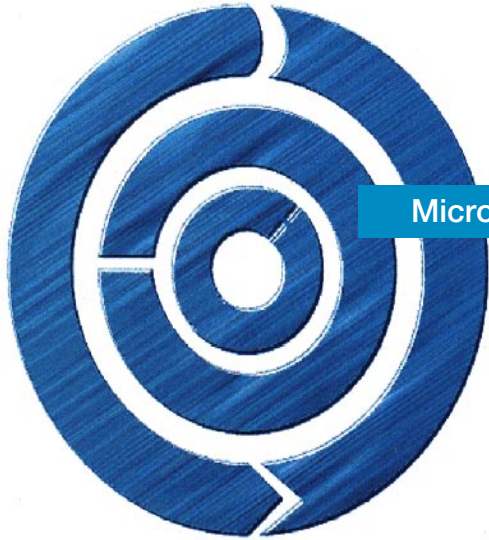


SEMICONDUCTOR SELECTION GUIDE

GUIDE BOOK



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Oct. 1995

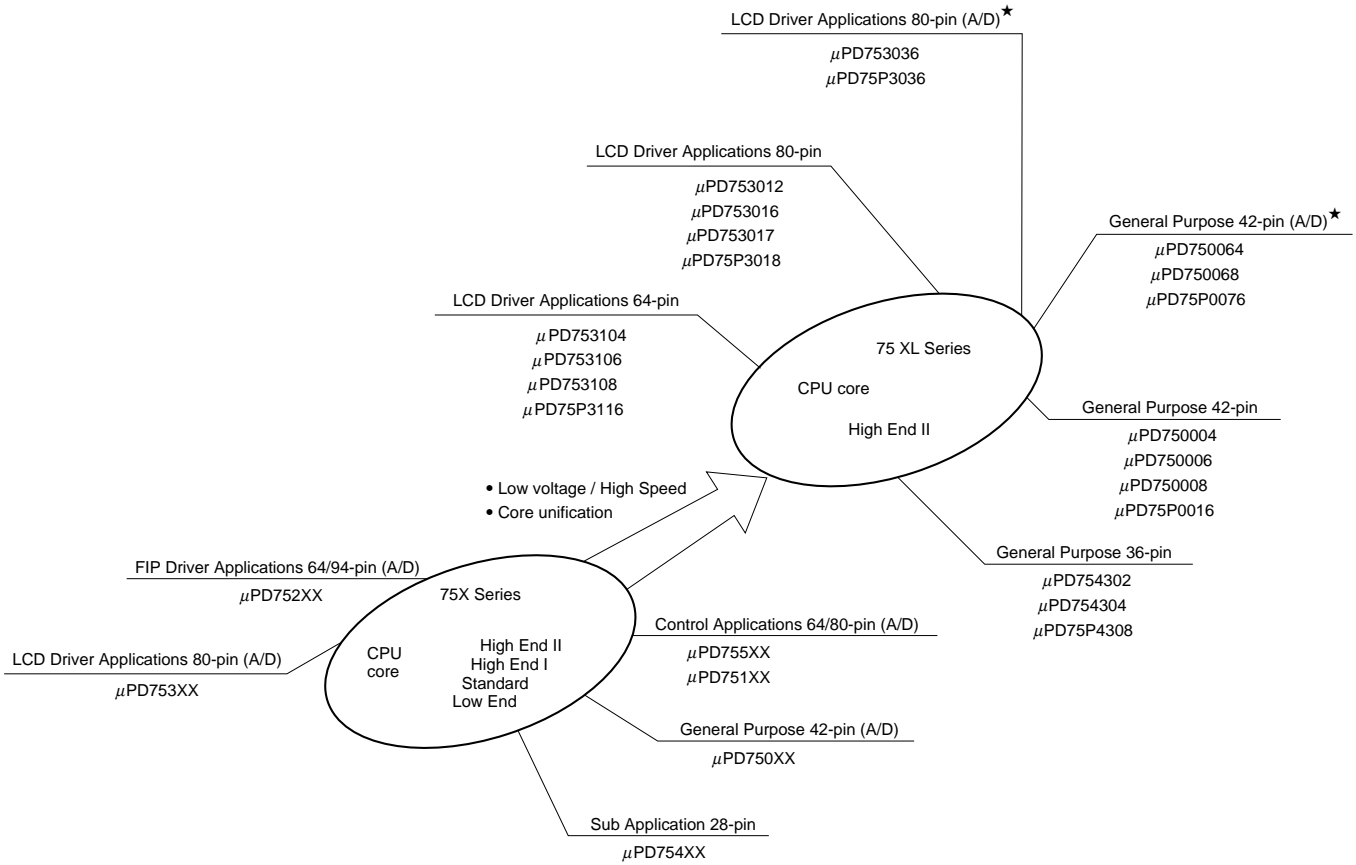
Microcomputer

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4-Bit Single Chip Microcomputer

75XL Series

■ **75XL series product evolution**



★ : Under development

4-Bit Single Chip Microcomputer

General Purpose Series

■ μ PD750008 series

| Type number | | μ PD750004/0006/0008 | μ PD75P0016 |
|---------------------------|------------------------|--|---|
| ROM (bytes) | | 4096/6144/8192 | 16384 (PROM) |
| RAM (∞ 4 bits) | | 512 | |
| General registers | | (4-bit ∞ 8) ∞ 4 banks or (8-bit ∞ 4) ∞ 4 banks | |
| Instruction cycle | | Selectable from 0.95 μ s/1.91 μ s/3.81 μ s/15.3 μ s (at main clock 4.19 MHz), 0.67 μ s/1.33 μ s/2.67 μ s/10.7 μ s (at main clock 6.0 MHz) and 122 μ s (at subclock 32 kHz) | |
| Input/ output ports | CMOS inputs | 8 (also serve as INT, SIO) | Can be pulled up by software except P00 |
| | CMOS inputs/outputs | 18 (can drive LED) | |
| | N-ch inputs/outputs | 8 (can drive LED, withstand voltage 12 V, can be pulled up by mask option except PROM version) | |
| Timer/Counters | | 4 channels • Timer/event counter • Basic interval timer/watchdog timer • Watch timer • 8-bit timer | |
| Serial interface | | NEC standard serial bus interface/3-line serial interface | |
| Interrupts | | • Vector interrupts: 7 (external: 3, internal: 4), • Test inputs: 2 (external: 1, internal: 1) | |
| Clock output (PCL) | | • Φ , 524 kHz, 262 kHz, 65.5 kHz (Main system clock: 4.19 MHz) • Φ , 750 kHz, 375 kHz, 93.7 kHz (Main system clock: 6.0 MHz) | |
| Buzzer output (BUZ) | | • 2 kHz, 4 kHz, 32 kHz (Main system clock: 4.19 MHz or subsystem clock: 32.768 kHz) • 2.86 kHz, 5.72 kHz, 45.8 kHz (Main system clock: 6.0 MHz) | |
| Instruction set | | • Bit data set/reset/test/boolean operation instructions • 4/8-bit data transfer/operation/increment/decrement/compare instructions | |
| Supply voltage | | 2.2 to 5.5 V (when external clock used $V_{DD} = 1.8$ to 5.5 V) | |
| Package | | • 42-pin plastic SDIP, • 44-pin plastic QFP | |

■ μ PD754304 series

| Type number | | μ PD754302/4304 | μ PD75P4308 |
|---------------------------|------------------------|--|---|
| ROM (bytes) | | 2048/4096 | 8192 (PROM) |
| RAM (∞ 4 bits) | | 256 | |
| General registers | | (4-bit ∞ 8) ∞ 4 banks or (8-bit ∞ 4) ∞ 4 banks | |
| Instruction cycle | | Selectable from 0.95 μ s/1.91 μ s/3.81 μ s/15.3 μ s (at main clock 4.19 MHz), 0.67 μ s/1.33 μ s/2.67 μ s/10.7 μ s (at main clock 6.0 MHz) | |
| Input/ output ports | CMOS inputs | 8 (also serve as INT, SIO) | Can be pulled up by software except P00 |
| | CMOS inputs/outputs | 18 (4 can drive LED) | |
| | N-ch inputs/outputs | 4 (can drive LED, withstand voltage 12 V, can be pulled up by mask option except PROM version) | |
| Timer/Counters | | 3 channels • Timer/event counter ∞ 2 ch. (Applicable at a 16-bit Timer/Event counter by Cascade connection) • Basic interval timer, • Watchdog timer | |
| Serial interface | | 2-line/3-line serial interface | |
| Interrupts | | • Vector interrupts: 7 (external: 3, internal: 4), • Test inputs: 1 (external: 1) | |
| Clock output (PCL) | | • Φ , 524 kHz, 262 kHz, 65.5 kHz (Main system clock: 4.19 MHz) • Φ , 750 kHz, 375 kHz, 93.7 kHz (Main system clock: 6.0 MHz) | |
| Instruction set | | • Bit data set/reset/test/boolean operation instructions • 4/8-bit data transfer/operation/increment/decrement/compare instructions | |
| Supply voltage | | 1.8 to 5.5 V | |
| Package | | • 36-pin plastic SSOP (300 mil, 0.8 mm pitch) | |

4-Bit Single Chip Microcomputer

General Purpose Series

■ μ PD750068 series

| Type number | μ PD750064 [★] /0068 [★] | μ PD75P0076 [★] |
|---------------------------|--|---|
| ROM (bytes) | 4096/8192 | 16384 (PROM) |
| RAM (∞ 4 bits) | 512 | |
| General registers | (4-bit ∞ 8) ∞ 4 banks or (8-bit ∞ 4) ∞ 4 banks | |
| Instruction cycle | Selectable from 0.95 μ s/1.91 μ s/3.81 μ s/15.3 μ s (at main clock 4.19 MHz), 0.67 μ s/1.33 μ s/2.67 μ s/10.7 μ s (at main clock 6.0 MHz) and 122 μ s (at subclock 32 kHz) | |
| Input/ output ports | CMOS inputs | Can be pulled up by software except P00 |
| | CMOS inputs/outputs | |
| | N-ch inputs/outputs | |
| A/D converter | • 8-bit ∞ 8 ch | |
| Timer/Counters | 4 channels • Timer/event counter ∞ 2 ch. (Applicable at a 16-bit Timer/Event counter by Cascade connection) • Basic interval timer/watchdog timer • Watch timer | |
| Serial interface | 2-line/3-line serial interface | |
| Interrupts | • Vector interrupts: 7 (external: 3, internal: 4), • Test inputs: 2 (external: 1, internal: 1) | |
| Clock output (PCL) | • Φ , 524 kHz, 262 kHz, 65.5 kHz (Main system clock: 4.19 MHz) • Φ , 750 kHz, 375 kHz, 93.7 kHz (Main system clock: 6.0 MHz) | |
| Buzzer output (BUZ) | • 2 kHz, 4 kHz, 32 kHz (Main system clock: 4.19 MHz or subsystem clock: 32.768 kHz) • 2.86 kHz, 5.72 kHz, 45.8 kHz (Main system clock: 6.0 MHz) | |
| Instruction set | • Bit data set/reset/test/boolean operation instructions • 4/8-bit data transfer/operation/increment/decrement/compare instructions | |
| Supply voltage | 1.8 to 5.5 V | |
| Package | • 42-pin plastic SDIP, • 44-pin plastic QFP | |

★: Under development

| |
|--|
| 4-Bit Single Chip Microcomputer |
|--|

LCD Driver Series

■ μ PD753017 series

| Type number | μ PD753012 | μ PD753016 | μ PD753017 | μ PD75P3018 |
|---------------------------|--|----------------|--|---|
| ROM (bytes) | 12288 | 16384 | 24576 | 32768 (PROM) |
| RAM (∞ 4 bits) | 1024 | | | |
| General registers | (4-bit ∞ 8) ∞ 4 banks or (8-bit ∞ 4) ∞ 4 banks | | | |
| Instruction cycle | Selectable from 0.95 μ s/1.91 μ s/3.81 μ s/15.3 μ s (at main clock 4.19 MHz) , 0.67 μ s/1.33 μ s/2.67 μ s/10.7 μ s (at main clock 6.0 MHz) and 122 μ s (at subclock 32 kHz) | | | |
| Input/ output ports | CMOS inputs | 40 | 8 (also serve as INT, SIO) | Can be pulled up by software except P00 |
| | CMOS inputs/outputs | | 16 (can drive LED) | |
| | N-ch inputs/outputs | | 8 (can drive LED, withstand voltage 12 V, can be pulled up by mask option except PROM version) | |
| | CMOS outputs | | 4/8 (also serve as segment outputs, selection by software) | |
| LCD controller | <ul style="list-style-type: none"> • Segment outputs: 32 ∞ 4 (MAX.), • Display mode (static, 1/2, 1/3, 1/4 duty) • LCD drive voltage generation step down register (except PROM version) | | | |
| Timer/Counters | 5 channels • Timer/event counter ∞ 3 ch. (Applicable as a 16-bit Timer/Event counter by Cascade connection, Infrared remote control carrier generator) <ul style="list-style-type: none"> • Basic interval timer/watchdog timer • Watch timer | | | |
| Serial interface | NEC standard serial bus interface/3-line serial interface | | | |
| Interrupts | <ul style="list-style-type: none"> • Vector interrupts: 8 (external: 3, internal: 5), • Test inputs: 2 (external: 1, internal: 1) | | | |
| Clock output (PCL) | <ul style="list-style-type: none"> • ϕ, 524 kHz, 262 kHz, 65.5 kHz (Main system clock: 4.19 MHz) • ϕ, 750 kHz, 375 kHz, 93.7 kHz (Main system clock: 6.0 MHz) | | | |
| Buzzer output (BUZ) | <ul style="list-style-type: none"> • 2 kHz, 4 kHz, 32 kHz (Main system clock: 4.19 MHz or subsystem clock: 32.768 kHz) • 2.86 kHz, 5.72 kHz, 45.8 kHz (Main system clock: 6.0 MHz) | | | |
| Instruction set | <ul style="list-style-type: none"> • Bit data set/reset/test/boolean operation instructions • 4/8-bit data transfer/operation/increment/decrement/compare instructions • 8-bit data transfer instructions | | | |
| Supply voltage | 2.2 to 5.5 V (when External clock used $V_{DD} = 1.8$ to 5.5 V) | | | |
| Package | <ul style="list-style-type: none"> • 80-pin plastic QFP (0.5/0.65 mm pitch) | | | |

4-Bit Single Chip Microcomputer

LCD Driver Series

■ μ PD753108 series

| Type number | μ PD753104 | μ PD753106 | μ PD753108 | μ PD75P3116 |
|---------------------------|--|----------------|--|---|
| ROM (bytes) | 4096 | 6144 | 8192 | 16384 (PROM) |
| RAM (∞ 4 bits) | 512 | | | |
| General registers | (4-bit ∞ 8) ∞ 4 banks or (8-bit ∞ 4) ∞ 4 banks | | | |
| Instruction cycle | Selectable from 0.95 μ s/1.91 μ s/3.81 μ s/15.3 μ s (at main clock 4.19 MHz) , 0.67 μ s/1.33 μ s/2.67 μ s/10.7 μ s (at main clock 6.0 MHz) and 122 μ s (at subclock 32 kHz) | | | |
| Input/ output ports | CMOS inputs | 32 | 8 (also serve as INT, SIO) | Can be pulled up by software except P00 |
| | CMOS inputs/outputs | | 12 (4 can drive LED) | |
| | N-ch inputs/outputs | | 4 (can drive LED, withstand voltage 12 V, can be pulled up by mask option except PROM version) | |
| | CMOS outputs | | 8 (also serve as segment outputs, selection by software) | |
| LCD controller | <ul style="list-style-type: none"> • Segment outputs: 24 ∞ 4 (MAX.) • Display mode (static, 1/2, 1/3, 1/4 duty) • LCD drive voltage generation step down register (except PROM version) | | | |
| Timer/Counters | 5 channels • Timer/event counter ∞ 3 ch. (Applicable as a 16-bit Timer/Event counter by Cascade connection, Infrared remote control carrier generator) <ul style="list-style-type: none"> • Basic interval timer/watchdog timer • Watch timer | | | |
| Serial interface | NEC standard serial bus interface/3-line serial interface | | | |
| Interrupts | <ul style="list-style-type: none"> • Vector interrupts: 6 (external: 3, internal: 3) • Test inputs: 2 (external: 1, internal: 1) | | | |
| Clock output (PCL) | <ul style="list-style-type: none"> • Φ, 524 kHz, 262 kHz, 65.5 kHz (Main system clock: 4.19 MHz) • Φ, 750 kHz, 375 kHz, 93.7 kHz (Main system clock: 6.0 MHz) | | | |
| Buzzer output (BUZ) | <ul style="list-style-type: none"> • 2 kHz, 4 kHz, 32 kHz (Main system clock: 4.19 MHz or subsystem clock: 32.768 kHz) • 2.86 kHz, 5.72 kHz, 45.8 kHz (Main system clock: 6.0 MHz) | | | |
| Instruction set | <ul style="list-style-type: none"> • Bit data set/reset/test/boolean operation instructions • 4-bit data transfer/operation/increment/decrement/compare instructions • 8-bit data transfer instructions | | | |
| Supply voltage | 1.8 to 5.5 V | | | |
| Package | • 64-pin plastic QFP (0.65/0.8 mm pitch) | | | |

4-Bit Single Chip Microcomputer

LCD Driver Series

■ μ PD753036 series

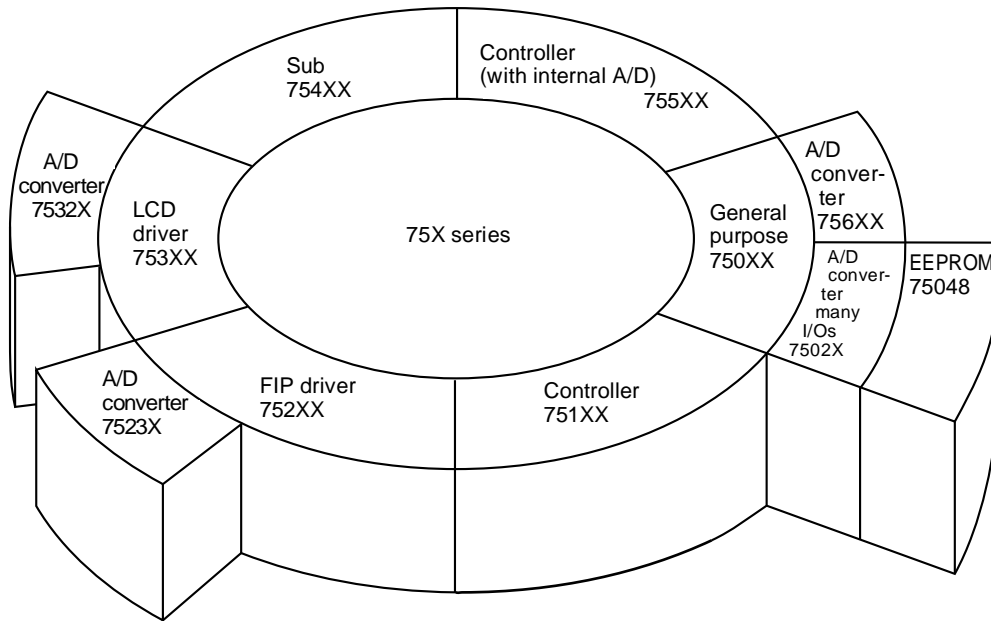
| Type number | | μ PD753036* | μ PD75P3036* |
|---------------------------|------------------------|--|--|
| ROM (bytes) | | 16384 | 16384 (PROM) |
| RAM (∞ 4 bits) | | 768 | |
| General registers | | (4-bit ∞ 8) ∞ 4 banks or (8-bit ∞ 4) ∞ 4 banks | |
| Instruction cycle | | Selectable from 0.95 μ s/1.91 μ s/3.81 μ s/15.3 μ s (at main clock 4.19 MHz) , 0.67 μ s/1.33 μ s/2.67 μ s/10.7 μ s (at main clock 6.0 MHz) and 122 μ s (at subclock 32 kHz) | |
| Input/ output ports | CMOS inputs | 44 | 8 (also serve as INT, SIO) |
| | CMOS inputs/outputs | | 20 (can drive LED) |
| | N-ch inputs/outputs | | 8 (can drive LED, withstand voltage 12 V, can be pulled up by mask option except PROM version) |
| | CMOS outputs | | 4/8 (also serve as segment outputs, selection by software) |
| A/D converter | | • 8-bit ∞ 8 ch | |
| LCD controller | | <ul style="list-style-type: none"> • Segment outputs: 20 ∞ 4 (MAX.), • Display mode (static, 1/2, 1/3, 1/4 duty) • LCD drive voltage generation step down register (except PROM version) | |
| Timer/Counters | | 5 channels • Timer/event counter ∞ 3 ch. (Applicable as a 16-bit Timer/Event counter by Cascade connection, Infrared remote control carrier generator) <ul style="list-style-type: none"> • Basic interval timer/watchdog timer • Watch timer | |
| Serial interface | | NEC standard serial bus interface/3-line serial interface | |
| Interrupts | | • Vector interrupts: 8 (external: 3, internal: 5), • Test inputs: 2 (external: 1, internal: 1) | |
| Clock output (PCL) | | <ul style="list-style-type: none"> • Φ, 524 kHz, 262 kHz, 65.5 kHz (Main system clock: 4.19 MHz) • Φ, 750 kHz, 375 kHz, 93.7 kHz (Main system clock: 6.0 MHz) | |
| Buzzer output (BUZ) | | <ul style="list-style-type: none"> • 2 kHz, 4 kHz, 32 kHz (Main system clock: 4.19 MHz or subsystem clock: 32.768 kHz) • 2.86 kHz, 5.72 kHz, 45.8 kHz (Main system clock: 6.0 MHz) | |
| Instruction set | | <ul style="list-style-type: none"> • Bit data set/reset/test/boolean operation instructions • 4/8-bit data transfer/operation/increment/decrement/compare instructions • 8-bit data transfer instructions | |
| Supply voltage | | 1.8 to 5.5 V | |
| Package | | • 80-pin plastic QFP (0.5/0.65 mm pitch) | |

* : Under development

4-Bit Single Chip Microcomputer

75X Series

■ **75X series product evolution**



4-Bit Single Chip Microcomputer

Controller Series

■ μ PD751XX series (1/2)

| Type number | | μ PD75104/106/108/112/116 | μ PD75104A/108A | μ PD75108F/112F/116F |
|------------------------------------|---------------------|--|-------------------------------------|--|
| ROM (bytes) | | 4096/6016/8064/12160/16256 | 4096/8064 | 8064/12160/16256 |
| RAM (x 4 bits) | | 320/320/512/512/512 | 320/512 | 512 |
| General registers | | (4-bit x 8) ∞ 4 banks or (8-bit ∞ 4) ∞ 4 banks | | |
| Instruction cycle | | Selectable from 0.95 μ s/1.91 μ s/15.3 μ s (at 4.19 MHz) | | |
| Minimum instruction execution time | | 0.95 μ s ($V_{DD} = 4.5$ V) 3.81 μ s ($V_{DD} = 2.7$ V) | | 0.95 μ s ($V_{DD} = 4.5$ V) 1.91 μ s ($V_{DD} = 2.7$ V) |
| Input/output ports | CMOS inputs | 10 (also serve as INT, SIO, 4 can be pulled up at μ PD75104A/108A only) | | |
| | CMOS inputs/outputs | 54 32 (capable of driving LED, 24 can be pulled up at μ PD75104A/108A only) | | |
| | N-ch inputs/outputs | 12 (capable of driving LED, withstand voltage 12 V, can be pulled up) | | |
| Comparator inputs | | 4-bit resolution ∞ 4 channels | | |
| Timer/Counters | | 3 channels • Timer/event counter ∞ 2, • Basic interval timer | | |
| Serial interface | | 3-line serial interface | | |
| Interrupts | | • Vector interrupts: 7 (external: 3, internal: 4), • External test inputs: 2 | | |
| Instruction set | | • Bit data set/reset/test/boolean operation instructions • 4/8-bit data transfer/operation/increment/decrement/compare instructions | | |
| Supply voltage | | 2.7 to 6.0 V | | 2.7 to 5.0 V ($T_a = -40$ to $+50$ °C) 2.8 to 5.0 V ($T_a = -40$ to $+60$ °C) |
| Package | | • 64-pin plastic SDIP • 64-pin plastic QFP (1.0 mm pitch) | • 64-pin plastic QFP (0.8 mm pitch) | • 64-pin plastic QFP (1.0 mm pitch) |

■ μ PD751XX series (2/2)

| Type number | | μ PD75P108B | μ PD75P116 | μ PD75116H/117H | μ PD75P117H |
|------------------------------------|---------------------|--|----------------|--|-----------------|
| ROM (bytes) | | 8064 (PROM) | 16256 (PROM) | 16256/24448 | 24448 (PROM) |
| RAM (x 4 bits) | | 512 | | 768 | |
| General registers | | (4-bit x 8) ∞ 4 banks or (8-bit ∞ 4) ∞ 4 banks | | | |
| Instruction cycle | | Selectable from 0.95 μ s/1.91 μ s/15.3 μ s (4.19 MHz) | | | |
| Minimum instruction execution time | | 0.95 μ s ($V_{DD} = 4.5$ V) 3.81 μ s ($V_{DD} = 2.7$ V) | 0.95 μ s | 0.95 μ s ($V_{DD} = 2.7$ V) 1.91 μ s ($V_{DD} = 1.8$ V) | |
| Input/output ports | CMOS inputs | 10 (also serve as INT, SIO) | | 10 (also serve as INT, SIO) | |
| | CMOS inputs/outputs | 54 32 (capable of driving LED) | | 54 32 (8 can drive LED) | |
| | N-ch inputs/outputs | 12 (capable of driving LED, withstand voltage 12 V) | | 12 (withstand voltage 6 V, can be pulled up except PROM version) | |
| Comparator inputs | | 4-bit resolution ∞ 4 channels | | | |
| Timer/Counters | | 3 channels • Timer/event counter ∞ 2, • Basic interval timer | | | |
| Serial interface | | 3-line serial interface | | | |
| Interrupts | | • Vector interrupts: 7 (external: 3, internal: 4), • External test inputs: 2 | | | |
| Instruction set | | • Bit data set/reset/test/boolean operation instructions • 4/8-bit data transfer/operation/increment/decrement/compare instructions | | | |
| Supply voltage | | 2.7 to 6.0 V | 4.5 to 5.5 V | 1.8 to 5.5 V ($T_a = -40$ to $+60$ °C) | |
| Package | | • 64-pin ceramic SDIP with window (μ PD75P108B only) • 64-pin plastic SDIP • 64-pin plastic QFP (1.0 mm pitch) | | • 64-pin plastic QFP (0.65/0.8 mm pitch) • 64-pin ceramic WQFN (0.8 mm pitch: μ PD75P117H only) | |

4-Bit Single Chip Microcomputer

Controller Series

■ μ PD755XX series

| Type number | | μ PD75512/516 | μ PD75P516 | μ PD75517/518 | μ PD75P518 |
|------------------------|---------------------|--|---|--|---|
| ROM (bytes) | | 12160/16256 | 16256 (PROM) | 24448/32640 | 32640 (PROM) |
| RAM (∞ 4 bits) | | 512 | | 1024 | |
| General registers | | (4-bit ∞ 8) ∞ 4 banks or (8-bit ∞ 4) ∞ 4 banks | | | |
| Instruction cycle | | Selectable from 0.95 μ s/1.91 μ s/15.3 μ s (at main clock 4.19 MHz) and 122 μ s (at subclock 32 kHz) | | Selectable from 0.67 μ s/1.33 μ s/2.67 μ s/10.7 μ s (at main clock 6 MHz) and 122 μ s (at subclock 32 kHz) | |
| Input/output ports | CMOS inputs | 16 (also serve as INT, SIO, A/D inputs) | | 7 can be pulled up by software | |
| | CMOS inputs/outputs | 64 28 (4 can drive LED) | | 4 can be pulled down by mask option except PROM version 16 can be pulled up by software | |
| | N-ch inputs/outputs | 20 (8 can drive LED, withstand voltage 9 V, can be pulled up by mask option except PROM version) | | | |
| A/D converter | | 8-bit resolution ∞ 8 channels | | | |
| Timer/Counters | | 3 channels • Timer/event counter, • Basic interval timer, • Watch timer | | | |
| Serial interface | | 2 channels • NEC standard serial bus interface/3-line serial interface • 3-line serial interface | | | |
| Interrupts | | • Vector interrupts: 7 (external: 3, internal: 4), • Test inputs: 2 (external: 1, internal: 1) | | | |
| Instruction set | | • Bit data set/reset/test/boolean operation instructions • 4/8-bit data transfer/operation/increment/decrement/compare instructions | | | |
| Supply voltage | | 2.7 to 6.0 V | 4.75 to 5.5 V | 2.7 to 6.0 V | |
| Package | | • 80-pin plastic QFP | • 80-pin plastic QFP • 80-pin ceramic WQFN | • 80-pin plastic QFP | • 80-pin plastic QFP • 80-pin ceramic WQFN |

General Purpose Series

■ μ PD7500X series

| Type number | | μ PD75004/006/008 | μ PD75P008 |
|------------------------|---------------------|--|---|
| ROM (bytes) | | 4096/6016/8064 | 8064 (PROM) |
| RAM (∞ 4 bits) | | 512 | |
| General registers | | 4-bit ∞ 8 or 8-bit ∞ 4 | |
| Instruction cycle | | Selectable from 0.95 μ s/1.91 μ s/15.3 μ s (at main clock 4.19 MHz) and 122 μ s (at subclock 32 kHz) | |
| Input/output ports | CMOS inputs | 8 (also serve as INT, SIO) | Can be pulled up by software except P00 |
| | CMOS inputs/outputs | 34 18 (4 can drive LED) | |
| | N-ch inputs/outputs | 8 (can drive LED, withstand voltage 10 V, can be pulled up by mask option except PROM version) | |
| Timer/Counters | | 3 channels • Timer/event counter, • Basic interval timer, • Watch timer | |
| Serial interface | | NEC standard serial bus interface/3-line serial interface | |
| Interrupts | | • Vector interrupts: 6 (external: 3, internal: 3), • Test inputs: 2 (external: 1, internal: 1) | |
| Instruction set | | • Bit data set/reset/test/boolean operation instructions • 4-bit data transfer/operation/increment/decrement/compare instructions • 8-bit data transfer instructions | |
| Supply voltage | | 2.7 to 6.0 V | 4.5 to 5.5 V |
| Package | | • 42-pin plastic SDIP, • 44-pin plastic QFP | |

4-Bit Single Chip Microcomputer

General Purpose Series

■ μ PD7502X series

| Type number | | μ PD75028/036 | μ PD75P036 | μ PD75048 | μ PD75P048 |
|---------------------------|------------------------|--|---|--|----------------|
| ROM (bytes) | | 8064/16256 | 16256 (PROM) | 8064 | 8064 (PROM) |
| RAM (∞ 4 bits) | | 512/1024 | 1024 | 512 | |
| EEPROM (∞ 4 bits) | | None | | 1024 | |
| General registers | | 4-bit ∞ 8 or 8-bit ∞ 4 | | | |
| Instruction cycle | | Selectable from 0.95 μ s/1.91 μ s/15.3 μ s (at main clock 4.19 MHz) and 122 μ s (at subclock 32 kHz) | | | |
| Input/ output ports | CMOS inputs | 48 | 12 (also serve as INT, SIO, A/D inputs) | 27 can be pulled up by software 4 can be pulled down by software | |
| | CMOS inputs/outputs | | 24 (4 can drive LED) | | |
| | N-ch inputs/outputs | | 12 (can drive LED, withstand voltage 10 V, can be pulled up by mask option except PROM version) | | |
| A/D converter | | 8-bit resolution ∞ 8 channels | | | |
| Timer/Counters | | 4 channels <ul style="list-style-type: none"> • Timer/event counter • Basic interval timer • Watch timer • Multi-function timer (can be used for integration A/D converter) | | | |
| Serial interface | | NEC standard serial bus interface/3-line serial interface | | | |
| Interrupts | | <ul style="list-style-type: none"> • Vector interrupts: 7 (external: 3, internal: 4) • Test inputs: 2 (external: 1, internal: 1) | | <ul style="list-style-type: none"> • Vector interrupts: 9 (external: 3, internal: 6) • Test inputs: 2 (external: 1, internal: 1) | |
| Instruction set | | <ul style="list-style-type: none"> • Bit data set/reset/test/boolean operation instructions • 4-bit data transfer/operation/increment/decrement/compare instructions • 8-bit data transfer instructions | | | |
| Supply voltage | | 2.7 to 6.0 V | | | |
| Package | | <ul style="list-style-type: none"> • 64-pin plastic SDIP • 64-pin ceramic WQFN (μPD75P036 only) • 64-pin plastic QFP | | | |

4-Bit Single Chip Microcomputer

General Purpose Series

■ **μPD7506X series**

| Type number | μPD75064/066/068 | | μPD75P068 |
|--------------------|--|--|---------------------------------|
| ROM (bytes) | 4096/6016/8064 | | 8064 (PROM) |
| RAM (∞ 4 bits) | 512 | | |
| General registers | 4-bit ∞ 8 or 8-bit ∞ 4 | | |
| Instruction cycle | Selectable from 0.95 μs/1.91 μs/15.3 μs (at main clock 4.19 MHz) and 122 μs (at subclock 32 kHz) | | |
| Input/output ports | CMOS inputs | 12 (also serve as INT, SIO) | 19 can be pulled up by software |
| | CMOS inputs/outputs | 12 (4 can drive LED, also serve as A/D inputs) | |
| | N-ch inputs/outputs | 8 (can drive LED, withstand voltage 10 V, also serve as A/D inputs, can be pulled up by mask option except PROM version) | |
| A/D converter | 8-bit resolution ∞ 8 channels | | |
| Timer/Counters | 3 channels • Timer/event counter • Basic interval timer • Watch timer | | |
| Serial interface | NEC standard serial bus interface/3-line serial interface | | |
| Interrupts | • Vector interrupts: 6 (external: 3, internal: 3) • Test inputs: 2 (external: 1, internal: 1) | | |
| Instruction set | • Bit data set/reset/test/boolean operation instructions • 4-bit data transfer/operation/increment/decrement/compare instructions • 8-bit data transfer instructions | | |
| Supply voltage | 2.7 to 6.0 V | | |
| Package | • 42-pin plastic SDIP • 44-pin plastic QFP | | |

Slave Series

■ **μPD754XX series**

| Type number | μPD75402A | | μPD75P402 |
|--------------------|--|--|---------------------------------|
| ROM (bytes) | 1920 | | 1920 (PROM) |
| RAM (∞ 4 bits) | 64 | | |
| General registers | 4-bit ∞ 4 or 8-bit ∞ 2 | | |
| Instruction cycle | Selectable from 0.95 μs/1.91 μs/15.3 μs (at 4.19 MHz) | | |
| Input/output ports | CMOS inputs | 6 (also serve as INT, SIO) | 16 can be pulled up by software |
| | CMOS inputs/outputs | 12 (8 can drive LED) | |
| | N-ch inputs/outputs | 4 (can drive LED, withstand voltage 10 V, can be pulled up by mask option except PROM version) | |
| Timer/Counters | Basic interval timer | | |
| Serial interface | NEC standard serial bus interface/3-line serial interface | | |
| Interrupts | • Vector interrupts: 3 (external: 1, internal: 2) • External test inputs: 1 | | |
| Instruction set | • Bit data set/reset/test/boolean operation instructions • 4-bit data transfer/increment/boolean operation/compare instructions • 8-bit data transfer instructions | | |
| Supply voltage | 2.7 to 6.0 V | | 4.5 to 5.5 V |
| Package | • 28-pin plastic DIP • 28-pin plastic SDIP • 44-pin plastic QFP | | |

4-Bit Single Chip Microcomputer

FIP Driver Series

■ μ PD752XX series

| Type number | | μ PD75206/208 | μ PD75212A/216A/217/218 | μ PD75P216A | μ PD75P218 | μ PD75268 |
|---------------------------|------------------------|---|---|-------------------------------------|---|--|
| ROM (bytes) | | 6016/8064 | 12160/16256/24448/32640 | 16256 | 32640 | 8064 |
| RAM (∞ 4 bits) | | 369/497 | 512/512/768/1024 | 512 | 1024 | 512 |
| General registers | | (4-bit ∞ 8) ∞ 4 banks or (8-bit ∞ 4) ∞ 4 banks | | | | 4-bit x 8 or 8-bit x 4 |
| Instruction cycle | | Selectable from 0.95 μ s/1.91 μ s/15.3 μ s (at main clock 4.19 MHz) and 122 μ s (at subclock 32 kHz) | | | | |
| Input/ output ports | CMOS inputs | 8 (also serve as INT, SIO) | | | | |
| | CMOS inputs/outputs | 32 20 (8 can drive LED, 4 can be pulled down by mask option except PROM version) | | | | |
| | P-ch outputs | 4 (also serve as segment pins, can be pulled down by mask option except PROM version) | | | | |
| FIP controller | | 9 to 12 segments, 9 to 16 digits (can be pulled down by mask option) | 9 to 16 segments, 9 to 16 digits (can be pulled down by mask option) | 9 to 16 segments, 9 to 16 digits | 9 to 16 segments, 9 to 16 digits (can be pulled down by mask option) | |
| Timer/Counter | | 4 channels <ul style="list-style-type: none"> • Timer/event counter • Basic interval timer • Watch timer • Timer/pulse generator (can output 14-bit PWM) | | | | 3 channels <ul style="list-style-type: none"> • Timer/event counter • Basic interval timer • Watch timer |
| Serial interface | | 3-line serial interface/serial bus interface | | | | |
| Interrupts | | <ul style="list-style-type: none"> • Vector interrupts: 8 (external: 3, internal: 5) • Test inputs: 2 (external: 1, internal: 1) | | | | <ul style="list-style-type: none"> • Vector interrupts: 6 (external: 3, internal: 3) • Test inputs: 3 (external: 1, internal: 2) |
| Instruction set | | <ul style="list-style-type: none"> • Bit data set/reset/test/boolean operation instructions • 4-bit data transfer/operation/increment/decrement/compare instructions • 8-bit data transfer/operation/increment/decrement/compare instructions (transfer only at μPD75268) | | | | |
| Supply voltage | | 2.7 to 6.0 V | | 4.5 to 5.5 V | 2.7 to 6.0 V | 2.7 to 6.0 V |
| Package | | <ul style="list-style-type: none"> • 64-pin plastic SDIP • 64-pin plastic QFP (except μPD75P216A) | | | | |

4-Bit Single Chip Microcomputer

FIP Driver Series

■ μ PD7523X series

| Type number | μ PD75236 | μ PD75237/238 | μ PD75P238 |
|---------------------------|---|--|---|
| ROM (bytes) | 16256 | 24448/32640 | 32640 (PROM) |
| RAM (∞ 4 bits) | 768 | 1024 | 1024 |
| General registers | (4-bit ∞ 8) ∞ 4 banks or (8-bit ∞ 4) ∞ 4 banks | | |
| Instruction cycle | Selectable from 0.95 μ s/1.91 μ s/3.81 μ s/15.3 μ s (at main clock 4.19 MHz) and 122 μ s (at subclock 32 kHz) | Selectable from 0.67 μ s/1.33 μ s/2.67 μ s/10.7 μ s (at main clock 6 MHz) 122 μ s (at subclock 32 kHz) | |
| Input/ output ports | CMOS inputs | 16 (also serve as INT, SIO, A/D inputs) | 19 can be pulled up by software 4 can be pulled down by mask option Same as left (however, no mask option) |
| | CMOS inputs/outputs | 16 | |
| | N-ch inputs/outputs | 8 (withstand voltage 10 V, can be pulled up by mask option) | |
| | P-ch outputs | 24 (also serve as segment pins, can be pulled down by mask option) | |
| FIP controller | 9 to 24 segments, 9 to 16 digits (can be pulled down by mask option except μ PD75P238) | | |
| A/D converter | 8-bit resolution x 8 channels | | |
| Timer/Counters | 5 channels <ul style="list-style-type: none"> • Timer/event counter • Event counter • Basic interval timer • Watch timer • Timer/pulse generator (can output 14-bit PWM) | | |
| Serial interface | 2 channels <ul style="list-style-type: none"> • NEC standard serial bus interface/3-line serial interface • 3-line serial interface | | |
| Interrupts | <ul style="list-style-type: none"> • Vector interrupts: 8 (external: 3, internal: 5) • Test inputs: 3 (external: 1, internal: 2) | | |
| Instruction set | <ul style="list-style-type: none"> • Bit data set/reset/test/boolean operation instructions • 4/8-bit data transfer/operation/increment/decrement/compare instructions | | |
| Supply voltage | 2.7 to 6.0 V | | |
| Package | <ul style="list-style-type: none"> • 94-pin plastic QFP | | <ul style="list-style-type: none"> • 94-pin plastic QFP • 94-pin ceramic WQFN |

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| 4-Bit Single Chip Microcomputer |
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LCD Driver Series

■ μ PD7530X series

| Type number | μ PD75304/306/308/312/316 | μ PD75P316A | μ PD75304B/306B/308B | μ PD75312B/316B | μ PD75P316B |
|---------------------------|--|--------------------|--|---|---|
| ROM (bytes) | 4096/6016/8064/12160/16256 | 16256 (PROM) | 4096/6016/8064 | 12160/16256 | 16256 (PROM) |
| RAM (∞ 4 bits) | 512 | 1024 | 512 | 1024 | |
| General registers | 4-bit ∞ 8 or 8-bit ∞ 4 | | | | |
| Instruction cycle | Selectable from 0.95 μ s/1.91 μ s/15.3 μ s (at main clock 4.19 MHz) and 122 μ s (at subclock 32 kHz) | | | | |
| Input/ output ports | CMOS inputs | 32 (40 MAX.) | 8 (also serve as INT, SIO) | Can be pulled up by software except P00 | |
| | CMOS inputs/outputs | | 16 (4 can drive LED) | | |
| | N-ch inputs/outputs | | 8 (can drive LED, withstand voltage 10 V, can be pulled up by mask option except PROM version) | | |
| | CMOS outputs | | 4/8 (also serve as segment outputs, selection by software) | | |
| LCD controller | <ul style="list-style-type: none"> • Segment outputs: 32 ∞ 4 (MAX.) • Display mode (static, 1/2, 1/3, 1/4 duty) • LCD drive voltage generation step down register (except PROM version) | | | | |
| Timer/Counters | 3 channels • Timer/event counter <ul style="list-style-type: none"> • Basic interval timer • Watch timer | | | | |
| Serial interface | NEC standard serial bus interface/3-line serial interface | | | | |
| Interrupts | <ul style="list-style-type: none"> • Vector interrupts: 6 (external: 3, internal: 3) • Test inputs: 2 (external: 1, internal: 1) | | | | |
| Instruction set | <ul style="list-style-type: none"> • Bit data set/reset/test/boolean operation instructions • 4-bit data transfer/operation/increment/decrement/compare instructions • 8-bit data transfer instructions | | | | |
| Supply voltage | 2.7 to 6.0 V | | 2.0 to 6.0 V | | 2.0 to 6.0 V |
| Package | <ul style="list-style-type: none"> • 80-pin plastic QFP (0.8 mm pitch) • 80-pin ceramic WQFN (0.8 mm pitch: μPD75P316A only) | | <ul style="list-style-type: none"> • 80-pin plastic QFP (0.5/0.65/0.8 mm pitch) | | <ul style="list-style-type: none"> • 80-pin plastic QFP (0.65/0.8 mm pitch) • 80-pin ceramic WQFN (0.65 mm pitch: μPD75P316B only) |

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| 4-Bit Single Chip Microcomputer |
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LCD Driver Series

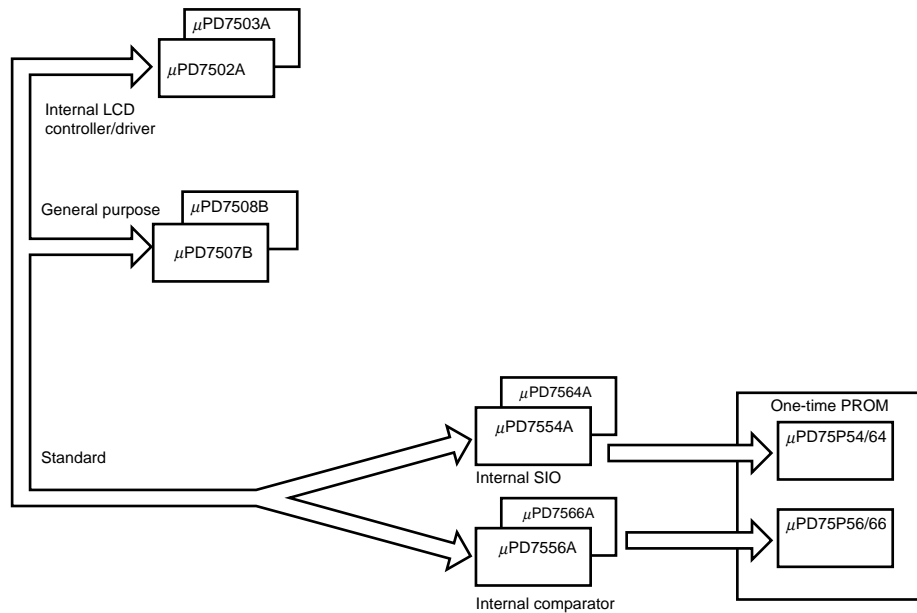
■ μ PD7532X series

| Type number | | μ PD75328 | μ PD75P328 | μ PD75336 | μ PD75P336 |
|---------------------------|------------------------|---|----------------|--|----------------|
| ROM (bytes) | | 8064 | 8064 (PROM) | 16256 | 16256 (PROM) |
| RAM (∞ 4 bits) | | 512 | | 768 | |
| General registers | | 4-bit ∞ 8 or 8-bit ∞ 4 | | (4-bit ∞ 8) ∞ 4 banks or (8-bit ∞ 4) x 4 banks | |
| Instruction cycle | | Selectable from 0.95 μ s/1.91 μ s/15.3 μ s (at main clock 4.19 MHz) and 122 μ s (at subclock 32 kHz) | | | |
| Input/ output ports | CMOS inputs | 8 (also serve as INT, SIO) | | Can be pulled up by software except P00 | |
| | CMOS inputs/outputs | 20 | | | |
| | N-ch inputs/outputs | 8 (can drive LED, withstand voltage 10 V, can be pulled up by mask option except PROM version) | | | |
| | CMOS outputs | 8 (also serve as segment outputs) | | | |
| LCD controller | | <ul style="list-style-type: none"> • Segment outputs: 20 ∞ 4 (MAX.) • Display mode (static, 1/2, 1/3, 1/4 duty) • LCD drive voltage generation step down resistor (except PROM version) | | | |
| A/D converter | | 8-bit resolution ∞ 6 channels | | 8-bit resolution ∞ 8 channels | |
| Timer/Counters | | 3 channels • Timer/event counter <ul style="list-style-type: none"> • Basic interval timer • Watch timer | | 4 channels • Timer/event counter ∞ 2 <ul style="list-style-type: none"> • Basic interval timer • Watch timer | |
| Serial interface | | NEC standard serial bus interface/3-line serial interface | | | |
| Interrupts | | <ul style="list-style-type: none"> • Vector interrupts: 6 (external: 3, internal: 3) • Test inputs: 2 (external: 1, internal: 1) | | <ul style="list-style-type: none"> • Vector interrupts: 7 (external: 3, internal: 4) • Test inputs: 2 (external: 1, internal: 1) | |
| Instruction set | | <ul style="list-style-type: none"> • Bit data set/reset/test/boolean operation instructions • 4-bit data transfer/operation/increment/decrement/compare instructions • 8-bit data transfer/operation/increment/decrement/compare instructions (transfer only except μPD75336) | | | |
| Supply voltage | | 2.7 to 6.0 V | 4.75 to 5.25 V | 2.7 to 6.0 V | |
| Package | | • 80-pin plastic QFP (0.65 mm pitch) | | • 80-pin plastic QFP (0.5, 0.65 mm pitch) | |

4-Bit Single Chip Microcomputer

μPD7500 Series

■ **μPD7500 series product evolution**



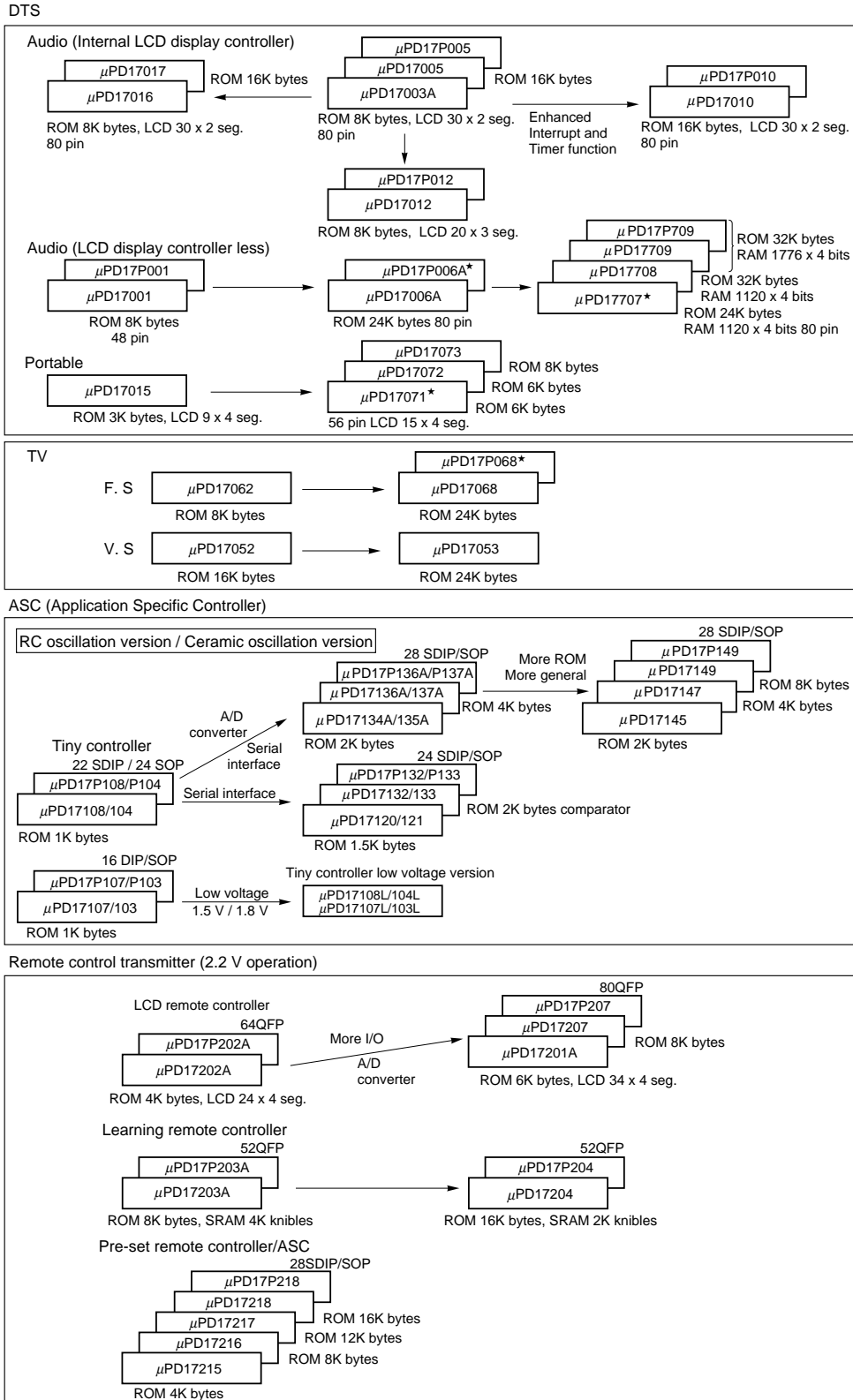
■ **μPD7500 series**

| Type number | Features | | ROM (∞8) | RAM (∞4) | I/O | Package | Supply voltage | |
|-------------|--------------------------------|---------------------------|----------|----------|--|-------------------------------|-------------------------------|--------------|
| μPD7502A | Internal LCD controller/driver | 24 SEG | 2K | 128 | 23 | • 64-pin QFP | 2.5 to 6.0 V | |
| μPD7503A | | | 4K | 224 | | | | |
| μPD7507B | General purpose | High speed (2.86 μs) | 2K | 128 | 32 | • 40-pin SDIP • 44-pin QFP | 2.2 to 6.0 V | |
| μPD7508B | | | 4K | 224 | | | | |
| μPD7554A | Standard device | Internal serial interface | 1K | 64 | 16 | • 20-pin SDIP • 20-pin SOP | 2.0 to 6.0 V | |
| μPD7564A | | | | | 15 | | 2.7 to 6.0 V | |
| μPD7556A | | Internal comparator | | | R oscillation External clock input Ceramic oscillation | 20 | • 24-pin SDIP • 24-pin SOP | 2.0 to 6.0 V |
| μPD7566A | | | | | | 19 | | 2.7 to 6.0 V |
| μPD75P54 | OTP | For 7554A | 1K | 64 | 16 | • 20-pin SDIP • 20-pin SOP | 4.5 to 6.0 V | |
| μPD75P64 | | For 7564A | | | 15 | | | |
| μPD75P56 | | For 7556A | | | 20 | • 24-pin SDIP • 24-pin SOP | | |
| μPD75P66 | | For 7566A | | | 19 | | | |

4-Bit Single Chip Microcomputer

17K Series

17K series product evolution



*: Under development

4-Bit Single Chip Microcomputer

■ μ PD170XX (DTS) (1/3)

| | μ PD17001 | μ PD17003A | μ PD17005 | μ PD17006A | μ PD17010 | μ PD17012 | μ PD17707* | μ PD17708* | μ PD17709* |
|-------------------------|--|--|-----------------------|------------------------|--|--|---|------------------------|----------------------|
| Typical applications | High performance tuner, car radio | | | | | | | | |
| Package | • 48-pin QFP | • 80-pin QFP | | | | • 64-pin QFP | • 80-pin QFP | | |
| Supply voltage | +5 V \pm 10 % | | | | | | | | |
| Supply current (CPU) | 500 μ A TYP. | | | | | | | | |
| ROM size | 3836 ∞ 16 bits | 3836 ∞ 16 bits | 7932 ∞ 16 bits | 12288 ∞ 16 bits | 7932 ∞ 16 bits | 4096 ∞ 16 bits | 12288 ∞ 16 bits | 16384 ∞ 16 bits | |
| RAM size | 224 ∞ 4 bits | 320 ∞ 4 bits | 432 ∞ 4 bits | 896 ∞ 4 bits | 432 ∞ 4 bits | 316 ∞ 4 bits | 1120 ∞ 4 bits | | 1776 ∞ 4 bits |
| Number of instructions | 35 | | | | | | | | |
| Display | — | Internal LCD driver Segments : 30 Common : 2 | | — | Internal LCD driver Segments : 30 Common : 2 | Internal LCD driver Segments : 20 Common : 3 | — | | |
| Input ports | 8 lines | 8 lines | | 8 lines | 8 lines | 8 lines | 12 lines | | |
| Output ports | 12 lines | 9 (+30) lines | | 13 lines | 9 (+30) lines | 8 (+20) lines | 4 lines | | |
| Input/output ports | 12 lines | 16 lines | | 40 lines | 16 lines | 14 lines | 46 lines | | |
| VDP (D/A converter) | 4 | 4 | | 4 | 4 | 3 | 3 | | |
| A/D converter | 6 | 6 | | 6 | 6 | 2 | 6 | | |
| Crystal oscillator | 4.5 MHz | | | | | | | | |
| PLL reference frequency | 1, 1.25, 2.5, 3, 5, 6.25, 9, 10, 12.5, 25, 50, 100 kHz | | | | | | 1, 1.25, 2.5, 3.5, 6.25, 9, 10, 12.5, 18, 20, 25, 50, 100 kHz | | |
| Applicable prescaler | Internally provided (130 MHz) | Internally provided (150 MHz) | | | | Internally provided (250 MHz) | Internally provided (130 MHz) | | |
| One-time PROM version | μ PD17P001 | μ PD17P005 | | μ PD17P006A* | μ PD17P010 | μ PD17P012 | μ PD17P709* | | |

* : Under development

■ μ PD170XX (DTS) (2/3)

| | μ PD17015 | μ PD17016 | μ PD17017 | μ PD17071* | μ PD17072 | μ PD17073 |
|-------------------------|---|---|-----------------------|--|---------------|-----------------------|
| Typical applications | Portable tuner radio | High performance tuner, car radio | | Portable tuner radio | | |
| Package | • 38-pin shrink SOP | • 80-pin QFP | | • 56-pin QFP | | |
| Supply voltage | 1.8 ~ 3.6 (PLL is operating) | +5 \pm 10% | | 1.8 ~ 3.6 (V) | | |
| Supply current (CPU) | 30 μ A | 500 μ A TYP. | | 30 μ A | | |
| ROM size | 1528 ∞ 16 bits | 3836 ∞ 16 bits | 7932 ∞ 16 bits | 3072 ∞ 16 bits | | 4096 ∞ 16 bits |
| RAM size | 97 ∞ 4 bits | 320 ∞ 4 bits | 432 ∞ 4 bits | 176 ∞ 4 bits | | |
| Number of instructions | 35 | | | | | |
| Display | Internal LCD driver Segments : 9 Common : 4 | Internal LCD driver Segments : 30 Common : 2 | | Internal LCD driver Segments : 15 Common : 4 | | |
| Input ports | 3 lines | 8 lines | | 4 lines | | |
| Output ports | 7 lines | 9 (+8) lines | | 9 lines | | |
| Input/output ports | 2 lines | 16 lines | | 8 lines | | |
| VDP (D/A converter) | — | 2 | | — | | |
| A/D converter | — | 6 | | — | 2 | |
| Crystal oscillator | 75 kHz | 4.5 MHz | | 75 kHz | | |
| PLL reference frequency | 1, 3, 5, 12.5 kHz | 1, 1.25, 2.5, 3.5, 6.25, 9, 10, 12.5, 25, 50, 100 kHz | | 1, 3, 5, 6.25, 12.5, 25 kHz | | |
| Applicable prescaler | Internal provided (220 MHz) | Internal provided (150 MHz) | | Internal provided (230 MHz) | | |
| One-time PROM version | — | μ PD17P005 | | — | | |

* : Under development

4-Bit Single Chip Microcomputer

■ μ PD170XX (DTS) (3/3)

| | μ PD17062 | μ PD17068 | μ PD17052 | μ PD17053 |
|-------------------------|---|---|---|---|
| Typical applications | TV, CATV, LCD TV | | | |
| Package | <ul style="list-style-type: none"> • 48-pin shrink DIP • 64-pin QFP | <ul style="list-style-type: none"> • 100-pin QFP | <ul style="list-style-type: none"> • 64-pin shrink DIP | <ul style="list-style-type: none"> • 64-pin shrink DIP |
| Supply voltage | +5 V \pm 10 % | | | |
| Supply current (CPU) | 500 μ A TYP. | | | |
| ROM size | 3968 x 16 bits | 12032 x 16 bits | 8192 x 16 bits | 12288 x 16 bits |
| RAM size | 336 x 4 bits | 1007 x 4 bits | 448 x 4 bits | 672 x 4 bits |
| Number of instructions | 35 | | | |
| Display | IDC (internally provided) 99 characters max. per frame Display: 14 rows ∞ 19 columns 120 different characters | IDC (internally provided) 192/350 character Display: 17/15 rows ∞ 24 columns 255 different characters | IDC (internally provided) 99 characters max. per frame Display: 14 rows ∞ 19 columns 128 different characters | IDC (internally provided) 99 characters max. per frame Display: 14 rows ∞ 19 columns 256 different characters |
| Input ports | 4 lines | 4 lines | 4 lines | |
| Output ports | 8 lines | 21 lines | 20 lines | |
| Input/output ports | 15 lines | 19 lines | 20 lines | |
| VDP (D/A converter) | 4 | 9 | 4 | |
| A/D converter | 6 | 8 | 8 | |
| Crystal oscillator | 8 MHz | | 8 MHz (ceramic resonator) | |
| PLL reference frequency | 6.25, 12.5, 25 kHz | 5, 6.25, 10, 12.5, 25 kHz | Voltage synthesizer (14-bit D/A converter internally provided) | |
| Applicable prescaler | μ PB595 (1 GHz) | | ————— | |
| One-time PROM version | ————— | μ PD17P068* | ————— | |

*: Under development

4-Bit Single Chip Microcomputer

■ μ PD17103 Sub-series (ASC) (1/3)

| Item | μ PD17103 | μ PD17104 | μ PD17103L | μ PD17104L | μ PD17107 | μ PD17108 | μ PD17107L | μ PD17108L |
|---|---|-------------------------------------|------------------------------|-------------------------------------|--|-------------------------------------|------------------------------|-------------------------------------|
| ROM size | 512 ∞ 16 bits | | | | | | | |
| RAM size | 16 ∞ 4 bits | | | | | | | |
| Input/output ports Parentheses indicate number of N-ch open-drain pins | 11 lines (3 lines) | 16 lines (4 lines) | 11 lines (3 lines) | 16 lines (4 lines) | 11 lines (3 lines) | 16 lines (4 lines) | 11 lines (3 lines) | 16 lines (4 lines) |
| System clock | Ceramic oscillation | | | | RC oscillation | | | |
| Supply voltage | 2.7 to 6.0 V (at 2MHz) 4.5 to 6.0 V (at 8 MHz) | | 1.8 to 3.6 V (at 2 MHz) | | 2.7 to 6.0 V (at 250 kHz) 4.5 to 6.0 V (at 1 MHz) | | 1.5 to 3.6 V (at 200 kHz) | |
| Package | • 16-pin DIP • 16-pin SOP | • 22-pin shrink DIP • 24-pin SOP | • 16-pin DIP • 16-pin SOP | • 22-pin shrink DIP • 24-pin SOP | • 16-pin DIP • 16-pin SOP | • 22-pin shrink DIP • 24-pin SOP | • 16-pin DIP • 16-pin SOP | • 22-pin shrink DIP • 24-pin SOP |
| PROM version | μ PD17P103 | μ PD17P104 | μ PD17P103 | μ PD17P104 | μ PD17P107 | μ PD17P108 | μ PD17P107 | μ PD17P108 |

■ μ PD17120 Sub-series/ μ PD17134A Sub-series (ASC) (2/3)

| Item | μ PD17120 | μ PD17121 | μ PD17132 | μ PD17133 | μ PD17134A | μ PD17135A | μ PD17136A | μ PD17137A |
|----------------------------|-------------------------------------|---------------------|------------------------|---------------------|--|---------------------|-----------------------|---------------------|
| ROM size | 768 ∞ 16 bits | | 1024 ∞ 16 bits | | 1024 ∞ 16 bits | | 2048 ∞ 16 bits | |
| RAM size | 64 ∞ 4 bits | | 111 ∞ 4 bits | | 112 ∞ 4 bits | | 112 ∞ 4 bits | |
| Input/output ports | 19 lines (input: 1) | | | | 22 lines (input: 2) | | | |
| External interrupt | 1 line | | | | 1 line | | | |
| Analog inputs | — | | Comparator 4 channels* | | A/D converter 4 channels | | | |
| Timers | 1 channel | | | | 3 channels | | | |
| Serial interface | 1 channel | | | | 1 channel | | | |
| Power-on reset | Provided (Built-in) | | | | Provided (Built-in) | | | |
| System clock | RC oscillation | Ceramic oscillation | RC oscillation | Ceramic oscillation | RC oscillation | Ceramic oscillation | RC oscillation | Ceramic oscillation |
| Instruction execution time | 8 μ s: @2 MHz | 2 μ s: @8 MHz | 8 μ s: @2 MHz | 2 μ s: @8 MHz | 8 μ s: @2 MHz | 2 μ s: @8 MHz | 8 μ s: @2 MHz | 2 μ s: @8 MHz |
| Supply voltage | 2.7 to 5.5 V | | | | 2.7 to 5.5 V (When using A/D converter 5 V \pm 10 %) | | | |
| Package | • 24-pin shrink DIP • 18-pin SOP | | | | • 28-pin shrink DIP • 28-pin SOP | | | |
| One-time PROM version | μ PD17P132 | μ PD17P133 | μ PD17P132 | μ PD17P133 | μ PD17P136A | μ PD17P137A | μ PD17P136A | μ PD17P137A |

*: can be used as low-resolution A/D converter by software

■ μ PD17145 Sub-series (ASC) (3/3)

| Item | μ PD17145 | μ PD17147 | μ PD17149 |
|----------------------------|---|-----------------------|-----------------------|
| ROM size | 1024 ∞ 16 bits | 2048 ∞ 16 bits | 4096 ∞ 16 bits |
| RAM size | 110 ∞ 4 bits | | |
| Input/output ports | 23 lines (input: 3) | | |
| External interrupt | 1 line | | |
| Analog inputs | A/D converter 4 channels | | |
| Timers | 3 channels | | |
| Serial interface | 1 channel | | |
| Power-on reset | Provided (Mask option) | | |
| System clock | Ceramic oscillation | | |
| Instruction execution time | 2 μ s: @8 MHz | | |
| Supply voltage | 2.7 to 5.5 V (when using A/D converter 4.0 ~ 5.5 V, VREF = 2.5 ~ VDD) | | |
| Package | • 28-pin shrink DIP • 28-pin SOP | | |
| One-time PROM version | μ PD17P149 | | |

4-Bit Single Chip Microcomputer

■ μ PD172XX (remote control transmitter) (1/2)

| | μ PD17201A | μ PD17207 | μ PD17202A | μ PD17203A | μ PD17204 |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| ROM size | 3072 ∞ 16 bits | 4096 ∞ 16 bits | 2048 ∞ 16 bits | 4096 ∞ 16 bits | 7936 ∞ 16 bits |
| RAM size | 336 ∞ 4 bits | | 112 ∞ 4 bits | 336 ∞ 4 bits | |
| Stack level | 5 levels | | 5 levels | 5 levels | 7 levels |
| Input/output ports | 19 lines | | 16 lines | 28 lines | |
| External interrupt | 1 line | | | | |
| Timers | 2 lines | | 2 lines | 4 lines | |
| Static RAM | None | | None | 4K knibbles | 2K knibbles |
| Infrared remote control carrier generator | Internally provided | | | | |
| Infrared remote control signal receive amplifier | None | | | Internally provided | |
| LCD controller/driver | 136 segments max. | | 96 segments max. | None | |
| 8-bit A/D converter | 4 channels | | None | | |
| Low voltage detection circuit | None | | | | |
| Subclock (32 kHz) | Internally provided | | | | |
| Operation voltage range | 2.2 to 5.5 V | | | | |
| Instruction execution time (4 MHz) | 4 μ s | | | | |
| Package | • 80-pin plastic QFP | | • 64-pin plastic QFP | • 52-pin plastic QFP | • 52-pin plastic QFP |
| One-time PROM version | μ PD17P207* | | μ PD17P202A | μ PD17P203A | μ PD17P204 |

★: Under development

■ μ PD172XX (remote control transmitter/ASC) (2/2)

| | μ PD17215 | μ PD17216 | μ PD17217 | μ PD17218 |
|---|--|-----------------------|-----------------------|-----------------------|
| ROM size | 2048 ∞ 16 bits | 4096 ∞ 16 bits | 6144 ∞ 16 bits | 8192 ∞ 16 bits |
| RAM size | 111 ∞ 4 bits | | 223 ∞ 4 bits | |
| Stack level | 5 levels | | | |
| Input/output ports | 20 lines | | | |
| External interrupt | 1 line | | | |
| Timers | 2 lines | | | |
| Infrared remote control carrier generator | Internally provided | | | |
| Low voltage detection circuit | Internally provided (WDOUT) | | | |
| Operation voltage range | 2.2 to 5.5 V (4 μ s) 2.0 to 5.5 V (8 μ s) | | | |
| Instruction execution time (4 MHz) | 4 μ s (high speed mode) | | | |
| Package | • 28-pin plastic SOP • 28-pin shrink DIP | | | |
| One-time PROM version | μ PD17P218 | | | |

4-Bit Single Chip Microcomputer

■ μ PD1700series (DTS) (1/2)

| | μ PD1708A | μ PD1709A | μ PD1713A |
|-------------------------|--|----------------------------------|--|
| Typical applications | Car radio, tuner | TV, CATV | Car radio, tuner |
| Package | • 52-pin QFP | • 28-pin shrink DIP | • 52-pin QFP |
| Supply voltage | 5 V \pm 10 % | | |
| Supply current (CPU) | 400 μ A TYP. | 600 μ A TYP. | 400 μ A TYP. |
| ROM | 16 bits x 1528 steps | 16 bits x 1526 steps | 16 bits x 1528 steps |
| RAM | 4 bits x 96 words | 4 bits x 64 words | 4 bits x 96 words |
| Number of instructions | 77 | 82 | 79 |
| Display | LCD (1/2 duty) | LED | LCD (1/2 duty) |
| Segments | Internal LCD driver provided Segments: 23 Commons: 2 | 7 (internal LED driver provided) | Internal LCD driver provided Segments: 21 Commons: 2 |
| Digits | | 2 | |
| Input ports | 4 (K ₀ to K ₃) | 0 | 4 (K ₀ to K ₃) + 2 |
| Output ports | 8 | 2 | 7 |
| I/O ports | 4 | 6 (internal serial I/O provided) | 4 |
| VDP (D/A converter) | 0 | 1 | 0 |
| A/D converter | 0 | 1 | 0 |
| Crystal oscillator | 4.5 MHz | | |
| PLL reference frequency | 1, 5, 6.25, 9, 10, 12.5, 25 kHz | | |
| Applicable prescaler | Internally provided (150 MHz) | μ PB595 (1 GHz) | Internally provided (150 MHz) |

■ μ PD1700series (DTS) (2/2)

| | μ PD1715 | μ PD1716 | μ PD1720A | μ PD1721 | μ PD1723 |
|-------------------------|--|---|--|----------------------------------|--|
| Typical applications | Portable radio | TV, VCR, car radio, high performance tuner | Car radio (for AM radio) | TV, VCR | High performance tuner, car radio |
| Package | • 54-pin QFP | • 28-pin shrink DIP | • 52-pin QFP | • 28-pin shrink DIP | • 64-pin QFP |
| Supply voltage | 2.0 V to 3.6 V | 5 V \pm 10 % | | | |
| Supply current (CPU) | 30 μ A TYP. | 500 μ A TYP. | 400 μ A TYP. | 600 μ A TYP. | 500 μ A TYP. |
| ROM | 16 bits ∞ 1528 steps | 16 bits ∞ 1016 steps | 16 bits ∞ 1016 steps | 16 bits ∞ 1526 steps | 16 bits ∞ 2040 steps |
| RAM | 4 bits ∞ 96 words | 4 bits ∞ 64 words | 4 bits ∞ 64 words | 4 bits ∞ 64 words | 4 bits ∞ 256 words |
| Number of instructions | 76 | 82 | 78 | 82 | 94 |
| Display | LCD (1/3 duty) | – | LCD (1/2 duty) | LED | LCD (1/2 duty) |
| Segments | Internal LCD driver provided Segments: 16 Commons: 3 | – | Internal LCD driver provided Segments: 21 Commons: 2 | 7 | Internal LCD driver provided Segments: 28 Commons: 2 |
| Digits | | – | | 2 | |
| Input ports | 4 (K ₀ to K ₃) | 0 | 4 (K ₀ to K ₃) | 0 | 4 (K ₀ to K ₃) |
| Output ports | 9 | 5 | 7 | 2 | 12 |
| I/O ports | 4 | 8 | 4 | 6 (internal serial I/O provided) | 8 (internal serial I/O provided) |
| VDP (D/A converter) | 1 | 0 | 0 | 1 | 1 |
| A/D converter | 0 | 1 | 0 | 1 | 1 |
| Crystal oscillator | 75 kHz | 4.5 MHz | | | |
| PLL reference frequency | 1, 3, 5, 6.25, 12.5, 25 kHz | 1, 5, 6.25, 9, 10, 12.5, 25 kHz | | | |
| Applicable prescaler | Internally provided (130 MHz) | Internally provided (150 MHz) μ PB587 (1 GHz) | – | μ PB595 (1 GHz) | Internally provided (150 MHz) |

4-Bit Single Chip Microcomputer

■ μ PD6133 series (remote control transmitter/ASC)

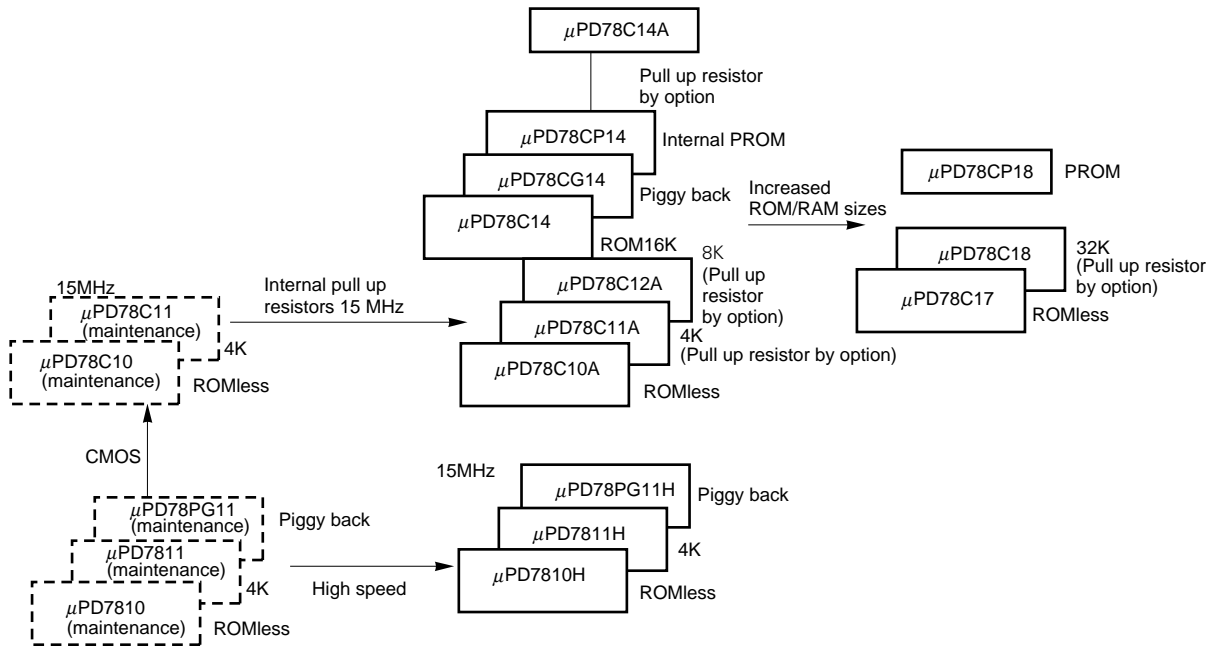
| Type number | μ PD6133 | μ PD63* | μ PD6134 | μ PD64* | μ PD6604 |
|-----------------------------------|---|--------------|-------------------------------------|---------------|-------------------------------------|
| Operating voltage range | 1.8 to 3.6 V | | | | |
| Operation clock (f _x) | 300 k to 1 MHz | 2 M to 8 MHz | 300 k to 1 MHz | 2 M to 8 MHz | 300 k to 1 MHz |
| | Ceramic oscillator | | | CR oscillator | |
| ROM size | 512 ∞ 10 bits | | 1002 ∞ 10 bits | | |
| RAM size | 32 ∞ 4 bits | | | | |
| Modulation carrier frequency | f _x , f _x /2, f _x /8, f _x /12, f _x /16, f _x /24, High level | | | | |
| 9 bits timer | 1 ch | | | | |
| Number of keys | 8 ∞ 6 = 48 | | | | |
| Low voltage detection circuit | Provided (Mask-option) | | | | |
| Package | • 20-pin SOP | | • 20-pin SOP • 20-pin shrink DIP | | • 20-pin shrink SOP • 20-pin SOP |
| Flash EEPROM version | μ PD61F35* | | | | |

*: Under development

8-Bit Single Chip Microcomputer

87AD Series

■ **87AD series product evolution**



■ **87AD series (1/2)**

| Item | | μPD7811H/10H |
|-------------------------------------|--------------------|---|
| Number of instructions | | 158 |
| Minimum instruction execution cycle | | 0.8 μs/15 MHz |
| Internal memory | ROM size | 4096 ∞ 8 bits (μPD7810H is ROMless) |
| | RAM size | 256 ∞ 8 bits |
| Inter-rupts | External sources | 3 (NMI, INT 1, 2) |
| | Internal sources | 8 (INTT 0, 1), (INTE 0, 1), (INTEIN, INTAD), (INTSR, INTST) |
| Timer/Counters | | 8-bits ∞ 2, 16-bit ∞ 1 |
| I/O pins | Input ports | 8-bit (AN) |
| | Input/output ports | 8-bit ∞ 5 (PA, PB, PC, PD, PF) |
| | Serial I/O | 1 channel (PC 0/TxD), (PC 1/RxD), (PC 2/SCK) |
| Features | | <ul style="list-style-type: none"> • 8 analog signal input pins. Internal 8-bit high precision A/D converter (absolute accuracy: 0.4 % ±1/2 LSB) • Serial interface can accommodate asynchronous, synchronous, and I/O interface (capable of 9600 bps in asynchronous mode). • Enhanced timer/counters for control applications • Internal zero-cross detection function for time or phase control. Enhanced interrupt function for effective utilization of abundant internal functions. |
| Process | | N-MOS |
| Package | | • 64-pin QUIP/SDIP |
| Piggy back or EPROM version | | μPD78PG11H |

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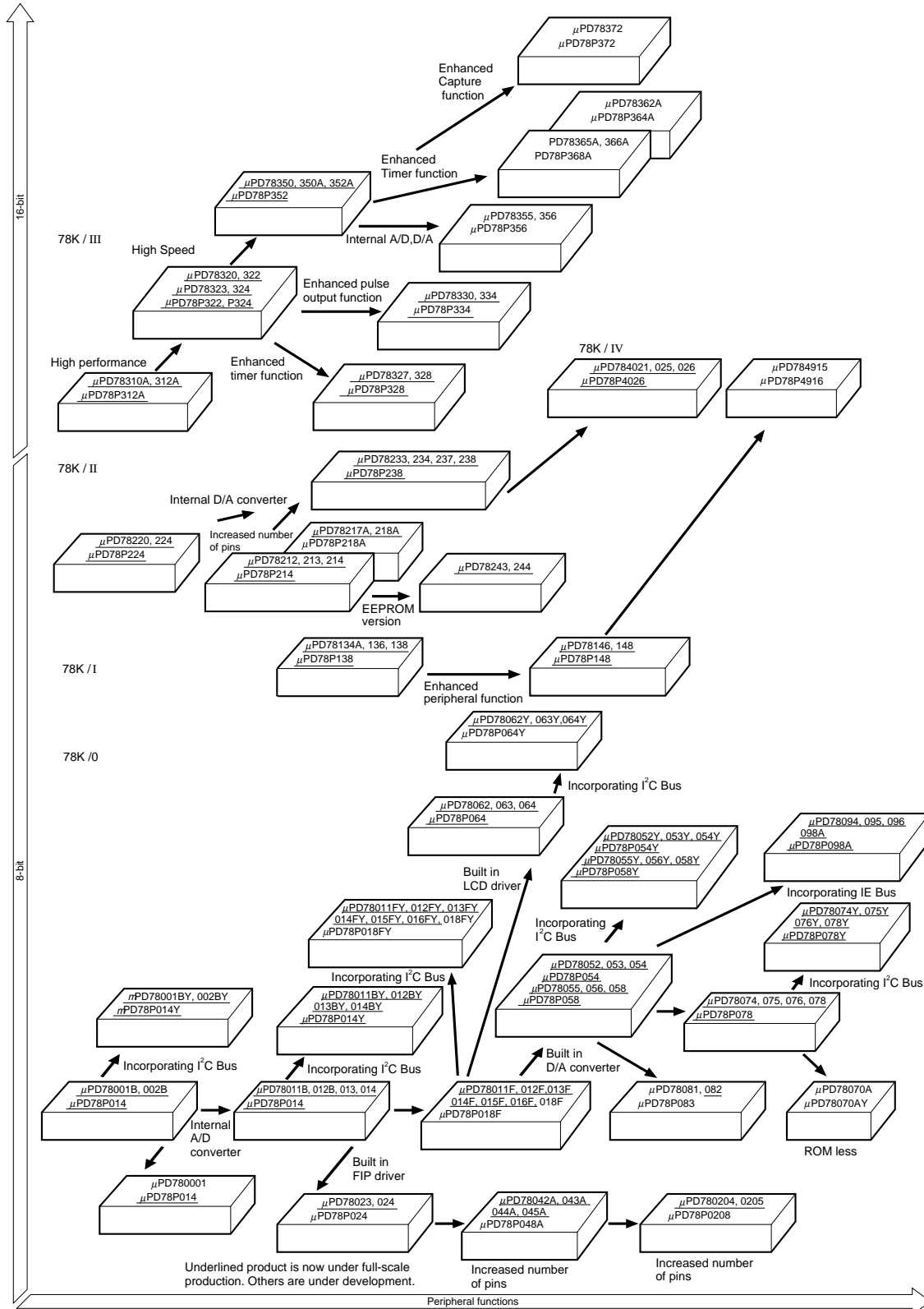
■ 87AD series (2/2)

| Item | | μ PD78C11A/10A | μ PD78C12A | μ PD78C14 | μ PD78C14A | μ PD78C18/17 |
|-------------------------------------|--------------------|---|---|---|--|---|
| Number of instructions | | 159 | | | | |
| Minimum instruction execution cycle | | 0.8 μ s/15 MHz | | | | |
| Internal memory | ROM size | 4K bytes (μ PD78C10A is ROMless) | 8K bytes | 16K bytes | | 32K bytes (μ PD78C17 is ROMless) |
| | RAM size | 256 ∞ 8-bits | | | | 1024 ∞ 8-bits |
| Inter-rupts | External sources | 3 | | | | |
| | Internal sources | 8 | | | | |
| Timer/Counters | | 8-bits ∞ 2, 16-bit ∞ 1 | | | | |
| I/O pins | Input ports | 8-bit (AN) | | | | |
| | Input/output ports | 8-bit ∞ 5 (PA, PB, PC, PD, PF) | | | | |
| | Serial I/O | 1 channel (PC 0/TxD), (PC 1/RxD), (PC 2/ $\overline{\text{SCK}}$) | | | | |
| Features | | <ul style="list-style-type: none"> • Full CMOS version of μPD7811H • Enhanced standby function (STOP mode) • Low power consumption: 1μA at 2.5 V (typ.) • Internal pull up resistors can be specified for ports A, B, and C, by mask option for μPD78C11A. | <ul style="list-style-type: none"> • 8K-byte ROM version of μPD78C11A • Internal pull up resistors can be specified. | <ul style="list-style-type: none"> • 16K-byte ROM version of μPD78C11 | <ul style="list-style-type: none"> • Same functions as μPD78C14 • Internal pull up resistors can be specified. • Package size: 14 mm ∞ 14 mm • Pin pitch: 0.8 mm For super miniature size system. | <ul style="list-style-type: none"> • Large internal ROM/ RAM ROM: 32K bytes (μPD78C18) RAM: 1024 bytes • Internal pull up resistors can be specified (μPD78C18) |
| Process | | CMOS | | | | |
| Package | | <ul style="list-style-type: none"> • 64-pin QUIP/SDIP/QFP (14 mm ∞ 20 mm) • 68-pin QFJ | | | <ul style="list-style-type: none"> • 64-pin QFP (\square 14 mm) | <ul style="list-style-type: none"> • 64-pin QUIP/SDIP/QFP (14 mm ∞ 20 mm) |
| Piggy back or EPROM version | | μ PD78CG14, μ PD78CP14 | | | | μ PD78CP18 |

8/16-Bit Single Chip Microcomputer

78K Series

78K series product evolution



8/16-Bit Single Chip Microcomputer

■ 78K/0 series (General purpose series)

| Type number | | μ PD780001* | μ PD78001B | μ PD78002B | μ PD78011B | μ PD78012B | μ PD78013 | μ PD78014 | μ PD78P014 | |
|---------------------------------|-------------------------|---|---|----------------|---|----------------|---------------|--|----------------|--|
| Number of instruction | | 63 | 61 | | 63 | | | | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s (10 MHz operation) | | | | | | | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | | | | | | | |
| Memory space extension function | | 64K bytes | | | | | | | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | | | | | | | |
| Internal memory | ROM size | 8K bytes | | 16K bytes | 8K bytes | 16K bytes | 24K bytes | 32K bytes | | |
| | Internal high speed RAM | 192 bytes | 256 bytes | 384 bytes | 512 bytes | | 1024 bytes | | | |
| | Buffer RAM size | - | | - | 32 bytes | | 32 bytes | | | |
| Interrupt | Internal source | 7 | | | 10 | | | | | |
| | External source | 4 | 5 | | 5 | | | | | |
| I/O port | CMOS input | 4 | 2 | | 2 | | | | | |
| | CMOS input/output | 35 | 47 | | 47 | | | | | |
| | N-ch open-drain I/O | - | 4 | | 4 | | | | | |
| Timer/Counter | | 8-bit timer ∞ 2 Watchdog timer ∞ 1 | 8-bit timer ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 | | 16-bit timer ∞ 1 8-bit timer ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 | | | | | |
| Serial interface | | Clock synchronized ∞ 1 ch | | | Clock synchronized ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch | | | | | |
| A/D converter | | 8-bit ∞ 8 ch | - | | 8-bit ∞ 8 ch | | | | | |
| Operation voltage | | 2.7 to 6.0 V | | | 2.7 to 6.0 V | | | | | |
| Package | | <ul style="list-style-type: none"> • 64-pin plastic shrink DIP • 64-pin plastic QFP (\square14 mm) | | | <ul style="list-style-type: none"> • 64-pin plastic shrink DIP • 64-pin plastic QFP (\square14 mm) | | | <ul style="list-style-type: none"> • 64-pin plastic shrink DIP • 64-pin plastic QFP (\square14 mm) • 64-pin ceramic shrink DIP with window | | |

* : Under development

8/16-Bit Single Chip Microcomputer

■ **78K/0 series (General purpose with I²C bus interface series)**

| Type number | | μ PD78001BY | μ PD78002BY | μ PD78011BY | μ PD78012BY | μ PD78013Y | μ PD78014Y | μ PD78P014Y |
|---------------------------------|-------------------------|---|-----------------|-----------------|---|----------------|--|-----------------|
| Number of instruction | | 61 | | | 63 | | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s (10 MHz operation) | | | | | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | | | | | |
| Memory space extension function | | 64K bytes | | | | | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | | | | | |
| Internal memory | ROM size | 8K bytes | 16K bytes | 8K bytes | 16K bytes | 24K bytes | 32K bytes | |
| | Internal high speed RAM | 256 bytes | 384 bytes | 512 bytes | | 1024 bytes | | |
| | Buffer RAM size | – | – | 32 bytes | | 32 bytes | | |
| Interrupt | Internal source | 7 | | | 10 | | | |
| | External source | 5 | | | 5 | | | |
| I/O port | CMOS input | 2 | | | 2 | | | |
| | CMOS input/output | 47 | | | 47 | | | |
| | N-ch open-drain I/O | 4 | | | 4 | | | |
| Timer/Counter | | 8-bit timer ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 | | | 16-bit timer ∞ 1 8-bit timer ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 | | | |
| Serial interface | | Clock synchronized ∞ 1 ch | | | I ² C bus interface ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch | | | |
| A/D converter | | – | | | 8-bit ∞ 8 ch | | | |
| Operation voltage | | 2.7 to 6.0 V | | | 2.7 to 6.0 V | | | |
| Package | | <ul style="list-style-type: none"> • 64-pin plastic shrink DIP • 64-pin plastic QFP (\square14 mm) | | | <ul style="list-style-type: none"> • 64-pin plastic shrink DIP • 64-pin plastic QFP (\square14 mm) | | <ul style="list-style-type: none"> • 64-pin plastic shrink DIP • 64-pin plastic QFP (\square14 mm) • 64-pin ceramic shrink DIP with window | |

8/16-Bit Single Chip Microcomputer

■ 78K/0 series (General purpose series)

| Type number | | μ PD78011F | μ PD78012F | μ PD78013F | μ PD78014F | μ PD78015F | μ PD78016F | μ PD78018F* | μ PD78P018F* |
|---------------------------------|-------------------------|---|----------------|----------------|----------------|----------------|----------------|---|------------------|
| Number of instruction | | 63 | | | | | | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s (10 MHz operation) | | | | | | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | | | | | | |
| Memory space extension function | | 64K bytes | | | | | | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | | | | | | |
| Internal memory | ROM size | 8K bytes | 16K bytes | 24K bytes | 32K bytes | 40K bytes | 48K bytes | 60K bytes | |
| | Internal high speed RAM | 512 bytes | | 1024 bytes | | 1536 bytes | | 2048 bytes | |
| | Buffer RAM size | 32 bytes | | | | | | | |
| Interrupt | Internal source | 10 | | | | | | | |
| | External source | 5 | | | | | | | |
| I/O port | CMOS input | 2 | | | | | | | |
| | CMOS input/output | 47 | | | | | | | |
| | N-ch open-drain I/O | 4 | | | | | | | |
| Timer/Counter | | 16-bit timer ∞ 1 8-bit timer ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 | | | | | | | |
| Serial interface | | Clock synchronized ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch | | | | | | | |
| A/D converter | | 8-bit ∞ 8 ch | | | | | | | |
| Operation voltage | | 1.8 to 5.5 V | | | | | | | |
| Package | | <ul style="list-style-type: none"> • 64-pin plastic shrink DIP • 64-pin plastic QFP (\square12 mm) • 64-pin plastic QFP (\square14 mm) | | | | | | <ul style="list-style-type: none"> • 64-pin plastic shrink DIP • 64-pin plastic QFP (\square12 mm) • 64-pin plastic QFP (\square14 mm) • 64-pin ceramic shrink DIP with window • 64-pin ceramic WQFN with window (\square14 mm) | |

* : Under development

8/16-Bit Single Chip Microcomputer

■ **78K/0 series (General purpose series)**

| Type number | | μ PD78011FY | μ PD78012FY | μ PD78013FY | μ PD78014FY | μ PD78015FY | μ PD78016FY | μ PD78018FY* | μ PD78P018FY* |
|---------------------------------|-------------------------|---|-----------------|-----------------|-----------------|-----------------|-----------------|--|-------------------|
| Number of instruction | | 63 | | | | | | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s (10 MHz operation) | | | | | | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | | | | | | |
| Memory space extension function | | 64K bytes | | | | | | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | | | | | | |
| Internal memory | ROM size | 8K bytes | 16K bytes | 24K bytes | 32K bytes | 40K bytes | 48K bytes | 60K bytes | |
| | Internal high speed RAM | 512 bytes | | 1024 bytes | | 1536 bytes | | 2048 bytes | |
| | Buffer RAM size | 32 bytes | | | | | | | |
| Interrupt | Internal source | 10 | | | | | | | |
| | External source | 5 | | | | | | | |
| I/O port | CMOS input | 2 | | | | | | | |
| | CMOS input/output | 47 | | | | | | | |
| | N-ch open-drain I/O | 4 | | | | | | | |
| Timer/Counter | | 16-bit timer ∞ 1 8-bit timer ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 | | | | | | | |
| Serial interface | | I ² C bus interface ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch | | | | | | | |
| A/D converter | | 8-bit ∞ 8 ch | | | | | | | |
| Operation voltage | | 1.8 to 5.5 V | | | | | | | |
| Package | | <ul style="list-style-type: none"> • 64-pin plastic shrink DIP • 64-pin plastic QFP (□12 mm) • 64-pin plastic QFP (□14 mm) | | | | | | <ul style="list-style-type: none"> • 64-pin plastic shrink DIP • 64-pin plastic QFP (□12 mm) • 64-pin plastic QFP (□14 mm) • 64-pin ceramic shrink DIP with window • 64-pin ceramic WQFN with window (□14 mm) | |

*: Under development

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| 8/16-Bit Single Chip Microcomputer |
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■ 78K/0 series (FIP series)

| Type number | | μ PD78023 | μ PD78024 | μ PD78P024 [★] |
|-----------------------|-------------------------|---|--|-----------------------------|
| Number of instruction | | 63 | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s (5 MHz operation) | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | |
| Internal memory | ROM size | 24K bytes | 32K bytes | |
| | Internal high speed RAM | 512 bytes | | |
| | Display data RAM size | 32 bytes | | |
| Interrupt | Internal source | 11 | | |
| | External source | 4 | | |
| I/O port | CMOS input | 2 | | |
| | CMOS input/output | 26 | | |
| | P-ch open-drain output | 18 | | |
| | P-ch open-drain I/O | 8 | | |
| Timer/Counter | | 16-bit timer ∞ 1 8-bit timer ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 | | |
| Serial interface | | Clock synchronized ∞ 2 ch | | |
| A/D converter | | 8-bit ∞ 8 ch | | |
| Operation voltage | | 2.7 to 6.0 V | | |
| Package | | <ul style="list-style-type: none"> • 64-pin plastic QFP (14 mm ∞ 20 mm) • 64-pin plastic shrink DIP | <ul style="list-style-type: none"> • 64-pin plastic QFP (14 mm ∞ 20 mm) • 64-pin plastic shrink DIP • 64-pin ceramic shrink DIP with window | |

★: Under development

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■ **78K/0 series (FIP series)**

| Type number | | μ PD78042A | μ PD78043A | μ PD78044A | μ PD78045A | μ PD78P048A |
|-----------------------|-------------------------|--|----------------|----------------|---|-----------------|
| Number of instruction | | 63 | | | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s (5 MHz operation) | | | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | | | |
| Internal memory | ROM size | 16K bytes | 24K bytes | 32K bytes | 40K bytes | 60K bytes |
| | Internal high speed RAM | 512 bytes | | 1024 bytes | | |
| | Buffer RAM size | 64 bytes | | | | |
| | Display data RAM size | 48 bytes | | | | |
| Interrupt | Internal source | 12 | | | | |
| | External source | 4 | | | | |
| I/O port | CMOS input | 2 | | | | |
| | CMOS input/output | 27 | | | | |
| | N-ch open-drain I/O | 5 | | | | |
| | P-ch open-drain output | 18 | | | | |
| | P-ch open-drain I/O | 16 | | | | |
| Timer/Counter | | 16-bit timer ∞ 1 8-bit timer ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 6-bit Up/Down counter ∞ 1 | | | | |
| FIP controller/driver | | Display output: 34 • Segment output: 9-24 • Digit output: 2-16 | | | | |
| Serial interface | | Clock synchronized ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch | | | | |
| A/D converter | | 8-bit ∞ 8 ch | | | | |
| Operation voltage | | 2.7 to 6.0 V | | | | |
| Package | | • 80-pin plastic QFP (14 mm ∞ 20 mm) | | | • 80-pin plastic QFP (14 mm ∞ 20 mm) • 80-pin ceramic WQFN (14 mm ∞ 20 mm) | |

| |
|---|
| 8/16-Bit Single Chip Microcomputer |
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■ **78K/0 series (FIP series)**

| Type number | | μ PD780204 | μ PD780205 | μ PD78P0208* |
|-----------------------|-------------------------|--|----------------|---|
| Number of instruction | | 63 | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s (5 MHz operation) | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | |
| Internal memory | ROM size | 32K bytes | 40K bytes | 60K bytes |
| | Internal high speed RAM | 1024 bytes | | |
| | Internal extended RAM | – | – | 1024 bytes |
| | Buffer RAM size | 64 bytes | | |
| | Display data RAM size | 80 bytes | | |
| Interrupt | Internal source | 12 | | |
| | External source | 4 | | |
| I/O port | CMOS input | 2 | | |
| | CMOS input/output | 27 | | |
| | N-ch open-drain I/O | 5 | | |
| | P-ch open-drain output | 24 | | |
| | P-ch open-drain I/O | 16 | | |
| Timer/Counter | | 16-bit timer ∞ 1 8-bit timer ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 6-bit Up/Down counter ∞ 1 | | |
| FIP controller/driver | | Display output: 53 • Segment output: 9-40 • Digit output: 2-16 | | |
| Serial interface | | Clock synchronized ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch | | |
| A/D converter | | 8-bit ∞ 8 ch | | |
| Operation voltage | | 2.7 to 6.0 V | | |
| Package | | • 100-pin plastic QFP (14 mm ∞ 20 mm) | | • 100-pin plastic QFP (14 mm ∞ 20 mm) • 100-pin ceramic WQFN (14 mm ∞ 20 mm) |

*: Under development

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■ **78K/0 series (General purpose series)**

| Type number | | μ PD78052 | μ PD78053 | μ PD78054 | μ PD78P054 | μ PD78055 | μ PD78056 | μ PD78058 | μ PD78P058 |
|-----------------------|-------------------------|--|---------------|--|----------------|---|---------------|---|----------------|
| Number of instruction | | 63 | | | | | | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s 12.8 μ s (5.0 MHz operation) | | | | | | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | | | | | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | | | | | | |
| Internal memory | ROM size | 16K bytes | 24K bytes | 32K bytes | 40K bytes | 48K bytes | 60K bytes | | |
| | Internal high speed RAM | 512 bytes | 1024 bytes | | | | | | |
| | Buffer RAM size | 32 bytes | | | | | | | |
| | Internal extended RAM | | | | | | | 1024 bytes | |
| Interrupt | Internal source | 15 | | | | | | | |
| | External source | 8 | | | | | | | |
| I/O port | CMOS input | 2 | | | | | | | |
| | CMOS input/output | 63 | | | | | | | |
| | N-ch open-drain I/O | 4 | | | | | | | |
| Timer/Counter | | 16-bit timer ∞ 1 8-bit timer ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 | | | | | | | |
| Serial interface | | Clock synchronized ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch Clock synchronized or UART ∞ 1 ch | | | | | | | |
| A/D converter | | 8-bit ∞ 8 ch | | | | | | | |
| D/A converter | | 8-bit ∞ 2 ch | | | | | | | |
| Operation voltage | | 2.0 to 6.0 V | | | | | | | |
| Package | | <ul style="list-style-type: none"> 80-pin plastic QFP (□12 mm) 80-pin plastic QFP (□14 mm) | | <ul style="list-style-type: none"> 80-pin plastic QFP (□12 mm) 80-pin plastic QFP (□14 mm) 80-pin ceramic WQFN (□14 mm) | | <ul style="list-style-type: none"> 80-pin plastic QFP (□14 mm) | | <ul style="list-style-type: none"> 80-pin plastic QFP (□14 mm) 80-pin ceramic WQFN (□14 mm) | |

8/16-Bit Single Chip Microcomputer

■ 78K/0 series (General purpose with I²C bus interface series)

| Type number | | μ PD78052Y | μ PD78053Y | μ PD78054Y | μ PD78P054Y | μ PD78055Y | μ PD78056Y | μ PD78058Y | μ PD78P058Y |
|-----------------------|-------------------------|---|----------------|--|-----------------|---|----------------|---|-----------------|
| Number of instruction | | 63 | | | | | | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s 12.8 μ s (5.0 MHz operation) | | | | | | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | | | | | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | | | | | | |
| Internal memory | ROM size | 16K bytes | 24K bytes | 32K bytes | 40K bytes | 48K bytes | 60K bytes | | |
| | Internal high speed RAM | 512 bytes | 1024 bytes | | | | | | |
| | Buffer RAM size | 32 bytes | | | | | | | |
| | Internal extended RAM | | | | | | | 1024 bytes | |
| Interrupt | Internal source | 15 | | | | | | | |
| | External source | 8 | | | | | | | |
| I/O port | CMOS input | 2 | | | | | | | |
| | CMOS input/output | 63 | | | | | | | |
| | N-ch open-drain I/O | 4 | | | | | | | |
| Timer/Counter | | 16-bit timer ∞ 1 8-bit timer ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 | | | | | | | |
| Serial interface | | Clock synchronized with I ² C bus interface function ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch Clock synchronized or UART ∞ 1 ch | | | | | | | |
| A/D converter | | 8-bit ∞ 8 ch | | | | | | | |
| D/A converter | | 8-bit ∞ 2 ch | | | | | | | |
| Operation voltage | | 2.0 to 6.0 V | | | | | | | |
| Package | | <ul style="list-style-type: none"> • 80-pin plastic QFP (□12 mm) • 80-pin plastic QFP (□14 mm) | | <ul style="list-style-type: none"> • 80-pin plastic QFP (□12 mm) • 80-pin plastic QFP (□14 mm) • 80-pin ceramic WQFN (□14 mm) | | <ul style="list-style-type: none"> • 80-pin plastic QFP (□14 mm) | | <ul style="list-style-type: none"> • 80-pin plastic QFP (□14 mm) • 80-pin ceramic WQFN (□14 mm) | |

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■ **78K/0 series (LCD series)**

| Type number | | μ PD78062 | μ PD78063 | μ PD78064 | μ PD78P064 |
|-----------------------|-------------------------|---|---------------|---|----------------|
| Number of instruction | | 63 | | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s, 12.8 μ s (5.0 MHz operation) | | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | | |
| Internal memory | ROM size | 16K bytes | 24K bytes | 32K bytes | |
| | Internal high speed RAM | 512 bytes | 1024 bytes | | |
| | Display data RAM size | 40 ∞ 4-bit | | | |
| Interrupt | Internal source | 14 | | | |
| | External source | 7 | | | |
| I/O port | CMOS input | 2 | | | |
| | CMOS input/output | 55 | | | |
| Timer/Counter | | 16-bit timer/event counter ∞ 1 8-bit timer/event counter ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 | | | |
| Serial interface | | Clock synchronized ∞ 1 ch Clock synchronized or UART ∞ 1 ch | | | |
| A/D converter | | 8-bit ∞ 8 ch | | | |
| LCD controller/driver | | <ul style="list-style-type: none"> • Segment output : 40 (max) • Common output : 4 (max) • Display mode : 1/2, 1/3 duty | | | |
| Operation voltage | | 2.0 to 6.0 V | | | |
| Package | | <ul style="list-style-type: none"> • 100-pin plastic QFP (\square14 mm, 0.5 mm pitch) • 100-pin plastic QFP (14 mm ∞ 20 mm, 0.65 mm pitch) | | <ul style="list-style-type: none"> • 100-pin plastic QFP (\square14 mm) • 100-pin plastic QFP (14 mm ∞ 20) • 100-pin ceramic WQFN (14 mm ∞ 20 mm) | |

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■ 78K/0 series (LCD series)

| Type number | | μ PD78062Y | μ PD78063Y | μ PD78064Y | μ PD78P064Y [★] |
|-----------------------|-------------------------|---|----------------|----------------|--|
| Number of instruction | | 63 | | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s, 12.8 μ s (5.0 MHz operation) | | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | | |
| Internal memory | ROM size | 16K bytes | 24K bytes | 32K bytes | |
| | Internal high speed RAM | 512 bytes | 1024 bytes | | |
| | Display data RAM size | 40 ∞ 4-bit | | | |
| Interrupt | Internal source | 14 | | | |
| | External source | 7 | | | |
| I/O port | CMOS input | 2 | | | |
| | CMOS input/output | 55 | | | |
| Timer/Counter | | 16-bit timer/event counter ∞ 1 8-bit timer/event counter ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 | | | |
| Serial interface | | Clock synchronized with I ² C bus interface function ∞ 1 ch Clock synchronized or UART ∞ 1 ch | | | |
| A/D converter | | 8-bit ∞ 8 ch | | | |
| LCD controller/driver | | <ul style="list-style-type: none"> • Segment output : 40 (max) • Common output : 4 (max) • Display mode : 1/2, 1/3 duty | | | |
| Operation voltage | | 2.0 to 6.0 V | | | |
| Package | | <ul style="list-style-type: none"> • 100-pin plastic QFP (\square14 mm, 0.5 mm pitch) • 100-pin plastic QFP (14 mm ∞ 20 mm, 0.65 mm pitch) | | | <ul style="list-style-type: none"> • 100-pin plastic QFP (\square14 mm) • 100-pin plastic QFP (14 mm ∞ 20 mm) • 100-pin ceramic WQFN (14 mm ∞ 20 mm) |

★: Under development

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■ **78K/0 series (General purpose series)**

| Type number | | μ PD78074 | μ PD78075 | μ PD78076 | μ PD78078 | μ PD78P078 | |
|---------------------------------|-------------------------|---|---------------|---------------|---------------|---|--|
| Number of instruction | | 63 | | | | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s, 12.8 μ s (5.0 MHz operation) | | | | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | | | | |
| Memory space extension function | | 64K bytes | | | | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | | | | |
| Internal memory | ROM size | 32K bytes | 40K bytes | 48K bytes | 60K bytes | 60K bytes | |
| | Internal high speed RAM | 1024 bytes | | | | | |
| | Internal extended RAM | ————— | | | 1024 bytes | | |
| | Buffer RAM size | 32 bytes | | | | | |
| Interrupt | Internal source | 17 | | | | | |
| | External source | 8 | | | | | |
| I/O port | CMOS input | 2 | | | | | |
| | CMOS input/output | 78 | | | | | |
| | N-ch open-drain I/O | 8 | | | | | |
| Timer/Counter | | 16-bit timer ∞ 1 8-bit timer ∞ 4 Watch timer ∞ 1 Watchdog timer ∞ 1 | | | | | |
| Serial interface | | Clock synchronized ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch Clock synchronized or UART ∞ 1 ch | | | | | |
| A/D converter | | 8-bit ∞ 8 ch | | | | | |
| D/A converter | | 8-bit ∞ 2 ch | | | | | |
| Operation voltage | | 1.8 to 5.5 V | | | | | |
| Package | | <ul style="list-style-type: none"> • 100-pin plastic QFP (□14 mm) • 100-pin plastic QFP (14 mm ∞ 20 mm) | | | | <ul style="list-style-type: none"> • 100-pin plastic QFP (□14 mm) • 100-pin plastic QFP (14 mm ∞ 20 mm) • 100-pin ceramic WQFN (14 mm ∞ 20 mm) | |

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■ 78K/0 series (General purpose series)

| Type number | | μ PD78074Y | μ PD78075Y | μ PD78076Y | μ PD78078Y | μ PD78P078Y | |
|---------------------------------|-------------------------|---|----------------|----------------|----------------|---|--|
| Number of instruction | | 63 | | | | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s, 12.8 μ s (5.0 MHz operation) | | | | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | | | | |
| Memory space extension function | | 64K bytes | | | | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | | | | |
| Internal memory | ROM size | 32K bytes | 40K bytes | 48K bytes | 60K bytes | 60K bytes | |
| | Internal high speed RAM | 1024 bytes | | | | | |
| | Internal extended RAM | ————— | | | 1024 bytes | | |
| | Buffer RAM size | 32 bytes | | | | | |
| Interrupt | Internal source | 17 | | | | | |
| | External source | 8 | | | | | |
| I/O port | CMOS input | 2 | | | | | |
| | CMOS input/output | 78 | | | | | |
| | N-ch open-drain I/O | 8 | | | | | |
| Timer/Counter | | 16-bit timer ∞ 1 8-bit timer ∞ 4 Watch timer ∞ 1 Watchdog timer ∞ 1 | | | | | |
| Serial interface | | Clock synchronized with I ² C bus interface function ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch Clock synchronized or UART ∞ 1 ch | | | | | |
| A/D converter | | 8-bit ∞ 8 ch | | | | | |
| D/A converter | | 8-bit ∞ 2 ch | | | | | |
| Operation voltage | | 1.8 to 5.5 V | | | | | |
| Package | | <ul style="list-style-type: none"> • 100-pin plastic QFP (□14 mm) • 100-pin plastic QFP (14 mm ∞ 20 mm) | | | | <ul style="list-style-type: none"> • 100-pin plastic QFP (□14 mm) • 100-pin plastic QFP (14 mm ∞ 20 mm) • 100-pin ceramic WQFN (14 mm ∞ 20 mm) | |

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■ 78K/0 series (General purpose series)

| Type number | | μ PD78070A | μ PD78070AY |
|---------------------------------|-------------------------|---|---|
| Number of instruction | | 63 | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s, 12.8 μ s (5.0 MHz operation) | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | |
| Memory space extension function | | 64K bytes | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | |
| Internal memory | Internal high speed RAM | 1024 bytes | |
| | Buffer RAM size | 32 bytes | |
| Interrupt | Internal source | 17 | |
| | External source | 8 | |
| I/O port | CMOS input | 2 | |
| | CMOS input/output | 78 | |
| | N-ch open-drain I/O | 8 | |
| Timer/Counter | | 16-bit timer ∞ 1 8-bit timer ∞ 4 Watch timer ∞ 1 Watchdog timer ∞ 1 | |
| Serial interface | | Clock synchronized ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch Clock synchronized or UART ∞ 1 ch | Clock synchronized with I ² C bus interface function ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch Clock synchronized or UART ∞ 1 ch |
| A/D converter | | 8-bit ∞ 8 ch | |
| D/A converter | | 8-bit ∞ 2 ch | |
| Operation voltage | | 1.8 to 5.5 V | |
| Package | | <ul style="list-style-type: none"> • 100-pin plastic QFP (□14 mm) • 100-pin plastic QFP (14 mm ∞ 20 mm) | |

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■ 78K/0 series (General purpose series)

| Type number | | μ PD78081 [★] | μ PD78082 | μ PD78P083 [★] |
|---------------------------------|-------------------------|---|---------------|--|
| Number of instruction | | 63 | | |
| Instruction cycle | Main system clock | 0.4 μ s, 0.8 μ s, 1.6 μ s, 3.2 μ s, 6.4 μ s, 12.8 μ s (5.0 MHz operation) | | |
| | | | | |
| Memory space extension function | | 64K bytes | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | |
| Internal memory | ROM size | 8K bytes | 16K bytes | 24K bytes |
| | Internal high speed RAM | 256 bytes | 384 bytes | 512 bytes |
| Interrupt | Internal source | 8 | | |
| | External source | 3 | | |
| I/O port | CMOS input | 1 | | |
| | CMOS input/output | 32 | | |
| Timer/Counter | | 8-bit timer ∞ 2 Watch timer ∞ 1 | | |
| Serial interface | | Clock synchronized or UART ∞ 1 ch | | |
| A/D converter | | 8 bit ∞ 8 ch | | |
| Operation voltage | | 1.8 to 5.5 V | | |
| Package | | <ul style="list-style-type: none"> • 42-pin plastic shrink DIP • 44-pin plastic QFP (10 mm ∞ 10 mm) | | <ul style="list-style-type: none"> • 42-pin plastic shrink DIP • 44-pin plastic QFP (10 mm ∞ 10 mm) • 42-pin ceramic shrink DIP with window |

★: Under development

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■ **78K/0 series (IEBus controller series)**

| Type number | | μ PD78094 | μ PD78095 | μ PD78096 | μ PD78098A | μ PD78P098A |
|-----------------------|-------------------------|--|---------------|---------------|---|-----------------|
| Number of instruction | | 63 | | | | |
| Instruction cycle | Main system clock | 0.5 μ s, 1.0 μ s, 2.0 μ s, 4.0 μ s, 8.0 μ s 16.0 μ s (6.0 MHz operation) | | | | |
| | Sub system clock | 122 μ s (32.768 kHz operation) | | | | |
| General register | | 8-bit ∞ 8 ∞ 4 banks | | | | |
| Internal memory | ROM size | 32K bytes | 40K bytes | 48K bytes | 60K bytes | |
| | Internal high speed RAM | 1024 bytes | | | 3072 bytes | |
| | Buffer RAM size | 32 bytes | | | | |
| Interrupt | Internal source | 16 | | | | |
| | External source | 8 | | | | |
| I/O port | CMOS input | 2 | | | | |
| | CMOS input/output | 63 | | | | |
| | N-ch open-drain I/O | 4 | | | | |
| Timer/Counter | | 16-bit timer ∞ 1 8-bit timer ∞ 2 Watch timer ∞ 1 Watchdog timer ∞ 1 | | | | |
| Serial interface | | Clock synchronized ∞ 1 ch Clock synchronized with automatic TX/RX function ∞ 1 ch Clock synchronized or UART ∞ 1 ch | | | | |
| IE bus controller | | TX/RX speed: 26k bps (max.) | | | | |
| A/D converter | | 8-bit ∞ 8 ch | | | | |
| D/A converter | | 8-bit ∞ 2 ch | | | | |
| Operation voltage | | 2.7 to 6.0 V | | | | |
| Package | | <ul style="list-style-type: none"> 80-pin plastic QFP (□14 mm) | | | <ul style="list-style-type: none"> 80-pin plastic QFP (□14 mm) 80-pin ceramic WQFN (□14 mm) | |

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■ 78K/I series

| Type number | | μ PD78134 | μ PD78134A | μ PD78136 | μ PD78138 | μ PD78P138 | μ PD78146 | μ PD78148 | μ PD78P148 | |
|--------------------------------------|--------------------|---|---|---------------|-------------------------------|--|---|---------------|---------------------------------|--|
| Number of instruction | | 63 | | 64 | | | | | | |
| Minimum instruction execution cycle | | 333 ns/12 MHz | | | | | | | | |
| Data memory space extension function | | 64K bytes | | | | | — | | | |
| Internal memory | ROM size | 16K bytes | | 24K bytes | 32K bytes | 32K bytes (PROM) | 24K bytes | 32K bytes | 32K bytes (PROM) | |
| | RAM size | 384 bytes | | 640 bytes | | | 688 bytes* | 816 bytes* | | |
| Inter-rupt | External sources | 5 | | | | | 5 | | | |
| | Internal sources | 12 | | | | | 20 | | | |
| I/O pins | Input ports | 10 | | | | | 24 | | | |
| | Output ports | 12 | | | | | 12 | | | |
| | Input/output ports | 36 | | | | | 40 | | | |
| Analog input | | 8-bit A/D converter 8 channels | | | | | 8-bit A/D converter 15 channels | | | |
| OP-amp | | — | | | | | 2 channels | | | |
| Timer/Counter | | 16-bit timer ∞ 3 7-bit timer ∞ 1 18-bit free-running-counter ∞ 1 | | | | | 16-bit timer ∞ 3 8-bit timer ∞ 1 22-bit free-running-counter ∞ 1 8-bit up-down-counter ∞ 1 | | | |
| PWM output | | 12-bit PWM ∞ 2 (carrier freq. 23.4 KHz) | 12-bit PWM ∞ 2 (carrier freq. 23.4 KHz/46.9 KHz) | | | 12-bit PWM ∞ 2 (carrier freq. 23.4 KHz/46.9 KHz) 8-bit PWM ∞ 3 (carrier freq. 5.9 KHz) 14-bit PWM ∞ 1 (carrier freq. 5.9 KHz) | | | | |
| Multiplier | | — | | | | | Hardware multiplier is included | | | |
| Serial interface | | Clock synchronized (can accommodate SBI) 1 channel | | | | | Clock synchronized (can accommodate SBI) 1 channel Clock synchronized (automatic data transmit function) 1 channel | | | |
| Features | | <ul style="list-style-type: none"> System-control and servo control for VCR Multi-function timer set for software servo control application such as VCR | | | | | <ul style="list-style-type: none"> System-control and servo control for VCR Multi-function timer set for software-servo control application such as VCR High-speed multiply with hardware multiplier Low-voltage and low-current count operation with Hardware clock function | | | |
| Package | | • 80-pin QFP | | | • 80-pin QFP • 80-pin WQFN | | • 100-pin QFP | | • 100-pin QFP • 100-pin WQFN | |

*: contained automatic data transmit buffer 48 byte

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■ **78K/II series (1/2)**

| Type number | | μPD78212 | μPD78213 | μPD78214 | μPD78P214 | μPD78217A | μPD78218A | μPD78P218A | μPD78243 | μPD78244 |
|--------------------------------------|--------------------|---|--------------------------------------|---|---|--|---|---|--------------------------------------|--------------------------------------|
| Number of instructions | | 65 | | | | | | | | |
| Minimum instruction execution cycle | | 333 ns/ 12 MHz | 500 ns/ 12 MHz | 333 ns/12 MHz | | 500 ns/ 12 MHz | 333 ns/12 MHz | | 500 ns/ 12 MHz | 333 ns/ 12 MHz |
| Data memory space extension function | | 1M bytes | | | | | | | | |
| Internal memory | ROM size | 8K bytes | – | 16K bytes | 16K bytes (PROM) | – | 32K bytes | 32K bytes (PROM) | – | 16K bytes |
| | RAM size | 384 bytes | 512 bytes | | | 1024 bytes | | | 512 bytes | |
| | EEPROM size | – | | | | | | | 512 bytes | |
| Inter-rupts | External sources | 7 | | | | | | | | |
| | Internal sources | 12 | | | | | | 14 | | |
| I/O pins | Inputs | 14 (of these, 6 can be pulled up by software) | | | | | | | | |
| | Outputs | 12 (of these, 8 can directly drive transistor.) | | | | | | | | |
| | Input/output ports | 28 (can be pulled up by software) | 10 (can be pulled up by software) | 28 (can be pulled up by software). Of these, 16 can directly drive LED. | | 10 (can be pulled up by software) | 28 (can be pulled up by software). Of these, 16 can directly drive LED. | | 10 (can be pulled up by software) | 28 (can be pulled up by software) |
| Analog inputs | | 8-bit A/D converter: 8 channels | | | | | | | | |
| Timer/Counter | | 16-bit timer/counter x 1 8-bit timer/counter x 3 | | | | | | | | |
| Serial interface | | UART (internal dedicated baud rate generator) ááá 1 channel Clock synchronized (can accommodate SBI) ááááá 1 channel | | | | | | | | |
| Features | | • Real-time output port for stepping motor control | | | | • Internal memory extended from μPD78214 | | | • First EEPROM version in 78K series | |
| Package | | • 64-pin SDIP • 64-pin QUIP (except μPD78212) • 68-pin QFJ (except μPD78212) • 64-pin QFP • 74-pin QFP | | | Same as left • 64-pin SDIP with window | • 64-pin SDIP • 64-pin QFP | | Same as left • 64-pin SDIP with window | • 64-pin SDIP • 64-pin QFP | |

| |
|---|
| 8/16-Bit Single Chip Microcomputer |
|---|

■ 78K/II series (2/2)

| Type number | | μ PD78220 | μ PD78224 | μ PD78P224 | μ PD78233 | μ PD78234 | μ PD78237 | μ PD78238 | μ PD78P238 |
|--------------------------------------|--------------------|---|--|------------------|--|---|--|---|-------------------------------|
| Number of instructions | | 65 | | | | | | | |
| Minimum instruction execution cycle | | 500 ns/ 12 MHz | 333 ns/12 MHz | | 500 ns/ 12 MHz | 333 ns/ 12 MHz | 500 ns/ 12 MHz | 333 ns/12 MHz | |
| Data memory space extension function | | 1M bytes | | | | | | | |
| Internal memory | ROM size | — | 16K bytes | 16K bytes (PROM) | — | 16K bytes | — | 32K bytes | 32K bytes (PROM) |
| | RAM size | 640 bytes | | | 640 bytes | | 1024 bytes | | |
| Inter-rupts | External sources | 8 | | | 7 | | | | |
| | Internal sources | 9 | | | 12 | | | | |
| I/O pins | Inputs | 8 | | | 16 | | | | |
| | Outputs | 12 | 20 | | 12 | | | | |
| | Input/output ports | 25 (of these, 8 can directly drive LED) | 35 (of these, 8 can directly drive LED) | | 18 (can be pulled up by software. 8 can directly drive LED) | 36 (can be pulled up by software. 24 can directly drive LED) | 18 (can be pulled up by software. 8 can directly drive LED) | 36 (can be pulled up by software. 24 can directly drive LED) | |
| Analog inputs | | Variable threshold voltage input port (16 steps): 8 | | | 8-bit A/D converter 8 channels | | | | |
| Analog outputs | | — | | | 8-bit D/A converter: 2 outputs | | | | |
| Timer/Counter | | 16-bit timer/counter ∞ 1 8-bit timer/counter ∞ 2 | | | 16-bit timer/counter ∞ 1 8-bit timer/counter ∞ 3 | | | | |
| Serial interface | | UART (internal dedicated baud rate generator) ááá 1 channel Clock synchronized (can accommodate SBI) ááááá 1 channel | | | | | | | |
| Features | | • Real-time output port for stepping motor control | | | • Real-time output port for stepping motor control • Two 12-bit PWM outputs | | | | |
| Package | | • 94-pin QFP • 84-pin QFJ | | | • 84-pin QFJ • 80-pin QFP • 94-pin QFP | | | | Same as left • 94-pin WQFN |

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■ **78K/III series (1/6)**

| Type number | | μ PD78310A | μ PD78312A | μ PD78P312A | μ PD78320 | μ PD78322 | μ PD78P322 | μ PD78323 | μ PD78324 | μ PD78P324 |
|-------------------------------------|--------------------|--|----------------|--|---|---------------|---|--|---------------|--|
| Number of instructions | | 96 | | | 111 | | | | | |
| Minimum instruction execution cycle | | 500 ns/12 MHz | | | 250 ns/16 MHz | | | | | |
| Internal memory | ROM size | – | 8K bytes | 8K bytes (PROM) | – | 16K bytes | 16K bytes (PROM) | – | 32K bytes | 32K bytes (PROM) |
| | RAM size | 256 bytes | | | 640 bytes | | | 1024 bytes | | |
| Inter-rupts | External sources | 4 | | | 8 | | | | | |
| | Internal sources | 14 | | | 13 | | | | | |
| I/O pins | Inputs | 8 | | | 16 | | | | | |
| | Outputs | – | | | – | | | | | |
| | Input/output ports | 24 | 40 | | 21 | 39 | | 21 | 39 | |
| Analog inputs | | 8-bit A/D converter 4 channels | | | 10-bit A/D converter 8 channels | | | | | |
| Timer/Counter | | 16-bit up/down counter ∞ 2 16-bit interval timer ∞ 2 | | | 18/16-bit free running timer ∞ 1 16-bit timer/event counter ∞ 1 | | | | | |
| Serial interface | | UART/clock synchronized 1 channel | | | UART 1 channel Clock synchronized (can accommodate SBI) 1 channel | | | | | |
| Features | | <ul style="list-style-type: none"> Compared to μPD78310/μPD78312 and μPD78P312, 16-bit data transfer instructions and 4-multiplied count mode added. Suitable for servo control | | | <ul style="list-style-type: none"> Real-time pulse unit which functions as a high performance pulse generator. | | | | | |
| Package | | <ul style="list-style-type: none"> 64-pin SDIP 68-pin QFJ 64-pin QUIP 64-pin QFP | | Same as left <ul style="list-style-type: none"> 64-pin SDIP with window 64-pin QUIP with window | <ul style="list-style-type: none"> 68-pin QFJ 74-pin QFP 80-pin QFP | | Same as left <ul style="list-style-type: none"> 68-pin WQFN 74-pin WQFN 80-pin WQFN | <ul style="list-style-type: none"> 68-pin QFJ 74-pin QFP | | Same as left <ul style="list-style-type: none"> 68-pin WQFN 74-pin WQFN |

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■ **78K/III series (3/6)**

| Type number | μ PD78350 | μ PD78350A | μ PD78352A | μ PD78P352 | μ PD78355 | μ PD78356 | μ PD78P356 | |
|-------------------------------------|--|---------------------------|----------------|----------------|---|---|------------------------|--|
| Number of instructions | 113 | | | | 115 | | | |
| Minimum instruction execution cycle | 160 ns/25 MHz | 125 ns/32 MHz | | | 125 ns/32 MHz | | | |
| Internal memory | ROM size | – | 32K | – | – | 48K bytes | – | |
| | PROM size | – | | 32K | – | – | 48K bytes | |
| | RAM size | 640 bytes | | | | 2K bytes | | |
| Inter-rupts | External sources | 5 | | | | 5 | | |
| | Internal sources | 4 | | | | 25 | | |
| I/O pins | Inputs | 6 | | | | 8 (8 can also serve as analog input pins) | | |
| | Outputs | – | | | | – | | |
| | Input/output ports | 24 | 44 | | 49 | 68 | | |
| PWM unit | 8-bit PWM output 2channels | | | | 12-bit PWM output 2 channels | | | |
| Analog inputs | – | | | | 10-bit A/D converter 8 channels | | | |
| | – | | | | High speed conversion time 2 μ s | | | |
| Analog outputs | – | | | | 8-bit D/A converter 2 channels | | | |
| Timer/Counter | 16-bit timer ∞ 3 | | | | 16-bit timer ∞ 2 16-bit counter ∞ 3 10-bit timer ∞ 1 | | | |
| Serial interface | – | | | | UART áááááááááááááááááááá 1 channel Clock synchronized (can accommodate SBI) áááááááááááááááááááááááááááááááá 1 channel Clock synchronized (with pin switching function) áááááááááááááááááááááááááááááááá 1 channel | | | |
| Features | <ul style="list-style-type: none"> • Sum of products operation instructions • Suitable as ASIC control | | | | <ul style="list-style-type: none"> • Fine pitch package (0.5 mm pitch) • Low voltage operation (2.7 to 5.5 V) • High performance internal A/D converter and D/A converter suitable for analog data | | | |
| Package | • 64-pin QFP (t = 2.7 mm) | • 64-pin QFP (t = 1.5 mm) | | • 64-pin WQFN | • 100-pin plastic QFP • 120-pin plastic QFP | | • 120-pin ceramic WQFN | |

| |
|---|
| 8/16-Bit Single Chip Microcomputer |
|---|

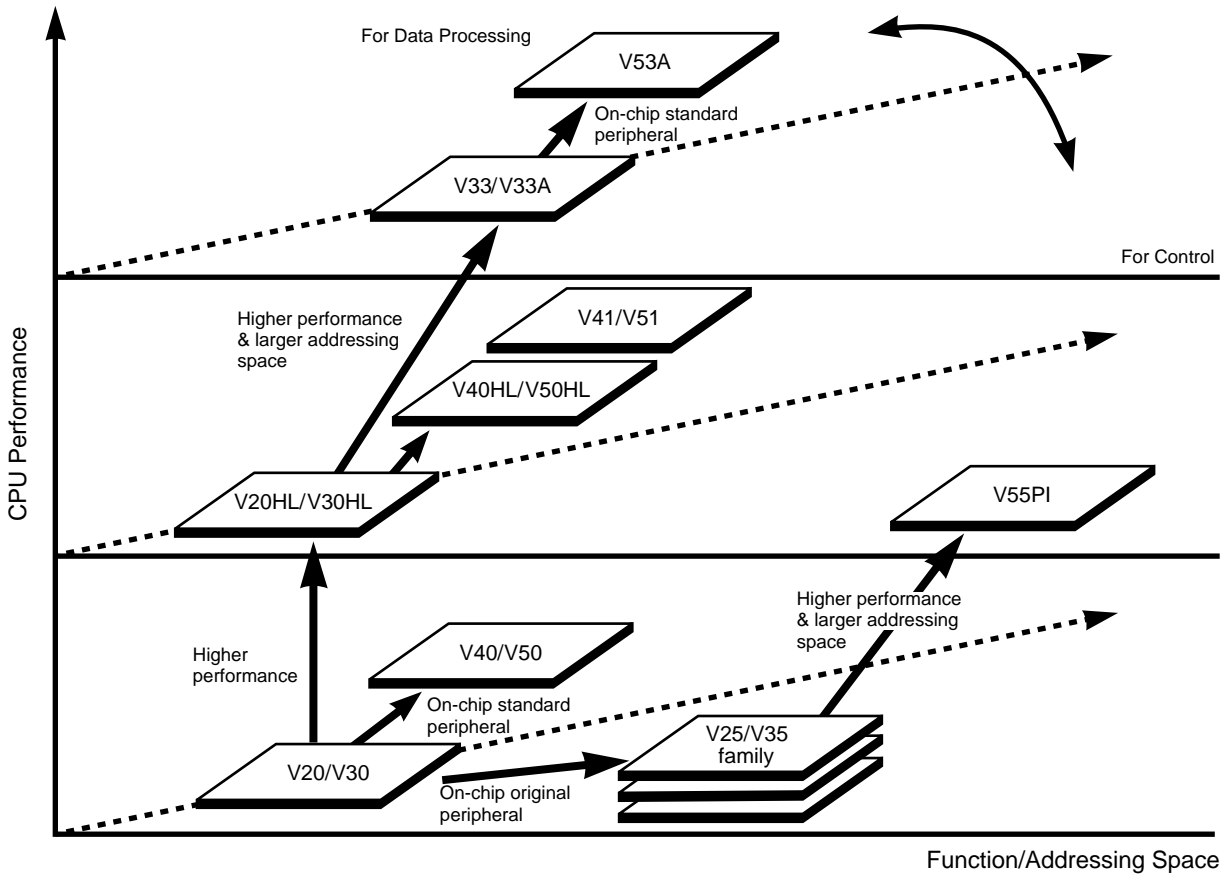
■ 78K/IV series (2/2)

| Type number | μ PD784915* | μ PD78P4916* |
|-------------------------------------|--|------------------|
| Number of instructions | 113 | |
| Minimum instruction execution cycle | 250 ns/16 MHz | |
| Internal memory | ROM size | 62K bytes (PROM) |
| | RAM size | 2048 bytes |
| Inter-rupts | External sources | 9 |
| | Internal sources | 20 |
| I/O pins | Inputs | 8 |
| | Outputs | 0 |
| | Input/output ports | 46 |
| A/D converter | 8-bit resolution ∞ 12 channels | |
| Analog circuit for VCR | CTL amplifier, RECCTL driver CFG amplifier DFG amplifier, DPG comparater, DPFG separation circuit Reel-FG comparater (2 channels) Csync comparater | |
| Timer/Counter | 22-bit FRC counter ∞ 1 16-bit timer ∞ 6 8-bit counter ∞ 2 5-bit UDC counter ∞ 1 | |
| PWM output | 16-bit PWM ∞ 3 (carrier freq.: 62.5 kHz) 8-bit PWM ∞ 3 (carrier freq.: 62.5 kHz) | |
| Serial interface | Clock synchronized ∞ 2 channels | |
| Features | <ul style="list-style-type: none"> • System-control and servo-control and timer-control for VCR • Super-timer-unit and Analog circuit for software servo control application such as VCR • CPU operation by subsystem clock (Low power operation) | |
| Package | <ul style="list-style-type: none"> • 100-pin QFP (14 ∞ 20 mm) | |

* : Under development

V Series™

■ 16-Bit V series product evolution



V Series

■ 16-Bit (1/2)

| Type number | Alias | Features | Internal bus | External bus | Real memory space | Operating frequency | Package |
|----------------|--------|--|--------------|------------------------|-------------------|---------------------|---|
| μ PD70108 | V20™ | CMOS process High speed, low power consumption Upward software and pin compatible, including interfacing with peripheral controller <u>Measures taken to increase speed</u> • Dual data bus system • Effective address generation circuit • Multiplication/division by programmable shifter • High speed processing by dedicated register | 16 bits | 8 bits | 1M bytes | 5/8/10 MHz | <ul style="list-style-type: none"> • 40-pin DIP • 44-pin QFJ • 52-pin QFP |
| μ PD70116 | V30™ | <u>Two operating modes</u> • 8080 emulation mode added <u>Standby function</u> | 16 bits | 16 bits | | | |
| μ PD70108H | V20HL™ | V20/V30 compatible, high speed low voltage operation • Capable of operating at 16 MHz (at 5 V) • Capable of operating at 3 V (at 8 MHz) • Clock can be stopped | 16 bits | 8 bits | 1M bytes | 10/12.5/16 MHz | <ul style="list-style-type: none"> • 40-pin DIP • 44-pin QFJ • 52-pin QFP • 52-pin TQFP |
| μ PD70116H | V30HL™ | | 16 bits | 16 bits | | | |
| μ PD70136A | V33A™ | Performance is approximately 4 times higher than V30 16M-byte address extension mode Internal bus sizing function 1 bus cycle = 2 clocks Internal floating point processor (μ PD72291) interface function | 16 bits | 8/16 bits (Selectable) | 16M bytes | 10/12.5/16 MHz | <ul style="list-style-type: none"> • 68-pin PGA • 68-pin QFJ |
| μ PD70136 | V33™ | | | | | | <ul style="list-style-type: none"> • 68-pin PGA • 68-pin QFJ • 74-pin QFP |
| μ PD70208 | V40™ | V20/V30 + peripheral controllers <u>V20/V30 CPU plus the following peripheral functions:</u> • 4-ch DMA controller • 3-ch 16-bit timer/counter • Interrupt controller • Clock generator • DRAM refresh controller • Programmable wait generator (Internal peripheral controllers are subset functions of μ PD7105X series) | 16 bits | 8 bits | 1M bytes | 8/10 MHz | <ul style="list-style-type: none"> • 68-pin QFJ • 68-pin PGA • 80-pin QFP |
| μ PD70216 | V50™ | | 16 bits | 16 bits | | | |
| μ PD70208H | V40HL™ | V40/V50 upper compatible, high speed low voltage operation • Capable of operating at 20 MHz (at 5 V) • Capable of operating at 3 V (at 10 MHz) • Selectable clock frequency • Enhanced peripheral functions | 16 bits | 8 bits | 1M bytes | 10/12.5/16/20 MHz | <ul style="list-style-type: none"> • 68-pin QFJ • 80-pin QFP • 80-pin TQFP |
| μ PD70216H | V50HL™ | | 16 bits | 16 bits | | | |
| μ PD70236A | V53A™ | V33A + enhanced peripheral functions of V40/V50 • DMA capable of supporting 16MB space • Dedicated BRG for timer/counter • Low power control · Stop mode · Halt mode · Variable clock mode • Capable of operating at 3 V and 10 MHz (only for V53A) • Capable of operating at 4 V and 16 MHz (only for V53A) | 16 bits | 8/16 bits (Selectable) | 16M bytes | 10/12.5/16/20 MHz | <ul style="list-style-type: none"> • 132-pin PGA • 120-pin QFP (0.8, 0.5 or 0.4 mm pin pitch) |

V Series

■ 16-Bit (2/2)

| Type number | Alias | Features | Internal bus | External bus | Real memory space | Operating frequency | Package |
|---------------|--------|---|--------------|------------------------|-------------------|---------------------|--|
| μ PD70270 | V41™ | <u>V20HL/30HL + Peripheral control unit</u> Each product is a microcomputer with a CPU core comprising NEC's "V20HL/V30HL" and peripheral circuits compatible with PC/XT™ • EMS Ver 4.0 support circuit • DMA control unit (equivalent to μ PD71037) | 16 bits | 8 bits | 16M bytes | 16 MHz | • 160-pin QFP |
| μ PD70280 | V51™ | • Interrupt control unit (equivalent to μ PD71059) • Timer/counter unit (equivalent to μ PD71037) • Keyboard control unit • Memory control unit • External I/O decoder • ROM decoder | 16 bits | 16 bits | | | |
| μ PD70433 | V55P1™ | <u>Software compatible with V20/30/25/35</u> • 16 general purpose register banks (512-byte internal RAM) <u>Following various peripheral features for mechanical control</u> • Multi-mode interrupt controller (Vectored/Register bank switching/Macro service) • 2 real time output ports for controlling stepping motors • 8-bit A/D converter with 4 inputs • 2 DMA controllers with intelligent modes • 5 16-bit timer/counters • 2 asynchronous/synchronous serial controllers • 8-bit parallel interface • Watchdog timer • MH/MR codec instructions | 16 bits | 8/16 bits (Selectable) | 16M bytes | 12.5/16 MHz | • 120-pin QFP (0.8 or 0.5 mm pin pitch) • 132-pin PGA |
| μ PD70320 | V25™ | <u>Software compatible with V20/V30.</u> <u>Following additional peripheral features including RAM:</u> • 2-ch DMA controller • 2-ch serial controller • 2-ch 16-bit timer/counter • Interrupt controller | 16 bits | 8 bits | 1M bytes | 8 MHz | • 84-pin QFJ • 94-pin QFP |
| μ PD70330 | V35™ | • 24 general purpose I/O port pins • 8 general purpose register banks • RAM 256B | 16 bits | 16 bits | | | |
| μ PD79011 | V25HS™ | CPU with built-in RTOS (internal ROM of V25/V35 to which real-time OS is transplanted) | 16 bits | 8 bits | 1M bytes | 8 MHz | • 84-pin QFJ • 94-pin QFP |
| μ PD79021 | V35HS™ | | 16 bits | 16 bits | | | |
| μ PD70325 | V25+™ | High speed version of V25/V35 DMA transfer function | 16 bits | 8 bits | 1M bytes | 8/10 MHz | • 84-pin QFJ • 94-pin QFP |
| μ PD70335 | V35+™ | | 16 bits | 16 bits | | | |

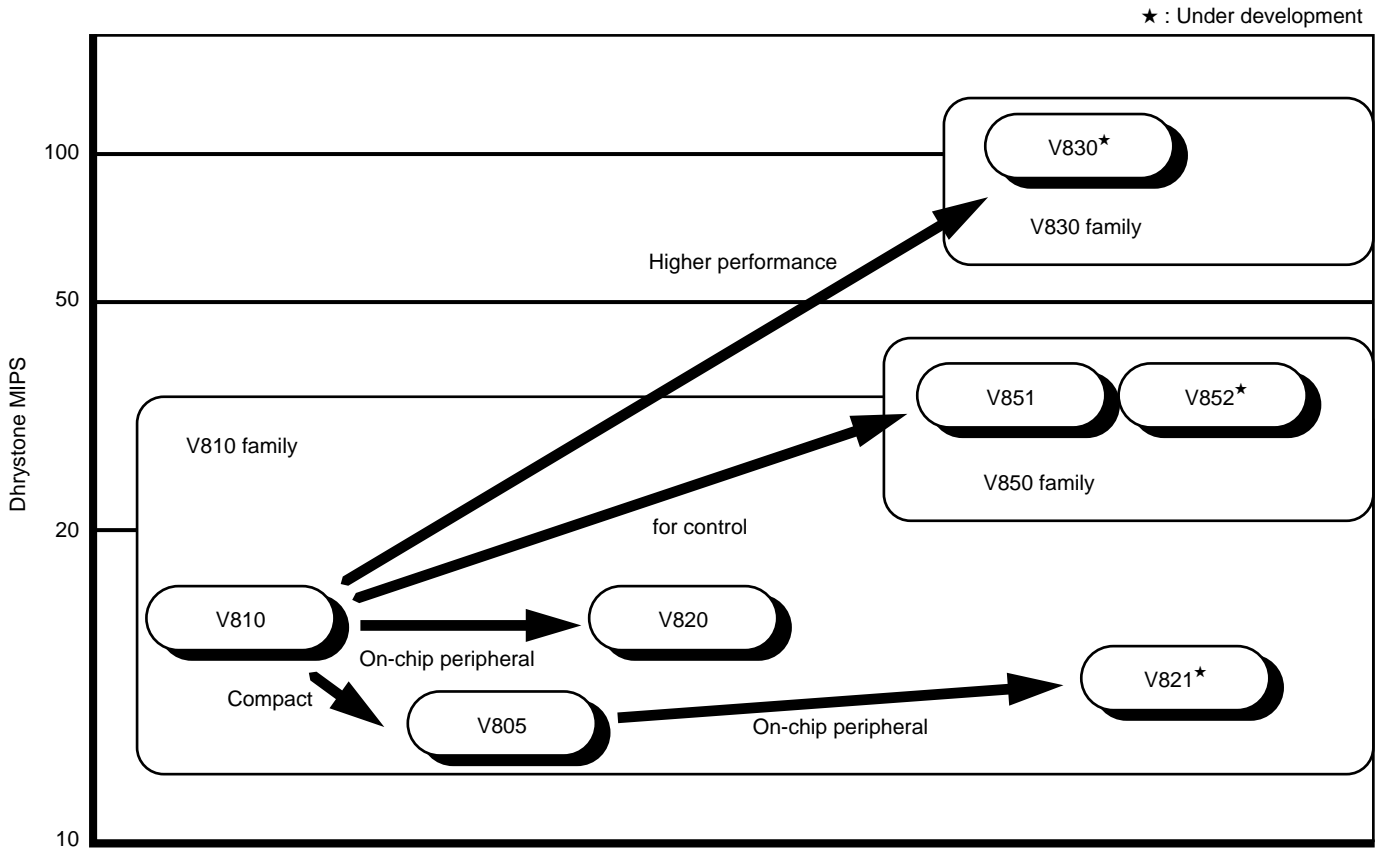
| |
|-----------------|
| V Series |
|-----------------|

■ 32-Bit

| Type number | Alias | Features | Address/data bus | Memory space | Operating frequency | Package |
|-----------------|-------|--|---------------------|--------------|---------------------|--|
| μPD70616 | V60™ | <ul style="list-style-type: none"> • Virtual memory (paging method) • Level protection architecture • 4-level hierarchical protection function for system multi-programming. • Abundant general registers • Thirty two 32-bit general registers for optimizing compiler • Refined instruction set • 2-address method: Arbitrary addressing mode can be used independently for source operand and destination operand. | 24 bits/ 16 bits | 4G bytes | 16 MHz | <ul style="list-style-type: none"> • 68-pin PGA |
| μPD70632 | V70™ | <ul style="list-style-type: none"> • Abundant address modes and data types • Auto increment/decrement mode for string process, and memory indirect addressing for pointer operation • Multiprocessor system • FRM function for increasing system reliability using two or more processors. • V20/V30 simulation mode | 32 bits/ 32 bits | | 20 MHz | <ul style="list-style-type: none"> • 132-pin PGA • 200-pin QFP |
| μPD70615 | V60 | <ul style="list-style-type: none"> • Identical with μPD70616 except that FRM function and V20/V30 emulation function are eliminated. High cost-to-performance chip | 24 bits/ 16 bits | | 16 MHz | <ul style="list-style-type: none"> • 120-pin QFP |

V Series

■ 32-Bit RISC V800 Series product evolution



V Series

■ 32-Bit RISC – V800 Series –

| Type number | Alias | Features | Address/data bus | Memory space | Performance/frequency | Package |
|---------------------------------------|-------|--|------------------|---|--|---|
| μ PD70732 | V810™ | <ul style="list-style-type: none"> 32-bit RISC architecture <ul style="list-style-type: none"> 1-instruction/clock with 5-stage pipeline 32 32-bit general purpose registers 1K-byte instruction cache | 32 bits/32 bits | 4G bytes | 18MIPS/25 MHz (Dhrystone) | <ul style="list-style-type: none"> 120-pin QFP 176-pin PGA |
| μ PD70731 | V805™ | <ul style="list-style-type: none"> Operation supply voltage 2.2 to 5.5 V Consumption power (TYP.) <ul style="list-style-type: none"> 500mW (V810 5 V, 25 MHz) 280mW (V805 5 V, 20 MHz) | 32 bits/16 bits | | 13MIPS/20 MHz (Dhrystone) | <ul style="list-style-type: none"> 100-pin QFP |
| μ PD70742 | V820™ | <ul style="list-style-type: none"> V810 core + peripheral controllers 2-ch Serial I/O 3-ch 16-bit timer/counter 4-ch 32-bit DMA controller Access controller Interrupt controller Clock generator | 32 bits/32 bits | | 18MIPS/25 MHz (Dhrystone) | <ul style="list-style-type: none"> 208-pin QFP 280-pin PGA |
| μ PD70741* | V821™ | <ul style="list-style-type: none"> V810 core + peripheral controllers Memory controller (DRAM, Page-ROM) 2-ch Serial I/O (UARTx1, CS1x1) 2-ch 16-bit timer/counter 2-ch DMA controller Interrupt controller Watchdog timer | 24 bits/16 bits | 4G bytes (Internal) 64M bytes (external MAX) | 16MIPS/25 MHz (Dhrystone) | <ul style="list-style-type: none"> 100-pin QFP |
| μ PD705100* | V830™ | <ul style="list-style-type: none"> High-performance RISC processor (V830 core) Multiplier (32 \times 32 \rightarrow 64-bit) Internal memory <ul style="list-style-type: none"> 4K-byte instruction cache 4K-byte data cache 4K-byte RAM for instruction 4K-byte RAM for data Consumption power (TARGET) 500mW (3.3 V, 100 MHz) | 32 bits/32 bits | 4G bytes | 118MIPS/100 MHz (Dhrystone) | <ul style="list-style-type: none"> 144-pin QFP |
| μ PD703000/ 70P3000/ 703001 | V851™ | <ul style="list-style-type: none"> 32-bit RISC (V850 core) 1 chip microcomputer Multiplier (16 \times 16 \rightarrow 32-bit) Internal memory <ul style="list-style-type: none"> 32K-byte ROM (μPD703001: ROM less), 1K-byte RAM 2-ch Serial I/O (UARTx1, CS1x1) 2-ch 16-bit timer/counter Interrupt controller Operation supply voltage <ul style="list-style-type: none"> 2.0 to 5.5 V (Mask ROM, ROM less) 2.7 to 5.5 V (PROM) Consumption power (TYP.) <ul style="list-style-type: none"> 207mW (5 V, 25 MHz), 267mW (5 V, 33 MHz)* | 24 bits/16 bits | 4G bytes (Internal) 16M bytes (external MAX) | 29MIPS/25 MHz 38MIPS/33 MHz* (Dhrystone, Except μ PD703001) | <ul style="list-style-type: none"> 100-pin QFP (μPD703000/70P3000/703001) 120-pin WQFN (μPD70P3000) |
| μ PD703002*/ 70P3002 | V852™ | <ul style="list-style-type: none"> 32-bit RISC (V850 core) 1 chip microcomputer Multiplier (16 \times 16 \rightarrow 32-bit) Internal memory <ul style="list-style-type: none"> 90K-byte ROM, 3K-byte RAM 4-ch Serial I/O (UARTx1, CS1x3) 2-ch 16-bit timer/counter Interrupt controller Operation supply voltage <ul style="list-style-type: none"> 2.0 to 5.5 V (Mask ROM) 2.7 to 5.5 V (PROM) Low consumption power | 24 bits/16 bits | 4G bytes (Internal) 16M bytes (external MAX) | 29MIPS/25 MHz (Dhrystone) | <ul style="list-style-type: none"> 100-pin QFP (μPD703000/70P3000) 120-pin WQFN (μPD70P3002) |

*: Under development

VR Series™

| Type number | Alias | Features | Address/ data bus | Virtual memory space | Performance | Package |
|------------------|------------------------|--|----------------------|---|---|--------------------------------|
| μPD30400 | V _R 4000PC™ | <ul style="list-style-type: none"> • 64-bit architecture • 2 operation per 1 clock execution with superpipelined processing • On chip floating point processing unit • On chip primary cache memory (instruction 8K + data 8K Byte) • Software uppered compatible with VR3000A • Internal 100 MHz, external 50 MHz operation | 36/64 | Kernel: 16EXA bytes User : 64G bytes | 41 SPEC int92 43 SPEC fp92 (Internal 100 MHz) | • 179-pin PGA |
| μPD30401 | V _R 4000SC™ | <ul style="list-style-type: none"> • Same function with V_R4000PC, furthermore on chip secondary cache memory controller supported • Internal 100 MHz, external 50 MHz operation | 36/64 | Kernel: 16EXA bytes User : 64G bytes | 62 SPEC int92 63 SPEC fp92 (Internal 100 MHz) | • 447-pin PGA |
| μPD30410 | V _R 4400PC™ | <ul style="list-style-type: none"> • V_R4000PC compatible • On chip primary cache (I16KB + D16KB) • Internal 200 MHz, external 100 MHz operation★ | 36/64 | Kernel: 16EXA bytes User : 64G bytes | 83 SPEC int92 92 SPEC fp92 (Internal 200 MHz) | • 179-pin PGA |
| μPD30412 | V _R 4400MC™ | <ul style="list-style-type: none"> • Same function with V_R4400PC, furthermore on chip secondary cache memory controller and correspond to multiprocessing system supported | 36/64 | Kernel: 16EXA bytes User : 64G bytes | 141 SPEC int92 143 SPEC fp92 (Internal 200 MHz) | • 447-pin PGA |
| μPD30450 | V _R 4200™ | <ul style="list-style-type: none"> • V_R4000PC compatible • Low power (1.5 W typ) • On chip primary cache (I16KB + D8KB) • Internal 80 MHz, external 40 MHz operation | 33/64 | Kernel: 16EXA bytes User : 8G bytes | 55 SPEC int92 30 SPEC fp92 (Internal 80 MHz) | • 208-pin QFP • 179-pin PGA |
| μPD30100★ | V _R 4100™ | <ul style="list-style-type: none"> • Low poewr (100 mW @33 MHz, 2.2 V) • 2 level power management • 64 bit architecture • On chip MMU | 32/32 | Kernel: 16EXA bytes User : 4G bytes | 40 MIPS (Internal 133 MHz) | • 100-pin QFP |
| μPD30200★ | V _R 4300™ | <ul style="list-style-type: none"> • High speed operation from 100 MHz pipe • Large on chip cache I16K + D8K byte • 64 bit architecture • High speed floating operation • On chip MMU | 32/32 | Kernel: 16EXA bytes User : 4G bytes | 70 SPEC int 45 SPEC fp92 (Internal 100 MHz) | • 120-pin QFP |

★: Under development

| |
|-------------------------------------|
| Microcomputer Peripheral LSI |
|-------------------------------------|

| Type number | Process | Function | Supply voltage | Clock frequency | Package | Remarks |
|---------------|---------|---|----------------|-----------------|--|---------|
| μ PD77C30 | CMOS | PCM \times ADPCM (Coding/decoding) | +5 V | 8.192 MHz | <ul style="list-style-type: none"> • 28-pin DIP • 44-pin QFJ | — |

■ V series peripheral LSI

| Type number | Process | Function | Supply voltage | Package |
|---------------|---------|---|----------------|--|
| μ PD71037 | CMOS | 8-bit DMA controller | +5 V | <ul style="list-style-type: none"> • 40-pin DIP • 44-pin QFJ |
| μ PD71051 | | Serial control unit | | <ul style="list-style-type: none"> • 28-pin SOP • 44-pin QFP |
| μ PD71054 | | Programmable timer/counter | | <ul style="list-style-type: none"> • 24-pin DIP • 28-pin QFJ |
| μ PD71055 | | Parallel interface unit | | <ul style="list-style-type: none"> • 40-pin DIP • 44-pin QFJ |
| μ PD71059 | | Interrupt control unit | | <ul style="list-style-type: none"> • 28-pin SOP • 44-pin QFP |
| μ PD71071 | | 16-bit DMA controller | | <ul style="list-style-type: none"> • 48-pin DIP • 52-pin QFP |
| μ PD71082 | | 8-bit latch Non-invert type | | <ul style="list-style-type: none"> • 20-pin DIP • 20-pin SOP |
| μ PD71083 | | 8-bit latch Invert type | | |
| μ PD71011 | | Clock generator | | <ul style="list-style-type: none"> • 18-pin DIP • 20-pin SOP |
| μ PD71084 | | Clock generator | | <ul style="list-style-type: none"> • 18-pin DIP • 20-pin SOP |
| μ PD71086 | | 8-bit bus transceiver Non-invert type | | <ul style="list-style-type: none"> • 20-pin DIP • 20-pin SOP |
| μ PD71087 | | 8-bit bus transceiver Invert type | | |
| μ PD71088 | | Bus controller | | <ul style="list-style-type: none"> • 120-pin QFP |
| μ PD71101 | | Composite peripheral LSI integrating μ PD71051 ∞ 2, μ PD71054, μ PD71055, μ PD71059, and BRG | | |
| μ PD71611 | | Clock generator for V60 | | <ul style="list-style-type: none"> • 20-pin DIP |
| μ PD71613 | | System controller for V60 | | |
| μ PD71621 | | Clock generator for V70 | | <ul style="list-style-type: none"> • 132-pin PGA |
| μ PD71641 | | Cache memory controller | | |
| μ PD72291 | | Floating point processor | | <ul style="list-style-type: none"> • 68-pin PGA |
| μ PD72691 | | | | |

■ VR series peripheral LSI

| Type number | Process | Function | Supply voltage | Package |
|----------------------------|---------|--|----------------|---|
| μ PD30311 (VR3010A) | CMOS | Floating point coprocessor (40/33 MHz operation) | +5 V | <ul style="list-style-type: none"> • 84-pin PGA • 84-pin PPGA |
| μ PD31441 | | Chip set for VR4000, VR4200, VR4400 | +3.3 V | <ul style="list-style-type: none"> • 240-pin QFP |
| μ PD31442 | | | | |

EMPTY PAGE

IC Memory

| | |
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| Dynamic RAM | 64 |
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Dynamic RAM

■ **Low Voltage Operation 64M Dynamic RAM**

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|--------------------------------|-------------|--------------------------------|-------------------------------------|---------------------------|-----------------|--------------------------|--|-----------------------------|
| | | | | Active (mA) | Standby (mA) | | | |
| 16M ∞ 4 | μPD4264400 | 50 60 70 | 8K/64* | 100 90 80 | 0.5 | 3.3±0.3 | • 32-pin SOJ (400 mil) • 32-pin TSOP II (400 mil) | Fast page |
| | μPD4265400 | 50 60 70 | 4K/64 | 130 110 100 | | | | |
| 8M ∞ 8 | μPD4264800 | 50 60 70 | 8K/64* | 105 95 85 | 0.5 | 3.3±0.3 | • 32-pin SOJ (400 mil) • 32-pin TSOP II (400 mil) | - |
| | μPD4265800 | 50 60 70 | 4K/64 | 135 115 105 | | | | |
| 4M ∞ 16 | μPD4264160 | 50 60 70 | 8K/64* | 110 100 90 | 0.5 | 3.3±0.3 | • 50-pin TSOP II (400 mil) | Fast page + Byte read/write |
| | μPD4265160 | 50 60 70 | 4K/64 | 140 120 110 | | | | |

* CBR/Hidden Refresh: 4K/64

■ **Low Voltage Operation 64M Dynamic RAM with Self Refresh**

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | | Supply voltage (V) | Package | Remarks |
|--------------------------------|--------------|--------------------------------|-------------------------------------|------------------------|-----------------|-------------------------|-------------------------|--------------------------|---|-----------|
| | | | | Active (mA) | Standby (mA) | Self refresh (μA) | Long refresh (μA) | | | |
| 16M ∞ 4 | μPD42S64400* | 50 60 70 | 8K/128* | 100 90 80 | 0.2 | 300 | 300 | 3.3±0.3 | • 32-pin SOJ (400 mil) • 32-pin TSOP II (400 mil) | Fast page |
| | μPD42S65400* | 50 60 70 | 4K/128 | 130 110 100 | | | | | | |
| 8M ∞ 8 | μPD42S64800* | 50 60 70 | 8K/128* | 105 95 85 | 0.2 | 300 | 300 | 3.3±0.3 | • 32-pin SOJ (400 mil) • 32-pin TSOP II (400 mil) | Fast page |
| | μPD42S65800* | 50 60 70 | 4K/128 | 135 115 105 | | | | | | |
| 4M ∞ 16 | μPD42S64160* | 50 60 70 | 8K/128* | 110 100 90 | 0.2 | 300 | 300 | 3.3±0.3 | • 50-pin TSOP II (400 mil) | Fast page |
| | μPD42S65160* | 50 60 70 | 4K/128 | 140 120 110 | | | | | | |

* CBR/Hidden Refresh: 4K/128

*: Under development

Dynamic RAM

■ **16M Dynamic RAM**

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|--------------------------------|-------------|--------------------------------|-------------------------------------|---------------------------|-----------------|--------------------------|--|-----------------------------|
| | | | | Active (mA) | Standby (mA) | | | |
| 4M ∞ 4 | μPD4216400 | 50 60 70 80 | 4K/64 | 100 90 80 70 | 1 | 5±10 % | • 26-pin SOJ (300 mil) • 26-pin TSOP II (300 mil) | Fast page |
| | μPD4217400 | 50 60 70 80 | 2K/32 | 10 110 100 90 | | | | |
| 2M ∞ 8 | μPD4216800 | 50 60 70 80 | 4K/64 | 100 90 80 70 | | | • 28-pin SOJ (400 mil) • 28-pin TSOP II (400 mil) | |
| | μPD4217800 | 50 60 70 80 | 2K/32 | 120 110 100 90 | | | | |
| 1M ∞ 16 | μPD4216160 | 60 70 80 | 4K/64 | 100 90 80 | | | • 42-pin SOJ (400 mil) • 50-pin TSOP II (400 mil) | Fast page + Byte read/write |
| | μPD4218160 | 60 70 80 | 1K/16 | 160 150 140 | | | | |

■ **16M Dynamic RAM with Self Refresh**

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | | Supply voltage (V) | Package | Remarks |
|--------------------------------|-------------|--------------------------------|-------------------------------------|-------------------------|-----------------|-------------------------|-------------------------|--------------------------|---|--------------------------------|
| | | | | Active (mA) | Standby (mA) | Self refresh (μA) | Long refresh (μA) | | | |
| 4M ∞ 4 | μPD42S16400 | 50 60 70 80 | 4K/128 | 100 90 80 70 | 0.25 | 250 | 450 | 5±10 % | • 26-pin SOJ (300 mil) • 26-pin TSOP II (300 mil) | Fast page |
| | μPD42S17400 | 50 60 70 80 | 2K/128 | 120 110 100 90 | | | | | | |
| 2M ∞ 8 | μPD42S16800 | 50 60 70 80 | 4K/128 | 100 90 80 70 | | | 450 | | • 28-pin SOJ (400 mil) • 28-pin TSOP II (400 mil) | |
| | μPD42S17800 | 50 60 70 80 | 2K/128 | 120 110 100 90 | | | | | | |
| 1M ∞ 16 | μPD42S16160 | 60 70 80 | 4K/128 | 100 90 80 | | | 450 | | • 42-pin SOJ (400 mil) • 50-pin TSOP II (400 mil) | Fast page + Byte read/write |
| | μPD42S18160 | 60 70 80 | 1K/128 | 160 150 140 | | | | | | |

Dynamic RAM

■ **Low Voltage Operation 16M Dynamic RAM**

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|--------------------------------|-------------|--------------------------------|-------------------------------------|---------------------------|-----------------|--------------------------|---|-----------------------------|
| | | | | Active (mA) | Standby (mA) | | | |
| 4M ∞ 4 | μPD4216400L | 60 70 80 | 4K/64 | 80 70 60 | 0.5 | 3.3±0.3 | • 26-pin SOJ (300 mil) • 26-pin TSOP II (300 mil) | Fast page |
| | μPD4217400L | 60 70 80 | 2K/32 | 100 90 80 | | | | |
| 2M ∞ 8 | μPD4216800L | 60 70 80 | 4K/64 | 80 70 60 | 0.5 | 3.3±0.3 | • 28-pin SOJ (400 mil) • 28-pin TSOP II (400 mil) | - |
| | μPD4217800L | 60 70 80 | 2K/32 | 100 90 80 | | | | |
| 1M ∞ 16 | μPD4216160L | 60 70 80 | 4K/64 | 90 80 70 | 0.5 | 3.3±0.3 | • 42-pin SOJ (400 mil) • 50-pin TSOP II (400 mil) | Fast page + Byte read/write |
| | μPD4218160L | 60 70 80 | 1K/16 | 150 140 130 | | | | |

■ **Low Voltage Operation 16M Dynamic RAM with Self Refresh**

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | | Supply voltage (V) | Package | Remarks |
|--------------------------------|--------------|--------------------------------|-------------------------------------|------------------------|-----------------|-------------------------|-------------------------|--------------------------|---|--------------------------------|
| | | | | Active (mA) | Standby (mA) | Self refresh (μA) | Long refresh (μA) | | | |
| 4M ∞ 4 | μPD42S16400L | 60 70 80 | 4K/128 | 80 70 60 | 0.15 | 150 | 220 | 3.3±0.3 | • 26-pin SOJ (300 mil) • 26-pin TSOP II (300 mil) | Fast page |
| | μPD42S17400L | 60 70 80 | 2K/128 | 100 90 80 | | | 200 | | | |
| 2M ∞ 8 | μPD42S16800L | 60 70 80 | 4K/128 | 80 70 60 | 0.15 | 150 | 220 | 3.3±0.3 | • 28-pin SOJ (400 mil) • 28-pin TSOP II (400 mil) | |
| | μPD42S17800L | 60 70 80 | 2K/128 | 100 90 80 | | | 200 | | | |
| 1M ∞ 16 | μPD42S16160L | 60 70 80 | 4K/128 | 90 80 70 | 0.15 | 150 | 220 | 3.3±0.3 | • 42-pin SOJ (400 mil) • 50-pin TSOP II (400 mil) | Fast page + Byte read/write |
| | μPD42S18160L | 60 70 80 | 1K/128 | 150 140 130 | | | 180 | | | |

| |
|--------------------|
| Dynamic RAM |
|--------------------|

■ 16M Dynamic RAM (Hyper Page Mode*)

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|--------------------------------|-------------|--------------------------------|-------------------------------------|---------------------------|-----------------|--------------------------|--|---------------------------------|
| | | | | Active (mA) | Standby (mA) | | | |
| 4M ∞ 4 | μPD4216405 | 50 60 70 80 | 4K/64 | 100 90 80 70 | 1 | 5±10 % | • 26-pin SOJ (300 mil) • 26-pin TSOP II (300 mil) | Hyper page |
| | μPD4217401 | 50 60 70 80 | 2K/32 | 10 110 100 90 | | | | |
| 2M ∞ 8 | μPD4217801 | 50 60 70 80 | 2K/32 | 120 110 100 90 | | | • 28-pin SOJ (400 mil) • 28-pin TSOP II (400 mil) | |
| 1M ∞ 16 | μPD4216161 | 60 70 80 | 4K/64 | 100 90 80 | | | • 42-pin SOJ (400 mil) • 50-pin TSOP II (400 mil) | Hyper page + Byte read/write |
| | μPD4218161 | 60 70 80 | 1K/16 | 160 150 140 | | | | |

*: Hyper Page Mode is equivalent to EDO

■ 16M Dynamic RAM with Self Refresh (Hyper Page Mode*)

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | | Supply voltage (V) | Package | Remarks |
|--------------------------------|-------------|--------------------------------|-------------------------------------|-------------------------|-----------------|-------------------------|-------------------------|--------------------------|---|---------------------------------|
| | | | | Active (mA) | Standby (mA) | Self refresh (μA) | Long refresh (μA) | | | |
| 4M ∞ 4 | μPD42S16405 | 50 60 70 80 | 4K/128 | 100 90 80 70 | 0.25 | 250 | 450 | 5±10 % | • 26-pin SOJ (300 mil) • 26-pin TSOP II (300 mil) | Hyper page |
| | μPD42S17401 | 50 60 70 80 | 2K/128 | 120 110 100 90 | | | | | | |
| 2M ∞ 8 | μPD42S17801 | 50 60 70 80 | 2K/128 | 120 110 100 90 | | | 400 | | • 28-pin SOJ (400 mil) • 28-pin TSOP II (400 mil) | |
| 1M ∞ 16 | μPD42S16161 | 60 70 80 | 4K/128 | 100 90 80 | | | 450 | | • 42-pin SOJ (400 mil) • 50-pin TSOP II (400 mil) | Hyper page + Byte read/write |
| | μPD42S18161 | 60 70 80 | 1K/128 | 160 150 140 | | | 350 | | | |

*: Hyper Page Mode is equivalent to EDO

Dynamic RAM

■ **Low Voltage Operation 16M Dynamic RAM (Hyper Page Mode*)**

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|--------------------------------|--------------|--------------------------------|-------------------------------------|---------------------------|-----------------|--------------------------|---|---------------------------------|
| | | | | Active (mA) | Standby (mA) | | | |
| 4M ∞ 4 | μPD42164005L | 60 70 80 | 4K/64 | 80 70 60 | 0.5 | 3.3±0.3 | • 26-pin SOJ (300 mil) • 26-pin TSOP II (300 mil) | Hyper page |
| | μPD4217401L | 60 70 80 | 2K/32 | 100 90 80 | | | | |
| 2M ∞ 8 | μPD4217801L | 60 70 80 | 2K/32 | 100 90 80 | 0.5 | 3.3±0.3 | • 28-pin SOJ (400 mil) • 28-pin TSOP II (400 mil) | - |
| 1M ∞ 16 | μPD4216161L | 60 70 80 | 4K/64 | 90 80 70 | | | | |
| | μPD4218161L | 60 70 80 | 1K/16 | 150 140 130 | 0.5 | 3.3±0.3 | • 42-pin SOJ (400 mil) • 50-pin TSOP II (400 mil) | Hyper page + Byte read/write |

*: Hyper Page Mode is equivalent to EDO

■ **Low Voltage Operation 16M Dynamic RAM with Self Refresh (Hyper Page Mode*)**

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | | Supply voltage (V) | Package | Remarks |
|--------------------------------|--------------|--------------------------------|-------------------------------------|------------------------|-----------------|-------------------------|-------------------------|--------------------------|---|---------------------------------|
| | | | | Active (mA) | Standby (mA) | Self refresh (μA) | Long refresh (μA) | | | |
| 4M ∞ 4 | μPD42S16401L | 60 70 80 | 4K/128 | 80 70 60 | 0.15 | 150 | 220 | 3.3±0.3 | • 26-pin SOJ (300 mil) • 26-pin TSOP II (300 mil) | Hyper page |
| | μPD42S17401L | 60 70 80 | 2K/128 | 100 90 80 | | | | | | |
| 2M ∞ 8 | μPD42S17801L | 60 70 80 | 2K/128 | 100 90 80 | 0.15 | 150 | 200 | 3.3±0.3 | • 28-pin SOJ (400 mil) • 28-pin TSOP II (400 mil) | - |
| 1M ∞ 16 | μPD42S16161L | 60 70 80 | 4K/128 | 90 80 70 | | | | | | |
| | μPD42S18161L | 60 70 80 | 1K/128 | 150 140 130 | 0.15 | 150 | 180 | 3.3±0.3 | • 42-pin SOJ (400 mil) • 50-pin TSOP II (400 mil) | Hyper page + Byte read/write |

*: Hyper Page Mode is equivalent to EDO

Dynamic RAM

■ 4M Dynamic RAM

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | Supply voltage (V) | Package | Remarks |
|--------------------------------|------------------|--------------------------------|-------------------------------------|------------------------|-----------------|-------------------------------|--------------------------|--|-----------------------------|
| | | | | Active (ms) | Standby (mA) | Long refresh (μ A) | | | |
| 1M ∞ 4 | μ PD424400 | 60 70 | 1K/16 | 120 100 | 1 | – | 5 \pm 10 % | • 26-pin SOJ (300 mil) • 26-pin TSOP II (300 mil) | Fastpage |
| | μ PD424400-L | 60 70 | 1K/128 | 120 100 | 0.2 | 300 | | | |
| 512K ∞ 8 | μ PD424800 | 60 70 80 | 1K/16 | 105 105 95 | 1 | – | | • 28-pin SOJ (400 mil) • 28-pin TSOP II (400 mil) | |
| 256K ∞ 16 | μ PD424260 | 60 70 80 | 512/8 | 160 160 145 | | | | • 40-pin SOJ (400 mil) • 44-pin TSOP II (400 mil) | Fastpage Byte read/write |

■ 4M Dynamic RAM with Self Refresh

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | | Supply voltage (V) | Package | Remarks |
|--------------------------------|-----------------|--------------------------------|-------------------------------------|------------------------|-----------------|-------------------------------|-------------------------------|--------------------------|--|-----------------------------|
| | | | | Active (ms) | Standby (mA) | Self refresh (μ A) | Long refresh (μ A) | | | |
| 1M ∞ 4 | μ PD42S4400 | 60 70 | 1K/128 | 120 100 | 0.15 | 150 | 200 | 5 \pm 10 % | • 26-pin SOJ (300 mil) • 26-pin TSOP II (300 mil) | Fastpage |
| 512K ∞ 8 | μ PD42S4800 | 60 70 80 | 1K/128 | 105 105 95 | | | | | | |
| 256K ∞ 16 | μ PD42S4260 | 60 70 80 | 512/128 | 160 160 145 | | | | | • 40-pin SOJ (400 mil) • 44-pin TSOP II (400 mil) | Fastpage Byte read/write |

■ Low Voltage Operation 4M Dynamic RAM

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|--------------------------------|------------------|--------------------------------|-------------------------------------|------------------------|-----------------|--------------------------|--|-----------------------------|
| | | | | Active (ms) | Standby (mA) | | | |
| 256K ∞ 16 | μ PD424260AL | 60 70 80 | 512/8 | 80 70 60 | 0.5 | 3.3 \pm 0.3 | • 40-pin SOJ (400 mil) • 44-pin TSOP II (400 mil) | Fastpage Byte read/write |

■ Low Voltage Operation 4M Dynamic RAM with Self Refresh

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | | Supply voltage (V) | Package | Remarks |
|--------------------------------|-------------------|--------------------------------|-------------------------------------|------------------------|-----------------|-------------------------------|-------------------------------|--------------------------|--|-----------------------------|
| | | | | Active (ms) | Standby (mA) | Self refresh (μ A) | Long refresh (μ A) | | | |
| 256K ∞ 16 | μ PD42S4260AL | 60 70 80 | 512/128 | 80 70 60 | 0.08 | 80 | 100 | 3.3 \pm 0.3 | • 40-pin SOJ (400 mil) • 44-pin TSOP II (400 mil) | Fastpage Byte read/write |

Dynamic RAM

■ **4M Dynamic RAM (Hyper Page Mode*)**

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | Supply voltage (V) | Package | Remarks |
|--------------------------------|----------------|--------------------------------|-------------------------------------|------------------------|-----------------|-------------------------------|--------------------------|--|-------------------------------|
| | | | | Active (ms) | Standby (mA) | Long refresh (μ A) | | | |
| 256K ∞ 16 | μ PD424210 | 60-G 70 | 512/8 | 160 150 | 1 | – | 5 \pm 10 % | • 40-pin SOJ (400 mil) • 44-pin TSOP II (400 mil) | Hyper page Byte read/write |

*: Hyper Page Mode is equivalent to EDO

■ **4M Dynamic RAM with Self Refresh (Hyper Page Mode*)**

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | | Supply voltage (V) | Package | Remarks |
|--------------------------------|-----------------|--------------------------------|-------------------------------------|------------------------|-----------------|-------------------------------|-------------------------------|--------------------------|--|-------------------------------|
| | | | | Active (ms) | Standby (mA) | Self refresh (μ A) | Long refresh (μ A) | | | |
| 256K ∞ 16 | μ PD42S4210 | 60-G 70 | 512/128 | 160 150 | 0.15 | 150 | 200 | 5 \pm 10 % | • 40-pin SOJ (400 mil) • 44-pin TSOP II (400 mil) | Hyper page Byte read/write |

*: Hyper Page Mode is equivalent to EDO

■ **Low Voltage Operation 4M Dynamic RAM (Hyper Page Mode*)**

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|--------------------------------|------------------|--------------------------------|-------------------------------------|------------------------|-----------------|--------------------------|--|-------------------------------|
| | | | | Active (ms) | Standby (mA) | | | |
| 256K ∞ 16 | μ PD424210AL | 60 70 80 | 512/8 | 80 70 60 | 0.5 | 3.3 \pm 0.3 | • 40-pin SOJ (400 mil) • 44-pin TSOP II (400 mil) | Hyper page Byte read/write |

*: Hyper Page Mode is equivalent to EDO

■ **Low Voltage Operation 4M Dynamic RAM with Self Refresh (Hyper Page Mode*)**

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | | Supply voltage (V) | Package | Remarks |
|--------------------------------|-------------------|--------------------------------|-------------------------------------|------------------------|-----------------|-------------------------------|-------------------------------|--------------------------|--|-------------------------------|
| | | | | Active (ms) | Standby (mA) | Self refresh (μ A) | Long refresh (μ A) | | | |
| 256K ∞ 16 | μ PD42S4210AL | 60 70 80 | 512/128 | 80 70 60 | 0.08 | 80 | 100 | 3.3 \pm 0.3 | • 40-pin SOJ (400 mil) • 44-pin TSOP II (400 mil) | Hyper page Byte read/write |

*: Hyper Page Mode is equivalent to EDO

| |
|--------------------|
| Dynamic RAM |
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■ Synchronous DRAM

| Organization (words ∞ bits) | Part number | Cycle time MIN. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | Inter- face | Supply voltage (V) | Package |
|--------------------------------|-----------------|----------------------------|-------------------------------------|---|--------------------------------------|-------------------------|----------------|--------------------------|-------------------------------|
| | | | | Active Normal/Burst (Grade-10, C.L.=3) (mA) | Standby (Power down Mode) (mA) | Self refresh (mA) | | | |
| 4M ∞ 4 | μ PD4516421 | 10 (100 MHz) | 2K/32 | 80 mA/150 mA (MAX.) | 2 | 2 | LVTTL | 3.3±0.3 | • 44-pin TSOP II (400 mil) |
| 2M ∞ 8 | μ PD4516821 | 12 (83 MHz) | | 85 mA/165 mA (MAX.) | | | | | |
| 1M ∞ 16 | μ PD4516161 | 13 (75 MHz) 15 (66 MHz) | | 90 mA/210 mA (MAX.) | | | | | |

C.L. = CAS Latency

■ Rambus™ DRAM (under development)

| Organization (words ∞ bits) | Part number | | Operating frequency (MHz) | Supply voltage (V) | Maximum supply current (mA) | Package |
|--------------------------------|-----------------|------|---------------------------------|--------------------|-----------------------------|-------------------------------------|
| 2M ∞ 9 | μ PD488170L | -A50 | 250 | 3.3 ±0.15 | 250 | • 32-pin SVP • 72/36-pin SSOP |
| | | -A40 | 200 | | | |
| 2M ∞ 8 | μ PD488130L | -A50 | 250 | | | |
| | | -A40 | 200 | | | |

Dynamic RAM Module

■ **SIMM**

| Capacity (byte) | Organiza- tion (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | Supply voltage (V) | Package | Remarks | |
|--------------------|--|---------------------|--------------------------------|-----------------------------|-----------------|--------------------------|--|---|-------------------------------|
| | | | | Active (mA) | Standby (mA) | | | | |
| 32M | 8M ∞ 36 | MC-428000A36 | 60 70 80 | 1420 1260 1140 | 24 | 5±10 % | • 72-pin SIMM socket type (solder-coated/gold-plated) | Fast page | |
| | | MC-428000A32 | 60 70 80 | 860 780 | 16 | | | Hyper page (EDO) | |
| | MC-428000F32 | | 60 70 | 940 860 | 16 | | | | |
| 16M | 4M ∞ 36 | MC-424000A36 | 60 70 80 | 1360 1200 1080 | 12 | | 5±10 % | • 72-pin SIMM socket type socket type (solder-coated/gold-plated) | Fast page |
| | | MC-424000A32 | 60 70 80 | 880 800 720 | 8 | | | | Hyper page (EDO) |
| | MC-424000F32 | | 60 70 | 880 800 | 8 | | | | |
| 8M | 2M ∞ 36 | MC-422000A36 | 60 70 80 100 | 1300 1180 1060 940 | 24 | 5±10 % | | | Fast page |
| | | MC-422000A32 | 60 70 80 | 324 304 284 | 4 | | | | Fast page 16M DRAM Base |
| | MC-422000F32 | | 60 70 | 324 304 | 4 | | | | Hyper page (EDO) |
| 4M | 1M ∞ 36 | MC-421000A36 | 60 70 80 100 | 1240 1120 1000 880 | 12 | | 5±10 % | • 72-pin SIMM socket type socket type (solder-coated/gold-plated) | Fast page |
| | | MC-421000A32 | 60 70 80 | 320 300 280 | 2 | | | | Fast page 16M DRAM Base |
| | MC-421000F32 | | 60 70 | 320 300 | 2 | | | | Hyper page (EDO) |

■ **SOD (SOD: Small Outline DIMM, DIMM: Dual Inline Memory Module)**

| Organiza- tion (words ∞ bits) | Bank | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | | Supply voltage (V) | Package | Mounted devices | Remarks |
|--|------|-------------------------|--------------------------------|-------------------------------------|------------------------|-----------------|-------------------------|--------------------------|--|--------------------------|-------------------------------|
| | | | | | Active (mA) | Standby (mA) | Self refresh (μA) | | | | |
| 1M ∞ 32 | 1 | MC-42S1000LAD32S | 60 70 80 | 1K/128 | 300 280 260 | 1 | 360 | 3.3±0.3 | • 72-pin SOD Socket type (Gold plated) | D42S18160LG5 ∞ 2 pcs. | Fast page Self refresh |
| 2M ∞ 32 | 1 | MC-42S2000LAB32S | 60 70 80 | 2K/128 | 400 360 320 | 2 | 600 | | | D42S17800LG5 ∞ 4 pcs. | |
| | | | | | | | | | | 2 | |
| 4M ∞ 32 | 1 | MC-42S4000LAC32S | 60 70 80 | 2K/128 | 800 720 640 | 4 | 1200 | | | D42S17400LG3 ∞ 8 pcs. | |
| | | | | | | | | | | 2 | |

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| Dynamic RAM Module |
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■ 8 Byte DIMM (DIMM: Dual Inline Memory Module)

| Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|--------------------------------|-----------------|--------------------------------|-------------------------------------|---------------------------|-----------------|--------------------------|--|------------------|
| | | | | Active (mA) | Standby (mA) | | | |
| 1M ∞ 64 | MC-421000AA64 | 60 70 80 | 1K/16 | 650 610 570 | 68 | 5.0±0.25 | • 168-pin DIMM Socket type (Gold plated) | Fast page |
| | MC-421000FA64 | 60 70 | | 650 610 | | | | Hyper page (EDO) |
| 2M ∞ 64 | MC-422000AA64 | 60 70 80 | | 660 620 580 | 72 | | | Fast page |
| | MC-422000FA64 | 60 70 | | 660 620 | | | | Hyper page (EDO) |
| 1M ∞ 72 (ECC) | MC-421000AD72 | 60 70 80 | | 890 810 750 | 70 | | | Fast page |
| 2M ∞ 72 (ECC) | MC-422000AB72 | 60 70 80 | | 1000 910 820 | 73 | | | Hyper page (EDO) |
| | MC-422000FB72 | 60 70 | | 1000 910 | | | | |
| | MC-422000LAB72 | 60 70 80 | | 910 820 730 | 14 | | | 3.3±0.3 |
| | MC-422000LFB72 | 60 70 | 910 820 | Hyper page (EDO) | | | | |
| 4M ∞ 72 (ECC) | MC-424000AB72 | 60 70 80 | 1990 1810 1630 | 82 | 5.0±0.25 | Fast page | | |
| | MC-424000AC72 | 60 70 80 | 1630 1480 1270 | | | | | |
| | MC-424000FB72* | 60 70 | 1990 1810 | Hyper page (EDO) | | | | |
| | MC-424000FC72 | 60 70 | 1630 1450 | | | | | |
| | MC-424000LAB72 | 60 70 80 | 1810 1630 1450 | 19 | 3.3±0.3 | Fast page | | |
| | MC-424000LAC72 | 70 80 | 1270 1090 | | | Hyper page (EDO) | | |
| | MC-424000LFB72* | 60 70 | 1810 1630 | Hyper page (EDO) | | | | |
| | MC-424000LFC72 | 60 70 | 1450 1270 | | | | | |

*: Under development

Dynamic RAM Module

■ **Synchronous DRAM DIMM**

| Organization (words ∞ bits) | Part number | Minimum cycle time MAX. (ns) | Refresh cycle (cycles/ ms) | Maximum supply current | | Supply voltage (V) | Package | Remarks | | |
|--------------------------------|----------------------|--|-------------------------------------|---------------------------|-----------------|--------------------------|--|------------|--|--|
| | | | | Active (mA) | Standby (mA) | | | | | |
| 2M ∞ 72 | MC-452AA72 | 10 12 13 | 2K/32 | 765 720 675 | 18 | 3.3±0.3 | • 200-pin DIMM Socket type (Gold plated) | Unbuffered | | |
| | MC-452BA72 | 10 12 13 | | TBD | TBD | | | Buffered | | |
| 2M ∞ 80 | MC-452AA80 | 10 12 13 | | 850 800 750 | 20 | | | Unbuffered | | |
| | MC-454BA80 | 10 12 13 | | TBD | TBD | | | Buffered | | |
| 4M ∞ 72 | MC-454BA/BC72 | 10 12 13 | | | | | | | | |
| 4M ∞ 80 | MC-454BA/BC80 | 10 12 13 | | | | | | | | |

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| Static RAM |
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■ Low Power Static RAM

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | | Supply voltage (V) | Package | Remarks |
|-----------------|-----------------------------|---|-----------------------|------------------------|--------------|---------------------|---|--|------------|
| | | | | Active (mA) | Standby (mA) | Data retention (μA) | | | |
| 256K | 32K ∞ 8 | μPD43256B with \overline{CS} , \overline{OE} | 70 | 45 | 0.1 | 50 | 5±10 % | <ul style="list-style-type: none"> 28-pin DIP (600 mil) 28-pin SOP (450 mil) 32-pin TSOP I (600 mil) 28-pin TSOP I (8 ∞ 13.4 mm) | L version |
| | | | 85 | 45 | 0.05 | 20 | | | LL version |
| | | μPD43257B with $\overline{CE1}$, $\overline{CE2}$ | 70 | 45 | 0.1 | 50 | | | L version |
| | | | 85 | 45 | 0.05 | 20 | | | LL version |
| 1M | 128K ∞ 8 | μPD431000A with $\overline{CE1}$, $\overline{CE2}$, \overline{OE} | 70 | 70 | 0.1 | 50 | <ul style="list-style-type: none"> 32-pin DIP (600 mil) 32-pin SOP (525 mil) 32-pin TSOP I (8 ∞ 20 mm) | L version | |
| | | | 85 | | 0.05 | 20 | | LL version | |
| | | | 100 | | | | | | |

■ Low Power Static RAM Low Voltage (2.7 to 5.5 V) Operation

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | | Supply voltage (V) | Package |
|-----------------|-----------------------------|---|-----------------------|------------------------|--------------|---------------------|-----------------------------|--|
| | | | | Active (mA) | Standby (μA) | Data retention (μA) | | |
| 256K | 32K ∞ 8 | μPD43256B-B12 with \overline{CS} , \overline{OE} | 120 | 20 | 25 | 20 | 3±10 % | <ul style="list-style-type: none"> 28-pin SOP (450 mil) 32-pin TSOP I (600 mil) 28-pin TSOP I (8 ∞ 13.4 mm) |
| | | | | 45 | 50 | | 3.3 < V _{CC} < 4.5 | |
| | | | 85 | | | 5±10 % | | |
| 1M | 128K ∞ 8 | μPD431000A-B15 with $\overline{CE1}$, $\overline{CE2}$, \overline{OE} | 150 | 20 | 25 | 20 | 3±10 % | <ul style="list-style-type: none"> 32-pin SOP (525 mil) 32-pin TSOP I (8 ∞ 20 mm) |
| | | | | 70 | 50 | | 3.3 < V _{CC} < 4.5 | |
| | | | 100 | | | 5±10 % | | |

■ Low Power Static RAM Low Voltage (3.0 to 5.5 V) Operation

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | | Supply voltage (V) | Package |
|-----------------|-----------------------------|---------------|-----------------------|------------------------|--------------|---------------------|--------------------|--|
| | | | | Active (mA) | Standby (mA) | Data retention (μA) | | |
| 256K | 32K ∞ 8 | μPD43256B-A10 | 100 | 45 | 50 | 20 | 3.3 ± 0.3 V | <ul style="list-style-type: none"> 28-pin SOP (450 mil) 32-pin TSOP I (600 mil) 28-pin TSOP I (8 ∞ 13.4 mm) |
| | | | 85 | | | | 5±10 % | |
| | | μPD43256B-A12 | 120 | 3.3 ± 0.3 V | | | | |
| | | | 85 | 5±10 % | | | | |

Static RAM

■ **Fast Static RAM**

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | | Supply voltage (V) | Package | Remarks |
|-----------------|-----------------------------|-------------|-----------------------|------------------------|--------------|---------------------|--------------------|------------------------|---------|
| | | | | Active (mA) | Standby (mA) | Data retention (μA) | | | |
| 1M | 128K ∞ 8 | μPD431008 | 15 17 20 | 160 150 140 | 10 | - | 5±10 % | • 32-pin SOJ (400 mil) | - |
| | 128K ∞ 9 | μPD431009 | 15 17 20 | 160 150 140 | | | | | |
| | 64K ∞ 16 | μPD431016 | 15 17 20 | 240 230 220 | | | | | |
| | 64K ∞ 18 | μPD431018 | 15 17 20 | 240 230 220 | | | | | |
| 4M | 1M ∞ 4 | μPD434004 | 20 25 140 | 150 140 | | | | • 32-pin SOJ (400 mil) | |
| | 512K ∞ 8 | μPD434008 | 20 25 170 | 190 170 | | | | | |

■ **Fast Static RAM Low Voltage (3.0 to 3.6 V) Operation**

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | | Supply voltage (V) | Package | |
|-----------------|-----------------------------|-------------|-----------------------|------------------------|--------------|---------------------|--------------------|------------------------|-----|
| | | | | Active (mA) | Standby (mA) | Data retention (μA) | | | |
| 1M | 128K ∞ 8 | μPD431008L | 17 20 | 120 | 5 | - | 3.3±0.3 | • 32-pin SOJ (400 mil) | |
| | 128K ∞ 9 | μPD431009L | | | | | | | 100 |
| | 64K ∞ 16 | μPD431016L | | | | | | | |
| | 64K ∞ 18 | μPD431018L | | | | | | | |

■ **Synchronous Static RAM**

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | | Supply voltage (V) | Package | Remarks |
|-----------------|-----------------------------|-------------|-----------------------|------------------------|--------------|---------------------|--------------------|----------------|---------|
| | | | | Active (mA) | Standby (mA) | Data retention (μA) | | | |
| 1M | 32K ∞ 32 | μPD431232L | 8 9 12 | 250 | 2 | - | 3.3±0.2 | • 100-pin TQFP | - |

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|-------------------|
| Static RAM |
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■ BiCMOS Fast Static RAM

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | | Supply voltage (V) | Package | Remarks |
|-----------------|-----------------------------|-------------|-----------------------|------------------------|--------------|---------------------|--------------------|------------------------|---------|
| | | | | Active (mA) | Standby (mA) | Data retention (μA) | | | |
| 256K | 32K ∞ 8 | μPD46258 | 6 7 | – | – | – | 5±10 % | • 32-pin SOJ (300 mil) | – |
| 1M | 128K ∞ 8 | μPD461008 | 8 9 10 | 185 | | | | • 32-pin SOJ (400 mil) | |

■ BiCMOS Fast Static RAM (3.3 V ± 0.3 V)

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | | Supply voltage (V) | Package | Remarks |
|-----------------|-----------------------------|-------------|-----------------------|------------------------|--------------|---------------------|----------------------|----------------------------|---------|
| | | | | Active (mA) | Standby (mA) | Data retention (μA) | | | |
| 256K | 32K ∞ 8 | μPD46259L | 12 | 130 | 20 | – | 3.3±0.3 | • 32-pin SOJ (300 mil) | – |
| 1M | 64K ∞ 16 | μPD461016L | 10 12 | 260 | 70 | – | +0.3 3.3 –0.15 | • 44-pin SOJ (400 mil) | |
| | | | | | | | 3.3±0.3 | | |
| | 64K ∞ 18 | μPD461018L | 10 12 | 260 | | | +0.3 3.3 –0.15 | • 44-pin TSOP II (400 mil) | |
| | | | | | | 3.3±0.3 | | | |

■ BiCMOS Synchronous Static RAM

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | | Supply voltage (V) | Package | Remarks |
|-----------------|-----------------------------|-------------|-----------------------|------------------------|--------------|---------------------|--------------------|---------------|---|
| | | | | Active (mA) | Standby (mA) | Data retention (μA) | | | |
| 1M | 32K ∞ 18 | μPD461318★ | 2 | TBD | TBD | – | 3.3±0.3 | • 119-pin BGA | User-option ① Dual-CLK R/L ② Single-CLK R/R |
| | | | 2.5 | | | | | | |
| | | | 3 | | | | | | |
| | | | 7 | | | | | | |
| | | | 8.5 | | | | | | |
| | 10 | | | | | | | | |
| | 32K ∞ 36 | μPD461336★ | 2 | | | | | | |
| | | | 2.5 | | | | | | |
| | | | 3 | | | | | | |
| | | | 7 | | | | | | |
| 8.5 | | | | | | | | | |
| 10 | | | | | | | | | |

★: Under development

Mask ROM

■ **Mask ROM**

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|-----------------|---------------------------------|--|-------------------------------------|------------------------|--|--------------------|--|--|
| | | | | Active (mA) | Standby (mA) | | | |
| 32M | 2M ∞ 16 or 1M ∞ 32 (selectable) | μ PD23C32140* | 100/30 | 120 | 0.1 | 5 ±10 % | <ul style="list-style-type: none"> • 70-pin SSOP (500 mil) • 70-pin TSOP II (400 mil) | with page access read mode |
| | 4M ∞ 8 or 2M ∞ 16 (selectable) | μ PD23C32000 | 120 | 70 | <ul style="list-style-type: none"> • 44-pin SOP (600 mil) • 48-pin TSOP I (12 ∞ 18 mm)* • 44-pin TSOP II (400 mil)* | | – | |
| 16M | 2M ∞ 8 or 1M ∞ 16 (selectable) | μ PD23C16000W μ PD23C16040A | 120 120/35 | 70 100 | | | <ul style="list-style-type: none"> • 42-pin DIP (600 mil) • 44-pin SOP (600 mil) • 48-pin TSOP I (12 ∞ 18 mm) • 44-pin TSOP II (400 mil) | μ PD16040A ... with page access read mode |
| | 8M | 1M ∞ 8 or 512K ∞ 16 (selectable) | μ PD23C8000W | 120 | | | 70 | <ul style="list-style-type: none"> • 32-pin DIP (600 mil) • 32-pin SOP (525 mil) |
| 4M | | 512K ∞ 8 or 256K ∞ 16 (selectable) | μ PD23C4000S μ PD23C4040 | 100 10/50 | 100 150 | | | <ul style="list-style-type: none"> • 40-pin DIP (600 mil) • 40-pin SOP (525 mil) |
| | 512K ∞ 8 | μ PD23C4001EJ | 120 | 50 | <ul style="list-style-type: none"> • 32-pin DIP (600 mil) • 32-pin SOP (525 mil) • 40-pin TSOP I (10 ∞ 20 mm) | | | Pin-compatible with PROM μ PD27C4001 |
| 2M | 256K ∞ 8 | μ PD23C2001E | 200 | 40 | | | <ul style="list-style-type: none"> • 32-pin DIP (600 mil) • 32-pin SOP (525 mil) • 40-pin TSOP I (10 ∞ 20 mm) | Pin-compatible with PROM μ PD27C2001 |
| 1M | 128K ∞ 8 | μ PD23C1001EA | 150 | 40 | | | | Pin-compatible with PROM μ PD27C1001A |
| | | μ PD23C1000EB | | | | | | Pin-compatible with PROM μ PD27C1000A |
| | | μ PD23C1000B | | | | | | – |
| | | μ PD23C1010B | | | | | | – |

*: Under development

■ **Mask ROM (Low Voltage Operation)**

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|-----------------|----------------------------------|--------------------|-----------------------|------------------------|--------------|--------------------|--|---------|
| | | | | Active (mA) | Standby (mA) | | | |
| 32M* | 4M ∞ 8 or 2M ∞ 16 (selectable) | μ PD23C32000 | 200 | 20 | 20 | 3.0±0.3 | <ul style="list-style-type: none"> • 44-pin SOP (600 mil) • 48-pin TSOP I (12 ∞ 18 mm) • 44-pin TSOP II (400 mil) | – |
| 16M | 2M ∞ 8 or 1M ∞ 16 (selectable) | μ PD23C16000LW | 200 | 20 | 20 | | <ul style="list-style-type: none"> • 42-pin DIP (600 mil) • 44-pin SOP (600 mil) • 48-pin TSOP I (12 ∞ 18 mm) • 44-pin TSOP II (400 mil) | |
| 8M | 1M ∞ 8 or 512K ∞ 16 (selectable) | μ PD23C8000LW | 230 | 30 | 30 | | | |

*: Under development

PROM

■ **UV EPROM**

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|-----------------|------------------------------------|-------------|---------------------------------------|------------------------|--------------|---|---|---|
| | | | | Active (mA) | Standby (mA) | | | |
| 8M | 1M ∞ 8 or 512K ∞ 16 (selectable) | μPD27C8000 | 120 150 170 | 50 | 0.1 | V _{PP} = 12.5±0.3 V _{CC} = 5 ±10 % | • 42-pin DIP (600 mil) | Pin-compatible with Mask ROM μPD23C8000 series |
| | 1M ∞ 8 | μPD27C8001 | 120 150 170 | 30 | | | • 32-pin DIP (600 mil) | Pin-compatible with Mask ROM μPD23C8001E series |
| 4M | 512K ∞ 8 or 256K ∞ 16 (selectable) | μPD27C4000 | 150 170 200 | 50 | | | • 40-pin DIP (600 mil) | Pin-compatible with Mask ROM μPD23C4000 series |
| | 256K ∞ 16 | μPD27C240 | 100 120 150 | | | | – | |
| | 512K ∞ 8 | μPD27C4001 | 120 [★] 150 170 200 | 30 | | | • 32-pin DIP (600 mil) | Pin-compatible with Mask ROM μPD23C4001E series |
| | | μPD27C040 | 100 120 150 | 50 | | | | |
| 2M | 256K ∞ 8 | μPD27C020 | 120 150 | 30 | | | Pin-compatible with Mask ROM μPD23C2001E series | |
| 1M | 128K ∞ 8 | μPD27C010A | 100 120 150 | | | | Pin-compatible with Mask ROM μPD23C1001E series | |
| | 64K ∞ 16 | μPD27C210A | 120 150 | 50 | | • 40-pin DIP (600 mil) | Pin-compatible with Mask ROM μPD23C1024E series | |

★: Under development

■ **ONE TIME PROM**

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|-----------------|------------------------------------|-------------|---------------------------------------|------------------------|--------------|---|--|---|
| | | | | Active (mA) | Standby (mA) | | | |
| 8M | 1M ∞ 8 or 512K ∞ 16 (selectable) | μPD27C8000 | 150 170 | 50 | 0.1 | V _{PP} = 12.5±0.3 V _{CC} = 5 ±10 % | • 42-pin DIP (600 mil) • 44-pin SOP (600 mil) • 48-pin TSOP I (12 ∞ 18 mm) | Pin-compatible with Mask ROM μPD23C8000 series |
| | 1M ∞ 8 | μPD27C8001 | 150 170 | 30 | | | • 32-pin DIP (600 mil) • 32-pin SOP (525 mil) | Pin-compatible with Mask ROM μPD23C8001E series |
| 4M | 512K ∞ 8 or 256K ∞ 16 (selectable) | μPD27C4000 | 150 170 200 | 50 | | | • 40-pin DIP (600 mil) • 40-pin SOP (525 mil) | Pin-compatible with Mask ROM μPD23C4000 series |
| | 512K ∞ 8 | μPD27C4001 | 120 [★] 150 170 200 | 30 | | | • 32-pin DIP (600 mil) • 32-pin SOP (525 mil) • 40-pin TSOP I (10 ∞ 20 mm) | Pin-compatible with Mask ROM μPD23C4001E series |

★: Under development

PROM

■ **EEPROM**

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|-----------------|-----------------------------|-------------|-----------------------|------------------------|--------------|--------------------|---|---------|
| | | | | Active (mA) | Standby (mA) | | | |
| 256K | 32K ∞ 8 | μPD28C256 | 200 250 | 50 | 0.1 | 5 ±10 % | • 28-pin DIP (600 mil) | - |
| 64K | 8K ∞ 8 | μPD28C64A | 150 200 | | | | • 28-pin DIP (600 mil) • 28-pin SOP (450 mil) • 32-pin TSOP I (600 mil) | |

■ **SERIAL EEPROM**

| Capacity (bits) | Organization (words ∞ bits) | Part number | Serial interface | Active current (mA) | Standby current (mA) | Supply voltage (V) | Package |
|-----------------|-----------------------------|-------------|-------------------------------|---------------------|----------------------|--------------------|--|
| 2K | 256 ∞ 8 | μPD6252 | CE, CS, SCL, SDA (2-wire BUS) | 1.5 | 0.02 | 5 V ±10 % | • 8-pin DIP (300 mil) • 8-pin SOP (300 mil) |
| 1K | 128 ∞ 8 | μPD6253 | | | | | |
| 4K | 512 ∞ 8 | μPD6254 | | | | | |
| 2K | 256 ∞ 8 | μPD6272 | CE, CS, I ² C BUS | 1.0 | 0.005 | 1.8 to 3.5 V | |
| 1K | 128 ∞ 8 | μPD6273 | | | | | |
| 4K | 512 ∞ 8 | μPD6274 | | | | | |
| 2K | 256 ∞ 8 | μPD6255 | CS, SCL, SDA (2-wire BUS) | 1.0 | 0.005 | 1.8 to 3.5 V | |
| 4K | 512 ∞ 8 | μPD6257 | CS, SCK, SI, SO (3-wire BUS) | 1.5 | 0.003 | 5 V ±10 % | |
| 8K | 1024 ∞ 8 | μPD6258 | | | | | |

Flash MEMORY

■ **Flash MEMORY**

| Capacity (bits) | Organization (words ∞ bits) | Part number | Access time MAX. (ns) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|-----------------|-----------------------------|-------------|-----------------------|------------------------|--------------|---|---|---------|
| | | | | Active (mA) | Standby (mA) | | | |
| 1M | 128K ∞ 8 | μPD28F001 | 80 100 120 | 50 | 0.1 | V _{PP} = 12±0.6 V _{CC} = 5 ±10 % | • 32-pin SOP (525 mil) • 32-pin TSOP I (8 ∞ 20 mm) • 32-pin QFJ | - |

Other

■ Dual-Port Graphic Buffer

| Capacity (bits) | Organization (words ∞ bits) | Part number | Random access time MAX. (ns) | Serial read cycle time (ns) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|-----------------|-----------------------------|-------------|------------------------------|-----------------------------|------------------------|--------------|--------------------|----------------------------------|---|
| | | | | | Active (mA) | Standby (mA) | | | |
| 4M | 256K ∞ 16 | μPD482444 | 60 70 80 | 20 22 25 | 130 110 90 | 10 | 5±10 % | • 64-pin SSOP (525 mil) | 2WE Byte Control Fast Page Flash/Block Write Split Buffer Stopping Column |
| | | μPD482445 | 60 70 80 | 20 22 25 | 130 110 90 | 7 | | | 3.3±0.3 |
| | | μPD482445L | 70 80 | 22 25 | 110 90 | | | | |
| 2M | 256K ∞ 8 | μPD482234 | 60 70 80 | 20 22 25 | 155 195 190 | 10 | 5±10 % | • 40-pin SOJ • 44-pin TSOP II | Fast page Flash write Block write Split buffer |
| | | μPD482235 | 60 70 80 | 20 22 25 | 155 195 190 | | | | |

■ Synchronous Graphics RAM

| Capacity (bits) | Organization | Part number | Cycle time MIN. (ns) | Refresh cycle (cycles/ms) | Maximum supply current (mA) | | | Interface | Supply voltage (V) | Package | Function |
|-----------------|--------------------------------|-------------|---|---------------------------|---------------------------------------|-------------------------|--------------|-----------|--------------------|----------------------------|---|
| | | | | | Active Normal/Burst (Grade-10, C.L=3) | Standby power down mode | Self refresh | | | | |
| 8M | 128K ∞ 2 banks ∞ 32 bits | μPD481850 | 10 (100 MHz) 12 (83 MHz) 15 (66 MHz) | 1024/16 | 105/365 90/310 85/285 | 3 | 2 | LVTTTL | 3.3±0.3 | • 100-pin QFP (14 ∞ 20 mm) | Synchronous Interface Write-per-bit (Old Mask) 8 column Block Write |

■ Graphic Memory

| Capacity (bits) | Organization (words ∞ bits) | Part number | Random access time MAX. (ns) | Page mode access time MAX. (ns) | Maximum supply current | | Supply voltage (V) | Package | Remarks |
|-----------------|-----------------------------|-------------|------------------------------|---------------------------------|------------------------|--------------|--------------------|------------------------|--|
| | | | | | Active (mA) | Standby (mA) | | | |
| 4M | 256K ∞ 16 | μPD481440 | 70 80 | 35 40 | 180 165 | 2 | 5±10 % | • 40-pin SOJ (400 mil) | 2WE Byte Control Flash write Block write |

Other

■ Silicon File

| Capacity (bits) | Organization (words ∞ bits) | Part number | Random access time MAX. (ns) | Page mode access time MAX. (ns) | Maximum supply current | | Supply voltage (V) | Package |
|-----------------|-----------------------------|-------------|------------------------------|---------------------------------|------------------------|---|--------------------|--|
| | | | | | Active (mA) | Self refresh (μA) | | |
| 16M | 16M ∞ 1 | μPD426171 | 60 70 80 | 40 45 50 | 100 90 80 | Ta=0 to 55 °C: 30 (-L) Ta=0 to 55 °C: 50 | 3.3±0.3 | <ul style="list-style-type: none"> • 26-pin SOJ (300 mil) • 26-pin TSOP II (300 mil) |
| | 4M ∞ 4 | μPD426174 | 60 70 80 | 40 45 50 | 100 90 80 | | | |
| 4M | 4M ∞ 1 | μPD42641 | 80 | 20 | 90 | Ta=0-70°C: 240 Ta=0-60°C: 120 Ta=0-50°C: 60 | 5±10 % | <ul style="list-style-type: none"> • 26-pin SOJ • 26-pin TSOP II |
| | 1M ∞ 4 | μPD42644 | | | | | | |
| | 4M ∞ 1 | μPD42641-L | | | | | | |
| | 1M ∞ 4 | μPD42644-L | | | | | | |

■ Field/Line Buffer

| Capacity (bits) | Organization (words ∞ bits) | Part number | Read/Write cycle time MIN. (ns) | Data hold period (ms) | Maximum supply current active (mA) | Supply voltage (V) | Package | Remarks |
|-----------------|-----------------------------|-------------|----------------------------------|-----------------------|------------------------------------|--------------------|--|--|
| 2M | 256 ∞ 8 | μPD42280 | 30/30 40/40 60/60 | – | 90 75 60 | 5±10 % | <ul style="list-style-type: none"> • 28-pin SOP • 28-pin ZIP | Field buffer FIFO structure |
| 80K | 10096 ∞ 8 5048 ∞ 16 | μPD485506 | 25/25 27/27 35/35 | | 140 | | <ul style="list-style-type: none"> • 44-pin TSOP II | FAX, PPC Line buffer FIFO structure |
| 40K | 5048 ∞ 8 | μPD485505 | 25/25 27/27 35/35 | | 90 | | <ul style="list-style-type: none"> • 24-pin SOP | |
| 7K | 910 ∞ 8 | μPD42101 | 34/34 34/69 69/69 | 1 | 70 60 35 | | <ul style="list-style-type: none"> • 24-pin DIP • 24-pin SOP | NTSC Line buffer FIFO structure |
| 9K | 1135 ∞ 8 | μPD42102 | 25/25 28/28 28/56 56/56 | | 80 80 70 40 | | | PAL Line buffer FIFO structure |

Semi-Custom IC

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Gate Array

CMOS Gate Array

■ CMOS-6 family (channelless type)

| Type number | | μ PD65658 | μ PD65664 | μ PD65672 | μ PD65676 |
|-------------------------|--------------------|---|---------------|---------------|---------------|
| Integration | Internal gates | 42240 | 72576 | 119232 | 177408 |
| | Usable gate number | 31680 | 54432 | 89424 | 133056 |
| | Pad number * | 236 | 304 | 384 | 464 |
| Delay time | Internal gate | 0.5 ns (fan-outs: 2, wiring length: 2 mm)/0.4 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | |
| | Input buffer | 1.0 ns | | | |
| | Output buffer | 2.0 ns (CL = 15 pF) | | | |
| Output drive capability | | IOL = 4.5, 9.0, 13.5, 18.0, 24.0 mA | | | |
| Supply voltage | | 5 V | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

■ CMOS-6A family (channelless type)

| Type number | | μ PD65630 | μ PD65636 | μ PD65640 | μ PD65646 | μ PD65650 | μ PD65654 | μ PD65656 | μ PD65662 |
|-------------------------|--------------------|---|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Integration | Internal gates | 5376 | 8000 | 11520 | 16240 | 21120 | 30720 | 40480 | 70272 |
| | Usable gate number | 3225 | 4800 | 6912 | 9744 | 12672 | 18432 | 24288 | 42163 |
| | Pad number * | 100 | 116 | 136 | 156 | 176 | 208 | 220 | 288 |
| Delay time | Internal gate | 0.5 ns (fan-outs: 2, wiring length: 2 mm)/0.4 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | | | | | |
| | Input buffer | 1.0 ns | | | | | | | |
| | Output buffer | 2.0 ns (CL = 15 pF) | | | | | | | |
| Output drive capability | | IOL = 4.5, 9.0, 13.5, 18.0, 24.0 mA | | | | | | | |
| Supply voltage | | 5 V | | | | | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

■ CMOS-6V family (channelless type) (1/2)

| Type number | | μ PD65631 | μ PD65641 | μ PD65644 | μ PD65647 |
|-------------------------|--------------------|---|---------------|---------------|---------------|
| Integration | Internal gates | 5544 | 11520 | 14040 | 16240 |
| | Usable gate number | 3326 | 6912 | 8424 | 9744 |
| | Pad number * | 156 | 176 | 176 | 176 |
| Delay time | Internal gate | 0.5 ns (fan-outs: 2, wiring length: 2 mm)/0.4 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | |
| | Input buffer | 1.0 ns | | | |
| | Output buffer | 2.0 ns (CL = 15 pF) | | | |
| Output drive capability | | IOL = 4.5, 9.0, 13.5, 18.0, 24.0 mA | | | |
| Supply voltage | | 5 V | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

■ CMOS-6V family (channelless type) (2/2)

| Type number | | μ PD65648 | μ PD65651 | μ PD65652 | μ PD65655 |
|-------------------------|--------------------|---|---------------|---------------|---------------|
| Integration | Internal gates | 18600 | 21120 | 26640 | 30720 |
| | Usable gate number | 11160 | 12672 | 15984 | 18432 |
| | Pad number * | 176 | 236 | 236 | 236 |
| Delay time | Internal gate | 0.5 ns (fan-outs: 2, wiring length: 2 mm)/0.4 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | |
| | Input buffer | 1.0 ns | | | |
| | Output buffer | 2.0 ns (CL = 15 pF) | | | |
| Output drive capability | | IOL = 4.5, 9.0, 13.5, 18.0, 24.0 mA | | | |
| Supply voltage | | 5 V | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

| |
|-------------------|
| Gate Array |
|-------------------|

CMOS Gate Array**■ CMOS-6X family (channelless type)**

| Type number | | μ PD65612 | μ PD65622 | μ PD65626 | μ PD65632 |
|-------------------------|--------------------|---|---------------|---------------|---------------|
| Inte- gration | Internal gates | 2244 | 4260 | 5760 | 8148 |
| | Usable gate number | 1346 | 2556 | 3456 | 4888 |
| | Pad number * | 80 | 100 | 120 | 120 |
| Delay time | Internal gate | 0.5 ns (fan-outs: 2, wiring length: 2 mm)/0.4 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | |
| | Input buffer | 1.0 ns | | | |
| | Output buffer | 2.0 ns (CL = 15 pF) | | | |
| Output drive capability | | IOL = 4.5, 9.0, 13.5, 18.0, 24.0 mA | | | |
| Supply voltage | | 5 V | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

■ CMOS-8 family (channelless type) 2-Metal-layer (1/2)

| Type number | | μ PD65800 | μ PD65801 | μ PD65802 | μ PD65803 |
|-------------------------|--------------------|---|---------------|---------------|---------------|
| Inte- gration | Internal gates | 11712 | 21504 | 32000 | 42688 |
| | Usable gate number | 7027 | 12902 | 19200 | 25612 |
| | Pad number * | 172 | 228 | 268 | 308 |
| Delay time | Internal gate | 0.34 ns (fan-outs: 2, wiring length: 2 mm)/0.29 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | |
| | Input buffer | 0.44 ns | | | |
| | Output buffer | 1.6 ns (CL = 15 pF) | | | |
| Output drive capability | | IOL = 3, 6, 9, 12, 18, 24 mA | | | |
| Supply voltage | | 5 V | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

■ CMOS-8 family (channelless type) 3-Metal-layer (2/2)

| Type number | | μ PD65804 | μ PD65806 | μ PD65808 | μ PD65810 | μ PD65811 | μ PD65812 | μ PD65813 |
|-------------------------|--------------------|---|---------------|---------------|---------------|---------------|---------------|---------------|
| Inte- gration | Internal gates | 42688 | 58752 | 82432 | 103680 | 138776 | 176720 | 233280 |
| | Usable gate number | 32016 | 44064 | 61824 | 77760 | 104082 | 132540 | 174960 |
| | Pad number * | 308 | 340 | 404 | 452 | 524 | 588 | 676 |
| Delay time | Internal gate | 0.34 ns (fan-outs: 2, wiring length: 2 mm)/0.29 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | | | | |
| | Input buffer | 0.44 ns | | | | | | |
| | Output buffer | 1.6 ns (CL = 15 pF) | | | | | | |
| Output drive capability | | IOL = 3, 6, 9, 12, 18, 24 mA | | | | | | |
| Supply voltage | | 5 V | | | | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

■ CMOS-8L family (channelless type) 2-Metal-layer (1/3)

| Type number | | μ PD65840 | μ PD65841 | μ PD65842 | μ PD65843 | μ PD65845 |
|-------------------------|--------------------|---|---------------|---------------|---------------|---------------|
| Inte- gration | Internal gates | 10912 | 20832 | 30192 | 40592 | 52528 |
| | Usable gate number | 6547 | 12499 | 18115 | 24355 | 31516 |
| | Pad number * | 164 | 204 | 212 | 244 | 276 |
| Delay time | Internal gate | 0.13 ns (fan-outs: 1, wiring length: 0 mm), 0.33 ns (fan-outs: 2, wiring length: 2 mm)/ 0.21 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | | |
| | Input buffer | 0.40 ns | | | | |
| | Output buffer | 1.67 ns (FO01, CL = 15 pF) | | | | |
| Output drive capability | | IOL = 3, 6, 9, 12, 18, 24 mA | | | | |
| Supply voltage | | 3.3 V \pm 0.3 V | | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

Gate Array

CMOS Gate Array

■ CMOS-8L family (channelless type) 2-Metal-layer (2/3)

| Type number | | μ PD65846 | μ PD65848 | μ PD65849 | μ PD65850 | μ PD65851 |
|-------------------------|--------------------|---|---------------|---------------|---------------|---------------|
| Integration | Internal gates | 61904 | 81984 | 102272 | 120768 | 148256 |
| | Usable gate number | 37142 | 49190 | 61363 | 72460 | 88953 |
| | Pad number * | 300 | 340 | 380 | 412 | 452 |
| Delay time | Internal gate | 0.13 ns (fan-outs: 1, wiring length: 0 mm), 0.33 ns (fan-outs: 2, wiring length: 2 mm)/ 0.21 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | | |
| | Input buffer | 0.40 ns | | | | |
| | Output buffer | 1.67 ns (FO01, C _L = 15 pF) | | | | |
| Output drive capability | | I _{OL} = 3, 6, 9, 12, 18, 24 mA | | | | |
| Supply voltage | | 3.3 V \pm 0.3 V | | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

■ CMOS-8L family (channelless type) 2-Metal-layer (3/3)

| Type number | | μ PD65852 | μ PD65853 | μ PD65855 | μ PD65858 | μ PD65859 |
|-------------------------|--------------------|---|---------------|---------------|---------------|---------------|
| Integration | Internal gates | 202752 | 255744 | 342000 | 488720 | 627328 |
| | Usable gate number | 121651 | 153446 | 205200 | 293232 | 376396 |
| | Pad number * | 524 | 588 | 676 | 804 | 908 |
| Delay time | Internal gate | 0.13 ns (fan-outs: 1, wiring length: 0 mm), 0.33 ns (fan-outs: 2, wiring length: 2 mm)/ 0.21 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | | |
| | Input buffer | 0.40 ns | | | | |
| | Output buffer | 1.67 ns (FO01, C _L = 15 pF) | | | | |
| Output drive capability | | I _{OL} = 3, 6, 9, 12, 18, 24 mA | | | | |
| Supply voltage | | 3.3 V \pm 0.3 V | | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

■ CMOS-8L family (channelless type) 3-Metal-layer (1/3)

| Type number | | μ PD65860 | μ PD65861 | μ PD65862 | μ PD65863 | μ PD65865 |
|-------------------------|--------------------|---|---------------|---------------|---------------|---------------|
| Integration | Internal gates | 10912 | 20832 | 30192 | 40592 | 52528 |
| | Usable gate number | 8184 | 15624 | 22644 | 30444 | 39396 |
| | Pad number * | 164 | 204 | 212 | 244 | 276 |
| Delay time | Internal gate | 0.13 ns (fan-outs: 1, wiring length: 0 mm), 0.33 ns (fan-outs: 2, wiring length: 2 mm)/ 0.21 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | | |
| | Input buffer | 0.40 ns | | | | |
| | Output buffer | 1.67 ns (FO01, C _L = 15 pF) | | | | |
| Output drive capability | | I _{OL} = 3, 6, 9, 12, 18, 24 mA | | | | |
| Supply voltage | | 3.3 V \pm 0.3 V | | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

■ CMOS-8L family (channelless type) 3-Metal-layer (2/3)

| Type number | | μ PD65866 | μ PD65868 | μ PD65869 | μ PD65870 | μ PD65871 |
|-------------------------|--------------------|---|---------------|---------------|---------------|---------------|
| Integration | Internal gates | 61904 | 81984 | 102272 | 120768 | 148256 |
| | Usable gate number | 46428 | 61488 | 76704 | 90576 | 111192 |
| | Pad number * | 300 | 340 | 380 | 412 | 452 |
| Delay time | Internal gate | 0.13 ns (fan-outs: 1, wiring length: 0 mm), 0.33 ns (fan-outs: 2, wiring length: 2 mm)/ 0.21 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | | |
| | Input buffer | 0.40 ns | | | | |
| | Output buffer | 1.67 ns (FO01, C _L = 15 pF) | | | | |
| Output drive capability | | I _{OL} = 3, 6, 9, 12, 18, 24 mA | | | | |
| Supply voltage | | 3.3 V \pm 0.3 V | | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

| |
|-------------------|
| Gate Array |
|-------------------|

CMOS Gate Array**■ CMOS-8L family (channelless type) 3-Metal-layer (3/3)**

| Type number | | μ PD65872 | μ PD65873 | μ PD65875 | μ PD65878 | μ PD65879 |
|-------------------------|--------------------|---|---------------|---------------|---------------|---------------|
| Inte- gration | Internal gates | 202752 | 255744 | 342000 | 488720 | 627328 |
| | Usable gate number | 152064 | 191808 | 256500 | 366540 | 470496 |
| | Pad number * | 524 | 588 | 676 | 804 | 908 |
| Delay time | Internal gate | 0.13 ns (fan-outs: 1, wiring length: 0 mm), 0.33 ns (fan-outs: 2, wiring length: 2 mm)/ 0.21 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | | |
| | Input buffer | 0.40 ns | | | | |
| | Output buffer | 1.67 ns (FO01, CL = 15 pF) | | | | |
| Output drive capability | | IOL = 3, 6, 9, 12, 18, 24 mA | | | | |
| Supply voltage | | 3.3 V \pm 0.3 V | | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

■ CMOS-8LCX family (channelless type) 3-Metal-layer (1/2)

| Type number | | μ PD65823 | μ PD65825 | μ PD65826 | μ PD65828 | μ PD65830 |
|-------------------------|--------------------|---|---------------|---------------|---------------|---------------|
| Inte- gration | Internal gates | 39856 | 50880 | 60320 | 80400 | 103360 |
| | Usable gate number | 29892 | 38160 | 45240 | 60300 | 77520 |
| | Pad number * | 284 | 316 | 340 | 388 | 436 |
| Delay time | Internal gate | 0.21 ns (fan-outs: 1, wiring length: 0 mm), 0.40 ns (fan-outs: 2, wiring length: 2 mm)/ 0.30 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | | |
| | Input buffer | - | | | | |
| | Output buffer | - | | | | |
| Output drive capability | | IOL = 1, 2, 3, 6, 9, 12, 18, 24 mA | | | | |
| Supply voltage | | 3.3 V \pm 0.3 V | | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

■ CMOS-8LCX family (channelless type) 3-Metal-layer (2/2)

| Type number | | μ PD65831 | μ PD65832 | μ PD65833 | μ PD65835 | μ PD65838 |
|-------------------------|--------------------|---|---------------|---------------|---------------|---------------|
| Inte- gration | Internal gates | 153264 | 200120 | 255360 | 347200 | 486048 |
| | Usable gate number | 114948 | 150090 | 191520 | 260400 | 364536 |
| | Pad number * | 524 | 596 | 668 | 772 | 908 |
| Delay time | Internal gate | 0.21 ns (fan-outs: 1, wiring length: 0 mm), 0.40 ns (fan-outs: 2, wiring length: 2 mm)/ 0.30 ns (power gate, fan-outs: 2, wiring length: 2 mm) | | | | |
| | Input buffer | - | | | | |
| | Output buffer | - | | | | |
| Output drive capability | | IOL = 1, 2, 3, 6, 9, 12, 18, 24 mA | | | | |
| Supply voltage | | 3.3 V \pm 0.3 V | | | | |

*: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

Gate Array

CMOS Gate Array

■ CMOS-9 family (1/2)

[2-Metal-layer]

| Type number | | μ PD65906 | μ PD65907 | μ PD65908 | μ PD65909 | μ PD65910 |
|-----------------------|-----------------------|--|---------------|---------------|---------------|---------------|
| Inte- gration | Internal gates *1 | 190152 | 249948 | 317904 | 376740 | 462088 |
| | Usable gate counts *2 | 76060 | 99979 | 127161 | 150696 | 184835 |
| Delay time | Internal gates | 138 ps (2-input NAND, fan-out = 1, standard wiring length) | | | | |
| | Input buffer *3 | 188 ps | | | | |
| | Output buffer *4 | 874 ps | | | | |
| Output drive capacity | | IoL = 1, 2, 3, 6, 9, 12, 18, 24 mA | | | | |
| Supply voltage | | 3.3 V \pm 0.3 V | | | | |

*1: 1 gate = 2-input NAND gate.

*2: usable gate: 40%

*3: fanout = 2, wiring length = 2 mm

*4: CL = 15pF, IoL = 18 mA

■ CMOS-9 family (2/2)

[2-Metal-layer]

| Type number | | μ PD65911 | μ PD65913 | μ PD65915 | μ PD65917 | μ PD65919 |
|-----------------------|-----------------------|--|---------------|---------------|---------------|---------------|
| Inte- gration | Internal gates *1 | 629824 | 805580 | 1076032 | 1545240 | 1990600 |
| | Usable gate counts *2 | 251929 | 322232 | 430412 | 618096 | 796240 |
| Delay time | Internal gates | 138 ps (2-input NAND, fan-out = 1, standard wiring length) | | | | |
| | Input buffer *3 | 188 ps | | | | |
| | Output buffer *4 | 874 ps | | | | |
| Output drive capacity | | IoL = 1, 2, 3, 6, 9, 12, 18, 24 mA | | | | |
| Supply voltage | | 3.3 V \pm 0.3 V | | | | |

*1: 1 gate = 2-input NAND gate.

*2: usable gate: 40%

*3: fanout = 2, wiring length = 2 mm

*4: CL = 15pF, IoL = 18 mA

■ CMOS-9 family (1/2)

[3-Metal-layer]

| Type number | | μ PD65926 | μ PD65927 | μ PD65928 | μ PD65929 | μ PD65930 |
|-----------------------|-----------------------|--|---------------|---------------|---------------|---------------|
| Inte- gration | Internal gates *1 | 190152 | 249948 | 317904 | 376740 | 462088 |
| | Usable gate counts *2 | 114091 | 149968 | 190742 | 226044 | 277252 |
| Delay time | Internal gates | 138 ps (2-input NAND, fan-out = 1, standard wiring length) | | | | |
| | Input buffer *3 | 188 ps | | | | |
| | Output buffer *4 | 874 ps | | | | |
| Output drive capacity | | IoL = 1, 2, 3, 6, 9, 12, 18, 24 mA | | | | |
| Supply voltage | | 3.3 V \pm 0.3 V | | | | |

*1: 1 gate = 2-input NAND gate.

*2: usable gate: 60%

*3: fanout = 2, wiring length = 2 mm

*4: CL = 15pF, IoL = 18 mA

■ CMOS-9 family (2/2)

[3-Metal-layer]

| Type number | | μ PD65931 | μ PD65933 | μ PD65935 | μ PD65937 | μ PD65939 |
|-----------------------|-----------------------|--|---------------|---------------|---------------|---------------|
| Inte- gration | Internal gates *1 | 629824 | 805580 | 1076032 | 1545240 | 1990600 |
| | Usable gate counts *2 | 377894 | 483348 | 645619 | 927144 | 1194360 |
| Delay time | Internal gates | 138 ps (2-input NAND, fan-out = 1, standard wiring length) | | | | |
| | Input buffer *3 | 188 ps | | | | |
| | Output buffer *4 | 874 ps | | | | |
| Output drive capacity | | IoL = 1, 2, 3, 6, 9, 12, 18, 24 mA | | | | |
| Supply voltage | | 3.3 V \pm 0.3 V | | | | |

*1: 1 gate = 2-input NAND gate.

*2: usable gate: 60%

*3: fanout = 2, wiring length = 2 mm

*4: CL = 15pF, IoL = 18 mA

| |
|-------------------|
| Gate Array |
|-------------------|

BiCMOS Gate Array■ **BiCMOS-5 family**

| Type number | | μ PD67021 | μ PD67031 | μ PD67050 | μ PD67070 | μ PD67101 | μ PD67240 |
|-------------------------|-------------------------------|--|---------------|---------------|---------------|---------------|---------------|
| Inte- gration | Maximum Number | 2208 | 3240 | 5320 | 7216 | 10152 | 24528 |
| | Maximum number of input pins | 80 | 96 | 124 | 148 | 176 | 272 |
| | Maximum number of output pins | 80 | 96 | 124 | 148 | 176 | 272 |
| Delay time | Internal gate | 0.4 ns (fan-outs: 2, wiring length: 2 mm) | | | | | |
| | Input buffer | 0.9 ns (TTL) | | | | | |
| | | 3.3 ns (TTL/ECL) | | | | | |
| | | 2.5 ns (ECL) | | | | | |
| | Output buffer | 2.3 ns (TTL) | | | | | |
| | | 3.5 ns (TTL/ECL) | | | | | |
| 1.3 ns (ECL) | | | | | | | |
| Output drive capability | | I _{OL} = 24, 48, 72 mA | | | | | |
| Supply voltage | | V _{CC} = 5 V (CMOS/TTL) V _{EE} = -5.2 V (ECL-10KH) -4.5 V (ECL-100K) | | | | | |

■ **BiCMOS-8 family**

| Type number | | μ PD67804 (Logic Type) | μ PD67852 (ECL mounted) |
|---|---|--|---|
| Inte- gration | CMOS Internal gates | 236 K | 57 K |
| | CMOS Usable gate number | 165 K | 40 K |
| | ECL Internal gates | – | 5.0 K |
| | ECL Usable gate number | – | 2.5 K |
| | Signal pin number | 320 | 156 |
| Delay time | Internal CMOS gate | 180 ps (fun-outs: 1, wiring length: 0 mm) 370 ps (fun-outs: 2, wiring length: 2 mm) | |
| | Internal ECL gate | – | 130 ps (fun-outs: 0, wiring length: 0 mm) |
| | Input buffer | 0.23 ns (ECL: fun-outs: 1, wiring length: 0 mm) | |
| | | 0.43 ns (LVTTTL: fun-outs: 1, wiring length: 0 mm) | |
| 1.17 ns (GTL: fun-outs: 1, wiring length: 0 mm) | | | |
| Output buffer | 1.37 ns (LVTTTL: C _L = 15 pF) | | |
| | 0.98 ns (GTL: C _L = 15 pF) | | |
| | 0.99 ns (Slew rate GTL: C _L = 15 pF) | | |
| Supply voltage | ECL-100K | V _{EE1} = -2.0 V \pm 5% V _{EE2} = -4.5 V \pm 0.3 V | |
| | ECL-10KH | V _{EE1} = -2.0 V \pm 5% V _{EE2} = -5.2 V \pm 5% | |
| | LV-TTL | V _{CC} = 3.3 V \pm 5% | |
| | GTL | V _{CC} = 3.3 V \pm 5% | |

| |
|-------------------|
| Gate Array |
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ECL Gate Array■ **ECL-4A family**

| Type number | | μ PB63020 | μ PB63040 | μ PB63060 | μ PB63080 | μ PB63100 |
|-----------------------------|-------------------------------|---|---------------|---------------|---------------|---------------|
| Integration | Internal gates | 2400 | 4000 | 6000 | 8000 | 10000 |
| | Maximum number of input pins | 102 | 140 | 174 | 200 | 236 |
| | Maximum number of output pins | 58 | 84 | 90 | 108 | 120 |
| Delay time | Internal gate | 0.27 ns (fan-outs: 3, wiring length: 3 mm) | | | | |
| | Input buffer | 0.3 ns (fan-outs: 1, wiring length: 3 mm) | | | | |
| | | 0.7 ns (TTL, fan-outs: 1, wiring length: 3 mm) | | | | |
| | Output buffer | 0.65 ns (ECL-100K, $C_L = 15$ pF), 0.63 ns (ECL-10K, $C_L = 15$ pF) | | | | |
| 2.5 ns (TTL, $C_L = 15$ pF) | | | | | | |
| Supply voltage | -5.2 V (ECL-10KH) | | | | | |
| | -4.5 V (ECL-100K) | | | | | |
| | 5 V (TTL) | | | | | |

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|----------------------|
| UNIVERSAL PCI |
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■ **UNIVERSAL PCI series (2-Metal-layer)**

| Type A *1 | | μ PD66001 | μ PD66002 | μ PD66004 | μ PD66006 | μ PD66008 | μ PD66010 | μ PD66011 | μ PD66012 |
|-------------------------|--------------------|--|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Type B *2 | | μ PD66081 | μ PD66082 | μ PD66084 | μ PD66086 | μ PD66088 | μ PD66090 | μ PD66091 | μ PD66092 |
| Integration | Internal gates | 23392 | 32640 | 46464 | 68208 | 87648 | 121684 | 155584 | 209712 |
| | Usable gate number | 14035 | 19584 | 27878 | 40925 | 52589 | 73008 | 93350 | 125827 |
| | Pad number *3 | 268 | 308 | 356 | 420 | 468 | 524 | 588 | 676 |
| Delay time | Internal gate | 0.14 ns (fan-out: 1, wiring length: 0 mm), 0.29 ns (fan-out: 2, wiring length: 2 mm)/ 0.20 ns (power gate, fan-out: 2, wiring length: 2 mm) | | | | | | | |
| | Input buffer | 0.86 ns (3.3 V), 0.34 ns (5 V) | | | | | | | |
| | Output buffer | 1.61 ns (3.3 V, $C_L = 15$ pF), 1.34 ns (5 V, $C_L = 15$ pF) | | | | | | | |
| Output drive capability | | $I_{OL} = 3, 6, 9, 12, 18, 24$ mA | | | | | | | |
| Supply voltage | | 5 V $\pm 5\%$, 3.3 V ± 0.3 V | | | | | | | |

*1: 5 V, 3.3 V, universal power supply interface

*2: 5 V, universal power supply interface

*3: V_{DD} , GND terminals included. Number of pin which can be actually used depends on package.■ **UNIVERSAL PCI series (3-Metal-layer)**

| Type A *1 | | μ PD66024 | μ PD66026 | μ PD66028 | μ PD66030 | μ PD66031 | μ PD66032 |
|-------------------------|--------------------|--|---------------|---------------|---------------|---------------|---------------|
| Type B *2 | | μ PD66104 | μ PD66106 | μ PD66108 | μ PD66110 | μ PD66111 | μ PD66112 |
| Integration | Internal gates | 46464 | 68208 | 87648 | 121684 | 155584 | 209712 |
| | Usable gate number | 34848 | 51156 | 65736 | 91260 | 116688 | 157284 |
| | Pad number *3 | 356 | 420 | 468 | 524 | 588 | 676 |
| Delay time | Internal gate | 0.14 ns (fan-out: 1, wiring length: 0 mm), 0.29 ns (fan-out: 2, wiring length: 2 mm)/ 0.20 ns (power gate, fan-out: 2, wiring length: 2 mm) | | | | | |
| | Input buffer | 0.86 ns (3.3 V), 0.34 ns (5 V) | | | | | |
| | Output buffer | 1.61 ns (3.3 V, $C_L = 15$ pF), 1.34 ns (5 V, $C_L = 15$ pF) | | | | | |
| Output drive capability | | $I_{OL} = 3, 6, 9, 12, 18, 24$ mA | | | | | |
| Supply voltage | | 5 V $\pm 5\%$, 3.3 V ± 0.3 V | | | | | |

*1: 5 V, 3.3 V, universal power supply interface

*2: 5 V, universal power supply interface

*3: V_{DD} , GND terminals included. Number of pin which can be actually used depends on package.

| |
|------------------|
| MV Series |
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■ MV series (1/2)

[2-Metal-layer]

| Type number | | μ PD66041 | μ PD66042 | μ PD66044 | μ PD66046 | μ PD66048 | μ PD66050 | μ PD66051 | μ PD66052 |
|-----------------------|-----------------------|---|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Inte- gration | Internal gates *1 | 23392 | 32640 | 46464 | 68208 | 87648 | 121648 | 155584 | 209712 |
| | Usable gate counts *2 | 14035 | 19584 | 27878 | 40925 | 52589 | 73000 | 93350 | 125827 |
| | Pad number *3 | 268 | 308 | 356 | 420 | 468 | 524 | 588 | 676 |
| Delay time | Internal gates | 0.14 ns (fan-outs = 1, wiring length = 0 mm) 0.29 ns (fan-outs = 2, wiring length = 2 mm) 0.20 ns (fan-outs = 2, wiring length = 2 mm) (power gate) | | | | | | | |
| | Input buffer *4 | 0.86 ns (3.3 V), 0.34 ns (5 V) | | | | | | | |
| | Output buffer *5 | 1.61 ns (3.3 V), 1.34 ns (5 V) | | | | | | | |
| Output drive capacity | | IOL = 3, 6, 9, 12, 18, 24 mA | | | | | | | |
| Supply voltage | | 5 V \pm 5%, 3.3 V \pm 0.3 V | | | | | | | |

*1: 1 gate = 2-input NAND gate. *2: usable gate: 60%

*3: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

*4: fanout = 2, wiring length = 2 mm *5: C_L = 15pF

■ MV series (2/2)

[3-Metal-layer]

| Type number | | μ PD66064 | μ PD66066 | μ PD66068 | μ PD66070 | μ PD66071 | μ PD66072 |
|-----------------------|-----------------------|---|---------------|---------------|---------------|---------------|---------------|
| Inte- gration | Internal gates *1 | 46464 | 68208 | 87648 | 121684 | 155584 | 209712 |
| | Usable gate counts *2 | 34848 | 51156 | 65736 | 91263 | 116688 | 157284 |
| | Pad number *3 | 356 | 420 | 468 | 524 | 588 | 676 |
| Delay time | Internal gates | 0.14 ns (fan-outs = 1, wiring length = 0 mm) 0.29 ns (fan-outs = 2, wiring length = 2 mm) 0.20 ns (fan-outs = 2, wiring length = 2 mm) (power gate) | | | | | |
| | Input buffer *4 | 0.86 ns (3.3 V), 0.34 ns (5 V) | | | | | |
| | Output buffer *5 | 1.61 ns (3.3 V), 1.34 ns (5 V) | | | | | |
| Output drive capacity | | IOL = 3, 6, 9, 12, 18, 24 mA | | | | | |
| Supply voltage | | 5 V \pm 5%, 3.3 V \pm 0.3 V | | | | | |

*1: 1 gate = 2-input NAND gate. *2: usable gate: 75%

*3: V_{DD}, GND terminals included. Number of pin which can be actually used depends on package.

*4: fanout = 2, wiring length = 2 mm *5: C_L = 15pF

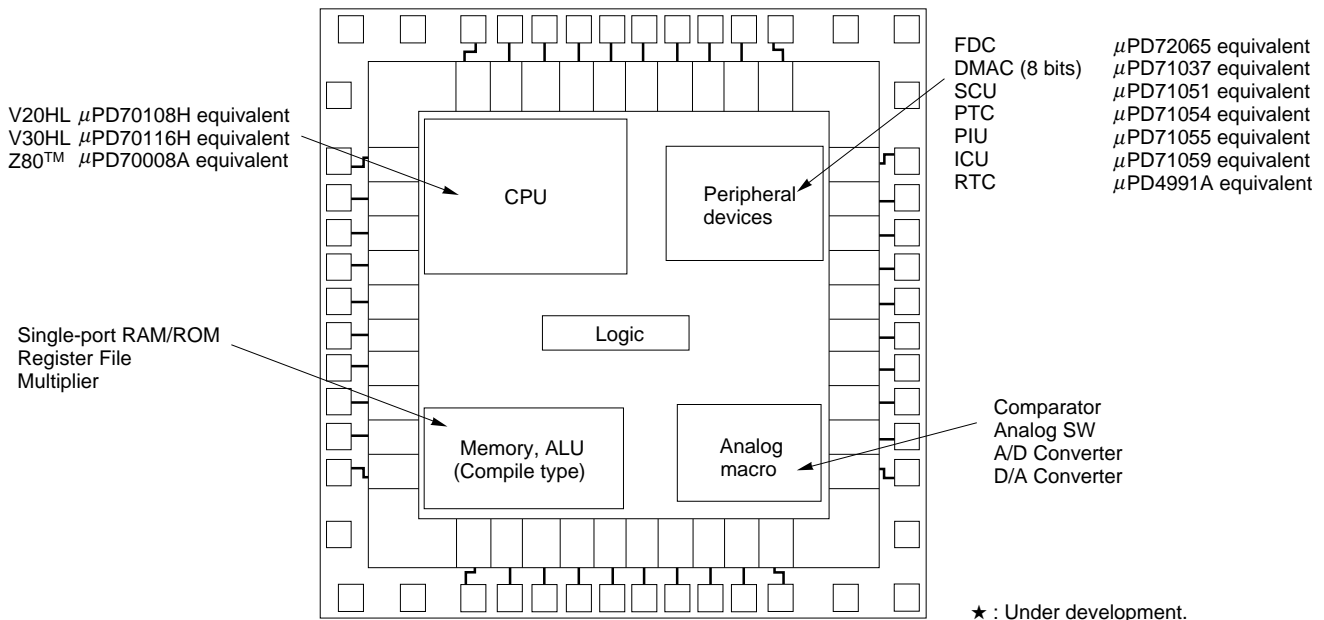
Cell Based IC

■ **CB-C7 family**

- CPU core and memory macro are mounted on high integration IC achieved by the advanced 0.8 μm processing technology.
- Three different types of user logic block; TAT intended type (FT type) and high integration intended type (HD type and VX type).

| Type number | | $\mu\text{PD93XXX}$ | $\mu\text{PD94XXX}$ | $\mu\text{PD951XX}$ | $\mu\text{PD961XX}$ | |
|---|---------------------|---|---------------------|---------------------|------------------------------------|----------|
| Integration * | | 120 K gate (max.) (2-layer wiring) / 180 K gate (max.) (3-layer wiring) / 270 K gate (max.) (VX, 3-layer wiring) | | | | |
| Maximum number of input/output signal lines | | 440 | | | | |
| Delay time | Internal gate | 0.18 ns (@5 V) / 0.43 ns (@3 V) (fan-outs: 1, wiring length: 0 mm), 0.44 ns (@5 V) / 0.90 ns (@3 V) (fan-outs: 2, wiring length: 2 mm) | | | | |
| | Power gate | 0.33 ns (@5 V) / 0.67 ns (@3 V) (fan-outs: 2, wiring length: 2 mm) | | | | |
| | Input buffer | 0.60 ns (@5 V) / 0.76 ns (@3 V) (fan-outs: 2, wiring length: 2 mm) | | | | |
| | Output buffer | 1.6 ns (@5 V, 8 mA buffer) / 3.2 ns (@3 V, 4.4 mA buffer) ($C_L = 15 \text{ pF}$) | | | | |
| Library | Input/output buffer | Same as NEC's Gate Array and Interface block with test mode, oscillator block | | | | |
| | Function block | Same as NEC's Gate Array | | | | |
| | Macro | CPU | - | | V20HL, V30HL, Z80, etc. | |
| | | Peripheral devices | - | | $\mu\text{PD71037/5X}$, FDC, etc. | |
| | | Memory | RAM | RAM, ROM | RAM | RAM, ROM |
| Analog | | A/D Converter, D/A Converter, etc. (Under development) | | | | |
| Power consumption | | 6.5 $\mu\text{W/MHz/Cell}$ (@5 V) / 2.6 $\mu\text{W/MHz/Cell}$ (@3 V) | | | | |
| Output drive capability | | $I_{OL} = 4, 8, 12, 24, 48 \text{ mA}$ (@5 V) / $I_{OL} = 2.2, 4.4, 6.6 \text{ mA}$ (@3 V) | | | | |
| Interface level | | CMOS, TTL compatible / 3 V Interface | | | | |
| Process | | 0.8 μm rule CMOS process, aluminum 2-layer/3-layer wiring | | | | |

*: When not mounting hard macro



| |
|----------------------|
| Cell Based IC |
|----------------------|

■ CB-C8 family

- High integration and high speed IC achieved by the most advanced 0.5 μm processing technology.
- Low power consumption (power supply: 3.3 V \pm 0.3 V)
- Lower power type of Y-block is available.

| Type number | | $\mu\text{PD93600}$ | $\mu\text{PD94600}$ | $\mu\text{PD95600}$ | $\mu\text{PD96600}$ | | |
|---|---------------------|--|---------------------|---------------------|---------------------|------------------------|----------|
| Integration * | | 400 K gate (MAX.) (2-layer wiring) 600 K gate (MAX.) (3-layer wiring) | | | | | |
| Maximum number of input/output signal lines | | 880 | | | | | |
| Delay time | Internal gate | 0.13 ns (fan-outs: 1, wiring length: 0 mm) 0.29 ns (fan-outs: 2, wiring length: 2 mm) | | | | | |
| | Power gate | 0.22 ns (fan-outs: 2, wiring length: 2 mm) | | | | | |
| | Input buffer | 0.36 ns (fan-outs: 2, wiring length: 2 mm) | | | | | |
| | Output buffer | 1.46 ns (9 mA buffer) (CL = 15 pF) | | | | | |
| Library | Input/output buffer | Input buffer: 3 V, 3.3 V, 5 V TTL-I/F buffer Output buffer: 3, 6, 9, 12, 18, 24, 48 mA (3.3 V, 3 V I/F) 1, 2, 3, 6, 9 mA (5 V I/F) | | | | | |
| | Macro | CPU | - | | V30MX, Z80, etc. | | |
| | | Memory | RAM | ROM, RAM | | RAM | ROM, RAM |
| | | Peripheral | - | - | | FDC, DMAC, 7105x, etc. | |
| | Analog | A/D Converter, D/A Converter (Under development) | | | | | |
| Power consumption | | 1.5 $\mu\text{W}/\text{MHz}/\text{Cell}$ (3.3 V), 1.1 $\mu\text{W}/\text{MHz}/\text{Cell}$ (Y-block, 3.3 V) | | | | | |
| Output drive capability | | IoL = 1, 2, 3, 6, 9, 12, 18, 24 mA | | | | | |
| Interface level | | LV-TTL interface (VIL = 0.8 V, VIH = 2.2 V) | | | | | |
| Process | | 0.5 μm rule CMOS process, aluminum 2-layer/3-layer wiring | | | | | |

∗: When not mounting hard macro

Library

| | | |
|----------------------------|------------|---|
| Macro | CPU | V30MX ^{*1} $\mu\text{PD70008}$ ^{*2} |
| | Peripheral | FDC, DMAC, 7105x |
| | Memory | ROM, RAM |
| | Analog | A/D Converter, D/A Converter, Analog switch |
| | Others | Register file |
| Special block [∗] | | Scan, Rambus TM , PLL, GTL, PCI |

*1: New developed original CPU core for CB-C8 family.
Software compatible with V20HL/V30HL CPU.

*2: Compatible with Z80

∗: Under development

Analog Master

The Analog Master is a semi-custom LSI for creating analog circuits on a master wafer by inter-connecting pre-defused elements (bipolar transistors, resistors, and capacitors, already formed on the wafer) with the user-defined wiring.

Feature

Very short development period

Four to eight weeks from layout design to ES (Engineering Sample) production

Suitable in case of small lot production

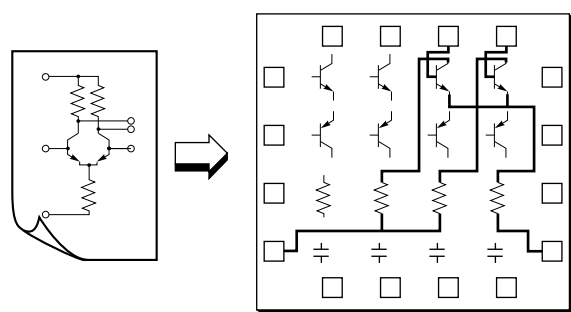
A few thousand LSIs per lot (six months) in case of simulation level interface (the number depends on product)

Powerful line-up

4 families (14 masters) are provided to cover wide range of operating frequency, withstand voltage, and number of elements used.

Various macro libraries

To reduce user's works, variety of macros are provided such as operational amplifier, comparator, regulator, etc.



bipolar transistors, resistors, and capacitors, already formed on master wafer.

Product list

| Item | Family name | CHS family | | | | | CHS-A family | | | V-CHS family | M-CHS family | | | | |
|--------------------------|------------------------------------|--|--------------|--------------|--------------|--------------|--|----------------|--------------|--------------------------|--|--|--------------|--------------|--------------|
| Process | | High speed bipolar | | | | | | | | Super high speed bipolar | High speed, high breakdown voltage bipolar | | | | |
| Absolute maximum ratings | | 14 V | | | | | | | | 11 V | 44 V | | | | |
| Features | | Allows high speed signal transaction of analog circuit | | | | | | | | | | <ul style="list-style-type: none"> High breakdown voltage: $V_{CCMax} = 44 V$ $f \leq$ Several MHz | | | |
| | | $f \leq$ Several ten of MHz | | | | | | $f \leq 1 GHz$ | | | | | | | |
| Product name | | $\mu PC5020$ | $\mu PC5021$ | $\mu PC5022$ | $\mu PC5023$ | $\mu PC5024$ | $\mu PC5031$ | $\mu PC5032$ | $\mu PC5034$ | $\mu PC5102$ | $\mu PC5200$ | $\mu PC5201$ | $\mu PC5202$ | $\mu PC5203$ | $\mu PC5204$ |
| Number of Pad | | 28 | 32 | 50 | 22 | 80 | 36 | 56 | 82 | 24 | 24 | 28 | 40 | 52 | 62 |
| Total number of element | | 1628 | 2328 | 3042 | 727 | 6152 | 576 | 1472 | 2252 | 1367 | 658 | 1038 | 1799 | 3104 | 4578 |
| | NPN Transistor (Driver Transistor) | 260 | 368 | 476 | 129 | 836 | 118 (13) | 298 (18) | 446 (26) | 186 | 105 | 163 | 283 | 484 | 710 |
| | PNP Transistor | 224 | 320 | 416 | 116 | 672 | 105 | 280 | 450 | 65 | 84 | 140 | 252 | 448 | 672 |
| | Resistors | 1116 | 1600 | 2098 | 468 | 4560 | 338 | 854 | 1266 | 1090 | 456 | 712 | 1225 | 2108 | 3108 |
| | Capacitors | 28 | 40 | 52 | 14 | 84 | 15 | 40 | 90 | 26 | 9 | 15 | 27 | 48 | 72 |
| Micro library | | Operational amplifier, Comparator, Regulator Filter, ECL, Switch, Timer, Super White TEG * | | | | | Super White TEG *, Another macro library is under development. | | | - | Operational amplifier, Comparator, Regulator, Switch | | | | |
| Package | | DIP, S-DIP, SOP, S-SOP, QFP, TQFP | | | | | S-DIP, SOP, S-SOP, QFP, TQFP | | | DIP, S-DIP, SOP | DIP, S-DIP, SOP, S-SOP, QFP, TQFP | | | | |

*: Super White TEG (Test Element Group) includes function macro libraries (regulator, operational amplifier, comparator, zero-cross-comparator, reset, driver, switch)

Particular Purpose IC

| | |
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| Vehicle Communication IC | 120 |

Speech Synthesis IC

■ **Fixed phrase play back**

| Item | | Device | μPD7755 | μPD7756A | μPD7757 | μPD7758A | μPD77P56 | μPD7759 |
|--------------------|---|---|-------------------|-------------------|------------------|--|------------------|--|
| Synthesis method | | ADPCM, PCM + waveform element | | | | | | |
| Sampling frequency | | 5, 6, 8 kHz | | | | | | |
| Speech data memory | | 96 Kbit mask ROM | 256 Kbit mask ROM | 512 Kbit mask ROM | 1 Mbit mask ROM | 256 Kbit one time PROM | 1 Mbit external | |
| Synthesizing time | Speech* (ADPCM) | 4 seconds typ. | 12 seconds typ. | 24 seconds typ. | 50 seconds typ. | 12 seconds typ. | 50 seconds typ. | |
| | Melodies & sound effects (PCM+waveform element) | 30 seconds typ. | 85 seconds typ. | 170 seconds typ. | 340 seconds typ. | 85 seconds typ. | 340 seconds typ. | |
| Package | | <ul style="list-style-type: none"> • 18-pin DIP (300 mil) • 24-pin SOP (375 mil, 450 mil) | | | | <ul style="list-style-type: none"> • 20-pin DIP (300 mil) • 24-pin SOP (450 mil) | | <ul style="list-style-type: none"> • 40-pin DIP • 52-pin QFP |

*: The synthesis time for the speech is the value for a 6 kHz sampling.

■ **Record/play back**

| | | μPD77501 | |
|-----------------------------|--------|---|---|
| Speech coding method | | ADPCM | |
| Sampling frequency | | 6 kHz | |
| Compressed speech data rate | | 2 bits (12 kbps), 3 bits (18 kbps), 4 bits (24 kbps) | |
| External memory type | | DRAM area (4M bits ∞ 4 max.) | ROM/SRAM area (1M bits max.) |
| Applications | | Message record/play back | Fixed phrase play back, response message record/play back |
| Record/play back time | 12kbps | Approximately 23 minutes and 18 seconds | Approximately 1 minute and 27 seconds |
| | 18kbps | Approximately 15 minutes and 30 seconds | Approximately 1 minute |
| | 24kbps | Approximately 11 minutes and 30 seconds | Approximately 44 seconds |
| Internal functions | | <ul style="list-style-type: none"> • DTMF receiver • Band-pass filter • Microphone amplifier (fixed/variable gain) | <ul style="list-style-type: none"> • 10-bit over sampling A/D, D/A converters • ADPCM encoder/decoder • Host CPU interface |
| Supply voltage | | 4.75 to 5.25 V | |
| Supply current | | 35 mA typ. (6 mA max. during power down) | |
| Process | | CMOS | |
| Package | | • 80-pin QFP (0.65 mm pitch) | |

| | | μPD77502 | |
|-----------------------------|--|--|--|
| Speech coding method | | FLC Method (Fixed point Low bit rate Coding) (FLC is a unique NEC method based on CELP) (CELP = Code Excited Linear Predictive coding) | |
| Sampling frequency | | 8 kHz | |
| Compressed speech data rate | | 4 kbps | |
| External memory type | | DRAM area (4M bits ∞ 4 or 16M bits ∞ 1) | ROM (or SRAM) area (16M bits max.) |
| Applications | | In Coming Message | Fixed. OGM *, Users OGM * |
| Record/play time length | | 60 minutes | 60 minutes |
| Functions | | <ul style="list-style-type: none"> • FLC Encoder/Decoder • Echo Canceller (For Full duplex speaker phone application) • DTMF/Sine Wave/etc, Generator | <ul style="list-style-type: none"> • μ/A low PCM I/F • Host CPU I/F • Silence Compression |
| Supply voltage | | 5 V ±10% | |
| Supply current | | 120 mA (operate mode), 20 mA (power down mode) | |
| Process | | CMOS | |
| Package | | • 100-pin QFP (0.65 mm pitch) | |

*1 : OGM: Out Going Message

| |
|------------|
| DSP |
|------------|

| | μ PD77C25 | μ PD77C25-10 | μ PD77220-10 | μ PD77230A | μ PD77240 |
|--|--|--|--|--|---|
| Instruction cycle (ns) | 122 | 100 | 100 | 150 | 90 |
| Data type *1 | fixed | | fixed | fixed/floating | fixed/floating |
| Multiplier precision (bits) | 16 ∞ 16 \emptyset 31 | | 24 ∞ 24 \emptyset 47 | 32 ∞ 32 \emptyset 55 | 32 ∞ 32 \emptyset 55 |
| ALU precision (bit) | 16 | | 47 | 55 | 55 |
| Internal memory (words ∞ bits) | Program ROM | 2K ∞ 24 | 2K ∞ 32 | 2K ∞ 32 | 2K ∞ 32 *2 |
| | Program RAM | – | – | – | – |
| | Data ROM | 1K ∞ 16 | 1K ∞ 24 | 1K ∞ 32 | 1K ∞ 32 *2 |
| | Data RAM | 256 ∞ 16 | 512 ∞ 24 | 1K ∞ 32 | 1K ∞ 32 |
| External memory (words x bits) | – | | 8K ∞ 24 | 8K ∞ 32 | 62K ∞ 32 (program) 16M ∞ 32 (data) |
| Package | <ul style="list-style-type: none"> • 28-pin DIP • 44-pin QFJ • 32-pin SOP | <ul style="list-style-type: none"> • 28-pin DIP • 28-pin QFJ • 32-pin SOP | <ul style="list-style-type: none"> • 68-pin PGA • 68-pin QFJ | <ul style="list-style-type: none"> • 68-pin PGA | <ul style="list-style-type: none"> • 132-pin PGA |

*1: fixed: Fixed point decimal floating: Floating point decimal

*2: Internal library program

| | μ PD77016 | μ PD77017 | μ PD77018 | μ PD77015 |
|--|---|---------------------------|---------------------------------------|---------------------------------------|
| Instruction cycle (ns) | 30 | 30 | 30 | 30 |
| Data type *1 | fixed | | fixed | fixed |
| Multiplier precision (bits) | 40 + 16 ∞ 16 \emptyset 40 | | 40 + 16 ∞ 16 \emptyset 40 | 40 + 16 ∞ 16 \emptyset 40 |
| ALU precision (bit) | 40 | | 40 | 40 |
| Internal memory (words ∞ bits) | Program ROM | – | 12K ∞ 32 | 24K ∞ 32 |
| | Program RAM | 1.5K ∞ 32 | 256 ∞ 32 | 256 ∞ 32 |
| | Data ROM | – | 8K ∞ 16 | 24K ∞ 16 |
| | Data RAM | 4K ∞ 16 | 4K ∞ 16 | 6K ∞ 16 |
| External memory (words x bits) | 48K ∞ 32 (program) 96K ∞ 16 (data) | 32K ∞ 16 (data) | 32K ∞ 16 (data) | 32K ∞ 16 (data) |
| Package | • 160-pin QFP | • 100-pin TQFP | • 100-pin TQFP | • 100-pin TQFP |

*1: fixed: Fixed point decimal floating: Floating point decimal

| |
|-------------------------|
| Liner CCD sensor |
|-------------------------|

■ Black-and-white

| Type number | Effective number of picture element (bit) | Sensitivity (TYP.) (V/Lx·s) | Data rate (MAX.) (MHz) | Package | Remarks |
|----------------|---|-----------------------------|------------------------|--------------|--|
| μ PD35H74 | 2592 | 5.4 | 10 | • 22-pin DIP | High sensitivity 2.5K-bit sensor |
| μ PD35H71A | 5000 | 5.2 | 40 | • 22-pin DIP | High speed 5K-bit sensor |
| μ PD3594 | 2592 | 144 | 2 | • 22-pin DIP | Built in timing gen., S/H, variable output Amp. |
| μ PD3732 | 1760 | 90 | 2 | • 22-pin DIP | Built in S/H, output Amp. |
| μ PD3733 | 2088 | 90 | 2 | • 22-pin DIP | Built in S/H, output Amp. |
| μ PD3734 | 2660 | 70 | 3 | • 22-pin DIP | Built in S/H, output Amp. |
| μ PD3743 | 2088 | 90 | 2 | • 22-pin DIP | Built in output Amp. CS output |
| μ PD3737 | 5150 | 7.5 | 20 | • 22-pin DIP | |
| μ PD3753 | 2088 | 90 | 2 | • 22-pin DIP | Single 5 V power supply Built in reset/clamp pulse gen. |

■ Color

| Type number | Effective number of picture element (bit) | Sensitivity (TYP.) (V/Lx·s) | Data rate (MAX.) (MHz) | Package |
|------------------|---|-----------------------------|------------------------|--------------|
| μ PD3725D-01 | 5000 ∞ 3 | R 3.87 G 3.80 B 2.07 | 16 | • 24-pin DIP |
| μ PD3726 | 3648 ∞ 3 | R 1.50 G 1.52 B 0.84 | 8 | • 22-pin DIP |
| μ PD3727 | 5300 ∞ 3 | R 2.20 G 2.00 B 1.20 | 10 | • 22-pin DIP |
| μ PD3723 | G 2048 R, B 1024 | R 9.2 G 7.5 B 3.8 | 1 | • 22-pin DIP |

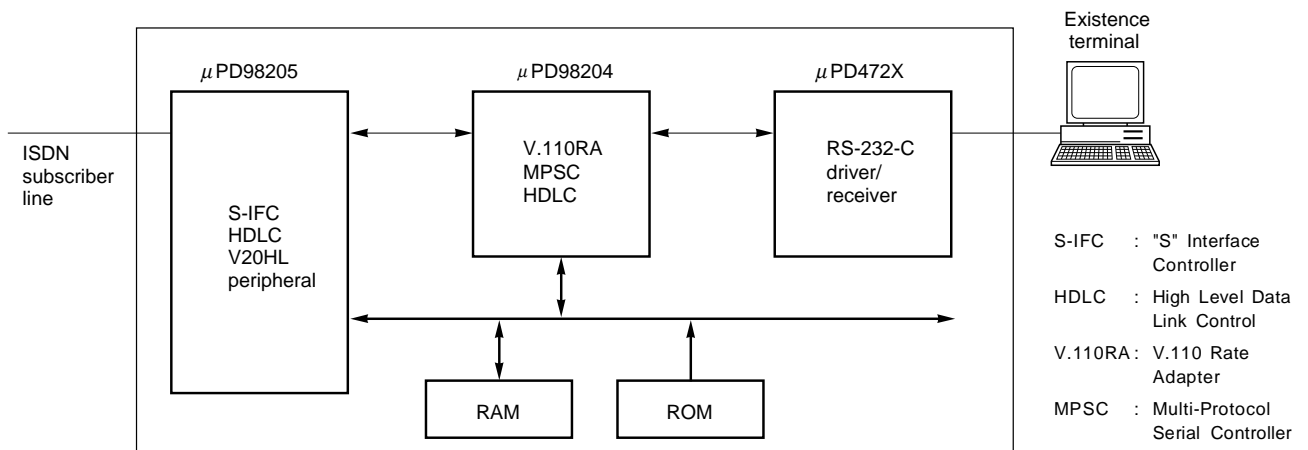
Communication IC

■ Communication LSI

| Type number | Function | Features | Package |
|------------------|---|---|---|
| μ PD72001-11 | Multi-protocol serial controller | Allows communication in ASYNC, COP, and BOP mode (2 ch) μ PD72001-11: 5 V Operation μ PD72001-A8: 3.3 V Operation | <ul style="list-style-type: none"> • 40-pin DIP • 52-pin QFP • 52-pin QFJ • 44-pin TQFP |
| μ PD72001-A8 | | | <ul style="list-style-type: none"> • 40-pin DIP • 52-pin QFJ • 52-pin QFP |
| μ PD72002-11 | Multi-protocol serial controller | Allows communication in ASYNC, COP, and BOP mode (1 ch) | <ul style="list-style-type: none"> • 40-pin DIP • 44-pin QFP • 44-pin QFJ • 44-pin TQFP |
| μ PD72103 | HDLC controller | HDLC frame control, link/separation are possible, internal DMA controller | <ul style="list-style-type: none"> • 64-pin SDIP • 68-pin QFJ • 80-pin QFP |
| μ PD72103A* | | 8 Mbps operation | |
| μ PD72105 | LAN controller | Accommodates CSMA/ACK | <ul style="list-style-type: none"> • 48-pin DIP • 52-pin QFJ |
| μ PD72107 | Packet communication control LSI (X.25 communication control) | Can accommodate high speed transmission (4 MHz) Conforms ITU-T recommendation X.25 (LAP-B '84 ver) | <ul style="list-style-type: none"> • 64-pin shrink DIP • 68-pin QFJ • 80-pin QFP |
| μ PD72305 | LAP-D protocol processing LSI | Supports LAP-D protocol of ITU-T recommendation | <ul style="list-style-type: none"> • 64-pin shrink DIP • 68-pin QFJ • 80-pin QFP |
| μ PD98201 | S interface transceiver for NT or TE | 4-wire full duplexed communication (basic access) Conforms to ITU-T recommendation I430 | <ul style="list-style-type: none"> • 64-pin QFP |
| μ PD98203 | S interface transceiver for NT | Conforms to ITU-T recommendation I430 | <ul style="list-style-type: none"> • 20-pin DIP |
| μ PD98204 | ISDN rate adapter | RA + MPSC + HDLC on 1 chip small/thin package | <ul style="list-style-type: none"> • 80-pin TQFP |
| μ PD98205 | ISDN basic rate interface controller | S-IFC + HDLC + V20HL + peripheral on 1 chip small/thin package | <ul style="list-style-type: none"> • 144-pin LQFP |
| μ PD9951 | 7 kHz-band linear codec | 7 kHz-band 16-bit A/D, D/A | <ul style="list-style-type: none"> • 52-pin QFP |
| μ PD9952 | SB-ADPCM codec | SB-ADPCM on 1 chip | <ul style="list-style-type: none"> • 32-pin SOP • 28-pin DIP |
| μ PD6316 | D2B controller/driver | Conforms to D2B interface | <ul style="list-style-type: none"> • 16-pin DIP/SOP |
| μ PD6708 | IE Bus™ controller/driver | Transmit data buffer: 4 bytes Receive data buffer: 20 bytes | <ul style="list-style-type: none"> • 16-pin SOP (300 mil) |
| μ PD72042A | | Transmit data buffer: 33 bytes Receive data buffer: 40 bytes | <ul style="list-style-type: none"> • 16-pin SOP (375 mil) |
| μ PD72042B | | | |
| μ PC2590 | IE Bus™ driver/receiver | Can connect to μ PD7809X | <ul style="list-style-type: none"> • 8-pin SOP |

*: Under development

[ISDN Terminal Adapter]

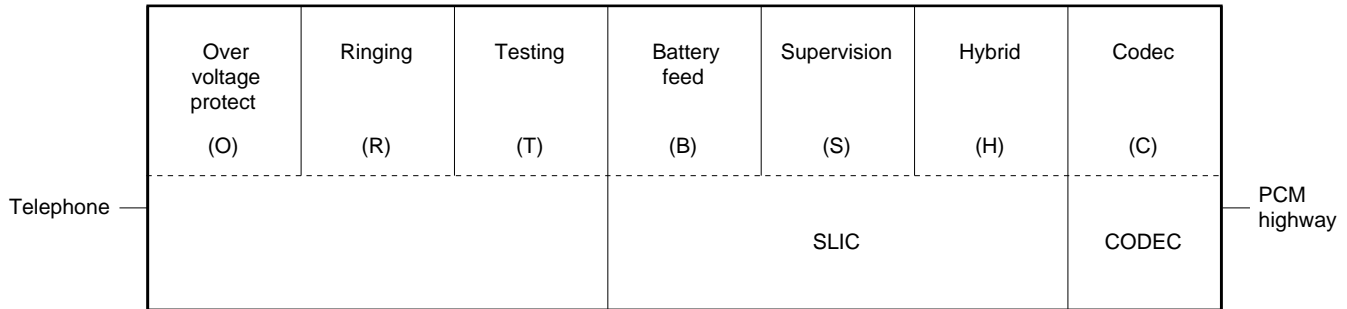


Communication IC

■ **Chip Set for ATM-LAN**

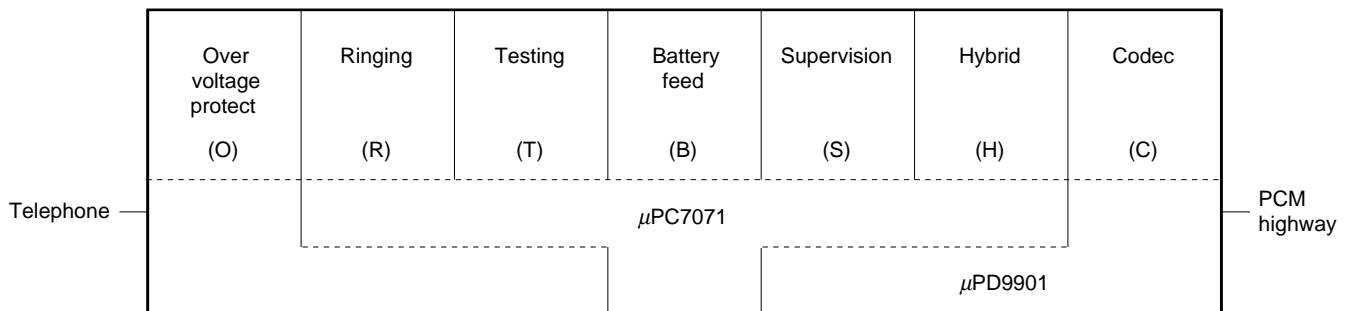
| Type number | Function | Features | Package |
|----------------|-------------------------|---|--|
| μ PD98401A | Local ATM SAR chip | <ul style="list-style-type: none"> • Comforms to ITU-TS, ANSI (T1S1) and ATM Forum Recommendations • Implements the required AAL-5 SAR sublayer and ATM layer function | <ul style="list-style-type: none"> • 208-pin QFP (Fine Pitch) |
| μ PD98402A | Local ATM SONET Frammer | <ul style="list-style-type: none"> • ATM physical layer having the TC sublayer function • Comforms to ATM Forum UNI specifications • SONET STS-3c frame format | <ul style="list-style-type: none"> • 160-pin QFP (Fine Pitch) |

■ **Analog Line Card LSI**



| | | | |
|-------------------|--------------|---|--------------|
| SLIC (BSH-LSI) | μ PC7151 | Constant resistance feeding method (-48V) | • 32-pin QFJ |
| | μ PC7063 | Constant current feeding method (-24V) | |
| | μ PC7161 | Constant current feeding method (-48V) | |

| | | | |
|----------------------|---------------|-------------------------------|--------------|
| CODEC (PCM CODEC) | μ PD9604A | μ -law, internal PLL, DGS | • 16-pin DIP |
| | μ PD9605A | A-law, internal PLL, DGS | |
| | μ PD9621 | A-law, internal PLL | • 16-pin DIP |
| | μ PD9622 | μ -law, internal PLL | • 18-pin QFJ |
| | μ PD9624 | μ -law, internal PLL, DGS | • 18-pin QFJ |
| | μ PD9625 | A-law, internal PLL, DGS | |

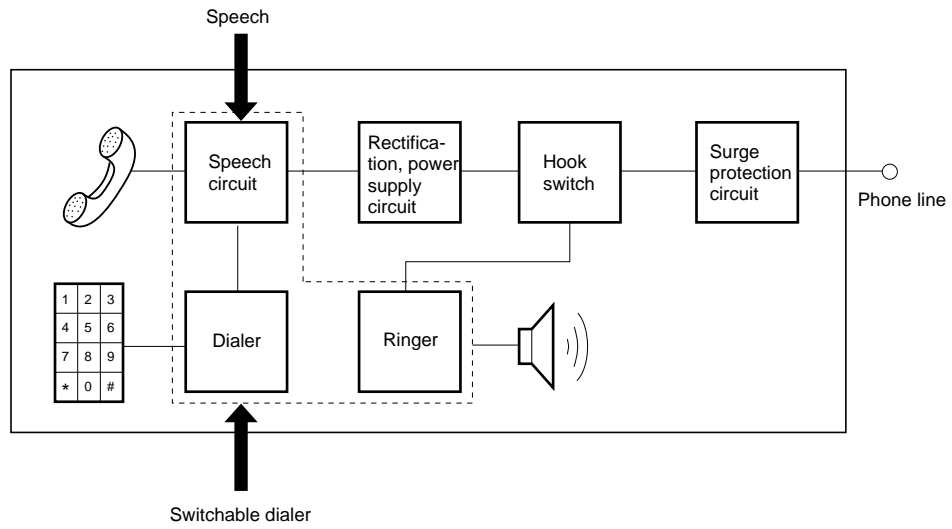


| | | | |
|---------|--------------|--|--------------|
| BS-SLIC | μ PC7071 | <ul style="list-style-type: none"> • Tip-Ring polarity reverse • 3 relay drivers | • 32-pin QFJ |
|---------|--------------|--|--------------|

| | | | |
|---------------|--------------|---|--------------|
| Digital-CODEC | μ PD9901 | <ul style="list-style-type: none"> • Terminal impedance and Hybrid balance network can be selected by combining μPC7071 | • 28-pin QFJ |
|---------------|--------------|---|--------------|

Communication IC

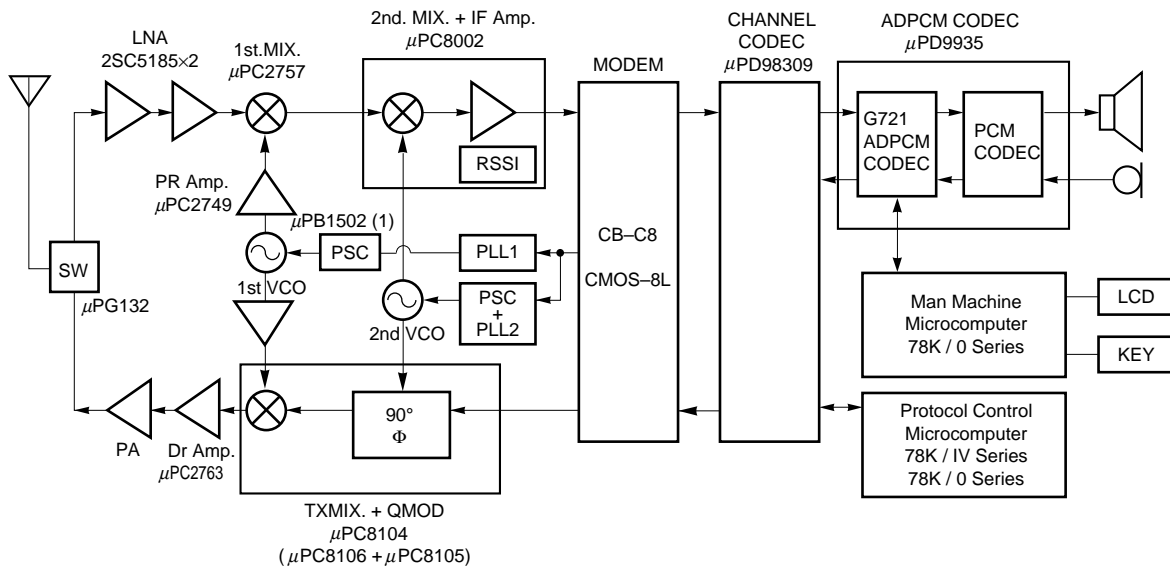
■ Telephone LSI



| | | | |
|--------|----------------|--|---------------|
| Speech | μPC7002 | Auto/manual pad function Adjustable receiver gain, internal receiver amplifier | • 28-pin SDIP |
|--------|----------------|--|---------------|

Communication IC

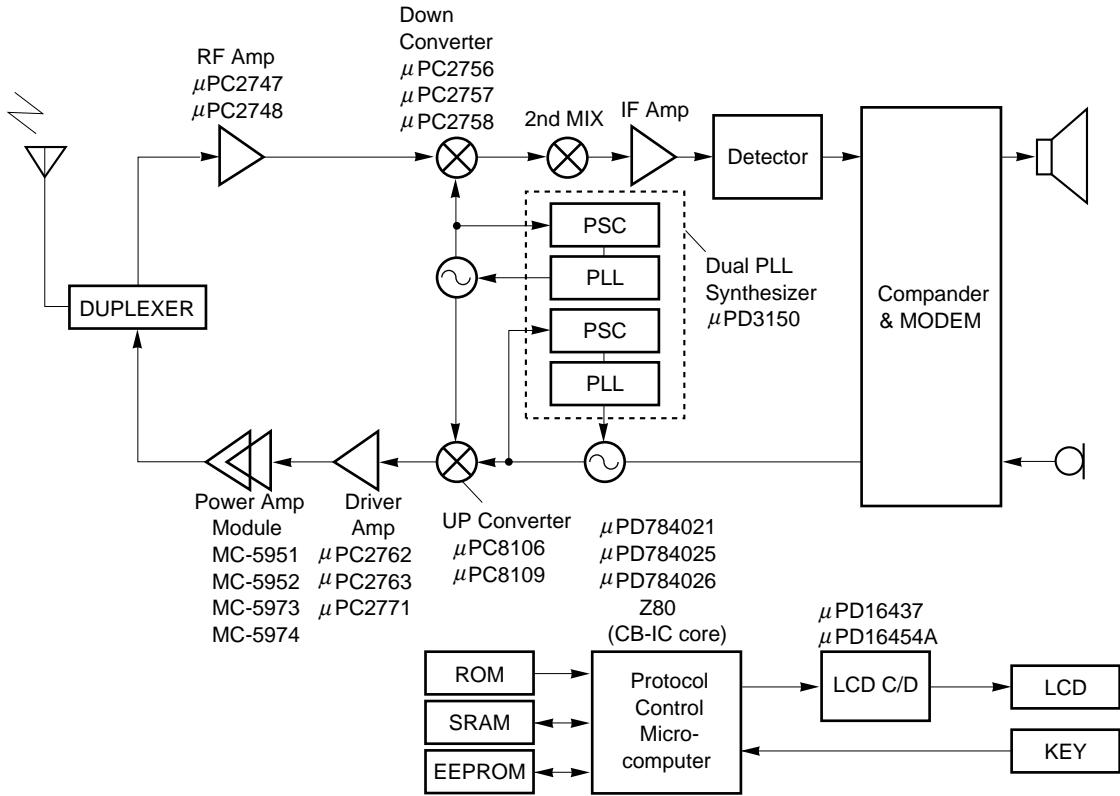
■ Digital Cordless Telephone (Hand Set) LSI



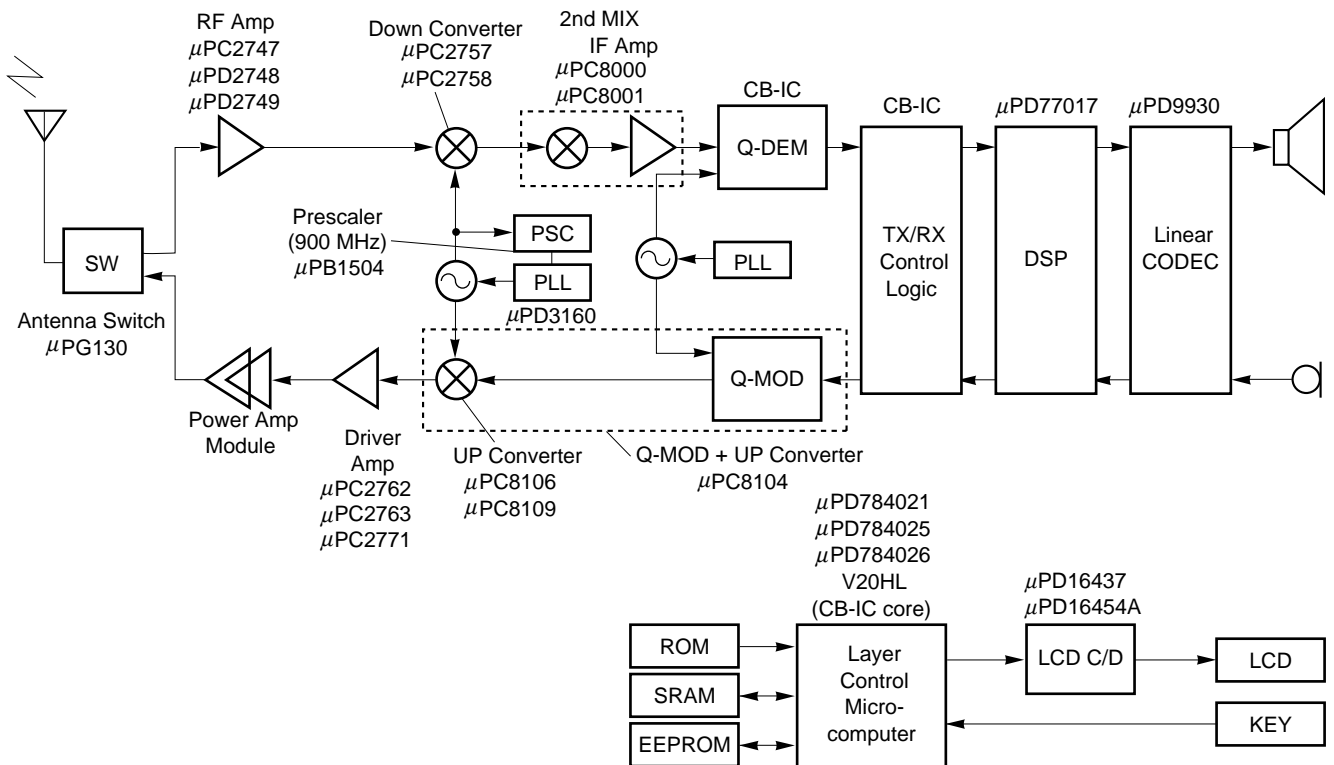
| Type number | Function | Features | Package |
|----------------------|--|--|---|
| μPG132 | SW: Antenna Switch (L-SPDT SW) | Low Power Loss: 0.6 dB (TYP.), @f = 2 GHz Hi speed switching time: 40 ns, 3 V operation | • 8-pin SSOP |
| 2SC5185 | LNA: Low Noise Transistor | NF: 1.3 dB (TYP.), @2V, 3 mA, f = 2 GHz ft: 13 GHz (TYP.), @2 V, 20 mA, f = 2GHz | • 4-pin super mini-mold |
| μPC2757 | 1st MIX.: L Band Down Converter | NF: 16 dB (TYP.), SSB mode, @fRF = 2GHz, fIF = 250 MHz, Power Consumption: Vcc = 3 V, Icc = 5.6 mA | • 6-pin mini-mold |
| μPC2749 | Pr Amp.: Low Noise Amp | NF: 4.0 dB (TYP.), @, f = 1.9 GHz, Vcc = 3 V GP: 16 dB (TYP.), @f = 1.9 GHz, Vcc = 3 V | • 6-pin mini-mold |
| μPC8002 | 2nd. MIX. + IF Amp. | Input Frequency Range: fMIX = 250 MHz (TYP.) ~ 500 MHz (MAX.) Power Consumption: Vcc = 3 V, Icc = 3.4 mA | • 20-pin SSOP |
| μPB1502(1) | PSC: ~ 2 GHz Prescaler | Operation Frequency: ~ 2 GHz, Input Power Sensivity: 130 ~ 220 mVp-p, Power Consumption: Vcc = 3 V, Icc = 6.7 mA | • 8-pin SOP |
| μPC8104 | TX MIX + QMOD: Up Converter + Quadrature Modulator | Operation Frequency Range: fRFout = 900 MHz ~ 2 GHz QMOD: fLo1in = fMODout = 100 MHz ~ 400 MHz, @Vcc = 3 V | • 20-pin SSOP |
| μPC8105 | 400 MHz Quadrature Modulator For Digital Mobile Communication | Operation Frequency: fLo = 100 MHz ~ 400 MHz, fI/Q = DC ~ 10 MHz Low Current Dissipation: 16 mA (TYP.) | • 16-pin SSOP |
| μPC8106 | 2.0 GHz Up Converter ICs For Cellular and Cordless Telephones | Operation Frequency Range: fRFout = 0.4 GHz ~ 2.0 GHz, fIFin = 100 MHz ~ 400 MHz Low Current Dissipation: 9 mA | • 6-pin-mini-mold |
| μPC2763 | Dr Amp.: Midium Power Amp. | Output Level Po (sat): +8.0 dBm, @f = 1.9 GHz, Vcc = 3 V NF: 5.5 dB (TYP.), @f = 1.9 GHz, Vcc = 3 V | • 6-pin mini-mold |
| μPD658XX | Modem: CMOS G/A | Supply Voltage: VDD = 3.3 V, 0.5 μm rule, 10 K ~ 627 K gate on Chip | (EX.) QFP (0.5P): 304pins, PGA: 528pins |
| μPD98309 | Digital Cordless Telephone (PHS) Channel Codec | 1 slot TDMA/TDD control conforming to RCRSTD-28 (for PS/CS), VDD = 2.7 ~ 3.3 V, IDD = 2 mA at 3 V | • 100-pin QFP |
| μPD9935 | ADPCM Codec | Internal allowing operation with 8 kHz frame Low Power Consumption: VDD = 3 V, IDD = 7 mA | • 38-pin SSOP |
| 78K/IV Series | Protocol Control 16-bit Single Chip Microcomputer | Supply Voltage Range: 2.7 V ~ 5.5 V, Memory Space: 1 M, Power Management Function | • 80-pin QFP |
| 78K/0 Series | Protocol Control/Man Machine 8-bit Single Chip Microcomputer | Supply Voltage Range: VDD = 2 ~ 6 V, Low Power Consumption: VDD = 3 V, IDD = 0.8 mA | • 80-pin QFP • 80-pin WQFN |

Communication IC

■ Analog Cellular Telephone IC



■ Digital Cellular Telephone IC



Communication IC

| Type number | Function | Features | Package |
|--|--|--|---------------------------------|
| MC-5951 | GaAs Power Amp for AMPS | V _{DD} = 5.8 V P _{OUT} ≥ 30.5 dBm, G _P ≥ 24 dB | metal package 17 ∞ 12 ∞ 4 mm |
| MC-5952 | GaAs Power Amp for E-TACS | V _{DD} = 5.8 V P _{OUT} ≥ 30.5 dBm, G _P ≥ 24 dB | |
| MC-5973 | GaAs Power Amp for AMPS | V _{DD} = 4.6 V P _{OUT} ≥ 30.5 dBm, G _P ≥ 24 dB | |
| MC-5974 | GaAs Power Amp for E-TACS | V _{DD} = 4.6 V P _{OUT} ≥ 30.5 dBm, G _P ≥ 24 dB | |
| μPG130 | GaAs Antenna Switch (100 MHz ~ 2 GHz) | low power loss; 0.5 dB (at 1 GHz) | • 8-pin SOP/ SSOP |
| μPC2747 | Low Noise RF Amp (900 MHz) | +3 V single power source, NF = 3.3 dB, f _u = 1.8 GHz | • 6-pin mini-mold |
| μPC2748 | | +3 V single power source, NF = 2.8 dB, high gain (19 dB) | |
| μPC2749 | Low Noise RF Amp (2 GHz) | +3 V single power source, low power consumption (I _{CC} = 6 mA) | • 6-pin mini-mold |
| μPC2757 | Down Converter (900 MHz ~ 2 GHz) | +3 V single power source, low power consumption | • 6-pin mini-mold |
| μPC2758 | | +3 V single power source, low distortion | |
| μPC8106 | Up Converter (100 MHz ~ 2 GHz) | +2.7 ~ 5.5 V low distortion (IP ₃ = +4.5 dBm) | • 6-pin mini-mold |
| μPC8109 | | +2.7 ~ 5.5 V low power consumption (I _{CC} = 5 mA) | |
| μPC2771 | Driver Amp (900 MHz ~ 1.5 GHz) | +3 V single power source, high output power (+12 dBm @900 MHz, +11 dBm @1.5 GHz) | • 6-pin mini-mold |
| μPC2762 | Driver Amp (~ 2 GHz) | +3 V single power source, f _u = 2.9 GHz | • 6-pin mini-mold |
| μPC2763 | | +3 V single power source, high gain (20 dB) | |
| μPC8000 | 5 V 2nd Mixer + IF Amp (455 kHz) | +5 V single power source, high limiting sensitivity (-90 dBm) wide RSSI dynamic range (90 dB) linearity ≤ ±2dB | • 14-pin SSOP |
| μPC8001 | 3 V 2nd Mixer + IF Amp (455 kHz) | +3 V single power source, on-chip RSSI resister high speed power on time (174 μs) | • 14-pin SSOP |
| μPC8104 | Up Converter + Quadrature Modulator | +2.7 ~ 5.5 V single power source, high phase variation stability, wide output range (0.9 ~ 1.9 GHz) | • 20-pin SSOP |
| μPD3150 | Dual PLL Synthesizer for Analog Cellular | +2.7 ~ 5.5 V power source, on-chip prescaler possible to switch lock sensitivity | • 20-pin SSOP |
| μPB1504 | Prescaler (500 MHz ~ 1.1 GHz) | +3 V single power source high input sensitivity (-19 ~ +4 dBm) low power consumption (2.4 mA) | • 8-pin SOP |
| μPD77017 | 16-bit DSP | V _{DD} = 3 V high performance (33 MIPS) GUI-based high integrated development tools low power consumption | • 100-pin QFP |
| μPD9930 | 13-bit Linear CODEC | programmable tone generator (DTMF, GSM triple tone) mic./receiver Amp, GSM DAI | • 44-pin QFP |
| μPD784021 μPD784025 μPD784026 | 16-bit Single Chip Microcomputer | V _{DD} = 2.7 ~ 6.0 V, low power consumption, 1 M byte linear addressing on-chip timers, serial I/O, A/D, D/A, ROM, RAM | • 80-pin QFP |
| V20HL (CB-IC core) | 16-bit Microprocessor | 3 V operation 1 M byte memory space peripheral options (CB-IC macro) (timers, serial I/O, A/D, D/A, ROM, RAM etc.) | QFP etc. |
| Z80 (CB-IC core) | 8-bit Microprocessor | 3 V operation (full static) peripheral options (CB-IC macro) (timers, serial I/O, A/D, D/A, ROM, RAM etc.) | QFP etc. |
| μPD16454A | LCD Controller/Driver | on-chip DC/DC Converter (5 V ∅ 10 V), 24 ∞ 2 | • TAB bare chip |
| μPD16437 | 3 V LCD Controller/Driver | on-chip DC/DC Converter (3 V ∅ 9 V, 5 V ∅ 10 V) 12 ∞ 2 | • TAB bare chip |

| |
|------------------------|
| Mass Storage IC |
|------------------------|

| Type number | Function | Features | Package |
|------------------|--|--|--|
| μPD72065B | Floppy disk controller | Low power consumption by CMOS | <ul style="list-style-type: none"> • 40-pin DIP • 52-pin QFP • 44-pin QFJ |
| μPD72068 | Floppy disk controller | Internal VFO write compensation circuit Internal register for accommodating IBM-PC/AT | <ul style="list-style-type: none"> • 80-pin QFP • 84-pin QFJ |
| μPD72064 | Floppy disk controller | Internal VFO for accommodating IBM-PC/AT | <ul style="list-style-type: none"> • 52-pin QFP • 44-pin QFJ |
| μPD72070 | Floppy disk controller | Functional superset of μPD765A, supports 4MB, 16-byte FIFO in the data resister | <ul style="list-style-type: none"> • 64-pin QFP |
| μPD72611 | SCSI-2 controller | Conforms to ANSI ∞ 3T9.2/86-109 Rev. 10C High speed synchronous transfer 10 MBytes/s | <ul style="list-style-type: none"> • 100-pin QFP |
| μPD72050 | MO (Magneto-Optical) disk controller | Support 3.5" (230 MB max), 5.25" (1.3 GB max) Embedded SCSI-2 controller/driver Buffer memory control up to 4 MB | <ul style="list-style-type: none"> • 160-pin QFP |
| μPD6378A | CD ROM decoder LSI | Conforms to CD-ROM XA format Supports CD triple-speed playback | <ul style="list-style-type: none"> • 100-pin QFP |
| μPD63701 | CD ROM decoder LSI | Supports 512K bytes of external DRAM | <ul style="list-style-type: none"> • 100-pin QFP |
| μPD63721 | 1 chip CD-ROM controller | Digital Servo, Data Processor, CD-ROM Decoder, Host I/F on 1 chip Supports Quadruple speed operation, ATAPI Include automatic adjust servo function Wide capture range Internal Digital Attenuator Supports PIO mode 3, DMA mode 1 Internal Buffer Memory Controller (128K word ∞ 4 bi-512K word ∞ 8 bit DRAM/256K byte SRAM) | <ul style="list-style-type: none"> • 160-pin QFP |
| μPC2138 | R/W amplifier for hard disk drive MIG Head | Low noise, low input capacitance, and high recording density | <ul style="list-style-type: none"> • 20-pin SSOP |
| μPC2132 | | | |
| μPC2133 | R/W amplifier for hard disk drive TF Head | Low noise, low input capacitance, and high recording density | <ul style="list-style-type: none"> • 20-pin SSOP |
| μPC2102 | R/W amplifier for floppy disk controller | Low power Internal PLA, D/A | <ul style="list-style-type: none"> • 20-pin SSOP |
| μPD72051 | PD controller | PCR format controller/Error Correction CD-ROM Decoder/Error Correction ATA-2 controller (Support ATAPI) Buffer Manager | <ul style="list-style-type: none"> • 144-pin QFP |

Display IC

■ **Fluorescence indicator panel (FIP) driver IC**

| Type number | Drives | Number of outputs | Withstand voltage (V) | Output current (mA) | Output type | Package | Main applications |
|--------------------|---------|-------------------|-----------------------|---------------------|-------------|---------------|-------------------------------|
| μPD6300 | Static | 20 | 40 | 5 | Pch-O.D | • 28-pin DIP | Automotive (instrument panel) |
| μPD6320 μPD6321 | Static | 39 | 18 | 1 | CMOS | • 52-pin QFP | Car stereo |
| μPD6323B | Static | 21 | 40 | 5 | Pch-O.D | • 28-pin DIP | Automotive (instrument panel) |
| 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* | |
| μPD16325* | Dynamic | 40 | 150 | 150 | CMOS | • 80-pin QFP* | |
| μPD16326* | Dynamic | 32 | 150 | 20 | CMOS | • 44-pin QFP | |

*: Three direction lead

*: Under development

■ **Fluorescence indicator panel (FIP®) controller/driver IC**

| Type 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) |

*: At maximum duty

Display IC

■ Liquid crystal display (LCD) controller/driver IC

| Type number | Drives | Duty (MAX.) | Number of outputs | | Number of characters*1 | Logic voltage (V)/ Drive voltage (V) | Package | Main application | Remarks |
|-----------------------------------|---------------|-------------|-------------------|---------|--|--------------------------------------|------------------------------|------------------|--------------------------|
| | | | Segments | Commons | | | | | |
| μ PD7225 | Segment | 1/4 | 32 | 4 | 128 segments | 2.7 ~ 5.5/ 2.7 ~ 5.5 | • 52-pin QFP • 56-pin QFP | | |
| μ PD7227 | DOT character | 1/16 | 40 | 8 | 8 ∞ 1 characters | 5/5 | • 64-pin QFP | | |
| μ PD7228 | DOT character | 1/16 | 42 | 16 | 8 ∞ 2 characters | 5/5 | • 80-pin QFP | | |
| μ PD7228A | DOT character | 1/16 | 42 | 16 | 8 ∞ 2 characters | 5/12 | • 80-pin QFP | | |
| μ PD7229 | DOT character | 1/16 | 42 | 16 | 8 ∞ 2 characters | 5/5 | • 80-pin QFP | | Custom ROM only |
| μ PD7229A | DOT character | 1/16 | 42 | 16 | 8 ∞ 2 characters | 5/12 | • 80-pin QFP | | Custom ROM only |
| μ PD16430A | Segment | 1/4 | 60 | 4 | 240 segments | 3.5 ~ 6/ 3.5 ~ 14 | • 80-pin QFP | Car audio | |
| μ PD16431A | Segment | 1/4 | 56 | 4 | 224 segments | 2.7 ~ 5.5/ 2.7 ~ 6.5 | • 80-pin QFP | Car audio | Included key scan |
| μ PD16432B* | DOT character | 1/15 | 60/65 | 15/8 | 12 ∞ 2 characters + 60 pictographs | 2.7 ~ 5.5/12 | • 100-pin QFP | Car audio | Included key scan |
| μ PD16434 | DOT character | 1/16 | 42 | 16 | 8 ∞ 2 characters | 2.7 ~ 5.5/12 | • 80-pin QFP | | |
| μ PD16435 μ PD16435A | Graphic | 1/73 | 119 | 73 | 119 ∞ 71 dots + 119 ∞ 2 pictographs | 2.7 ~ 5.5/10*2 | • TCP | Mobile phone | Included DC/DC Converter |
| μ PD16437 | DOT character | 1/16 | 60 | 16 | 12 ∞ 2 characters + 60 ∞ 2 pictographs | 3.0 ~ 5.5/10*2 | • TCP | Mobile phone | Included DC/DC Converter |
| μ PD16437A* | DOT character | 1/16 | 60 | 16 | 12 ∞ 2 characters + 60 ∞ 2 pictographs | 2.7 ~ 5.5/10*2 | • TCP | Mobile phone | Included DC/DC Converter |
| μ PD16454A | DOT character | 1/14 | 120 | 14 | 24 ∞ 2 characters | 5/10*2 | • TCP | Mobile phone | Included DC/DC Converter |
| μ PD16670* | DOT character | 1/33 | 60 | 33 | 12 ∞ 4 characters + 60 pictographs | 2.7 ~ 3.6/12*2 | • CHIP | Mobile phone | Included DC/DC Converter |
| μ PD16675* | Graphic | 1/36 | 128 | 34 | 128 ∞ 32 dots + 128 ∞ 32 pictographs | 2.7 ~ 5.5/10*2 | • TCP | Pager | Included DC/DC Converter |
| μ PD16676* μ PD16676A* | Graphic | 1/32 | 61 | 16 | 61 ∞ 16 dots | 2.7 ~ 5.5/12 | • TCP | Pager | – |

*1 : At maximum duty

*2 : Under development

*2 : Internal DC/DC Converter

Display IC

■ Liquid crystal display (LCD) driver IC

| Type number | Drives | Number of outputs | Withstand voltage (V) | Package | Main applications |
|------------------------------|--|-------------------|-----------------------|-------------------|--|
| μ PD6320 μ PD6321 | Static | 39 | 18 | • 52-pin QFP | Car stereo |
| μ PD16443B | TFT (source) 8 gray scale | 192 | 20 | • TCP (slim type) | LCD module for OA |
| μ PD16444A | TFT (source) 8 gray scale | 192 | 20 | • TCP (slim type) | LCD module for OA |
| μ PD16445 | TFT (source) 8 gray scale | 192 | 20 | • TCP (slim type) | LCD module for OA |
| μ PD16446 | TFT (gate) | 120 | 31 | • TCP (slim type) | LCD-TV & for OA |
| μ PD16650* | TFT (gate) | 120/128 | 40 | • TCP (slim type) | LCD-TV & for OA |
| μ PD16405 | TFT (source) | 120 | 20 | • TCP | LCD-TV |
| μ PD16447 | TFT (source) | 120 | 15 | • TCP | LCD-TV for Automobile |
| μ PD16448* | TFT (source) | 240 | 5 | • TCP | LCD-TV |
| μ PD16406 | TFT (source) | 120 | 20 | • TCP | LCD-HDTV |
| μ PD16407 | TFT (source) | 120 | 20 | • TCP (slim type) | LCD-HDTV |
| μ PD16404 | TFT (gate) | 140 | 25 | • TCP | LCD-TV |
| μ PD16429A | TFT (source) 8 gray scale | 192 | 20 | • TCP | EWS |
| μ PD16408 | TFT (source) Analog | 192 | 20 | • TCP | EWS |
| μ PD16601* | TFT (source) Analog | 192 | 15 | • TCP (slim type) | EWS |
| μ PD16409A* | TFT (source) Analog | 192 | 20 | • TCP | VGA |
| μ PD16620* | TFT (source) 64 gray scale | 240 | 5 | • TCP (slim type) | For VGA standard (logic; 5 V) |
| μ PD16622 | TFT (source) 64 gray scale | 240 | 5 | • TCP (slim type) | For VGA standard (logic; 5 V) |
| μ PD16623 | TFT (source) 64 gray scale | 240 | 5 | • TCP (slim type) | For VGA standard (logic; 3.3 V) |
| μ PD16624 | TFT (source) 64 gray scale | 240 | 5 | • TCP (slim type) | For SVGA standard (logic; 5 V) |
| μ PD16625 | TFT (source) 64 gray scale | 240 | 5 | • TCP (slim type) | For SVGA standard (logic; 3.3 V) |
| μ PD16629* | TFT (source) 64 gray scale | 240 | 5 | • TCP (slim type) | For SVGA standard (logic; 3.3 V) |
| μ PD16630 | TFT (source) 64 gray scale | 240 | 15 | • TCP (slim type) | For VGA/SVGA standard |
| μ PD16640* | TFT (source) 64 gray scale | 300/309 | 5 | • TCP (slim type) | For SVGA/XGA standard (drive; 3.3/5 V) |
| μ PD16641* | TFT (source) 64 gray scale | 240 | 5 | • TCP (slim type) | For VGA standard (drive; 3.3/5 V) |
| μ PD16661* | STN (column) 4 gray scale included RAM | 160 | 5 | • TCP | For PDA (1/8 VGA ~ VGA) |
| μ PD16666* | STN (row) | 240 | 31 | • TCP | For PDA (1/8 VGA ~ VGA) |

*: Under development

■ Plasma display, EL display driver IC

| Type number | Drives | Number of outputs | Withstand voltage (V) | Output current (mA) | Output type | Package |
|----------------|-------------------|-------------------|-----------------------|---------------------|-------------|---------------|
| μ PD6337 | AC-PDP row/column | 32 | 200 | 300 | Nch-O.D | • 52-pin QFP |
| μ PD16300 | DC-PDP row | 41 | 150 | 500 | NPN-O.C | • 80-pin QFP* |
| μ PD16301 | DC-PDP column | 64 | 200 | 3 | Pch-O.D | • 80-pin QFP |
| μ PD16302 | EL column | 40 | 250 | 100 | CMOS | • 80-pin QFP* |
| μ PD16305 | AC-PDP row | 40 | 200 | 400 | CMOS | • 80-pin QFP* |
| μ PD16306 | AC-PDP/EL column | 64 | 80 | 50 | CMOS | • 100-pin QFP |
| μ PD16306A | AC-PDP/EL column | 64 | 80 | 25 | CMOS | • 100-pin QFP |
| μ PD16307 | DC-PDP row | 41 | 150 | 300 | NPN-O.C | • 80-pin QFP* |
| μ PD16309 | DC-PDP column | 64 | 200 | 3 | Pch-O.D | • 100-pin QFP |
| μ PD16325* | AC-PDP row | 40 | 150 | 150 | CMOS | • 80-pin QFP* |
| μ PD16327* | AC-PDP column | 64 | 150 | 40 | CMOS | • 100-pin QFP |

*: Three direction lead

*: Under development

Display IC

Other driver IC

| Type number | Number of outputs | Withstand voltage (V) | Output current (mA) | Output type | Package | Main applications |
|------------------------------|-------------------|-----------------------|---------------------|-------------|------------------------------|-----------------------------|
| μ PD6320 μ PD6321 | 4 ∞ 4 | 18 | 20 | NPN+Nch | • 52-pin QFP | Car stereo (LED) |
| μ PD6322 | 4 ∞ 6 | 7 | 20 | NPN+Nch | • 20-pin DIP | Car stereo (LED) |
| μ PD6345 | 8 | 40 | 100 | NPN-O.C | • 16-pin DIP • 16-pin SOP | Thermal head, LED, solenoid |
| μ PD16320A | 48 | 20 | 130 | Nch-O.D | • 80-pin QFP | Thermal head, LED |
| μ PD16322 | 32 | 250 | 50 | Nch-O.D | • 52-pin QFP | Ink jet printer |

Pch-O.D : P-ch open-drain output (source driver), Nch-O.D: N-ch open-drain output (sink driver)

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

Motor Driver

| Type number | Function | | Recommended operating voltage range (V) | Output current (A) | Package | Main application |
|---------------|--|--------------------------|---|--------------------|--------------|------------------|
| μ PD16804 | Control the revolution direction of the DC motor | H Bridge 1 circuit | 3.0 to 7.5 | 0.5 | • 16-pin SOP | Camera motor |
| μ PD16805 | | | | 1.0 | | |
| μ PD16823 | | H Bridge 1.5 circuits | | 0.5 | • 20-pin SOP | |

Image IC

| Type number | Function | Package |
|---------------|--|--|
| μ PD42101 | NTSC high speed line buffer | • 24-pin DIP • 24-pin SOP |
| μ PD42102 | PAL high speed line buffer | • 24-pin DIP • 24-pin SOP |
| μ PD42280 | 2M bits high speed field buffer (256K words ∞ 8 bits) | • 28-pin ZIP • 28-pin SOP |
| μ PD72020 | Graphics display controller | • 40-pin DIP • 52-pin QFP |
| μ PD72123 | Advanced graphics display controller | • 84-pin QFJ • 94-pin QFP |
| μ PD72185 | Advanced compression expansion engine | • 64-pin shrink DIP • 68-pin QFJ • 80-pin QFP |
| μ PD72186 | Advanced compression expansion engine | • 100-pin QFP |
| μ PD72187 | Advanced Bi-level image compression expansion | • 100-pin PQFP |

MPEG IC

| Type number | Function | Package |
|---------------|-------------------------------------|----------------|
| μ PD61000 | MPEG1 Audio Decompression LSI | • 100-pin PQFP |
| μ PD61010 | MPEG1 Audio/Video Decompression LSI | • 160-pin PQFP |

Audio IC

■ **Radio frequency amplification**

| Type number | Recommended operating voltage range (V) | Function | | | | | Recommended application | Package |
|--------------|---|----------|--------------|---------------------|--------------|---|-------------------------|--------------|
| | | AM tuner | FM front end | FM IF amplification | FM detection | Other functions | | |
| μ PC2535 | 7.5 to 8.5 | | | ● | ● | Quadrature detection Internal NC+MPX | ● | • 48-pin QFP |
| μ PC2533 | 7.5 to 8.5 | ● | | | | Double super heterodyne DTS use | ● | • 36-pin SOP |

■ **FM stereo demodulation**

| Type number | Recommended operating voltage range (V) | Voltage gain (monaural) | Function | | | Recommended application | Package |
|---------------------|---|-------------------------|----------------|--------------|----------------|-------------------------|--------------|
| | | | Pilot canceler | Lamp driving | Noise canceler | | |
| MC-5720 MC-5720A | 7.5 to 15 | -1 dB | ● | ● | ● | ● | • 16-pin SIP |

■ **Pre-amplifier**

| Type number | Recommended operating voltage range (V) | Function | | | | Recommended application | | Package |
|--------------|---|---------------------|---------------------|---------------|-----------------|-------------------------|-----------|-------------|
| | | Play back amplifier | Recording amplifier | MIC amplifier | Other functions | Radio cassette recorder | Car radio | |
| μ PC1228 | 6 to 16 | ● | | | Dual | ● | ● | • 8-pin SIP |
| μ PC1313 | 4 to 15 | ● | ● | | Dual, ALC | ● | ● | • 9-pin SIP |

■ **Power amplifier**

| Type 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 | |
| μ PC1188 | ± 17 to ± 23 | 18 | ± 22 | 8 | | ● | | | • 10-pin SIP |
| μ PC1238 | ± 6 to ± 15 | 8.4 | ± 13 | 8 | | ● | | | • 5-pin V-DIP |
| μ PC1308 | 9 to 16 | 15 | 13.2 | 4 | BTL, standby switch | | | ● | • 14-pin V-VIP |
| μ PC1310 | 9 to 16 | 5.8 | 13.2 | 4 | Dual, standby switch | | | ● | • 14-pin V-DIP |
| μ PC1316 | 3 to 16 | 1.2 | 9 | 8 | Dual | | ● | | • 14-pin DIPTAB |
| | | 0.5 | 6 | 8 | Low pop noise | | | | |
| μ PC1318A | 9 to 16 | 20 | 13.2 | 4 | BTL, standby switch | | | ● | • 14-pin V-DIP |
| μ PC2002 | 8 to 18 | 4.5 | 13.2 | 4 | Low pop noise | | | ● | • 5-pin V-DIP |
| μ PC2500A | 9 to 16 | 40 | 13.2 | 2 | BTL, standby switch | | | ● | • 12-pin SIP |
| | | 24 | 13.2 | 4 | | | | | |
| μ PC2502 | 9 to 16 | 19 | 13.2 | 4 | BTL, DUAL, standby switch | | | ● | • 15-pin V-DIP |
| μ PC2505 | 9 to 16 | 40 | 13.2 | 2 | BTL, standby switch Low pop noise | | | ● | • 12-pin SIP |
| | | 24 | 13.2 | 4 | | | | | |
| μ PC2506 | 9 to 16 | 40 | 13.2 | 2 | BTL, standby switch Low pop noise | | | ● | • 15-pin V-DIP |
| | | 24 | 13.2 | 4 | | | | | |

| |
|-----------------|
| Audio IC |
|-----------------|

■ D/A converter for audio system

| Type number | Recommended operating voltage range (V) | Function | Recommended application | | | Package |
|---------------|---|--|-------------------------|----------|------------|------------------------------|
| | | | Home stereo | Portable | Car stereo | |
| μ PD6376 | 4.5 to 5.5 | 16-bit D/A converter | ● | ● | ● | • 16-pin DIP • 16-pin SOP |
| μ PD6379 | 3.0 to 5.5 | 16-bit D/A converter | ● | ● | ● | • 8-pin SOP |
| μ PD63200 | 4.5 to 5.5 | 18-bit D/A converter | ● | ● | ● | • 16-pin SOP |
| μ PD63210 | 3.0 to 5.5 | 16-bit D/A converter with digital filter | ● | ● | ● | • 28-pin SOP |

■ DSP for audio system

| Type number | Recommended operating voltage range (V) | Function | Recommended application | | | Package |
|--------------|---|----------------------------------|-------------------------|----------|------------|---------------|
| | | | Home stereo | Portable | Car stereo | |
| μ PD6382 | 4.5 to 5.5 | DSP for audio (19 bit) | ● | ● | ● | • 80-pin QFP |
| μ PD6383 | 4.75 to 5.5 | DSP for audio (24 bit) | ● | ● | ● | • 100-pin QFP |
| μ PD6384 | 4.5 to 5.5 | Expander/Compressor DSP (19-bit) | ● | ● | ● | • 16-pin SOP |

■ Device kit for CD

| Type number | Recommended operating voltage range (V) | Function | Recommended application | | | Package |
|---------------|---|--|-------------------------|----------|------------|--------------|
| | | | Home stereo | Portable | Car stereo | |
| μ PC2572 | 4.5 to 5.5 | RF amp, error amp, APC for CD player | | | ● | • 36-pin SOP |
| μ PD63702 | 4.5 to 5.5 | Digital servo, data processor, DAC for CD player | | | ● | • 80-pin QFP |
| μ PD63703 | 4.5 to 5.5 | Digital servo, data processor, ATT for CD player | | | ● | • 80-pin QFP |

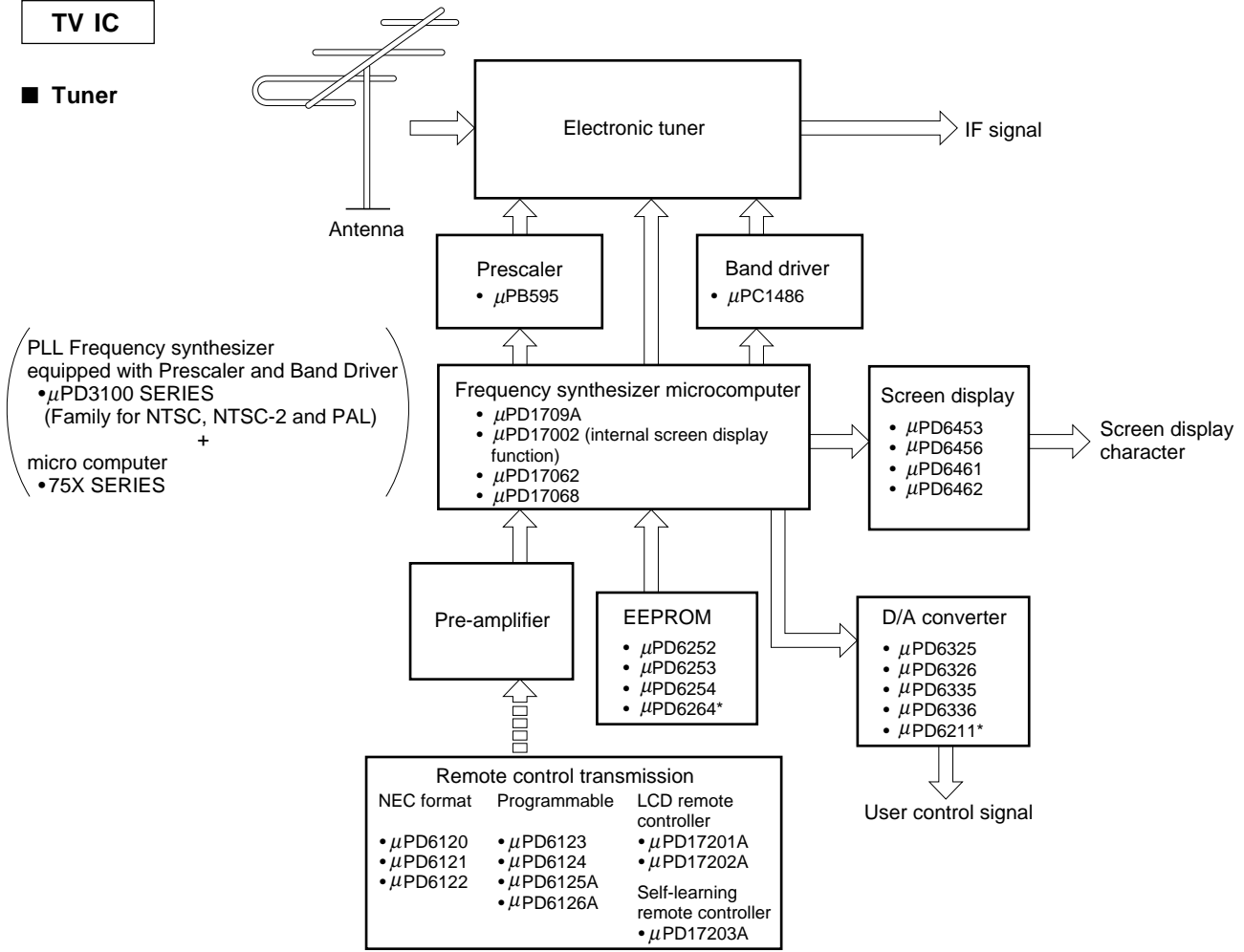
■ Other functions

| Type number | Recommended operating voltage range (V) | Function | Recommended application | | | Package |
|--------------|---|---|-------------------------|-----------|-------------------------|-----------------------------|
| | | | Home stereo | Tape deck | Radio cassette recorder | |
| μ PC1225 | ± 18 to ± 36 | 30 to 50 W power amplifier driver | ● | | | • 10-pin SIP |
| μ PC1237 | 25 to 60 | Stereo power amplifier protection circuit | ● | | | • 8-pin SIP |
| μ PC1270 | ± 18 to ± 36 | 30 to 50 W power amplifier driver | ● | | | • 10-pin SIP |
| μ PC1297 | 8 to 18 | Dolby HX PRO system | | ● | | • 18-pin S-DIP |
| μ PC1298 | ± 20 to ± 46 | 50 to 80 W power amplifier driver | ● | | | • 14-pin V-DIP |
| μ PC1330 | 4.5 to 14.4 | Head selection switch circuit | | ● | | • 9-pin SIP • 14-pin SOP |
| μ PC1342 | ± 20 to ± 52 | 50 to 110 W power amplifier driver | ● | | | • 14-pin V-DIP |
| μ PC2560 | 8.1 to 13.2 | Surround, Vocal cancel, Bass boost | ● | | ● | • 36-pin SSOP |
| μ PC2581 | ± 20 to ± 75 | 100 to 130 W dual power amplifier driver | ● | | | • 15-pin V-DIP |

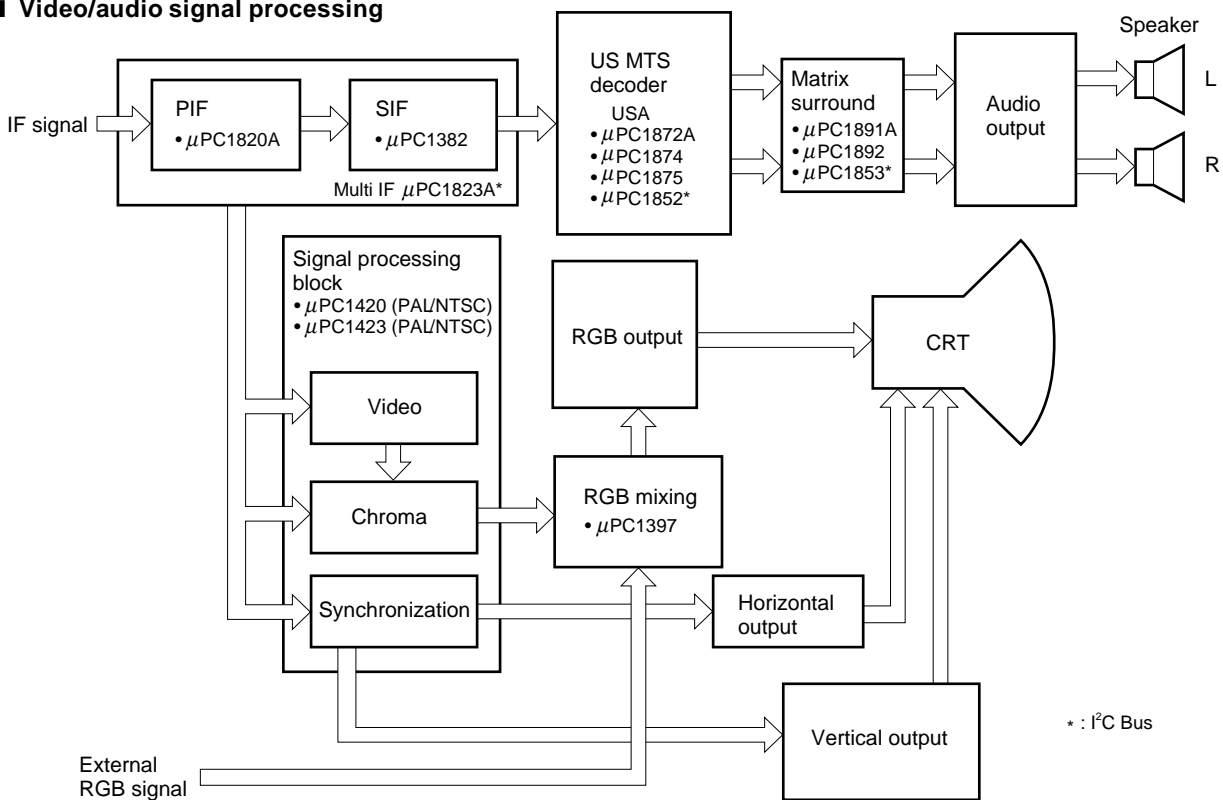
★: Under development

TV IC

■ Tuner



■ Video/audio signal processing



TV IC

■ US MTS Decoder

US MTS: Multi Television Sound for USA specifications

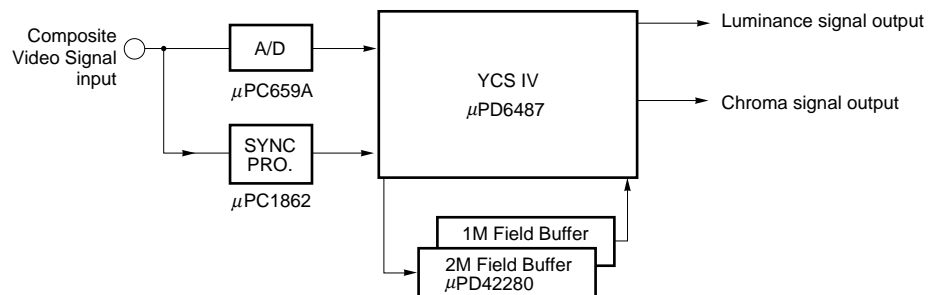
| Type number | Function | Package |
|---------------|---|----------------------------|
| μ PC1872A | dbx NR, SAP Decoder, Normal Output | • 42-pin SDIP • 48-pin QFP |
| μ PC1874 | dbx NR, Stereo only | • 28-pin SDIP |
| μ PC1875 | Input Selector (1 ch), dbx NR, Stereo only | • 30-pin SDIP |
| μ PC1851 | I ² C Bus, Input Selector (3 ch), dbx NR, SAP Decoder, Tone/Volume control | • 42-pin SDIP |
| μ PC1852A | I ² C Bus, dbx NR, SAP Decoder, Normal Output | • 28-pin SDIP |

■ Matrix Surround

| Type number | Function | Package |
|---------------|--|---------------|
| μ PC1891A | Matrix Surround (Phase Shift) | • 20-pin DIP |
| μ PC1892 | Matrix Surround (Phase Shift), Tone/Balance/Volume, L + R output | • 30-pin SDIP |
| μ PC1853 | I ² C bus, BASS boost, Matrix Surround, Tone/Balance/Volume, Audio output, L + R output | • 30-pin SDIP |

Digital Image IC

■ Three-Dimensional Y-C separation system block diagram



■ 3DYC LSI

| Type number | Function | Package |
|--------------|--|---------------|
| μ PD6487 | 3D Dimensional Y/C separation (I ² C Bus) | • 100-pin QFP |

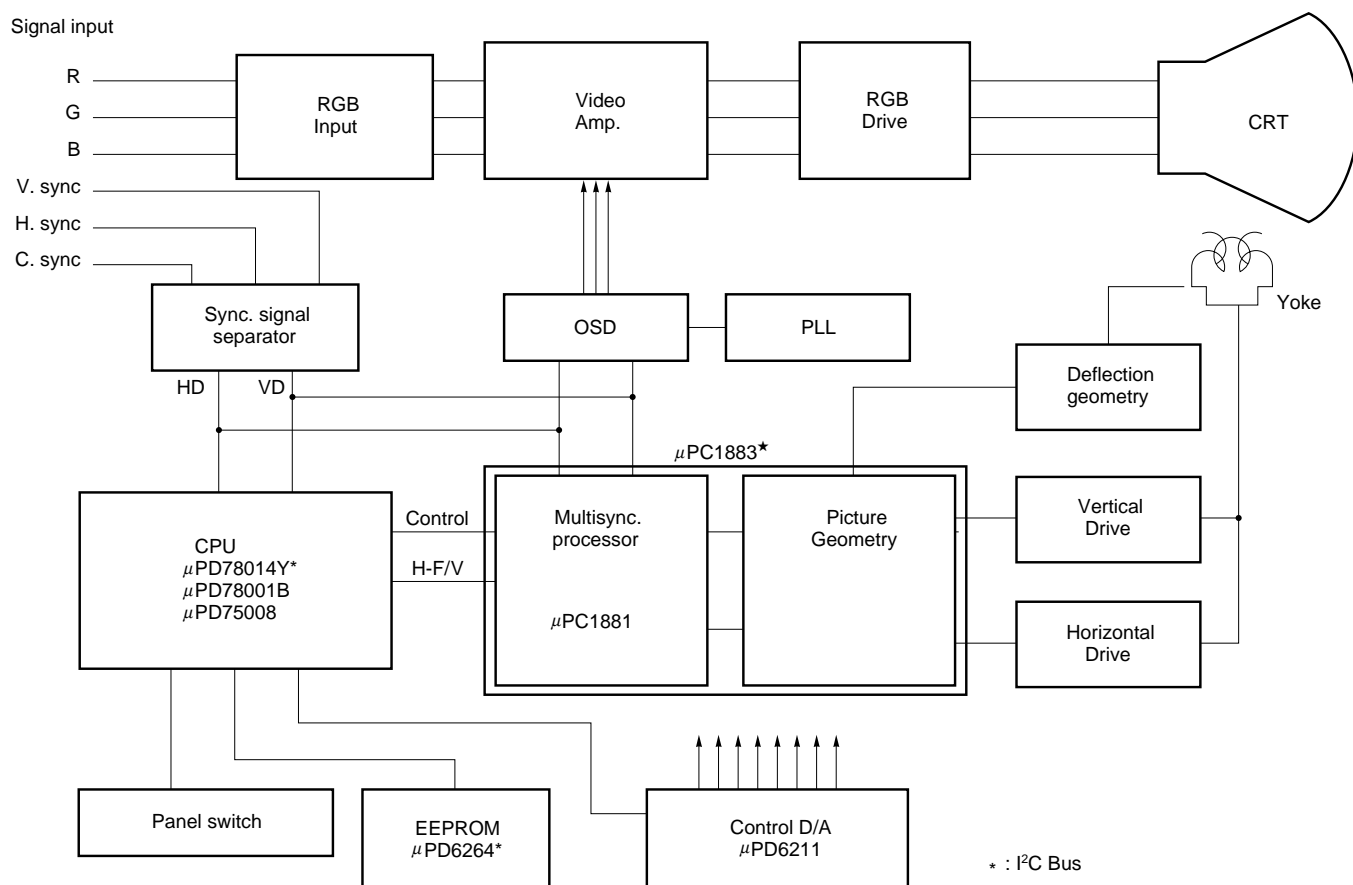
■ Clock generator

| Type number | Function | Package |
|--------------|---|--------------|
| μ PC1860 | Burst signal locked clock generator | • 36-pin SOP |
| μ PC1862 | Burst signal locked clock generator (External Burst gate input available) | • 36-pin SOP |

■ Analog Frontend IC

| Type number | Function | Package |
|--------------|--|--------------|
| μ PC1830 | 5 V operation chroma decoder NTSC/PAL, 525/625 line, 50/60 Hz selectable, Matrix circuit | • 42-pin SOP |

Multisync Monitor IC



■ Multisync. monitor IC

| Type number | Function | Package |
|-------------|---|---------------|
| μPC1881 | Horizontal Vertical sync. processor | • 30-pin SDIP |
| μPC1883* | Horizontal Vertical sync. processor, Picture geometry processor | • 30-pin SDIP |

*: Under development

| |
|---------------------------------------|
| On-Screen Character Display IC |
|---------------------------------------|

■ Video type

| Function \ Type number | μ PD6450 | μ PD6454 | μ PD6458 | μ PD6464 | μ PD6465 |
|------------------------------|--|---|--------------|---|--------------|
| Number of character types | 128 (ROM) | 256 (ROM) | 128 (ROM) | 128 (ROM) | 256 (ROM) |
| Number of display characters | 288 (12 lines ∞ 24 digits) | | | | |
| Character configuration | 12 ∞ 18 | | | | |
| Character color | Single (White) | The level of a character can be set in 9 stages per field (from white to black) | | Single (white, the luminance level of a character can be set in 2 stages.) | |
| Character size | 1 dot/1H, 2H, 3H, 4H (per line) | | | 1 dot/1H, 2H (per line) | |
| Internal video signal color | White/Black/Red/ Green/Blue | 8 color | | White/Black/Blue/Green | |
| Background | None/Fringed/Squared/Solid (per field) | | | | |
| Applicable video signal mode | NTSC/PAL | | | NTSC/PAL/PAL-M/SECAM | |
| Supply Voltage | 4.5 to 5.5 V | | | | |
| Package | <ul style="list-style-type: none"> • 18-pin DIP (300 mil) • 20-pin SOP (375 mil) | | | <ul style="list-style-type: none"> • 24-pin SDIP (300 mil) • 24-pin SOP (375 mil) | |

- Internal sync. process circuit (μ PD6454, μ PD6458)

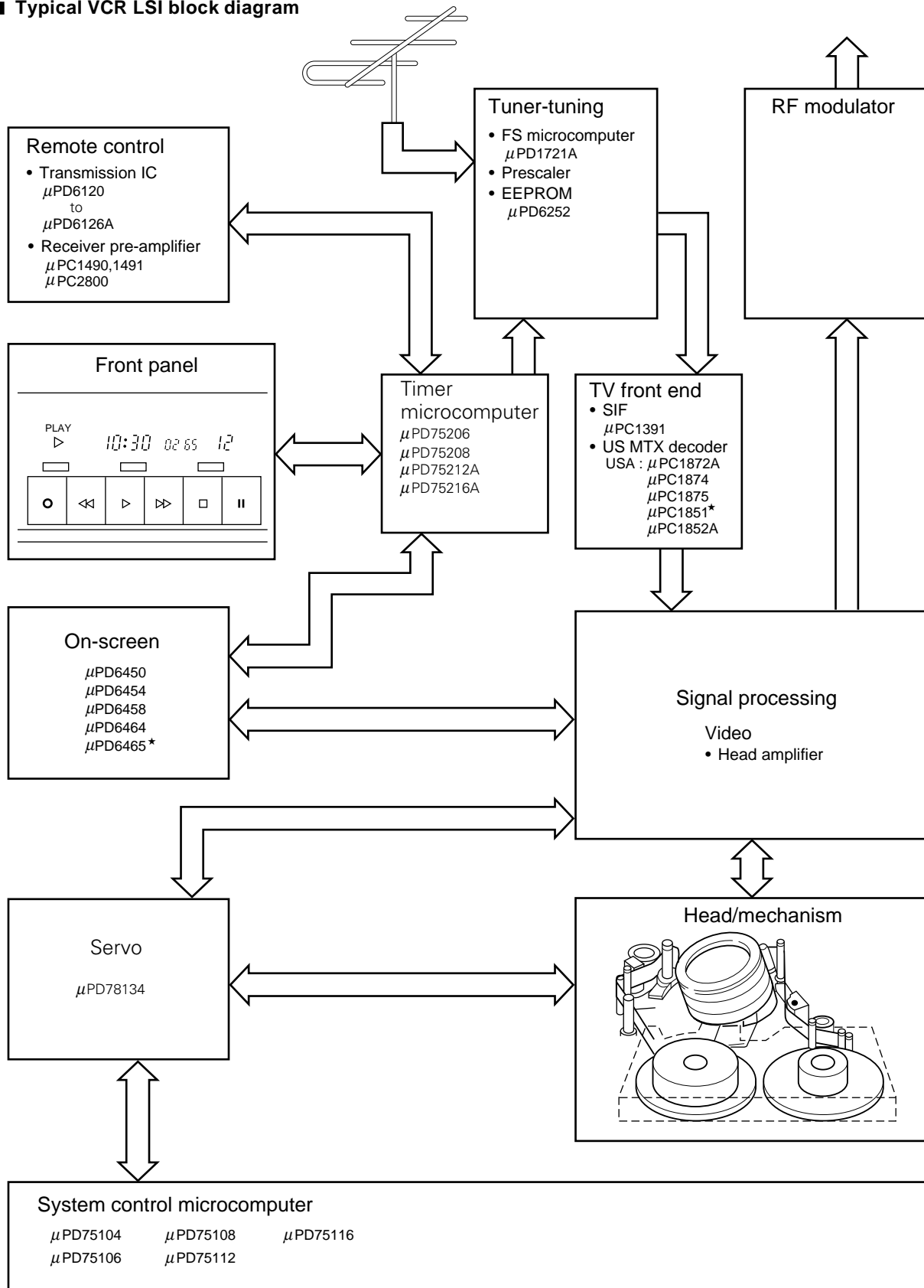
■ RGB type

| Function \ Type number | μ PD6451A | μ PD6453 | μ PD6456 | μ PD6461 | μ PD6462 | μ PD6466 |
|--|--|--|--|---|---|--|
| Number of character types | 128 (ROM) | 240 (ROM) 16 (RAM) | 128 (ROM) | 256 (ROM) | 128 (ROM) | 512 (ROM) |
| Number of display characters | 288 (12 lines ∞ 24 digits) | | | | | |
| Character configuration | 12 ∞ 18 | | | | | |
| Character color | 8 colors | | Single color (White) | 8 colors | | |
| Character size (per line) | 1 dot/1H, 2H, 3H, 4H | | 1 dot/1H, 2H | | | 1 dot/1H, 2H, 3H, 4H |
| Character color reverse (per character) | None | | | Black character/No fringed | | Black character/ No fringed White character/ Fringed |
| Background (per frame) | None Square (8 colors) Solid (8 colors) | | None Square (Black) Solid (Black) | None Square (8 colors) Solid (8 colors) | | |
| Fringed (per frame) | Single color (Black) | Two colors (Black, White) | Single color (Black) | Two colors (Black, White) | | |
| Supply voltage | 4.5 to 5.5 V | | 3.0 to 5.5 V | 2.7 to 5.5 V | | |
| Package | <ul style="list-style-type: none"> • 18-pin DIP (300 mil) • 20-pin SOP (375 mil) | <ul style="list-style-type: none"> • 20-pin DIP (400 mil) • 20-pin SOP (375 mil) | <ul style="list-style-type: none"> • 16-pin SOP (300 mil) • 16-pin SOP (375 mil) | <ul style="list-style-type: none"> • 20-pin SSOP (300 mil) • 24-pin SOP (375 mil) | <ul style="list-style-type: none"> • 20-pin SSOP (300 mil) | <ul style="list-style-type: none"> • 20-pin SOP (375 mil) |

- Double speed TV switching is possible by command (μ PD6451A, μ PD6453)
- Making ideally suited for camcoders (μ PD6461, μ PD6462)
- μ PD6461 and μ PD6462 are commands convertible and pins convertible for 20-pin SSOP package.
- μ PD6466 has a blue background and character mirror reverse function.

VCR IC

■ Typical VCR LSI block diagram



★ : Under development

Video Camera IC

■ CCD driver circuit

| Type number | Function | Package |
|---------------|---|----------------------------|
| μ PD16501 | Area sensor vertical drive interface | • 16-pin SOP |
| μ PD16502 | Area sensor vertical drive interface | • 20-pin SOP |
| μ PD16503 | Area sensor VOD shutter driver | • 8-pin SOP |
| μ PD16506 | Area sensor vertical, VOD shutter driver | • 20-pin SOP • 20-pin SSOP |
| μ PD16510 | Area sensor vertical, VOD shutter driver, for low voltage logic | • 22-pin SSOP |

■ AGC process amplifier

| Type number | Function | Package |
|--------------|-----------------------------------|--------------|
| μ PC2372 | 3ch AGC-process amplifier circuit | • 88-pin QFP |

■ Sample and hold circuit

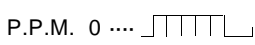

| Type number | Function | Package |
|--------------|---|-------------|
| μ PC2394 | Dedicated area sensor use sample and hold circuit | • 8-pin SOP |

Remote Control IC

■ Infrared remote control preamplifiers IC

| Type number | Supply voltage | Features | Package | Remarks |
|--------------------------------|----------------|----------------------------|-------------|------------------|
| μ PC2800A μ PC2801A | 5 V \pm 10% | Internal high trap circuit | • 8-pin SOP | Active low type |
| μ PC2803 | | | | Active high type |
| | | | | Active low type |

■ Infrared remote control IC

| Type number | μ PD6121-001 | μ PD6122-001 |
|-------------------------|--|--------------------|
| Operating voltage range | 2.0 to 3.3 V | |
| Operation clock (fosc) | 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 (fosc = 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

| Type number | Function | Features | Package |
|---------------|------------------------------------|---|------------------------------|
| μ PD4990A | Serial I/O real-time clock | Wide operating voltage range, low power consumption | • 14-pin DIP • 16-pin SOP |
| μ PD4991A | 4-bit parallel I/O real-time clock | Wide operating voltage range, low power consumption | • 18-pin DIP • 20-pin SOP |
| μ PD4992 | 8-bit parallel I/O real-time clock | Wide operating voltage range, low power consumption | • 20-pin DIP • 20-pin SOP |

Rotary Encoder IC

| Type number | Function | Features | Package |
|---------------|--------------------------------------|-------------------------------------|------------------------------|
| μ PD4701A | 12-bit incremental encoder counter | Direct mouse connection is possible | • 20-pin DIP • 24-pin SOP |
| μ PD4702 | 8-bit incremental encoder counter | High speed count f = 3.6 MHz | • 20-pin DIP • 20-pin SOP |
| μ PD4704 | μ PD4702 extension 8-bit counter | | • 20-pin DIP • 20-pin SOP |

A/D Converter IC**■ A/D Converter**

| Type number | Resolution (bits) | Linearity (%FSR) | Conversion time (μ s) | Supply voltage (V) | Data format | Output format | Package | Remarks |
|--------------|-------------------|------------------|----------------------------|--------------------|-----------------------|-----------------------|-----------------------|---|
| μ PC650 | 12 | 0.05 | 45 | +5 -15 | Binary | 12-bit parallel | • 28-pin DIP | Successive approximation |
| μ PD7001 | 8 | 0.8 | 140 (TYP.) | +5 | Binary | Serial | • 16-pin DIP | Parallel approximation, microcomputer I/F, 4-channel MPX input |
| μ PD7002 | 10 | 0.2 | 15 (ms) | +5 | Binary | 8-bit parallel | • 28-pin DIP | Integrative approximation, microcomputer I/F, 8-channel MPX input |
| μ PD7003 | 8 | 0.5 | 4 | +5 | Binary | 8-bit parallel | • 24-pin DIP | Parallel approximation, microcomputer I/F |
| μ PD7004 | 10 | 0.1 | 104 | +5 | Binary 2's complement | 8-bit parallel/serial | • 28-pin DIP (400mil) | Successive approximation, microcomputer I/F, 8-channel MPX input |

■ A/D Converter for Video processing

| Type number | Resolution (bits) | Linearity (%FSR) | Sampling time (MSPS) | Supply voltage (V) | Data format | Output format | Package | Remarks |
|---------------|-------------------|------------------|----------------------|--------------------|-------------|-----------------|--------------|--|
| μ PC668* | 10 | 0.2 | 20 | +5 | Binary | 10-bit parallel | • 30-pin SOP | Parallel approximation Video processing |
| μ PC659A | 8 | 0.2 | 20 | +5 | Binary | 8-bit parallel | • 24-pin SOP | Parallel approximation Video processing |
| μ PC660 | 6 | 0.8 | 20 | +5 | Binary | 6-bit parallel | • 16-pin SOP | Parallel approximation Video processing |
| μ PC661 | 6 | 0.8 | 20 | +5 | Binary | 6-bit parallel | • 24-pin SOP | 4-input multiplexer Video processing |
| μ PD6952* | 10 | 0.2 | 20 | +5 | Binary | 10-bit parallel | • 24-pin SOP | Parallel approximation Video processing |

*: Under development

D/A Converter IC

■ D/A Converter

| Type number | Resolution (bits) | Linearity (%FSR) | Settling time (μ s) | Supply voltage (V) | Input format | Output format | Package | Remarks |
|------------------------------|-------------------|------------------|--------------------------|---------------------|-----------------------------|----------------|------------------------------|---|
| μ PC610 | 10 | 0.2 | 6 | ± 15 | Sign+Binary | Voltage output | • 18-pin DIP | Parallel input |
| μ PC624 | 8 | 0.19 | 150 (ns) | ± 5 to ± 15 | Binary | Current output | • 16-pin DIP | Parallel input |
| μ PC648 | 12 | 0.05 | 400 (ns) | ± 15 | Binary | Current output | • 20-pin DIP | Parallel input |
| μ PD6325 μ PD6335 | 6 (4 circuits) | Monotonicity | 10 | +5 to +15 +5 | Binary | Voltage output | • 16-pin DIP • 16-pin SOP | Serial input, CMOS |
| μ PD6326 μ PD6336 | 6 (8 circuits) | Monotonicity | 10 | +5 to +15 +5 | Binary | Voltage output | • 16-pin DIP | Serial input, CMOS |
| μ PD6211 | 8 (8 circuits) | 0.39 | 10 | +5 | Binary | Voltage output | • 20-pin DIP • 20-pin SOP | I ² C-bus compatible Internal Output CMOS' Buffer |
| μ PD7011 | 8 | 0.2 0.4 | 3 | +5 | Binary 2's complement | Current output | • 18-pin DIP | Parallel/serial input microcomputer I/F, NMOS |

■ D/A Converter for Video processing

| Type number | Resolution (bits) | Linearity (%FSR) | Sampling rate (MSPS) | Supply voltage (V) | Input format | Output format | Package | Remarks |
|-------------|-------------------|------------------|----------------------|--------------------|--------------|----------------|---------------|--|
| μ PC667 | 10 | 0.1 | 60 | +5 | Binary | Voltage output | • 30-pin SDIP | Parallel input Video processing |
| μ PC662 | 8 (3 circuits) | 0.2 | 35 | +5 | Binary | Voltage output | • 48-pin QFP | Parallel input, 3 circuits Video processing |
| μ PC664 | 8 (2 circuits) | 0.2 | 35 | +5 | Binary | Voltage output | • 36-pin SOP | Parallel input, 2 circuits Video processing |
| μ PC665 | 8 | 0.2 | 35 | +5 | Binary | Voltage output | • 16-pin SOP | Parallel input Video processing |
| μ PC666 | 6 (3 circuits) | 0.8 | 35 | +5 | Binary | Voltage output | • 36-pin SOP | Parallel input, 3 circuits Video processing |

Line Driver Receiver IC

| Type number | Function | Features | Package |
|---------------|---|---|------------------------------|
| μ PD4711B | RS-232 line driver/receiver Drivers: 2, Receivers: 2 | +5V power source, standby function | • 20-pin DIP • 20-pin SOP |
| μ PD4712 | RS-232 line driver/receiver Drivers: 4, Receivers: 4 | +5V power source, standby function | • 28-pin DIP • 28-pin SOP |
| μ PD4713A | RS-232 line driver/receiver Drivers: 3, Receivers: 3 | +5V power source, standby function | • 24-pin DIP • 24-pin SOP |
| μ PD4714A | RS-232 line driver/receiver Drivers: 3, Receivers: 5 | +5V power source, standby function | • 28-pin DIP • 28-pin SOP |
| μ PD4715A | RS-232 line driver/receiver Drivers: 5, Receivers: 3 | +5V power source, standby function | • 28-pin DIP • 28-pin SOP |
| μ PD4721 | RS-232 line driver/receiver Drivers: 2, Receivers: 2 | +3.3V or +5V power source, standby function | • 20-pin SSOP |
| μ PD4722 | RS-232 line driver/receiver Drivers: 4, Receivers: 4 | +3.3V or +5V power source, standby function | • 30-pin SSOP |
| μ PD4723 | RS-232 line driver/receiver Drivers: 3, Receivers: 3 | +3.3V or +5V power source, standby function | • 30-pin SSOP |
| μ PD4724 | RS-232 line driver/receiver Drivers: 3, Receivers: 5 | +3.3V or +5V power source, standby function | • 30-pin SSOP |
| μ PD4726 | RS-232 line driver/receiver Drivers: 4, Receivers: 7 | +5V power source, standby function, for PC | • 36-pin SSOP |

Vehicle Communication IC

| Type number | Function | Features | Package |
|----------------|--|---|---|
| μ PD72005* | CAN (Controller Area Network) Controller | Support the standard and extended message identifiers in CAN spec 2.0 2-wire serial communication bus Multimaster architecture Multicast message transfer Transfer rate up to 1M bit per second | <ul style="list-style-type: none">• 52-pin QFP• 52-pin QFJ |

*: Under development

General Purpose Linear IC

| | |
|--|------------|
| Operational Amplifier | 122 |
| Comparator | 123 |
| Fixed Output Voltage, 3-Terminal Regulator..... | 123 |
| Variable Output Voltage Regulator | 124 |
| Regulator with System Reset | 124 |
| High Precision Reference Voltage | 124 |
| Switching Regulator Control Circuit..... | 125 |
| Functional Block | 125 |

Operational Amplifier

| Type number | | Function*1 | | | Recommended power supply voltage*2 (V) | Common mode input voltage range TYP. (V) T _A = +25 fC | Input stage transistor | GND Input/ Output on single power | Low V _{io} Low T _A drift | Low input bias current | High speed | Wide band | Low noise | Low power | Packages*3 | | | | Number of pins | | |
|----------------------------|-------------|------------|------|------|--|---|------------------------|-----------------------------------|--|------------------------|------------|-----------|-----------|-----------|------------|---|----|----|----------------|------|---|
| Communication/industry use | General use | Single | Dual | Quad | | | | | | | | | | | D ED | C | G2 | HA | | | |
| μPC151 | μPC741 | ○ | | | ±7.5 to ±16 | V+2 to V*-0.5 | NPN | | ○ | | | | | | | | | | 8 | | |
| μPC251 | μPC1458 | | ○ | | | | | | | | | | | | | | | | | | |
| μPC254 | | ○ | | | ±3 to ±16 | V+1 to V*-1 | NPN | | ◎ | ◎ | | | ○ | | | | | | | 8 | |
| μPC354 | | ○ | | | ±3 to ±16 | V+1 to V*-1 | NPN | | ◎ | ◎ | | | ○ | | | | | | | 8 | |
| μPC454 | | | ○ | | | | | | | | | | | | | | | | | | |
| μPC815 | | ○ | | | ±3 to ±20 | V+1.5 to V*-2.5 | NPN | | ◎ | ○ | | | ◎ | | | | | | | 8 | |
| μPC816 | | ○ | | | ±3 to ±20 | V+1.5 to V*-2.5 | NPN | | ◎ | ○ | ○ | ◎ | ◎ | | | | | | | | 8 |
| μPC157 | μPC301A | ○ | | | ±5 to ±16 | V+2 to V* | NPN | | ○ | | | | | | | | | | | 8 | |
| μPC159 | μPC318 | ○ | | | ±5 to ±18 | V+2.5 to V*-2 | NPN | | | | ◎ | ◎ | | | | | | | | 8 | |
| μPC802 | μPC4250 | ○ | | | ±1 to ±16 | V+0.2 to V*-0.6 | PNP | | ○ | ○ | | | | ◎ | | | | | | 8 | |
| μPC801 | μPC4081 | ○ | | | ±5 to ±16 | V+2.3 to V* | J-FET | | | ◎ | ○ | ○ | | | | | | | | 8 | |
| μPC803 | μPC4082 | | ○ | | | | | | | | | | | | | | | | | | |
| μPC804 | μPC4084 | | | ○ | | | | | | | | | | | | | | | | | |
| μPC811 | | ○ | | | ±5 to ±16 | V+3 to V*-1 | J-FET | | ○ | ◎ | ○ | ○ | ○ | | | | | | | 8 | |
| μPC812 | | | ○ | | ±5 to ±16 | V+3 to V*-1 | J-FET | | ○ | ◎ | ◎ | ○ | ○ | | | | | | | 8 | |
| μPC813 | | ○ | | | | | | | | | | | | | | | | | | | |
| μPC814 | | | ○ | | | | | | | | | | | | | | | | | | |
| μPC821 | μPC4071 | ○ | | | ±5 to ±16 | V+2 to V* | J-FET | | | ◎ | ○ | ○ | ○ | | | | | | | 8 | |
| μPC822 | μPC4072 | | ○ | | | | | | | | | | | | | | | | | | |
| μPC824 | μPC4074 | | | ○ | | | | | | | | | | | | | | | | | |
| μPC831 | μPC4061 | ○ | | | ±2 to ±16 | V+2 to V* | J-FET | | | ◎ | | | | ○ | | | | | | 8 | |
| μPC832 | μPC4062 | | ○ | | | | | | | | | | | | | | | | | | |
| μPC834 | μPC4064 | | | ○ | | | | | | | | | | | | | | | | | |
| μPC258 | μPC4558 | | ○ | | ±4 to ±16 | V+1 to V*-1 | PNP | | ○ | | | ○ | ○ | | | | | | | 8 | |
| μPC458 | μPC4741 | | | ○ | | | | | | | | | | | | | | | | | |
| μPC259 | μPC4560 | ○ | | | ±4 to ±16 | V+1 to V*-1 | PNP | | ○ | | | ○ | ○ | | | | | | | 8 | |
| | μPC4556 | ○ | | | ±4 to ±16 | V+1 to V*-1 | PNP | | ○ | | ○ | ◎ | ○ | | | | | | | 8 | |
| | μPC4557 | ○ | | | ±4 to ±16 | V+1 to V*-1 | PNP | | ○ | | | ○ | ○ | | | | | | | 8 | |
| | μPC4559 | ○ | | | ±4 to ±16 | V+1 to V*-1 | PNP | | ○ | | | ○ | ○ | | | | | | | 8 | |
| | μPC4570 | | ○ | | ±4 to ±16 | V+1 to V*-1 | PNP | | ○ | | ○ | ◎ | ◎ | | | | | | | 8**4 | |
| | μPC4574 | | | ○ | | | | | | | | | | | | | | | | | |
| | μPC4572 | ○ | | | ±2 to ±7 | V+1 to V*-1 | PNP | | ○ | | ○ | ◎ | ◎ | | | | | | | 8**4 | |
| μPC1251 | μPC358 | | ○ | | +3 to ±30 | GND to V*-1.5 | PNP | ○ | | ○ | | | | ○ | | | | | | 8**4 | |
| μPC451 | μPC324 | | | ○ | | | | | | | | | | | | | | | | | |
| μPC452 | μPC3403 | | | ○ | +3 to ±32 | GND to V*-1.5 | PNP | ○ | | ○ | | | | | | | | | | 14 | |
| μPC842 | | | ○ | | ±3 to ±32 | GND to V*-1.8 | PNP | ○ | | | ○ | ○ | | | | | | | | 8 | |
| μPC844 | | | | ○ | | | | | | | | | | | | | | | | | |

○ : Recommended for designing ◎ : High performance ◎ : Very high performance

*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, D, ED, G2 or HA shows Package Type, as follows.

- C : Plastic DIP (300 mil)
- D, ED: Ceramic DIP (300 mil)
- G2 : Plastic SOP (225 mil)
- HA : 9-pin plastic slim SIP

*4 : HA has 9 pins.

Comparator

| Type number | | Function | | | Recommended power supply voltage (V) | Common mode input voltage range TYP. (V) T _A = +25 °C | Input stage transistor | GND Input on single power | High speed | Low power | Output circuit type | | Packages*1 | | | | Number of pins |
|----------------------------|-------------|----------|------|------|--------------------------------------|---|------------------------|---------------------------|------------|-----------|---------------------|------------------|------------|---|----|----|----------------|
| Communication/industry use | General use | Single | Dual | Quad | | | | | | | Open-collector | Emitter-follower | D ED | C | G2 | HA | |
| μPC271 | μPC311 | ○ | | | +5 to +32 | V ⁻ +0.3 to V ⁺ -1.2 | PNP | | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | 8 |
| μPC272 | μPC319 | | ○ | | +5 to +32 | V ⁻ +2 to V ⁺ -2 | NPN | | ○ | | ○ | | ○ | ○ | ○ | | 14 |
| μPC277 | μPC393 | | ○ | | +2 to +32 | GND to V ⁺ -1.5 | PNP | ○ | | ○ | ○ | | ○ | ○ | ○ | ○ | 8*2 |
| μPC177 | μPC339 | | | ○ | | | | | | | | | ○ | ○ | | | |

*1 : C, D, ED, G2 or HA shows Package Type, as follows.

- C : Plastic DIP (300 mil)
- D, ED : Ceramic 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 | Type number | Output current (A) | Output voltage (V) | | | | | | | | | | | | Absolute maximum ratings | | Package | Remarks | | | |
|-------------------------|-------------|--------------------|--------------------|-----|---|---|---|---|---|---|----|----|----|----|--------------------------|-------------------|---------|-------------------------|----------------------------------|-----------------------------|------------------------------|
| | | | 3 | 3.3 | 4 | 5 | 6 | 7 | 8 | 9 | 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 • SOT-89 | |
| | | | | | | | | | | | | | | ○ | ○ | ○ | | 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 | | | |
| | μPC2600 | 0.5 | | | | ○ | | | | | ○ | | | | | | | 35 (DC) ±100 (surge) | 20 | • TO-220AB | |
| | μPC29L00 | 0.1 | ○ | ○ | ○ | ○ | | | | | | | | | | | | 16 | 0.7/2*3 | • TO-92 • SOT-89 | Low dropout voltage type |
| μPC29M00* | 0.5 | ○ | ○ | | ○ | | | | | | | | | ○ | | | 20 | 1.0/2.0*4 15 | • MP-3 • MP-3Z*5 • MP-45*2 | Low dropout voltage type | |
| μPC2900* | 1.0 | ○ | ○ | | ○ | | | | | | | | | ○ | | | 20 | 1.0/2.0*4 15 | • MP-3 • MP-3Z*5 • 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 : Plastic insulated package
- *3 : With 16 cm² ∞ 0.7 mm ceramic substrate
- *4 : With 7.5 cm² ∞ 0.7 mm ceramic substrate
- *5 : Surface mount package of MP-3

*: Under development

Variable Output Voltage Regulator

| Type | Type number | Output current (A) | Output voltage range (V) | Absolute maximum ratings | | Package | Remarks |
|-------------------------|-------------------|--------------------|--------------------------|--------------------------|-----------------------------|--|-----------------|
| | | | | Input voltage (V) | Total power dissipation (W) | | |
| Positive voltage output | μ PC141/305*3 | 0.05 | 4.5 to 30 | 40 | 0.35, 0.5/0.35, 0.44 | • 8-pin DIP (plastic/ceramic) • 8-pin SOP | |
| | μ PC317 | 1.5 | 1.3 to 30 | 40 | 20*1, 15*1 | • TO-220AB • MP-45*2 | 3-pin regulator |
| | μ PC1093 | 0.15 | 2.5 to 36 | 37 | 0.48, 0.7, 2*4 | • 8-pin SOP • TO-92 • SOT-89 | Shunt regulator |
| | μ PC1943 | 0.05 | 1.26 to 24 | 25 | 1.6*4 | • SOT-89 | Shunt regulator |
| | μ PC1944 | 0.05 | 1.26 to 24 | 25 | 0.385, 0.56 | • 8-pin SOP • TO-92 | Shunt regulator |
| Negative voltage output | μ PC337 | 1.5 | -1.3 to -30 | -40 | 20*1 | • TO-220AB | 3-pin regulator |

- *1 : Limited by internal circuit
- *2 : Plastic insulated package
- *3 : μ PC141 is for communication/industry use.
- *4 : When mounted on 16 cm² (0.7 mm thick) ceramic board

Regulator with System Reset

| Type | Type 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 | μ PC2251 | 0.1 | 3 | 2.85 | ○ | | 12 | 1.2* | • TO-126 (4-pin) | Low dropout type |
| | μ PC2252 | 0.1 | 3 | 2.85 | | ○ | 12 | 1.2* | • TO-126 (4-pin) | Low dropout type |
| | μ PC2253 | 0.1 | 5 | 2.85 | ○ | | 12 | 1.2* | • TO-126 (4-pin) | Low dropout type |
| | μ PC2254 | 0.1 | 5 | 2.85 | | ○ | 12 | 1.2* | • TO-126 (4-pin) | Low dropout type |
| | μ PC2255 | 0.1 | 5 | 4.75 | ○ | | 12 | 1.2* | • TO-126 (4-pin) | Low dropout type |
| | μ PC2256 | 0.1 | 5 | 4.75 | | ○ | 12 | 1.2* | • TO-126 (4-pin) | Low dropout type |
| | μ PC2260 | 0.5 | 5 | 4.85 | ○ | | 35 | 20* | • TO-220 (5-pin) | Low dropout type |
| Supervisory for Micro-processor | μ PC2270A | - | - | 4.3 | ○ | ○ | 8 | 0.35 | • 8-pin DIP | Manual Reset Input |
| | | | | | | | | 0.44 | • 8-pin SOP | |
| | | | | | | | | 0.35 | • 9-pin Slim SIP | |
| | μ PC1074A | 0.01 | 2 ~ 5.18 | Adjustable | ○ | | 40 | 0.5 | • 16-pin SOP | Watch-dog Timer |

*: Limited by internal circuit

High Precision Reference Voltage

| Type number | Input voltage range (V) | Output voltage (V) | Output current (mA) | Total power dissipation (mW) | Output voltage vs. temperature (ppm/fC) | Package |
|--------------|-------------------------|--------------------|---------------------|------------------------------|---|--------------------------------|
| μ PC1060 | 4.5 to 40 | 2.5 ±0.025 | 10 | 350, 500 | 40 | • 8-pin DIP (plastic, ceramic) |

Switching Regulator Control Circuit

| Type number | Input voltage range (V) | Absolute maximum ratings | | Package | Output circuit operation mode | Applications |
|--------------|---------------------------------------|--------------------------|--------------------------------|--|---|--|
| | | Output current (mA) | Total power dissipation (W) | | | |
| μ PC494 | 7 to 40 | 250 | 1, 0.78*2, 0.65*2 | <ul style="list-style-type: none"> • 16-pin DIP (plastic) • 16-pin SOP*1 | Push-pull/single selectable | General purpose |
| μ PC1094 | 11 to 24 | 1200 (peak) | 0.57, 0.55 | <ul style="list-style-type: none"> • 14-pin DIP (plastic) • 14-pin SOP | Totem pole circuit configuration Single mode | Can operate up to 500 kHz General purpose |
| μ PC1099 | 11.5 to 24 | 1200 (peak) | 1, 0.694 | <ul style="list-style-type: none"> • 16-pin DIP (plastic) • 16-pin SOP | Totem pole circuit configuration Single mode | Can operate up to 500 kHz General purpose |
| μ PC1905 | 16.5 to 30 | 1200 (peak) | 1, 0.694 | <ul style="list-style-type: none"> • 16-pin DIP (plastic) • 16-pin SOP | Totem pole circuit configuration Single mode | Can operate up to 500 kHz General purpose |
| μ PC1906 | 16.5 to 30 | 1200 (peak) | 1, 0.694 | <ul style="list-style-type: none"> • 16-pin DIP (plastic) • 16-pin SOP | Totem pole circuit configuration Single mode | Can operate up to 500 kHz General purpose |
| μ PC1900 | 12 to 30 | 1200 (peak) | 1.225, 0.775 | <ul style="list-style-type: none"> • 24-pin DIP (plastic) • 24-pin SOP | Totem pole circuit configuration 2 outputs | Can operate up to 500 kHz General purpose |
| μ PC1394 | 6.6 V _{TYP.} (shunt type) | 10 | 0.15 (T _a =75fC) | <ul style="list-style-type: none"> • 14-pin DIP (plastic) • 14-pin SOP | Single mode | TV/VCR |
| μ PC1100 | 3.6 to 40 | 25 | 1, 0.694 | <ul style="list-style-type: none"> • 16-pin DIP (plastic) • 16-pin SOP | 2 outputs (synchronous control possible) If one output is shorted, both outputs will be turned OFF. | DC/DC converter |
| μ PC1150 | 3.6 to 40 | 25 | 1, 0.694 | <ul style="list-style-type: none"> • 16-pin DIP (plastic) • 16-pin SOP | 2 outputs (synchronous control possible) If one output is shorted, only the output will be turned OFF. | DC/DC converter |

*1 : μ PC494G is 375 mil. μ PC494GS is 300 mil.

*2 : When mounted on 5 \times 5 cm² (1.6 mm thick) glass epoxy board.

Functional Block

| Function | Type number | Features | Package |
|--------------------|--------------|--|---|
| Analog Multiplexer | μ PD5205 | Single-pole 8 position mode/double-pole 4 position mode Supply Voltage: 44 V, ON Resistance: 270 Ω TYP. | <ul style="list-style-type: none"> • 24-pin shrink DIP • 24-pin SOP |
| Precision Timer | μ PC1555 | CR Timer, Operating Temperature: -20 ~ +80°C Supply Voltage: 4.5 ~ 16 V, Free Running Frequency: 0.1 ~ 100 kHz | <ul style="list-style-type: none"> • 8-pin DIP • 8-pin SOP |
| | μ PC617 | CR Timer, Operating Temperature: -20 ~ +80°C Supply Voltage: 4.5 ~ 16 V, Free Running Frequency: 0.1 ~ 100 kHz | <ul style="list-style-type: none"> • 8-pin DIP • 8-pin SOP |
| | μ PD5555 | CMOS CR Timer, CMOS Type of μ PC1555 Supply Voltage: 3 ~ 16 V, Free Running Frequency: 0.1 ~ 500 kHz | <ul style="list-style-type: none"> • 8-pin DIP • 8-pin SOP |
| | μ PD5556 | CMOS CR Timer Dual Type of μ PD5555 | <ul style="list-style-type: none"> • 8-pin DIP • 8-pin SOP |
| Sample and Hold | μ PC398 | Sample and Hold, Operating Temperature: 0 ~ +70°C Supply voltage: $\pm 5 \sim \pm 15$ V, Acquisition Time: 2.5 μ s TYP. | • 8-pin DIP |
| | μ PC649 | Sample and Hold, Operating Temperature: -20 ~ +70°C Supply voltage: $\pm 5 \sim \pm 15$ V, Acquisition Time: 2.5 μ s TYP. | • 8-pin DIP |

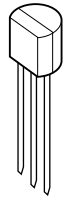
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Transistor/Diode/Thyristor

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Quick Reference by Package

■ TO-92 Type Transistor



TO-92

| V_{CE0} (V) \ I_C (A) | ~15 | ~30 | ~50 | ~70 | ~100 | ~150 | ~200 | ~250 | ~400 |
|---------------------------|-----------|--|---|---|---|--|--|---------|---------|
| ~20 m | | 2SC1674 | | | | | | | |
| ~30 m | | 2SC1675 | 2SA1005 | | | | | | |
| ~50 m | 2SA1206** | | | | | 2SA988 2SA992 2SC1841 2SC1845 | | | |
| ~100 m | | | 2SA733 2SA987 2SA990 2SA1151 2SC945 2SC945 (L) 2SC1840 2SC1842 2SC1843 2SC2718 AA1[] AN1[] | 2SA991 2SC1844 | 2SA675 ¹⁾ | | 2SA1376 2SA1376A 2SC3478 2SC3478A | 2SA1544 | |
| ~200 m | 2SC2901** | 2SA1409* (25 V/ 150 mA) | 2SC3622* (150 mA) 2SC3622A* (150 mA) | | | | | | |
| ~500 m | | | 2SC3615* (300 mA) | 2SA953 2SC2002 | 2SA954 2SA1152 2SC2003 2SC2719 | | | | 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) AC1[] (20 V/2.0 A) AQ1[] (20 V/2.0 A) | | 2SD1939 (60 V/1.5 A) | | | | | |
| ~3.0 | | 2SB1300 (16 V/3 A) AC2[] (16 V/3 A) AQ2[] (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 Type Transistor |
|------------------------------|

| V_{CE0} (V) I_C (A) | -15 | -20 | -30 | -50 | -120 |
|----------------------------|-----------|----------------------|--------------------------------------|--|--------------------|
| ~20 m | 2SC2786 | BA3[] BN3[] | 2SC2787 | | |
| ~50 m | 2SA1459** | | | | 2SA1174 2SC2784 |
| ~100 m | | | | 2SA1175 2SC2785 2SC3623* BA1[] BN1[] BA2[] BN2[] | |
| ~200 m | 2SC3732** | 2SA1410* (150 mA) | | 2SA1458** (40 V) 2SC3623A* (150 mA) 2SC3731** (40 V) | |
| ~700 m | | 2SB810 2SD1020 | BB1[] (25 V) BP1[] (25 V) | | |
| ~1.0 | | 2SB811 2SD1021 | | | |

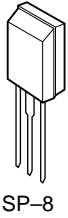


SST

*: High hFE transistor, **: High speed switching

Quick Reference by Package

■ **SP-8 Type Transistor**



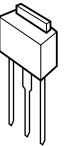
| V _{CEO} (V) I _c (A) | ~16 | ~25 | ~50 | ~80 | ~140 | ~160 | ~300 | ~400 | ~600 |
|--|------------------|------------------|--|---|--------------------|--------------------|--|---------|---------|
| ~50 m | | | | | 2SA915 2SC1940 | 2SA916 2SC1941 | | | |
| ~200 m | | | | | | | 2SC3209 2SC4000 (250 V/ 100 mA) | | |
| ~500 m | | | | | 2SA1221 2SC2958 | 2SA1222 2SC2959 | | | |
| ~700 m | | | 2SB605 2SA1154 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 hFE transistor, **: High speed switching, ***: Internal zener diode

Quick Reference by Package

■ **MP-3 Type Transistor**

| V_{CE0} (V) $I_{C(DC)}$ (A) | ~20 | ~40 | ~60 | ~100 | ~150 | ~300 | ~400 | ~600 |
|----------------------------------|-----------|----------------------|--|-------------------------------------|--------------------------------|----------------------------------|----------------------|----------------------|
| ~0.5 | | | | | | 2SC2802 | { 2SA1400 2SC3588 | |
| ~1.0 | | | { 2SB963 2SD1286 2SC4337 | | | | | { 2SA1413 2SC3632 |
| ~2.0 | 2SD1583 ● | 2SD992 | 2SD1164 | 2SC4338 | { 2SB768 2SD1033 2SD1557 | 2SC2885 2SC2946 2SC2946(1) | { 2SA1412 2SC3631 | |
| ~3.0 | | 2SB962 ◎ | 2SD1448 2SD1584 ● 2SB1261 ◎ 2SD1899 ◎ | 2SC4339 | | | | |
| ~5.0 | | | { 2SA1385 ◎ 2SC3518 ◎ 2SA1648 ◎ 2SC4332 ◎ | { 2SA1647 ◎ 2SC4331 ◎ 2SC4345 | | | 2SC4346 | |
| 10 | 2SA1615 ◎ | { 2SA1649 2SC4333 | 2SC4344 | 2SC4343 | | | | |

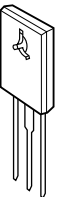


MP-3

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

■ **MP-5 (TO-126) Type Transistor**

| V_{CE0} (V) $I_{C(DC)}$ (A) | ~20 | ~45 | ~60 | ~80 | ~120 | ~160 | ~300 | ~400 | ~600 |
|----------------------------------|----------|---|---|-------------------------------|--|------------------------|---------------------------------|----------------------|----------------------|
| ~1.0 | | | | | | { 2SA1142 2SC2682 | { 2SC2371 2SA1546 2SC4001 | | |
| ~0.5 | | | | | | | 2SC2688 | { 2SA1156 2SC2752 | |
| ~1.0 | | | { 2SB731 2SD809(1) 2SD1630* 2SC4340 | 2SB548 2SD414 | { 2SB549 2SD415 | | | | { 2SA1486 2SC3840 |
| ~2.0 | | 2SD1695* | { 2SB794 2SD985 2SB1111* 2SD1491* | { 2SB795 2SD986 2SC4341 | { 2SA1220 2SC2690 | { 2SA1220A 2SC2690A | | | |
| ~3.0 | | { 2SB744 2SD794 2SB772 ◎ 2SD882 ◎ 2SC1449 | { 2SB744A 2SD794A 2SB1150* 2SD1693* 2SD1694 ● 2SB1217 ◎ 2SD1818 ◎ | | { 2SA1714 2SB1149 2SD1692 2SC4342 | | | | |
| ~5.0 | 2SD741 ◎ | | { 2SB1151 ◎ 2SD1691 ◎ | | | | | | |

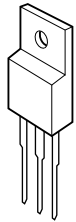


MP-5
(TO-126)

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

Quick Reference by Package

■ **MP-25 (TO-220) Type Transistor**

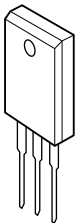


MP-25
(TO-220)

| V_{CE0} (V) I_C (DC) (A) | ~40 | ~60 | ~80 | ~100 | ~150 | ~200 | ~250 | ~300 | ~400 | ~800 |
|------------------------------------|----------------------|------------------------|--|---|---|------------------------|------------------------|---------------------------------|-----------------------|---------|
| ~0.5 | | | | | | { 2SA1383 2SC3514 | | { 2SC1505 2SC1506 2SC1507 | | |
| ~2.0 | | { 2SD1481* 2SD1629* | | { 2SA1008 2SC2331 2SA985 2SC2275 | { 2SA985A 2SC2275A 2SA1006 2SC2336 2SB536 2SB537 2SD381 2SD382 2SB546A 2SB547A 2SD401A 2SD402A | { 2SA1006A 2SC2336A | { 2SA1006B 2SC2336B | 2SA1009 | { 2SA1009A 2SC2333 | |
| ~3.0 | 2SD795 | 2SD288 2SD289 | | | | | | | | 2SC3531 |
| ~5.0 | | { 2SA1069 2SC2516 | { 2SA1069A 2SC2516A 2SB703 2SD743 | { 2SA1644 ◎ 2SC4328 ◎ 2SB601 2SD560 2SB703A 2SD743A 2SC2517 | | | | { 2SD1162 | { 2SC2518 2SD987 | |
| ~7.0 | { 2SA1129 2SC2654 | { 2SB707 2SD568 | { 2SB708 2SD569 | { 2SA1010 2SC2334 2SC2373 2SA1645 ◎ 2SC4329 ◎ | | | | | 2SC2335 | |
| ~8.0 | | | | { 2SA1716 2SC4496* | | | | | | |
| ~7.0 | | | | { 2SA1717 2SA1646 ◎ 2SC4330 ◎ | | | | | | |

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

■ **MP-40 Type Transistor**

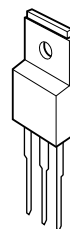


MP-40

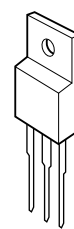
| V_{CE0} (V) I_C (DC) (A) | ~40 | ~60 | ~80 | ~100 | ~150 | ~200 | ~250 | ~300 | ~400 | ~800 |
|------------------------------------|-----|------------------------|-----|---------------------------------|------|------|------|------|----------------------|---------|
| ~3.0 | | 2SB1038 2SD1310 | | | | | | | | |
| ~4.0 | | | | 2SD1311 | | | | | | 2SC3532 |
| ~5.0 | | { 2SD1392* 2SC4347* | | { 2SB974 2SD1308 2SC4348 | | | | | 2SC3431 ☆ | |
| ~7.0 | | | | | | | | | 2SC3158 2SC3432 ☆ | |
| ~8.0 | | | | { 2SB975 2SD1309 2SC4349 | | | | | | |
| ~10 | | | | { 2SA1261 2SC3157 2SC4350 | | | | | 2SC3159 | |

□: Darlington transistor, { : Complementary pair, *: Internal zener diode between C-B, ☆: High speed switching

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

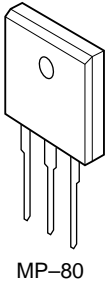
| V _{CE0} (V) I _{C(DC)} (A) Package | -60 | | -100 | | -150 | -300 | -400 |
|---|--|--------------------------|--|---------------------------------|----------------------|---------|---------|
| | MP-45 | MP-45F | MP-45 | MP-45F | MP-45 | MP-45 | MP-45 |
| -2.0 | | | { 2SA1395 2SC3567 | | { 2SB1096 2SD1587 | | 2SC3569 |
| -3.0 | { 2SB1094 2SD1585 2SD1593 ● | 2SD2164 ● | | | | | |
| -4.0 | | | 2SD1586 | | | | |
| -5.0 | { 2SA1394 2SC3566 2SA1441 ⊙ 2SC3691 ⊙ 2SC4351* 2SD1595* | { 2SA1741 ⊙ 2SC4549 ⊙ | { 2SA1718 2SC4352 2SB1098 2SD1589 2SA1650 ⊙ 2SC4334 ⊙ | { 2SB1430 2SD2161 | | 2SD1592 | 2SC3570 |
| -6.0 | | | 2SD1594 ● | 2SD2165 ● | | | |
| -7.0 | { 2SB1097 2SD1588 2SA1442 ⊙ 2SC3692 ⊙ | { 2SA1742 ⊙ 2SC4550 ⊙ | { 2SC4062 2SA1651 ⊙ 2SC4335 ⊙ | 2SC4553 | | | 2SC3571 |
| -8.0 | | | { 2SA1719 2SD1928 2SB1099 2SD1590 | { 2SA1833 2SB1431 2SD2162 | | | |
| -10 | { 2SA1443 ⊙ 2SC3693 ⊙ | { 2SA1743 ⊙ 2SC4551 ⊙ | { 2SA1396 2SC3568 2SA1652 ⊙ 2SC4336 ⊙ 2SA1720 2SC4353 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 Type Transistor**

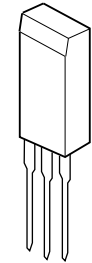


MP-80

| V_{CE0} (V) $I_{C(DC)}$ (A) | ~80 | ~100 | ~120 | ~130 | ~140 | ~160 | ~250 | ~400 | ~800 |
|----------------------------------|---------|------------------------------|--|----------------------|----------------------|------------------------|---------|--------------------------------|--------------------|
| ~2.0 | | | | | | | 2SD1017 | | |
| ~5.0 | | 2SC2908 | | | | | 2SD1018 | | 2SC3533 2SC3534 |
| ~7.0 | | | { 2SB849A 2SD1110A 2SB965 2SD1288 | | | | | | 2SC3535 |
| ~1.0 | 2SD1070 | 2SA1141 2SB897 2SD1210 | { 2SB966 2SD1289 | { 2SA1232 2SC3012 | | | | 2SC2749 2SC3434☆ 2SD1298 | 2SC3536 |
| ~15 | | 2SC2750 2SD1296 | | | { 2SA1227 2SC2987 | { 2SA1227A 2SC2987A | | 2SC2751 2SC3435☆ | |
| ~25 | | 2SD1297 | | | | | | | |

□: Darlington transistor, { : Complementary pair, ☆: High speed switching

■ **MP-10 Type Transistor**



MP-10

| V_{CE0} (V) $I_{C(DC)}$ (A) | ~60 | ~100 |
|----------------------------------|--------------------------|--|
| 2.5 | | 2SC4814 ● |
| ~5 | { 2SA1843 ◎ 2SC4815 ◎ | { 2SA1840 2SC4810 2SA1845 ◎ 2SC4817 ◎ |
| ~7 | { 2SA1844 ◎ 2SC4816 ◎ | { 2SA1846 ◎ 2SC4818 ◎ 2SC4813 ● |
| ~8 | | { 2SA1841 2SC4811 |
| ~10 | | { 2SA1842 2SC4812 2SA1847 ◎ 2SC4819 ◎ |

□: 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_{CE0} (V) I_c (mA) | ~15 | ~20 | ~30 | ~40 | ~50 | ~60 | ~80 | ~120 | ~200 | ~300 |
|-----------------------------|--|---|--|--------------------|---------------------------------------|------------------|--------------------|---|--|---------|
| ~10 | 2SC3663 (8 V, 5 mA) | | | | | | | | | |
| ~20 | | 2SC2223 2SC2758 | 2SK160 | | | | | | | 2SD2383 |
| ~30 | | 2SC4568 | | 2SA1226 | | | | | | |
| ~50 | 2SA1424 (-12 V) 2SA1462 2SC2757 2SC2759 2SC3545 2SC3583 (10 V, 65 mA) 2SC3585 (10 V, 35 mA) | 2SC4095 (35 mA) | 2SC1009A | | | | | 2SA811A 2SA1247 2SC1622A 2SC3115 | 2SC1653 (130 V) 2SC1654 (160 V) | |
| ~100 | 2SC2351 (70 mA) 2SC3356 (12 V) | 2SC4093 2SC4094 (65 mA) 2SC4569 (60 mA) | 2SC4092 (25 V, 70 mA) FN2[] (-25 V) | | 2SA812 2SC1623 FA1[] FN1[] | FA2[] | | | 2SA1330 2SC3360 | |
| ~150 | | | 2SA1411 (-25 V) | | 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) | | | | | | | |
| ~1000 | | | 2SA1467 (-25 V) 2SC3742 (25 V) | | | | | | | |

Quick Reference by Package



Power mini mold
SC-62

■ Power Mini-Mold Transistor

| V_{CE0} (V) I_c (A) | ~20 | ~25 | ~50 | ~60 | ~80 | ~100 | ~120 | ~140 | ~300 |
|----------------------------|--|------------------------------------|---|--|------------------------------|-------------------|-------------------|--------------------|---------|
| ~50 m | | | | | | | | 2SA1173 2SC2780 | |
| ~200 m | 2SC2954 (18 V, 150 mA) 2SC3357 (12 V, 100 mA) | | | | | | | | 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 HC1[] HQ1[] | 2SD1950 2SJ179 (30 V, 1.5 A) | | | | | | | |
| ~3.0 | 2SB1301 HC2[] (16 V) HQ2[] (-16 V) | | | 2SB1572 2SD2403 | | | | | |
| ~5.0 | | | 2SB1571 2SD2402 | | | | | | |

: Darlington connection

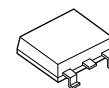


MP-2

■ MP-2 Type Transistor

| V_{CE0} (V) I_c (A) | ~20 | ~60 | ~100 | ~400 | ~600 |
|----------------------------|---------|--------------------|------|------|--------------------|
| ~1.0 | | | | | 2SA1871 2SC4942 |
| ~3.0 | 2SB1581 | | | | |
| ~5.0 | | 2SB1578 2SD2425 | | | |

Quick Reference by Package



MP-3

■ **MP-3 Type (SC-63) Transistor**

| V_{CE0} (V) I_c (A) | ~20 | ~30 | ~45 | ~60 | ~100 | ~200 | ~300 | ~400 | ~600 |
|----------------------------|-----------|----------|-----------|-------------------------------------|------|---|---------|------------------------|------------------------|
| ~0.2 | | | | | | | 2SC2802 | | |
| ~0.5 | | | | | | | | 2SA1400-Z 2SC3588-Z | |
| ~1.0 | | | | 2SB963-Z 2SD1286-Z | | | | | 2SA1413-Z 2SC3632-Z |
| ~2.0 | 2SD1583-Z | 2SD992-Z | | 2SD1164-Z (1.5 A) | | 2SB768 (150 V) 2SD1033 (150 V) 2SC2946(1) | | 2SA1412-Z 2SC3631-Z | |
| ~3.0 | | 2SB962-Z | 2SD1448-Z | 2SB1261-Z 2SD1584-Z 2SD1899-Z | | | | | |
| ~5.0 | | | | 2SA1385-Z 2SC3518-Z | | | | | |
| ~10 | 2SA1615-Z | | | | | | | | |

: Darlington connection



Small mini mold

■ **Small Mini-Mold Transistor**

| V_{CE0} (V) I_c (mA) | ~15 | ~20 | ~30 | ~40 | ~50 | ~120 | ~160 |
|-----------------------------|---------|-------------------|---|--------------------|--|--------------------|---------|
| ~10 | | | | | | | |
| ~20 | | 2SC4178 | | | | | |
| ~30 | | | | | | | |
| ~50 | 2SA1610 | | 2SC4179 | | | 2SA1612 2SC4180 | 2SA1609 |
| ~100 | | | | | 2SA1611 2SC4177 GA1[] GN1[] | | |
| ~150 | | 2SA1613 (25 V) | | | 2SC4181 | | |
| ~200 | 2SC4176 | 2SC4175 | | | | | |
| ~500 | | | 2SB1475 (-25 V) 2SD2228 (25 V) | 2SA1608 2SC4173 | | | |

■ **Ultra Small Mini-Mold Transistor**

| V_{CE0} (V) I_c (mA) | ~50 |
|-----------------------------|--------------------|
| ~100 | 2SA1836 2SC4783 |



Ultra small mini mold

Quick Reference Table by Function/Application

■ **Small Signal Transistor (1/2)**

| | TO-92 | SP-8 | SST | SMALL MINI MOLD | MINI MOLD | POWER MINI |
|-------------------------------|-----------------------|---------|-----------|-----------------|-----------|------------|
| FM/FM RF | 2SA1005 | | | | 2SA1226 | |
| | RF/MIX/CON 2SC1674 | | 2SC2786 | 2SC4178 | 2SC2223 | |
| FM AM/FM/AM MIX/OSC/IF | 2SC1675 | | 2SC2787 | 2SC4179 | 2SC1009A | |
| Audio Frequency Amplification | 2SA733 | | 2SA1175 | 2SA1611 | 2SA812 | |
| | 2SA987 | | | | (2SA812) | |
| | 2SA988 | | | 2SA1612 | 2SA811A | |
| | 2SA1409 | | 2SA1410 | 2SA1613 | 2SA1411 | |
| | 2SC945 | | 2SC2785 | 2SC4177 | 2SC1623 | |
| | 2SC945 (L) | | | | (2SC1623) | |
| | 2SC1840 | | | | (2SC1623) | |
| | 2SC1841 | | | | 2SC1622A | |
| | 2SC3622/A | | 2SC3623/A | 2SC4181 | 2SC3624/A | |
| Low Noise Amplification | 2SA990 | | | | | |
| | 2SA991 | | | | | |
| | 2SA992 | | 2SA1174 | | 2SA1247 | |
| | 2SC1842 | | | | | |
| | 2SC1843 | | | | | |
| | 2SC1844 | | | | | |
| | 2SC1845 | | 2SC2784 | | 2SC3115 | |
| | | 2SA1138 | | | | |
| Driver Output | 2SA952 | | 2SB810 | | 2SB624 | |
| | 2SA953 | | | | 2SB736 | |
| | 2SA954 | | | | 2SB736A | 2SB800 |
| | 2SA1376 | | | | 2SA1330 | |
| | | 2SA915 | | | | 2SA1173 |
| | | 2SA916 | | 2SA1609 | | |
| | | 2SB564 | 2SB811 | | | 2SB798 |
| | | 2SB605 | | | | 2SB799 |
| | | 2SB733 | | | | |
| | | 2SB734 | | | | |
| | 2SB1068 | | | | | 2SB1114 |
| | 2SB1116 | | | | | 2SB1115 |
| | 2SB1116A | | | | | 2SB1115A |
| | | | | | | 2SB804 |
| | | | | | | 2SB805 |
| | | | | | | 2SB806 |
| | 2SC2001 | | 2SD1020 | | 2SD596 | |
| | 2SC2002 | | | | 2SD780 | |
| | 2SC2003 | | | | 2SD780A | 2SD1001 |
| | 2SC3478 | | | | 2SC3360 | |

| |
|--|
| Quick Reference Table by Function/Application |
|--|

■ Small Signal Transistor (2/2)

| | TO-92 | SP-8 | SST | SMALL MINI MOLD | MINI MOLD | POWER MINI |
|---------------|----------|---------|---------|-----------------|-----------|------------|
| Driver Output | | 2SC1940 | | | 2SC1653 | 2SC2780 |
| | | 2SC1941 | | | 2SC1654 | |
| | | 2SC3209 | | | | 2SC3554 |
| | 2SC3615 | | | | | 2SC3617 |
| | 2SC3616 | | | | | 2SC3618 |
| | | 2SD471 | | | | 2SD999 |
| | | 2SD571 | | | | 2SD1000 |
| | | 2SD773 | | | | |
| | | 2SD774 | | | | |
| | 2SD1513 | | | | | 2SD1614 |
| | 2SD1616 | | | | | 2SD1615 |
| | 2SD1616A | | | | | 2SD1615A |
| | | | | | | 2SD1005 |
| | | | | | | 2SD1006 |
| | | | | | | 2SD1007 |
| | 2SD1698 | 2SD1697 | | | | 2SD1699 |
| | 2SD1701 | 2SD1700 | | | | 2SD1702 |
| | 2SD1581 | | | | 2SD1950 | |
| Switching | 2SA1206 | | 2SA1459 | 2SA1610 | 2SA1462 | |
| | 2SA1153 | | | 2SA1608 | 2SA1464 | |
| | | 2SA1460 | | | | 2SA1463 |
| | | | 2SA1458 | | 2SA1461 | |
| | 2SC2720 | | | 2SC4173 | 2SC3739 | |
| | 2SC2901 | | 2SC3732 | 2SC4176 | 2SC3735 | |
| | | 2SC3733 | | | | 2SC3736 |
| | | | 2SC3731 | | 2SC3734 | |

Quick Reference Table by Function/Application

Power Transistor

■ **Low $V_{CE(sat)}$ Transistor**

| Charac- teristics $V_{CE0}, I_{C(DC)}$ | 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, 5 A | | | | 2SD741 | | | | |
| 20 V, 10 A | 2SA1897 (5A) | | 2SA1615 | | | | | |
| 25 V, 3 A | 2SB1117 | | | | | | | |
| 30 V, 3 A | | | 2SB962 | 2SB772 2SD882 | | | | |
| 30 V, 10 A | | | 2SA1649 2SC4333 | | | | | |
| 60 V, 3A | | | 2SB1261 2SD1899 | 2SB1217 2SD1818 | | | | |
| 60 V, 5 A | | 2SB1578 2SD2425 | 2SA1385 2SC3518 | 2SB1151 2SD1691 | | 2SA1843 2SC4815 | | |
| | | | 2SA1648 2SC4332 | | | | 2SA1441 2SC3691 | 2SA1741 2SC4549 |
| 60 V, 7 A | | | 2SC4344 | | | 2SA1844 2SC4816 | 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 | | 2SA1644 2SC4328 | 2SA1845 2SC4817 | 2SA1650 2SC4334 | |
| 100 V, 7 A | | | 2SC4343 | | 2SA1645 2SC4329 | 2SA1846 2SC4818 | 2SA1651 2SC4335 | |
| 100 V, 10 A | | | | | 2SA1646 2SC4330 | 2SA1847 2SC4819 | 2SA1652 2SC4336 | |

■ **High h_{FE} Transistor**

| Charac- teristics $V_{CE0}, I_{C(DC)}$ | 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 $V_{CE(sat)}$ & High h_{FE}

Quick Reference Table by Function/Application

■ **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 2SC2516 | { 2SA1394 2SC3566 | |
| 100 V, 2 A | | { 2SA1008 2SC2331 | { 2SA1395 2SC3567 | |
| 100 V, 5 A | | 2SC2517 | | |
| 100 V, 7 A | | { 2SA1010 2SC2334 | | |
| 100 V, 7.5A | | 2SC2373 | | |
| 100 V, 10 A | | | { 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 | | | 2SC2518 | | 2SC3570 | |
| 400 V, 7 A | | | 2SC2335 | 2SC3158 | 2SC3571 | |
| 400 V, 10 A | | | | 2SC3159 | 2SC3572 | 2SC2749 |
| 400 V, 15 A | | | | | | 2SC2571 |
| 600 V, 2 A | { 2SA1413 2SC3632 | { 2SA1486 2SC3840 | | | | |

■ **800 V, High Speed Switching Transistor**
($t_f = 0.5 \mu s$ MAX.)

| Characteristics V _{CEO} , I _{C(DC)} | MP-25 (TO-220) | MP-40 | MP-80 |
|--|-------------------|---------|---------|
| 800 V, 3 A | 2SC3531 | | 2SC3533 |
| 800 V, 4 A | | 2SC3532 | 2SC3534 |
| 800 V, 6 A | | | 2SC3535 |
| 800 V, 10 A | | | 2SC3536 |

■ **High Voltage, High Speed Switching Transistor**
($t_f = 0.3 \mu s$ MAX.)

| Characteristics V _{CEO} , I _{C(DC)} | MP-3 | MP-40 | MP-80 |
|--|---------|---------|---------|
| 400 V, 5 A | 2SC4346 | 2SC3431 | |
| 400 V, 7 A | | 2SC3432 | |
| 400 V, 10 A | | | 2SC3434 |
| 400 V, 15 A | | | 2SC3435 |

Quick Reference Table by Function/Application

■ **Audio Frequency Amplification Transistor**

| Charac- teristics V _{CEO} , I _{C(DC)} | MP-3 | MP-5 (TO-126) | MP-25 (TO-220) | MP-40 | MP-45 | MP-80 | MP-85 |
|---|--------------------------------|-----------------------|--|----------------------|----------------------|--|----------------------|
| 30 V, 2 A | 2SD992 | | | | | | |
| 45 V, 3 A | 2SD1448 | { 2SB744 2SD794 | 2SD795 | | | | |
| 50 V, 1 A | | { 2SB731 2SD809(1) | | | | | |
| 60 V, 3 A | | { 2SB744A 2SD794A | { 2SB1089 2SD1567 2SD288 2SD289 | { 2SB1038 2SD1310 | { 2SB1094 2SD1585 | | |
| 60 V, 7 A | | | { 2SB707 2SD568 | | { 2SB1097 2SD1588 | | |
| 60 V, 10 A | | | | | | 2SD1070 | |
| 80 V, 0.8 A | | 2SB548 2SD414 | | | | | |
| 80 V, 4 A | | | { 2SB703 2SD743 | | | | |
| 80 V, 7 A | | | { 2SB708 2SD569 | | | | |
| 100 V, 0.8 A | | { 2SB549 2SD415 | | | | | |
| 100 V, 4 A | | | { 2SB703A 2SD743A 2SD1568 | 2SD1311 | 2SD1586 | | |
| 120 V, 1.5 A | | | { 2SB536 2SB537 2SD381 2SD382 | | | | |
| 120 V, 7 A | | | | | | { 2SB849A 2SD1110A { 2SB965 2SD1288 | |
| 120 V, 8 A | | | | | | { 2SB966 2SD1289 | { 2SB1315 2SD1977 |
| 150 V, 2 A | { 2SB768 2SD1033 2SD1557 | | { 2SB546A 2SB547A 2SD401A 2SD402A | | { 2SB1096 2SD1587 | | |
| 250 V, 2 A | | | | | | 2SD1017 | |
| 250 V, 4 A | | | | | | 2SD1018 | |

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|--|
| Quick Reference Table by Function/Application |
|--|

■ High Frequency Amplification Transistor

| Characteristics V_{CE0} , $I_{C(DC)}$ | SP-8 | MP-3 | MP-5 (TO-126) | MP-25 (TO-220) | MP-80 |
|--|---------|---------|------------------------|-------------------------------|------------------------|
| 35 V, 2 A | | | 2SC1449 | | |
| 40 V, 7 A | | | | { 2SA1129 2SC2654 | |
| 120 V, 1.2 A | | | { 2SA1220 2SC2690 | | |
| 120 V, 1.5 A | | | | { 2SA985 2SC2275 | |
| 130 V, 10 A | | | | | { 2SA1232 2SC3012 |
| 140 V, 12 A | | | | | { 2SA1227 2SC2987 |
| 150 V, 1.5 A | | | | { 2SA985A 2SC2275A | |
| 160 V, 1.2 A | | | { 2SA1220A 2SC2690A | | |
| 160 V, 12 A | | | | | { 2SA1227A 2SC2987A |
| 180 V, 1.5 A | | | | { 2SA1006 2SC2336 | |
| 200 V, 1.5 A | | | | { 2SA1006A 2SC2336A | |
| 250 V, 0.1 A | 2SC4000 | | { 2SA1546 2SC4001 | | |
| 250 V, 1.5 A | | | | 2SA1006B 2SC2336B | |
| 300 V, 0.1 A | | | 2SC2371 | | |
| 300 V, 0.2 A | 2SC3209 | 2SC2802 | 2SC2688 | | |
| | | | | 2SC1505 2SC1506 2SC1507 | |

Quick Reference Table by Function/Application

■ **Darlington Transistor**

| Charac- teristics 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 2SC4337◎ | { 2SD1630* 2SC4340◎ | | | | | | |
| 60 V, 1.5 A | | 2SD1164 | { 2SB794 2SD985 2SB1111* 2SD1491* | | | | | | |
| 60 V, 3 A | | | { 2SB1150* 2SD1693* | | | | | | |
| 60 V, 5 A | | | | 2SD1564* | | { 2SD1392* 2SC4347◎* | { 2SD1595* 2SC4351◎ | | |
| 80 V, 0.8 A | 2SD1697 | | | | | | | | |
| 80 V, 1.5 A | { 2SB1093 2SD1579 | | { 2SB795 2SD986 | | | | | | |
| 80 V, 2 A | | 2SC4338◎ | 2SC4341 | | | | | | |
| 100 V, 3 A | | 2SC4339 | { 2SB1149 2SD1692 2SA1714◎ 2SC4342◎ | | | | | | |
| 100 V, 5 A | | 2SC4345 | | { 2SB601 2SD560 | { 2SA1840 2SC4810 | { 2SA1715◎ 2SC4348◎ | { 2SA1718◎ 2SC4352◎ | | |
| | | | | { 2SB1087 2SD1565 | | { 2SB974 2SD1308 | { 2SB1098 2SD1589 | { 2SB1430 2SD2161 | |
| 100 V, 8 A | | | | | { 2SA1841 2SC4811 | { 2SA1716◎ 2SC4349◎ 2SB975 2SD1309 | { 2SA1719◎ 2SD1928◎ 2SB1099 2SD1590 | { 2SB1431 2SD2162 2SA1833◎ | |
| 100 V, 10 A | | | | | { 2SA1842 2SC4812 | { 2SA1717◎ 2SC4350◎ | { 2SA1720◎ 2SC4353◎ 2SB1100 2SD1591 | { 2SB1432 2SD2163 | { 2SB897 2SD1210 |
| 100 V, 15 A | | | | | | | | | 2SD1296 |
| 100 V, 25 A | | | | | | | | | 2SD1297 |
| 300 V, 5 A | | | | 2SD1162 | | | 2SD1592 | | |
| 400 V, 5 A | | | | 2SD987 | | | | | |
| 400 V, 10 A | | | | | | | | | 2SD1298 |

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

Field Effect Transistor

Small Signal FET

■ 2SK type (Junction type)

| Type number | Package | Absolute maximum ratings ($T_A = 25\text{ }^\circ\text{C}$) | | | Electrical characteristics ($T_A = 25\text{ }^\circ\text{C}$) | | Applications |
|-------------|-----------|--|---------------------|---------------------|--|-----------------------|-----------------------------|
| | | V _{GSD} (V) | I _D (mA) | P _T (mW) | Y _{fs1} (ms) | I _{DSS} (mA) | |
| 2SK104 | TO-92 | 30 | 20 | 250 | 2.5 TYP. | 2.5 TYP. | HF amplification |
| 2SK105 | TO-92 | 50 | 20 | 250 | 2.1 | 2.5 | AF amplification |
| 2SK162 | TO-92 | 40 | 50 | 400 | 45 | 18 | AF low noise amplification |
| 2SK163 | TO-92 | 50 | 30 | 400 | 9.0 | 8.0 | AF low noise amplification |
| 2SK193 | SST | 20 | 10 | 250 | 3.5 | 2.5 | FM tuner |
| 2SK195 | TO-92 | 20 | 10 | 250 | 3.5 | 2.5 | FM tuner |
| 2SK505 | TO-92 | 15 | 50 | 400 | 19 | 20 | Video band RF amplification |
| 2SK507 | SST | 15 | 50 | 350 | 19 | 20 | Video band RF amplification |
| 2SK514 | SST | 50 | 20 | 250 | 1.8 | 3.5 | AF amplification |
| 2SK518 | TO-92 | 30 | 50 | 400 | 17 | 60 | HF amplification |
| 2SK519 | SST | 30 | 50 | 350 | 17 | 60 | HF amplification |
| 2SK523 | TO-92 | 50 | 30 | 400 | 9.0 | 8.0 | AF low noise amplification |
| 2SK533 | TO-92 | 50 | 30 | 400 | 9.0 | 8.0 | AF low noise amplification |
| 2SK660 | SST | 20 | 10 | 100 | 150 (MAX.) | 0.5 (MAX.) | ECM impedance conversion |
| 2SK997 | SST | 20 | 10 | 100 | 0.27 | 0.5 (MAX.) | ECM impedance conversion |
| 2SK998 | TO-92 | 20 | 35 | 350 | 16 | 20 | HF amplification |
| 2SK1000 | SST | 22* | 50 | 250 | 28 | 20 | AM tuner, HF amplification |
| 2SK1109 | Mini mold | 20 | 10 | 80 | 0.48 | 0.6 (MAX.) | ECM impedance conversion |

*: V_{GSD}

■ 2SK type (MOS type) (1/2)

| Type number | Package | Absolute maximum rating ($T_A = 25\text{ }^\circ\text{C}$) | | | | Electrical characteristics ($T_A = 25\text{ }^\circ\text{C}$) | | | | | | | 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 | |

Field Effect Transistor

■ 2SK type (MOS type) (2/2)

| Type number | Package | Absolute maximum rating (T _A = 25 fC) | | | | Electrical characteristics (T _A = 25 fC) | | | | | | | 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. | |
| 2SK1274 | SP-8 | 60 | ±1.5 | ±3.0 | 1.0 | 10 | 0.5 | 0.4 | 4 | 0.5 | — | 1.0 | Switching |
| 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 | |
| 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 | |
| 2SK2053 | MP-2 | 16 | ±5 | ±10 | 2.0 | 3 | 2.5 | 0.4 | 1.5 | 0.5 | 0.2 | 0.4 | |
| 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 | |

Field Effect Transistor

■ 2SJ type (Junction type)

| Type number | Package | Absolute maximum ratings ($T_A = 25\text{ fC}$) | | | Electrical characteristics ($T_A = 25\text{ fC}$) | | Applications |
|-------------|---------|--|------------|------------|--|----------------|----------------------------|
| | | V_{GDO} (V) | I_D (mA) | P_T (mW) | $ Y_{fs1} $ (mS) | I_{DSS} (mA) | |
| 2SJ44 | TO-92 | 40 | 30 | 400 | 9.0 TYP. | 9.0 TYP. | AF low noise amplification |
| 2SJ45 | TO-92 | 40 | 30 | 400 | 9.0 | 9.0 | AF amplification |

■ 2SJ type (MOS type)

| Type number | Package | Absolute maximum rating ($T_A = 25\text{ fC}$) | | | | Electrical characteristics ($T_A = 25\text{ fC}$) | | | | | | | Applications |
|-------------|---------------------------|---|-----------|--------------|--------------------------------------|--|--------------|------|---------------------------|--------------|-------|------|--------------|
| | | V_{DSS} (V) | I_D | | P_T $T_C = 25\text{ °C}$ (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 | |
| 2SJ218 | 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 | |
| 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 | |
| 2SJ463 | SC-70 | -30 | ∓ 0.1 | ∓ 0.2 | 0.15 | -3 | -0.01 | 0.02 | -2.5 | -0.001 | 30 | 60 | |

Field Effect Transistor

Power MOS FET

■ **2SK type (1/5)**

| Type number | Package | Absolute maximum rating (T _A = 25 fC) | | | | Electrical characteristics (T _A = 25 fC) | | | | | | | 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. | |
| 2SK459 | MP-25 | 200 | ±10 | ±15 | 60 | 10 | 3 | 1 | 10 | 3 | 0.35 | 0.5 | Switching |
| 2SK591 | MP-45 | 60 | ±15 | ±60 | 35 | 10 | 6 | 5 | 4 | 6 | 0.05 | 0.07 | |
| 2SK611 | MP-3 | 100 | ±1 | ±3 | 10 | 10 | 0.5 | 0.2 | 4 | 0.2 | 5.0 | 6.0 | |
| 2SK612 | MP-3 | 100 | ±2 | ±8 | 10 | 10 | 1 | 1 | 4 | 0.8 | 0.35 | 0.6 | |
| 2SK654 | MP-3 | 100 | ±1 | ±3 | 10 | 10 | 0.5 | 0.5 | 4 | 0.2 | 1.7 | 4.0 | |
| 2SK659 | MP-45 | 60 | ±12 | ±60 | 35 | 10 | 6 | 5 | 4 | 6 | 0.08 | 0.095 | |
| 2SK699 | MP-5 | 100 | ±2.0 | ±6.0 | 15 | 10 | 1 | 0.5 | 4 | 1 | 1.0 | 1.5 | |
| 2SK700 | MP-5 | 80 | ±2 | ±6 | 15 | 10 | 1 | 0.5 | 4 | 1 | 0.8 | 1.0 | |
| 2SK701 | MP-5 | 60 | ±2 | ±6 | 15 | 10 | 1 | 0.5 | 4 | 1 | 0.6 | 0.85 | |
| 2SK702 | MP-25 | 100 | ±5 | ±20 | 50 | 10 | 3 | 5 | 4 | 5 | 0.25 | 0.5 | |
| 2SK703 | MP-45 | 100 | ±5 | ±20 | 35 | 10 | 3 | 5 | 4 | 5 | 0.25 | 0.5 | |
| 2SK704 | MP-25 | 60 | ±5 | ±20 | 50 | 10 | 3 | 5 | 4 | 5 | 0.17 | 0.3 | |
| 2SK705 | MP-45 | 60 | ±5 | ±20 | 35 | 10 | 3 | 5 | 4 | 5 | 0.17 | 0.3 | |
| 2SK707 | MP-80 | 250 | ±25 | ±100 | 120 | 10 | 13 | 5 | 10 | 13 | 0.14 | 0.18 | |
| 2SK719 | MP-80 | 900 | ±5 | ±10 | 120 | 20 | 3 | 1 | 10 | 3 | 3.2 | 4.0 | |
| 2SK720A | MP-80 | 250 | ±20 | ±80 | 120 | 10 | 10 | 5 | 10 | 10 | 0.18 | 0.23 | |
| 2SK735 | MP-88 | 450 | ±10 | ±30 | 120 | 10 | 5 | 3 | 10 | 5 | 0.6 | 0.8 | |
| 2SK736 | MP-45 | 100 | ±15 | ±60 | 35 | 10 | 6 | 5 | 4 | 6 | 0.055 | 0.10 | |
| 2SK737 | MP-45 | 100 | ±12 | ±60 | 35 | 10 | 6 | 5 | 4 | 6 | 0.08 | 0.20 | |
| 2SK738 | MP-3 | 30 | ±2 | ±8 | 20 | 10 | 1 | 1 | 4 | 0.8 | 0.13 | 0.25 | |
| 2SK739 | MP-3 | 60 | ±2 | ±8 | 20 | 10 | 1 | 1 | 4 | 0.8 | 0.25 | 0.35 | |
| 2SK773 | MP-80 | 500 | ±12 | ±40 | 120 | 10 | 6 | 5 | 10 | 6 | 0.47 | 0.6 | |
| 2SK774 | MP-80 | 500 | ±18 | ±60 | 120 | 10 | 9 | 8 | 10 | 9 | 0.35 | 0.45 | |
| 2SK784 | MP-88 | 450 | ±20 | ±80 | 150 | 10 | 10 | 9 | 10 | 10 | 0.25 | 0.35 | |
| 2SK785 | MP-88 | 500 | ±20 | ±80 | 150 | 10 | 10 | 9 | 10 | 10 | 0.3 | 0.4 | |
| 2SK786 | MP-25 | 900 | ±3 | ±6 | 50 | 20 | 1.5 | 0.8 | 10 | 1.5 | 6.0 | 7.5 | |
| 2SK787 | MP-88 | 900 | ±8 | ±16 | 150 | 10 | 4 | 1 | 10 | 4 | 1.25 | 1.6 | |
| 2SK797 | MP-88 | 60 | ±40 | ±120 | 150 | 10 | 6 | 5 | 4 | 20 | — | 0.025 | |
| 2SK798 | MP-88 | 100 | ±40 | ±120 | 150 | 10 | 6 | 5 | 4 | 20 | — | 0.04 | |
| 2SK799 | MP-80 | 450 | ±12 | ±40 | 120 | 10 | 6 | 5 | 10 | 6 | 0.4 | 0.5 | |
| 2SK800 | MP-80 | 450 | ±18 | ±60 | 120 | 10 | 9 | 8 | 10 | 9 | 0.32 | 0.38 | |
| 2SK801 | MP-3 | 30 | ±2 | ±8 | 12 | 10 | 1 | 1 | 4 | 1 | 0.3 | 0.5 | |
| 2SK802 | MP-5 | 30 | ±2 | ±8 | 15 | 10 | 1 | 1 | 4 | 1 | 0.3 | 0.5 | |
| 2SK810 | MP-25 | 100 | ±14 | ±56 | 60 | 10 | 8 | 4 | 4 | 8 | 0.15 | 0.25 | |
| 2SK811 | MP-45 | 100 | ±12 | ±48 | 35 | 10 | 8 | 4 | 4 | 8 | 0.15 | 0.25 | |
| 2SK812 | MP-25 | 60 | ±27 | ±108 | 60 | 10 | 15 | 6 | 4 | 15 | 0.1 | 0.15 | |
| 2SK813 | MP-45 | 60 | ±21 | ±84 | 35 | 10 | 15 | 6 | 4 | 15 | 0.1 | 0.15 | |
| 2SK814 | MP-45 | 30 | ±15 | ±60 | 35 | 10 | 8.0 | 6 | 4 | 8.0 | 0.07 | 0.1 | |

Field Effect Transistor

■ 2SK type (2/5)

| Type number | Package | Absolute maximum rating (T _A = 25 fC) | | | | Electrical characteristics (T _A = 25 fC) | | | | | | | Applications |
|-------------|---------|---|----------------|--------------|--|--|-----------------------|------|-------------------------|-----------------------|------|------|--------------|
| | | V _{DSS} (V) | I _D | | P _T T _C = 25 °C (W) | y _{fs} (S) | | | R _{DS(on)} (y) | | | | |
| | | | DC (A) | Pulse (A) | | V _{DS} (V) | I _D (A) | MIN. | V _{GS} (V) | I _D (A) | TYP. | MAX. | |
| 2SK815 | MP-45 | 100 | ±21 | ±84 | 35 | 10 | 15 | 6 | 4 | 15 | 0.09 | 0.15 | |
| 2SK817 | MP-45 | 60 | ±26 | ±104 | 35 | 10 | 15 | 8 | 4 | 15 | 0.06 | 0.08 | |
| 2SK819 | MP-88 | 500 | ±10 | ±30 | 120 | 10 | 5.0 | 3 | 10 | 5.0 | 0.7 | 1.0 | |
| 2SK820 | MP-85 | 250 | ±18 | ±72 | 80 | 10 | 10 | 5 | 10 | 10 | 0.18 | 0.23 | |
| 2SK821 | MP-88 | 250 | ±20 | ±80 | 150 | 10 | 10 | 5 | 10 | 10 | 0.18 | 0.23 | |
| 2SK822 | MP-85 | 250 | ±22 | ±88 | 90 | 10 | 13 | 5 | 10 | 13 | 0.12 | 0.15 | |
| 2SK823 | MP-88 | 250 | ±25 | ±100 | 150 | 10 | 13 | 5 | 10 | 13 | 0.12 | 0.15 | |
| 2SK824 | MP-85 | 450 | ±12 | ±40 | 90 | 10 | 7.5 | 5 | 10 | 7.5 | 0.4 | 0.5 | |
| 2SK825 | MP-88 | 450 | ±15 | ±40 | 150 | 10 | 7.5 | 5 | 10 | 7.5 | 0.4 | 0.5 | |
| 2SK826 | MP-85 | 450 | ±15 | ±60 | 95 | 10 | 9.0 | 8 | 10 | 9.0 | 0.32 | 0.38 | |
| 2SK827 | MP-88 | 450 | ±18 | ±60 | 150 | 10 | 9.0 | 8 | 10 | 9.0 | 0.32 | 0.38 | |
| 2SK828 | MP-85 | 500 | ±12 | ±40 | 90 | 10 | 7.5 | 5 | 10 | 7.5 | 0.47 | 0.6 | |
| 2SK829 | MP-88 | 500 | ±15 | ±40 | 150 | 10 | 7.5 | 5 | 10 | 7.5 | 0.47 | 0.6 | |
| 2SK830 | MP-85 | 500 | ±15 | ±60 | 95 | 10 | 9.0 | 8 | 10 | 9.0 | 0.35 | 0.45 | |
| 2SK831 | MP-88 | 500 | ±18 | ±60 | 150 | 10 | 9.0 | 8 | 10 | 9.0 | 0.35 | 0.45 | |
| 2SK832 | MP-85 | 900 | ±4 | ±10 | 85 | 10 | 3.0 | 1 | 10 | 3.0 | 3.2 | 4.0 | |
| 2SK833 | MP-88 | 900 | ±5 | ±10 | 150 | 20 | 3.0 | 1 | 10 | 3.0 | 3.2 | 4.0 | |
| 2SK854 | MP-25 | 450 | ±5 | ±20 | 50 | 10 | 2.5 | 2.5 | 10 | 2.5 | 1.0 | 1.4 | |
| 2SK855 | MP-25 | 500 | ±5 | ±20 | 50 | 10 | 2.5 | 2.5 | 10 | 2.5 | 1.2 | 1.5 | |
| 2SK871 | MP-88 | 900 | ±4 | ±8 | 120 | 10 | 2.0 | 1 | 10 | 2.0 | 4.0 | 5.5 | |
| 2SK872 | MP-88 | 900 | ±6 | ±12 | 150 | 10 | 3.0 | 2 | 10 | 3.0 | 1.7 | 2.5 | |
| 2SK873 | MP-88 | 450 | ±8 | ±32 | 100 | 10 | 4.0 | 3 | 10 | 4.0 | 0.8 | 1.1 | |
| 2SK874 | MP-88 | 500 | ±8 | ±32 | 100 | 10 | 4.0 | 3 | 10 | 4.0 | 0.9 | 1.2 | |
| 2SK875 | MP-88 | 450 | ±12 | ±48 | 120 | 10 | 6.0 | 5 | 10 | 6.0 | 0.5 | 0.6 | |
| 2SK876 | MP-88 | 500 | ±12 | ±48 | 120 | 10 | 6.0 | 5 | 10 | 6.0 | 0.6 | 0.7 | |
| 2SK926 | MP-25 | 250 | ±10 | ±40 | 60 | 10 | 5.0 | 2.5 | 10 | 5.0 | 0.4 | 0.5 | |
| 2SK928 | MP-45 | 450 | ±5 | ±10 | 40 | 10 | 2.5 | 2.5 | 10 | 2.5 | 1.0 | 1.4 | |
| 2SK929 | MP-45 | 500 | ±5 | ±10 | 40 | 10 | 2.5 | 2.5 | 10 | 2.5 | 1.2 | 1.5 | |
| 2SK946 | MP-45 | 900 | ±3 | ±8 | 40 | 10 | 2.0 | 1 | 10 | 2.0 | 4.0 | 5.5 | |
| 2SK991 | MP-25 | 100 | ±4 | ±8 | 35 | 10 | 2.0 | 1 | 4 | 2.0 | 0.5 | 0.7 | |
| 2SK992 | MP-45 | 100 | ±4 | ±8 | 30 | 10 | 2.0 | 1 | 4 | 2.0 | 0.5 | 0.7 | |
| 2SK993 | MP-25 | 60 | ±8 | ±16 | 35 | 10 | 4.0 | 1.5 | 4 | 4.0 | 0.3 | 0.4 | |
| 2SK994 | MP-45 | 60 | ±7 | ±14 | 30 | 10 | 4.0 | 1.5 | 4 | 4.0 | 0.3 | 0.4 | |
| 2SK1059 | MP-3 | 60 | ±5 | ±20 | 20 | 10 | 3.0 | 4 | 4 | 3.0 | 0.15 | 0.22 | |
| 2SK1060 | MP-3 | 100 | ±5 | ±20 | 20 | 10 | 3.0 | 4 | 4 | 3.0 | 0.22 | 0.38 | |
| 2SK1122 | MP-88 | 100 | ±40 | ±160 | 100 | 10 | 20 | 12 | 4 | 20 | 0.05 | 0.07 | |
| 2SK1123 | MP-88 | 60 | ±40 | ±160 | 100 | 10 | 20 | 12 | 4 | 20 | 0.03 | 0.05 | |
| 2SK1149 | MP-85 | 100 | ±40 | ±160 | 75 | 10 | 20 | 12 | 4 | 20 | 0.05 | 0.07 | |
| 2SK1150 | MP-85 | 60 | ±40 | ±160 | 75 | 10 | 20 | 12 | 4 | 20 | 0.03 | 0.05 | |
| 2SK1198 | MP-45 | 700 | ±2 | ±8 | 35 | 10 | 1.0 | 1 | 10 | 1.0 | 2.5 | 3.2 | |

Field Effect Transistor

■ 2SK type (3/5)

| Type number | Package | Absolute maximum rating (T _A = 25 fC) | | | | Electrical characteristics (T _A = 25 fC) | | | | | | | Applications |
|-------------|---------|---|----------------|--------------|--|--|-----------------------|------|-------------------------|-----------------------|-------|-------|--------------|
| | | V _{DSS} (V) | I _D | | P _T T _C = 25 °C (W) | y _{fs} (S) | | | R _{DS(on)} (y) | | | | |
| | | | DC (A) | Pulse (A) | | V _{DS} (V) | I _D (A) | MIN. | V _{GS} (V) | I _D (A) | TYP. | MAX. | |
| 2SK1271 | MP-88 | 1400 | ±5 | ±10 | 150 | 20 | 3.0 | 1.5 | 10 | 3.0 | 3.5 | 4.0 | Switching |
| 2SK1281 | MP-88 | 700 | ±4 | ±8 | 120 | 10 | 2.0 | 1.0 | 10 | 2.0 | 2.5 | 3.2 | |
| 2SK1282 | MP-3 | 60 | ±3 | ±12 | 20 | 10 | 2.0 | 2.4 | 4 | 2.0 | 0.2 | 0.3 | |
| 2SK1283 | MP-5 | 60 | ±3 | ±12 | 20 | 10 | 2.0 | 2.4 | 4 | 2.0 | 0.2 | 0.3 | |
| 2SK1284 | MP-3 | 100 | ±3 | ±12 | 20 | 10 | 2.0 | 2.4 | 4 | 2.0 | 0.32 | 0.45 | |
| 2SK1285 | MP-5 | 100 | ±3 | ±12 | 20 | 10 | 2.0 | 2.4 | 4 | 2.0 | 0.32 | 0.45 | |
| 2SK1286 | MP-45F | 60 | ±15 | ±60 | 35 | 10 | 8.0 | 7 | 4 | 8.0 | 0.075 | 0.095 | |
| 2SK1287 | MP-25 | 60 | ±20 | ±80 | 60 | 10 | 8.0 | 7 | 4 | 8.0 | 0.075 | 0.095 | |
| 2SK1288 | MP-45F | 100 | ±15 | ±60 | 35 | 10 | 8.0 | 7 | 4 | 8.0 | 0.12 | 0.14 | |
| 2SK1289 | MP-25 | 100 | ±20 | ±80 | 60 | 10 | 8.0 | 7 | 4 | 8.0 | 0.12 | 0.14 | |
| 2SK1290 | MP-45F | 60 | ±25 | ±100 | 35 | 10 | 15 | 12 | 4 | 15 | 0.045 | 0.06 | |
| 2SK1291 | MP-25 | 60 | ±30 | ±120 | 60 | 10 | 15 | 12 | 4 | 15 | 0.045 | 0.06 | |
| 2SK1292 | MP-45F | 100 | ±20 | ±100 | 35 | 10 | 15 | 12 | 4 | 15 | 0.07 | 0.085 | |
| 2SK1293 | MP-25 | 100 | ±30 | ±120 | 60 | 10 | 15 | 12 | 4 | 15 | 0.07 | 0.085 | |
| 2SK1294 | MP-45F | 60 | ±40 | ±160 | 35 | 10 | 20 | 12 | 4 | 20 | 0.03 | 0.05 | |
| 2SK1295 | MP-45F | 100 | ±30 | ±160 | 35 | 10 | 20 | 12 | 4 | 20 | 0.06 | 0.075 | |
| 2SK1491 | MP-88 | 250 | ±25 | ±100 | 120 | 10 | 13 | 7.0 | 10 | 13 | 0.12 | 0.15 | |
| 2SK1492 | MP-88 | 250 | ±35 | ±140 | 140 | 10 | 18 | 10 | 10 | 18 | 0.08 | 0.1 | |
| 2SK1493 | MP-25 | 450 | ±3.0 | ±12 | 50 | 10 | 2.0 | 1.0 | 10 | 2.0 | 2.2 | 2.8 | |
| 2SK1494 | MP-25 | 500 | ±3.0 | ±12 | 50 | 10 | 2.0 | 1.0 | 10 | 2.0 | 2.4 | 3.0 | |
| 2SK1495 | MP-25 | 450 | ±7.0 | ±28 | 50 | 10 | 4.0 | 3.0 | 10 | 4.0 | 0.7 | 0.9 | |
| 2SK1496 | MP-25 | 450 | ±7.0 | ±28 | 50 | 10 | 4.0 | 3.0 | 10 | 4.0 | 0.8 | 1.0 | |
| 2SK1497 | MP-88 | 450 | ±20 | ±80 | 130 | 10 | 10 | 7.5 | 10 | 10 | 0.28 | 0.35 | |
| 2SK1498 | MP-88 | 500 | ±20 | ±80 | 130 | 10 | 10 | 7.5 | 10 | 10 | 0.32 | 0.40 | |
| 2SK1499 | MP-88 | 450 | ±25 | ±100 | 160 | 10 | 13 | 8.0 | 10 | 13 | 0.20 | 0.25 | |
| 2SK1500 | MP-88 | 500 | ±25 | ±100 | 160 | 10 | 13 | 8.0 | 10 | 13 | 0.22 | 0.27 | |
| 2SK1501 | MP-25 | 900 | ±4.0 | ±8.0 | 70 | 10 | 2.0 | 1.0 | 10 | 2.0 | 2.8 | 4.0 | |
| 2SK1502 | MP-88 | 900 | ±7.0 | ±14 | 120 | 10 | 4.0 | 2.0 | 10 | 4.0 | 1.7 | 2.0 | |
| 2SK1594 | MP-45F | 30 | ±20 | ±80 | 30 | 10 | 10 | 7.0 | 4 | 10 | 0.05 | 0.08 | |
| 2SK1595 | MP-45F | 30 | ±30 | ±120 | 35 | 10 | 15 | 12 | 4 | 15 | 0.03 | 0.05 | |
| 2SK1596 | MP-45F | 30 | ±40 | ±160 | 35 | 10 | 20 | 20 | 4 | 20 | 0.02 | 0.03 | |
| 2SK1664 | MP-45F | 700 | ±2.0 | ±8.0 | 35 | 10 | 1.0 | 0.5 | 10 | 1.0 | 0.5 | 0.6 | |
| 2SK1748 | MP-3 | 60 | ±8.0 | ±32 | 20 | 10 | 4.0 | 5.0 | 4 | 4.0 | 0.11 | 0.16 | |
| 2SK1749 | MP-88 | 60 | ±50 | ±200 | 150 | 10 | 25 | 20 | 4 | 25 | 0.022 | 0.025 | |
| 2SK1750 | MP-25 | 450 | ±5.0 | ±20 | 50 | 10 | 2.5 | 1.0 | 10 | 2.5 | 1.1 | 1.4 | |
| 2SK1751 | MP-25 | 500 | ±5.0 | ±20 | 50 | 10 | 2.5 | 1.0 | 10 | 2.5 | 1.2 | 1.5 | |
| 2SK1752 | MP-88 | 450 | ±10 | ±40 | 100 | 10 | 5.0 | 3.5 | 10 | 5.0 | 0.7 | 0.9 | |
| 2SK1753 | MP-88 | 500 | ±10 | ±40 | 100 | 10 | 5.0 | 3.5 | 10 | 5.0 | 0.8 | 1.0 | |
| 2SK1756 | MP-88 | 450 | ±15 | ±60 | 120 | 10 | 8.0 | 5.0 | 10 | 8.0 | 0.4 | 0.5 | |
| 2SK1757 | MP-88 | 500 | ±15 | ±60 | 120 | 10 | 8.0 | 5.0 | 10 | 8.0 | 0.5 | 0.6 | |

Field Effect Transistor

■ 2SK type (4/5)

| Type number | Package | Absolute maximum rating ($T_A = 25\text{ }^\circ\text{C}$) | | | | Electrical characteristics ($T_A = 25\text{ }^\circ\text{C}$) | | | | | | | | Applications |
|-------------|---------|---|-----------|--------------|--|--|--------------|------|---------------------------|--------------|-------|-------|-----------|--------------|
| | | V_{DSS} (V) | I_D | | P_T $T_C = 25\text{ }^\circ\text{C}$ (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. | | |
| 2SK1758 | MP-45F | 600 | ± 2.0 | ± 8.0 | 30 | 10 | 1.0 | 0.5 | 10 | 1.0 | 2.8 | 4.2 | Switching | |
| 2SK1760 | MP-88 | 900 | ± 5.0 | ± 10 | 100 | 20 | 3.0 | 1.0 | 10 | 3.0 | 3.1 | 4.0 | | |
| 2SK1784 | MP-88 | 450 | ± 12 | ± 48 | 100 | 10 | 6.0 | 1.5 | 10 | 6.0 | 0.5 | 0.6 | | |
| 2SK1785 | MP-88 | 500 | ± 12 | ± 48 | 100 | 10 | 6.0 | 1.5 | 10 | 6.0 | 0.6 | 0.7 | | |
| 2SK1793 | MP-25 | 900 | ± 3.0 | ± 6.0 | 75 | 20 | 2.0 | 0.8 | 10 | 2.0 | 6.2 | 7.5 | | |
| 2SK1794 | MP-88 | 900 | ± 6.0 | ± 12 | 100 | 20 | 3.0 | 2.0 | 10 | 3.0 | 1.8 | 2.8 | | |
| 2SK1795 | MP-88 | 900 | ± 8.0 | ± 16 | 140 | 20 | 4.0 | 1.0 | 10 | 4.0 | 1.3 | 1.6 | | |
| 2SK1796 | MP-88 | 900 | ± 10 | ± 20 | 150 | 20 | 5.0 | 1.5 | 10 | 5.0 | 1.0 | 1.2 | | |
| 2SK1850 | MP-10 | 60 | ± 10 | ± 40 | 1.8 | 10 | 5.0 | 7.0 | 4 | 5.0 | 0.08 | 0.095 | | |
| 2SK1851 | MP-10 | 60 | ± 15 | ± 60 | 1.8 | 10 | 7.5 | 12 | 4 | 7.5 | 0.045 | 0.06 | | |
| 2SK1852 | MP-10 | 100 | ± 10 | ± 40 | 1.8* | 10 | 5.0 | 7.0 | 4 | 5.0 | 0.15 | 0.2 | | |
| 2SK1853 | MP-10 | 100 | ± 15 | ± 60 | 1.8* | 10 | 7.5 | 12 | 4 | 7.5 | 0.08 | 0.1 | | |
| 2SK1953 | MP-45F | 600 | ± 2.0 | ± 6.0 | 25* | 20 | 1.0 | 0.5 | 10 | 1.0 | 4.2 | 5.0 | | |
| 2SK1954 | MP-3 | 180 | ± 4.0 | ± 16 | 20* | 10 | 2.0 | 0.5 | 10 | 2.0 | 0.5 | 0.65 | | |
| 2SK1987 | MP-45F | 250 | ± 7.0 | ± 28 | 30 | 10 | 4.0 | 2.1 | 10 | 4.0 | 0.4 | 0.5 | | |
| 2SK1988 | MP-45F | 450 | ± 2.5 | ± 10 | 30 | 10 | 1.5 | 0.9 | 10 | 1.5 | 2.2 | 2.8 | | |
| 2SK1989 | MP-45F | 500 | ± 2.5 | ± 10 | 30 | 10 | 1.5 | 0.9 | 10 | 1.5 | 2.4 | 3.0 | | |
| 2SK1990 | MP-45F | 450 | ± 4.5 | ± 18 | 30 | 10 | 2.5 | 1.5 | 10 | 2.5 | 1.1 | 1.4 | | |
| 2SK1991 | MP-45F | 500 | ± 4.5 | ± 18 | 30 | 10 | 2.5 | 1.5 | 10 | 2.5 | 1.2 | 1.5 | | |
| 2SK1992 | MP-45F | 450 | ± 6.0 | ± 24 | 35 | 10 | 3.0 | 2.8 | 10 | 3.0 | 0.7 | 0.9 | | |
| 2SK1993 | MP-45F | 500 | ± 6.0 | ± 24 | 35 | 10 | 3.0 | 2.8 | 10 | 3.0 | 0.8 | 1.0 | | |
| 2SK1994 | MP-45F | 900 | ± 2.0 | ± 4.0 | 30 | 20 | 1.0 | 0.6 | 10 | 1.0 | 6.2 | 7.5 | | |
| 2SK1995 | MP-45F | 900 | ± 3.0 | ± 6.0 | 35 | 20 | 2.0 | 1.0 | 10 | 2.0 | 3.2 | 4.0 | | |
| 2SK2040 | MP-3 | 600 | ± 2.0 | ± 6.0 | 20 | 20 | 1.0 | 0.5 | 10 | 1.0 | 4.2 | 5.0 | | |
| 2SK2131 | MP-45F | 150 | ± 15 | ± 60 | 35 | 10 | 8.0 | 10 | 10 | 8.0 | 0.1 | 0.12 | | |
| 2SK2132 | MP-10 | 180 | ± 4 | ± 16 | 1.8 | 10 | 2.0 | 0.5 | 10 | 2.0 | 0.52 | 0.65 | | |
| 2SK2133 | MP-25 | 250 | ± 16 | ± 64 | 75 | 10 | 8.0 | 4.0 | 10 | 8.0 | 0.21 | 0.26 | | |
| 2SK2134 | MP-25 | 200 | ± 13 | ± 52 | 70* | 10 | 7.0 | 2 | 10 | 7.0 | 0.32 | 0.4 | | |
| 2SK2135 | MP-45F | 200 | ± 14 | ± 56 | 35 | 10 | 7.0 | 4 | 10 | 7.0 | 0.14 | 0.18 | | |
| 2SK2136 | MP-25 | 200 | ± 20 | ± 80 | 75 | 10 | 10 | 4 | 10 | 10 | 0.14 | 0.18 | | |
| 2SK2137 | MP-45F | 600 | ± 4 | ± 16 | 30 | 10 | 20 | 1 | 10 | 2.0 | 2.0 | 2.4 | | |
| 2SK2138 | MP-25 | 600 | ± 5 | ± 20 | 70 | 10 | 2.5 | 1 | 10 | 2.5 | 2.0 | 2.4 | | |
| 2SK2139 | MP-45F | 600 | ± 5 | ± 20 | 35 | 10 | 2.5 | 1.5 | 10 | 2.5 | 1.25 | 1.5 | | |
| 2SK2140 | MP-25 | 600 | ± 7 | ± 28 | 75 | 10 | 3.5 | 1.5 | 10 | 3.5 | 1.25 | 1.5 | | |
| 2SK2141 | MP-45F | 600 | ± 6 | ± 24 | 40 | 10 | 3.0 | 2.0 | 10 | 3.0 | 0.9 | 1.1 | | |
| 2SK2234 | MP-45F | 500 | ± 8 | ± 32 | 40 | 10 | 4.0 | 3.0 | 10 | 4.0 | 0.5 | 0.6 | | |
| 2SK2275 | MP-45F | 900 | ± 3.5 | ± 7.0 | 35 | 20 | 2.0 | 4.0 | 10 | 2.0 | 2.4 | 2.8 | | |
| 2SK2341 | MP-45F | 250 | ± 11 | ± 44 | 35 | 10 | 6.0 | 3.0 | 10 | 6.0 | 0.21 | 0.26 | | |
| 2SK2409 | MP-45F | 60 | ± 40 | ± 160 | 35 | 10 | 20 | 20 | 4 | 20 | 0.03 | 0.05 | | |
| 2SK2410 | MP-45F | 60 | ± 30 | ± 120 | 35 | 10 | 15 | 15 | 4 | 15 | 0.04 | 0.06 | | |

*: $T_A = 25\text{ }^\circ\text{C}$

Field Effect Transistor

■ **2SK type (5/5)**

| Type number | Package | Absolute maximum rating (T _A = 25 fC) | | | | Electrical characteristics (T _A = 25 fC) | | | | | | | Applications |
|-------------|---------|---|----------------|--------------|--|--|-----------------------|------|-------------------------|-----------------------|-------|-------|--------------|
| | | V _{DSS} (V) | I _D | | P _T T _C = 25 °C (W) | y _f s (S) | | | R _{DS(on)} (ȳ) | | | | |
| | | | DC (A) | Pulse (A) | | V _{DS} (V) | I _D (A) | MIN. | V _{GS} (V) | I _D (A) | TYP. | MAX. | |
| 2SK2411 | MP-25 | 60 | ±30 | ±120 | 75 | 10 | 15 | 15 | 4 | 15 | 0.04 | 0.06 | Switching |
| 2SK2412 | MP-45F | 60 | ±20 | ±80 | 30 | 10 | 10 | 7 | 4 | 10 | 0.067 | 0.095 | |
| 2SK2413 | MP-10 | 60 | ±10 | ±40 | 1.8* | 10 | 5 | 7 | 4 | 10 | 0.07 | 0.095 | |
| 2SK2414 | MP-3 | 60 | ±10 | ±40 | 20 | 10 | 5 | 7 | 4 | 10 | 0.07 | 0.095 | |
| 2SK2415 | MP-3 | 60 | ±8.0 | ±32 | 20 | 10 | 4 | 5 | 4 | 4 | 0.1 | 0.15 | |
| 2SK2461 | MP-45F | 100 | ±20 | ±80 | 35 | 10 | 10 | 12 | 4 | 10 | 0.07 | 0.1 | |
| 2SK2462 | MP-45F | 100 | ±15 | ±60 | 30 | 10 | 8 | 7 | 4 | 8 | 0.12 | 0.17 | |
| 2SK2476 | MP-45F | 800 | ±3.0 | ±9.0 | 40 | 20 | 2 | 1 | 10 | 2 | 3.4 | 5.0 | |
| 2SK2477 | MP-45F | 800 | ±10 | ±30 | 150 | 20 | 5 | 3.5 | 10 | 5 | 0.65 | 1.0 | |
| 2SK2478 | MP-88 | 900 | ±2.0 | ±8.0 | 30 | 20 | 1 | 0.6 | 10 | 1 | 5.0 | 7.5 | |
| 2SK2479 | MP-25 | 900 | ±3.0 | ±8.0 | 70 | 20 | 2 | 0.8 | 10 | 2 | 5.6 | 7.5 | |
| 2SK2480 | MP-45F | 900 | ±3.5 | ±12 | 35 | 20 | 2 | 1 | 10 | 2 | 3.2 | 4.0 | |
| 2SK2481 | MP-25 | 900 | ±4.0 | ±12 | 70 | 20 | 2 | 1 | 10 | 2 | 3.2 | 4.0 | |
| 2SK2482 | MP-88 | 900 | ±5.0 | ±12 | 100 | 20 | 3 | 1 | 10 | 3 | 3.2 | 4.0 | |
| 2SK2483 | MP-45F | 900 | ±3.5 | ±10.5 | 40 | 20 | 2 | 1 | 10 | 2 | 2.2 | 2.8 | |
| 2SK2484 | MP-25 | 900 | ±5.0 | ±10 | 75 | 20 | 3 | 2 | 10 | 3 | 2.2 | 2.8 | |
| 2SK2485 | MP-88 | 900 | ±6.0 | ±12 | 100 | 20 | 3 | 2 | 10 | 3 | 2.2 | 2.8 | |
| 2SK2486 | MP-88 | 900 | ±7.0 | ±18 | 120 | 20 | 4 | 2.5 | 10 | 4 | 1.4 | 2.0 | |
| 2SK2487 | MP-88 | 900 | ±8.0 | ±20 | 140 | 20 | 4 | 3.0 | 10 | 4 | 1.1 | 1.6 | |
| 2SK2488 | MP-88 | 900 | ±10 | ±30 | 150 | 20 | 5 | 6 | 10 | 5 | 1.0 | 1.2 | |
| 2SK2498 | MP-45F | 60 | ±50 | ±200 | 35 | 10 | 25 | 20 | 4 | 25 | 0.011 | 0.014 | |
| 2SK2499 | MP-25 | 60 | ±50 | ±200 | 75 | 10 | 25 | 20 | 4 | 25 | 0.011 | 0.014 | |
| 2SK2510 | MP-45F | 60 | ±40 | ±160 | 35 | 10 | 20 | 13 | 4 | 20 | 0.024 | 0.03 | |
| 2SK2511 | MP-88 | 60 | ±40 | ±160 | 80 | 10 | 20 | 10 | 4 | 20 | 0.032 | 0.04 | |
| 2SK2512 | MP-45F | 60 | ±45 | ±180 | 35 | 10 | 23 | 15 | 4 | 23 | 0.016 | 0.023 | |
| 2SK2513 | MP-25 | 60 | ±45 | ±180 | 75 | 10 | 23 | 15 | 4 | 23 | 0.016 | 0.023 | |
| 2SK2514 | MP-88 | 60 | ±50 | ±200 | 150 | 10 | 25 | 15 | 4 | 25 | 0.016 | 0.023 | |
| 2SK2515 | MP-88 | 60 | ±50 | ±200 | 150 | 10 | 25 | 20 | 4 | 25 | 0.011 | 0.014 | |

*: T_A = 25°C

■ **Power SOP8 series**

| Type number | Package | Absolute maximum rating (T _A = 25 fC) | | | | Electrical characteristics (T _A = 25 fC) | | | | | | | Applications |
|-------------|-----------|---|----------------|--------------|--|--|-----------------------|------|-------------------------|-----------------------|-------|-------|--------------|
| | | V _{DSS} (V) | I _D | | P _T T _C = 25 °C (W) | y _f s (S) | | | R _{DS(on)} (ȳ) | | | | |
| | | | DC (A) | Pulse (A) | | V _{DS} (V) | I _D (A) | MIN. | V _{GS} (V) | I _D (A) | TYP. | MAX. | |
| μPA1700* | PowerSOP8 | 30 | ±7 | ±28 | 2.0* | 10 | 3.5 | 5.0 | 4 | 3.5 | 0.040 | 0.050 | |
| μPA1701* | PowerSOP8 | 20 | ±7 | ±28 | 2.0* | 10 | 3.5 | 5.0 | 2.5 | 3.5 | 0.031 | 0.048 | |

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

*: Under development

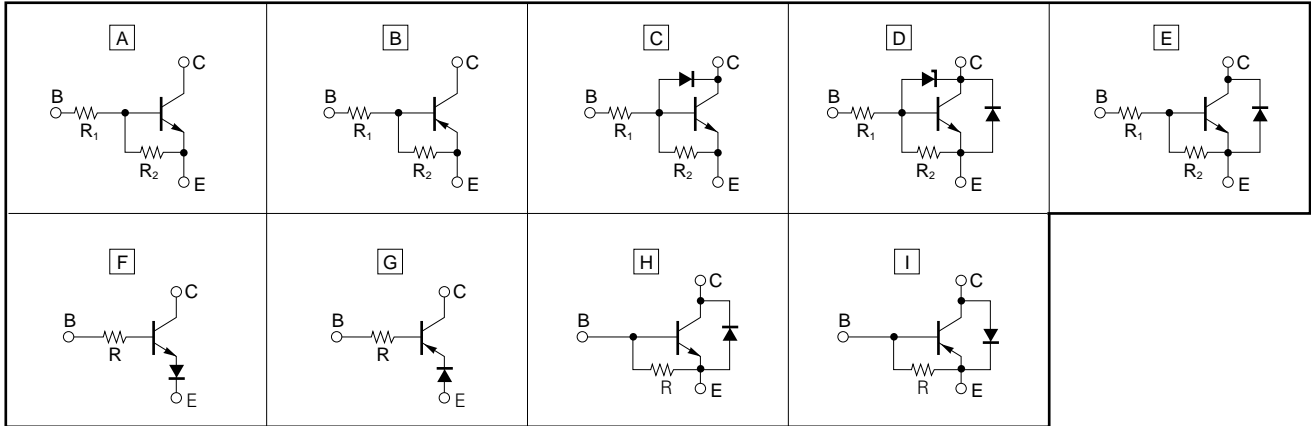
Field Effect Transistor

■ 2SJ type

| Type number | Package | Absolute maximum rating ($T_A = 25\text{ }^\circ\text{C}$) | | | | Electrical characteristics ($T_A = 25\text{ }^\circ\text{C}$) | | | | | | | Applications |
|-------------|---------|---|-----------|--------------|--|--|--------------|------|---------------------------|--------------|-------|-------|--------------|
| | | V_{DSS} (V) | I_D | | P_T $T_C = 25\text{ }^\circ\text{C}$ (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. | |
| 2SJ128 | MP-3 | -100 | ∓ 2 | ∓ 8 | 20 | -10 | -1 | 1 | -4 | -0.8 | 1.1 | 1.5 | Switching |
| 2SJ132 | MP-3 | -30 | ∓ 2 | ∓ 8 | 20 | -10 | -1 | 1 | -4 | -0.8 | 0.47 | 0.6 | |
| 2SJ133 | MP-3 | -60 | ∓ 2 | ∓ 8 | 20 | -10 | -1 | 1 | -4 | -0.8 | 0.7 | 1.3 | |
| 2SJ134 | MP-25 | -100 | ∓ 6 | ∓ 24 | 40 | -10 | -3.5 | 1 | -4 | -3.5 | 0.5 | 0.9 | |
| 2SJ135 | MP-45 | -100 | ∓ 5 | ∓ 20 | 30 | -10 | -3.5 | 1 | -4 | -3.5 | 0.5 | 0.9 | |
| 2SJ136 | MP-25 | -60 | ∓ 12 | ∓ 48 | 40 | -10 | -6.5 | 2 | -4 | -6.5 | 0.45 | 0.5 | |
| 2SJ137 | MP-45 | -60 | ∓ 10 | ∓ 40 | 30 | -10 | -6.5 | 2 | -4 | -6.5 | 0.45 | 0.5 | |
| 2SJ138 | MP-25 | -100 | ∓ 12 | ∓ 48 | 60 | -10 | -6.5 | 2 | -4 | -6.5 | 0.3 | 0.45 | |
| 2SJ139 | MP-45 | -100 | ∓ 10 | ∓ 40 | 35 | -10 | -6.5 | 2 | -4 | -6.5 | 0.3 | 0.45 | |
| 2SJ140 | MP-25 | -60 | ∓ 19 | ∓ 76 | 60 | -10 | -10 | 5 | -4 | -8 | 0.3 | 0.4 | |
| 2SJ141 | MP-45 | -60 | ∓ 13 | ∓ 52 | 35 | -10 | -10 | 5 | -4 | -8 | 0.3 | 0.4 | |
| 2SJ142 | MP-45 | -100 | ∓ 13 | ∓ 52 | 35 | -10 | -10 | 5 | -4 | -8 | 0.25 | 0.3 | |
| 2SJ143 | MP-45 | -60 | ∓ 16 | ∓ 64 | 35 | -10 | -10 | 5 | -4 | -10 | 0.22 | 0.25 | |
| 2SJ151 | MP-25 | -100 | ∓ 3.0 | ∓ 6.0 | 35 | -10 | -1.5 | 0.8 | -4 | -1.5 | — | 1.8 | |
| 2SJ152 | MP-45 | -100 | ∓ 3.0 | ∓ 6.0 | 30 | -10 | -1.5 | 0.8 | -4 | -1.5 | — | 1.8 | |
| 2SJ153 | MP-25 | -60 | ∓ 6.0 | ∓ 12 | 40 | -10 | -3.5 | 0.9 | -4 | -1.5 | — | 0.9 | |
| 2SJ154 | MP-45 | -60 | ∓ 5.0 | ∓ 10 | 30 | -10 | -3.5 | 0.9 | -4 | -1.5 | — | 0.9 | |
| 2SJ302 | MP-25 | -60 | ∓ 16 | ∓ 64 | 75 | -10 | -8 | 6.0 | -4 | -6 | 0.13 | 0.24 | |
| 2SJ303 | MP-45F | -60 | ∓ 14 | ∓ 56 | 35 | -10 | -7 | 5.0 | -4 | -6 | 0.13 | 0.24 | |
| 2SJ324 | MP-3 | -30 | ∓ 2.0 | ∓ 8.0 | 20 | -10 | -1.0 | 1.0 | -4 | -0.8 | 0.40 | 0.52 | |
| 2SJ325 | MP-3 | -30 | ∓ 4.0 | ∓ 16 | 20 | -10 | -2.0 | 3.0 | -4 | -1.6 | 0.15 | 0.24 | |
| 2SJ326 | MP-3 | -60 | ∓ 2.0 | ∓ 8.0 | 20 | -10 | -1.0 | 1.0 | -4 | -0.8 | 0.5 | 0.68 | |
| 2SJ327 | MP-3 | -60 | ∓ 4.0 | ∓ 16 | 20 | -10 | -2.0 | 3.0 | -4 | -1.6 | 0.22 | 0.34 | |
| 2SJ328 | MP-25 | -60 | ∓ 20 | ∓ 80 | 75 | -10 | -10 | 8.0 | -4 | -8 | 0.085 | 0.11 | |
| 2SJ329 | MP-45F | -60 | ∓ 15 | ∓ 60 | 35 | -10 | -8 | 8.0 | -4 | -6 | 0.085 | 0.11 | |
| 2SJ330 | MP-45F | -60 | ∓ 20 | ∓ 80 | 35 | -10 | -10 | 10 | -4 | -8 | 0.065 | 0.09 | |
| 2SJ331 | MP-88 | -60 | ∓ 30 | ∓ 120 | 150 | -10 | -15 | 15 | -4 | -12 | 0.04 | 0.055 | |

Transistor with Internal Resistor

■ Equivalent circuit



■ AA1[], AN1[], BA1[], BN1[] series (TO-92, SST)

| Type number | | Equivalent circuit and applications | Absolute maximum ratings ($T_A = 25\text{ }^\circ\text{C}$) | | | | | | Electrical characteristics ($T_A = 25\text{ }^\circ\text{C}$) | | | | | |
|-------------|---------|---|--|-------------------------|-------------------------|------------------------|------------------------|--|--|---------------------------------|-----------------|------------------------|------------------------|---------|
| | | | V _{CBO} (V) | V _{CEO} (V) | V _{EB0} (V) | I _C (mA) | P _T (mW) | T _j ($^\circ\text{C}$) | R ₁ (k Ω) | R ₂ (k Ω) | 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 | BNN1F4M | -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 | BNN1A3Q | -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)**

| Type number | | Equivalent circuit and applications | Absolute maximum ratings ($T_A = 25\text{ }^\circ\text{C}$) | | | | | | Electrical characteristics ($T_A = 25\text{ }^\circ\text{C}$) | | | | | | |
|-------------|--------|-------------------------------------|--|----------|----------|--------|---------|-----|--|---------|---------|-------|---------|--------|--------------|
| | | | VCBO (V) | VCEO (V) | VEBO (V) | Ic (A) | PT (mW) | | Tj (fC) | R1 (kΩ) | R2 (kΩ) | hFE | VCE (V) | Ic (A) | Re- marks |
| TO-92 | SST | | | | | TO-92 | SST | | | | | | | | |
| AB1A4A | BB1A4A | Refer to equivalent circuit [A] | 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] | -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 | |

■ **AC1[], AQ1[] series (TO-92)**

| Type number | | Equivalent circuit and applications | Absolute maximum ratings ($T_A = 25\text{ }^\circ\text{C}$) | | | | | | Electrical characteristics ($T_A = 25\text{ }^\circ\text{C}$) | | | | | |
|-------------|--|-------------------------------------|--|----------|----------|--------|---------|---------|--|---------|-------|---------|--------|---------|
| | | | VCBO (V) | VCEO (V) | VEBO (V) | Ic (A) | PT (mW) | Tj (fC) | R1 (kΩ) | R2 (kΩ) | hFE | VCE (V) | Ic (A) | Remarks |
| TO-92 | | | | | | | | | | | | | | |
| AC1A4A | | Refer to equivalent circuit [A] | 20 | 20 | 10 | 2.0 | 750 | 150 | — | 10 | 300 ~ | 2.0 | 1.0 | |
| AC1F2Q | | | 20 | 20 | 10 | 2.0 | 750 | 150 | 0.22 | 2.2 | 300 ~ | 2.0 | 1.0 | |
| AC1L2N | | | 20 | 20 | 10 | 2.0 | 750 | 150 | 0.47 | 1.0 | 300 ~ | 2.0 | 1.0 | |
| AC1L2Q | | | 20 | 20 | 10 | 2.0 | 750 | 150 | 0.47 | 4.7 | 300 ~ | 2.0 | 1.0 | |
| AC1A3M | | | 20 | 20 | 10 | 2.0 | 750 | 150 | 1.0 | 1.0 | 300 ~ | 2.0 | 1.0 | |
| AC1F3M | | | 20 | 20 | 10 | 2.0 | 750 | 150 | 2.2 | 2.2 | 300 ~ | 2.0 | 1.0 | |
| AC1F3P | | | 20 | 20 | 10 | 2.0 | 750 | 150 | 4.7 | 10 | 300 ~ | 2.0 | 1.0 | |
| AQ1A4A | | Refer to equivalent circuit [B] | -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

■ **AC2[], AQ2[] series (TO-92)**

| Type number | Equivalent circuit and applications | Absolute maximum ratings (TA = 25 fC) | | | | | | Electrical characteristics (TA = 25 fC) | | | | | |
|-------------|-------------------------------------|--|----------|----------|--------|---------|---------|--|---------|-------|---------|--------|---------|
| | | VCBO (V) | VCEO (V) | VEBO (V) | Ic (A) | PT (mW) | Tj (fC) | R1 (kΩ) | R2 (kΩ) | hFE | VCE (V) | Ic (A) | Remarks |
| TO-92 | | | | | | | | | | | | | |
| AC2A4A | Refer to [H] | 20 | 16 | 6.0 | ±3.0 | 750 | 150 | – | 10 | 135 ~ | 2.0 | 0.1 | |
| AQ2A4A | Refer to [I] | –20 | –16 | –6.0 | ±3.0 | 750 | 150 | – | 10 | 135 ~ | –2.0 | –0.1 | |

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

| Type number | Equivalent circuit and applications | Absolute maximum ratings (TA = 25 fC) | | | | | | Electrical characteristics (TA = 25 fC) | | | | | |
|-------------|-------------------------------------|--|----------|----------|--------|---------|---------|--|---------|-------|---------|--------|---------|
| | | VCBO (V) | VCEO (V) | VEBO (V) | Ic (A) | PT (mW) | Tj (fC) | R1 (kΩ) | R2 (kΩ) | hFE | VCE (V) | Ic (A) | Remarks |
| TO-92 | | | | | | | | | | | | | |
| AD1A3M | Refer to equivalent circuit [A] | 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] | 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] | –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)**

| Type number | Equivalent circuit and applications | Absolute maximum ratings (TA = 25 fC) | | | | | | Electrical characteristics (TA = 25 fC) | | | | | |
|-------------|-------------------------------------|--|----------|----------|--------|--------|---------|--|---------|--------------|---------|--------|--|
| | | VCBO (V) | VCEO (V) | VEBO (V) | Ic (A) | PT (W) | Tj (fC) | R1 (kΩ) | R2 (kΩ) | hFE | VCE (V) | Ic (A) | |
| SP-8 | | | | | | | | | | | | | |
| 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

■ **BA2[], BN2[] series (SST)**

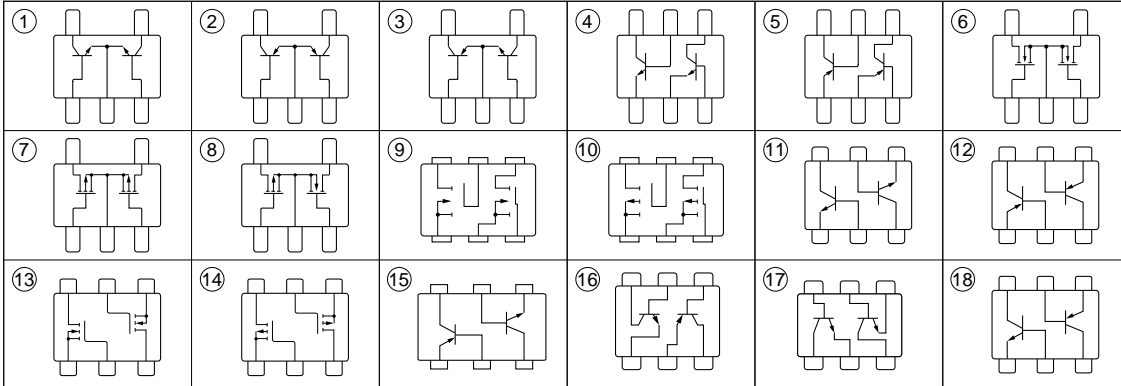
| Type number | Equivalent circuit and applications | Absolute maximum ratings ($T_A = 25\text{ }^\circ\text{C}$) | | | | | | Electrical characteristics ($T_A = 25\text{ }^\circ\text{C}$) | | | | | | |
|-------------|--------------------------------------|--|--------------------------------------|-------------------------|------------------------|------------------------|--|--|---------------------------------|-----------------|------------------------|------------------------|---------|------|
| | | V _{CBO} (V) | V _{CEO} (V) | V _{EB0} (V) | I _C (mA) | P _T (mW) | T _J ($^\circ\text{C}$) | R ₁ (k Ω) | R ₂ (k Ω) | h _{FE} | V _{CE} (V) | I _C (mA) | Remarks | |
| SST | | | | | | | | | | | | | | |
| BA2A4M | Refer to equivalent circuit A | 60 | 50 | 20 | 100 | 250 | 150 | 10 | 10 | 60 to 105 | 5.0 | 5.0 | | |
| BA2A4P | | 60 | 50 | 10 | 100 | 250 | 150 | 10 | 47 | 230 to 460 | 5.0 | 5.0 | | |
| BA2F4M | | 60 | 50 | 20 | 100 | 250 | 150 | 22 | 22 | 125 to 230 | 5.0 | 5.0 | | |
| BA2F4N | | 60 | 50 | 15 | 100 | 250 | 150 | 22 | 47 | 230 to 460 | 5.0 | 5.0 | | |
| BA2L4M | | 60 | 50 | 20 | 100 | 250 | 150 | 47 | 47 | 230 to 460 | 5.0 | 5.0 | | |
| BA2L4L | | 60 | 50 | 30 | 100 | 250 | 150 | 47 | 22 | 125 to 230 | 5.0 | 5.0 | | |
| BA2L3Z | | 60 | 50 | 10 | 100 | 250 | 150 | 4.7 | – | 1000 to 3200 | 5.0 | 5.0 | | |
| BA2A4Z | | 60 | 50 | 10 | 100 | 250 | 150 | 10 | – | 1000 to 3200 | 5.0 | 5.0 | | |
| BA2F4Z | | Switching | 60 | 50 | 10 | 100 | 250 | 150 | 22 | – | 1000 to 3200 | 5.0 | 5.0 | |
| BA2L4Z | | | 60 | 50 | 10 | 100 | 250 | 150 | 47 | – | 1000 to 3200 | 5.0 | 5.0 | |
| BA2L3M | | | 60 | 50 | 20 | 100 | 250 | 150 | 4.7 | 4.7 | 30 to 50 | 5.0 | 5.0 | |
| BA2L3N | | | 60 | 50 | 15 | 100 | 250 | 150 | 4.7 | 10 | 60 to 105 | 5.0 | 5.0 | |
| BA2A3Q | | | 60 | 50 | 10 | 100 | 250 | 150 | 1.0 | 10 | 60 to 105 | 5.0 | 5.0 | |
| BN2A4M | | | Refer to equivalent circuit B | –25 | –25 | –20 | –100 | 250 | 150 | 10 | 10 | 55 to 90 | –5.0 | –5.0 |
| BN2A4P | –25 | –25 | | –10 | –100 | 250 | 150 | 10 | 47 | 200 to 350 | –5.0 | –5.0 | | |
| BN2F4M | –25 | –25 | | –20 | –100 | 250 | 150 | 22 | 22 | 115 to 200 | –5.0 | –5.0 | | |
| BN2F4N | –25 | –25 | | –15 | –100 | 250 | 150 | 22 | 47 | 200 to 350 | –5.0 | –5.0 | | |
| BN2L4M | –25 | –25 | | –20 | –100 | 250 | 150 | 47 | 47 | 200 to 350 | –5.0 | –5.0 | | |
| BN2L4L | –25 | –25 | | –30 | –100 | 250 | 150 | 47 | 22 | 115 to 200 | –5.0 | –5.0 | | |
| BN2L3Z | –25 | –25 | | –10 | –100 | 250 | 150 | 4.7 | – | 800 to 1200 | –5.0 | –5.0 | | |
| BN2A4Z | –25 | –25 | | –10 | –100 | 250 | 150 | 10 | – | 800 to 1200 | –5.0 | –5.0 | | |
| BN2F4Z | Switching | –25 | | –25 | –10 | –100 | 250 | 150 | 22 | – | 800 to 1200 | –5.0 | –5.0 | |
| BN2L4Z | | –25 | | –25 | –10 | –100 | 250 | 150 | 47 | – | 800 to 1200 | –5.0 | –5.0 | |
| BN2L3M | | –25 | | –25 | –20 | –100 | 250 | 150 | 4.7 | 4.7 | 30 to 45 | –5.0 | –5.0 | |
| BN2L3N | | –25 | | –25 | –15 | –100 | 250 | 150 | 4.7 | 10 | 55 to 90 | –5.0 | –5.0 | |
| BN2A3Q | | –25 | | –25 | –10 | –100 | 250 | 150 | 1.0 | 10 | 65 to 90 | –5.0 | –5.0 | |

■ **BA3[], BN3[] series (SST)**

| Type number | Equivalent circuit and applications | Absolute maximum ratings ($T_A = 25\text{ }^\circ\text{C}$) | | | | | Electrical characteristics ($T_A = 25\text{ }^\circ\text{C}$) | | | | |
|-------------|-------------------------------------|--|-------------------------|-------------------------|-----------------------|------------------------|--|--------------------|-----------------|------------------------|------------------------|
| | | V _{CBO} (V) | V _{CEO} (V) | V _{EB0} (V) | V _R (V) | P _T (mW) | T _J (k Ω) | R (k Ω) | h _{FE} | V _{CE} (V) | I _C (mA) |
| BA3L4Z | Refer to F | 20 | 20 | 5 | 6 | 250 | 150 | 47 | 30 ~ | 2.0 | 1.0 |
| BN3L4Z | Refer to G | –20 | –20 | –5 | 6 | 250 | 150 | 47 | 30 ~ | –2.0 | –1.0 |

Transistor for Array

Equivalent Circuit



■ **Bipolar Transistor**

| Type number | Equivalent circuit | V _{CEO} (V) | I _{C(DC)} (mA) | P _{T*} (mW) | hFE | hFE | | Package |
|-------------|--------------------|----------------------|-------------------------|----------------------|------------------------|-------------------------|---------------------|-------------------------|
| | | | | | | V _{CE} (V) | I _C (mA) | |
| μPA570T | ● | 50 | 100 | 200 | 90 to 600 | 6 | 1 | • 5-pin Super Mini-Mold |
| μPA571T | ● | -50 | -100 | 200 | | -6 | -1 | |
| μPA574T | ● | 50/-50 | 100/-100 | 300 | | 6/-6 | 1/-1 | |
| μPA670T | ● | 50 | 100 | 200 | | 6 | 1 | • 6-pin Super Mini-Mold |
| μPA671T | ● | -50 | -100 | 200 | | -6 | -1 | |
| μPA500T | ● | 50 | 100 | 300 | | 6 | 1 | • 5-pin Mini-Mold |
| μPA501T | ● | -50 | -100 | 300 | | -6 | -1 | |
| μPA504T | ● | 50/-50 | 100/-100 | 300 | | 6/-6 | 1/-1 | • 6-pin Mini-Mold |
| μPA600T | ● | 50 | 100 | 300 | | 6 | 1 | |
| μPA601T | ● | -50 | -100 | 300 | | -6 | -1 | |
| μPA604T | ● | 50 | 100 | 300 | | 6 | 1 | |
| μPA605T | ● | -50 | -100 | 300 | | -6 | -1 | |
| μPA608T | ● | 50 -16 | 100 -500 | 300 | | 90 to 600 110 to 400 | 6 -1 | |
| μPA609T | ● | 40 -40 | 500 -500 | 300 | | 75 to 300 75 to 300 | 1 -1 | 150 -150 |
| μPA673T | ● | 15 | 200 | 200 | 82 to 180 | 6 | 1 | • 6-pin Super Mini-Mold |
| μPA674T | ● | 15 -15 | 200 -50 | 200 | 40 to 200 50 to 150 | 1 -1 | 10 -10 | |

*: Total

■ **MOS FET**

| Type number | Equivalent circuit | V _{DSS} (V) | I _{D(DC)} (mA) | P _{T*} (mW) | R _{DS(on)} (Ω) MAX | R _{DS(on)} | | Package |
|-------------|--------------------|----------------------|-------------------------|----------------------|-----------------------------|---------------------|---------------------|-------------------------|
| | | | | | | V _{GS} (V) | I _D (mA) | |
| μPA572T | ● | 30 | 100 | 200 | 13 | 2.5 | 10 | • 5-pin Super Mini-Mold |
| μPA573T | ● | -30 | -100 | 200 | 60 | -2.5 | -10 | |
| μPA502T | ● | 50 | 100 | 300 | 30 | 4 | 10 | |
| μPA503T | ● | -50 | -100 | 300 | 100 | -4 | -10 | • 5-pin Mini-Mold |
| μPA505T | ● | 50/-50 | 100/-100 | 300 | 30/100 | 4/-4 | 10/-10 | |
| μPA602T | ● | 50 | 100 | 300 | 30 | 4 | 10 | • 6-pin Mini-Mold |
| μPA603T | ● | -50 | -100 | 300 | 100 | -4 | -10 | |
| μPA606T | ● | 50 | 100 | 300 | 30 | 4 | 10 | |
| μPA607T | ● | -50 | -100 | 300 | 100 | -4 | -10 | |
| μPA672T | ● | 50 | 100 | 200 | 40 | 2.5 | 10 | • 6-pin Super Mini-Mold |

*: Total

Power MOS IC

| Type number | Function | Withstand Voltage (V) | Output Current (A) | Package | Main Application |
|-----------------|--|-----------------------------|--------------------|----------------|----------------------------|
| μ PD16804 | Control the revolution direction of the DC motor (1 unit) | 6.5/8.0* | 0.5 | • 16-pin SOP | Camera motor drive |
| μ PD16805 | | | 1.0 | | |
| μ PD16823 | Control the revolution direction of the DC motor (1.5 unit) | | 0.5 | • 20-pin SOP | |
| μ PD16812A* | <ul style="list-style-type: none"> High side switch Protection for over current and over heating | 60 ($\tau \leq 250$ ms) | 2.0 | • 5-pin MP-45F | Automotive solenoid driver |

*: Charge Pump Circuit used / Charge Pump Circuit not used

*: Under development

Transistor Array

■ Signal transistor array

| Type Number | Number of circuits | | | | Output voltage V _O (V) | Output current I _O (mA/Unit) | Surge absorber diode | Input impedance | Active level | | Input/output relationship | | Output current relationship | | Remarks | Number of pins |
|-------------------|--------------------|---|---|---|-----------------------------------|---|----------------------|------------------------|--------------|-----|---------------------------|-------------------|-----------------------------|-----------|---------------------------|----------------|
| | 5 | 6 | 7 | 8 | | | | | "H" | "L" | Inverter type | Non-inverter type | Source type | Sink type | | |
| μ PA53C | ○ | | | | 30 | 400 | — | 20 k Ω | ○ | | ○ | | | ○ | Darlington | 14 |
| μ PA56C | | | ○ | | 40 | 100 | — | — | ○ | | | ○ | ○ | | Single (Common collector) | 16 |
| μ PA57C | | ○ | | | 30 | 400 | — | 4 k Ω | ○ | | ○ | | | ○ | Darlington | 14 with tab |
| μ PA67C | | ○ | | | 30 | 70 | — | 22 k Ω | ○ | | ○ | | | ○ | Darlington | 14 |
| μ PA79C | | | ○ | | 20 | 150* ¹ | ○ | 20 k Ω | ○ | | ○ | | | ○ | Low saturation driver | 16 |
| μ PA80C, GR | | | ○ | | 60 | 50 | — | 20 k Ω | | ○ | ○ | | ○ | | Darlington | 16 |
| μ PA81C | | | ○ | | 45 | 400* ² | — | 20 k Ω | ○ | | ○ | | | ○ | FIP driver | 18 |
| μ PA2001C, GR | | | ○ | | 60 | 500 | ○ | — | ○ | | ○ | | | ○ | Darlington | 16 |
| μ PA2002C, GR | | | ○ | | 60 | 500 | ○ | 7VZDi +10.5 k Ω | ○ | | ○ | | | ○ | Darlington | 16 |
| μ PA2003C, GR | | | ○ | | 60 | 500 | ○ | 2.7 k Ω | ○ | | ○ | | | ○ | Darlington | 16 |
| μ PA2004C, GR | | | ○ | | 60 | 500 | ○ | 10.5 k Ω | ○ | | ○ | | | ○ | Darlington | 16 |
| μ PA2981C | | | | ○ | 50 | 500 | ○ | 3 k Ω | ○ | | | ○ | ○ | | Darlington output stage | 18 |
| μ PA2982C | | | | ○ | 50 | 500 | ○ | 8.5 k Ω | ○ | | | ○ | ○ | | Darlington output stage | 18 |
| μ PA2987C | | | | ○ | 50 | 500 | ○ | 3 k Ω | ○ | | | ○ | ○ | | Darlington output stage | 16 |
| μ PA6118C | | | | ○ | 85 | 40 | — | 37 k Ω | ○ | | | ○ | ○ | | FIP driver | 18 |

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

Transistor Array

■ Power transistor array

| Type Number | Number of circuits | Collector-emitter voltage VCE (V) | Collector current IC (A) | Surge absorber diode | Input impedance | Output current relationship | | Remarks | Number of pins |
|-------------|--------------------|-----------------------------------|--------------------------|----------------------|-----------------|-----------------------------|-----------|--------------|----------------|
| | | | | | | Source type | Sink type | | |
| μPA1424H | 4 | 60 ±10 | ±2.0 | ○ | 680 Ω | | ○ | High beta | 10 |
| μPA1426H | 4 | 80 | ±2.0 | — | — | | ○ | Darlington | 10 |
| μPA1427H | 4 | -80 | ∓2.0 | — | — | ○ | | Darlington | 10 |
| μPA1428H | 4 | 60 ±10 | ±2.0 | ○ | — | | ○ | Darlington | 10 |
| μPA1428AH | 4 | 60 | 3.0 | — | — | | ○ | High beta | 10 |
| μPA1436H | 4 | 100 | ±3.0 | — | — | | ○ | Darlington | 10 |
| μPA1436AH | 4 | 100 | ±3.0 | — | — | | ○ | Darlington | 10 |
| μPA1437H | 4 | -100 | ∓3.0 | — | — | ○ | | Darlington | 10 |
| μPA1438H | 4 | 60 ±10 | ±3.0 | ○ | — | | ○ | Darlington | 10 |
| μPA1452H | 4 | 60 | 5.0 | — | — | | ○ | Low VCE(sat) | 10 |
| μPA1453H | 4 | -60 | 5.0 | — | — | ○ | | Low VCE(sat) | 10 |
| μPA1454H | 4 | 100 | 5.0 | — | — | | ○ | High beta | 10 |
| μPA1456H | 4 | 100 | ±5.0 | — | — | | ○ | Darlington | 10 |
| μPA1457H | 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 |

■ Power MOS FET array

| Type Number | Number of circuits | | | V _{DSS} (V) | I _b (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 | |
| μPA1500H/1500BH | ○ | | | 60 | ±3 | ○ | ○ | ○ | | ○ | | | ○ | 12 |
| μPA1501H | ○ | | | 120 | ±3 | ○ | ○ | ○ | | ○ | | | ○ | 12 |
| μPA1520H/1520BH | ○ | | | 30 | ±2 | — | ○ | ○ | | ○ | | | ○ | 10 |
| μPA1522H | ○ | | | 60 | ±2 | — | ○ | ○ | | ○ | | | ○ | 10 |
| μPA1523H/1523BH* | ○ | | | -60 | ∓2 | — | ○ | | ○ | | ○ | | ○ | 10 |
| μPA1524H | ○ | | | 80 | ±2 | — | ○ | ○ | | ○ | | | ○ | 10 |
| μPA1526H | ○ | | | 100 | ±2 | — | ○ | ○ | | ○ | | | ○ | 10 |
| μPA1527H | ○ | | | -100 | ∓2 | — | ○ | | ○ | | ○ | | ○ | 10 |
| μPA1550H | ○ | | | 30 | ±5 | — | ○ | ○ | | ○ | | | ○ | 10 |
| μPA1552H/1552AH | ○ | | | 60 | ±5 | — | ○ | ○ | | ○ | | | ○ | 10 |
| μPA1552BH | ○ | | | 60 | ±5 | — | ○ | ○ | | ○ | | | ○ | 10 |
| μPA1556H/1556AH | ○ | | | 100 | ±5 | — | ○ | ○ | | ○ | | | ○ | 10 |
| μPA1570H | ○ | | | 30 | ±2 | — | ○ | ○ | | ○ | | | ○ | 10 |
| μPA1572H | ○ | | | 60 | ±2 | — | ○ | ○ | | ○ | | | ○ | 10 |
| μPA1576H | ○ | | | 100 | ±2 | — | ○ | ○ | | ○ | | | ○ | 10 |

*: Under development

■ Monolithic MOS FET array

| Type Number | Number of circuits | | | V _{DSS} (V) | I _b (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 |
| μPA1640GS | | | ○ | 30 | 0.1 | — | ○ | ○ | | ○ | | | ○ | 20 |

Zener Diode

■ Zener Diode Quick Reference (1/2)

| Vz (V) | P (W) | | | | | | |
|---------|-----------------------|-----------------|-------------------|-----------------|-------------------------|-----------------------|---------|
| | 0.15 | | 0.2 | | | 1.0 | |
| TYP. | | | | | | | |
| 2.0 | | RD2.0UM | RD2.0M | | RD2.0S | RD2.0P | |
| 2.2 | | RD2.2UM | RD2.2M | | RD2.2S | RD2.2P | |
| 2.4 | | RD2.4UM | RD2.4M | RD2.4MW | RD2.4S | RD2.4P | |
| 2.7 | | RD2.7UM | RD2.7M | RD2.7MW | RD2.7S | RD2.7P | |
| 3.0 | | RD3.0UM | RD3.0M | RD3.0MW | RD3.0S | RD3.0P | |
| 3.3 | | RD3.3UM | RD3.3M | RD3.3MW | RD3.3S | RD3.3P | |
| 3.6 | | RD3.6UM | RD3.6M | RD3.6MW | RD3.6S | RD3.6P | |
| 3.9 | | RD3.9UM | RD3.9M | RD3.9MW | RD3.9S | RD3.9P | |
| 4.3 | | RD4.3UM | RD4.3M | RD4.3MW | RD4.3S | RD4.3P | |
| 4.7 | RD4.7UJ | RD4.7UM | RD4.7M | RD4.7MW | RD4.7S | RD4.7P | RD4.7FM |
| 5.1 | RD5.1UJ | RD5.1UM | RD5.1M | RD5.1MW | RD5.1S | RD5.1P | RD5.1FM |
| 5.6 | RD5.6UJ | RD5.6UM | RD5.6M | RD5.6MW | RD5.6S | RD5.6P | RD5.6FM |
| 6.2 | RD6.2UJ | RD6.2UM | RD6.2M | RD6.2MW | RD6.2S | RD6.2P | RD6.2FM |
| 6.8 | RD6.8UJ | RD6.8UM | RD6.8M | RD6.8MW | RD6.8S | RD6.8P | RD6.8FM |
| 7.5 | RD7.5UJ | RD7.5UM | RD7.5M | RD7.5MW | RD7.5S | RD7.5P | RD7.5FM |
| 8.2 | RD8.2UJ | RD8.2UM | RD8.2M | RD8.2MW | RD8.2S | RD8.2P | RD8.2FM |
| 9.1 | RD9.1UJ | RD9.1UM | RD9.1M | RD9.1MW | RD9.1S | RD9.1P | RD9.1FM |
| 10 | RD10UJ | RD10UM | RD10M | | RD10S | RD10P | RD10FM |
| 11 | RD11UJ | RD11UM | RD11M | | RD11S | RD11P | RD11FM |
| 12 | RD12UJ | RD12UM | RD12M | | RD12S | RD12P | RD12FM |
| 13 | RD13UJ | RD13UM | RD13M | | RD13S | RD13P | RD13FM |
| 15 | RD15UJ | RD15UM | RD15M | | RD15S | RD15P | RD15FM |
| 16 | RD16UJ | RD16UM | RD16M | | RD16S | RD16P | RD16FM |
| 18 | RD18UJ | RD18UM | RD18M | | RD18S | RD18P | RD18FM |
| 20 | RD20UJ | RD20UM | RD20M | | RD20S | RD20P | RD20FM |
| 22 | RD22UJ | RD22UM | RD22M | | RD22S | RD22P | RD22FM |
| 24 | RD24UJ | RD24UM | RD24M | | RD24S | RD24P | RD24FM |
| 27 | RD27UJ | RD27UM | RD27M | | RD27S | RD27P | RD27FM |
| 30 | RD30UJ | RD30UM | RD30M | | RD30S | RD30P | RD30FM |
| 33 | RD33UJ | RD33UM | RD33M | | RD33S | RD33P | RD33FM |
| 36 | RD36UJ | RD36UM | RD36M | | RD36S | RD36P | RD36FM |
| 39 | RD39UJ | RD39UM | RD39M | | RD39S | RD39P | RD39FM |
| 43 | | | RD43M | | | RD43P | RD43FM |
| 47 | | | RD47M | | | RD47P | RD47FM |
| 51 | | | | | | RD51P | RD51FM |
| 56 | | | | | | RD56P | |
| 62 | | | | | | RD62P | |
| 68 | | | | | | RD68P | |
| 75 | | | | | | RD75P | |
| 82 | | | | | | RD82P | |
| 91 | | | | | | RD91P | |
| 100 | | | | | | RD100P | |
| 110 | | | | | | RD110P | |
| 120 | | | | | | RD120P | |
| Package | 2-pin ultra mini-mold | | Mini-mold (SC-59) | 2-pin mini-mold | Power mini-mold (SC-62) | 2-pin power mini-mold | |
| | Low noise | General Purpose | | | | | |


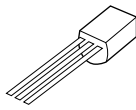
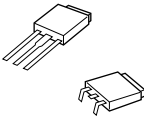
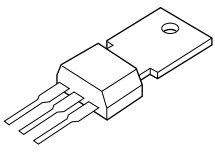
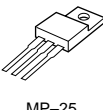
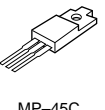
Zener Diode

■ Zener Diode Quick Reference (2/2)

| Vz (V) | P (W) | | | | |
|---------|---------|---------|---------|--------|--------|
| | 0.25 | 0.4 | 0.4 | 0.5 | 1.0 |
| TYP. | | | | | |
| 2.0 | RD2.0HS | | RD2.0ES | RD2.0E | RD2.0F |
| 2.2 | RD2.2HS | | RD2.2ES | RD2.2E | RD2.2F |
| 2.4 | RD2.4HS | | RD2.4ES | RD2.4E | RD2.4F |
| 2.7 | RD2.7HS | | RD2.7ES | RD2.7E | RD2.7F |
| 3.0 | RD3.0HS | | RD3.0ES | RD3.0E | RD3.0F |
| 3.3 | RD3.3HS | | RD3.3ES | RD3.3E | RD3.3F |
| 3.6 | RD3.6HS | | RD3.6ES | RD3.6E | RD3.6F |
| 3.9 | RD3.9HS | | RD3.9ES | RD3.9E | RD3.9F |
| 4.3 | RD4.3HS | | RD4.3ES | RD4.3E | RD4.3F |
| 4.7 | RD4.7HS | 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-34 | DO-35 | DO-41 |


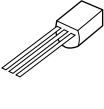
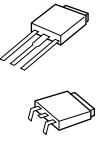
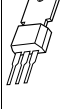
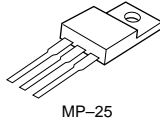
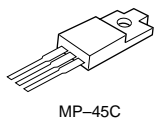
Thyristor

■ **SCR**

| Package |  | |  | | | |  | | |  | | | | |  | |  | |
|-------------------------------|---|-------|---|--------------|--------|----------------|---|----------------|------|--|--------|-------|------|------|---|-------|---|--|
| | 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 | 8 | 12 | |
| $I_{T(AV)}$ (A) | 0.3 | 0.3 | | | | 3 | 5 | 8 | 2 | 2 | 2.5 | 3 | 3 | 5 | 8 | 5 | 8 | |
| I_{TSM} (A) | 6 | 8 | | | | 35 | 65 | 80 | 20 | 20 | 35 | 65 | – | 80 | 100 | 80 | 100 | |
| $T_J(fC)$ | 125 | 125 | | | | 125 | | | 125 | | | | | 125 | | 125 | | |
| V_{DRM} V_{RRM} (V) | 200 | 03P2J | 03P2M | – | – | – | – | – | – | 2S2M | – | – | – | – | 8P2M | – | 8P2SM | |
| | 400 | 03P4J | 03P4M | – | 03P4MG | 3P4J 3P4J-Z | 5P4J 5P4J-Z | 8P4J 8P4J-Z | 2P4M | 2S4M | 2V5P4M | 3P4MH | 3S4M | 5P4M | 8P4M | 5P4SM | 8P4SM | |
| | 500 | 03P5J | – | 03P4MF | 03P5MG | – | – | – | 2P5M | – | – | 3P5MH | – | 5P5M | – | – | – | |
| | 600 | – | – | – | 03P6MG | – | 5P6J 5P6J-Z | – | 2P6M | – | – | 3P6MH | – | 5P6M | – | 5P6SM | – | |
| I_{GT} (mA) | 0.2 | 0.2 | 50 μ A | 3-50 μ A | 0.1 | 0.2 | 10* | 0.2 | 0.3 | 0.1 | 0.2 | 30 | 10 | 10 | 10 | 10 | | |
| t_q (TYP.) (μ s) | 25 | 25 | 100 | 60 | 80 | 100 | 50 | 30 | 15* | 80 | 80 | 5* | 50 | 100 | 50 | 100 | | |

*: indicates MAX.

■ **TRIAC**

| Package |  | |  | | |  | |  |  | | | | |  | | | | | |
|-------------------------------|---|---------|---|-------------|------------------------------|--|-------------|---|--|-------------|-------------|-------------|-------------|--|-------------|-------------|-------------|-------------|--|
| | 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 | 10 | 30 | 50 | 30 | 50 | 80 | 80 | 100 | 150 | 30 | 50 | 80 | 80 | 100 | 150 | | |
| $T_J(fC)$ | 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 | – | – | – | – | – | – | 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/ μ s) | MIN. | 0.5 | 1 | 0.5 | 5 | 5 | 5 | 5 | 10 | 10 | 10 | 10 | 5 | 5 | 10 | 10 | 10 | 10 | |

EMPTY PAGE

Microwave Device/Consumer-Use High Frequency Device

| | |
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GaAs MMIC

■ Analog IC

| Type number | Function | Features | Package |
|-------------|---------------------------------------|---|-----------------------------|
| μ PG100 | Wide band, low noise amplifier | f = 50 MHz to 3 GHz Gp \geq 14 dB, N _F \leq 3.5 dB | • 8-pin ceramic, Chip |
| μ PG101 | Wide band, medium output amplifier | f = 50 MHz to 3 GHz P _O (1dB) \geq 16 dBm | • 8-pin ceramic, Chip |
| μ PG103 | Wide band, low noise amplifier | f = 50 MHz to 3 GHz Gp \geq 10 dB, N _F \leq 5 dB | • 8-pin ceramic, Chip |
| μ PG105 | S band, low noise amplifier | f = 2.7 to 4.2 GHz Gp \geq 21 dB, N _F \leq 2.2 dB | • 16-pin ceramic |
| μ PG106 | AGC amplifier | f = 100 kHz to 2.5 GHz Gp \geq 16 dB, G _{AGC} \geq 25 dB | • 8-pin ceramic |
| μ PG107 | SPDT switch | f = DC to 3.4 GHz L _{ins} \leq 1.7 dB, t _{sw} = 5 ns (typ.) | • 8-pin ceramic chip, Chip |
| μ PG110 | Wide band, medium output amplifier | f = 2 to 8 GHz P _O (1dB) \geq 10 dBm, Gp \geq 12 dB | • 4-pin ceramic chip, Chip |
| μ PG130 | SPDT switch (for digital cellular) | f = 0.1 to 1 GHz, P _O (1 dB) = 33 dBm L _{ins} = 0.5 dB, I _{SO} = 30 dB at 1 GHz | • 8-pin SOP • 8-pin SSOP |
| μ PG131 | SPDT switch (for digital cordless) | f = 0.1 to 2 GHz, P _O (1 dB) = 28 dBm L _{ins} = 0.6 dB, I _{SO} = 23 dB at 2 GHz | • 8-pin SOP • 8-pin SSOP |
| μ PG132 | SPDT switch (for digital cordless) | f = 0.1 to 2 GHz, P _O (1 dB) = 28 dBm L _{ins} = 0.6 dB, I _{SO} = 23 dB at 2 GHz | • 8-pin SSOP |

■ Prescaler IC

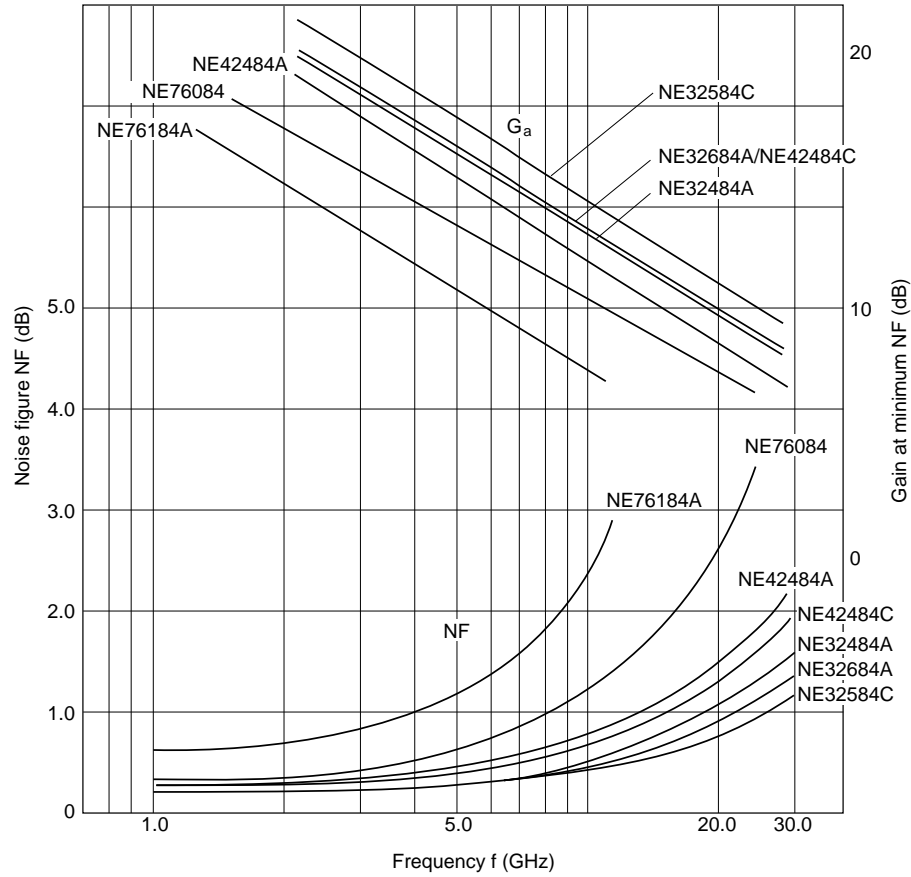
| Type number | Function | Features | Package |
|-------------|------------------------------------|--|-----------------------|
| μ PG501 | 5 GHz, 1/4 static type prescaler | f = 1.5 to 5 GHz @P _{in} = +10 dBm | • 8-pin ceramic, Chip |
| μ PG502 | 5 GHz, 1/2 static type prescaler | f = 1 to 5 GHz @P _{in} = +10 dBm | • 8-pin ceramic, Chip |
| μ PG503 | 9 GHz, 1/4 dynamic type prescaler | f = 3.5 to 90 GHz @P _{in} = +10 dBm | • 8-pin ceramic, Chip |
| μ PG504 | 9 GHz, 1/2 dynamic type prescaler | f = 2.0 to 9.0 GHz @P _{in} = +10 dBm | • 8-pin ceramic, Chip |
| μ PG506 | 14 GHz, 1/8 dynamic type prescaler | f = 8 to 14 GHz @P _{in} = 6 dBm | • 8-pin ceramic, Chip |
| μ PG508 | 14 GHz, 1/4 dynamic type prescaler | f = 8 to 14 GHz @P _{in} = 6 dBm | • 8-pin ceramic, Chip |

GaAs MCIC

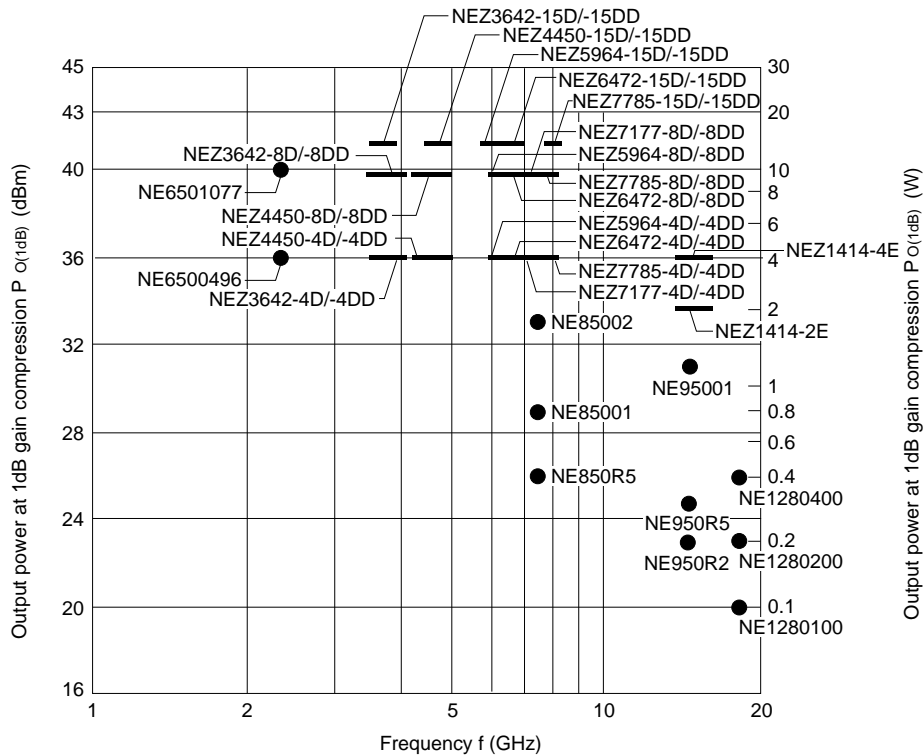
| Type number | Function | Features | Package |
|-------------|---|--|---|
| MC-5950 | for Japan Analog f = 925 to 942 MHz | V _{DD} = 5.8 V, P _{out} \geq 30.8 dBm Gp \geq 24 dB, η_T = 63% | Metal package 17 ∞ 12 ∞ 4 mm |
| MC-5951 | for AMPS f = 824 to 849 MHz | V _{DD} = 5.8 V, P _{out} \geq 30.5 dBm Gp \geq 24 dB, η_T = 63% | |
| MC-5952 | for E-TACS f = 872 to 905 MHz | V _{DD} = 5.8 V, P _{out} \geq 30.5 dBm Gp \geq 24 dB, η_T = 63% | |
| MC-5973 | for AMPS f = 824 to 849 MHz | V _{DD} = 4.6 V, P _{out} \geq 30.5 dBm Gp \geq 24 dB, η_T = 63% | |
| MC-5974 | for E-TACS f = 872 to 905 MHz | V _{DD} = 4.6 V, P _{out} \geq 30.5 dBm Gp \geq 24 dB, η_T = 63% | |
| MC-7620 | for Japan Digital f = 940 to 956 MHz | V _{DD} = 3.4 V, P _{out} = 31.2 dBm Gp \geq 25.2 dB, η_T = 45% | 14.2 ∞ 11.3 ∞ 2.7 mm |
| MC-7621 | for Japan Digital f = 1429 to 1453 MHz | V _{DD} = 3.4 V, P _{out} = 31.2 dBm Gp \geq 20.2 dB, η_T = 45% | |

Field Effect Transistor

Low Noise GaAs FET Quick Reference Graph



Power GaAs FET Quick Reference Graph



Transistor

■ **Low Noise Transistor Quick Reference Table**

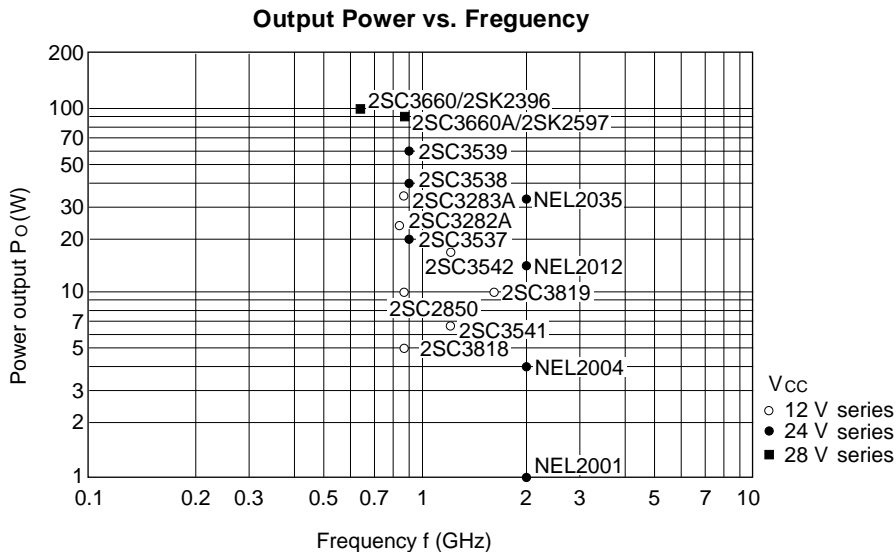
| Frequency (MHz) \ NF (dB) | 2.5 | 3.5 | 4.0 | 5.0 or higher |
|---------------------------|---------|---------|--------------------|---------------|
| 200 | ———— | ———— | 2SC1044 2SC1426 | ———— |
| 500 | ———— | 2SC2148 | 2SC1275 2SC1424 | ———— |
| 2000 | 2SC3604 | 2SC3603 | 2SC2149 | ———— |
| 4000 | 2SC3587 | ———— | ———— | 2SC2150 |

■ **Power Transistor Quick Reference Table (for fixed radio station)**

| Frequency \ Output power | 10 W or higher |
|--------------------------|---|
| 500 MHz or higher | 2SC3660 |
| 800 MHz or higher | 2SC3217-M 2SC3218-M 2SC3660A 2SK2396 |
| 900 MHz or higher | 2SC3537 2SC3538 2SC3539 2SK2597 |
| 1900 MHz or higher | NEL2000 SERIES |

■ **Power Transistor Quick Reference Table (for mobile and portable radio station)**

| Frequency \ Output power | 0.1 W or higher | 1 W or higher | 10 W or higher |
|--------------------------|-----------------|-------------------------------|----------------------|
| 500 MHz or higher | ———— | 2SC2762 | ———— |
| 800 MHz or higher | ———— | 2SC2850-KA/MA | 2SC3282A 2SC3283A |
| 1000 MHz or higher | 2SC3817 | 2SC3541 2SC3818 2SC3819 | 2SC3542 |



Diode**■ Schottky Barrier Diode**

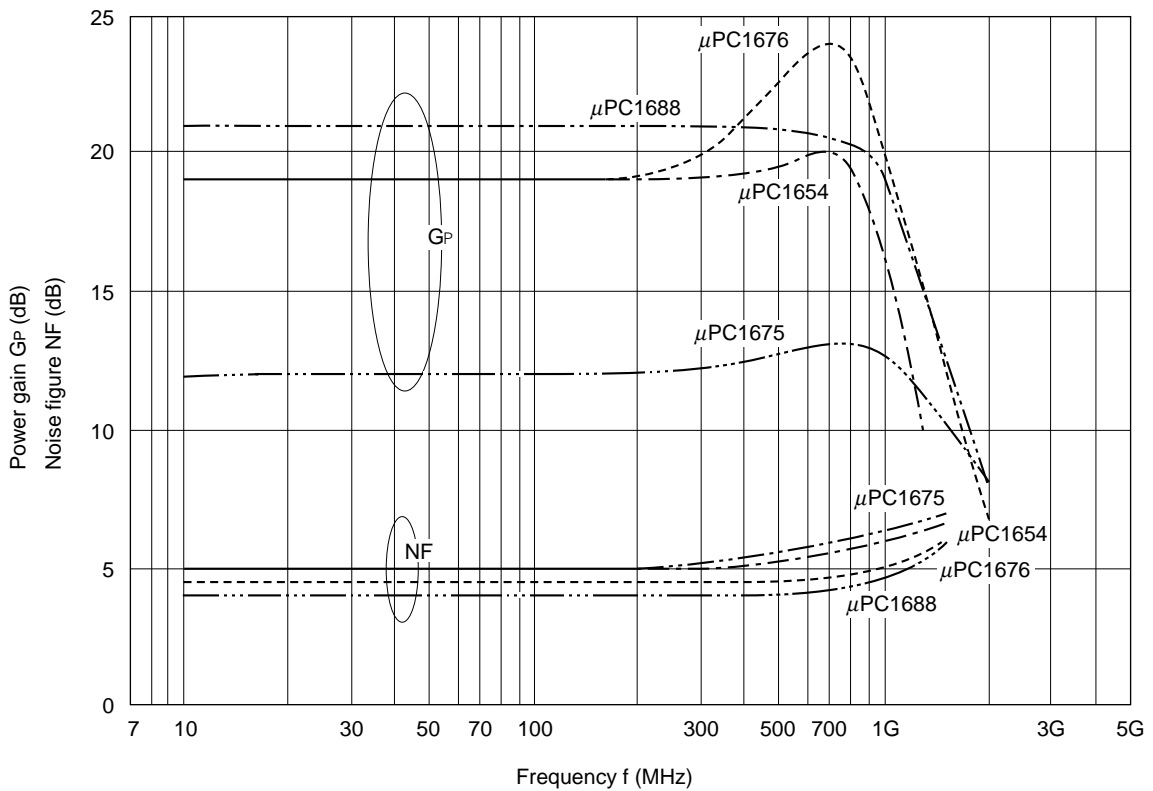
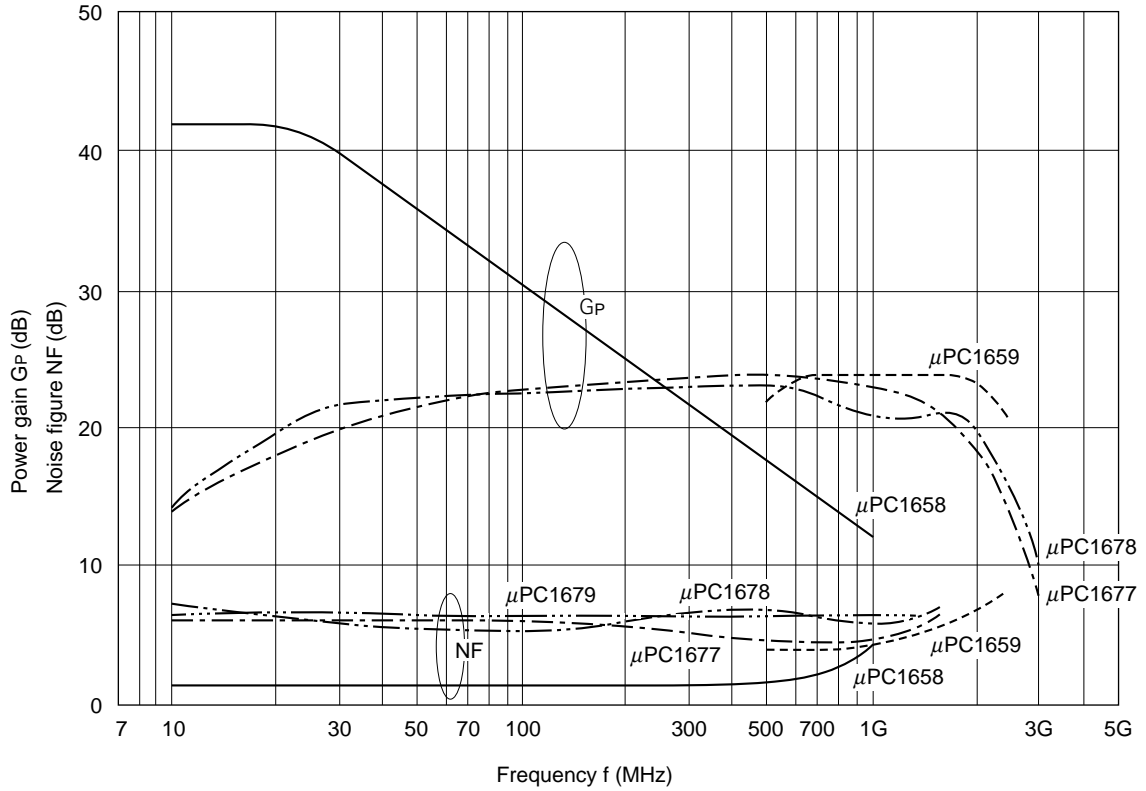
| Type number | Application | Electrical characteristics (TYP.) | | | |
|-------------------|---------------------------|-----------------------------------|-----------|------------|------------|
| | | V_R (V) | V_F (V) | I_F (mA) | C_t (pF) |
| ND487C1-3P | Double balanced modulator | – | ~ 0.7 | – | ~ 1.0 |
| ND487C2-3P | Double balanced modulator | – | ~ 1.0 | – | ~ 1.0 |

MMIC

| Type number | Function | Features | Package |
|--------------|---|--|---|
| μ PC1652 | General purpose HF wide band amplifier | BW = 1.2 GHz, Gp = 18 dB, NF = 5.5 dB | • 8-pin SOP |
| μ PC1653 | | BW = 1.3 GHz, Gp = 18 dB, NF = 5.5 dB | • TO-72 CAN equivalent |
| μ PC1654 | | BW = 1.1 GHz, Gp = 19 dB, NF = 5.5 dB | • TO-12 CAN equivalent |
| μ PC1655 | | BW = 1.0 GHz, Gp = 18 dB, NF = 5.5 dB | • 8-pin DIP |
| μ PC1656 | | BW = 0.85 GHz, Gp = 19 dB, NF = 5.5 dB | • 8-pin DIP |
| μ PC1675 | | BW = 1.9 GHz, Gp = 12 dB, NF = 5.5 dB | • 4-pin mini-mold |
| μ PC1676 | | BW = 1.2 GHz, Gp = 22 dB, NF = 4.5 dB | • 4-pin mini-mold |
| μ PC1688 | | BW = 1.1 GHz, Gp = 21 dB, NF = 4 dB | • 4-pin mini-mold |
| μ PC1658 | Low noise HF wide band amplifier | Gp = 31 dB/f = 100 MHz, GP = 17 dB/f = 500 MHz, (GAIN CONTROLABLE) NF = 1.5 dB/f = 100 MHz, NF = 2.0 dB/f = 500 MHz | • 8-pin CAN • 8-pin SOP • 8-pin DIP |
| μ PC1659 | Ultra wide band amplifier | BW = 0.6 to 2.3 GHz, Gp = 19.5 dB, NF = 5 dB | • 4-pin CAN |
| | | BW = 0.6 to 2.3 GHz, Gp = 23 dB, NF = 5 dB | • Ceramic |
| | | BW = 0.7 to 1.75 GHz, Gp = 23 dB, NF = 5 dB | • 8-pin SOP |
| μ PC1663 | Ultra high speed video amplifier | BW = 700 MHz/Ga = 20 dB, GAIN CONTROLABLE INPUT NOISE 3 μ Vr.m.s. | • 8-pin DIP • 8-pin SOP |
| μ PC1677 | Wide band, medium output amplifier | BW = 1.8 GHz, Gp = 24 dB, NF = 6 dB, Po = 19.5 dBm | • 8-pin DIP |
| μ PC1678 | | BW = 2.0 GHz, Gp = 23 dB, NF = 6 dB, Po = 17.5 dBm | • 8-pin SOP |
| μ PC1668 | High isolation IF amplifier | Ga = 14.5 dB, ISL = 55 dB/f = 70 MHz | • 8-pin DIP |
| μ PC1669 | | Ga = 10.5 dB, ISL = 55 dB/f = 70 MHz | • 8-pin DIP |
| μ PC1670 | | Ga = 7.0 dB, ISL = 55 dB/f = 70 MHz | • 8-pin DIP |
| μ PC2708 | Middle power wide band amplifier | BW = 2.9 GHz, Po (sat) = +10 dBm, Gp = 15 dB | • 6-pin mini-mold |
| μ PC2709 | | BW = 2.3 GHz, Po (sat) = +11.5 dBm, Gp = 23 dB | |
| μ PC2710 | | BW = 1.0 GHz, Po (sat) = +13.5 dBm, Gp = 33 dB | |
| μ PC2711 | Low noise wide band amplifier | BW = 2.9 GHz, Gp = 13 dB, NF = 5.0 dB | • 6-pin mini-mold |
| μ PC2712 | | BW = 2.6 GHz, Gp = 20 dB, NF = 4.5 dB | |
| μ PC2713 | | BW = 1.2 GHz, Gp = 29 dB, NF = 3.2 dB | |
| μ PC2714 | Low power consumption wide band amplifier | BW = 1.8 GHz, Icc = 4.5 mA, Vcc = 3.4 V | • 6-pin mini-mold |
| μ PC2715 | | BW = 1.2 GHz, Icc = 4.5 mA, Vcc = 3.4 V | |
| μ PC2745 | | BW = 2.7 GHz, Icc = 7.5 mA, Vcc = 3.0 V, Gp = 12 dB | |
| μ PC2746 | | BW = 1.5 GHz, Icc = 7.5 mA, Vcc = 3.0 V, Gp = 19 dB | |
| μ PC2747 | 900 MHz Band | BW = 0.1 – 1.8 GHz, Icc = 5.0 mA, Vcc = 3.0 V, Gp = 12 dB | • 6-pin mini-mold |
| μ PC2748 | Low noise amplifier | BW = 0.3 – 1.5 GHz, Icc = 6.0 mA, Vcc = 3.0 V, Gp = 19 dB | |
| μ PC2749 | 1.9 GHz Low noise amplifier | BW = 2.9 GHz, Icc = 6 mA, Gp = 16 dB, NF = 4 dB | • 6-pin mini-mold |
| μ PC2762 | Medium power amplifier | BW = 2.9 GHz, Icc = 26.5 mA, Gp = 14.5 dB, P _{1dB} = 7 dBm | • 6-pin mini-mold |
| μ PC2763 | | BW = 2.4 GHz, Icc = 27 mA, Gp = 19.5 dB, P _{1dB} = 6.5 dBm | |
| μ PC2771 | | BW = 2.1 GHz, Icc = 36 mA, Gp = 21 dB, P _{1dB} = +11.5 dBm | |
| μ PC2723 | 1.1 GHz AGC amplifier | BW = 1.1 GHz, Gpmax. = 13 dB, GCR = 38 dB, Vcc = 5.0 V | • 6-pin mini-mold |
| μ PC2726 | 1.6 GHz differential amplifier | BW = 1.6 GHz, Icc = 11.5 mA, Gp = 15 dB, Vcc = 5.0 V | • 6-pin mini-mold |
| μ PC8104 | 1.9 GHz Up Converter + QPSK MOD | Vcc = 2.7 ~ 5.5 V, Icc = 28 mA | • 20-pin SSOP |
| μ PC8105 | 400 MHz QPSK MOD | Vcc = 2.7 ~ 5.5 V, Icc = 16 mA | • 16-pin SSOP |
| μ PC8110 | 900 MHz QPSK MOD | Vcc = 2.7 ~ 3.6 V, Icc = 24 mA | • 20-pin SSOP |

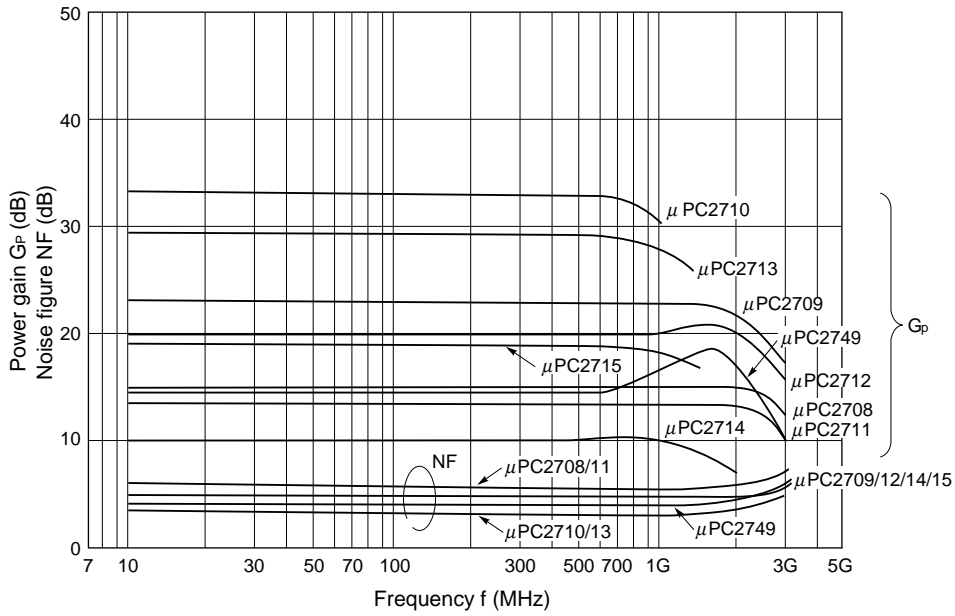
MMIC

Power gain, noise figure vs. frequency

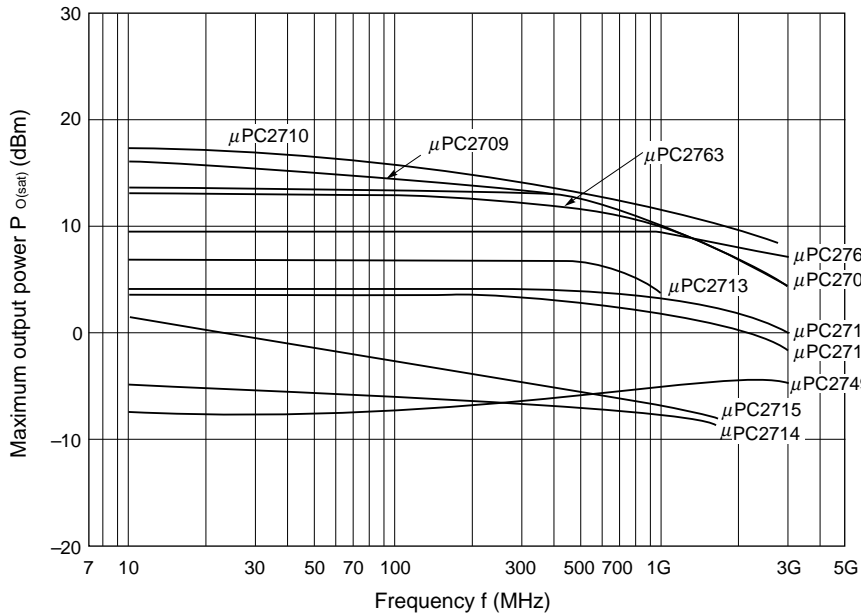


MMIC

Power gain, noise figure vs. frequency

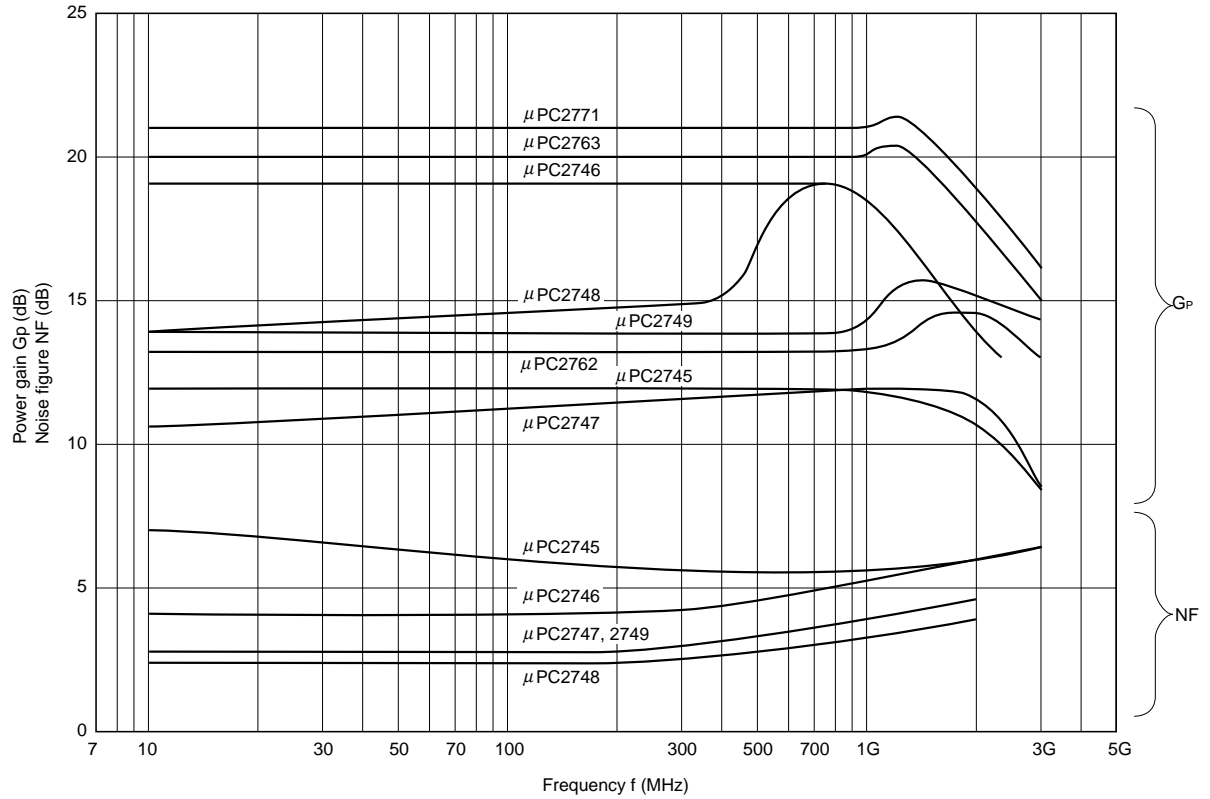


P_0 (sat) vs. frequency

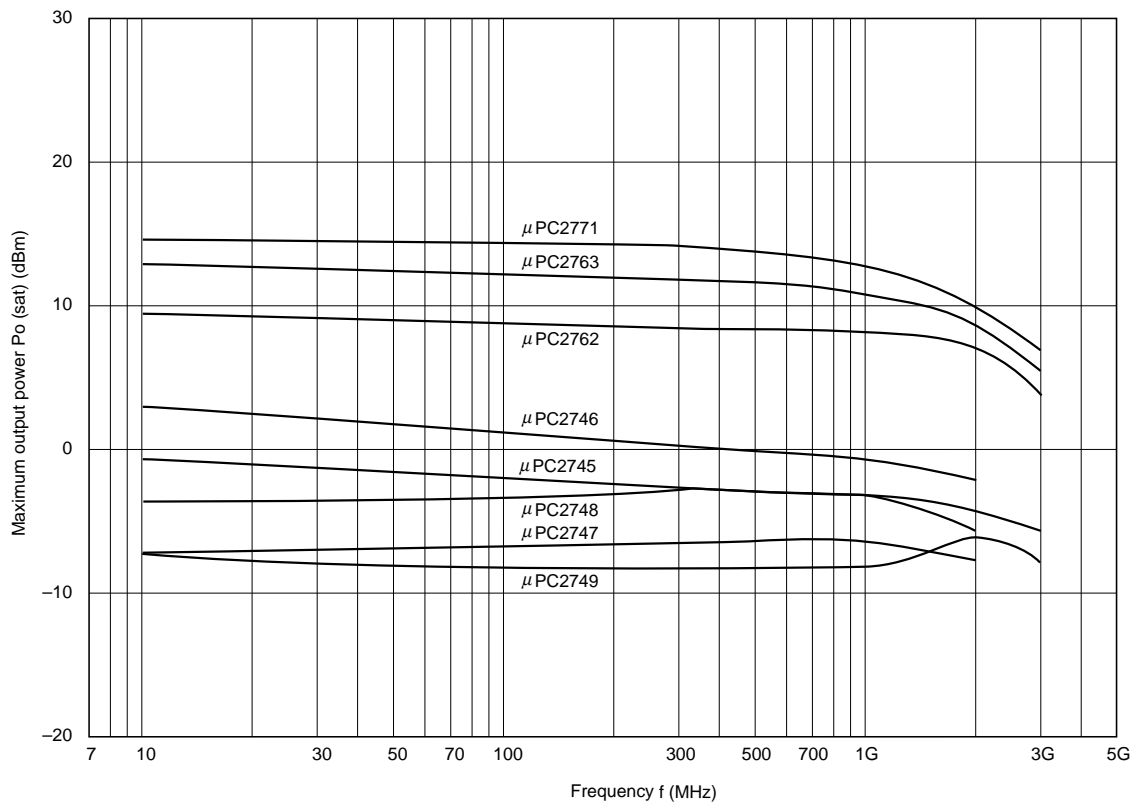


MMIC

Power gain, noise figure vs. frequency



Po (sat) vs. frequency



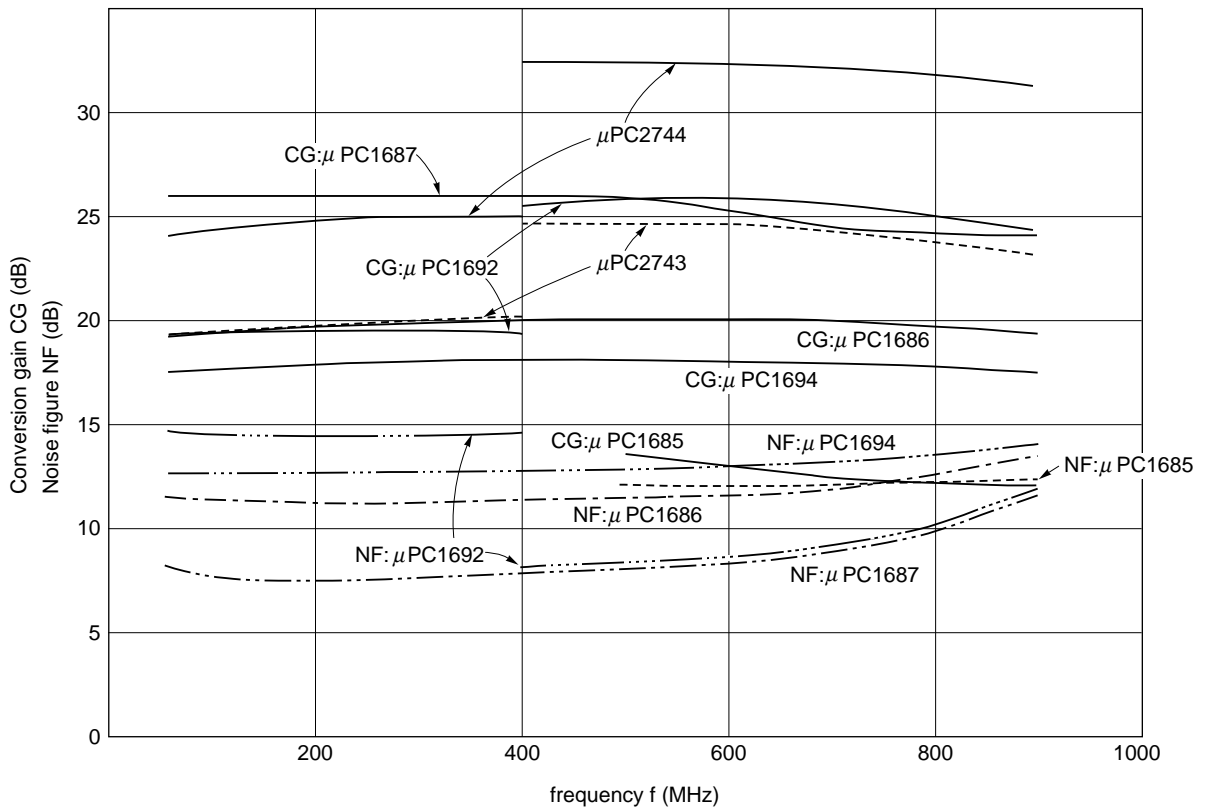
MMIC

| Type number | Function | Features | Package |
|-----------------|--|---|--|
| μ PC1685 | Down converter (MIX/OSC/IF amplifier) | CG = 12 dB, NF = 12.5 dB, CM = 86 dB μ , @900 MHz | • 8-pin SOP |
| μ PC1686 | | CG = 20 dB, NF = 12 dB, CM = 94 dB μ , @470 MHz | • 8-pin SOP |
| μ PC1687 | | CG = 24 dB, NF = 10 dB, CM = 89 dB μ , @900 MHz | • 8-pin SOP |
| μ PC1673 | | CG = 23 dB, NF = 11.0 dB, CM = 92 dB μ , @470 MHz | • 16-pin SOP |
| μ PC1692 | | CG = 19 dB @470 MHz, CG = 24 dB @890 MHz | • 20-pin SOP |
| μ PC1694 | | CG = 18 dB, NF = 12.5 dB, CM = 103 dB μ , @470 MHz | • 14-pin SOP |
| μ PC2743 | | CG = 20 dB, @470 MHz, CG = 23 dB @890 MHz | • 20-pin SOP |
| μ PC2744 | | CG = 25 dB, @470 MHz, CG = 31 dB @890 MHz | • 20-pin SOP |
| μ PC2721 | | CG = 20 dB, NF = 11 dB, f_{RF} = 0.9 ~ 2.0 GHz | • 8-pin SOP |
| μ PC2722 | | CG = 15 dB, NF = 11 dB, f_{RF} = 0.9 ~ 2.0 GHz | |
| μ PC2731 | AGC Amplifier + Down converter | CG = 14 dB, NF = 12 ~ 17 dB, f_{RF} = 0.9 ~ 2.0 GHz, GCR = 65 dB | • 20-pin SOP |
| μ PC2734 | Down converter (MIX/OSC/IF Amp.) | CG = 10 ~ 13 dB, NF = 9 ~ 14 dB, f_{RF} = 0.9 ~ 2.1 GHz @ f_{IF} = 402.8 MHz | • 20-pin SSOP |
| μ PC2757 | Down converter (MIX/Lo Amp./IF Amp.) | f_{RFBW} = 2.0 GHz, CG = 15 dB, I_{CC} = 5.6 mA, V_{CC} = 3.0 V | • 6-pin mini-mold |
| μ PC2758 | | f_{RFBW} = 2.0 GHz, CG = 15 dB, I_{CC} = 11 mA, V_{CC} = 3.0 V | |
| μ PC2753 | Down converter | f_{in} = DC ~ 400 MHz, CG_{MAX} = 79 dB, 3 V, 6.5 mA | • 20-pin SSOP |
| μ PC8106 | Up converter | CG = 10 dB, I_{CC} = 9 mA, OIP_3 = +7 dBm, 3 ~ 5 V | • 6-pin mini-mold |
| μ PC8109 | | CG = 7 dB, I_{CC} = 5 mA, OIP_3 = +5 dBm, 3 ~ 5 V | |
| μ PC8100 | Up/Down converter | Up converter + Down converter 1 chip IC | • 20-pin SSOP |
| μ PB584 | Prescaler | 1/2, $f_{max.}$ = 2.5 GHz | • 8-pin SOP |
| μ PB585 | | 1/4, $f_{max.}$ = 2.5 GHz | • 8-pin SOP |
| μ PB586 | | 1/256, 1/512, $f_{max.}$ = 2.5 GHz | • 8-pin SOP |
| μ PB587 | | 1/2, 1/4, 1/8 $f_{max.}$ = 1 GHz | • 8-pin SOP |
| μ PB588 | | 1/64, 1/128, $f_{max.}$ = 2.5 GHz | • 8-pin SOP |
| μ PB581 | | 1/2, $f_{max.}$ = 2.8 GHz | • 8-pin CAN |
| μ PB582 | | 1/4, $f_{max.}$ = 2.8 GHz | • 8-pin CAN |
| μ PB1502 | | Prescaler with power save mode | $f_{max.}$ = 1.7 GHz, 64/65, 128/129, V_{CC} = 3.0 V |
| μ PB1502(1) | $f_{max.}$ = 2.0 GHz, 64/65, 128/129, V_{CC} = 3.0 V | | |
| μ PB1504 | Prescaler | $f_{max.}$ = 1.1 GHz, 64/65, 128/129, 3 V, 1.9 mA | |
| μ PB1505 | | $f_{max.}$ = 3.0 GHz, "256, "128, "64, 5 V, 14 mA | |
| μ PA101 | Transistor array | MULTIPLAYER | • 14-pin ceramic • 8-pin SOP |
| μ PA102 | | 2 DIFF AMP | • 14-pin ceramic • 14-pin SOP |
| μ PA103 | | 3 Trs+1 PIAR Tr | • 14-pin ceramic • 14-pin SOP |
| μ PA104 | | ADDER | • 14-pin ceramic • 14-pin SOP |

MMIC

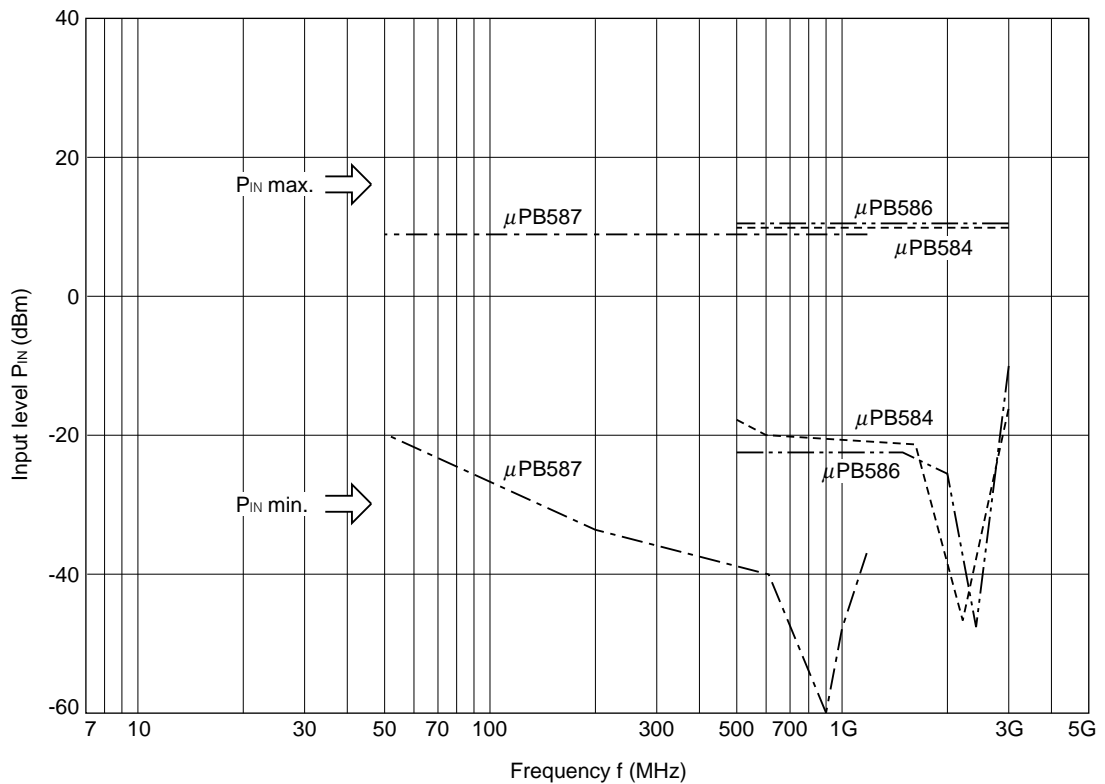
[Down converter]

Conversion gain, noise figure vs. frequency



[Prescaler]

Input level vs. frequency

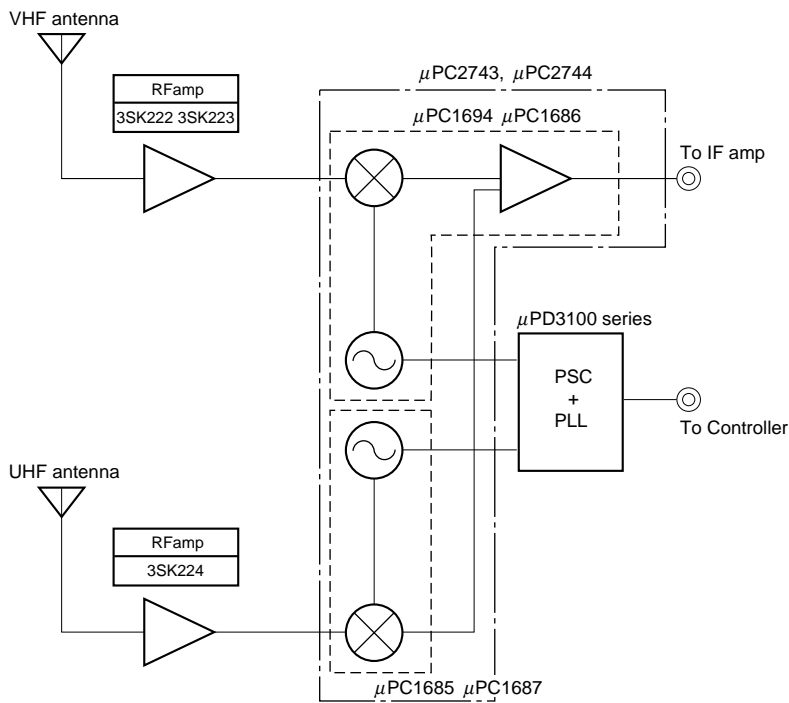


Transistor, FET

■ TV tuner

| Application | | Bi-polar transistor | | Dual gate FET | |
|-------------|--------------------|---------------------|--|--|--|
| | | Mini-mold (3-pin) | Small mini-mold (3-pin) | Mini-mold (4-pin) | Super mini-mold (4-pin) |
| VHF band | RF | | | 3SK131 3SK222 3SK223 3SK230 3SK252 | 3SK242 3SK246 3SK243 3SK254 |
| | MIX | 2SC3545 | 2SC4182 2SC4184 | 3SK131 | 3SK242 |
| | OSC | 2SC3545 | 2SC4182 2SC4184 | | |
| UHF band | RF ($\lambda/4$) | | 2SC4183 | 3SK135A 3SK224 3SK231 3SK253 | 3SK244 3SK255 |
| | RF ($\lambda/2$) | | | 3SK134B | 3SK245 |
| | RF (GaAs FET) | | | 3SK177 3SK206 | |
| | MIX | 2SC3545 2SC3841 | 2SC4183 2SC4185 2SC4184 2SC4186 | | |
| | OSC | 2SC3545 2SC3841 | 2SC4182 2SC4184 2SC4185 | | |

Application Block Diagram

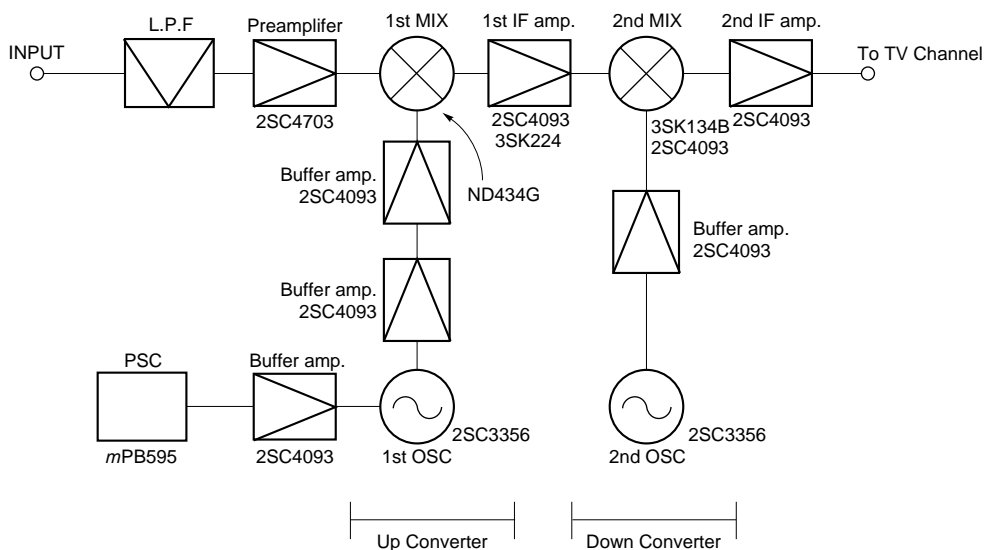


Transistor, FET

■ **CATV converter**

| Application | Type number | | | | | | Electrical characteristics | |
|-----------------|-----------------|----------------|----------------|-----------------|----------------|----------------------|----------------------------|-------------|
| | TO-92 | Mini-mold | | Super mini-mold | | Ultrasuper mini-mold | 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) | | |

Application Block Diagram



Diode

■ **Mixer diode**

| Plastic mold package | | | | Electrical characteristics (TYP.) | | |
|----------------------------------|-----------------------------------|------------------------|------------------|---|---|---------------------|
| 4-pin mold (pair, each separate) | 4-pin mini-mold (pair/PIN common) | 6-pin mini-mold (QUAD) | 8-pin SOP (QUAD) | V _F (V) (I _F = 1.0 mA) | I _F (mA) (V _F = 1.0 V) | C _t (pF) |
| ND414G-2 | ND412G-2 | ND487C1T/R1T | ND434G | ~ 0.41 | 35 ~ | 1.0 |
| ND413G-2 | ND411G-2 | ND487C2T/R2T | ND433G | ~ 0.23 | 30 ~ (V _F =0.5 V) | 0.9 |

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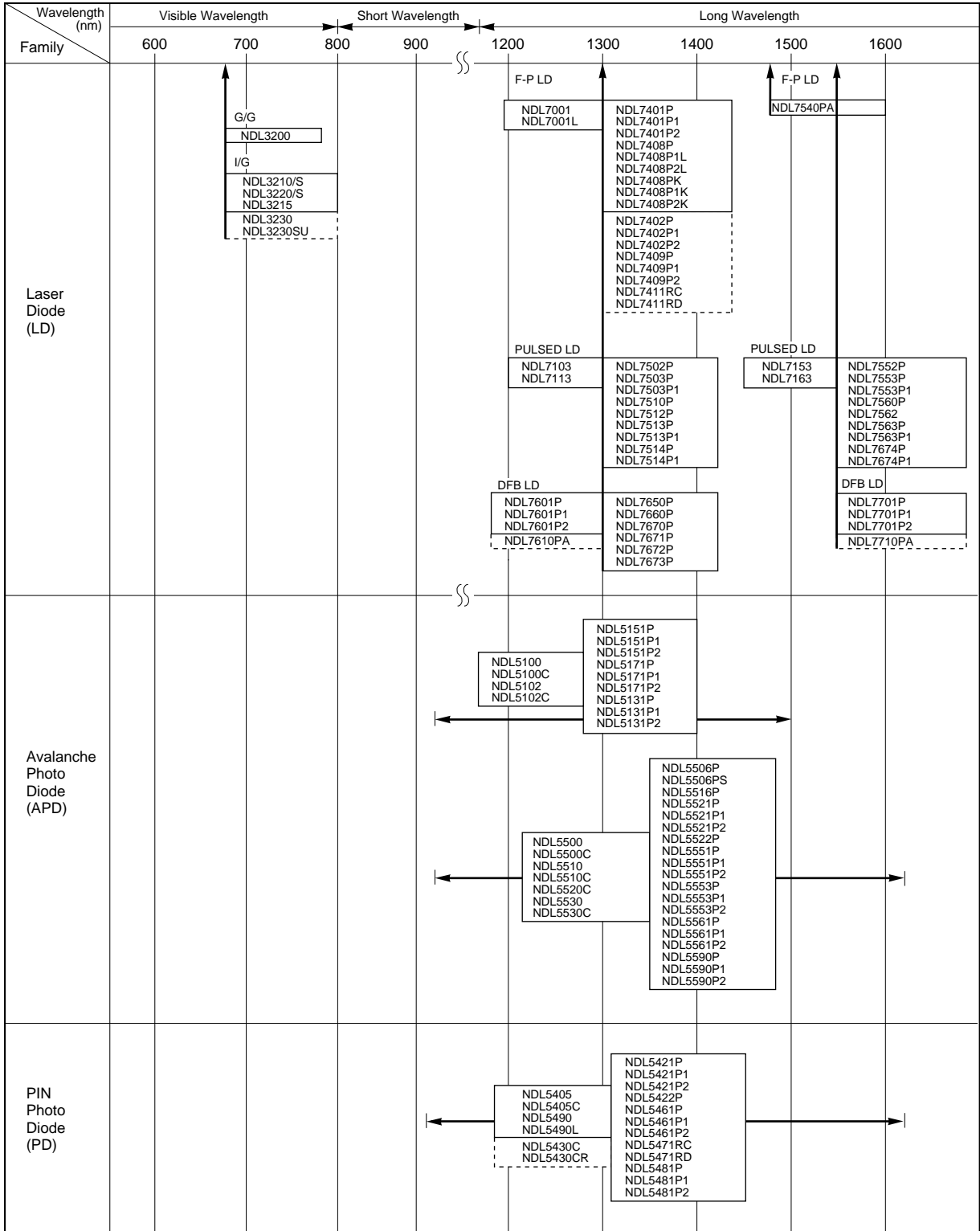
Optical Device

| | |
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| Fiber Optic Communication/Light Beam Application Device | 180 |
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Fiber Optic Communication/Light Beam Application Devices

■ **Product map of optical communication/light beam application device**



[] : Under development → : Mark wavelength or operating range
 Modules are available with FC-PC or SC-PC connector.

Fiber Optic Communication/Light Beam Application Devices

Laser Diodes

■ Visible LD for Beam Applications

| Type number | Absolute maximum ratings | | | Typical characteristics | | | | | | Remarks |
|-------------------|--------------------------|------------|--------------|-------------------------|-------------|---------------|------------|-------------|-------------|---|
| | Po/Pf (mW) | Tc (fC) | Tstg (fC) | Ith (mA) | Iop (mA) | Po/Pf (mW) | λc (nm) | θ⊥ (deg) | θΠ (deg) | |
| | | | | TYP. | TYP. | TYP. | TYP. | TYP. | TYP. | |
| NDL3200 | 4 | -10 to +50 | -40 to +85 | 80 | 85 | 3 | 670 | 34 | 7 | for BCR, Measurement etc. |
| NDL3210 | 6 | -10 to +50 | -40 to +85 | 40 | 60 | 5 | 670 | 34 | 9 | for BCR, Measurement etc. |
| NDL3210S | 5 | -10 to +50 | -40 to +85 | 40 | 60 | 4 | 670 | 34 | 9 | for BCR, Measurement etc. |
| NDL3220 | 6 | -10 to +60 | -40 to +85 | 20 | 30 | 5 | 670 | 30 | 8 | Low threshold current, High temperature operating |
| NDL3220S | 6 | -10 to +60 | -40 to +85 | 20 | 30 | 5 | 670 | 30 | 8 | Small package |
| NDL3215 | 10 | -10 to +50 | -40 to +85 | 50 | 60 | 10 | 670 | 31 | 8 | for Long Distance BCR etc. |
| NDL3230* | 35 | -10 to +60 | -40 to +85 | 50 | 100 | 30 | 685 | 20 | 9 | for Magnetic Optical Disk, High Power application |
| NDL3230SU* | 35 | -10 to +60 | -40 to +85 | 50 | 100 | 30 | 685 | 20 | 9 | Small package |
| NDL3310* | 4 | -10 to +50 | -40 to +85 | 70 | 80 | 3 | 650 | 34 | 9 | Short wavelength |

*: Under development

■ For Fiber Optic Communications

• Fabry Perrot LD

| Type number | Absolute maximum ratings | | | Typical characteristics (25°C) | | | | | Remarks |
|------------------------|--------------------------|------------|--------------|--------------------------------|-------------|------------|------------|---------------|-----------------------------------|
| | If (mA) | Tc (fC) | Tstg (fC) | Po/Pf (mW) | Ith (mA) | λp (nm) | σ* (nm) | tr/ta (ns) | |
| | | | | | TYP. | TYP. | TYP. | MAX. | |
| NDL7001 | — | -40 to +85 | -55 to +125 | 5.0 | 12 | 1310 | 1.0 | 0.5/0.5 | with monitor PD, small package |
| NDL7001L | — | -40 to +85 | -55 to +125 | 5.0 | 12 | 1310 | 1.0 | 0.5/0.5 | with monitor PD, small package |
| NDL7401P/P1/P2 | Ith+50 | -40 to +85 | -40 to +85 | 2.0 | 12 | 1310 | 1.3 | 0.5/0.5 | with monitor PD |
| NDL7402P/P1/P2* | 100 | -40 to +85 | -40 to +85 | 2.0 | 5 | 1310 | 1.5 | 0.5/0.5 | with monitor PD |
| NDL7408PL/1L/2L | Ith+50 | -40 to +85 | -40 to +85 | 0.2 | 12 | 1310 | 1.3 | 0.5/0.5 | with monitor PD |
| NDL7408PK/1K/2K | Ith+50 | -40 to +85 | -40 to +85 | 1.0 | 12 | 1310 | 1.3 | 0.5/0.5 | with monitor PD |
| NDL7409P/P1/P2* | 100 | -40 to +85 | -40 to +85 | 0.2 | 5 | 1310 | 1.5 | 0.5/0.5 | with monitor PD |
| NDL7411RC/RD* | 100 | -40 to +85 | -40 to +85 | 0.2 | 12 | 1310 | 1.3 | 0.5/0.5 | with monitor PD, FC/SC receptacle |

*: RMS (-20 dB)

*: Under development

• DFBLD

| Type number | Absolute maximum ratings | | | | Typical characteristics | | | | Remarks |
|-----------------------|--------------------------|---------------|------------|--------------|-------------------------|-------------|------------|---------------|-----------------------------------|
| | If (mA) | Po/Pf (mW) | Tc (fC) | Tstg (fC) | Po/Pf (mW) | Ith (mA) | λp (nm) | tr/ta (ns) | |
| | | | | | | TYP. | TYP. | TYP. | |
| NDL7601P/P1/P2 | Ith+50 | 5 | -20 to +85 | -20 to +85 | 2.0 | 15 | 1310 | 0.5/0.5 | with monitor PD |
| NDL7610PA* | 150 | 5 | -20 to +65 | -40 to +70 | 2.0 | 20 | 1310 | 0.1/0.17 | with monitor PD, isolator and TEC |
| NDL7701P/P1/P2 | Ith+50 | 5 | -20 to +85 | -20 to +85 | 2.0 | 15 | 1550 | 0.5/0.5 | with monitor PD |
| NDL7710PA* | 150 | 5 | -20 to +65 | -40 to +70 | 2.0 | 25 | 1550 | 0.1/0.17 | with monitor PD, isolator and TEC |

*: Under development

Fiber Optic Communication/Light Beam Application Devices

Laser Diodes

■ For Analog Applications

| Type number | Absolute maximum ratings | | | | Typical characteristics (25°C) | | | | | | Remarks |
|-------------|--------------------------|------------------------|------------------------|--------------------------|---------------------------------|--------------------------------|--------------------------------|------------------------|----------------------|----------------------|-----------------------------------|
| | I _F (mA) | P _F (mW) | T _C (°C) | T _{stg} (°C) | I _{th} (mA) TYP. | P _F (mW) MIN. | λ _p (nm) TYP. | RIN (dB/Hz) TYP. | CSO (dBc) TYP. | CTB (dBc) TYP. | |
| NDL7650P | 150 | 15 | -20 to +65 | -40 to +70 | 20 | 4 | 1310 | -155 | -62 | -70 | with monitor PD, isolator and TEC |
| NDL7660P | 150 | 15 | -20 to +65 | -40 to +70 | 20 | 6 | 1310 | -155 | -62 | -70 | with monitor PD, isolator and TEC |
| NDL7670P | 150 | 15 | -20 to +65 | -40 to +70 | 20 | 8 | 1310 | -155 | -58 | -65 | with monitor PD, isolator and TEC |
| NDL7671P | 150 | 15 | -20 to +65 | -40 to +70 | 20 | 10 | 1310 | -155* | -58 | -65 | with monitor PD, isolator and TEC |
| NDL7672P | 150 | 25 | -20 to +65 | -40 to +70 | 20 | 12 | 1310 | -158 | -60 | -65 | with monitor PD, isolator and TEC |
| NDL7673P | 150 | 25 | -20 to +65 | -40 to +70 | 20 | 16 | 1310 | -158 | -60 | -65 | with monitor PD, isolator and TEC |

*: MAX.

■ For EDFA Pumping and High Power OTDR Applications

| Type number | Absolute maximum ratings | | | Typical characteristics | | | | | | Remarks |
|-------------|--------------------------|------------------------|--------------------------|---------------------------------|---------------------------------|--|--------------------------------|---------------------------------|--|-------------------------------|
| | I _{FL} (mA) | T _C (°C) | T _{stg} (°C) | I _{th} (mA) TYP. | I _{op} (mA) TYP. | P _o /P _F (mW) TYP. | λ _C (nm) TYP. | σ ^{*2} (nm) MAX. | t _r /t _f (ns) TYP. | |
| NDL7540PA | 600 | -20 to +70 | -40 to +85 | 40 | 500 | 110 | 1480 | 8 | - | with TEC, thermistor and m-PD |
| NDL7103 | 1200 ^{*3} | -40 to +70 | -55 to +125 | 35 | 1000 ^{*3} | 320 ^{*3} | 1310 ^{*3} | 7 | 1.5/1.7 | ø5.6 can |
| NDL7113 | 600 ^{*3} | -40 to +70 | -55 to +125 | 20 | 400 ^{*3} | 175 ^{*3} | 1310 ^{*3} | 10 | 0.5/0.7 | ø5.6 can |
| NDL7502P | 1200 ^{*3} | -20 to +65 | -40 to +70 | 35 | 1000 ^{*3} | 190 ^{*3} | 1310 ^{*3} | 10 | 2/2 ^{*1} | with TEC |
| NDL7503P/P1 | 1200 ^{*3} | -20 to +60 | -40 to +85 | 35 | 1000 ^{*3} | 180 ^{*3} | 1310 ^{*3} | 10 | 1.5/1.7 | |
| NDL7510P | 600 ^{*3} | -20 to +65 | -40 to +70 | 20 | 400 ^{*3} | 55 ^{*3} | 1310 ^{*3} | 10 | 0.5/0.7 | with TEC |
| NDL7512P | 600 ^{*3} | -20 to +65 | -40 to +70 | 20 | 400 ^{*3} | 110 ^{*3} | 1310 ^{*3} | 10 | 1/1 ^{*1} | with TEC |
| NDL7513P/P1 | 600 ^{*3} | -20 to +60 | -40 to +85 | 20 | 400 ^{*3} | 110 ^{*3} | 1310 ^{*3} | 10 | 1/1 ^{*1} | |
| NDL7514P/P1 | 600 ^{*3} | -20 to +60 | -40 to +85 | 20 | 400 ^{*3} | 50 ^{*3} | 1310 ^{*3} | 10 | 1/1 ^{*1} | |
| NDL7153 | 1200 ^{*3} | -40 to +70 | -55 to +125 | 45 | 1000 ^{*3} | 240 ^{*3} | 1550 ^{*3} | 8 | 1.5/1.7 | ø5.6 can |
| NDL7163 | 600 ^{*3} | -40 to +70 | -55 to +125 | 30 | 400 ^{*3} | 120 ^{*3} | 1550 ^{*3} | 10 | 0.5/0.7 | ø5.6 can |
| NDL7552P | 1200 ^{*3} | -20 to +65 | -40 to +70 | 40 | 1000 ^{*3} | 125 ^{*3} | 1550 ^{*3} | 10 | 2/2 ^{*1} | with TEC |
| NDL7553P/P1 | 1200 ^{*3} | -20 to +60 | -40 to +85 | 45 | 1000 ^{*3} | 145 ^{*3} | 1550 ^{*3} | 10 | 2/2 ^{*1} | |
| NDL7560P | 600 ^{*3} | -20 to +65 | -40 to +70 | 20 | 400 ^{*3} | 30 ^{*3} | 1550 ^{*3} | 10 | 0.5/0.7 | with TEC |
| NDL7562P | 600 ^{*3} | -20 to +65 | -40 to +70 | 40 | 400 ^{*3} | 75 ^{*3} | 1550 ^{*3} | 10 | 1/1 ^{*1} | with TEC |
| NDL7563P/P1 | 600 ^{*3} | -20 to +60 | -40 to +85 | 40 | 400 ^{*3} | 80 ^{*3} | 1550 ^{*3} | 10 | 1/1 ^{*1} | |
| NDL7564P/P1 | 600 ^{*3} | -20 to +60 | -40 to +85 | 40 | 400 ^{*3} | 40 ^{*3} | 1550 ^{*3} | 10 | 1/1 ^{*1} | |

*1 : MAX.

*2 : RMS (-20 dB)

*3 : Pulse conditions; measurement of wavelength

pulse width = 1 μs, duty = 1%

measurement of optical output power

pulse width = 10 μs, duty = 1% (modules)

pulse width = 1 μs, duty = 1% (ø5.6 can)

Fiber Optic Communication/Light Beam Application Devices

Detectors

■ PIN Photo Diodes

| Type number | Absolute maximum ratings | | | | Detecting area size (μm) | Typical characteristics | | | | | | | | Remarks | Package |
|----------------|--------------------------|------------|------------------------------|----------------------------------|---------------------------------------|-------------------------|------|------------|------|------------------------|------|-------------|--|--------------------------------------|---------|
| | I_F (mA) | I_R (mA) | T_C ($^{\circ}\text{C}$) | T_{stg} ($^{\circ}\text{C}$) | | I_D (nA) | | C_i (pF) | | S (A/W) | | f_c (GHz) | t_r / t_f (ns) | | |
| | | | | | | V_R (V) | TYP. | V_R (V) | TYP. | λ (nm) | TYP. | | | | |
| NDL5405 | 10 | 0.5 | -40 to +85 | -55 to +150 | $\phi 80$ | 5 | 0.1 | 5 | 1.0 | 1300 0.89 1550 1.00 | - | 0.3 | | CAN Package | |
| NDL5405C | 10 | 0.5 | -40 to +85 | -55 to +150 | $\phi 80$ | 5 | 0.1 | 5 | 1.0 | 1300 0.89 1550 1.00 | - | 0.3 | | Chip on carrier | |
| NDL5430C/CR | 10 | 3.0 | -40 to +85 | -55 to +150 | $\phi 30$ | 5 | 5.0* | - | - | 1300 0.89 1550 1.00 | 2.5 | - | for 10 Gb/s CR: With Resistance | Chip on carrier | |
| NDL5471RC/RD | 10 | 0.5 | -40 to +85 | -40 to +85 | $\phi 120$ | 5 | 0.1 | 5 | 1.1 | 1300 0.89 1550 1.00 | 1.5 | - | RC: FC receptacle RD: SC receptacle | Receptacle module | |
| NDL5461P/P1/P2 | 10 | - | -40 to +85 | -40 to +85 | $\phi 80$ | 5 | 0.1 | 5 | 1.0 | 1300 0.89 1550 0.94 | 2.5 | - | P: Without flange P1: With flat mount flange P2: With vertical flange | Coaxial module (With MMF) | |
| NDL5481P/P1/P2 | 10 | - | -40 to +85 | -40 to +85 | $\phi 80$ | 10 | 0.1 | 10 | 0.7 | 1300 0.85 | 2.5 | - | for analog applications P: Without flange P1: With flat mount flange P2: With vertical flange | Coaxial module (With SMF) | |
| NDL5421P/P1/P2 | 10 | 0.5 | -40 to +85 | -40 to +85 | $\phi 50$ | 5 | 0.1 | 5 | 1.0 | 1300 0.89 1550 0.94 | 2.5 | - | P: Without flange P1: With flat mount flange P2: With vertical flange | Coaxial module (With MMF) | |
| NDL5490 | 10 | 0.5 | -40 to +85 | -40 to +85 | $\phi 50$ | 5 | 2.0* | - | - | 1330 0.78 | 1.0 | - | With Pre-AMP P = -24 dBm typ. 1 Gb/s | CAN Package | |
| NDL5490L | 10 | 0.5 | -40 to +85 | -40 to +85 | $\phi 50$ | 5 | 2.0* | - | - | 1330 0.78 | 1.0 | - | With Pre-AMP P = -24 dBm typ. 1 Gb/s | CAN Package with ball lens | |
| NDL5422P | - | 0.5 | -40 to +70 | -40 to +85 | $\phi 50$ | 5 | 0.1 | - | - | 1330 0.89 1550 1.00 | 2.5 | - | With Pre-AMP P = -23 dBm typ. 2.5 Gb/s | BFY Package (6-pin) (With MMF) | |

*: MAX.

Fiber Optic Communication/Light Beam Application Devices

Detectors

■ Avalanche Photo Diodes

| Type | Type number | Absolute maximum ratings | | | | Detecting area size (μm) | Typical characteristics | | | | | | | Remarks | Package | |
|------------|-----------------|--------------------------|---------------------|---------------------|-----------------------|--------------------------|-------------------------|--|--------------------|--------------|--------------|------|----------------------|---------|---|--------------------------------------|
| | | I _F (mA) | I _R (mA) | T _C (°C) | T _{stg} (°C) | | V _{(BR)R} (V) | I _D (nA) | | S (A/W) | | M | f _c (GHz) | | | t _r / t _f (ns) |
| | | | | | | | | TYP. | V _R (V) | TYP. | λ (nm) | | | | | |
| Ge-APD | NDL5100 | 50 | 0.5 | -40 to +60 | -55 to +125 | ∅100 | 48*2 | V _{(BR)R} ∞0.9 | 200 | 1300 | 0.78 | 40 | - | 0.5 | | CAN Package |
| | NDL5100C | 50 | 0.5 | -40 to +60 | -55 to +125 | ∅100 | 48*2 | V _{(BR)R} ∞0.9 | 200 | 1300 | 0.78 | 40 | - | 0.5 | | Chip on carrier |
| | NDL5102 | 50 | 0.5 | -40 to +60 | -55 to +125 | ∅30 | 35 | V _{(BR)R} ∞0.9 | 80 | 1300 | 0.78 | 50 | - | 0.3 | | CAN Package |
| | NDL5102C | 50 | 0.5 | -40 to +60 | -55 to +125 | ∅30 | 35 | V _{(BR)R} ∞0.9 | 80 | 1300 | 0.78 | 50 | - | 0.3 | | Chip on carrier |
| | NDL5171P /P1/P2 | 50 | 0.5 | -40 to +85 | -40 to +85 | ∅100 | 48*2 | V _{(BR)R} ∞0.9 | 200 | 1300 | 0.84 | 40 | - | 0.5 | P: Without flange P1: With flat mount flange P2: With vertical flange | Coaxial module (With MMF) |
| | NDL5151P /P1/P2 | 50 | 0.5 | -40 to +85 | -40 to +85 | ∅50 | 35 | V _{(BR)R} ∞0.9 | 150 | 1300 | 0.84 | 50 | - | 0.4 | P: Without flange P1: With flat mount flange P2: With vertical flange | Coaxial module (With MMF) |
| | NDL5131P /P1/P2 | 50 | 0.5 | -40 to +85 | -40 to +80 | ∅30 | 35 | V _{(BR)R} ∞0.9 | 80 | 1300 | 0.84 | 40 | - | 0.3 | P: Without flange P1: With flat mount flange P2: With vertical flange | Coaxial module (With SMF) |
| InGaAs-APD | NDL5510 | 10 | 0.5 | -40 to +70 | -55 to +100 | ∅80 | 75 | V _{(BR)R} ∞0.9 | 8 | 1300 1550 | 0.89 1.00 | 40 | 0.7 | - | | CAN Package |
| | NDL5510C | 10 | 0.5 | -40 to +70 | -55 to +100 | ∅80 | 75 | V _{(BR)R} ∞0.9 | 8 | 1300 1550 | 0.89 1.00 | 40 | 0.7 | - | | Chip on carrier |
| | NDL5500 | 10 | 0.5 | -40 to +70 | -55 to +100 | ∅50 | 70 | V _{(BR)R} ∞0.9 | 5 | 1300 1550 | 0.89 1.00 | 40 | 1.0 | - | | CAN Package |
| | NDL5500C | 10 | 0.5 | -40 to +70 | -55 to +100 | ∅50 | 70 | V _{(BR)R} ∞0.9 | 5 | 1300 1550 | 0.89 1.00 | 40 | 1.0 | - | | Chip on carrier |
| | NDL5520C | 10 | 0.5 | -40 to +70 | -55 to +100 | ∅50 | 55 | V _{(BR)R} ∞0.9 | 5 | 1300 1550 | 0.89 1.00 | 40 | 2.5 | - | for 2.5 Gb/s (∅50) | Chip on carrier |
| | NDL5530 | 10 | 0.5 | -40 to +85 | -55 to +100 | ∅30 | 70 | V _{(BR)R} ∞0.9 | 5 | 1300 1550 | 0.94 0.96 | 40 | 2.5 | - | | CAN Package |
| | NDL5530C | 10 | 0.5 | -40 to +85 | -55 to +100 | ∅30 | 70 | V _{(BR)R} ∞0.9 | 5 | 1300 1550 | 0.89 1.00 | 40 | 1.0 | - | | Chip on carrier |
| | NDL5561P /P1/P2 | 10 | 0.5 | -40 to +85 | -40 to +85 | ∅80 | 75 | V _{(BR)R} ∞0.9 | 8 | 1300 1550 | 0.94 0.96 | 40 | 1.0 | - | P: Without flange P1: With flat mount flange P2: With vertical flange | Coaxial Module (With MMF GI-62.5) |
| | NDL5551P /P1/P2 | 10 | 0.5 | -40 to +85 | -40 to +85 | ∅50 | 70 | V _{(BR)R} ∞0.9 | 5 | 1300 1550 | 0.94 0.96 | 40 | 1.0 | - | P: Without flange P1: With flat mount flange P2: With vertical flange | Coaxial module (With MMF) |
| | NDL5521P /P1/P2 | 10 | 0.5 | -40 to +85 | -40 to +85 | ∅50 | 70 | V _{(BR)R} ∞0.9 | 5 | 1300 1550 | 0.94 0.96 | 40 | 2.5 | - | for 2.5 G Applications P: Without flange P1: With flat mount flange P2: With vertical flange | Coaxial module (With MMF) |
| | NDL5553P /P1/P2 | 10 | 0.5 | -40 to +85 | -40 to +85 | ∅50 | 70 | M = 20 | 50 | 1300 1550 | 0.89 0.94 | 20*1 | - | 0.5*2 | for OTDR Applications P: Without flange P1: With flat mount flange P2: With vertical flange | Coaxial module (With MMF) |
| | NDL5516P | 10 | 0.5 | -20 to +55 | -40 to +85 | ∅80 | 75 | V _{(BR)R} ∞0.9 I _C =1.1A @ 55°C | 2 | 1300 1550 | 0.89 1.00 | 40 | 0.7 | - | for OTDR Applications With TEC ΔT ≥ 45K | DIP module (With MMF GI-62.5) |
| | NDL5506P /PS | 10 | 0.5 | -20 to +55 | -40 to +85 | ∅50 | 70 | V _{(BR)R} ∞0.9 I _C =1.1A @ 55°C | 2 | 1300 1550 | 0.89 1.00 | 40 | 1.0 | - | for OTDR Applications With TEC ΔT ≥ 45K P: With MMF, PS: With SMF | DIP module |
| | NDL5590P /P1/P2 | - | 0.5 | -40 to +85 | -40 to +85 | ∅50 | 70 | V _{(BR)R} ∞0.9 | 5 | 1300 1550 | 0.94 0.96 | - | 1.0 | - | With Pre-AMP P̄ = -36 dBm typ. 622 Mb/s P: Without flange P1: With flat mount flange P2: With vertical flange | Coaxial module (With MMF) |
| | NDL5522P | - | 0.5 | -40 to +70 | -40 to +85 | ∅50 | 55 | V _{(BR)R} ∞0.9 | 5 | 1300 1550 | 0.89 1.00 | - | 2.5 | - | With Pre-AMP P̄ = -33 dBm typ. 2.5 Gb/s | BFY Package (6-pin) (With MMF) |


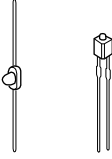


*1: MIN.
*2: MAX.

| |
|-------------------------------|
| Light Emitting Element |
|-------------------------------|

■ Infrared Ray Emitting Diode

| Type number | Materials | Features | Absolute maximum ratings ($T_a = 25\text{ }^\circ\text{C}$) | | | Electrical characteristics ($T_a = 25\text{ }^\circ\text{C}$) | | Package (package No.) |
|-------------|----------------|---------------------------------------|--|---------------|---|--|---|--------------------------|
| | | | P (mW) | I_F (mA) | V_F TYP. (V) ($I_F = 300\text{ mA}$) | λ_p TYP. (nm) ($I_F = 30\text{ mA}$) | P_o TYP. (mW) ($I_F = 30\text{ mA}$) | |
| SE301A | GaAs | High output, high reliability | 150 | 100 | 1.2 ($I_F = 50\text{ mA}$) | 940 | 6 ($I_F = 50\text{ mA}$) | P1 |
| SE302A | GaAs | Ultra miniature double end | 75 | 50 | 1.2 | 940 | 1.5 | P2 |
| SE303 | GaAs | High output, narrow beam | 150 | 100 | 1.25 ($I_F = 50\text{ mA}$) | 940 | 3 ($I_F = 50\text{ mA}$) | P4 |
| SE303A-C | GaAs | High output, wide beam | 150 | 100 | 1.25 ($I_F = 50\text{ mA}$) | 940 | 8 ($I_F = 50\text{ mA}$) | P4 |
| SE304 | GaAs | Horizontal output | 100 | 50 | 1.2 | 940 | 1.5 | P5 |
| SE306 | GaAs | Horizontal output with lens | 100 | 50 | 1.1 ($I_F = 10\text{ mA}$) | 940 | 0.5 mW/sr ($I_F = 10\text{ mA}$) | P6 |
| SE307-C | GaAs | High output, narrow beam | 150 | 100 | 1.25 ($I_F = 50\text{ mA}$) | 940 | 30 mW/sr ($I_F = 50\text{ mA}$) | P4 |
| SE308 | GaAs | Small horizontal output with lens | 100 | 50 | 1.1 ($I_F = 20\text{ mA}$) | 940 | 0.85 mW/sr ($I_F = 20\text{ mA}$) | P7 |
| SE310 | GaAs | Vertical high output with lens | 150 | 60 | 1.25 ($I_F = 50\text{ mA}$) | 940 | 11 mW/sr ($I_F = 50\text{ mA}$) | P3 |
| SE313 | GaAs | High output with moderately wide beam | 150 | 100 | 1.25 ($I_F = 50\text{ mA}$) | 940 | 25 mW/sr ($I_F = 50\text{ mA}$) | P4 |
| SE314 | GaAs | Miniature Type | 75 | 50 | 1.2 ($I_F = 10\text{ mA}$) | 940 | 0.2 ($I_F = 10\text{ mA}$) | P5 |
| SE316(L) | GaAs | Ultra miniature double end | 75 | 50 | 1.2 ($I_F = 10\text{ mA}$) | 940 | 0.4 ($I_F = 10\text{ mA}$) | P14 |
| SE1003-C | GaAlAs on GaAs | Ultra high output with wide beam | 150 | 100 | 1.27 ($I_F = 50\text{ mA}$) | 950 | 20 mW/sr ($I_F = 50\text{ mA}$) | P4 |
| SE1103 | GaAlAs | High speed (3 MHz) | 150 | 50 | 1.6 ($I_F = 50\text{ mA}$) | 890 | 7 mW/sr ($I_F = 50\text{ mA}$) | P4 |

Package (package appearance)

| Package | TO-18 glass | Small resin mold | Domed resin mold | Square resin mold |
|-------------|---|---|---|---|
| |  |  |  |  |
| Package No. | P1 | P2 P3 | P4 | P5 P6 P7 |

Light Receiving Element

■ **Photo-transistor**

| Type number | Features | Absolute maximum ratings (T _a = 25 fC) | | | Electrical characteristics (T _a = 25 fC) | | | Package (package No.) |
|-------------|--|---|---------------------|----------------------|---|--|---|-----------------------|
| | | P _c (mW) | I _c (mA) | V _{CEO} (V) | I _{CEO} (nA) V _{CE} = 10 V I _L = 0 | V _{CE} (sat) (V) (L = 1000 lx) | I _L (μA) V _{CE} = 2 V I _C = 100 lx | |
| PH101 | Small Darlington connection | 100 | 50 | 20 | ~ 500 (V _{ce} = 15 V) | ~ 1.5 | 10mA ~ | P8 |
| PH102 | Small High speed response | 100 | 40 | 30 | ~ 200 | ~ 0.3 | 50 ~ | P8 |
| PH103 | Darlington connection | 100 | 50 | 30 | ~ 400 | ~ 1.5 | 2 mA ~ | P9 |
| PH104 | High speed response | 100 | 40 | 30 | ~ 100 | ~ 0.3 | 20 ~ | P9 |
| PH105 | φ4.8 lens package | 150 | 50 | 30 | ~ 200 | ~ 0.3 | 500 ~ (V _{CE} = 10 V) | P4 |
| PH106 | Horizontal type with lens High speed response | 100 | 40 | 30 | ~ 100 | ~ 1.3 | 60 ~ | P6 |
| PH107 | Horizontal type with lens Darlington connection | 100 | 50 | 30 | ~ 400 | ~ 1.5 | 10 mA ~ | P6 |
| PH108 | Small horizontal type with lens High speed response | 100 | 40 | 30 | ~ 100 | ~ 0.3 (H = 5 m W/cm*) | 0.3 mA ~ V _{CE} = 5 V I _C H = 0.5 mW/cm* | P7 |
| PH108A | Horizontal type with lens High speed response, visible ray cut resin | 100 | 40 | 30 | ~ 100 | ~ 0.3 (H = 5 m W/cm*) | 0.2mA ~ V _{CE} = 5 V I _C H = 0.5 mW/cm* | P7 |
| PH109 | Horizontal type with lens Darlington connection | 100 | 50 | 30 | ~ 400 | ~ 1.2 | 10 mA ~ | P7 |
| PH110 | Horizontal type with lens High sensitivity, visible ray cut resin | 100 | 40 | 30 | ~ 100 | ~ 0.3 (H = 500 μ W/sr) | 200 ~ V _{CE} = 5 V I _C H = 50 μW/cm* | P3 |
| PH114 | Miniature type | 75 | 25 | 30 | ~ 100 | ~ 0.4 | 40 ~ | P5 |
| PH116(L) | Ultra miniature double end | 75 | 25 | 30 | ~ 100 | ~ 0.4 | 40 ~ | P14 |

*: Measured with infrared of λ_P = 940 nm (peak emission wavelength)

Package (package appearance)

| Package | TO-18 glass | Small resin mold | Domed resin mold | Square resin mold |
|-------------|-------------|------------------|------------------|-------------------|
| Package No. | P1 | P2 P3 | P4 | P5 P6 P7 |

| Package | Small resin mold | Square | | | | | |
|-------------|------------------|--------|-----|-----|-----|-----|-----|
| Package No. | P8 | P9 | P10 | P11 | P12 | P13 | P14 |

| |
|--------------------------------|
| Light Receiving Element |
|--------------------------------|

PIN Photo-diode
■ PIN photo-diode for remote control application

| Type number | Features | Absolute maximum ratings ($T_a = 25\text{ }^\circ\text{C}$) | | | Electrical characteristics ($T_a = 25\text{ }^\circ\text{C}$) | | Package (package No.) |
|---------------|--|---|------------|--|---|---|-----------------------|
| | | V_R (V) | P_c (mW) | Sensitivity (nA/lx) ($V_R = 5\text{ V}$) | I_D (nA) ($V_R = 10\text{ V}$) | t_r (ns) ($R_L = 1\text{ k}\Omega$) | |
| PH302 | Mold case | 32 | 150 | 50^{*1} ($6\text{ }(\mu\text{A})^{*2}$) | ~ 30 | 50 | P10 |
| PH302C | Mold case Visible ray cut filter | 32 | 150 | 32^{*1} ($5\text{ }(\mu\text{A})^{*2}$) | ~ 30 | 50 | P10 |
| PH309 | Small mold case with lens Visible ray cut resin | 32 | 150 | 32^{*1} ($5\text{ }(\mu\text{A})^{*2}$) | ~ 10 | 30 | P12 |
| PH310 | Small mold case with lens Visible ray cut resin | 32 | 150 | 32^{*1} ($5\text{ }(\mu\text{A})^{*2}$) | ~ 10 | 30 | P13 |
| PH320 | Small mold case with lens Visible ray cut resin | 32 | 150 | $4.3\text{ }(\mu\text{A})^{*2}$ | ~ 10 | 30 | P13 |

*1: Light source color temperature 2854K

*2: Sensitivity (@H = 0.1 mW/cm²) for infrared ray ($\lambda_P = 940\text{ nm}$)
■ PIN photo-diode for CD, VD

| Type number | Absolute maximum ratings ($T_a = 25\text{ }^\circ\text{C}$) | | | | Electrical-optical typical characteristics ($T_a = 25\text{ }^\circ\text{C}$) | | | | | | Remarks | |
|--------------|---|------------|-----------|--------------------------------|---|------|------------|---------------|----------------|-------|---------|-----------------|
| | I_F (mA) | I_L (mA) | V_R (V) | T_{stg} ($^\circ\text{C}$) | I_D | | C_t | | S | | | t_r, t_f (ns) |
| | | | | | V_R (V) | (nA) | Focus (pF) | Tracking (pF) | λ (nm) | (A/W) | | |
| PH315 | 10 | 5 | 20 | -40 to +100 | 15 | 4 | 1.6 | 1.9 | 780 | 0.52 | 1 | 6 unit PD |

Light Receiving Element

Light Receiving IC

■ Light Receiving IC with built-in Schmidt trigger circuit

| Type number | Features | Absolute maximum ratings ($T_a = 25\text{ }^\circ\text{C}$) | | Electrical characteristics ($T_a = 25\text{ }^\circ\text{C}$) | | Package |
|-------------|--|--|-------------------------|---|---|------------------------------|
| | | V _{CC} (V) | I _{OL} (mA) | Threshold irradiance ($\mu\text{W}/\text{cm}^2$) (V _{CC} = 5 V) $\lambda = 940\text{ nm}$ | V _{OL} (V) I _{OL} = 16 mA V _{CC} = 5 V | |
| PH502HR | Active high (without incidence: low level) Internal pull-up resistor | 17 | 50 | ~ 50 | ~ 0.4 | • 3-pin square resin mold |
| PH502HC | Active high (without incidence: low level) Open-collector output | 17 | 50 | ~ 50 (R _L = 280 Ω) | ~ 0.4 (R _L = 280 Ω) | • 3-pin square resin mold |
| PH502LR | Active low (without incidence: high level) Internal pull-up resistor | 17 | 50 | ~ 50 | ~ 0.4 | • 3-pin square resin mold |
| PH502LC | Active low (without incidence: high level) Open-collector output | 17 | 50 | ~ 50 (R _L = 280 Ω) | ~ 0.4 (R _L = 280 Ω) | • 3-pin square resin mold |
| PH514HR | Active high (without incidence: low level) Internal pull-up resistor | 17 | 50 | ~ 500 | ~ 0.4 | • 3-pin square resin mold |
| PH514HC | Active high (without incidence: low level) Open-collector output | 17 | 50 | ~ 500 (R _L = 280 Ω) | ~ 0.4 (R _L = 280 Ω) | • 3-pin square resin mold |
| PH514LR | Active low (without incidence: high level) Internal pull-up resistor | 17 | 50 | ~ 500 | ~ 0.4 | • 3-pin square resin mold |
| PH514LC | Active low (without incidence: high level) Open-collector output | 17 | 50 | ~ 500 (R _L = 28 Ω) | ~ 0.4 (R _L = 280 Ω) | • 3-pin square resin mold |
| PH516HR(L) | Active high (without incidence: low level) Internal pull-up resistor | 17 | 50 | ~ 60 | ~ 0.4 | • Ultra miniature double end |
| PH516HC(L) | Active high (without incidence: low level) Open-collector output | 17 | 50 | ~ 60 (R _L = 280 Ω) | ~ 0.4 (R _L = 280 Ω) | • Ultra miniature double end |
| PH516LR(L) | Active low (without incidence: high level) Internal pull-up resistor | 17 | 50 | ~ 60 | ~ 0.4 | • Ultra miniature double end |
| PH516LC(L) | Active low (without incidence: high level) Open-collector output | 17 | 50 | ~ 60 (R _L = 280 Ω) | ~ 0.4 (R _L = 280 Ω) | • Ultra miniature double end |

■ PIN photo-diode with built-in amplifier for CD

| Type number | Absolute maximum ratings ($T_a = 25\text{ }^\circ\text{C}$) | | | | Light-electrical typical characteristics ($T_a = 25\text{ }^\circ\text{C}$) | | | | | | Remarks |
|-------------|---|-------------------------|------------------------|--|---|----------------|------------------|-------------------|-------|----------------|-----------------------------------|
| | V _{CC} (V) | I _{CC} (mA) | P _D (mW) | T _{stg} ($^\circ\text{C}$) | V _{CC} (V) | V _O | | S | | f _r | |
| | | | | | | Focus (mV) | Tracking (mV) | λ (nm) | (A/W) | (MHz) | |
| PH522 | 11 | — | 100 | -30 to +85 | 5 | TYP. 110 | TYP. 500 | 780 | — | TYP. 8 | 6 unit PD with internal amplifier |
| PH525 | 11 | — | 100 | -40 to +85 | 5 | TYP. 340 | TYP. 710 | 780 | — | TYP. 8 | 6 unit PD with internal amplifier |

Photocoupler

| Type number | Features | BV1-2 | IF (mA) | VCEO (V) | CTR (%) | Package | Remarks | | |
|----------------|--|-------------------------------|-----------------------|--|---|----------------------------|---|-------------------|---|
| PS1001 | | 1 kVdc | 60 | 30 | 20 ~ | TO-5 | Single transistor output | | |
| PS2501-1 to -4 | High isolation voltage | 5 kVr.m.s. | 80 | 80 | 80 to 600 | • 4- to 16-pin DIP (multi) | Darlington transistor output | | |
| PS2502-1 to -4 | | | | 40 | 200 ~ | | Single transistor output | | |
| PS2503-1 to -4 | | | 50 | 40 | 100 to 400 | | AC input | | |
| PS2505-1 to -4 | | | ±80 | 80 | 80 to 600 | | Single transistor output | | |
| PS2506-1 to -4 | | | | 40 | 200 ~ | | AC input Darlington transistor output | | |
| PS2521-1 to -4 | High isolation voltage | 5 kVr.m.s. | 150 | 80 | 20 to 80 | • 4-pin DIP | Single transistor | | |
| PS2525-1 to -4 | Large current input | | ±150 | | | | Darlington transistor | | |
| PS2532-1 to -4 | High isolation voltage | 5 kVr.m.s. (3.75 kVr.m.s.) | 80 | 300 | 1500 to 6500 | • 4- to 16-pin DIP (multi) | Darlington transistor | | |
| PS2533-1 to -4 | | | | 350 | 1500 to 6500 | | Single transistor | | |
| PS2561-1 to -2 | High isolation voltage (VDE0884 Approved) | | 80 | 80 | 80 to 400 | | Darlington transistor | | |
| PS2562-1 to -2 | | | | | ±80 | | 200 ~ | Single transistor | |
| PS2565-1 to -2 | | | 80 to 400 | Darlington transistor | | | | | |
| PS2566-1 to -2 | | 200 ~ | Darlington transistor | | | | | | |
| PS2601 | High isolation voltage | | 80 | 80 | 80 to 600 | • 6-pin DIP | Single transistor With base | | |
| PS2602 | | | | | | | Single transistor Without base | | |
| PS2603 | | | | 40 | 200 ~ | | Darlington transistor With base | | |
| PS2604 | | | | | | | Darlington transistor Without base | | |
| PS2605 | | | ±80 | 80 | 80 to 600 | | AC input Single transistor With base | | |
| PS2606 | | | | | | | AC input Single transistor Without base | | |
| PS2607 | | | | | | | 40 | 200 ~ | AC input Darlington transistor With base |
| PS2608 | | | | | | | | | AC input Darlington transistor Without base |
| PS2621 | High isolation voltage Large current input | | 150 | 80 | 20 to 50 | • 6-pin DIP | Single transistor With base | | |
| PS2622 | | | | | | | Single transistor Without base | | |
| PS2625 | | | ±150 | AC input Single transistor With base | | | | | |
| PS2626 | | | | | AC input Single transistor Without base | | | | |
| PS2633 | High isolation voltage | | 80 | 300 | 1000 to 15000 | | Darlington transistor Without base | | |
| PS2634 | High VCEO | | | | | | Darlington transistor Without base | | |
| PS2651 | High isolation voltage (VDE0884 Approved) | | 80 | 80 | 50 to 400 | • 6-pin DIP (lead forming) | Single transistor With base | | |
| PS2652 | | | | | | | Single transistor Without base | | |
| PS2653 | | | 40 | 200 ~ | Darlington transistor With base | | | | |
| PS2654 | | | | | Darlington transistor Without base | | | | |

Photocoupler

■ SOP Photocoupler

| Type number | Features | BV ₁₋₂ | I _F (mA) | V _{CEO} (V) | CTR(%) | Package | Remarks | |
|----------------|---|-------------------|---------------------|----------------------|---------------------------------|--------------------|---------------------------------|---------------------------------|
| PS2701-1,-2,-4 | High isolation voltage | 2.5 kVr.m.s. | 50 | 40 | 50 to 300 | • SOP (2.54 pitch) | Single transistor | |
| PS2702-1,-2,-4 | | | | | 200 ~ | | Darlington transistor | |
| PS2703-1,-2,-4 | | | | | 50 to 400 | | Single transistor | |
| PS2705-1,-2,-4 | | | ±50 | 40 | 50 to 300 | | AC input, Single transistor | |
| PS2706-1,-2,-4 | | | | | 200 ~ | | AC input, Darlington transistor | |
| PS2707-1,-2,-4 | | | | | 50 to 400 | | AC input, Single transistor | |
| PS2732-1,-2,-4 | High isolation voltage High V _{CEO} | | 50 | 300 | 1500 to 6500 | | • SOP (1.27 pitch) | Darlington transistor |
| PS2733-1,-2,-4 | | | | | | | | |
| PS2801-1 | High isolation voltage | | | 50 | 80 | | | 80 to 600 |
| PS2802-1 | | | 40 | | 200 ~ | | | Darlington transistor |
| PS2805-1 | | | ±50 | | 80 | | | 80 to 600 |
| PS2806-1 | | | 50 | 40 | 200 ~ | | | AC input, Darlington transistor |
| PS2801-4 | | 80 | | 80 to 600 | Single transistor | | | |
| PS2802-4 | | 40 | | 200 ~ | Darlington transistor | | | |
| PS2805-4 | | ±50 | 80 | 80 to 600 | AC input, Single transistor | | | |
| PS2806-4 | | 50 | 40 | 200 ~ | AC input, Darlington transistor | | | |

■ High Speed Photocoupler

| Type number | Features | BV ₁₋₂ | I _F (mA) | V _{CC} (V) | CTR (%) | Package | Remarks |
|-------------|---------------------|-------------------|---------------------|---------------------|-------------|--------------------------------------|-------------------------|
| PS2041 | High speed response | 2.5 kVr.m.s. | 25 | -0.5 to 15 | 15 ~ | • 6-pin DIP | Photodiode + transistor |
| PS2043 | | | | | | • 8-pin DIP | |
| PS2044 | | | | | | | |
| PS2741 | | | | | | | |
| PS8601 | | 5 kVr.m.s. | 35 | 15 ~ | • 8-pin DIP | Photodiode + transistor without base | |
| PS8602 | | | | | | Photodiode + transistor | |

■ High Speed Photocoupler

| Type number | Features | BV ₁₋₂ | I _F (mA) | V _{CC} (V) | t _{PHL} , t _{PLH} (ns) | Package | Remarks |
|-------------|---------------------------------|-------------------|---------------------|---------------------|--|-------------|---------|
| PS9601 | High speed response (IC output) | 5 kVr.m.s. | 20 | 7 | 50 (TYP.) | • 8-pin DIP | — |
| PS9701 | | 2.5 kVr.m.s. | 30 | | 50 (TYP.) | • 5-pin SOP | |

■ Inverter Control Photocoupler

| Type number | Features | BV ₁₋₂ | I _F (mA) | V _{CC} (V) | I _{O2} (A) | Package | Remarks |
|-------------|----------------------------------|-------------------|---------------------|---------------------|---------------------|-------------|--------------------|
| PS9634 | High output, high noise immunity | 5 kVr.m.s. | 30 | 18 | 0.8 | • 8-pin DIP | Built-in amplifier |

■ IGBT Drive Photocoupler

| Type number | Features | BV ₁₋₂ | I _F (mA) | V _{CC} (V) | t _{PHL} , t _{PLH} (μs) | Package | Remarks |
|-------------|-------------|-------------------|---------------------|---------------------|--|-------------|--------------------|
| PS9636 | High output | 5 kVr.m.s. | 20 | 35 | 0.5 (TYP.) | • 8-pin DIP | Built-in amplifier |

Photocoupler

■ Photo TRIAC Photocoupler

| Type number | Features | BV ₁₋₂ | I _{FT} (mA) | V _{DRM} (V) | I _T (mA) | Package | Remarks |
|-------------|---|-------------------|----------------------|----------------------|---------------------|--------------|-------------------|
| PS3601 | High isolation voltage | 5 kVr.m.s. | ~ 5 | 600 | 0.1 | • 5-pin DIP | without zerocross |
| PS3602 | | | | 400 | | | with zerocross |
| PS3611* | | | | 600 | | | |
| PS3612* | | | | 400 | | | |
| PS3701 | Small size (SOP type) High isolation voltage | 3.75 kVr.m.s. | ~ 5 | 600 | 0.1 | • 4-pin SOP | without zerocross |
| PS3702 | | | | 400 | | | with zerocross |
| PS3711* | | | | 600 | | | |
| PS3712* | | | | 400 | | | |
| PS3901 | High output power (1.2 A) High isolation voltage | 5 kVr.m.s. | ~ 5 | 600 | 1.2 | • 10-pin DIP | without zerocross |
| PS3911* | | | | 600 | | | with zerocross |
| PS3912* | | | | 400 | | | |

★: Under development

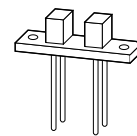
Photointerrupter

PS4XXX Family (phototransistor type)

■ PS40XX - PS45XX family

| Type number | Current transfer ratio | | | Features |
|----------------------------------|------------------------|---------------------|---------------------|--|
| | CTR (%) | I _F (mA) | V _{CE} (V) | |
| PS4001 | 20 ~ | 10 | 2 | Light receiving window: 1mm [■] , Darlington transistor output |
| PS4003 | 15 ~ | 10 | 2 | Darlington transistor output |
| PS4005, PS4007 PS4009, PS4010 | 20 ~ | 10 | 2 | Darlington transistor output |
| PS4008 | 0.5 ~ | 10 | 2 | Single transistor output |
| PS4011 | 20 ~ | 10 | 2 | Light receiving window: 1mm [■] , Darlington transistor output |
| PS4015 | 3 ~ | 10 | 2 | Light receiving window: 1mm [■] , Single transistor output |
| PS4016 | 270 ~ | 10 | 2 | Light receiving window: 0.5mm Darlington transistor output |
| PS4501 | 0.5 ~ | 10 | 2 | Light receiving window: 0.5mm Slit, Single transistor output |
| PS4502 | 200 ~ | 10 | 2 | Light receiving window: 0.5mm Slit, Darlington transistor output |
| PS4503A | 270 ~ | 10 | 2 | Light receiving window: 0.5mm Slit, Darlington transistor output |
| PS4504A | 270 ~ | 10 | 2 | Light receiving window: 0.5mm Slit, Darlington transistor output |
| PS4506 | 2.5 ~ | 20 | 2 | Light receiving window: 0.5mm Slit, Single transistor output |

PS4501



Photointerrupter

■ **PS46XX family**

| Type number | Current transfer ratio | | | Features |
|------------------|------------------------|---------|---------|---|
| | CTR (%) | IF (mA) | VCE (V) | |
| PS4601 | 1.5 ~ | 5 | 2 | Small all-in-one type (2.5 mm thick) Single transistor output |
| PS4602 | 1.5 ~ | 5 | 2 | Small all-in-one type (PS4601 with light shield case) Single transistor output |
| PS4602(1) | 1.5 ~ | 5 | 2 | Small all-in-one type (PS4602 short lead type) Single transistor output |
| PS4651 | 40 ~ | 5 | 2 | Small all-in-one type (2.5 mm thick) Darlington transistor output |
| PS4652 | 40 ~ | 5 | 2 | Small all-in-one type (PS4651 with light shield case) Darlington transistor output |
| PS4652(1) | 40 ~ | 5 | 2 | Small all-in-one type (PS4652 short lead type) Darlington transistor output |

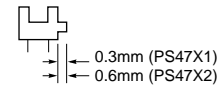
PS4601



■ **PS47XX Family**

| Type number | Current transfer ratio | | | Features |
|--------------------------------|------------------------|---------|---------|---|
| | CTR (%) | IF (mA) | VCE (V) | |
| PS4701 PS4702 | 5 ~ | 5 | 0.6 | Miniature type (4 x 4 x 4 mm) Single transistor output Light receiving window: 0.3mm slit |
| PS4703 | 1.3 ~ | 10 | 0.6 | Snap-in type Single transistor output Light receiving window: 0.5mm slit |
| PS4704 | 1.0 ~ | 10 | 0.6 | Miniature type (3.8 x 4 x 4 mm) Single transistor output Light receiving window: 0.15mm slit |
| PS4751 PS4752 | 100 ~ | 5 | 2 | Miniature type (4 x 4 x 4 mm) Darlington transistor output Light receiving window: 0.3mm slit |

PS4701



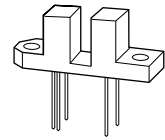
Photointerrupter

PS5XXX Family (photo IC type)

■ PS50XX Family

| Type number | Threshold current | | | Features |
|-------------|----------------------------|---------------------|--------------------|--|
| | (mA) | V _{CC} (V) | R _L (Ω) | |
| PS5001HR | (I _{FLH}) ~ 5 | 5 | - | Internal Schmidt trigger circuit Active high type Internal pull-up resistor Light receiving window: 0.5mm slit (equivalent to 0.5mm [■]) |
| PS5002HR | | | | |
| PS5003HR | | | | |
| PS5001HC | (I _{FLH}) ~ 5 | 5 | 280 | Internal Schmidt trigger circuit Active high type Open-collector output Light receiving window: 0.5mm slit (equivalent to 0.5mm [■]) |
| PS5002HC | | | | |
| PS5003HC | | | | |
| PS5001LR | (I _{FLH}) ~ 5 | 5 | - | Internal Schmidt trigger circuit Active low type Internal pull-up resistor Light receiving window: 0.5mm slit (equivalent to 0.5mm [■]) |
| PS5002LR | | | | |
| PS5003LR | | | | |
| PS5001LC | (I _{FLH}) ~ 5 | 5 | 280 | Internal Schmidt trigger circuit Active low type Open-collector output Light receiving window: 0.5mm slit (equivalent to 0.5mm [■]) |
| PS5002LC | | | | |
| PS5003LC | | | | |

PS5001HR



■ PS57XX Family

| Type number | Threshold current | | | Features |
|----------------------|----------------------------|---------------------|--------------------|---|
| | (mA) | V _{CC} (V) | R _L (Ω) | |
| PS5701HR PS5702HR | (I _{FLH}) ~ 5 | 5 | - | Miniature type (4 ∞ 4 ∞ 4 mm, Light receiving window: 0.3 mm) Internal Schmidt trigger circuit Active high type/internal pull-up resistor |
| PS5701HC PS5702HC | (I _{FLH}) ~ 5 | 5 | 280 | Miniature type (4 ∞ 4 ∞ 4 mm, Light receiving window: 0.3 mm) Internal Schmidt trigger circuit Active high type/open-collector output |
| PS5701LR PS5702LR | (I _{FLH}) ~ 5 | 5 | - | Miniature type (4 ∞ 4 ∞ 4 mm, Light receiving window: 0.3 mm) Internal Schmidt trigger circuit Active low type/internal pull-up resistor |
| PS5701LC PS5702LC | (I _{FLH}) ~ 5 | 5 | 280 | Miniature type (4 ∞ 4 ∞ 4 mm, Light receiving window: 0.3 mm) Internal Schmidt trigger circuit Active low type/open-collector output |
| PS5732LR-R | (I _{FLH}) ~ 3 | 3 | - | Miniature type (4 ∞ 4 ∞ 4 mm, Light receiving window: 0.3 mm) Low supply voltage (1.4 to 7 V) Internal Schmidt trigger circuit Active low type/internal pull-up resistor |

PS5701HR



0.3 mm (PS5701XX)
0.6 mm (PS5702XX)

■ PS6XXX family (reflective type sensor)

| Type number | Light current | | | Features |
|-------------|-------------------------------------|---------------------|---------------------|---|
| | I _L (μA) | I _F (mA) | V _{CE} (V) | |
| PS6001A | 100 ~ (Metal reflection surface) | ≒ 30 | 5 | Single transistor output |
| PS6002A | 400 ~ (White reflection surface) | 10 | 2 | Single transistor output Long detection distance (effective detection distance: 3 to 10 mm) Visible ray cut resin used (light receiving side) |

PS6002A



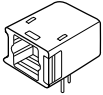
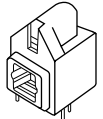
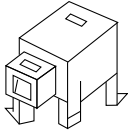
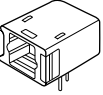
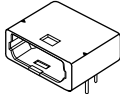
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|---------------------------|
| Opto MOS FET Relay |
|---------------------------|

| Type number | Features | V _{I-O} (V) | V _{BOUT} (V) | I _L (mA) | R _{on} (Ω) | Working I _F (mA) | Package | Remarks |
|-------------|--------------------------|-------------------------|--------------------------|------------------------|---------------------------------|--------------------------------|-----------|---------|
| PFA101A | General use | 1500 | 60 | 150 | 10.0 | 10 | 6-pin DIP | AC/DC |
| PFA112A | | | 100 | 200 | 6.0 | | | |
| PFA113A | | | 100 | 350 | 2.5 | | | |
| PFA122A | | | 200 | 250 | 5.0 | | | |
| PFA141A | | | 400 | 150 | 10.0 | | | |
| PFD102A | | | 60 | 200 | 5.0 | | | DC |
| PFD112A | | | 100 | 250 | 3.0 | | | |
| PFD114A | | | 100 | 450 | 1.3 | | | |
| PFD123A | | | 200 | 350 | 2.5 | | | |
| PFD142A | | | 400 | 200 | 5.0 | | | |
| PFA112B | High sensitivity | 2500 | 100 | 200 | 6.0 | 5 | 6-pin DIP | AC/DC |
| PFA113B | | | 100 | 350 | 2.5 | | | |
| PFA122B | | | 200 | 250 | 5.0 | | | |
| PFA141B | | | 400 | 150 | 10.0 | | | |
| PFA160B | | | 600 | 100 | 50.0 | | | |
| PFD112B | | | 100 | 250 | 3.0 | | | DC |
| PFD114B | | | 100 | 450 | 1.3 | | | |
| PFD123B | | | 200 | 350 | 2.5 | | | |
| PFD142B | | | 400 | 200 | 5.0 | | | |
| PFD161B | | | 600 | 140 | 25.0 | | | |
| PFA141C | High isolation voltage | 5000 | 400 | 150 | 10.0 | 10 | 6-pin DIP | AC/DC |
| PFA160C | | | 600 | 90 | 50.0 | | | DC |
| PFD142C | | | 400 | 200 | 5.0 | | | |
| PFD161C | | | 600 | 120 | 25.0 | | | |
| PFA141E | | 2500 | 400 | 120 | 50.0 | 5 | 6-pin DIP | AC/DC |
| PFA201A | General use 2-channel | 1500 | 60 | 100 | 10.0 | 5 | 8-pin DIP | AC/DC |
| PFA213A | | | 100 | 300 | 2.5 | | | |
| PFA222A | | | 200 | 200 | 5.0 | | | |
| PFA260A | | | 600 | 90 | 50.0 | | | |

Light Transmission Link

| Type number | Absolute maximum rating ($T_a = 25\text{ }^\circ\text{C}$) | | Electrical characteristics ($T_a = 25\text{ }^\circ\text{C}$) | | | |
|-----------------------|---|--------------------------------|---|------------------------------|-----------------------------------|-----------------------|
| | V_{CC} (V) | T_{opt} ($^\circ\text{C}$) | Transmission capacity (bps, NRZ) | Transmission distance (m) | I_{CC} (mA) TYP. | Light output (dBm) |
| PLX101 series | | | DC to 6M | 0.2 to 5 | | |
| PLT101 | -0.5 to +7 | -20 to +70 | | | 15 ($R_L = 8.2\text{ k}\Omega$) | -21 to -15 |
| PLR101 | -0.5 to +7 | -20 to +70 | | | 25 | |
| PLX102 series | | | DC to 6M | 0.2 to 5 | | |
| PLT102 | -0.5 to +7 | -20 to +70 | | | 15 ($R_L = 8.2\text{ k}\Omega$) | -21 to -15 |
| PLR102 | -0.5 to +7 | -20 to +70 | | | 25 | |
| PLX104 series | | | DC to 6M | 0.2 to 5 | | |
| PLT104 | -0.5 to +7 | -20 to +70 | | | 15 ($R_L = 8.2\text{ k}\Omega$) | -21 to -15 |
| PLR104 | -0.5 to +7 | -20 to +70 | | | 25 | |
| PLX1101 series | | | DC to 6M | 0.1 to 50 | | |
| PLT1101 | -0.5 to +7 | -20 to +70 | | | 15 ($R_L = 8.2\text{ k}\Omega$) | -21 to -11 |
| PLR1101 | -0.5 to +7 | -20 to +70 | | | 25 | |
| PLX201 series | | | DC to 6M | 0.1 to 50 | | |
| PLD201A | -0.5 to +7 | -20 to +70 | | | | -21 to -11 |

Configuration

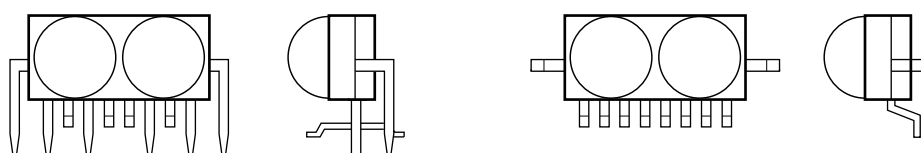
| Link name | Optical transmission module | Optical receive module | Optical transmission/receive module | Remarks |
|----------------|--|------------------------|---|---|
| PLX101 series | PLT101  | PLR101 | — | BS tuner TV with BS tuner Audio equipment |
| PLX102 series | PLT102  | PLR102 | — | |
| PLX104 series | PLT104  | PLR104* | — | |
| PLX1101 series | PLT1101  | PLR1101 | — | FA, OA, measurement and test equipment |
| PLX201 series | — | — | PLD201A  | |

★: Under development

Infra-Red Link Unit

Conform to IrDA Ver. 1.0/Ver. 2.0

| Type number | Absolute maximum rating (T _A = 25 fC) | | Electrical characteristics (T _A = 25 fC) | | | Package (package No.) |
|------------------|---|--------------------------|---|---------------------------------|-----------------------|--------------------------|
| | V _{CC} (V) | T _{opt} (fC) | Data rate (bps) | Transmission distance (m) | Viewing angle (°C) | |
| PLS4001L1 | -0.5 to +7.0 | 0 to +70 | 2.4 k to 4 M | ~ 1.0 | 30 | P1 |
| PLS4001L2 | | | | | | P2 |

| | | |
|-------------|--|----|
| Package |  | |
| Package No. | P1 | P2 |

Packages

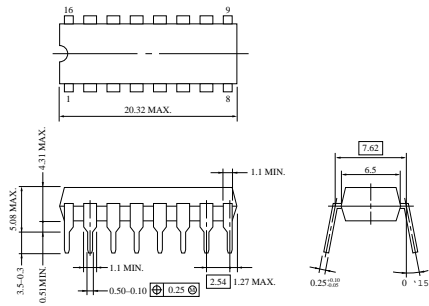
| | |
|---------------------|-----|
| Plastic DIP | 198 |
| Ceramic DIP | 201 |
| Plastic SOP | 202 |
| Plastic TSOP | 204 |
| Plastic QFP | 205 |
| QFJ | 208 |
| Ceramic PGA..... | 209 |
| Plastic SIP | 210 |
| Plastic V-DIP | 211 |
| Plastic ZIP | 211 |
| Plastic Mold..... | 212 |

Note: Only typical packages are shown here.



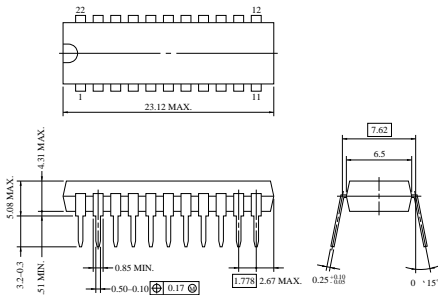
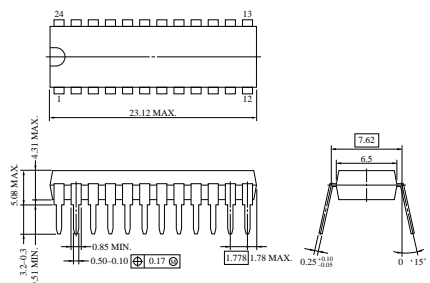
Plastic DIP (Dual In-line Package)

Units in mm

| | |
|--|--|
| <p>8-pin plastic DIP (300mil)</p> <p style="text-align: right;">P8C-100-300B, C</p> | <p>14-pin plastic DIP (300mil)</p> <p style="text-align: right;">P14C-100-300B1</p> |
| <p>14-pin plastic shrink DIP (300mil)</p> <p style="text-align: right;">P14C-70-300B</p> | <p>16-pin plastic DIP (300mil)</p>  <p style="text-align: right;">P16C-100-300B-1</p> |
| <p>16-pin plastic shrink DIP (300mil)</p> <p style="text-align: right;">P16C-70-300B</p> | <p>16-pin plastic DIP with TAB (300mil)</p> <p style="text-align: right;">P16CT-100-300B</p> |
| <p>18-pin plastic DIP (mil)</p> <p style="text-align: right;">P18C-100-300A, C</p> | <p>18-pin plastic shrink DIP (300mil)</p> <p style="text-align: right;">P18C-70-300B</p> |

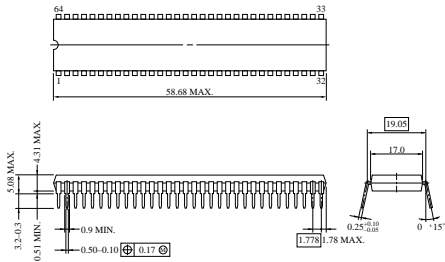
Plastic DIP (Dual In-line Package)

Units in mm

| | |
|--|--|
| <p>20-pin plastic DIP (300mil)</p> <p style="text-align: center;">P20C-100-300A, C</p> | <p>20-pin plastic shrink DIP (300mil)</p> <p style="text-align: center;">P20C-70-300B</p> |
| <p>22-pin plastic DIP (300mil)</p> <p style="text-align: center;">P22C-100-300WA</p> | <p>22-pin plastic shrink DIP (300mil)</p>  <p style="text-align: center;">S22C-70-300B-1</p> |
| <p>24-pin plastic DIP (300mil)</p> <p style="text-align: center;">P24C-100-300A</p> | <p>24-pin plastic shrink DIP (300mil)</p>  <p style="text-align: center;">S24C-70-300B-1</p> |
| <p>28-pin plastic DIP (400mil)</p> <p style="text-align: center;">P28C-100-400</p> | <p>28-pin plastic shrink DIP (400mil)</p> <p style="text-align: center;">S28C-70-400B</p> |

Plastic DIP (Dual In-line Package)

Units in mm

| | |
|--|--|
| <p>30-pin plastic shrink DIP (400mil)</p> <p style="text-align: right;">S30C-70-400B</p> | <p>40-pin plastic DIP (600mil)</p> <p style="text-align: right;">P40C-100-600A</p> |
| <p>40-pin plastic shrink DIP (600mil)</p> <p style="text-align: right;">P40C-70-600A</p> | <p>42-pin plastic DIP (600mil)</p> <p style="text-align: right;">P42C-100-600A, B</p> |
| <p>42-pin plastic shrink DIP (600mil)</p> <p style="text-align: right;">P42C-70-600A</p> | <p>48-pin plastic DIP (600mil)</p> <p style="text-align: right;">P48C-100-600A</p> |
| <p>48-pin plastic shrink DIP (600mil)</p> <p style="text-align: right;">P48C-70-600B</p> | <p>64-pin plastic shrink DIP (750mil)</p>  <p style="text-align: right;">P64C-70-750A, C-1</p> |

Ceramic DIP (Dual In-line Package)

Units in mm

| | |
|--|---|
| <p>8-pin ceramic DIP (300mil)</p> <p>Top view: 10.16 MAX. Side view: 5.08 MAX., 3.80, 0.89 MIN., 0.25-0.05, 0°-15°. Detail view: 3.0-0.3, 0.51 MIN., 1.42 MIN., 2.54, 1.27 MAX., 0.46-0.05, 0.25.</p> <p>P8DH-100-300A, B-1</p> | <p>14-pin ceramic DIP (300mil)</p> <p>Top view: 20.32 MAX. Side view: 5.08 MAX., 3.80, 6.30, 0.25-0.05, 0°-15°. Detail view: 3.0-0.3, 0.51 MIN., 1.42 MIN., 2.54, 2.54 MAX., 0.46-0.05, 0.25.</p> <p>P14DH-100-300A1, B-1</p> |
| <p>16-pin ceramic DIP (300mil)</p> <p>Top view: 20.32 MAX. Side view: 5.08 MAX., 3.70, 0.89 MIN., 0.25-0.05, 0°-15°. Detail view: 3.0-0.3, 0.51 MIN., 1.42 MIN., 2.54, 1.27 MAX., 0.46-0.05, 0.25.</p> <p>P16DH-100-300A1-1</p> | <p>24-pin ceramic DIP (600mil)</p> <p>Top view: 33.02 MAX. Side view: 4.57 MAX., 2.64, 15.24, 14.93, 0.25-0.05, 0°-15°. Detail view: 3.5-0.3, 1.0 MIN., 0.92 MIN., 2.54, 2.54 MAX., 0.46-0.05, 0.25.</p> <p>P24D-100-600A-1</p> |
| <p>28-pin ceramic DIP (600mil)</p> <p>Top view: 38.10 MAX. Side view: 4.57 MAX., 2.64, 15.24, 14.93, 0.25-0.05, 0°-15°. Detail view: 3.5-0.3, 1.0 MIN., 0.92 MIN., 2.54, 2.54 MAX., 0.46-0.05, 0.25.</p> <p>P28D-100-600A1-1</p> | <p>42-pin ceramic DIP (600mil)</p> <p>Top view: 55.88 MAX. Side view: 4.57 MAX., 2.64, 15.24, 14.93, 0.25-0.05, 0°-15°. Detail view: 3.5-0.3, 1.0 MIN., 0.92 MIN., 2.54, 2.54 MAX., 0.46-0.05, 0.25.</p> <p>P42D-100-600A-1</p> |
| <p>48-pin ceramic DIP (600mil)</p> <p>Top view: 63.50 MAX. Side view: 4.57 MAX., 2.74, 15.24, 14.93, 0.25-0.05, 0°-15°. Detail view: 3.5-0.3, 1.0 MIN., 0.92 MIN., 2.54, 2.54 MAX., 0.46-0.05, 0.25.</p> <p>P48D-100-600A-1</p> | <p>64-pin ceramic DIP (750mil)</p> <p>Top view: 58.68 MAX. Side view: 5.08 MAX., 2.62, 19.05, 18.8, 0.25-0.05, 0°-15°. Detail view: 3.5-0.3, 1.0 MIN., 0.8 MIN., 1.778 MAX., 0.46-0.05, 0.25.</p> <p>P64D-70-750A-1</p> |

Plastic SOP (Small Out-line Package)

Units in mm

| | |
|--|--|
| <p>8-pin plastic SOP (225mil)</p> <p style="text-align: center;">S8GM-50-225B-4</p> | <p>14-pin plastic SOP (225mil)</p> <p style="text-align: center;">S14GM-50-225B, C-4</p> |
| <p>14-pin plastic shrink SOP (225mil)</p> <p style="text-align: center;">P14GM-65-225B-2</p> | <p>16-pin plastic SOP (225mil)</p> <p style="text-align: center;">S16GM-50-225B, C-4</p> |
| <p>16-pin plastic SOP (300mil)</p> <p style="text-align: center;">P16GM-50-300B-4</p> | <p>16-pin plastic SOP (375mil)</p> <p style="text-align: center;">P16GM-50-375A-2</p> |
| <p>16-pin plastic SOP (575mil)</p> <p style="text-align: center;">P16GM-50-375B-3</p> | <p>20-pin plastic SOP (300mil)</p> <p style="text-align: center;">P20GM-50-300B, C-4</p> |

Plastic SOP (Small Out-line Package)

Units in mm

| | |
|--|--|
| <p>20-pin plastic SOP (375mil)</p> <p>Detail of lead end</p> <p>P20GM-50-375B-4</p> | <p>24-pin plastic SOP (300mil)</p> <p>Detail of lead end</p> <p>P24GM-50-300B-4</p> |
| <p>24-pin plastic SOP (375mil)</p> <p>Detail of lead end</p> <p>P24GM-50-375B-3</p> | <p>24-pin plastic SOP (450mil)</p> <p>Detail of lead end</p> <p>P24GM-50-450A-2</p> |
| <p>28-pin plastic SOP (375mil)</p> <p>Detail of lead end</p> <p>P28GM-50-375B-3</p> | <p>28-pin plastic SOP (450mil)</p> <p>Detail of lead end</p> <p>P28GM-50-450A1-2</p> |
| <p>28-pin plastic SOP (450mil)</p> <p>Detail of lead end</p> <p>P28GM-50-450A2-2</p> | <p>36-pin plastic shrink SOP (300mil)</p> <p>Detail of lead end</p> <p>P36GM-80-300B-3</p> |

Plastic TSOP (Thin Small Out-line Package)

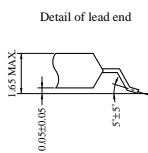
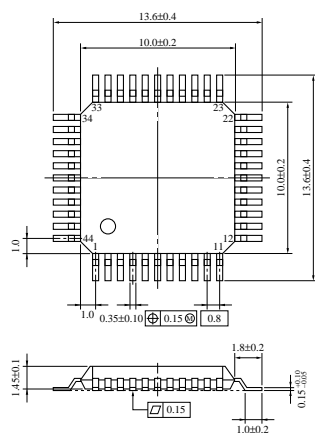
Units in mm

| | |
|---|--|
| <p>32-pin plastic TSOP(I) (8 ∞ 20)</p> <p style="text-align: center;">S32GZ-50-KJH-1</p> | <p>32-pin plastic TSOP(II) (400mil)</p> <p style="text-align: center;">S32G5-50-7JD-2</p> |
| <p>40-pin plastic TSOP(I) (10 ∞ 20)</p> <p style="text-align: center;">S40GZ-50-LJH-1</p> | <p>44-pin plastic TSOP(II) (400mil)</p> <p style="text-align: center;">S44G5-80-7JF1-1</p> |
| <p>26-pin plastic TSOP(II) (300mil)</p> <p style="text-align: center;">S26G3-50-7JD1</p> | <p>50-pin plastic TSOP(II) (400mil)</p> <p style="text-align: center;">S50G5-80-7JF2</p> |
| <p>28-pin plastic TSOP(II) (400mil)</p> <p style="text-align: center;">S28G5-50-7JD-2</p> | <p>70-pin plastic TSOP(II) (400mil)</p> <p style="text-align: center;">S70G5-65-7JG</p> |

Plastic QFP (Quad Flat Package)

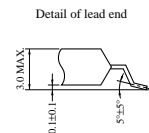
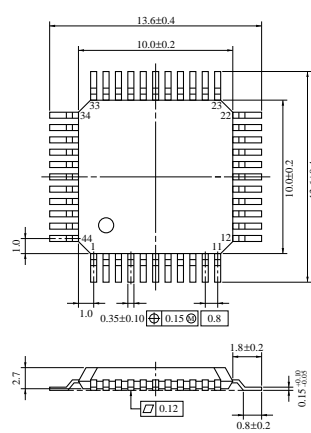
Units in mm

44-pin plastic QFP



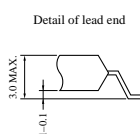
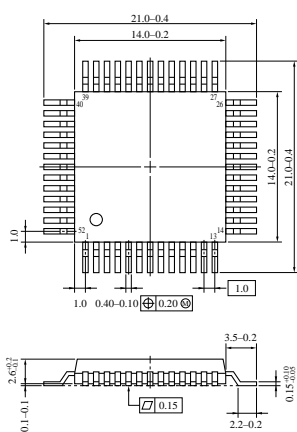
P44G-80-22-2

44-pin plastic QFP



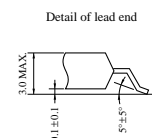
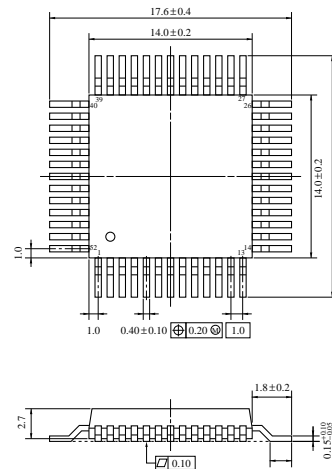
P44GB-80-3B4-2

52-pin plastic QFP



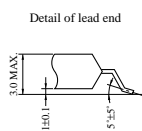
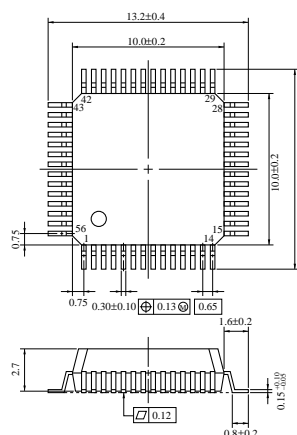
P52G-100-00-2

52-pin plastic QFP



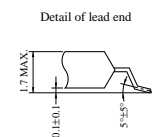
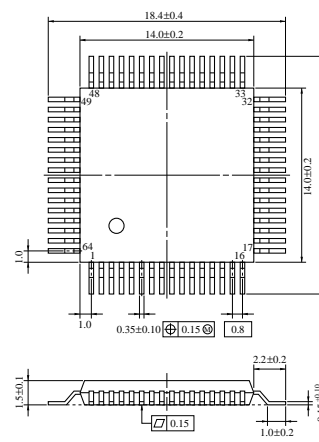
P52GC-100-3B6, 3BH-2

56-pin plastic QFP



S56GB-65-3B7-2

64-pin plastic QFP



P64G-80-22-2

Plastic QFP (Quad Flat Package)

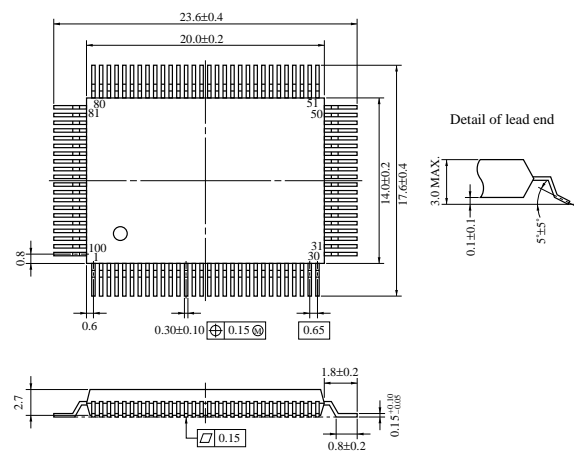
Units in mm

| | |
|---|--|
| <p>64-pin plastic QFP</p> <p style="text-align: center;">P64GC-80-3BE-2</p> | <p>64-pin plastic QFP</p> <p style="text-align: center;">P64G-100-12, 1B-2</p> |
| <p>64-pin plastic QFP</p> <p style="text-align: center;">P64GF-100-3B8, 3BE-1</p> | <p>80-pin plastic QFP</p> <p style="text-align: center;">P80G-80-12-2</p> |
| <p>80-pin plastic QFP</p> <p style="text-align: center;">P80GF-80-3B9-2</p> | <p>100-pin plastic QFP</p> <p style="text-align: center;">P100G-65-12-2</p> |

Plastic QFP (Quad Flat Package)

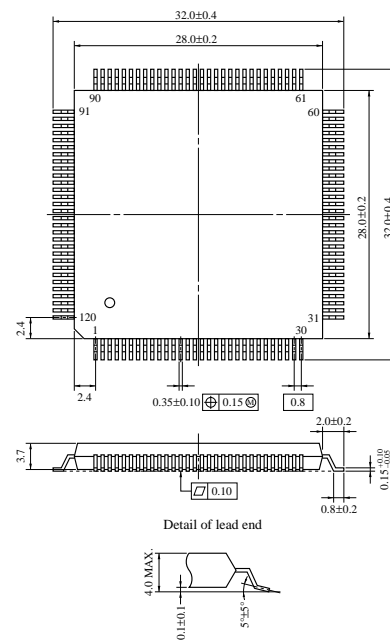
Units in mm

100-pin plastic QFP



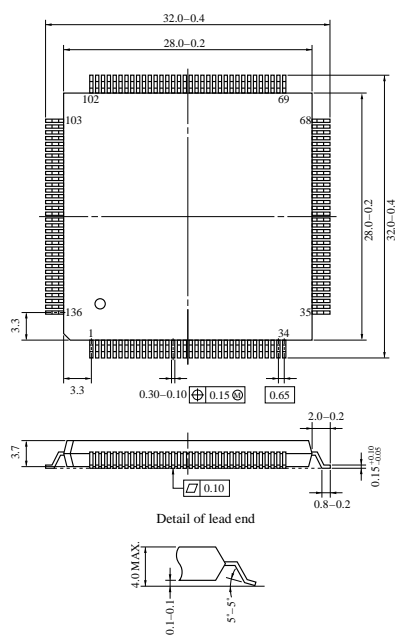
P100GF-65-3BA-2

120-pin plastic QFP



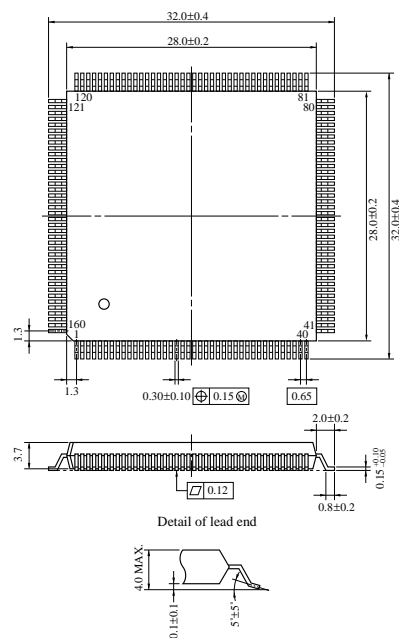
P120GD-80-5BB-3

136-pin plastic QFP



P136GD-65-5BC-3

160-pin plastic QFP

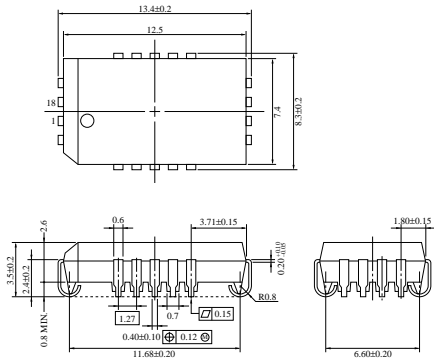


P160GD-65-5BD-2

QFJ (Quad Flat J-Lead)

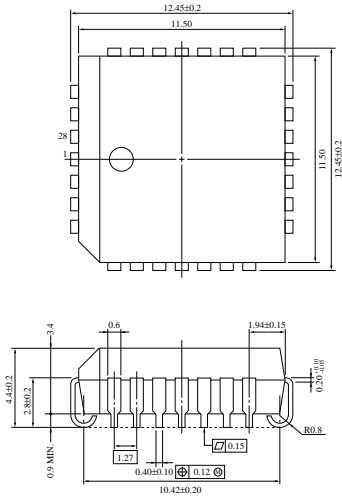
Units in mm

18-pin QFJ



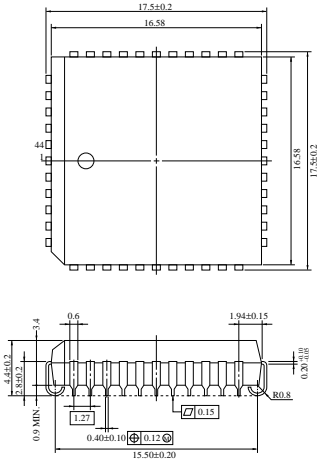
P18L-50A-2

28-pin QFJ



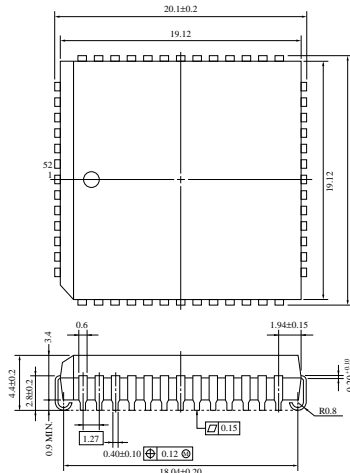
P28L-50A1-2

44-pin QFJ



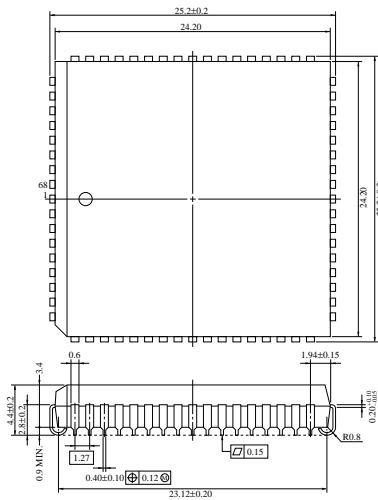
P44L-50A1-2

52-pin QFJ



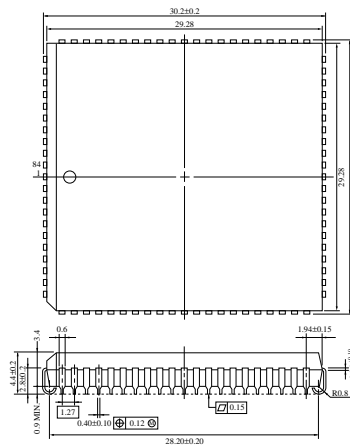
P52L-50A1-2

68-pin QFJ



P68L-50A1-2

84-pin QFJ



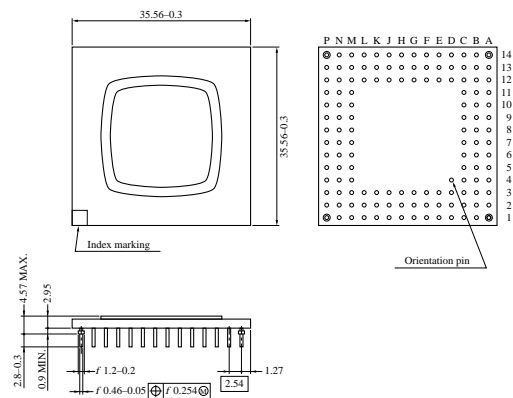
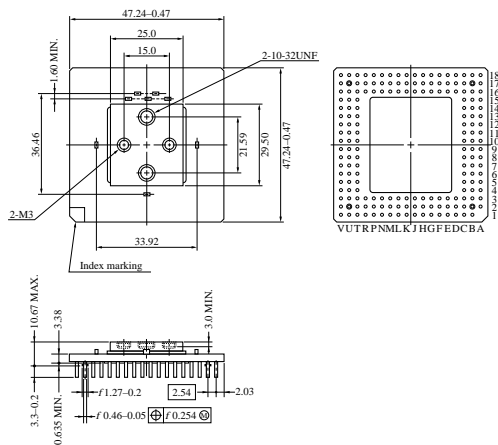
P84L-50A3-2

Ceramic PGA (Pin Grid Array)

Units in mm

68-pin ceramic PGA

132-pin ceramic PGA

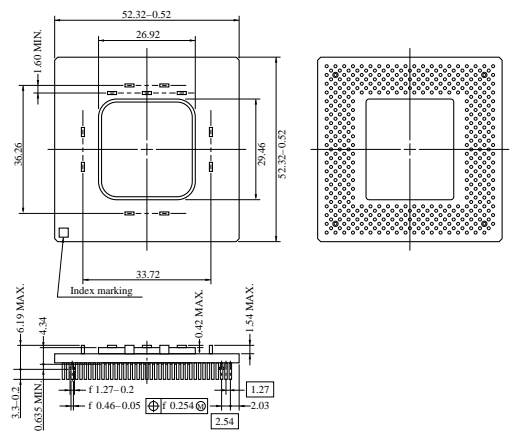
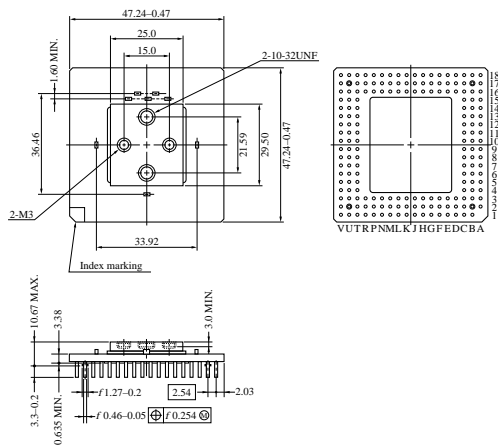


X68R-100A-1

X132R-100A-1

179-pin ceramic PGA

447-pin ceramic PGA



X179RP-100A

X447RG-50A-2

Plastic SIP (Single In-line Package)

Units in mm

| | |
|--|---|
| <p>7-pin plastic slim SIP</p> <p style="text-align: right;">P7HA-254B</p> | <p>7-pin plastic power SIP</p> <p style="text-align: right;">P7HP-254B</p> |
| <p>8-pin plastic slim SIP</p> <p style="text-align: right;">P8HA-254B</p> | <p>8-pin plastic power SIP</p> <p style="text-align: right;">P8HP-254B</p> |
| <p>9-pin plastic slim SIP</p> <p style="text-align: right;">P9HA-254B</p> | <p>9-pin plastic power SIP</p> <p style="text-align: right;">P9HP-254B-1</p> |
| <p>10-pin plastic slim SIP</p> <p style="text-align: right;">P10HP-254B1</p> | <p>12-pin plastic power SIP</p> <p style="text-align: right;">P12HP-154B2</p> |

**Plastic V-DIP
(Vertical Dual In-line Package)**

**Plastic ZIP
(Zigzag In-line Package)**

Units in mm

| | |
|--|--|
| <p>5-pin plastic power V-DIP</p> <p style="text-align: right;">P5VP-340B3-1</p> | <p>16-pin plastic ZIP</p> <p style="text-align: right;">P16V-254A-1</p> |
| <p>11-pin plastic power V-DIP</p> <p style="text-align: right;">P11VP-340B</p> | <p>19-pin plastic ZIP</p> <p style="text-align: right;">P19V-254B-1</p> |
| <p>14-pin plastic power V-DIP</p> <p style="text-align: right;">P15VP-254B</p> | <p>20-pin plastic ZIP</p> <p style="text-align: right;">P20V-254A-1</p> |
| <p>14-pin plastic power V-DIP</p> <p style="text-align: right;">P14VP-340B</p> | <p>24-pin plastic ZIP</p> <p style="text-align: right;">P24V-254-400A-1</p> |

Plastic Mold

Units in mm

| | |
|---|---|
| <p>2-pin ultra super mini mold</p> | <p>3-pin super mini mold (SC-70)</p> |
| <p>2-pin super mini mold</p> | <p>3-pin mini mold (SC-59)</p> |
| <p>2-pin power mini mold</p> | <p>3-pin power mini mold (SC-62)</p> |
| <p>3-pin ultra super mini mold</p> | <p>MP-2</p> |

Plastic Mold

Units in mm

| | |
|------------------------------|------------------------------|
| MP-3Z (SC-64) | 6-pin super mini mold |
| MP-25Z | 6-pin mini mold |
| 5-pin super mini mold | |
| 5-pin mini mold | |

Plastic Mold

Units in mm

| | |
|------------------------------|----------------------------|
| <p>TO-92</p> | <p>SST</p> |
| <p>SP-8</p> | <p>MP-3 (SC-63)</p> |
| <p>MP-25 (TO-220)</p> | <p>MP-45F</p> |
| <p>MP-10</p> | <p>MP-88</p> |

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