

# S1C17624/604/622/602/621

## 16-bit Single Chip Microcontroller

- Low Power MCU: Operating voltage 1.8V, 0.75uA/SLEEP, 2.3uA/HALT
- Built in Flash memory: 8.2MHz high-speed operation with 1.8V low voltage
- Built in LCD driver: 52SEG × 8COM(max.), power supply voltage booster circuit
- Analog I/F: 10-bit A/D converter, 24-bit R/F converter, Supply voltage detector
- Real time clock: calendar function(support leap year)

### ■ DESCRIPTIONS

The S1C17624/604/622/602/621 is a 16-bit MCU featuring high-speed low-power operations, compact dimensions, wide address space, and on-chip ICE. Based on an S1C17 CPU core, this product consists of a Flash memory, RAM, serial interface modules supporting sensors such as UART to support high-bit rate and IrDA1.0, SPI, and I2C, various timers, maximum 47 general input/output ports, maximum 52 segment × 8 common LCD driver and a power supply voltage booster circuit, A/D converter, R/F converter, supply voltage detector, and 32 kHz and maximum 8.2 MHz oscillator circuits.

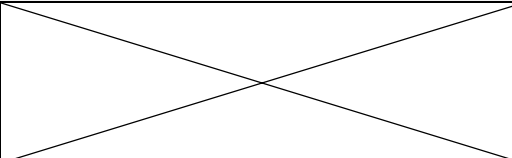
It allows 8.2 MHz high-speed operation at a minimum of 1.8 V operating voltage, and executes a basic instruction in one clock cycle with 16-bit RISC processing. The S1C17624/604/622/602/621 also includes a coprocessor supporting multiplication, division, and MAC (multiply and accumulation) operations.

The on-chip ICE function allows onboard Flash programming/erasing, program debugging, and evaluations using the ICDmini (S5U1C17001H) that can be connected with three signal wires.

The S1C17624/604/622/602/621 is ideal for applications, such as health care products with sensors, sports watches, and meter modules that must be driven with battery power and require sensor interfaces and a high-definition LCD display.

### ■ FEATURES

The main features of the S1C17624/604/622/602/621 are listed below.

| Model                      | S1C17624                                                                                                                                                                                                                | S1C17604  | S1C17622                                                                             | S1C17602  | S1C17621 |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------|-----------|----------|
| CPU                        |                                                                                                                                                                                                                         |           |                                                                                      |           |          |
| CPU core                   | Seiko Epson original 16-bit RISC CPU core S1C17                                                                                                                                                                         |           |                                                                                      |           |          |
| Multiplier/Divider (COPRO) | <ul style="list-style-type: none"><li>• 16-bit × 16-bit multiplier</li><li>• 16-bit × 16-bit + 32-bit multiply and accumulation unit</li><li>• 16-bit ÷ 16-bit divider</li></ul>                                        |           |                                                                                      |           |          |
| Embedded Flash memory      |                                                                                                                                                                                                                         |           |                                                                                      |           |          |
| Capacity                   | 128K bytes                                                                                                                                                                                                              | 64K bytes |                                                                                      | 32K bytes |          |
|                            | (Can be used for both instructions and data.)                                                                                                                                                                           |           |                                                                                      |           |          |
| Erase/program count        | 1,000 cycles (min.)                                                                                                                                                                                                     |           |                                                                                      |           |          |
| Other                      | <ul style="list-style-type: none"><li>• Read/program protection function</li><li>• Allows on-board programming using a debugging tool such as ICDmini (S5U1C17001H) and self-programming by software control.</li></ul> |           |                                                                                      |           |          |
| Embedded RAM               |                                                                                                                                                                                                                         |           |                                                                                      |           |          |
| Capacity                   | 8K bytes                                                                                                                                                                                                                | 4K bytes  |                                                                                      | 2K bytes  |          |
| Embedded Display RAM       |                                                                                                                                                                                                                         |           |                                                                                      |           |          |
| Capacity                   | 56 bytes                                                                                                                                                                                                                | 40 bytes  | 56 bytes                                                                             | 40 bytes  |          |
| Clock generator            |                                                                                                                                                                                                                         |           |                                                                                      |           |          |
| System clock source        | 3 sources (IOSC/OSC3/OSC1)                                                                                                                                                                                              |           |                                                                                      |           |          |
| IOSC oscillator circuit    | 2.7 MHz(typ.) internal oscillator circuit (oscillation start time 5 μs min.)                                                                                                                                            |           |                                                                                      |           |          |
| OSC3 oscillator circuit    | 8.2 MHz (max.) crystal or ceramic oscillator circuit<br>Supports an external clock input.                                                                                                                               |           |                                                                                      |           |          |
| OSC1 oscillator circuit    | 32.768 kHz (typ.) crystal oscillator circuit<br>Supports an external clock input.                                                                                                                                       |           |                                                                                      |           |          |
| Other                      | <ul style="list-style-type: none"><li>• Core clock frequency control</li><li>• Peripheral module clock supply control</li><li>• IOSC control for quick-restart processing from SLEEP mode</li></ul>                     |           |                                                                                      |           |          |
| Real-time clock            |                                                                                                                                                                                                                         |           |                                                                                      |           |          |
| RTC module                 | Included<br>(Contains second, minute, hour, day, days of week, month, and year counters.)                                                                                                                               |           |  |           |          |

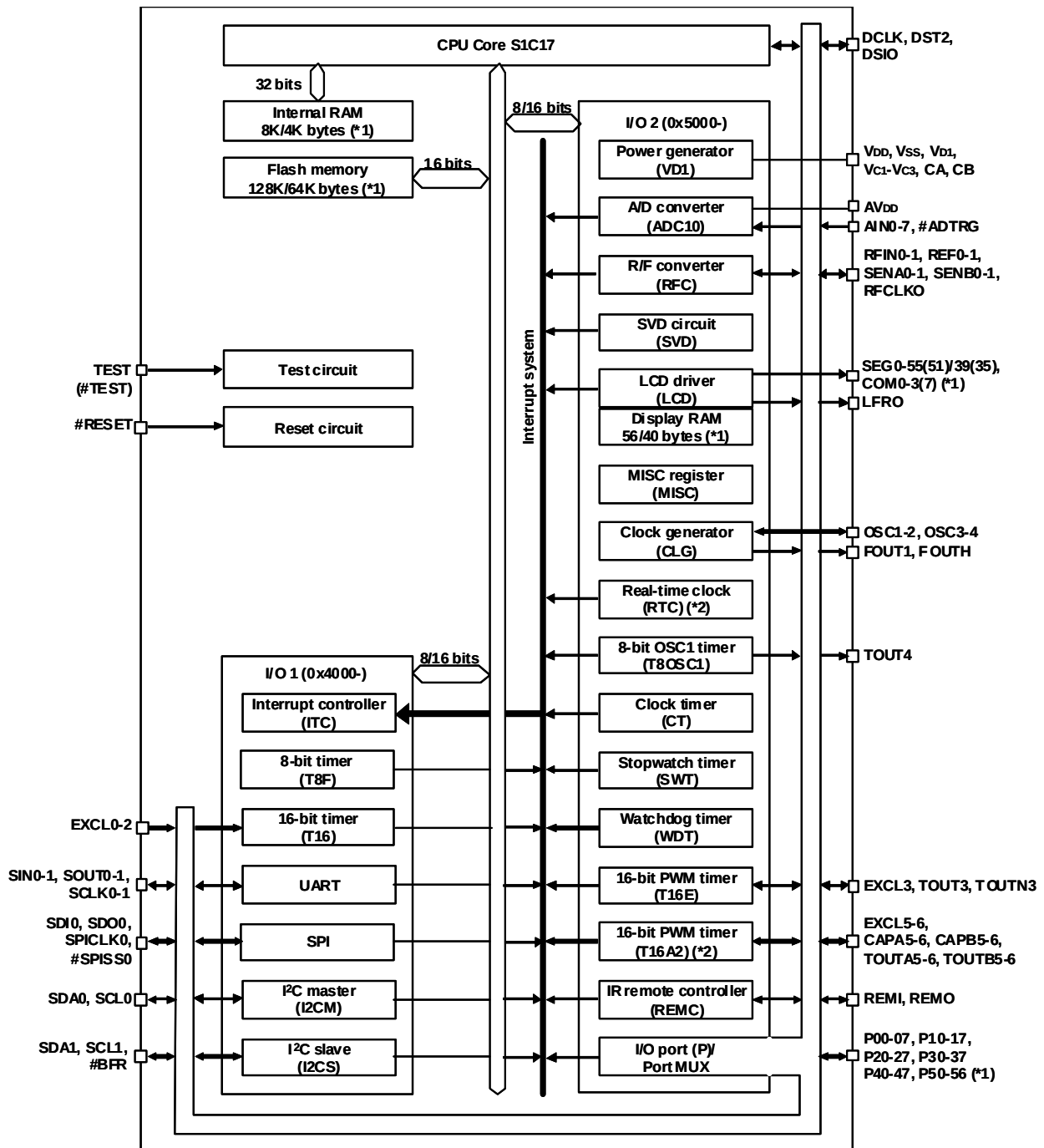
# S1C17624/604/622/602/621

| Model                               | S1C17624                                                                                                                                                        | S1C17604                         | S1C17622                         | S1C17602                         | S1C17621 |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------|
| I/O ports                           |                                                                                                                                                                 |                                  |                                  |                                  |          |
| Number of general-purpose I/O ports | Max. 47 bits                                                                                                                                                    | Max. 36 bits                     | Max. 47 bits                     | Max. 36 bits                     |          |
|                                     | (Pins are shared with the peripheral I/O.)                                                                                                                      |                                  |                                  |                                  |          |
| Serial interfaces                   |                                                                                                                                                                 |                                  |                                  |                                  |          |
| SPI                                 | 1 channel                                                                                                                                                       |                                  |                                  |                                  |          |
| I <sup>2</sup> C master (I2CM)      | 1 channel                                                                                                                                                       |                                  |                                  |                                  |          |
| I <sup>2</sup> C slave (I2CS)       | 1 channel                                                                                                                                                       |                                  |                                  |                                  |          |
| UART                                | 2 channels (IrDA1.0 supported)                                                                                                                                  |                                  |                                  |                                  |          |
| IR remote controller (REMC)         | 1 channel                                                                                                                                                       |                                  |                                  |                                  |          |
| LCD driver                          |                                                                                                                                                                 |                                  |                                  |                                  |          |
| LCD outputs                         | · 56SEG × 4COM<br>· 52SEG × 8COM                                                                                                                                | · 40SEG × 4COM<br>· 36SEG × 8COM | · 56SEG × 4COM<br>· 52SEG × 8COM | · 40SEG × 4COM<br>· 36SEG × 8COM |          |
| Other                               | 1/3 bias (built-in power supply voltage booster circuit)                                                                                                        |                                  |                                  |                                  |          |
| Timers                              |                                                                                                                                                                 |                                  |                                  |                                  |          |
| 8-bit timer (T8F)                   | 2 channels (with fine mode)                                                                                                                                     |                                  |                                  |                                  |          |
| 16-bit timer (T16)                  | 3 channels                                                                                                                                                      |                                  |                                  |                                  |          |
| 16-bit PWM timer (T16E)             | 1 channel                                                                                                                                                       |                                  |                                  |                                  |          |
| 16-bit PWM timer (T16A2)            | 2 channels                                                                                                                                                      |                                  |                                  |                                  |          |
| 8-bit OSC1 timer (T8OSC1)           | 1 channel                                                                                                                                                       |                                  |                                  |                                  |          |
| Clock timer (CT)                    | 1 channel                                                                                                                                                       |                                  |                                  |                                  |          |
| Stopwatch timer (SWT)               | 1 channel                                                                                                                                                       |                                  |                                  |                                  |          |
| Watchdog timer (WDT)                | 1 channel                                                                                                                                                       |                                  |                                  |                                  |          |
| A/D converter                       |                                                                                                                                                                 |                                  |                                  |                                  |          |
| Conversion method                   | Successive approximation type                                                                                                                                   |                                  |                                  |                                  |          |
| Number of analog input channels     | 8 channels (max.)                                                                                                                                               |                                  |                                  |                                  |          |
| Resolution                          | 10 bits                                                                                                                                                         |                                  |                                  |                                  |          |
| R/F converter                       |                                                                                                                                                                 |                                  |                                  |                                  |          |
| Conversion method                   | CR oscillation type with 24-bit counter                                                                                                                         |                                  |                                  |                                  |          |
| Number of conversion channels       | 2 channels (2 sensors can be connected to each channel.)                                                                                                        |                                  |                                  |                                  |          |
| Sensor supported                    | DC-bias resistive/capacitive sensors and AC-bias resistive sensors                                                                                              |                                  |                                  |                                  |          |
| Other                               | Supports external input for counting pulses                                                                                                                     |                                  |                                  |                                  |          |
| Supply voltage detector (SVD)       |                                                                                                                                                                 |                                  |                                  |                                  |          |
| Detection levels                    | 15 programmable detection levels (1.8 V to 3.2 V)                                                                                                               |                                  |                                  |                                  |          |
| Interrupts                          |                                                                                                                                                                 |                                  |                                  |                                  |          |
| Reset interrupt                     | #RESET pin                                                                                                                                                      |                                  |                                  |                                  |          |
| NMI                                 | Watchdog timer                                                                                                                                                  |                                  |                                  |                                  |          |
| Programmable interrupts             | 20 systems (8 levels)                                                                                                                                           |                                  | 19 systems (8 levels)            |                                  |          |
| Power supply voltage                |                                                                                                                                                                 |                                  |                                  |                                  |          |
| Operating voltage (VDD)             | · 1.8 V to 3.6 V (for normal operation)<br>· 2.7 V to 3.6 V (for Flash erasing/programming)<br>· Built-in voltage regulator (two operating voltages switchable) |                                  |                                  |                                  |          |
| Analog voltage (AVDD)               | AVDD = VDD                                                                                                                                                      |                                  |                                  |                                  |          |
| Operating temperature               |                                                                                                                                                                 |                                  |                                  |                                  |          |
| Operating temperature range         | -25°C to 70°C                                                                                                                                                   |                                  |                                  |                                  |          |
| Current consumption (Typ. value)    |                                                                                                                                                                 |                                  |                                  |                                  |          |
| SLEEP state (ISLP)                  | 0.75μA                                                                                                                                                          |                                  |                                  |                                  |          |
|                                     | OSC1 = OFF, IOSC = OFF, OSC3 = OFF                                                                                                                              |                                  |                                  |                                  |          |
| HALT state (IHALT1)                 | 2.3μA                                                                                                                                                           |                                  |                                  | 2.5μA                            |          |
|                                     | OSC1 = 32kHz, IOSC = OFF, OSC3 = OFF, PCKEN[1:0] = 0x0, LCD OFF                                                                                                 |                                  |                                  |                                  |          |
| HALT state (IHALT1 + ILCD2)         | 4.0μA                                                                                                                                                           |                                  |                                  | 3.5μA                            |          |
|                                     | OSC1 = 32kHz, IOSC = OFF, OSC3 = OFF, PCKEN[1:0] = 0x0, LCD ON (checker pattern displayed, highest contrast, VC2 reference voltage)                             |                                  |                                  |                                  |          |
| Run state (IEXE1)                   | 14μA                                                                                                                                                            |                                  |                                  | 15μA                             |          |
|                                     | CPU = OSC1, OSC1 = 32kHz, IOSC = OFF, OSC3 = OFF, LCD OFF                                                                                                       |                                  |                                  |                                  |          |
| Run state (IEXE2)                   | 400μA                                                                                                                                                           |                                  |                                  | 410μA                            |          |
|                                     | CPU = OSC3, OSC1 = 32kHz, IOSC = OFF, OSC3 = 1MHz ceramic oscillation                                                                                           |                                  |                                  |                                  |          |

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| Model         | S1C17624                                                                                                                                                                                                                 | S1C17604      | S1C17622      | S1C17602      | S1C17621 |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|---------------|----------|
| Shipping form |                                                                                                                                                                                                                          |               |               |               |          |
| 1             | TQFP15-128pin                                                                                                                                                                                                            | TQFP14-100pin | TQFP15-128pin | TQFP14-100pin |          |
| 2             | Die form                                                                                                                                                                                                                 |               |               |               |          |
| 3             |                                                                                                                                                                                                                          |               |               | VFBGA7H-144   |          |
| Size/pitch    | TQFP15-128pin (body size: 14 mm × 14 mm, lead pitch: 0.4 mm)<br>TQFP14-100pin (body size: 12 mm × 12 mm, lead pitch: 0.4 mm)<br>VFBGA7H-144 (body size: 7 mm × 7 mm, ball pitch: 0.5 mm)<br>Die form (pad pitch: 100 μm) |               |               |               |          |

## ■ BLOCK DIAGRAM



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\*1: The models have a different memory size, LCD outputs and I/O port configurations.

\*2: The real-time clock (RTC) and 16-bit PWM timer (T16A2) are available only in the S1C17624 and S1C17604.

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