

S1C17W03/W04 (rev1.0)

EPSON
EXCEED YOUR VISION

New Series

16-bit Single Chip Microcontroller

- Low voltage operation from 1.2 V with a single alkaline or silver oxide button battery.
- Ultra low standby power consumption (0.3 μ A during HALT state in super economy mode)
- Embedded A/D converter to support various sensing applications

■ DESCRIPTIONS

The S1C17W03/W04 is a 16-bit MCU that features low-voltage operation from 1.2 V even though Flash memory is included. The embedded high-efficiency DC-DC converter generates the constant-voltage to drive the IC with lower power consumption than 4-bit MCUs. This IC includes a real-time clock, a stopwatch, an A/D converter, and a PWM timer capable of being used to generate drive waveforms for a motor driver as well as a high-performance 16-bit CPU. It is suitable for battery-driven applications that require an A/D conversion function and timers.

■ FEATURES

| Model | S1C17W03 | S1C17W04 |
|---|--|--|
| CPU | | |
| CPU core | Seiko Epson original 16-bit RISC CPU core S1C17 | |
| Other | On-chip debugger | |
| Embedded Flash memory | | |
| Capacity | 16K bytes (for both instructions and data) | 32K bytes (for both instructions and data) |
| Erase/program count | 50 times (min.) * Programming by the debugging tool ICDmini | |
| Other | Security function to protect from reading/programming by ICDmini On-board programming function using ICDmini | |
| Embedded RAM | | |
| Capacity | 2K bytes | |
| Clock generator (CLG) | | |
| System clock source | 4 sources (IOSC/OSC1/OSC3/EXOSC) | |
| System clock frequency (operating frequency) | 1.1 MHz (max.) $V_{DD} = 1.2$ to 1.6 V 4.2 MHz (max.) $V_{DD} = 1.6$ to 3.6 V | |
| IOSC oscillator circuit (boot clock source) | 700 kHz (typ.) embedded oscillator 23 μ s (max.) starting time (time from cancelation of SLEEP state to vector table read by the CPU) | |
| OSC1 oscillator circuit | 32.768 kHz (typ.) crystal oscillator Oscillation stop detection circuit included | |
| OSC3 oscillator circuit | 4.2 MHz (max.) crystal/ceramic oscillator (48-pin package or chip) 250, 384, 500 kHz, 1, 2, and 4 MHz-switchable embedded oscillator 2.1 MHz (max.) CR oscillator (an external R is required) (48-pin package or chip) | |
| EXOSC clock input | 4.2 MHz (max.) square or sine wave input | |
| Other | Configurable system clock division ratio Configurable system clock used at wake up from SLEEP state Operating clock frequency for the CPU and all peripheral circuits is selectable. | |
| I/O port (PPORT) | | |
| Number of general-purpose I/O ports | Input/output port: 34 bits (max., 48-pin package or chip) 23 bits (max., 32-pin package) Output port: 1 bit (max.) Pins are shared with the peripheral I/O. | |
| Number of input interrupt ports | 30 bits (max., 48-pin package or chip) 21 bits (max., 32-pin package) | |
| Number of ports that support universal port multiplexer (UPMUX) | 24 bits (48-pin package or chip) 21 bits (32-pin package) A peripheral circuit I/O function selected via software can be assigned to each port. | |
| Timers | | |
| Watchdog timer (WDT) | Generates NMI or watchdog timer reset. | |
| Real-time clock (RTCA) | 128-1 Hz counter, second/minute/hour/day/day of the week/month/year counters Theoretical regulation function for 1-second correction Alarm and stopwatch functions | |

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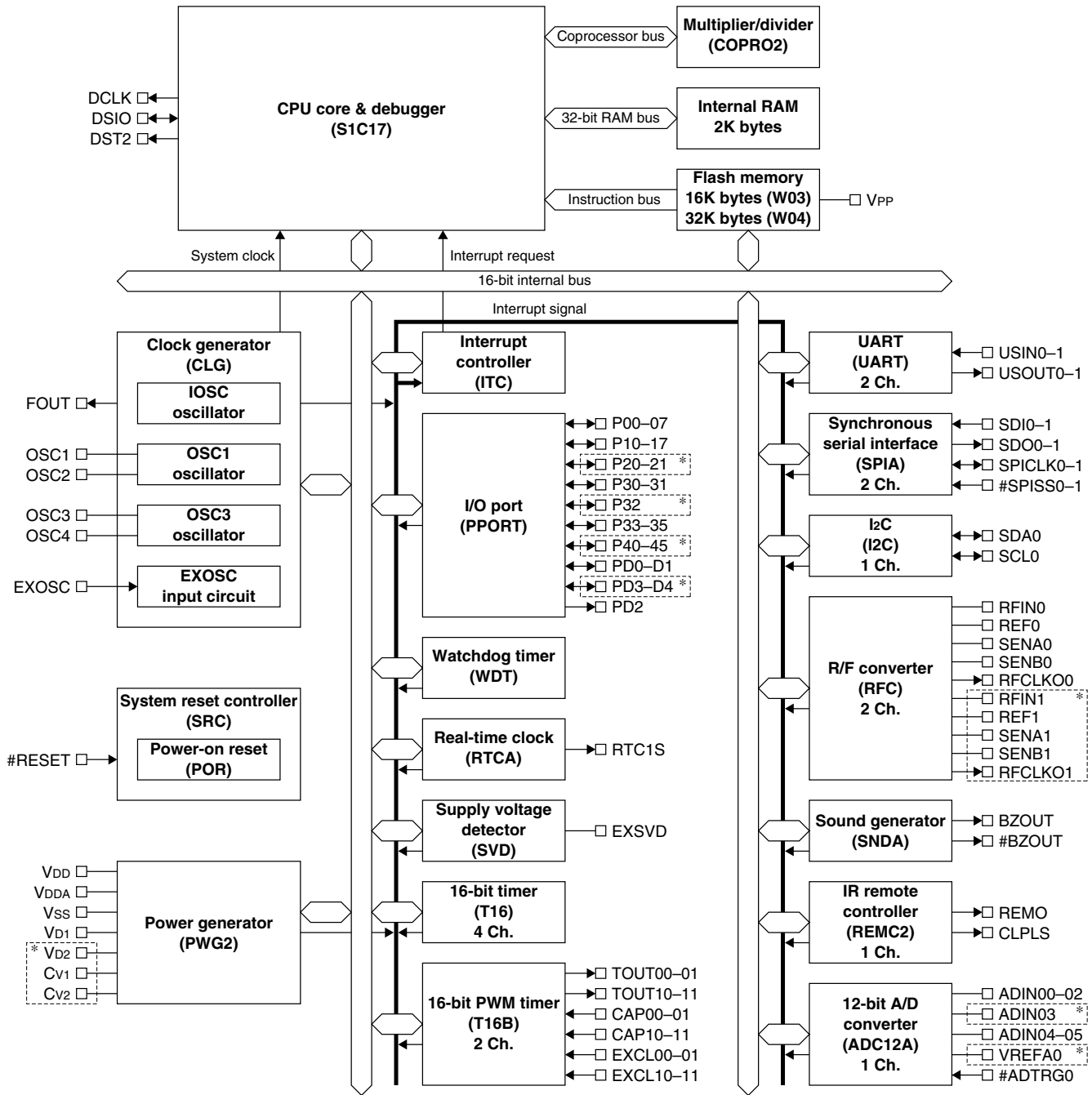
| Model | S1C17W03 | S1C17W04 |
|--------------------------------------|---|----------|
| Timers | | |
| 16-bit timer (T16) | 4 channels Generates the SPIA master clocks and the ADC12A operating clock/trigger signal. | |
| 16-bit PWM timer (T16B) | 2 channels Event counter/capture function PWM waveform generation function Number of PWM output or capture input ports: 2 ports/channel | |
| Supply voltage detector (SVD) | | |
| Detection level | 30 levels (1.2 to 3.6 V) | |
| Detection accuracy | ±3 % | |
| Other | Intermittent operation mode Generates an interrupt or reset according to the detection level evaluation. | |
| Serial interfaces | | |
| UART (UART) | 2 channels Baud-rate generator included, IrDA1.0 supported | |
| Synchronous Serial Interface (SPIA) | 2 channels 2 to 16-bit variable data length The 16-bit timer (T16) can be used for the baud-rate generator in master mode. | |
| I ² C (I2C) | 1 channel Baud-rate generator included | |
| Sound generator (SNDA) | | |
| Buzzer output function | 512 Hz to 16 kHz output frequencies One-shot output function | |
| Melody generation function | Pitch: 128 Hz to 16 kHz ≈ C3 to C6 Duration: 7 notes/rests (Half note/rest to thirty-second note/rest) Tempo: 16 tempos (30 to 480) Tie/slur may be specified. | |
| IR remote controller (REMC2) | | |
| Number of transmitter channels | 1 channel | |
| Other | EL lamp drive waveform can be generated for an application example. | |
| R/F converter (RFC) | | |
| Conversion method | CR oscillation type with 24-bit counters | |
| Number of conversion channels | 2 channels (48-pin package or chip) 1 channel (32-pin package) (Up to two sensors can be connected to each channel.) | |
| Supported sensors | DC-bias resistive sensors, AC-bias resistive sensors (Ch.0 only) | |
| 12-bit A/D converter (ADC12A) | | |
| Conversion method | Successive approximation type | |
| Resolution | 12 bits | |
| Number of conversion channels | 1 channel | |
| Number of analog signal inputs | 6 ports/channel (48-pin package or chip) 5 ports/channel (32-pin package) | |
| Multiplier/divider (COPRO2) | | |
| Arithmetic functions | 16-bit × 16-bit multiplier 16-bit × 16-bit + 32-bit multiply and accumulation unit 32-bit ÷ 32-bit divider | |
| Reset | | |
| #RESET pin | Reset when the reset pin is set to low. | |
| Power-on reset | Reset at power on. | |
| Key entry reset | Reset when the P00 to P01/P02/P03 keys are pressed simultaneously (can be enabled/disabled using a register). | |
| Watchdog timer reset | Reset when the watchdog timer overflows (can be enabled/disabled using a register). | |
| Supply voltage detector reset | Reset when the supply voltage detector detects the set voltage level (can be enabled/disabled using a register). | |
| Interrupt | | |
| Non-maskable interrupt | 4 systems (Reset, address misaligned interrupt, debug, NMI) | |
| Programmable interrupt | External interrupt: 1 system (8 levels) Internal interrupt: 20 systems (8 levels) | |

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| Model | S1C17W03 | S1C17W04 |
|--|--|----------|
| Power supply voltage | | |
| V _{DD} operating voltage | 1.2 to 3.6 V | |
| V _{DD} operating voltage for Flash programming | 1.8 to 3.6 V (V _{PP} = 7.5 V external power supply is required.) | |
| V _{DD} operating voltage for super economy mode | 2.5 to 3.6 V (48-pin package or chip) | |
| V _{DDA} analog operating voltage | 1.2 to 3.6 V (Power supply for P3[5:0] and P4[5:4] ports) | |
| V _{DDA} analog operating voltage for A/D conversion | 1.8 to 3.6 V | |
| Operating temperature | | |
| Operating temperature range | -40 to 85 °C | |
| Current consumption (Typ. value) | | |
| SLEEP mode | 0.15 μA IOSC = OFF, OSC1 = OFF, OSC3 = OFF | |
| HALT mode | 0.5 μA OSC1 = 32 kHz, RTC = ON | |
| | 0.3 μA (48-pin package or chip) OSC1 = 32 kHz, RTC = ON, super economy mode | |
| RUN mode | 8 μA OSC1 = 32 kHz, RTC = ON, CPU = OSC1 | |
| | 4 μA (48-pin package or chip) OSC1 = 32 kHz, RTC = ON, CPU = OSC1, super economy mode | |
| | 250 μA | |
| | OSC3 = 1 MHz (ceramic oscillator), OSC1 = 32 kHz, RTC = ON, CPU = OSC3 | |
| Shipping form | | |
| 1 | TQFP12-48pin (Lead pitch: 0.5 mm) | |
| 2 | SQFN5-32pin (Lead pitch: 0.5 mm) | |
| 3 | Die form (Pad pitch: 80 μm (min.)) | |

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■ BLOCK DIAGRAM

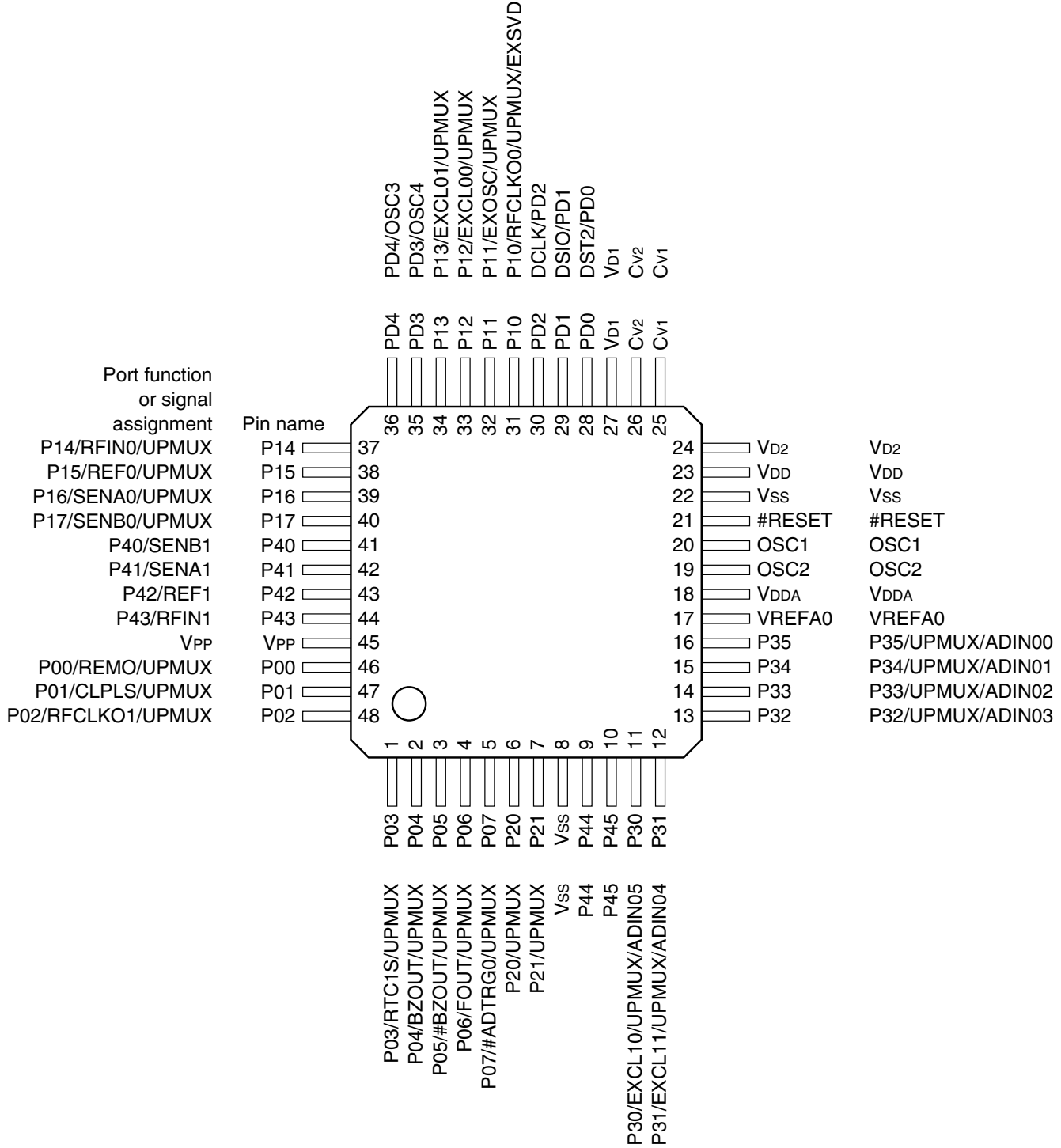


* These pins do not exist in the 32-pin package.

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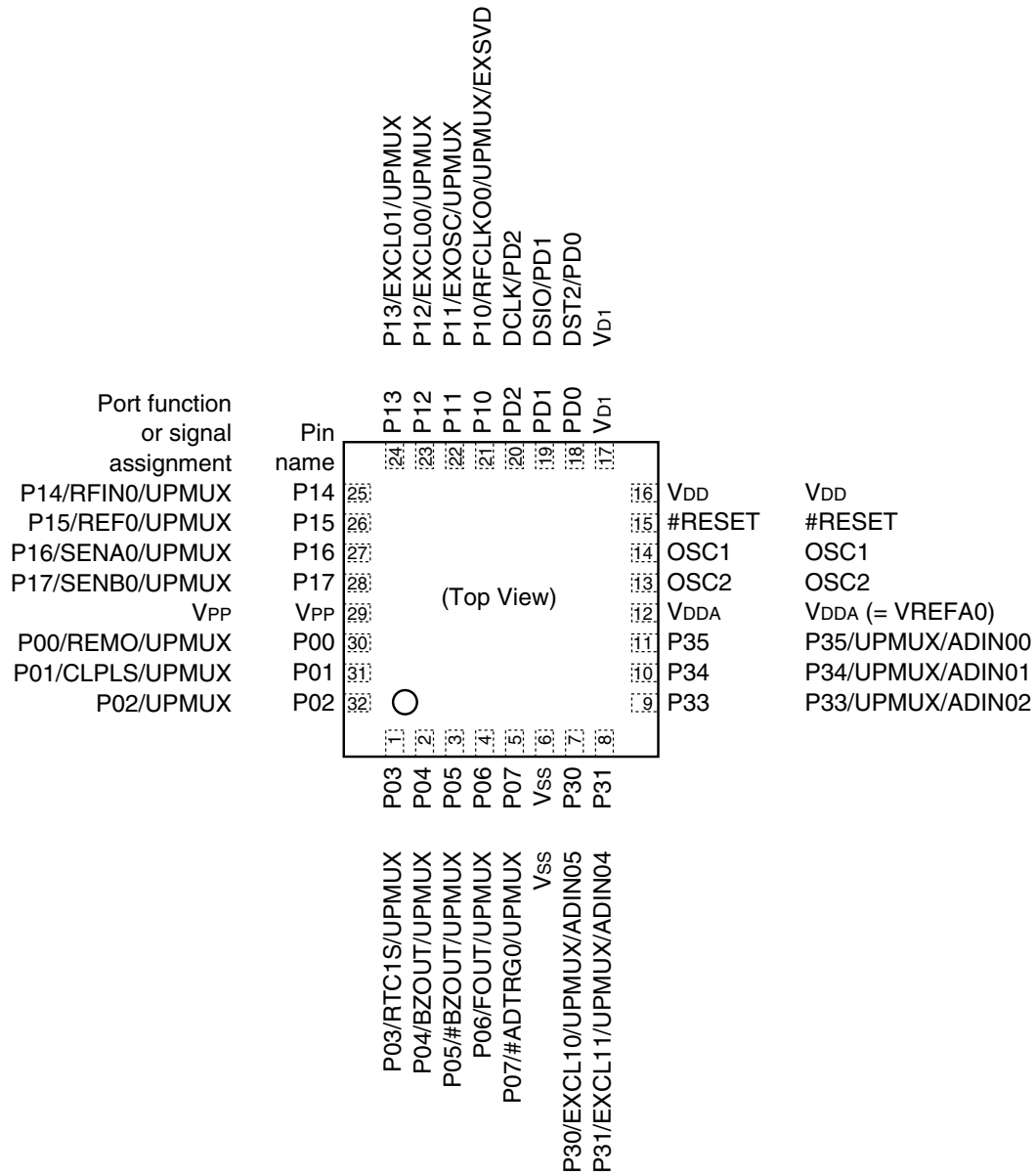
■ PIN CONFIGURATION DIAGRAMS

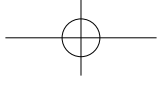
TQFP12-48pin



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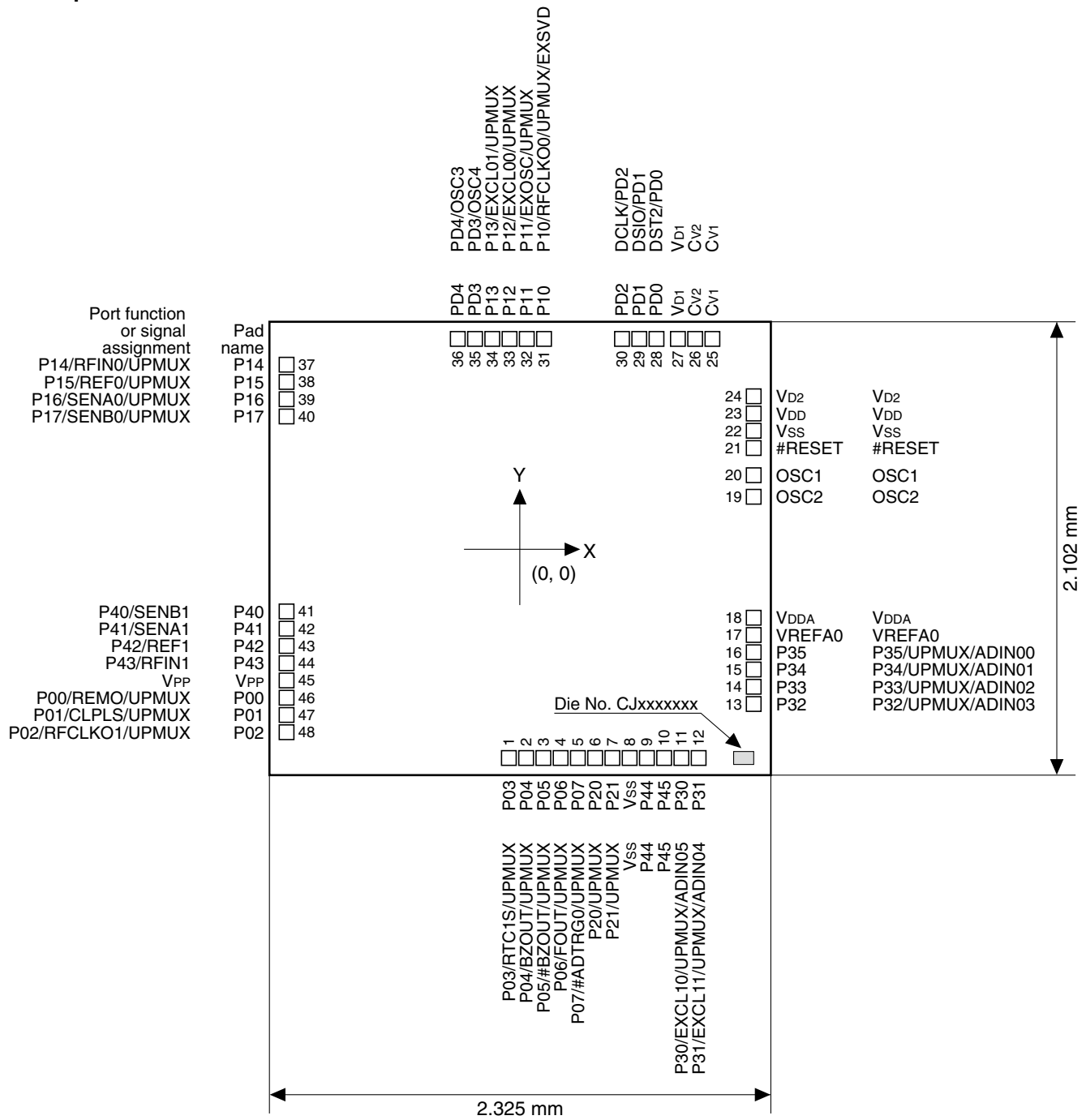
SQFN5-32pin





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Chip



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■ PIN DESCRIPTIONS

Symbol meanings

Assigned signal: The signal listed at the top of each pin is assigned in the initial state. The pin function must be switched via software to assign another signal (see the “I/O Ports” chapter).

| | | |
|----------------|---------------|--------------------------|
| I/O: | I | = Input |
| | O | = Output |
| | I/O | = Input/output |
| | P | = Power supply |
| | A | = Analog signal |
| | Hi-Z | = High impedance state |
| Initial state: | I (Pull-up) | = Input with pulled up |
| | I (Pull-down) | = Input with pulled down |
| | Hi-Z | = High impedance state |
| | O (H) | = High level output |
| | O (L) | = Low level output |

Tolerant fail-safe structure:

| | |
|---|--|
| ✓ | = Over voltage tolerant fail-safe type I/O cell included (see the “I/O Ports” chapter) |
| | The over voltage tolerant fail-safe type I/O cell allows interfacing without passing unnecessary current even if a voltage exceeding V_{DD} is applied to the port. Also unnecessary current is not consumed when the port is externally biased without supplying V_{DD} . |

| Pin/pad name | Assigned signal | I/O | Initial state | Tolerant fail-safe structure | Function | 32-pin | 48-pin/Chip |
|--------------|-----------------|-----|---------------|------------------------------|---|--------|-------------|
| VDD | VDD | P | – | – | Power supply (+) | ✓ | ✓ |
| VDDA | VDDA | P | – | – | Analog power supply (+) | ✓ | ✓ |
| VSS | VSS | P | – | – | GND | ✓ | ✓ |
| VPP | VPP | P | – | – | Power supply for Flash programming | ✓ | ✓ |
| Vd1 | Vd1 | A | – | – | DC-DC converter output | ✓ | ✓ |
| Vd2 | Vd2 | A | – | – | DC-DC converter stabilization capacitor connect pin | – | ✓ |
| CV1-2 | CV1-2 | A | – | – | DC-DC converter charge pump capacitor connect pins | – | ✓ |
| OSC1 | OSC1 | A | – | – | OSC1 oscillator circuit input | ✓ | ✓ |
| OSC2 | OSC2 | A | – | – | OSC1 oscillator circuit output | ✓ | ✓ |
| VREFA0 | VREFA0 | A | – | – | 12-bit A/D converter Ch.0 reference voltage input | – | ✓ |
| #RESET | #RESET | I | I (Pull-up) | – | Reset input | ✓ | ✓ |
| P00 | P00 | I/O | Hi-Z | – | I/O port | ✓ | ✓ |
| | REMO | O | | | IR remote controller transmit data output | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P01 | P01 | I/O | Hi-Z | – | I/O port | ✓ | ✓ |
| | CLPLS | O | | | IR remote controller clear pulse output | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P02 | P02 | I/O | Hi-Z | – | I/O port | ✓ | ✓ |
| | RFCLKO1 | O | | | R/F converter Ch.1 clock monitor output | – | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P03 | P03 | I/O | Hi-Z | – | I/O port | ✓ | ✓ |
| | RTC1S | O | | | Real-time clock 1-second cycle pulse output | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P04 | P04 | I/O | Hi-Z | – | I/O port | ✓ | ✓ |
| | BZOUT | O | | | Sound generator output | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P05 | P05 | I/O | Hi-Z | – | I/O port | ✓ | ✓ |
| | #BZOUT | O | | | Sound generator inverted output | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P06 | P06 | I/O | Hi-Z | – | I/O port | ✓ | ✓ |
| | FOUT | O | | | Clock external output | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P07 | P07 | I/O | Hi-Z | – | I/O port | ✓ | ✓ |
| | #ADTRG0 | I | | | 12-bit A/D converter Ch.0 trigger input | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |

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| Pin/pad name | Assigned signal | I/O | Initial state | Tolerant fail-safe structure | Function | 32-pin | 48-pin/Chip |
|--------------|-----------------|-----|---------------|------------------------------|---|--------|-------------|
| P10 | P10 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | RFCLK00 | O | | | R/F converter Ch.0 clock monitor output | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| | EXSVD | A | | | External power supply voltage detection input | ✓ | ✓ |
| P11 | P11 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | EXOSC | I | | | Clock generator external clock input | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P12 | P12 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | EXCL00 | I | | | 16-bit PWM timer Ch.0 event counter input 0 | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P13 | P13 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | EXCL01 | I | | | 16-bit PWM timer Ch.0 event counter input 1 | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P14 | P14 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | RFIN0 | A | | | R/F converter Ch.0 oscillation input | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P15 | P15 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | REF0 | A | | | R/F converter Ch.0 reference oscillator pin | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P16 | P16 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | SENA0 | A | | | R/F converter Ch.0 sensor A oscillator pin | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P17 | P17 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | SENB0 | A | | | R/F converter Ch.0 sensor B oscillator pin | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| P20 | P20 | I/O | Hi-Z | - | I/O port | - | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | - | ✓ |
| P21 | P21 | I/O | Hi-Z | - | I/O port | - | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | - | ✓ |
| P30 | P30 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | EXCL10 | I | | | 16-bit PWM timer Ch.1 event counter input 0 | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| | ADIN05 | A | | | 12-bit A/D converter Ch.0 analog signal input 5 | ✓ | ✓ |
| P31 | P31 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | EXCL11 | I | | | 16-bit PWM timer Ch.1 event counter input 1 | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| | ADIN04 | A | | | 12-bit A/D converter Ch.0 analog signal input 4 | ✓ | ✓ |
| P32 | P32 | I/O | Hi-Z | - | I/O port | - | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | - | ✓ |
| | ADIN03 | A | | | 12-bit A/D converter Ch.0 analog signal input 3 | - | ✓ |
| P33 | P33 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| | ADIN02 | A | | | 12-bit A/D converter Ch.0 analog signal input 2 | ✓ | ✓ |
| P34 | P34 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| | ADIN01 | A | | | 12-bit A/D converter Ch.0 analog signal input 1 | ✓ | ✓ |
| P35 | P35 | I/O | Hi-Z | - | I/O port | ✓ | ✓ |
| | UPMUX | I/O | | | User-selected I/O (universal port multiplexer) | ✓ | ✓ |
| | ADIN00 | A | | | 12-bit A/D converter Ch.0 analog signal input 0 | ✓ | ✓ |
| P40 | P40 | I/O | Hi-Z | - | I/O port | - | ✓ |
| P41 | SENB1 | A | Hi-Z | - | R/F converter Ch.1 sensor B oscillator pin | - | ✓ |
| | SENA1 | A | | | R/F converter Ch.1 sensor A oscillator pin | - | ✓ |
| P42 | P42 | I/O | Hi-Z | - | I/O port | - | ✓ |
| | REF1 | A | | | R/F converter Ch.1 reference oscillator pin | - | ✓ |
| P43 | P43 | I/O | Hi-Z | - | I/O port | - | ✓ |
| | RFIN1 | A | | | R/F converter Ch.1 oscillation input | - | ✓ |

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| Pin/pad name | Assigned signal | I/O | Initial state | Tolerant fail-safe structure | Function | 32-pin | 48-pin/Chip |
|--------------|-----------------|-----|---------------|------------------------------|------------------------------------|--------|-------------|
| P44 | P44 | I/O | Hi-Z | - | I/O port | - | ✓ |
| P45 | P45 | I/O | Hi-Z | - | I/O port | - | ✓ |
| PD0 | DST2 | O | O (L) | - | On-chip debugger status output | ✓ | ✓ |
| | PD0 | I/O | | | I/O port | ✓ | ✓ |
| PD1 | DSIO | I/O | I (Pull-up) | - | On-chip debugger data input/output | ✓ | ✓ |
| | PD1 | I/O | | | I/O port | ✓ | ✓ |
| PD2 | DCLK | O | O (H) | - | On-chip debugger clock output | ✓ | ✓ |
| | PD2 | O | | | Output port | ✓ | ✓ |
| PD3 | PD3 | I/O | Hi-Z | - | I/O port | - | ✓ |
| | OSC4 | A | | | OSC3 oscillator circuit output | - | ✓ |
| PD4 | PD4 | I/O | Hi-Z | - | I/O port | - | ✓ |
| | OSC3 | A | | | OSC3 oscillator circuit input | - | ✓ |

Universal port multiplexer (UPMUX)

The universal port multiplexer (UPMUX) allows software to select the peripheral circuit input/output function to be assigned to each pin from those listed below. Note, however, that a function cannot be assigned to two or more pins simultaneously.

| Peripheral circuit | Signal to be assigned | I/O | Channel number <i>n</i> | Function |
|-------------------------------------|--|-----|---------------------------|--|
| Synchronous serial interface (SPIA) | SDIn | I | S1C17W03: <i>n</i> = 0, 1 | SPIA Ch. <i>n</i> data input |
| | SDOn | O | S1C17W04: <i>n</i> = 0, 1 | SPIA Ch. <i>n</i> data output |
| | SPICLK _{<i>n</i>} | I/O | | SPIA Ch. <i>n</i> clock input/output |
| | #SPISS _{<i>n</i>} | I | | SPIA Ch. <i>n</i> slave-select input |
| I ² C (I2C) | SCL _{<i>n</i>} | I/O | S1C17W03: <i>n</i> = 0 | I2C Ch. <i>n</i> clock input/output |
| | SDA _{<i>n</i>} | I/O | S1C17W04: <i>n</i> = 0 | I2C Ch. <i>n</i> data input/output |
| UART (UART) | USIN _{<i>n</i>} | I | S1C17W03: <i>n</i> = 0, 1 | UART Ch. <i>n</i> data input |
| | USOUT _{<i>n</i>} | O | S1C17W04: <i>n</i> = 0, 1 | UART Ch. <i>n</i> data output |
| 16-bit PWM timer (T16B) | TOUT _{<i>n</i>} 0/CAP _{<i>n</i>} 0 | I/O | S1C17W03: <i>n</i> = 0, 1 | T16B Ch. <i>n</i> PWM output/capture input 0 |
| | TOUT _{<i>n</i>} 1/CAP _{<i>n</i>} 1 | I/O | S1C17W04: <i>n</i> = 0, 1 | T16B Ch. <i>n</i> PWM output/capture input 1 |

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SEIKO EPSON CORPORATION

MICRODEVICES OPERATIONS DIVISION

Device Sales & Marketing Department

421-8 Hino, Hino-shi, Tokyo 191-8501, JAPAN
Phone: +81-42-587-5814 FAX: +81-42-587-5117

EPSON semiconductor website

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Document Code: 412748100
Issue February 2015 in JAPAN ©

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[002-BND-ERE1](#) [ML62Q1569-NNNGAZ0AX](#) [ML62Q1739-NNNGAZ0AX](#) [ML62Q1749-NNNGAZ0AX](#) [ML62Q1579-NNNGAZ0AX](#)
[ML62Q1559-NNNGAZ0AX](#)