm)	t_r/t_f (ns)	
				TYP.	TYP.	TYP.	TYP.	MAX.	MAX.	
NDL7103	1200	–40 to +70	–55 to +125	35	1000	320	1310	7	2/2	CAN
NDL7113	600	–40 to +70	–55 to +125	20	400	175	1310	10	1/1	CAN
NDL7153	1200	–40 to +70	–55 to +125	45	1000	240	1550	8	2/2	CAN
NDL7163	600	–40 to +70	–55 to +125	30	400	120	1550	10	1/1	CAN
NDL7502P	1200	–20 to +65	–40 to +70	35	1000	190	1310	10	2/2	DIP
NDL7503P Series	1200	–20 to +60	–40 to +85	35	1000	180	1310	10	2/2	Coaxial
NDL7510P	600	–20 to +65	–40 to +70	20	400	55	1310	10	1/1	DIP
NDL7512P	600	–20 to +65	–40 to +70	20	400	110	1310	10	1/1	DIP
NDL7513P Series	600	–20 to +60	–40 to +85	20	400	110	1310	10	1/1	Coaxial
NDL7514P Series	600	–20 to +60	–40 to +85	20	400	50	1310	10	1/1	Coaxial
NDL7515P Series	600	–20 to +60	–40 to +85	20	400	30	1310	10	1/1	Coaxial
NDL7552P	1200	–20 to +65	–40 to +70	40	1000	125	1550	10	2/2	DIP
NDL7553P Series	1200	–20 to +60	–40 to +85	45	1000	145	1550	10	2/2	Coaxial
NDL7560P	600	–20 to +65	–40 to +70	20	400	30	1550	10	1/1	DIP
NDL7562P	600	–20 to +65	–40 to +70	40	400	80	1550	10	1/1	DIP
NDL7563P Series	600	–20 to +60	–40 to +85	45	400	80	1550	10	1/1	Coaxial
NDL7564P Series	600	–20 to +60	–40 to +85	40	400	40	1550	10	1/1	Coaxial
NDL7565P Series	600	–20 to +60	–40 to +85	20	400	11	1550	10	1/1	Coaxial
NDL7580P	1200	–20 to +65	–40 to +70	30	1000	100*3	1625	15	2/2	DIP

*1: Pulse drive: Pulse width = 10 μs, duty = 1 % (Coaxial, DIP)
Pulse width = 1 μs, duty = 1 % (CAN)

*2: RMS (–20 dB)

*3: MIN.

Fiberoptic Devices

■ Detectors

- **InGaAs PIN-PD**

Part Number	Absolute Maximum Ratings			Electro-Optical Characteristics (T_C = 25 °C)								Package
	P_{in} (mW)	T_C (°C)	T_{stg} (°C)	Detecting area size (μm)	I_D (nA) VR (V)	I_D (nA) TYP.	C_t (pF) VR (V)	C_t (pF) TYP.	S (A/W) λ (nm)	S (A/W) TYP.	f_C (GHz) MIN.	
NDL5421P Series	8	–40 to +85	–40 to +85	ϕ 50	5	0.1	5	0.7	1300	0.89	2.5	Coaxial
									1550	0.94		
NDL5422P	–	–40 to +70	–40 to +85	ϕ 50	5	0.1	–	–	1300	0.89	2.5	Butterfly with AMP
									1550	1.00		
NDL5461P Series	8	–40 to +85	–40 to +85	ϕ 80	5	0.1	5	1.0	1300	0.89	2.5	Coaxial
									1550	0.94		
NDL5481P Series	8	–40 to +85	–40 to +85	ϕ 80	10	0.1	10	0.7	1300	0.85	2.5	Coaxial

- **InGaAs APD**

Part Number	Absolute Maximum Ratings			Electro-Optical Characteristics (T_C = 25 °C)						Package
	I_R (mA)	T_C (°C)	T_{stg} (°C)	Detecting area size (μm)	$V_{(BR)R}$ (V) TYP.	I_D (nA)* TYP.	S (A/W) λ (nm)	S (A/W) TYP.	f_C (GHz) MIN.	
NDL5506P Series	0.5	–20 to +55	–40 to +85	ϕ 50	70	2	1300	0.89	1.0	DIP with internal cooler
							1550	1.00		
NDL5516P	0.5	–20 to +55	–40 to +85	ϕ 80	75	2	1300	0.89	0.7	DIP with internal cooler
							1550	1.00		
NDL5520C	0.5	–40 to +70	–55 to +100	ϕ 50	70	5	1300	0.89	2.5	Chip on carrier
							1550	1.00		
NDL5521P Series	0.5	–40 to +85	–40 to +85	ϕ 50	55	5	1300	0.94	2.5	Coaxial
							1550	0.96		
NDL5522P	0.5	–40 to +70	–40 to +85	ϕ 50	55	5	1310	0.89	2.5	Butterfly with AMP
							1550	1.00		
NDL5530	0.5	–40 to +85	–55 to +100	ϕ 30	70	5	1300	0.94	2.5	CAN
							1550	0.96		
NDL5530C	0.5	–40 to +85	–55 to +100	ϕ 30	70	5	1300	0.94	2.5	Chip on carrier
							1550	0.96		
NDL5531P Series	0.5	–40 to +85	–40 to +85	ϕ 30	70	5	1300	0.94	2.5	Coaxial
							1550	0.96		
NDL5551P Series	0.5	–40 to +85	–40 to +85	ϕ 50	70	5	1300	0.94	1.0	Coaxial
							1550	0.96		
NDL5590P Series	0.5	–40 to +85	–40 to +85	ϕ 50	70	5	1310	0.94	1.0	Coaxial with AMP
							1550	0.96		
NDL5592P Series	0.5	–40 to +85	–40 to +85	ϕ 30	70	5	1310	0.94	2.5	Coaxial with AMP
							1550	0.96		

*: Conditions: $V_{(BR)R} \times 0.9$

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