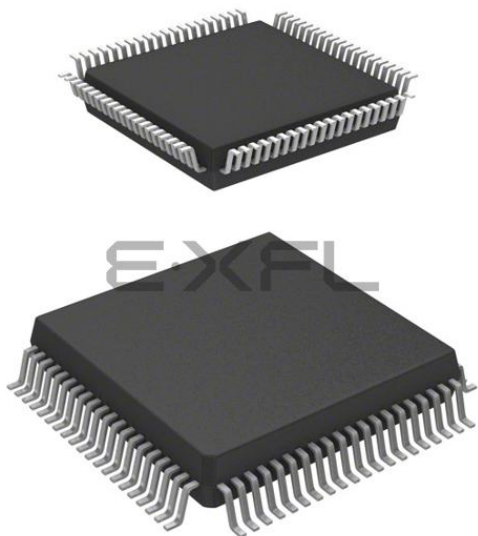




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## What is "[Embedded - Microcontrollers](#)"?

"[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               | I <sup>2</sup> C, IrDA, SPI, UART/USART                                                                                             |
| Peripherals                | LCD, PWM, RFC, WDT                                                                                                                  |
| Number of I/O              | 48                                                                                                                                  |
| Program Memory Size        | 96KB (96K x 8)                                                                                                                      |
| Program Memory Type        | FLASH                                                                                                                               |
| EEPROM Size                | -                                                                                                                                   |
| RAM Size                   | 8K x 8                                                                                                                              |
| Voltage - Supply (Vcc/Vdd) | 1.2V ~ 3.6V                                                                                                                         |
| Data Converters            | A/D 9x12b                                                                                                                           |
| Oscillator Type            | Internal                                                                                                                            |
| Operating Temperature      | -40°C ~ 85°C (TA)                                                                                                                   |
| Mounting Type              | Surface Mount                                                                                                                       |
| Package / Case             | 80-TQFP                                                                                                                             |
| Supplier Device Package    | 80-TQFP14 (12x12)                                                                                                                   |
| Purchase URL               | <a href="https://www.e-xfl.com/product-detail/epson/s1c17w18f103100">https://www.e-xfl.com/product-detail/epson/s1c17w18f103100</a> |

## 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  $\mu$ A during HALT state in super economy mode)
- Embedded A/D converter to support various sensing applications

### ■ DESCRIPTIONS

The S1C17W18 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, a temperature sensor, 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 LCD display and a temperature measurement function.

### ■ FEATURES

| Model                                                           | S1C17W18                                                                                                                                                                                                |
|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CPU</b>                                                      |                                                                                                                                                                                                         |
| CPU core                                                        | Seiko Epson original 16-bit RISC CPU core S1C17                                                                                                                                                         |
| Other                                                           | On-chip debugger                                                                                                                                                                                        |
| <b>Embedded Flash memory</b>                                    |                                                                                                                                                                                                         |
| Capacity                                                        | 128K bytes (for both instructions and data)                                                                                                                                                             |
| Erase/program count                                             | 1,000 times (min.) * Programming by the debugging tool ICDmini                                                                                                                                          |
| Other                                                           | Security function to protect from reading/programming by ICDmini<br>On-board programming function using ICDmini<br>Flash programming voltage can be generated internally.                               |
| <b>Embedded RAM</b>                                             |                                                                                                                                                                                                         |
| Capacity                                                        | 8K bytes                                                                                                                                                                                                |
| <b>Embedded display RAM</b>                                     |                                                                                                                                                                                                         |
| Capacity                                                        | 96 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<br>4.2 MHz (max.) $V_{DD} = 1.6$ to $3.6$ V                                                                                                                    |
| IOSC oscillator circuit (boot clock source)                     | 700 kHz (typ.) embedded oscillator<br>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<br>Oscillation stop detection circuit included                                                                                                                     |
| OSC3 oscillator circuit                                         | 4.2 MHz (max.) crystal/ceramic oscillator<br>250, 384, 500 kHz, 1, 2, and 4 MHz-switchable embedded oscillator<br>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<br>Configurable system clock used at wake up from SLEEP state<br>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: 67 bits (max., 128-pin package or chip)<br>56 bits (max., 80-pin package)<br>48 bits (max., 64-pin package)<br>Output port: 1 bit (max.)<br>Pins are shared with the peripheral I/O. |
| Number of input interrupt ports                                 | 63 bits (max., 128-pin package or chip)<br>52 bits (max., 80-pin package)<br>44 bits (max., 64-pin package)                                                                                             |
| Number of ports that support universal port multiplexer (UPMUX) | 32 bits (max., 128-pin package or chip)<br>29 bits (max., 80-pin package)<br>24 bits (max., 64-pin package)<br>A peripheral circuit I/O function selected via software can be assigned to each port.    |
| <b>Timers</b>                                                   |                                                                                                                                                                                                         |
| 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<br>Theoretical regulation function for 1-second correction<br>Alarm and stopwatch functions                                |
| 16-bit timer (T16)                                              | 4 channels<br>Generates the SPIA master clocks and the ADC12A operating clock/trigger signal.                                                                                                           |

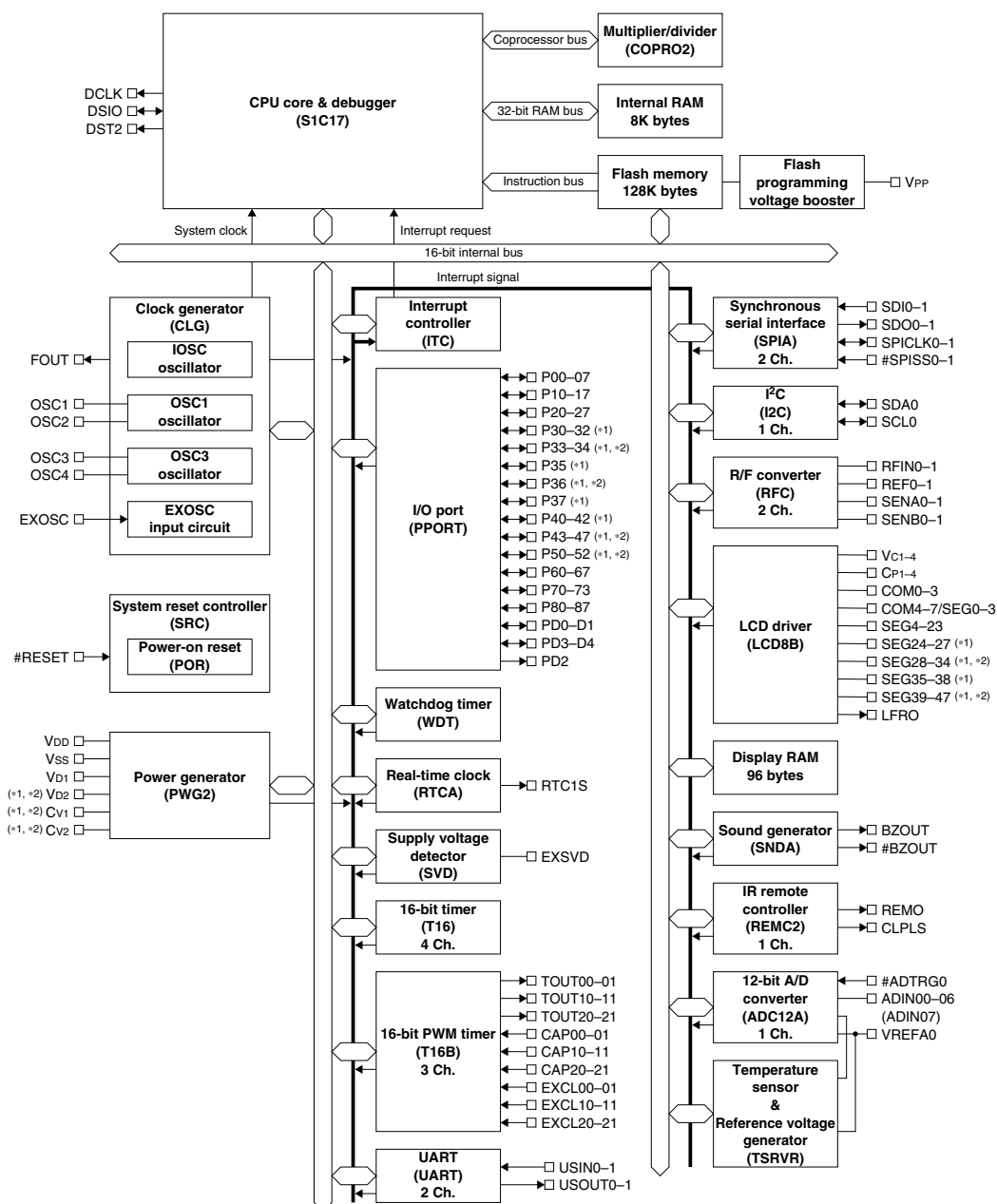
# S1C17W18

| Model                                                         | S1C17W18                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Timers</b>                                                 |                                                                                                                                                                                                                                                                |
| 16-bit PWM timer (T16B)                                       | 3 channels<br>Event counter/capture function<br>PWM waveform generation function<br>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)                                                                                                                                                                                                                                       |
| Other                                                         | Intermittent operation mode<br>Generates an interrupt or reset according to the detection level evaluation.                                                                                                                                                    |
| <b>Serial interfaces</b>                                      |                                                                                                                                                                                                                                                                |
| UART (UART)                                                   | 2 channels<br>Baud-rate generator included, IrDA1.0 supported                                                                                                                                                                                                  |
| Synchronous serial interface (SPIA)                           | 2 channels<br>2 to 16-bit variable data length<br>The 16-bit timer (T16) can be used for the baud-rate generator in master mode.                                                                                                                               |
| I <sup>2</sup> C (I2C)                                        | 1 channel<br>Baud-rate generator included                                                                                                                                                                                                                      |
| <b>Sound generator (SNDA)</b>                                 |                                                                                                                                                                                                                                                                |
| Buzzer output function                                        | 512 Hz to 16 kHz output frequencies<br>One-shot output function                                                                                                                                                                                                |
| Melody generation function                                    | Pitch: 128 Hz to 16 kHz $\approx$ C3 to C6<br>Duration: 7 notes/rests (Half note/rest to thirty-second note/rest)<br>Tempo: 16 tempos (30 to 480)<br>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                                                    | 44 SEG $\times$ 5–8 COM (max.), 48 SEG $\times$ 1–4 COM (max.) (128-pin package or chip)<br>28 SEG $\times$ 5–8 COM (max.), 32 SEG $\times$ 1–4 COM (max.) (80-pin package)<br>20 SEG $\times$ 5–8 COM (max.), 24 SEG $\times$ 1–4 COM (max.) (64-pin package) |
| LCD contrast                                                  | 32 levels                                                                                                                                                                                                                                                      |
| Other                                                         | 1/4 or 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                                 | 2 channels (Up to two sensors can be connected to each channel.)                                                                                                                                                                                               |
| Supported 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                                | 8 ports/channel (The temperature sensor output is connected to a port.)                                                                                                                                                                                        |
| <b>Temperature sensor/reference voltage generator (TSRVR)</b> |                                                                                                                                                                                                                                                                |
| Temperature sensor circuit                                    | Sensor output can be measured using ADC12A.                                                                                                                                                                                                                    |
| Reference voltage generator                                   | Reference voltage for ADC12A is selectable from 2.0 V, 2.5 V, V <sub>DD</sub> , and external input.                                                                                                                                                            |
| <b>Multiplier/divider (COPRO2)</b>                            |                                                                                                                                                                                                                                                                |
| Arithmetic functions                                          | 16-bit $\times$ 16-bit multiplier<br>16-bit $\times$ 16-bit + 32-bit multiply and accumulation unit<br>32-bit $\div$ 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)<br>Internal interrupt: 22 systems (8 levels)                                                                                                                                                                           |
| <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.)<br>2.7 to 3.6 V (When V <sub>PP</sub> is generated internally)                                                                                                                       |
| V <sub>DD</sub> operating voltage for super economy mode      | 2.5 to 3.6 V (128-pin package or chip)                                                                                                                                                                                                                         |
| <b>Operating temperature</b>                                  |                                                                                                                                                                                                                                                                |
| Operating temperature range                                   | -40 to 85 °C                                                                                                                                                                                                                                                   |

# S1C17W18

| Model                                   | S1C17W18                                                                                                                                                                                                                                    |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Current consumption (Typ. value)</b> |                                                                                                                                                                                                                                             |
| SLEEP mode                              | 0.15 $\mu$ A<br>IOSC = OFF, OSC1 = OFF, OSC3 = OFF                                                                                                                                                                                          |
| HALT mode                               | 0.5 $\mu$ A<br>OSC1 = 32 kHz, RTC = ON<br>0.3 $\mu$ A (128-pin package or chip)<br>OSC1 = 32 kHz, RTC = ON, super economy mode                                                                                                              |
| <b>Current consumption (Typ. value)</b> |                                                                                                                                                                                                                                             |
| RUN mode                                | 4 $\mu$ A<br>OSC1 = 32 kHz, RTC = ON, CPU = OSC1<br>2 $\mu$ A (128-pin package or chip)<br>OSC1 = 32 kHz, RTC = ON, CPU = OSC1, super economy mode<br>140 $\mu$ A<br>OSC3 = 1 MHz (ceramic oscillator), OSC1 = 32 kHz, RTC = ON, CPU = OSC3 |
| <b>Shipping form</b>                    |                                                                                                                                                                                                                                             |
| 1                                       | SQFN9-64pin (Lead pitch: 0.5 mm)                                                                                                                                                                                                            |
| 2                                       | TQFP14-80pin (Lead pitch: 0.5 mm)                                                                                                                                                                                                           |
| 3                                       | TQFP15-128pin (Lead pitch: 0.4 mm)                                                                                                                                                                                                          |
| 4                                       | Die form (Pad pitch: 80 $\mu$ m (min.))                                                                                                                                                                                                     |

## BLOCK DIAGRAM



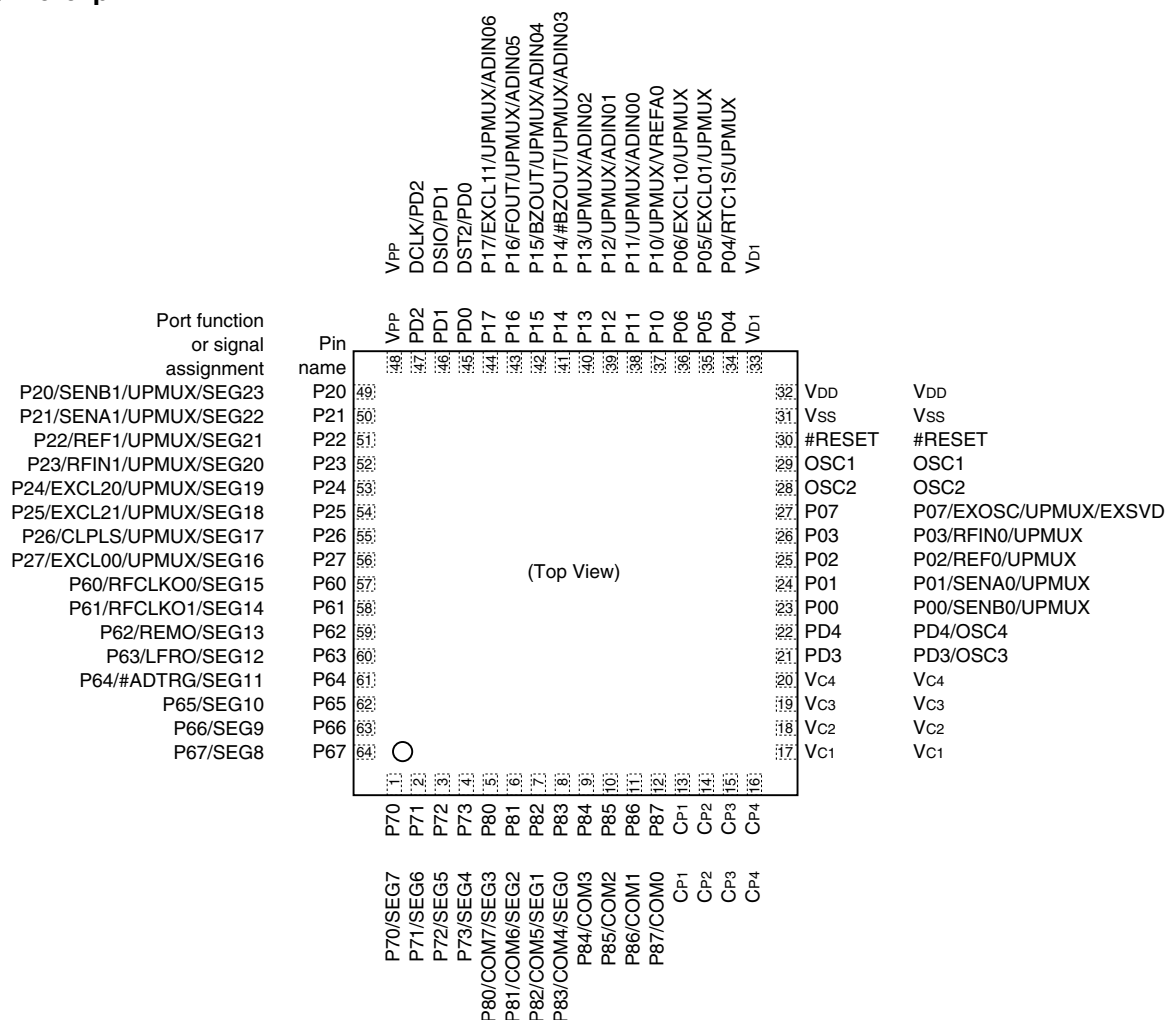
\*1 These pins do not exist in the 64-pin package.

\*2 These pins do not exist in the 80-pin package.

# S1C17W18

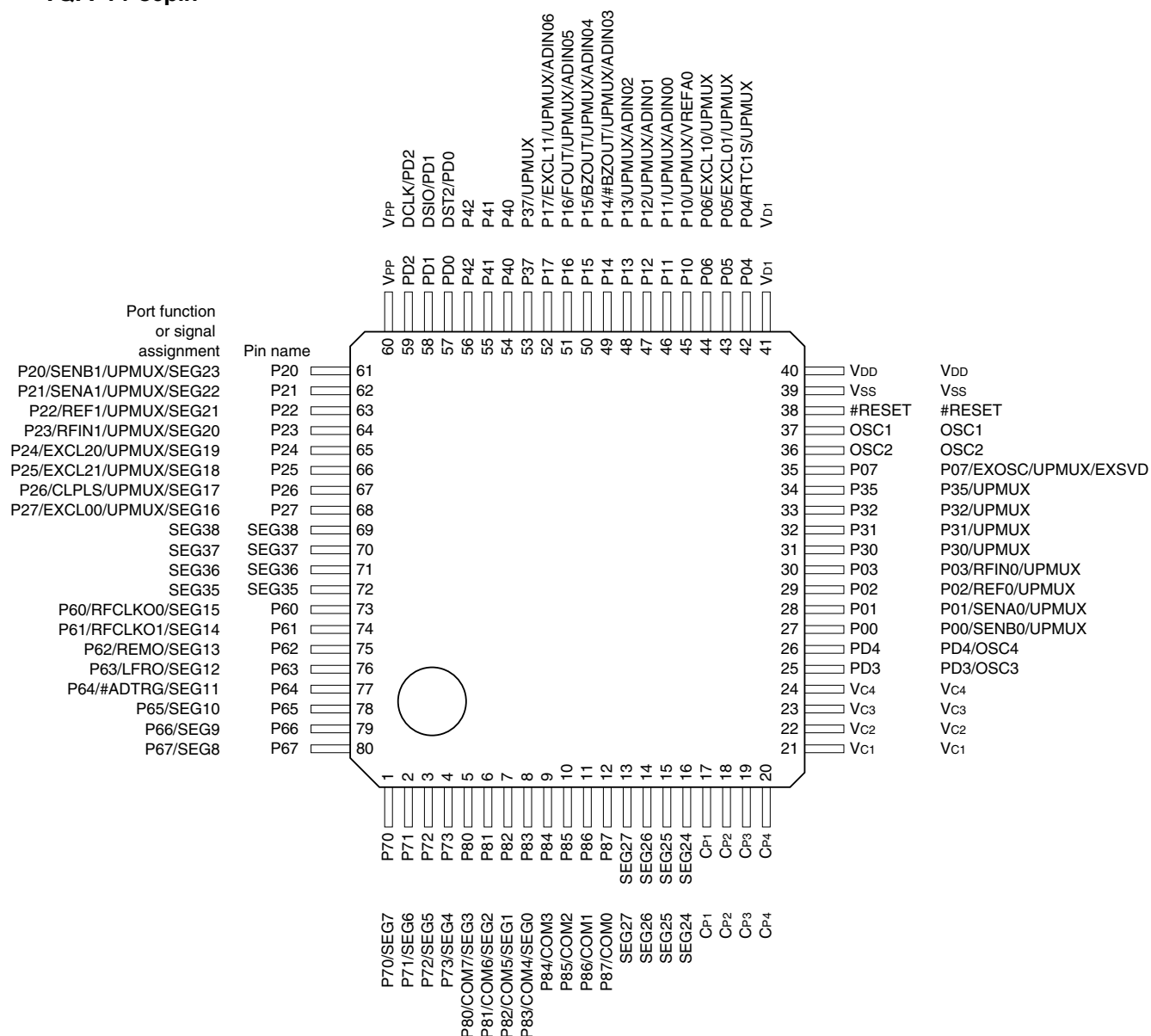
## PIN CONFIGURATION DIAGRAMS

### SQFN9-64pin



**Note:** The model in this package cannot be placed into super economy mode, as it does not have the V<sub>D2</sub>, C<sub>V1</sub>, and C<sub>V2</sub> pins.

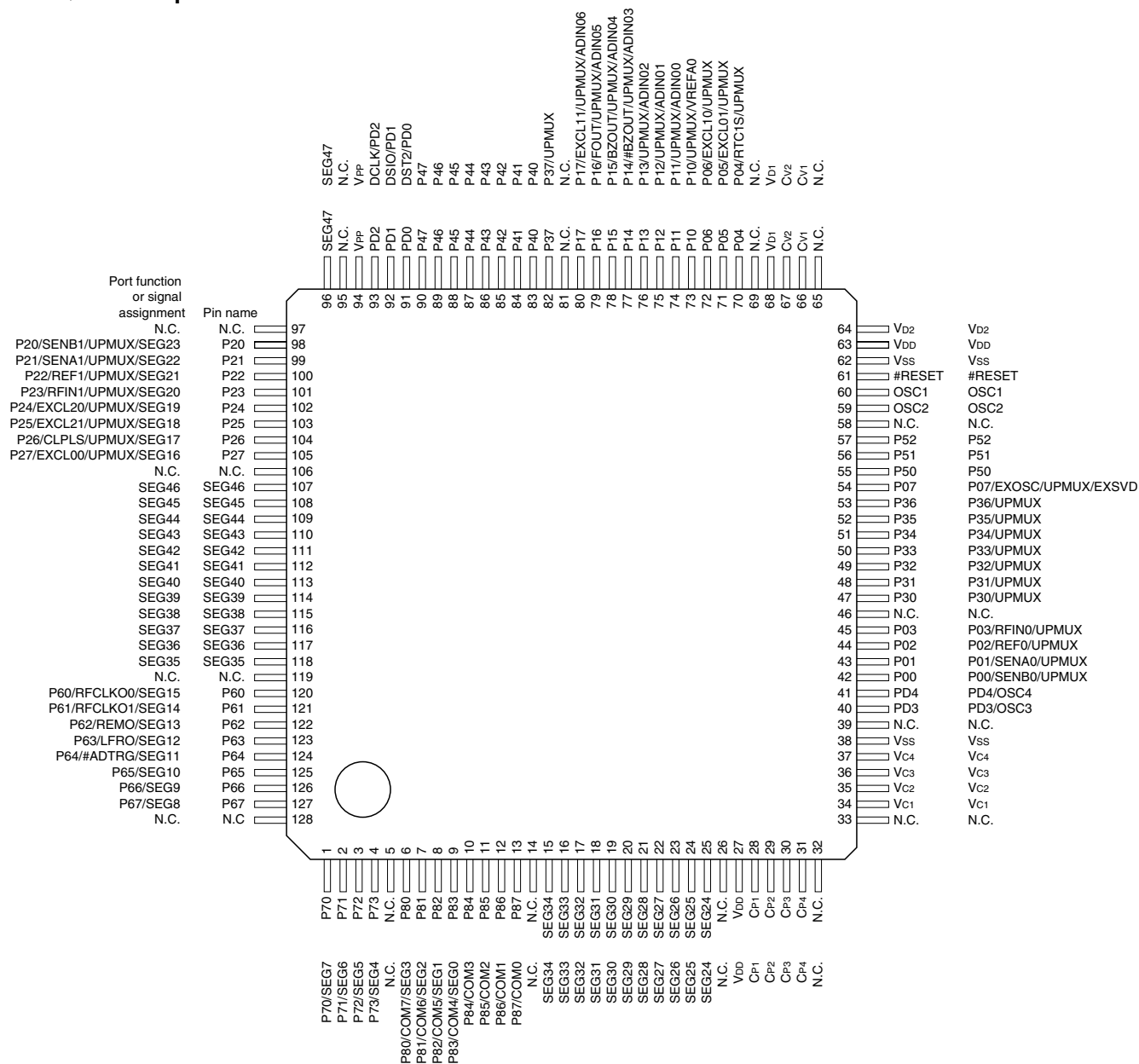
## TQFP14-80pin



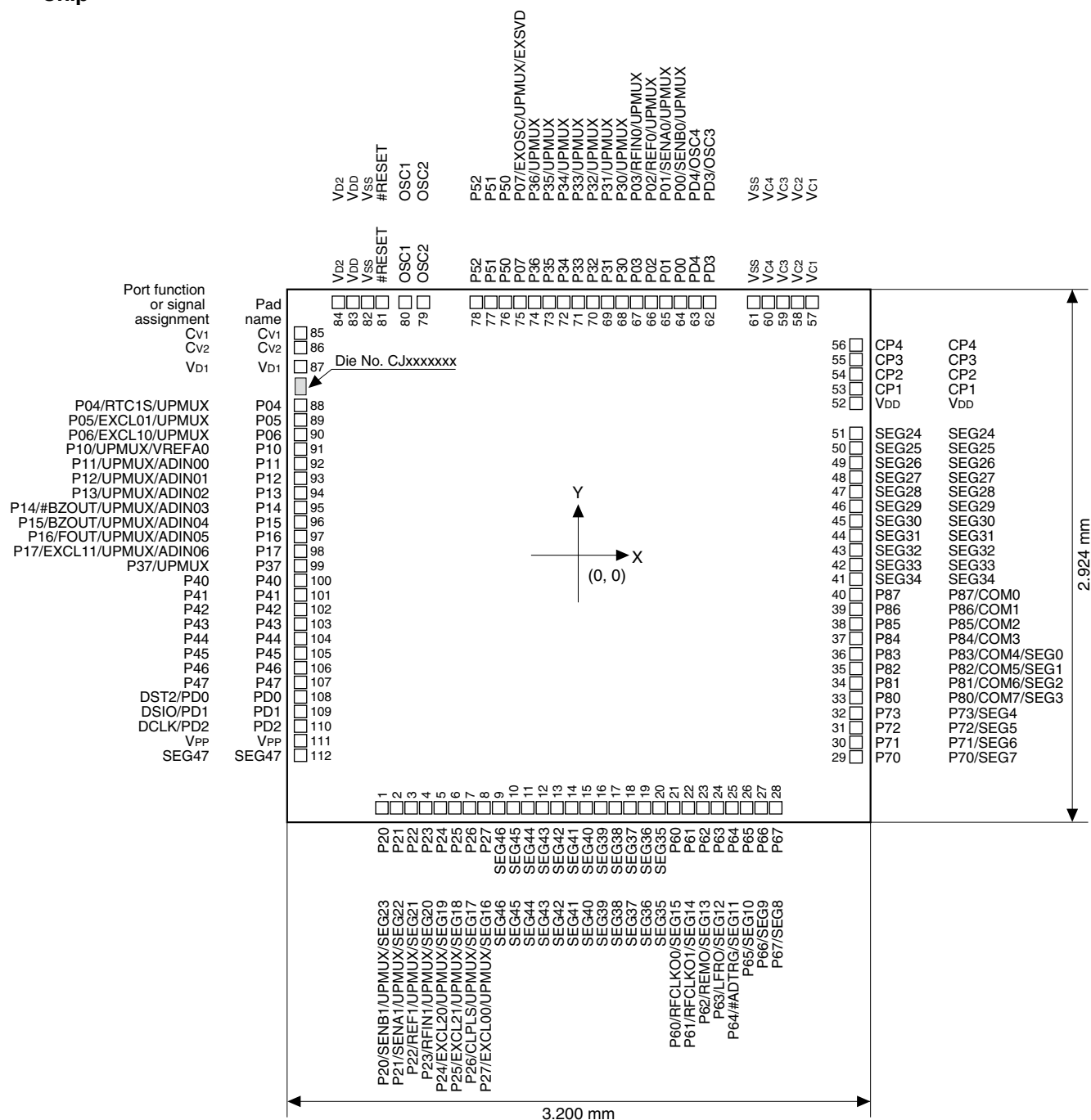
**Note:** The model in this package cannot be placed into super economy mode, as it does not have the V<sub>D2</sub>, C<sub>V1</sub>, and C<sub>V2</sub> pins.

# S1C17W18

## TQFP15-128pin



## Chip



# S1C17W18

## 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                                            | 128pin/chip | 80pin | 64pin |
|--------------|-----------------|-----|---------------|------------------------------|-----------------------------------------------------|-------------|-------|-------|
| $V_{DD}$     | $V_{DD}$        | P   | –             | –                            | 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 | ✓           | –     | –     |
| $CV1-2$      | $CV1-2$         | A   | –             | –                            | DC-DC converter charge pump capacitor connect pins  | ✓           | –     | –     |
| $VC1-4$      | $VC1-4$         | P   | –             | –                            | LCD panel driver power supply                       | ✓           | ✓     | ✓     |
| $CP1-4$      | $CP1-4$         | 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                                            | ✓           | ✓     | ✓     |
|              | RTC1S           | O   |               |                              | Real-time clock 1-second cycle pulse output         | ✓           | ✓     | ✓     |
|              | 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                                            | ✓           | ✓     | ✓     |
|              | EXCL10          | I   |               |                              | 16-bit PWM timer Ch.1 event counter input 0         | ✓           | ✓     | ✓     |
|              | UPMUX           | I/O |               |                              | User-selected I/O (universal port multiplexer)      | ✓           | ✓     | ✓     |
| P07          | P07             | I/O | Hi-Z          | ✓                            | I/O port                                            | ✓           | ✓     | ✓     |
|              | EXOSC           | I   |               |                              | Clock generator external clock input                | ✓           | ✓     | ✓     |
|              | UPMUX           | I/O |               |                              | User-selected I/O (universal port multiplexer)      | ✓           | ✓     | ✓     |
|              | EXSVD           | A   |               |                              | External power supply voltage detection input       | ✓           | ✓     | ✓     |

| Pin/pad name | Assigned signal | I/O | Initial state | Tolerant fail-safe structure | Function                                          | 128pin/chip | 80pin | 64pin |
|--------------|-----------------|-----|---------------|------------------------------|---------------------------------------------------|-------------|-------|-------|
| P10          | P10             | 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 | ✓           | ✓     | ✓     |
| P11          | P11             | 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   | ✓           | ✓     | ✓     |
| P12          | P12             | 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   | ✓           | ✓     | ✓     |
| P13          | P13             | 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   | ✓           | ✓     | ✓     |
| P14          | P14             | I/O | Hi-Z          | -                            | I/O port                                          | ✓           | ✓     | ✓     |
|              | #BZOUT          | O   |               |                              | Sound generator inverted output                   | ✓           | ✓     | ✓     |
|              | UPMUX           | I/O |               |                              | User-selected I/O (universal port multiplexer)    | ✓           | ✓     | ✓     |
|              | ADIN03          | A   |               |                              | 12-bit A/D converter Ch.0 analog signal input 3   | ✓           | ✓     | ✓     |
| P15          | P15             | I/O | Hi-Z          | -                            | I/O port                                          | ✓           | ✓     | ✓     |
|              | BZOUT           | O   |               |                              | Sound generator output                            | ✓           | ✓     | ✓     |
|              | UPMUX           | I/O |               |                              | User-selected I/O (universal port multiplexer)    | ✓           | ✓     | ✓     |
|              | ADIN04          | A   |               |                              | 12-bit A/D converter Ch.0 analog signal input 4   | ✓           | ✓     | ✓     |
| P16          | P16             | I/O | Hi-Z          | -                            | I/O port                                          | ✓           | ✓     | ✓     |
|              | FOUT            | O   |               |                              | Clock external output                             | ✓           | ✓     | ✓     |
|              | UPMUX           | I/O |               |                              | User-selected I/O (universal port multiplexer)    | ✓           | ✓     | ✓     |
|              | ADIN05          | A   |               |                              | 12-bit A/D converter Ch.0 analog signal input 5   | ✓           | ✓     | ✓     |
| P17          | P17             | 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)    | ✓           | ✓     | ✓     |
|              | ADIN06          | A   |               |                              | 12-bit A/D converter Ch.0 analog signal input 6   | ✓           | ✓     | ✓     |
| P20          | P20             | I/O | Hi-Z          | ✓                            | I/O port                                          | ✓           | ✓     | ✓     |
|              | SENB1           | A   |               |                              | R/F converter Ch.1 sensor B oscillator pin        | ✓           | ✓     | ✓     |
|              | UPMUX           | I/O |               |                              | User-selected I/O (universal port multiplexer)    | ✓           | ✓     | ✓     |
|              | SEG23           | A   |               |                              | LCD segment output                                | ✓           | ✓     | ✓     |
| P21          | P21             | I/O | Hi-Z          | ✓                            | I/O port                                          | ✓           | ✓     | ✓     |
|              | SENA1           | A   |               |                              | R/F converter Ch.1 sensor A oscillator pin        | ✓           | ✓     | ✓     |
|              | UPMUX           | I/O |               |                              | User-selected I/O (universal port multiplexer)    | ✓           | ✓     | ✓     |
|              | SEG22           | A   |               |                              | LCD segment output                                | ✓           | ✓     | ✓     |
| P22          | P22             | I/O | Hi-Z          | ✓                            | I/O port                                          | ✓           | ✓     | ✓     |
|              | REF1            | A   |               |                              | R/F converter Ch.1 reference oscillator pin       | ✓           | ✓     | ✓     |
|              | UPMUX           | I/O |               |                              | User-selected I/O (universal port multiplexer)    | ✓           | ✓     | ✓     |
|              | SEG21           | A   |               |                              | LCD segment output                                | ✓           | ✓     | ✓     |
| P23          | P23             | I/O | Hi-Z          | ✓                            | I/O port                                          | ✓           | ✓     | ✓     |
|              | RFIN1           | A   |               |                              | R/F converter Ch.1 oscillation input              | ✓           | ✓     | ✓     |
|              | UPMUX           | I/O |               |                              | User-selected I/O (universal port multiplexer)    | ✓           | ✓     | ✓     |
|              | SEG20           | A   |               |                              | LCD segment output                                | ✓           | ✓     | ✓     |
| P24          | P24             | I/O | Hi-Z          | ✓                            | I/O port                                          | ✓           | ✓     | ✓     |
|              | EXCL20          | I   |               |                              | 16-bit PWM timer Ch.2 event counter input 0       | ✓           | ✓     | ✓     |
|              | UPMUX           | I/O |               |                              | User-selected I/O (universal port multiplexer)    | ✓           | ✓     | ✓     |
|              | SEG19           | A   |               |                              | LCD segment output                                | ✓           | ✓     | ✓     |
| P25          | P25             | I/O | Hi-Z          | ✓                            | I/O port                                          | ✓           | ✓     | ✓     |
|              | EXCL21          | I   |               |                              | 16-bit PWM timer Ch.2 event counter input 1       | ✓           | ✓     | ✓     |
|              | UPMUX           | I/O |               |                              | User-selected I/O (universal port multiplexer)    | ✓           | ✓     | ✓     |
|              | SEG18           | A   |               |                              | LCD segment output                                | ✓           | ✓     | ✓     |
| P26          | P26             | 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)    | ✓           | ✓     | ✓     |
|              | SEG17           | A   |               |                              | LCD segment output                                | ✓           | ✓     | ✓     |
| P27          | P27             | 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)    | ✓           | ✓     | ✓     |
|              | SEG16           | A   |               |                              | LCD segment output                                | ✓           | ✓     | ✓     |
| P30          | P30             | I/O | Hi-Z          | ✓                            | I/O port                                          | ✓           | ✓     | -     |
|              | 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                                       | 128pin/chip | 80pin | 64pin |
|--------------|-----------------|-----|---------------|------------------------------|------------------------------------------------|-------------|-------|-------|
| 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                                       | ✓           | ✓     | —     |
|              | 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                                       | ✓           | ✓     | —     |
|              | UPMUX           | I/O |               |                              | User-selected I/O (universal port multiplexer) | ✓           | ✓     | —     |
| P40          | P40             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | —     |
| P41          | P41             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | —     |
| P42          | P42             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | —     |
| P43          | P43             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | —     | —     |
| P44          | P44             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | —     | —     |
| P45          | P45             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | —     | —     |
| P46          | P46             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | —     | —     |
| P47          | P47             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | —     | —     |
| 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                                       | ✓           | —     | —     |
| P60          | P60             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | RFCLKO0         | O   |               |                              | R/F converter Ch.0 clock monitor output        | ✓           | ✓     | ✓     |
|              | SEG15           | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P61          | P61             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | RFCLKO1         | O   |               |                              | R/F converter Ch.1 clock monitor output        | ✓           | ✓     | ✓     |
|              | SEG14           | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P62          | P62             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | REMO            | O   |               |                              | IR remote controller transmit data output      | ✓           | ✓     | ✓     |
|              | SEG13           | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P63          | P63             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | LFRO            | O   |               |                              | LCD frame signal monitor output                | ✓           | ✓     | ✓     |
|              | SEG12           | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P64          | P64             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | #ADTRG0         | I   |               |                              | 12-bit A/D converter Ch.0 trigger input        | ✓           | ✓     | ✓     |
|              | SEG11           | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P65          | P65             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | SEG10           | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P66          | P66             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | SEG9            | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P67          | P67             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | SEG8            | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P70          | P70             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | SEG7            | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P71          | P71             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | SEG6            | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P72          | P72             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | SEG5            | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P73          | P73             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | SEG4            | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P80          | P80             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | COM7            | A   |               |                              | LCD common output                              | ✓           | ✓     | ✓     |
|              | SEG3            | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |
| P81          | P81             | I/O | Hi-Z          | ✓                            | I/O port                                       | ✓           | ✓     | ✓     |
|              | COM6            | A   |               |                              | LCD common output                              | ✓           | ✓     | ✓     |
|              | SEG2            | A   |               |                              | LCD segment output                             | ✓           | ✓     | ✓     |

| Pin/pad name | Assigned signal | I/O | Initial state | Tolerant fail-safe structure | Function                           | 128pin/chip | 80pin | 64pin |
|--------------|-----------------|-----|---------------|------------------------------|------------------------------------|-------------|-------|-------|
| P82          | P82             | I/O | Hi-Z          | ✓                            | I/O port                           | ✓           | ✓     | ✓     |
|              | COM5            | A   |               |                              | LCD common output                  | ✓           | ✓     | ✓     |
|              | SEG1            | A   |               |                              | LCD segment output                 | ✓           | ✓     | ✓     |
| P83          | P83             | I/O | Hi-Z          | ✓                            | I/O port                           | ✓           | ✓     | ✓     |
|              | COM4            | A   |               |                              | LCD common output                  | ✓           | ✓     | ✓     |
|              | SEG0            | A   |               |                              | LCD segment output                 | ✓           | ✓     | ✓     |
| P84          | P84             | I/O | Hi-Z          | ✓                            | I/O port                           | ✓           | ✓     | ✓     |
|              | COM3            | A   |               |                              | LCD common output                  | ✓           | ✓     | ✓     |
| P85          | P85             | I/O | Hi-Z          | ✓                            | I/O port                           | ✓           | ✓     | ✓     |
|              | COM2            | A   |               |                              | LCD common output                  | ✓           | ✓     | ✓     |
| P86          | P86             | I/O | Hi-Z          | ✓                            | I/O port                           | ✓           | ✓     | ✓     |
|              | COM1            | A   |               |                              | LCD common output                  | ✓           | ✓     | ✓     |
| P87          | P87             | I/O | Hi-Z          | ✓                            | I/O port                           | ✓           | ✓     | ✓     |
|              | COM0            | A   |               |                              | LCD common 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   |               |                              | OSC4 oscillator circuit output     | ✓           | ✓     | ✓     |
| SEG24–27     | SEG24–27        | A   | Hi-Z          | –                            | LCD segment output                 | ✓           | ✓     | –     |
| SEG28–34     | SEG28–34        | A   | Hi-Z          | –                            | LCD segment output                 | ✓           | –     | –     |
| SEG35–38     | SEG35–38        | A   | Hi-Z          | –                            | LCD segment output                 | ✓           | ✓     | –     |
| SEG39–47     | SEG39–47        | A   | Hi-Z          | –                            | LCD segment output                 | ✓           | –     | –     |

## 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) | SDIn                  | I   | $n = 0, 1$         | SPIA Ch. $n$ data input                 |
|                                     | SDOn                  | 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 <sup>2</sup> C (I2C)              | SCL $n$               | I/O | $n = 0$            | I2C Ch. $n$ clock input/output          |
|                                     | SDA $n$               | I/O |                    | I2C Ch. $n$ data input/output           |
| UART (UART)                         | USIN $n$              | I   | $n = 0, 1$         | UART Ch. $n$ data input                 |
|                                     | USOUT $n$             | O   |                    | UART Ch. $n$ data output                |
| 16-bit PWM timer (T16B)             | TOUT $n$ 0/CAP $n$ 0  | I/O | $n = 0, 1, 2$      | T16B Ch. $n$ PWM output/capture input 0 |
|                                     | TOUT $n$ 1/CAP $n$ 1  | I/O |                    | T16B Ch. $n$ PWM output/capture input 1 |

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Document Code: 413096402

First Issue August 2015

Revised May 2016 in JAPAN ©