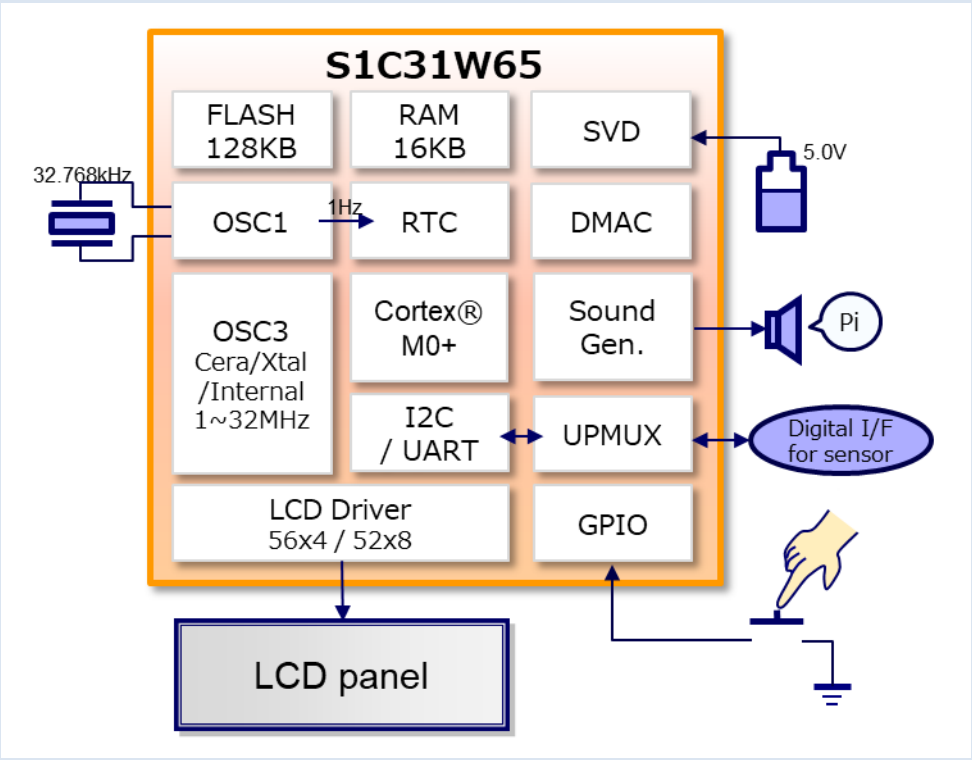
“S1C31W65” Power-efficient 32-bit Microcontroller with Arm®Cortex®-M0+ Processor

- LCD driver integrated Microcontroller that supports 1.8V – 5.5V driving voltages and guarantees operation at up to 105℃ -

Seiko Epson Corporation(“Epson”) has developed “S1C31W65”, a new power-efficient 32-bit Microcontroller with Arm®Cortex®-M0+ processor.
It features an integrated segment LCD display driver, and it supports operating temperature up to 105℃ and operating voltages ranging between 1.8V and 5.5V, making usable under a wide range of environmental conditions.

Industrial equipment and consumer electronics are increasingly IoT-enabled systems hosting a multitude of functions. They require high-performance processing while still maintaining low current consumption. To meet these market requirements, Epson has leveraged its low-leakage and low-current consumption technologies and used Arm®Cortex®-M0+ processors to expand and upgrade the S1C31 Family of MCUs, which offer high performance yet consume minimal current.



S1C31W65 system block diagram

This document introduces the features of S1C31W65 as follows.

Low power consumption

Based on the low current consumption technology which is a feature of Epson MCUs, the S1C31W65 consumes just 0.3µA in Sleep mode [1] and operates at 130µA/MHz [2].

Segment LCD display driver

Epson leveraged its signature display driving technology to provide an LCD display driver that can drive up to 416 segments. The bias power supply necessary for driving an LCD panel can be generated by the internal power supply circuit [3] ,so display quality is not affected by the remaining battery power. In addition, drive voltage is software adjusted. The MCU supports LCD contrast adjustment and LCD panels with different voltages.

Peripherals on one chip

In addition to Flash memory and LCD display driver, the S1C31W65 offers a wide rage of built-in peripherals including real-time clock(RTC), various timers, R/F converter [4], A/D converter, and temperature sensor. It enables to achieve the functionality required for user application without the need for external devices.

- Self-programmable flash memory
- LCD display driver with integrated power supply circuit
- Real-time clock
- Supply voltage detector(SVD) circuit that does not require an external power supply monitor
- R/F converter, A/D converter, temperature sensor / reference voltage generator circuit
- Universal port multiplexer(UPMUX): I/O pin assignments changeable with software

Usable under a wide range of environmental conditions

The S1C31W65 supports operating temperatures up to 105℃ and operating voltages ranging between 1.8V and 5.5V, making it ideal for industrial equipment and for consumer electronics that require sensing.

- Operating voltage range: 1.8V to 5.5V
- Operating temperature range: -40℃ to 105℃
- High-speed operation up to 33 MHz
- Boot clock startup as fast as 2µs [5]
- Low-power 32.768kHz crystal oscillator / 32 kHz built-in oscillation circuit

1: Equivalent to the Cortex®-M0+ processor's deep sleep mode

2: When VD1 voltage mode is mode 1

3: The external input mode of the bias power supply is also supported.

4: RC oscillation type A/D converter. Resistance components are converted to frequency. Low-error, high-accuracy measurement is achieved by oscillating a reference resistance and sensor under identical conditions and finding the difference.

5: The time it takes for the CPU to read the vector table from the sleep state with a 32-MHz system clock.

■**Product specifications**

Product number	S1C31W65
CPU core	Arm®Cortex®-M0+ 32-bit RISC processor
Flash memory	128 Kbytes
RAM	16 Kbytes
Operating voltage	1.8 V to 5.5 V
Operating frequency	Max. 33 MHz (V_{D1} voltage mode: mode 0) Max. 2.1 MHz (V_{D1} voltage mode: mode 1)
LCD display driver	Max. 416 dots (52 SEG x 5–8 COM) Max. 224 dots (56 SEG x 1–4 COM)
Serial interfaces	UART: 2 channels SPI: 2 channels I^2C: 2 channels
R/F converter	CR oscillator with 24-bit counters and DC oscillation mode, 1ch
A/D converter	12-bit successive-approximation ADC External signal inputs: 7 max. Internal signal inputs: 1 Connect temperature sensor output
Temperature sensor / reference voltage generator circuit	Sensor output can be read by the A/D converter Reference voltage for A/D converter is selectable from 2.0 V, 2.5 V, V_{DD}, and external input
Supply voltage detector	V_{DD} or external voltage 32 levels (1.7 V to 5.0 V)
Timers	16-bit timer: 8 channels 16-bit PWM timer: 3 channels Watchdog timer Real-time clock
I/O ports	I/O ports: Max. 63 bits. Output ports 1 bit. Universal port multiplexer: 32 bits
Current consumption(typical)	Sleep mode: 0.3 µA RTC mode: 0.8 µA Run mode: 195 µA/MHz (V_{D1} voltage mode: mode 0) 130 µA/MHz (V_{D1} voltage mode: mode 1)
Operating temperature	-40°C to 105°C
Package	P-LQFP100-1212-0.40 (pin pitch: 0.4 mm)

S1C31W65 product information

- S1C31W65 information
- Contact windows