

# S1C17F57

## Low Power 16-bit Single Chip Microcontroller

- Low power MCU (100nA/SLEEP, 210nA/RTC, 550nA/HALT)
- Flash memory (32K bytes), RAM (2K bytes)
- Built-in EPD driver (voltage booster circuit)
- EPD driving waveform generator circuit
- Real-time clock
- Built-in temperature sensor
- Compact codes optimized for C, and high throughput of an instruction/clock. Support serial ICE, and comes equipped with RISC CPU core S1C17.

### ■ DESCRIPTIONS

S1C17F57 is a 16-bit MCU that has achieved high processing speeds with low voltage operation, compact size, wide address space and on-chip ICE. It consists of a 16-bit core CPU S1C17 as the core CPU, 32K bytes flash memory, 2K bytes RAM, Serial I/F such as UART/SPI/I2C, timers, real-time clock, multiplier circuit. In addition, it has 64 segment EPD driver, EPD driving waveform generator circuit, temperature sensor. It can drive E-paper display by 1chip.

S1C17F57 is suitable for battery driven and E-paper application like smartcard, watch, and tags.

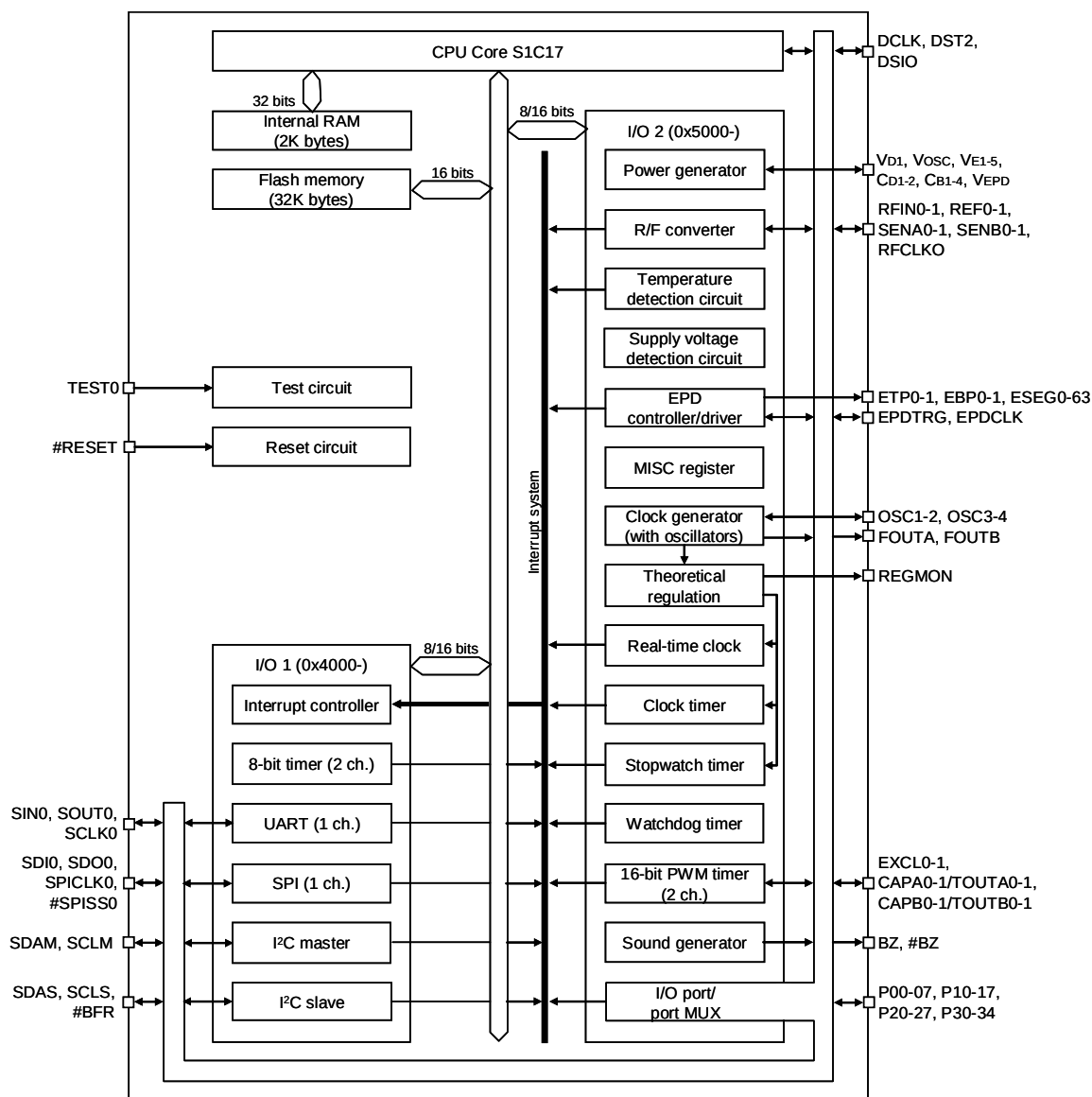
### ■ FEATURES

| CPU                                 |                                                                                                                                                                |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CPU core                            | Seiko Epson original 16-bit RISC CPU core S1C17                                                                                                                |
| Multiplier/Divider (COPRO)          | - 16-bit × 16-bit multiplier<br>- 16-bit × 16-bit + 32-bit multiply and accumulation unit<br>- 16-bit ÷ 16-bit divider                                         |
| Embedded Flash memory               |                                                                                                                                                                |
| Capacity                            | 32K bytes (for both instructions and data)                                                                                                                     |
| Erase/program count                 | Three times                                                                                                                                                    |
| Other                               | - Read/program protection function<br>- A programming power supply (VPP) is required.<br>- Allows on-board programming using a debugging tool such as ICDmini. |
| Embedded RAM                        |                                                                                                                                                                |
| Capacity                            | 2K bytes                                                                                                                                                       |
| Clock generator                     |                                                                                                                                                                |
| System clock source                 | 3 sources (OSC3B/OSC3A/OSC1)                                                                                                                                   |
| OSC3B oscillator circuit            | 2M/1M/500k Hz (typ.) internal oscillator circuit                                                                                                               |
| OSC3A oscillator circuit            | 4.2 MHz (max.) crystal or ceramic oscillator circuit                                                                                                           |
| OSC1B oscillator circuit            | 32 kHz (typ.) internal oscillator circuit                                                                                                                      |
| OSC1A oscillator circuit            | 32.768 kHz (typ.) crystal oscillator circuit                                                                                                                   |
| Other                               | Oscillation adjustment by theoretical regulation<br>- Core clock frequency control<br>- Peripheral module clock supply control                                 |
| EPD controller/driver               |                                                                                                                                                                |
| Number of driver outputs            | Segment output: 64 pins<br>Top plane output: 2 pins<br>Back plane output: 2 pins                                                                               |
| Drive voltage                       | 0 V/15 V (VSS/VEPD)                                                                                                                                            |
| Other                               | - Includes a drive power supply.<br>- Includes a display data memory.<br>- Output drive waveforms can be programmed.<br>- Supports pin output direct control.  |
| I/O ports                           |                                                                                                                                                                |
| Number of general-purpose I/O ports | Max. 29 bits (Pins are shared with the peripheral I/O.)                                                                                                        |
| Other                               | - Schmitt input<br>- Pull-up control function<br>- Port input interrupt: 8 bits × 2 channels                                                                   |
| Serial interfaces                   |                                                                                                                                                                |
| SPI                                 | 1 channel                                                                                                                                                      |
| I <sup>2</sup> C master (I2CM)      | 1 channel                                                                                                                                                      |
| I <sup>2</sup> C slave (I2CS)       | 1 channel                                                                                                                                                      |
| UART                                | 1 channel (IrDA1.0 supported)                                                                                                                                  |
| Timers/Counters                     |                                                                                                                                                                |
| 8-bit timer (T8)                    | 2 channels (Generates the SPI Ch.0 and I2CM clocks.)                                                                                                           |

# S1C17F57

|                                                              |                                                                                                            |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| 16-bit PWM timer (T16A2)                                     | 2 channels (PWM output, event counter, and count capture functions)                                        |
| Watchdog timer (WDT)                                         | 1 channel (Generates NMI/reset.)                                                                           |
| <b>Clock functions</b>                                       |                                                                                                            |
| Real-time clock (RTC)                                        | 1 channel<br>(Hour, minute, and second counters) with theoretical regulation support                       |
| Clock timer (CT)                                             | 1 channel (128 Hz to 1 Hz counters) with theoretical regulation support                                    |
| Stopwatch timer (SWT)                                        | 1 channel<br>(1/100 second and 1/10 second counters) with theoretical regulation support                   |
| Theoretical regulation function (TR)                         | Time adjustment function in +16/32768 to -15/32768 second units                                            |
| <b>Sound generator</b>                                       |                                                                                                            |
| Buzzer frequency                                             | 8 frequencies selectable                                                                                   |
| Volume control                                               | 8 steps adjustable                                                                                         |
| Other                                                        | - One-shot buzzer<br>- Auto envelope function                                                              |
| <b>Analog circuits</b>                                       |                                                                                                            |
| R/F converter (RFC)                                          | 2 channels (24-bit CR oscillation type. Supports DC-bias resistive sensors and AC-bias resistive sensors.) |
| Temperature detection circuit (TEM)                          | 1 channel (Measurement range: 0°C to 50°C)                                                                 |
| Supply voltage detection circuit (SVD)                       | 1 channel (Detection voltage: 13 levels)                                                                   |
| <b>Interrupts</b>                                            |                                                                                                            |
| Reset interrupt                                              | #RESET pin/watchdog timer                                                                                  |
| NMI                                                          | Watchdog timer                                                                                             |
| Programmable interrupts                                      | 16 systems (8 levels)                                                                                      |
| <b>Power supply voltage</b>                                  |                                                                                                            |
| Operating voltage (VDD)                                      | 2.0 V to 3.6 V                                                                                             |
| Flash programming/erasing voltage (VPP)                      | 7 V/7.5 V                                                                                                  |
| <b>Operating temperature</b>                                 |                                                                                                            |
| Operating temperature range                                  | -40°C to 85°C                                                                                              |
| <b>Current consumption (Typ value, VDD = 2.0 V to 3.6 V)</b> |                                                                                                            |
| SLEEP state                                                  | 100 nA (OSC1 = Off, RTC = Off, OSC3B = Off, OSC3A = Off)                                                   |
| HALT state                                                   | 0.55 $\mu$ A (OSC1 = 32 kHz (OSC1A), RTC = Off, OSC3B = Off, OSC3A = Off)                                  |
|                                                              | 0.5 $\mu$ A (OSC1 = 32 kHz (OSC1A), RTC = On, OSC3B = Off, OSC3A = Off)                                    |
|                                                              | 12 $\mu$ A (OSC1 = 32 kHz (OSC1A), RTC = Off, OSC3B = Off, OSC3A = Off)                                    |
|                                                              | 1440 $\mu$ A (OSC1 = Off, RTC = Off, OSC3B = Off, OSC3A = 4 MHz ceramic)                                   |
| Run state                                                    | 770 $\mu$ A (OSC1 = Off, RTC = Off, OSC3B = 2 MHz, OSC3A = Off)                                            |
| <b>Shipping form</b>                                         |                                                                                                            |
| 1                                                            | QFP15-128pin (14 mm $\times$ 14 mm $\times$ 1.4 mm, lead pitch: 0.4 mm)                                    |
| 2                                                            | Aluminum pad chip                                                                                          |
| 3                                                            | Gold bump chip                                                                                             |

## ■ BLOCK DIAGRAM



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