

# S1C17W14/W16 (rev1.0)

## 16-bit Single Chip Microcontroller

- Low power operation from 1.2V with a single alkaline or silver oxide button battery.
- Low power consumption standby driving at HALT 0.3  $\mu$ A .  
\*super economy mode
- Built-in LCD Driver: 50 SEG x 8 COM (max.) S1C17W14  
Built-in LCD Driver: 56 SEG x 8 COM (max.) S1C17W16

### ■ DESCRIPTIONS

The S1C17W14/W16 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 LCD driver, 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 LCD display and timers.

### ■ FEATURES

Model	S1C17W14	S1C17W16
<b>CPU</b>		
CPU core	Seiko Epson original 16-bit RISC CPU core S1C17	
Other	On-chip debugger	
<b>Embedded Flash memory</b>		
Capacity	48K bytes (for both instructions and data)	64K 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	
<b>Embedded RAM</b>		
Capacity	4K bytes	8K bytes
<b>Embedded display RAM</b>		
Capacity	108 bytes	120 bytes
<b>Clock generator (CLG)</b>		
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 $\mu$ 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 256, 384, 500 kHz, 1, 2, and 4 MHz-switchable embedded oscillator 2.1 MHz (max.) CR oscillator (an external R is required)	
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.	
<b>I/O port (PPORT)</b>		
Number of general-purpose I/O ports	Input/output port: 32 bits (max.) Output port: 1 bit (max.) Pins are shared with the peripheral I/O.	Input/output port: 39 bits (max.)
Number of input interrupt ports	28 bits	35 bits
Number of ports that support universal port multiplexer (UPMUX)	24 bits	30 bits
A peripheral circuit I/O function selected via software can be assigned to each port.		
<b>Timers</b>		
Watchdog timer (WDT)	Generates 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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16-bit timer (T16)	3 channels	5 channels
	Generates the SPIA master clocks	Generates the SPIA master clocks and trigger signal of ADC12A
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	
<b>Supply voltage detector (SVD)</b>		
Detection level	30 levels (1.2 to 3.6 V)	
Detection accuracy	±3 %	
Other	Intermittent operation mode	
	Generates an interrupt and reset according to the detection level evaluation.	
<b>Serial interfaces</b>		
UART (UART)	2 channels	
	Baud-rate generator included, IrDA1.0 supported	
Synchronous Serial Interface (SPIA)	2 channels	3 channels
	2 to 16-bit variable data length	
	The 16-bit timer (T16) can be used for the baud-rate generator in master mode.	
I2C (I2C)	1 channel	
	Baud-rate generator included	
<b>Sound generator (SNDA)</b>		
Buzzer output function	512 Hz to 16 kHz output frequencies	
	One-shot output function	
Melody generation function	Pitch: 128 Hz to 16 kHz $\approx$ 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.	
<b>IR remote controller (REMC2)</b>		
Number of transmitter channels	1 channel	
Other	EL lamp drive waveform can be generated for an application example.	
<b>LCD driver (LCD8B)</b>		
LCD output	50 SEG × 5–8 COM (max.), 54 SEG × 1–4 COM (max.)	56 SEG × 5–8 COM (max.), 60 SEG × 1–4 COM (max.)
LCD contrast	16 levels	
Other	1/3 bias power supply included, external voltage can be applied.	
<b>R/F converter (RFC)</b>		
Conversion method	CR oscillation type with 24-bit counters	
Number of conversion channels	1 channel (Up to two sensors can be connected.)	2 channels (Up to two sensors can be connected to each channel.)
Supported sensors	DC-bias resistive sensors, AC-bias resistive sensors	DC-bias resistive sensors, AC-bias resistive sensors (Ch.0 only)
<b>12-bit A/D converter (ADC12A)</b>		
Conversion method	-	Successive approximation type
Resolution	-	12 bits
Number of conversion channels	-	1 channel
Number of analog signal inputs	-	4 ports/channel
<b>Multiplier/divider (COPRO2)</b>		
Arithmetic functions	16-bit × 16-bit multiplier	
	16-bit × 16-bit + 32-bit multiply and accumulation unit	
	32-bit ÷ 32-bit divider	
<b>Reset</b>		
#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).	
<b>Interrupt</b>		
Non-maskable interrupt	4 systems (Reset, address misaligned interrupt, debug, NMI)	
Programmable interrupt	External interrupt: 1 system (8 levels)	
	Internal interrupt: 18 systems (8 levels)	Internal interrupt: 23 systems (8 levels)

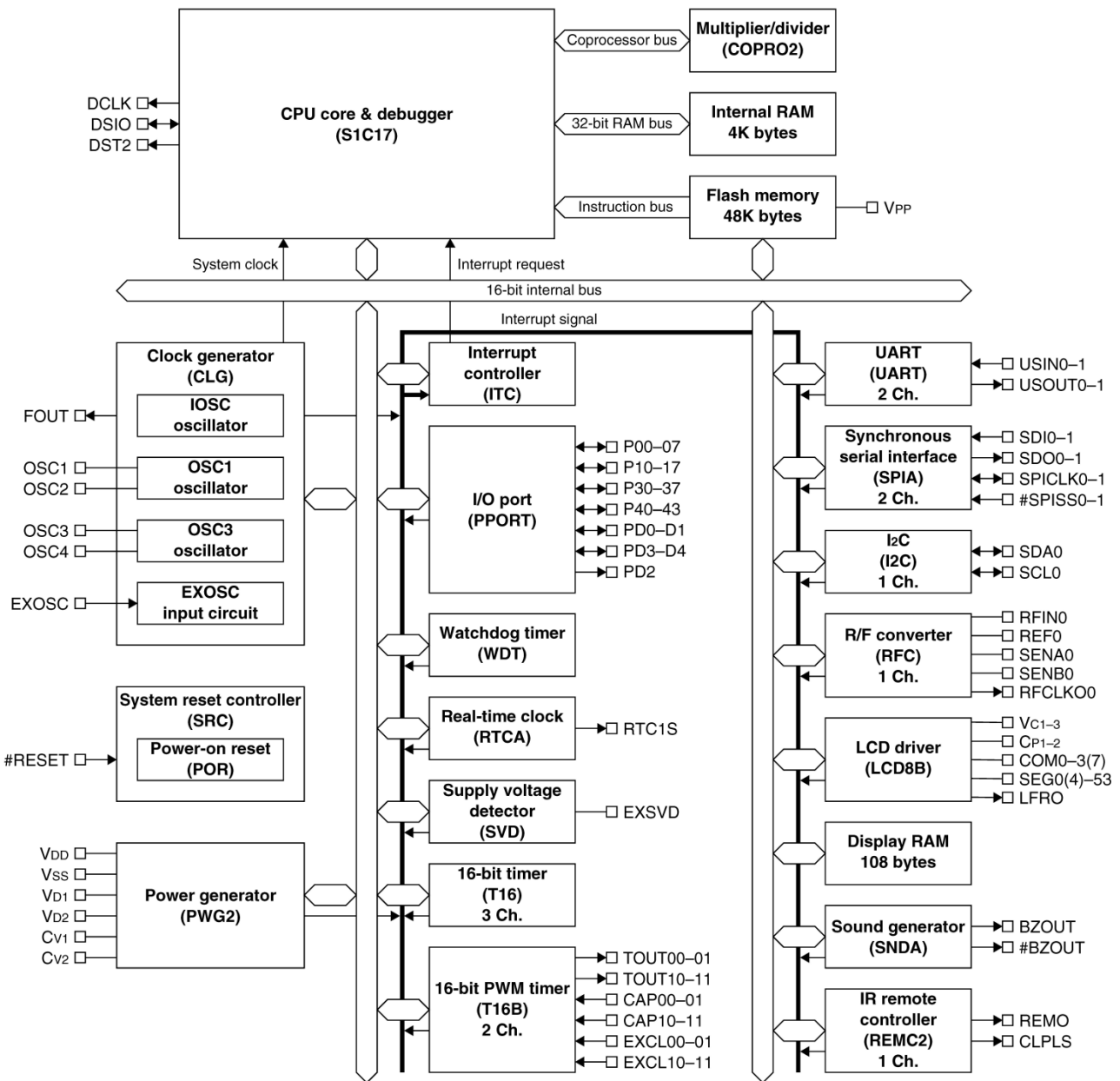
# S1C17W14/W16

<b>Power supply voltage</b>	
V <sub>DD</sub> operating voltage	1.2 to 3.6 V
V <sub>DD</sub> operating voltage for Flash programming	1.8 to 3.6 V (V <sub>PP</sub> = 7.5 V external power supply is required.)
V <sub>DD</sub> operating voltage for super economy mode	2.5 to 3.6 V
<b>Operating temperature</b>	
Operating temperature range	-40 to 85 °C
<b>Current consumption</b>	
SLEEP mode	0.15 μA I <sub>OSC</sub> = OFF, OSC1 = OFF, OSC3 = OFF
HALT mode	0.5 μA OSC1 = 32 kHz, RTC = ON
	0.3 μA OSC1 = 32 kHz, RTC = ON, super economy mode
RUN mode	6 μA OSC1 = 32 kHz, RTC = ON, CPU = OSC1
	3 μA OSC1 = 32 kHz, RTC = ON, CPU = OSC1, super economy mode
	200 μA OSC3 = 1 MHz (internal oscillator), OSC1 = 32 kHz, RTC = ON, CPU = OSC3
<b>Shipping form</b>	
1	QFP15-100pin (Lead pitch: 0.5 mm)   TQFP15-128pin (Lead pitch: 0.4 mm)
2	Die form (Pad pitch: 80 μm (min.))

# S1C17W14/W16

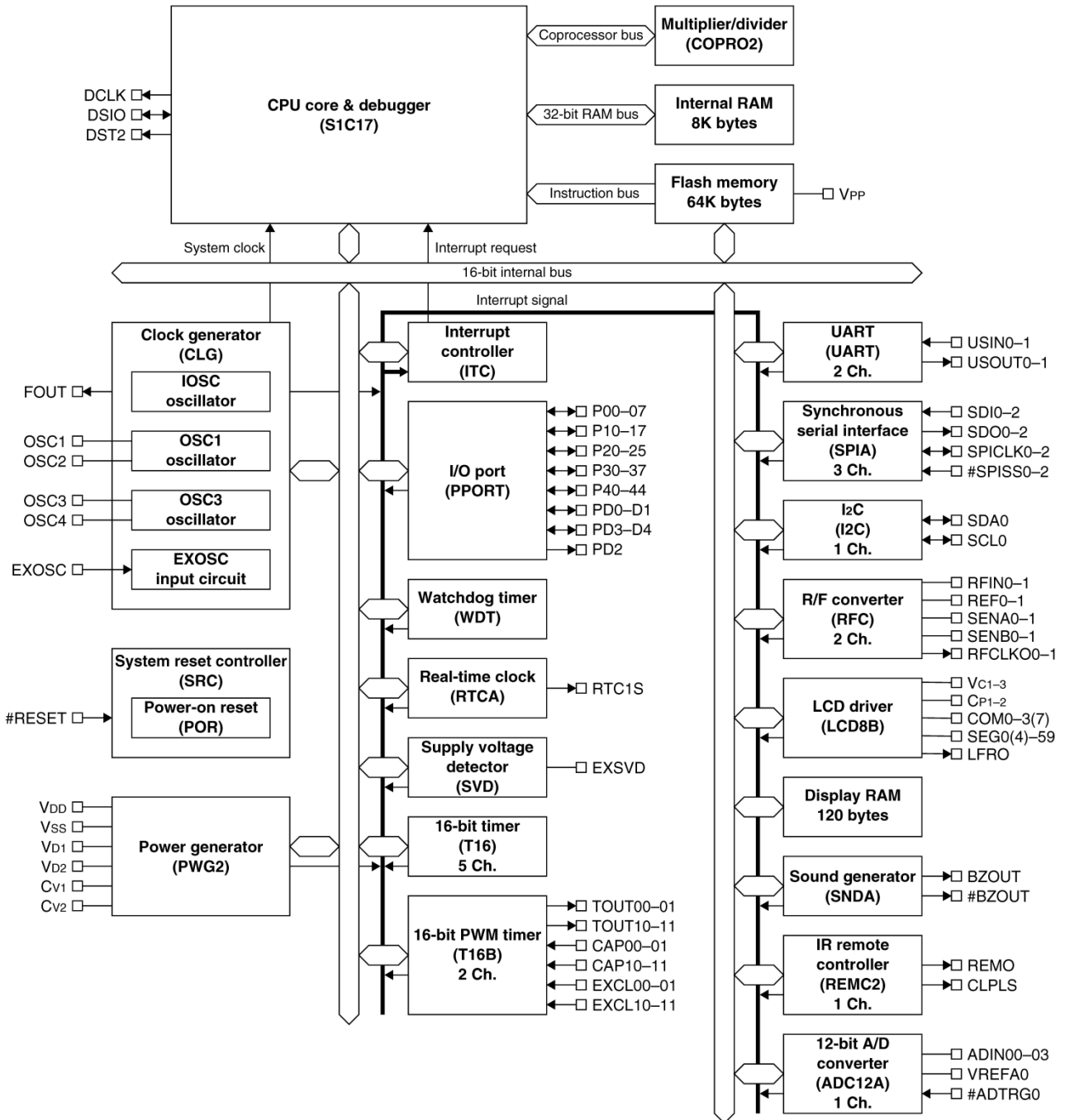
## ■ BLOCK DIAGRAM

### S1C17W14



# S1C17W14/W16

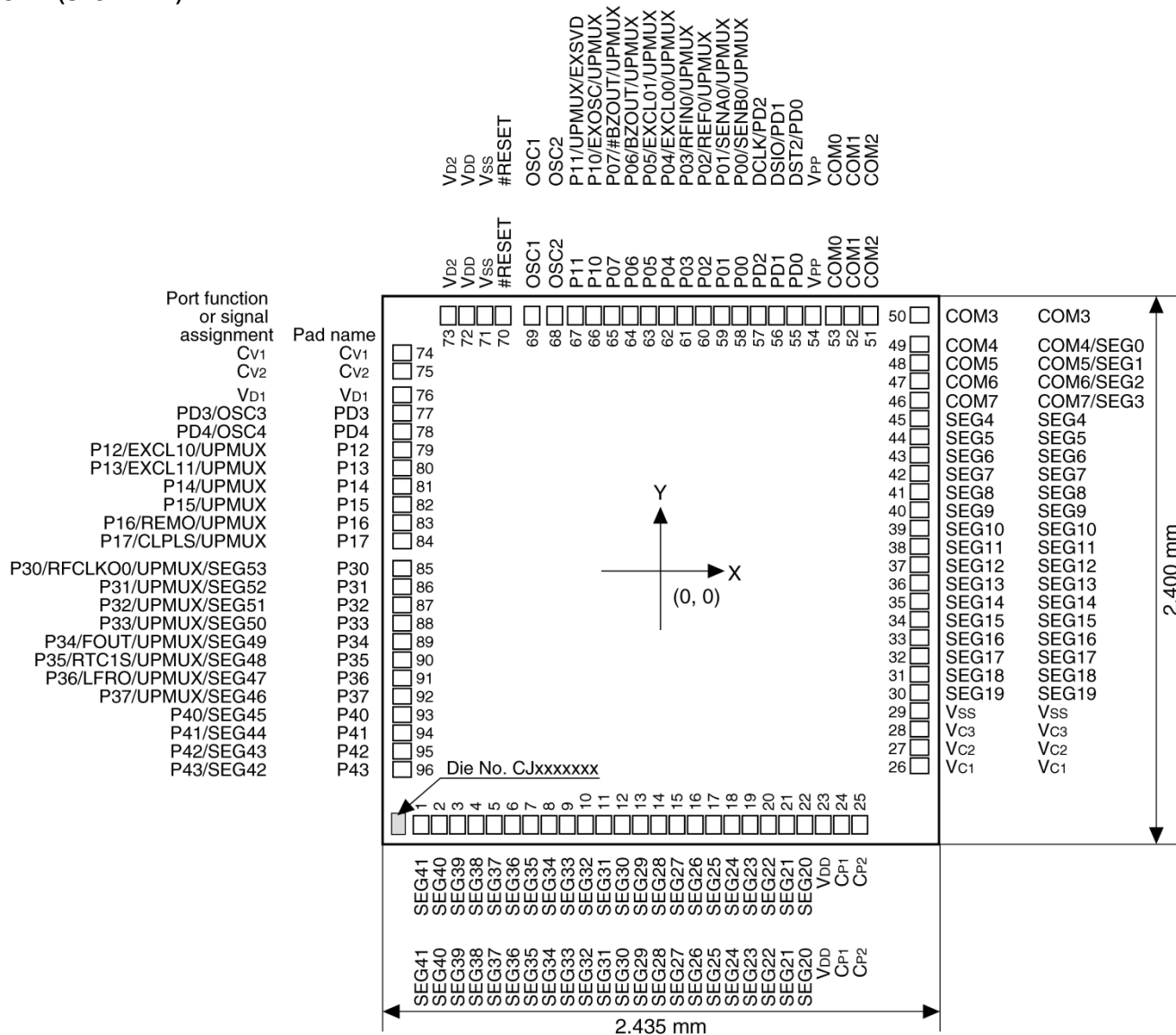
## S1C17W16



# S1C17W14/W16

## Pin Configuration Diagram

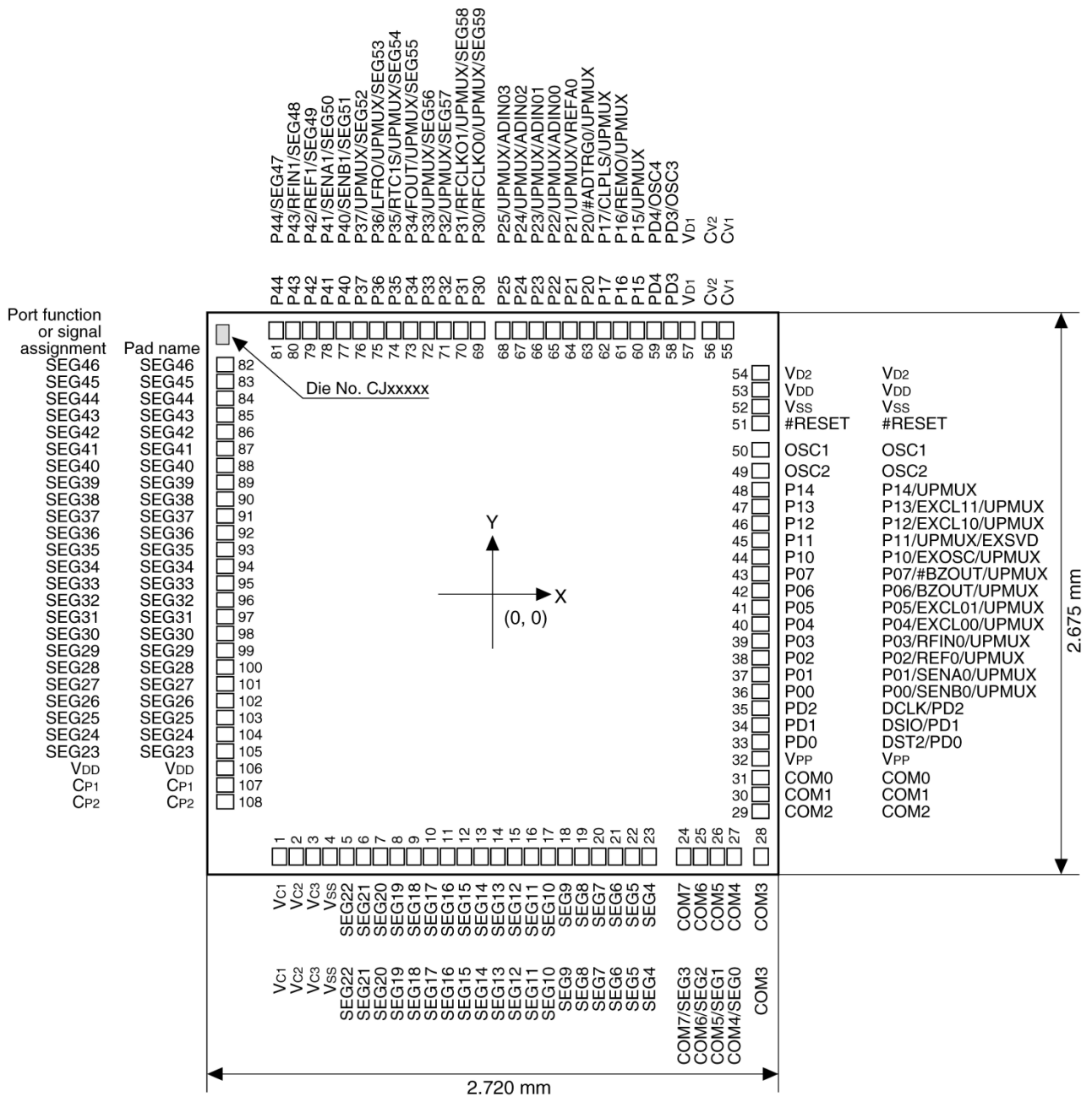
CHIP (S1C17W14)



Pad opening No. 1–25, 51–73: X = 68 μm, Y = 80 μm  
 No. 26–50, 74–96: X = 80 μm, Y = 68 μm  
 Chip thickness 400 μm

# S1C17W14/W16

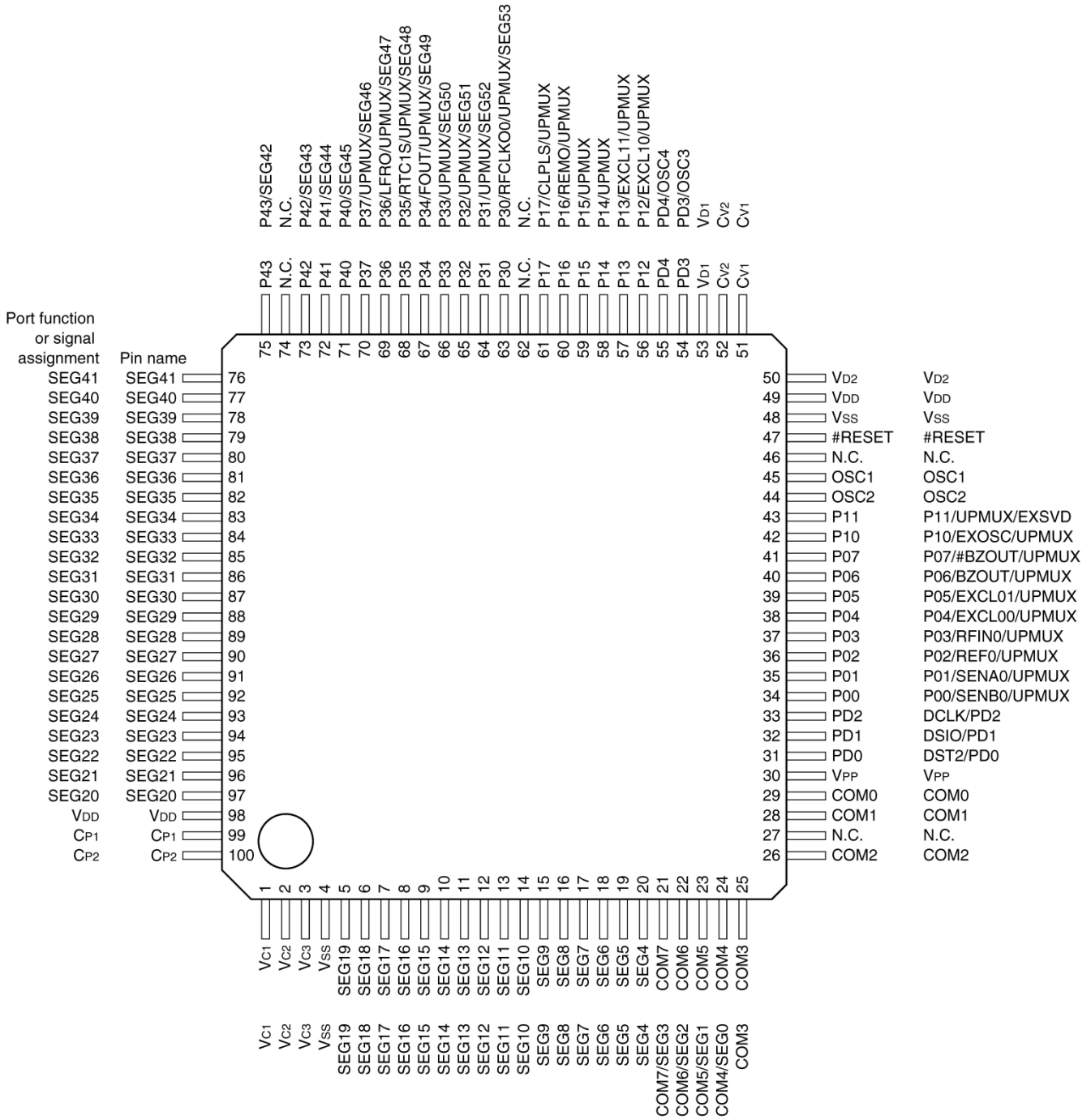
## CHIP (S1C17W16)



Pad opening No. 1–28, 55–81: X = 68 μm, Y = 80 μm  
 No. 29–54, 82–108: X = 80 μm, Y = 68 μm  
 Chip thickness 400 μm

# S1C17W14/W16

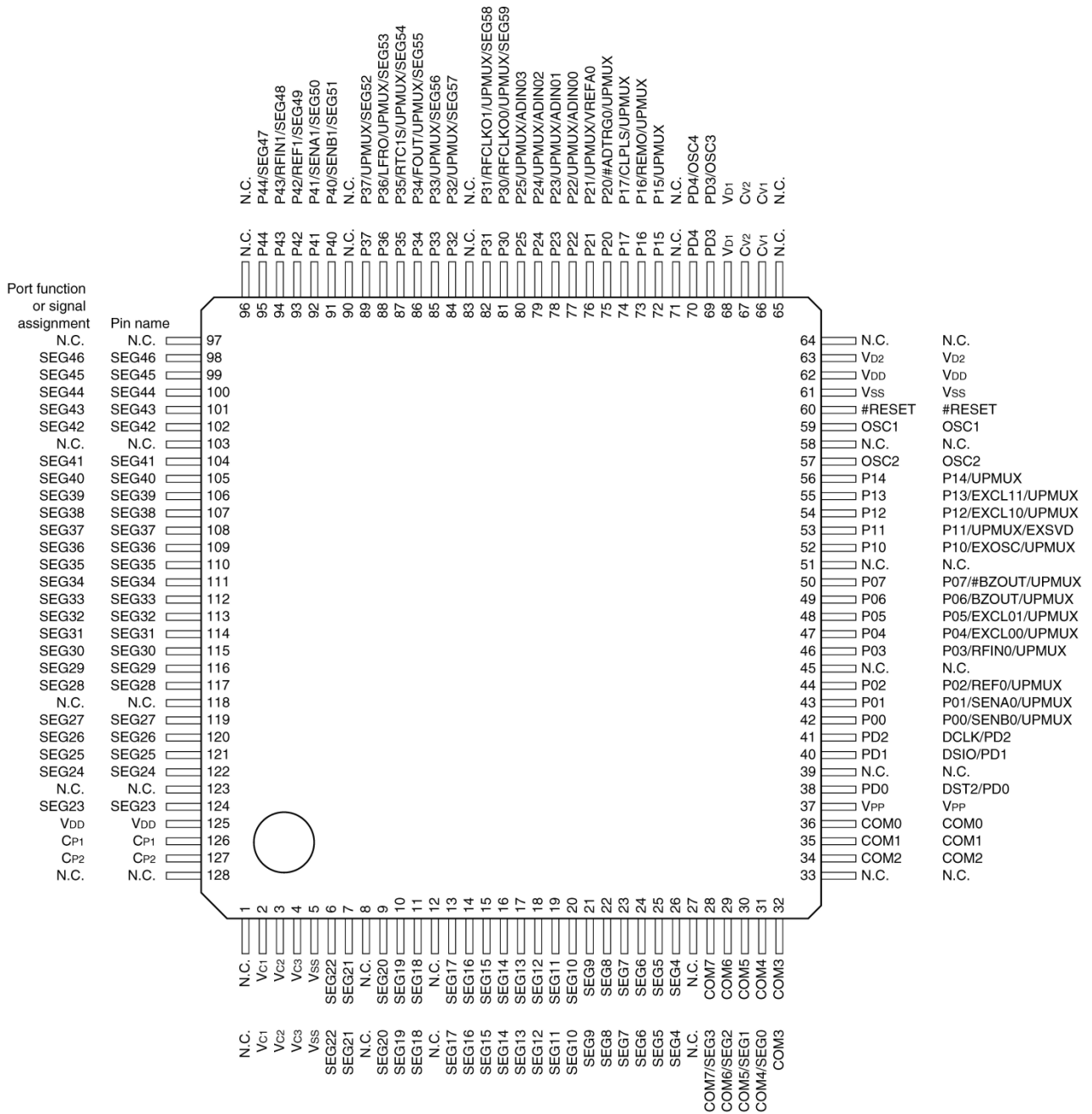
S1C17W14 (QFP15-100pin)





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## S1C17W16 (TQFP15-128pin)



# S1C17W14/W16

## ■ 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)

Pin/pad name	Assigned signal	I/O	Initial state	Tolerant fail-safe structure	Function	S1C17W14	S1C17W16
VDD	VDD	P	–	–	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	✓	✓
VC1-3	VC1-3	P	–	–	LCD panel driver power supply	✓	✓
CP1-2	CP1-2	A	–	–	LCD power supply booster capacitor connect pins	✓	✓
OSC1	OSC1	A	–	–	OSC1 oscillator circuit input	✓	✓
OSC2	OSC2	A	–	–	OSC1 oscillator circuit output	✓	✓
#RESET	#RESET	I	I (Pull-up)	–	Reset input	✓	✓
P00	P00	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)	✓	✓
P01	P01	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)	✓	✓
P02	P02	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)	✓	✓
P03	P03	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)	✓	✓
P04	P04	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)	✓	✓
P05	P05	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)	✓	✓
P06	P06	I/O	Hi-Z	–	I/O port	✓	✓
	BZOUT	O			Sound generator output	✓	✓
	UPMUX	I/O			User-selected I/O (universal port multiplexer)	✓	✓
P07	P07	I/O	Hi-Z	–	I/O port	✓	✓
	#BZOUT	O			Sound generator inverted output	✓	✓
	UPMUX	I/O			User-selected I/O (universal port multiplexer)	✓	✓
P10	P10	I/O	Hi-Z	–	I/O port	✓	✓
	EXOSC	I			Clock generator external clock input	✓	✓
	UPMUX	I/O			User-selected I/O (universal port multiplexer)	✓	✓

# S1C17W14/W16

P11	P11	I/O	Hi-Z	-	I/O port	✓	✓
	UPMUX	I/O			User-selected I/O (universal port multiplexer)	✓	✓
	EXSVD	A			External power supply voltage detection input	✓	✓
P12	P12	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)	✓	✓
P13	P13	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)	✓	✓
P14	P14	I/O	Hi-Z	-	I/O port	✓	✓
	UPMUX	I/O			User-selected I/O (universal port multiplexer)	✓	✓
P15	P15	I/O	Hi-Z	-	I/O port	✓	✓
	UPMUX	I/O			User-selected I/O (universal port multiplexer)	✓	✓
P16	P16	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)	✓	✓
P17	P17	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)	✓	✓
P20	P20	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)	-	✓
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	-	✓
	UPMUX	I/O			User-selected I/O (universal port multiplexer)	-	✓
	ADIN00	A			12-bit A/D converter Ch.0 analog signal input 0	-	✓
P23	P23	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	-	✓
P24	P24	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	-	✓
P25	P25	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	-	✓
P30	P30	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)	✓	✓
	SEG53	A			LCD segment output	✓	-
	SEG59	A			LCD segment output	-	✓
P31	P31	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)	✓	✓
	SEG52	A			LCD segment output	✓	-
	SEG58	A			LCD segment output	-	✓
P32	P32	I/O	Hi-Z	✓	I/O port	✓	✓
	UPMUX	I/O			User-selected I/O (universal port multiplexer)	✓	✓
	SEG51	A			LCD segment output	✓	-
	SEG57	A			LCD segment output	-	✓
P33	P33	I/O	Hi-Z	✓	I/O port	✓	✓
	UPMUX	I/O			User-selected I/O (universal port multiplexer)	✓	✓
	SEG50	A			LCD segment output	✓	-
	SEG56	A			LCD segment output	-	✓
P34	P34	I/O	Hi-Z	✓	I/O port	✓	✓
	FOUT	O			Clock external output	✓	✓
	UPMUX	I/O			User-selected I/O (universal port multiplexer)	✓	✓
	SEG49	A			LCD segment output	✓	-
	SEG55	A			LCD segment output	-	✓

# S1C17W14/W16

P35	P35	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)	✓	✓
	SEG48	A			LCD segment output	✓	-
	SEG54	A			LCD segment output	-	✓
P36	P36	I/O	Hi-Z	✓	I/O port	✓	✓
	LFRO	O			LCD frame signal monitor output	✓	✓
	UPMUX	I/O			User-selected I/O (universal port multiplexer)	✓	✓
	SEG47	A			LCD segment output	✓	-
	SEG53	A			LCD segment output	-	✓
P37	P37	I/O	Hi-Z	✓	I/O port	✓	✓
	UPMUX	I/O			User-selected I/O (universal port multiplexer)	✓	✓
	SEG46	A			LCD segment output	✓	-
	SEG52	A			LCD segment output	-	✓
P40	P40	I/O	Hi-Z	✓	I/O port	✓	✓
	SENB1	A			R/F converter Ch.1 sensor B oscillator pin	-	✓
	SEG45	A			LCD segment output	✓	-
	SEG51	A			LCD segment output	-	✓
P41	P41	I/O	Hi-Z	✓	I/O port	✓	✓
	SENA1	A			R/F converter Ch.1 sensor A oscillator pin	-	✓
	SEG44	A			LCD segment output	✓	-
	SEG50	A			LCD segment output	-	✓
P42	P42	I/O	Hi-Z	✓	I/O port	✓	✓
	REF1	A			R/F converter Ch.1 oscillation input	-	✓
	SEG43	A			LCD segment output	✓	-
	SEG49	A			LCD segment output	-	✓
P43	P43	I/O	Hi-Z	✓	I/O port	✓	✓
	RFIN1	A			R/F converter Ch.1 oscillation input	-	✓
	SEG42	A			LCD segment output	✓	-
	SEG48	A			LCD segment output	-	✓
P44	P44	I/O	Hi-Z	✓	I/O port	-	✓
	SEG47	A			LCD segment output	-	✓
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	✓	✓
	OSC3	A			OSC3 oscillator circuit input	✓	✓
PD4	PD4	I/O	Hi-Z	-	I/O port	✓	✓
	OSC4	A			OSC3 oscillator circuit output	✓	✓
COM0-3	COM0-3	A	Hi-Z	-	LCD common output	✓	✓
COM4	COM4	A	Hi-Z	-	LCD common output	✓	✓
	SEG0	A			LCD segment output	✓	✓
COM5	COM5	A	Hi-Z	-	LCD common output	✓	✓
	SEG1	A			LCD segment output	✓	✓
COM6	COM6	A	Hi-Z	-	LCD common output	✓	✓
	SEG2	A			LCD segment output	✓	✓
COM7	COM7	A	Hi-Z	-	LCD common output	✓	✓
	SEG3	A			LCD segment output	✓	✓
SEG4-41	SEG4-41	A	Hi-Z	-	LCD segment output	✓	✓
SEG42-46	SEG42-46	A	Hi-Z	-	LCD segment output	-	✓

Notes: · In the peripheral circuit descriptions, the assigned signal name is used as the pin name.

# S1C17W14/W16

## 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.

Peripheral circuit	Signal to be assigned	I/O	Channel number <i>n</i>	Function
Synchronous serial interface (SPIA)	SDI $n$	I	S1C17W14: $n = 0, 1$	SPIA Ch. $n$ data input
	SDO $n$	O	S1C17W16: $n = 0, 1, 2$	SPIA Ch. $n$ data output
	SPICLK $n$	I/O		SPIA Ch. $n$ clock input/output
	#SPISS $n$	I		SPIA Ch. $n$ slave-select input
I2C (I2C)	SCL $n$	I/O	S1C17W14: $n = 0$	I2C Ch. $n$ clock input/output
	SDA $n$	I/O	S1C17W16: $n = 0$	I2C Ch. $n$ data input/output
UART (UART)	USIN $n$	I	S1C17W14: $n = 0, 1$	UART Ch. $n$ data input
	USOUT $n$	O	S1C17W16: $n = 0, 1$	UART Ch. $n$ data output
16-bit PWM timer (T16B)	TOUT $n0$ /CAP $n0$	I/O	S1C17W14: $n = 0, 1$	T16B Ch. $n$ PWM output/capture input 0
	TOUT $n1$ /CAP $n1$	I/O	S1C17W16: $n = 0, 1$	T16B Ch. $n$ PWM output/capture input 1

Note: Do not assign a function to two or more pins simultaneously.

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