S7C17M11 (rev1.0)

EPSON
EXCEED YOUR VISION

16-bit Single Chip Microcontroller with RTCH

- Built-in high precision RTC with temperature compensation function (RTCH) (comes with a 32.768 kHz crystal resonator stacked into the package).
- 128KB Flash ROM with read/write protection function, 8KB RAM.
- Equipped with a 30-segment × 8-common LCD driver.
- Achieve ultra-low current consumption, 2.25 µA when RTCH is running.
- Built-in smart card interface conforming to ISO7816-3 specification.
- Supports various serial interfaces (UART, SPI, I^2C).
- Built-in power supply switching circuit.

■ DESCRIPTIONS

The S7C17M11 is a controller suitable for controlling power meters that includes a 16-bit CPU, 128K-byte Flash memory, a high precision RTC with temperature compensation function, a lot of serial interface ports, and A/D converter input ports.

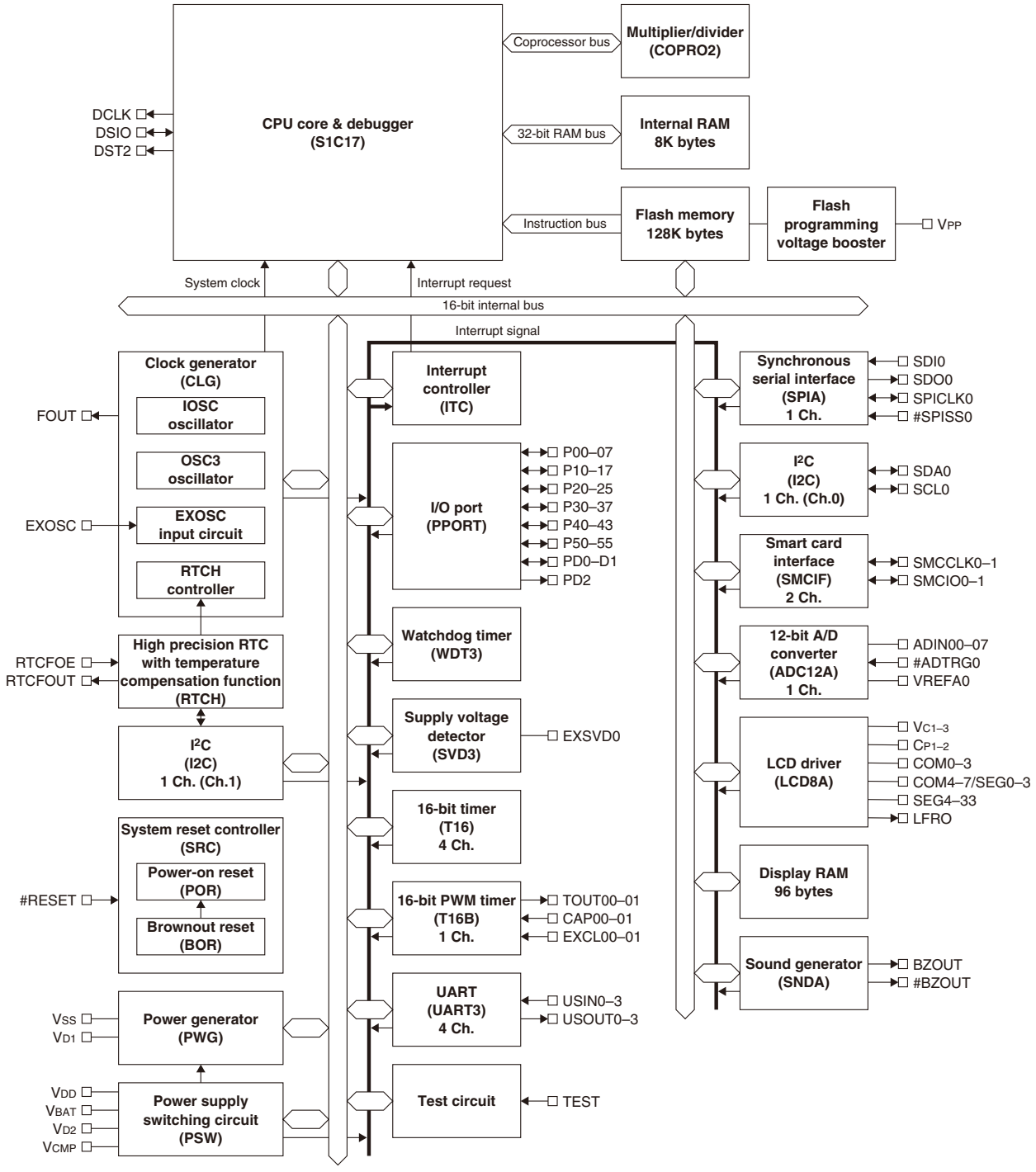
■ FEATURES

Model	S7C17M11
CPU	
CPU core	Seiko Epson original 16-bit RISC CPU core S1C17
Other	On-chip debugger
Embedded Flash memory	
Capacity	126K bytes (for both instructions and data) 2K bytes (for temperature compensation adjustment data)
Erase/program count	1,000 times (min.) * Programming by the debugging tool ICDmini
Other	Security function to protect from reading/programming by ICDmini
	On-board programming function using ICDmini
	Flash programming voltage can be generated internally.
Embedded RAM	
Capacity	8K bytes
Embedded display RAM	
Capacity	96 bytes
Clock generator (CLG)	
System clock source	4 sources (IOSC/OSC1/OSC3/EXOSC)
System clock frequency (operating frequency)	16.8 MHz (max.)
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)
RTCH controller	Controller for the clock generated by the high precision RTC with temperature compensation function
	Uses the clock as OSC1CLK.
OSC3 oscillator circuit	4, 8, 12, and 16 MHz-switchable embedded oscillator
	Auto-trimming function for the embedded oscillator
EXOSC clock input	16.8 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: 42 bits (max.)
	Output port: 1 bit (max.)
	Pins are shared with the peripheral I/O.
Number of input interrupt ports	40 bits (max.)
Number of ports that support universal port multiplexer (UPMUX)	30 bits
	A peripheral circuit I/O function selected via software can be assigned to each port.
Timers	
Watchdog timer (WDT3)	Generates NMI or watchdog timer reset.
	Programmable NMI/reset generation cycle
16-bit timer (T16)	4 channels
	Generates the SPIA master clock and the ADC12A operating clock/trigger signal.
16-bit PWM timer (T16B)	1 channel
	Event counter/capture function
	PWM waveform generation function
	Number of PWM output or capture input ports: 2 ports/channel
Supply voltage detector (SVD3)	
Detection voltage	V_{BAT}, V_{D2}, or an external voltage (one external voltage input port is provided and an external voltage level can be detected even if it exceeds V_{DD}.)
Detection level	V_{BAT}, V_{D2}: 28 levels (1.8 to 5.0 V)/external voltage: 32 levels (1.2 to 5.0 V)

Model	S7C17M11
Supply voltage detector (SVD3)	
Other	Intermittent operation mode
	Generates an interrupt or reset according to the detection level evaluation.
Serial interfaces	
UART (UART3)	4 channels
	Baud-rate generator included, IrDA1.0 supported
	Open drain output, signal polarity, and baud rate division ratio are configurable.
	Infrared communication carrier modulation output function
Serial interfaces	
Synchronous serial interface (SPIA)	1 channel
	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)	2 channels (Ch.1 is exclusive for RTCH circuit control.)
	Baud-rate generator included
Smart card interface (SMCIF)	2 channels
	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.
LCD driver (LCD8A)	
LCD output	30SEG × 7–8COM, 32SEG × 5–6COM, 34SEG × 1–4COM (max.)
LCD contrast	16 levels
Other	1/3 bias power supply included, external voltage can be applied.
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	8 ports/channel
High precision RTC with temperature compensation function (RTCH)	
Oscillator circuit	32.768 kHz (typ.) digital temperature compensated oscillator (DTCXO) included
Oscillation stop detection circuit	Interrupt generation function when the oscillation has stopped
Real-time clock	Second/minute/hour/day/day of the week/month/year
	Automatic leap year correction function
	Timer, alarm, and second/minute interrupt functions
Power supply switching circuit (PSW)	
Power supply switching function	Switches between V_{DD} and V_{BAT} according to the detected V_{CMP} voltage.
	Generates an interrupt by evaluating the detected V_{CMP} voltage level.
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.
Brownout reset	Reset when the power supply voltage drops (when $V_{D2} \leq 1.45$ V (typ.) is detected).
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)
Power supply voltage	
V_{DD}/V_{BAT} operating voltage	2.5 to 5.5 V (for normal operation) 2.3 to 5.5 V (only for SLEEP mode, OSC1 HALT mode, IOSC HALT mode, OSC1 RUN mode, or IOSC RUN mode (peripheral circuits other than RTCH and IOSC oscillator must be idle.)) 2.0 to 5.5 V (only for SLEEP mode or OSC1 HALT mode (peripheral circuits other than RTCH must be idle.))
V_{DD}/V_{BAT} operating voltage for Flash programming	2.5 to 5.5 V (V_{PP} = 7.5 V external power supply is required.) 2.7 to 5.5 V (when V_{PP} is generated internally)

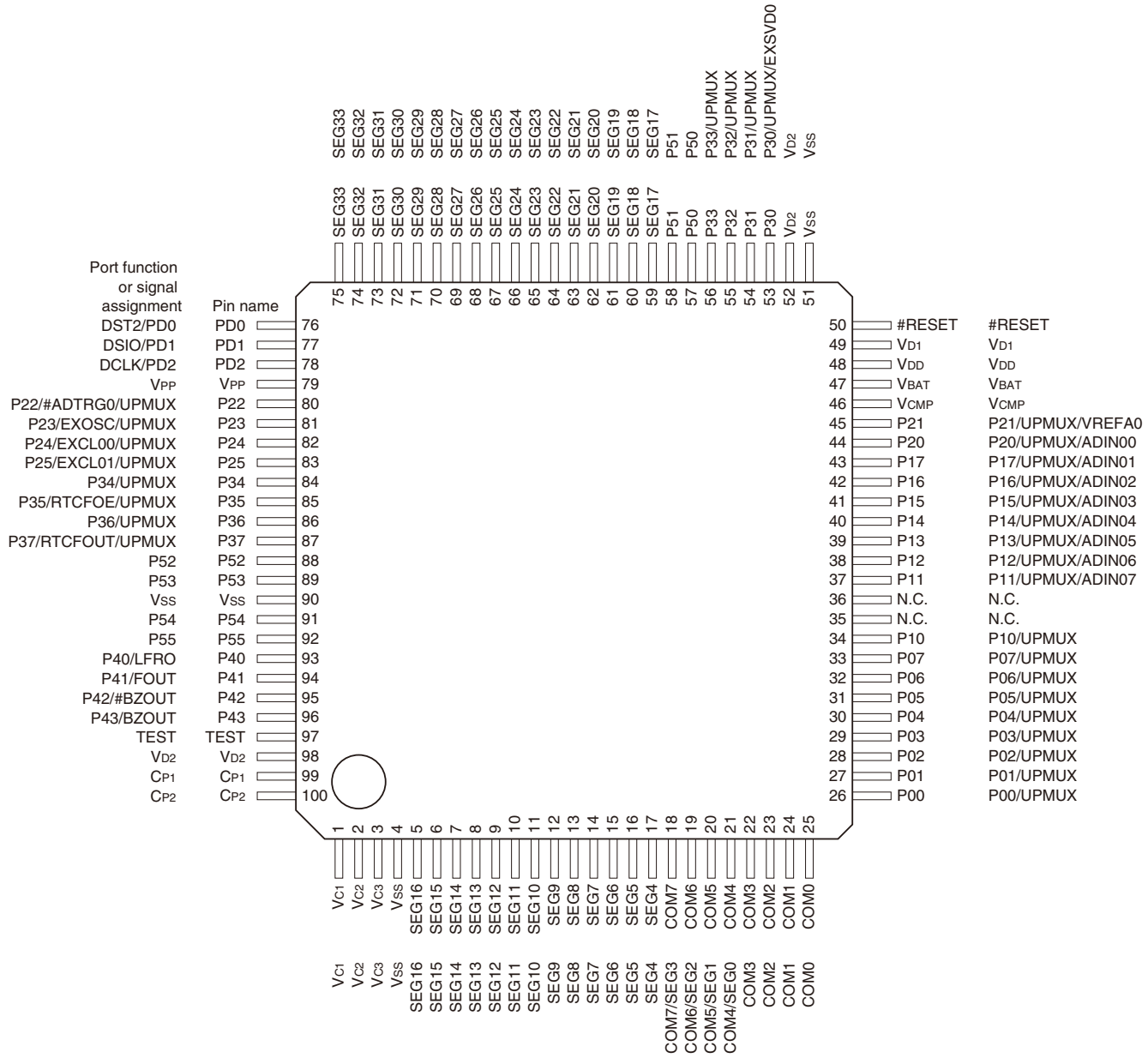
Model	S7C17M11
Operating temperature	
Operating temperature range	-40 to 85 °C
Current consumption (Typ. value)	
SLEEP mode	2.25 µA IOSC = OFF, RTCH = ON, OSC3 = OFF
HALT mode	2.35 µA IOSC = OFF, RTCH = ON, OSC3 = OFF
RUN mode	8 µA IOSC = OFF, RTCH = ON, OSC3 = OFF, CPU = RTCH
	1,500 µA IOSC = OFF, RTCH = ON, OSC3 = 8 MHz, CPU = OSC3
Shipping form	
1	H4QFP15-100pin (Lead pitch: 0.5 mm)

■ BLOCK DIAGRAM



■ PIN CONFIGURATION DIAGRAMS

H4QFP15-100pin



■ 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 name	Assigned signal	I/O	Initial state	Tolerant fail-safe structure	Function
V_{DD}	V_{DD}	P	–	–	Main power supply (+)
V_{BAT}	V_{BAT}	P	–	–	Sub-power supply (+)
V_{SS}	V_{SS}	P	–	–	GND
V_{PP}	V_{PP}	P	–	–	Power supply for Flash programming
V_{D1}	V_{D1}	A	–	–	Internal regulator output
V_{D2}	V_{D2}	A	–	–	Power supply switching circuit output
V_{CMP}	V_{CMP}	A	–	–	Voltage detection input
$V_{C1–3}$	$V_{C1–3}$	P	–	–	LCD panel driver power supply
$C_{P1–2}$	$C_{P1–2}$	A	–	–	LCD power supply booster capacitor connect pins
#RESET	#RESET	I	I (Pull-up)	–	Reset input
TEST	TEST	I	I (Pull-down)	–	Test input (Fixed at V_{SS}.)
P00	P00	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P01	P01	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P02	P02	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P03	P03	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P04	P04	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P05	P05	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P06	P06	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P07	P07	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P10	P10	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P11	P11	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
	ADIN07	A			12-bit A/D converter Ch.0 analog signal input 7
P12	P12	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
	ADIN06	A			12-bit A/D converter Ch.0 analog signal input 6

Pin name	Assigned signal	I/O	Initial state	Tolerant fail-safe structure	Function
P13	P13	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
	ADIN05	A			12-bit A/D converter Ch.0 analog signal input 5
P14	P14	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
	ADIN04	A			12-bit A/D converter Ch.0 analog signal input 4
P15	P15	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
P16	P16	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
P17	P17	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
P20	P20	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
P21	P21	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
	VREFA0	A			12-bit A/D converter Ch.0 reference voltage input
P22	P22	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)
P23	P23	I/O	Hi-Z	–	I/O port
	EXOSC	I			Clock generator external clock input
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P24	P24	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)
P25	P25	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)
P30	P30	I/O	Hi-Z	✓	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
	EXSVD0	A			External power supply voltage detection input
P31	P31	I/O	Hi-Z	✓	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P32	P32	I/O	Hi-Z	✓	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P33	P33	I/O	Hi-Z	✓	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P34	P34	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P35	P35	I/O	Hi-Z	–	I/O port
	RTCFOE	I			FOUT output enable for high precision RTC with temperature compensation function
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P36	P36	I/O	Hi-Z	–	I/O port
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P37	P37	I/O	Hi-Z	–	I/O port
	RTCFOUT	O			FOUT output from high precision RTC with temperature compensation function
	UPMUX	I/O			User-selected I/O (universal port multiplexer)
P40	P40	I/O	Hi-Z	–	I/O port
	LFRO	O			LCD frame signal monitor output

Pin name	Assigned signal	I/O	Initial state	Tolerant fail-safe structure	Function
P41	P41	I/O	Hi-Z	–	I/O port
	FOUT	O			Clock external output
P42	P42	I/O	Hi-Z	–	I/O port
	#BZOUT	O			Sound generator inverted output
P43	P43	I/O	Hi-Z	–	I/O port
	BZOUT	O			Sound generator output
P50	P50	I/O	Hi-Z	–	I/O port
P51	P51	I/O	Hi-Z	–	I/O port
P52	P52	I/O	Hi-Z	–	I/O port
P53	P53	I/O	Hi-Z	–	I/O port
P54	P54	I/O	Hi-Z	–	I/O port
P55	P55	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
COM0–3	COM0–3	A	Hi-Z	–	LCD common outputs
COM4–5	COM4–5	A	Hi-Z	–	LCD common outputs
	SEG0–1	A			LCD segment outputs
COM6–7	COM6–7	A	Hi-Z	–	LCD common outputs
	SEG2–3	A			LCD segment outputs
SEG4–33	SEG4–33	A	Hi-Z	–	LCD segment outputs

Universal port multiplexer (UPMUX)

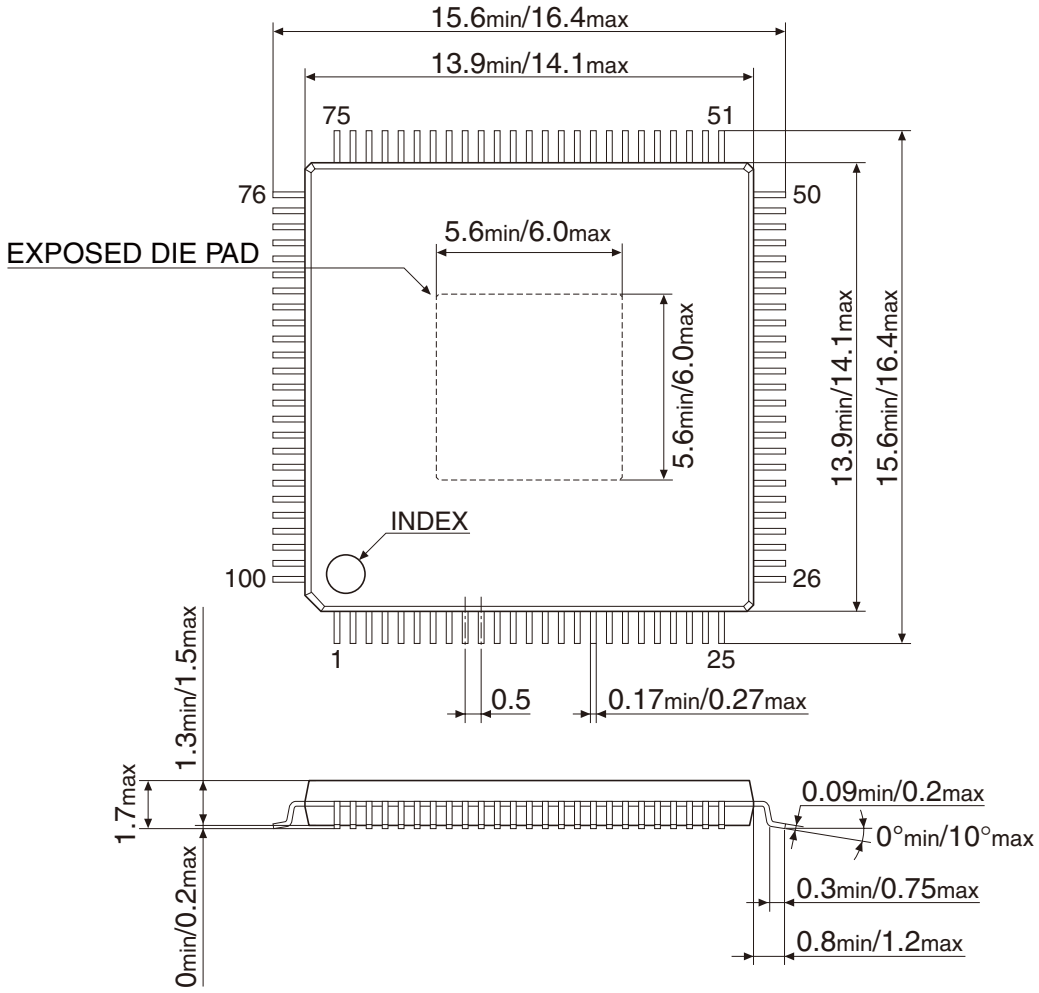
The universal port multiplexer (UPMUX) allows software to select the peripheral circuit input/output function to be assigned to each pin from those listed below. Note, however, that a function cannot be assigned to two or more pins simultaneously.

Peripheral circuit	Signal to be assigned	I/O	Channel number *n*	Function
Synchronous serial interface (SPIA)	SDI*n*	I	*n* = 0	SPIA Ch.*n* data input
	SDO*n*	O		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	*n* = 0	I2C Ch.*n* clock input/output
	SDA*n*	I/O		I2C Ch.*n* data input/output
UART (UART3)	USIN*n*	I	*n* = 0, 1, 2, 3	UART3 Ch.*n* data input
	USOUT*n*	O		UART3 Ch.*n* data output
16-bit PWM timer (T16B)	TOUT*n*0/CAP*n*0	I/O	*n* = 0	T16B Ch.*n* PWM output/capture input 0
	TOUT*n*1/CAP*n*1	I/O		T16B Ch.*n* PWM output/capture input 1
Smart card interface (SMCIF)	SMCCLK*n*	I/O	*n* = 0, 1	SMCIF Ch.*n* clock input/output
	SMCIO*n*	I/O		SMCIF Ch.*n* data input/output

■ PACKAGE

H4QFP15-100pin package

(Unit: mm)



* The EXPOSED DIE PAD is the lead frame in the package structure for mounting the IC chip.
The IC chip is fixed onto it with a paste (Ag), therefore, the potential is the same as that of the substrate potential (V_{SS}) on the back of the IC chip.

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
http://global.epson.com/products/semicon/

Document Code: 413396400
Issue January 2017 in JAPAN Ⓒ