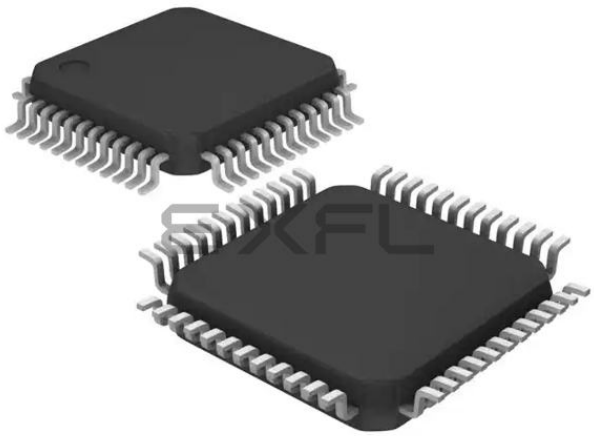
Epson Electronics America Inc-Semiconductor Div - S1C17W04F101100 Datasheet



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What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	S1C17
Core Size	16-Bit
Speed	4.2MHz
Connectivity	I²C, IrDA, SSI, UART/USART
Peripherals	POR, PWM, WDT
Number of I/O	34
Program Memory Size	32KB (32K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	2K x 8
Voltage - Supply (Vcc/Vdd)	1.2V ~ 3.6V
Data Converters	A/D 6x12b SAR
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C
Mounting Type	Surface Mount
Package / Case	48-TQFP
Supplier Device Package	48-TQFP (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/epson/s1c17w04f101100

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 µA 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.

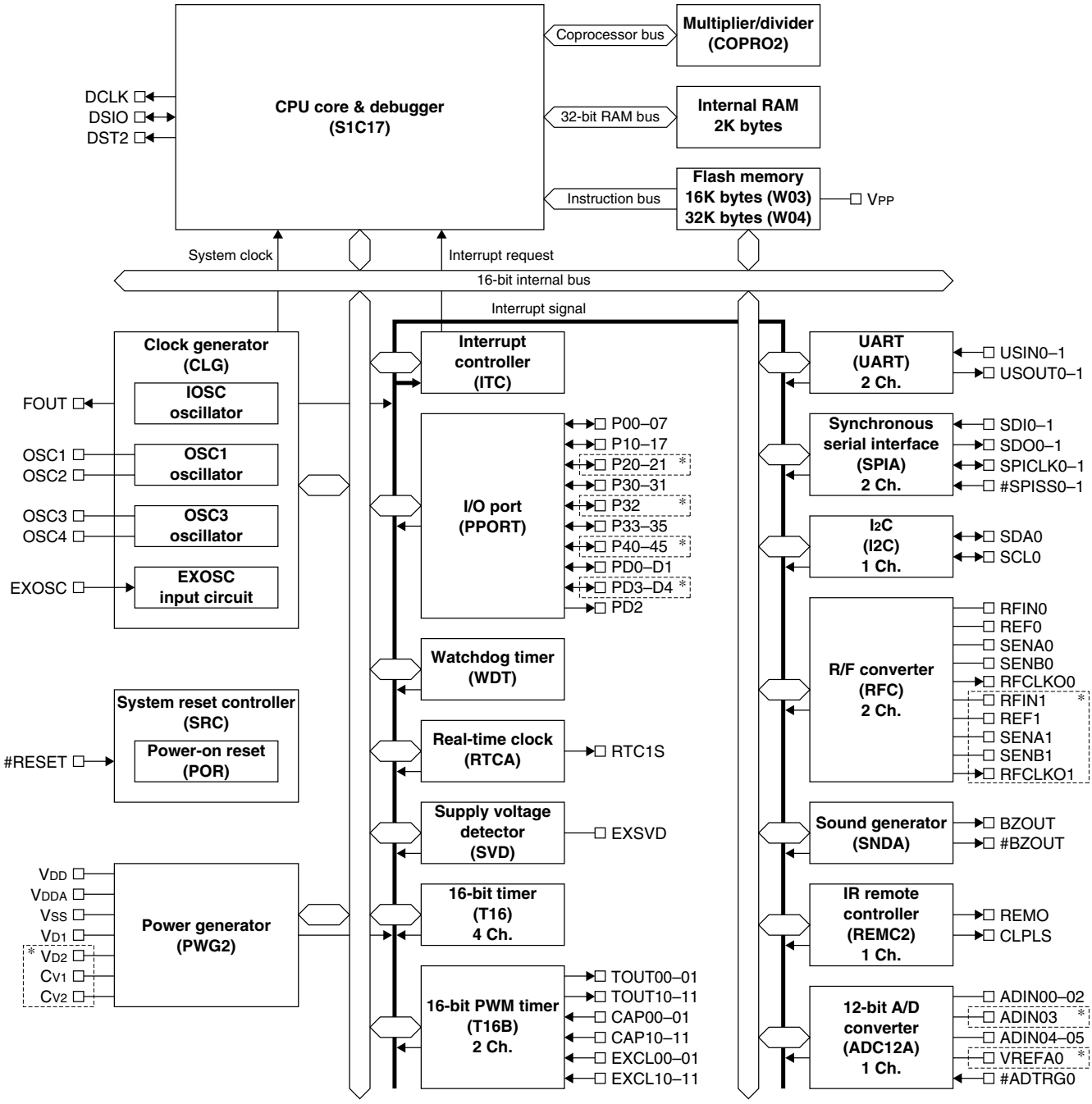
■ FEATURES

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 µs (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	

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^2C (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)	

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.))	

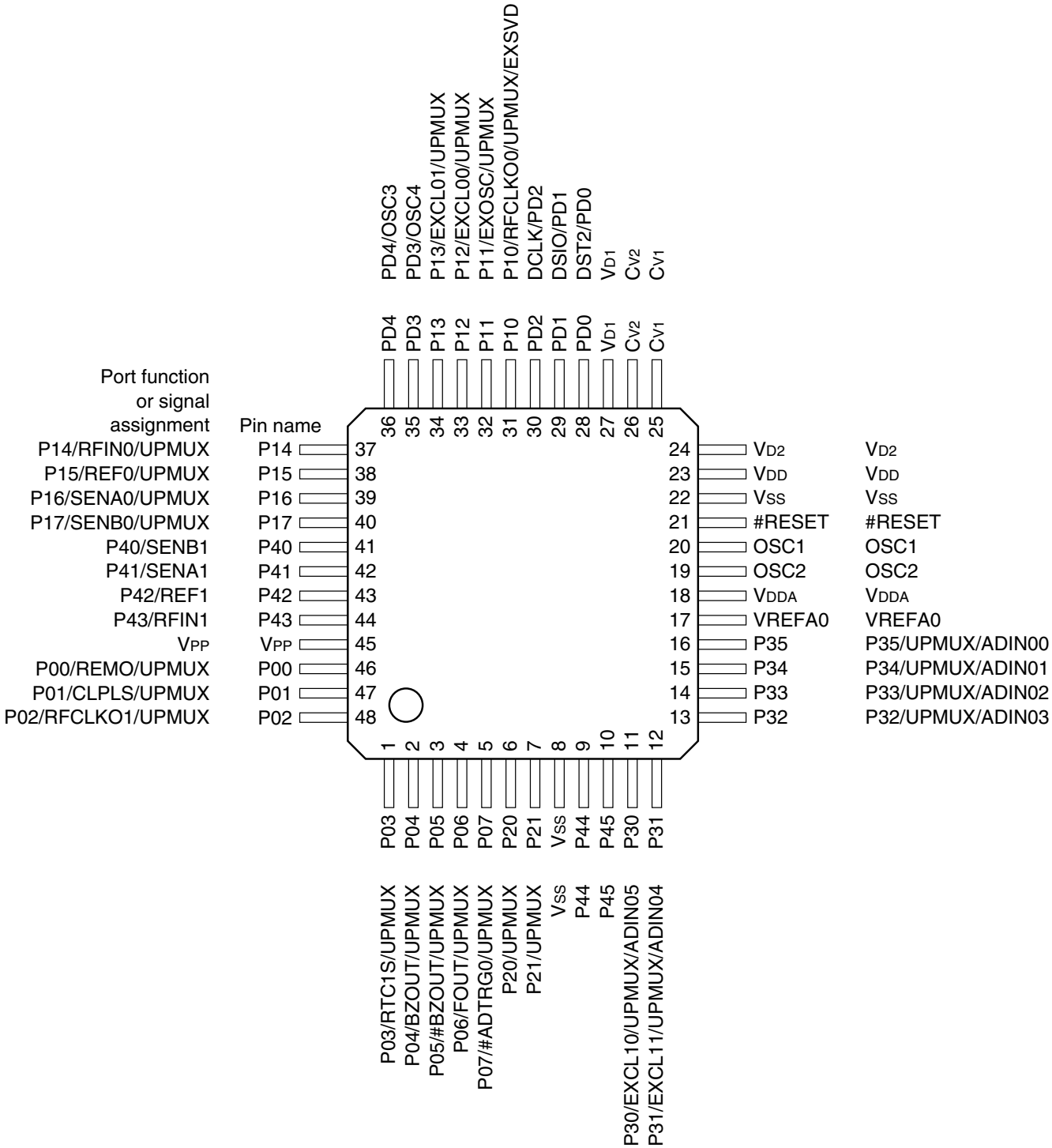
■ BLOCK DIAGRAM



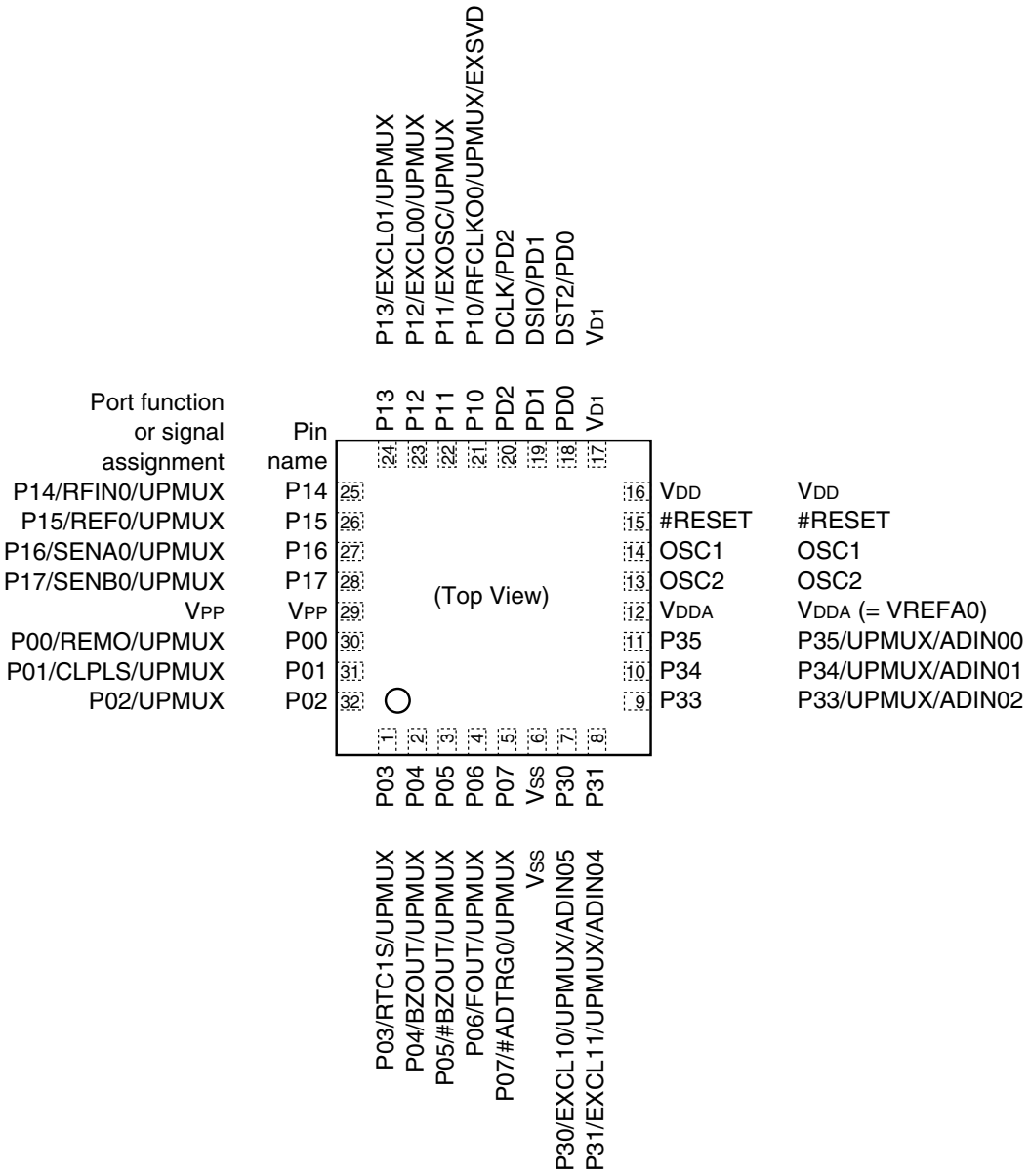
* These pins do not exist in the 32-pin package.

■ PIN CONFIGURATION DIAGRAMS

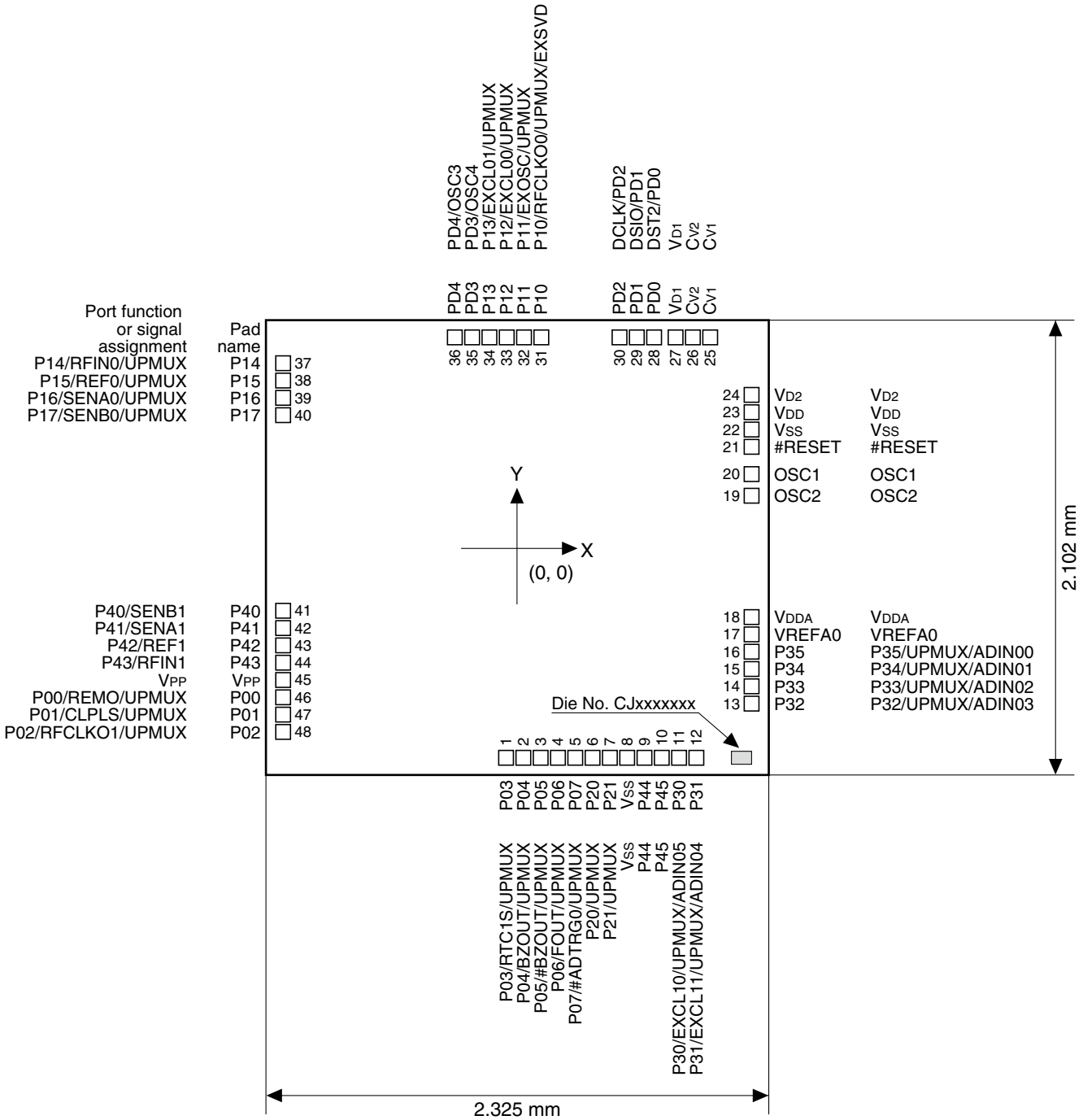
TQFP12-48pin



SQFN5-32pin


Port function or signal assignment
Pin name
P14/RFIN0/UPMUX P14 25
P15/REF0/UPMUX P15 26
P16/SENA0/UPMUX P16 27
P17/SENB0/UPMUX P17 28
VPP VPP 29
P00/REMO/UPMUX P00 30
P01/CLPLS/UPMUX P01 31
P02/UPMUX P02 32
24 P13
23 P12
22 P11
21 P10
20 PD2
19 PD1
18 PD0
17 VD1
16 VDD VDD
15 #RESET #RESET
14 OSC1 OSC1
13 OSC2 OSC2
12 VDDA VDDA (= VREFA0)
11 P35 P35/UPMUX/ADIN00
10 P34 P34/UPMUX/ADIN01
9 P33 P33/UPMUX/ADIN02
(Top View)
1 P03 P03/RTC1S/UPMUX
2 P04 P04/BZOUT/UPMUX
3 P05 P05/#BZOUT/UPMUX
4 P06 P06/FOUT/UPMUX
5 P07 P07/#ADTRG0/UPMUX
6 VSS VSS
7 P30 P30/EXCL10/UPMUX/ADIN05
8 P31 P31/EXCL11/UPMUX/ADIN04
P13/EXCL01/UPMUX
P12/EXCL00/UPMUX
P11/EXOSC/UPMUX
P10/RFCLKO0/UPMUX/EXSVD
DCLK/PD2
DSIO/PD1
DST2/PD0
VD1

Chip


Port function or signal assignment
Pad name
P14/RFIN0/UPMUX P14 37
P15/REF0/UPMUX P15 38
P16/SENA0/UPMUX P16 39
P17/SENB0/UPMUX P17 40
P40/SENB1 P40 41
P41/SENA1 P41 42
P42/REF1 P42 43
P43/RFIN1 P43 44
VPP VPP 45
P00/REMO/UPMUX P00 46
P01/CLPLS/UPMUX P01 47
P02/RFCLKO1/UPMUX P02 48
PD4/OSC3 PD4 36
PD3/OSC4 PD3 35
P13/EXCL01/UPMUX P13 34
P12/EXCL00/UPMUX P12 33
P11/EXOSC/UPMUX P11 32
P10/RFCLKO0/UPMUX/EXSVD P10 31
DCLK/PD2 PD2 30
DSIO/PD1 PD1 29
DST2/PD0 PD0 28
VD1 VD1 27
CV2 CV2 26
CV1 CV1 25
24 VD2 VD2
23 VDD VDD
22 VSS VSS
21 #RESET #RESET
20 OSC1 OSC1
19 OSC2 OSC2
18 VDDA VDDA
17 VREFA0 VREFA0
16 P35 P35/UPMUX/ADIN00
15 P34 P34/UPMUX/ADIN01
14 P33 P33/UPMUX/ADIN02
13 P32 P32/UPMUX/ADIN03
Y
X
(0, 0)
Die No. CJxxxxxxx
1 P03 P03/RTC1S/UPMUX
2 P04 P04/BZOUT/UPMUX
3 P05 P05/#BZOUT/UPMUX
4 P06 P06/FOUT/UPMUX
5 P07 P07/#ADTRG0/UPMUX
6 P20 P20/UPMUX
7 P21 P21/UPMUX
8 VSS VSS
9 P44 P44
10 P45 P45
11 P30 P30/EXCL10/UPMUX/ADIN05
12 P31 P31/EXCL11/UPMUX/ADIN04
2.102 mm
2.325 mm

■ 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
V_{DD}	V_{DD}	P	–	–	Power supply (+)	✓	✓
V_{DDA}	V_{DDA}	P	–	–	Analog power supply (+)	✓	✓
V_{SS}	V_{SS}	P	–	–	GND	✓	✓
V_{PP}	V_{PP}	P	–	–	Power supply for Flash programming	✓	✓
V_{D1}	V_{D1}	A	–	–	DC-DC converter output	✓	✓
V_{D2}	V_{D2}	A	–	–	DC-DC converter stabilization capacitor connect pin	–	✓
C_{V1-2}	C_{V1-2}	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)	✓	✓

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	✓	✓
	RFCLKO0	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	–	✓
	SENB1	A			R/F converter Ch.1 sensor B oscillator pin	–	✓
P41	P41	I/O	Hi-Z	–	I/O port	–	✓
	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	–	✓

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 *n*	Function
Synchronous serial interface (SPIA)	SDI*n*	I	S1C17W03: *n* = 0, 1	SPIA Ch.*n* data input
	SDO*n*	O	S1C17W04: *n* = 0, 1	SPIA Ch.*n* data output
	SPICLK*n*	I/O		SPIA Ch.*n* clock input/output
	#SPISS*n*	I		SPIA Ch.*n* slave-select input
I^2C (I2C)	SCL*n*	I/O	S1C17W03: *n* = 0	I2C Ch.*n* clock input/output
	SDA*n*	I/O	S1C17W04: *n* = 0	I2C Ch.*n* data input/output
UART (UART)	USIN*n*	I	S1C17W03: *n* = 0, 1	UART Ch.*n* data input
	USOUT*n*	O	S1C17W04: *n* = 0, 1	UART Ch.*n* data output
16-bit PWM timer (T16B)	TOUT*n*0/CAP*n*0	I/O	S1C17W03: *n* = 0, 1	T16B Ch.*n* PWM output/capture input 0
	TOUT*n*1/CAP*n*1	I/O	S1C17W04: *n* = 0, 1	T16B Ch.*n* PWM output/capture input 1

SEIKO EPSON CORPORATION

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