S1C17002

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Low Power 16-bit Single Chip Microcontroller

● Low power MCU (Operating voltage 1.8V、Power consumption SLEEP 0.5 uA, HALT 3.3 mA)
● High code density and high processing power 16bitRISC C17CPU,   optimize to C, serial ICE
● 128KB ROM, 8KB RAM
● 10-bit ADC
● Infrared Remote Controller Circuit

■ DESCRIPTIONS

The S1C17002 is a cost effective, high performance and compact 16-bit RISC application specific controller (ASC).
It is suitable for various products that require analog inputs and interfaces for connection, such as healthcare goods, sensor systems, alarms, home electric appliance (rice cookers, microwave ovens and remote controllers).
The S1C17002 consists of a S1C17 16-bit compact RISC CPU Core, a 128K-byte ROM, an 8K-byte RAM, a 10-bit ADC with four analog input channels, a 16-bit multi-function timer, an infrared remote controller, serial interfaces (UART with IrDA 1.0, SPI and I2C), an RTC, 16-bit and 8-bit timers, a watchdog timer, and GPIO ports.
The S1C17002 provides a 16 bits × 16 bits + 32 bits MAC (multiply and accumulate) and 16 bits ÷ 16 bits division functions to implement a DSP function.
The S1C17002 has adopted the EPSON SoC (System on Chip) design technology using 0.18 μm mixed analog low power CMOS process.

■ FEATURES

● CPU
    Seiko Epson original 16-bit RISC processor S1C17 Core
    Internal 3-stage pipeline
    Instruction set
        - 16-bit fixed length
        - 111 basic instructions (184 including variations)
        - Compact and fast instruction set optimized for development in C language
    Registers
        - Eight 24-bit general-purpose registers
        - Three special registers (24-bit × 2, 8-bit × 1)
    Memory space
        - Up to 16M bytes accessible (24-bit address)
● Internal Memories
    Mask ROM
        - 128K bytes
    RAM
        - 8K bytes
● Operating Clock
    Main clock
        - 20 MHz (max.)
        - On-chip oscillator (crystal or ceramic) or external clock input
    Sub clock
        - 32.768 kHz (typ.) for the RTC, usable as the main clock
        - On-chip oscillator (crystal) or external clock input
● Interrupt Controller
    Four non-maskable interrupts
        - Reset (#RESET pin or watchdog timer)
        - Address misaligned
        - Debug
        - NMI (watchdog timer)
    29 maskable interrupts
        - Port inputs (eight systems)
        - 16-bit multi-function timer (one system)
        - A/D converter (two systems)
        - 16-bit timer of clock generator (one system)
        - 8-bit timers of clock generator (three systems)
        - UART (one system)
        - SPI (one system)

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           - I2C master (one system)
           - I2C slave (two systems)
           - RTC (one system)
           - 8-bit programmable timers (four systems)
           - 8-bit OSC1 timers (two systems)
           - Extended SPI (one system)
           - Remote controller (one system)
           - The interrupt level (priority) of each maskable interrupt system is configurable (levels 0 to 7).

● Prescaler
    Generates the source clocks for the clock generator.

● 16-bit Multi-Function Timer
    One channel of 16-bit timer/counter with PWM output function is available.
    Can generate two compare-match interrupts.
    Supports the IGBT output control function using the A/D converter out-of-range signal.

● Clock Generator
    One channel of 16-bit timer and three channels of 8-bit timers are available.
    Can be used as the clock source for the UART, SPI, and I2C master.
    Each timer can generate an underflow interrupt.

● 8-bit Programmable Timers
    Four channels of 8-bit timers (presettable down counter) are available.
    Can be used as an interval timer to trigger the ADC.
    Each timer can generate an underflow interrupt.

● 8-bit OSC1 Timers
    Two channels of 8-bit timers (presettable down counter) that are driven with the OSC1 clock are available.
    Each timer can generate an underflow interrupt.

● Watchdog Timer
    30-bit watchdog timer to generate a reset or an NMI
    The watchdog timer overflow period (reset or NMI interrupt period) is programmable.
    The watchdog timer overflow signal can be output outside the IC.

● RTC
    Contains time counters (second, minute, and hour) and calendar counters (day, day of the week, month, and year).
    Periodic interrupts are possible.

● UART
    One channel of UART is available.
    Supports IrDA 1.0 interface.
    Two-byte receive data buffer and one-byte transmit buffer are built in to support full-duplex communication.
    Transfer rate: 150 to 460800 bps, character length: seven or eight bits, parity mode: even, odd, or no parity, stop bit: one or two bits
    Parity error, framing error, and overrun error detectable
    Each channel can generate receive buffer full, transmit buffer empty, and receive error interrupts.

● SPI
    Supports both master and slave modes.
    One-byte receive data buffer and one-byte transmit buffer are built in.
    Data length: eight bits fixed (MSB first)
    Data transfer timing (clock phase and polarity variations) is selectable from among 4 types.
    Can generate receive buffer full and transmit buffer empty interrupts.

● Extended SPI
    Supports both master and slave modes.
    One-byte receive data buffer and one-byte transmit buffer are built in.
    Data length: eight bits fixed (MSB first)
    Data transfer timing (clock phase and polarity variations) is selectable from among 4 types.
    Can generate receive buffer full and transmit buffer empty interrupts.
    Exclusive clock source is available.

● I^2C Master
    Data format: 8 bits (MSB first)
    Addressing mode: 7-bit addressing (10-bit addressing is not supported.)
    Incorporates a noise rejector (can be enabled by a register).
    Can generate receive buffer full and transmit buffer empty interrupts.

● I^2C Slave
    Data format: 8 bits (MSB first)
    Addressing mode: 7-bit addressing (10-bit addressing is not supported.)
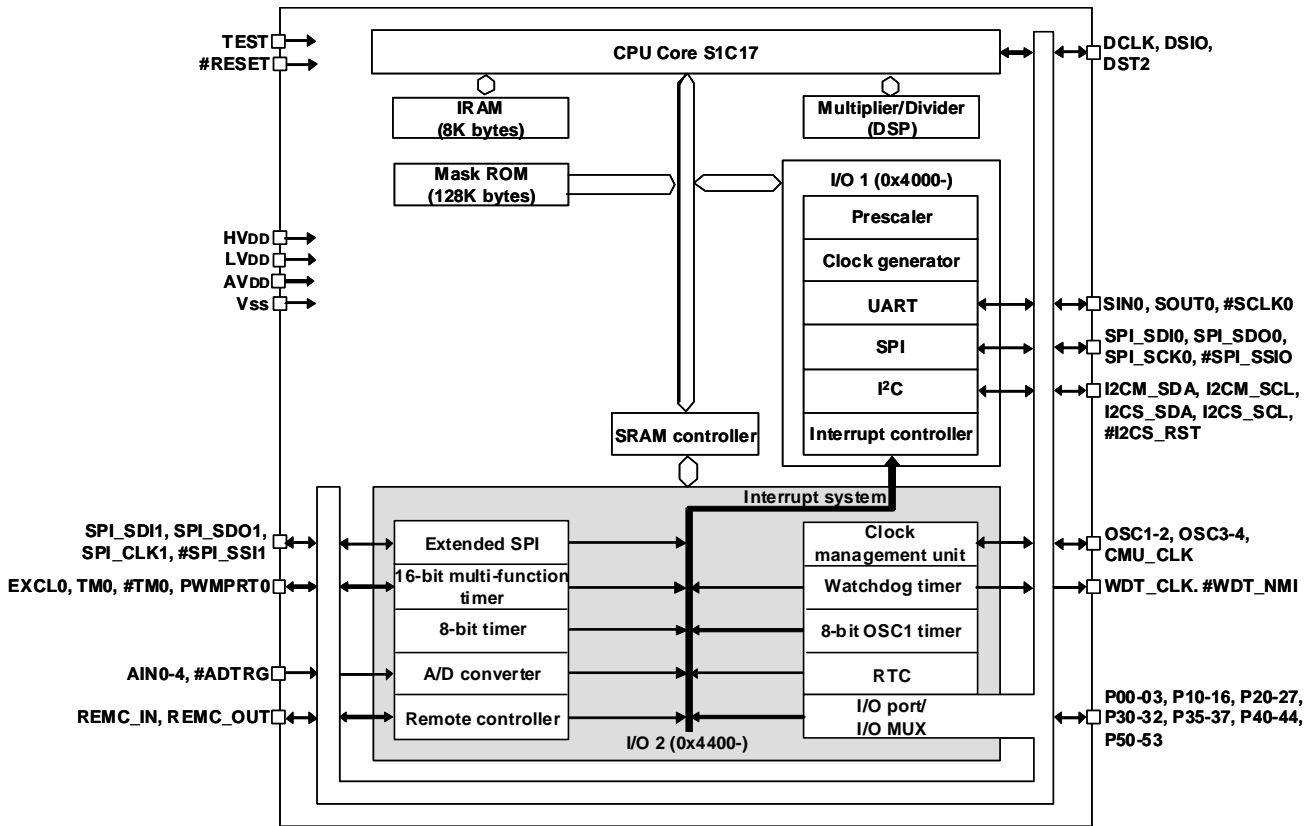   Supports a clock stretch function
    Incorporates a noise rejector (can be enabled by a register).
    Can generate receive, transmit, and bus status interrupts.

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● Infrared Remote Controller
　　Outputs a modulated carrier signal and inputs remote control pulses.
　　Embedded carrier signal generator and data length counter.
　　Can generates REMC interrupts.
● General-Purpose I/O Ports
　　Maximum 30 I/O ports and four input ports are available.
　　Can generate input interrupts from the six ports selected with software.
　　* The GPIO ports are shared with other peripheral function pins (UART, PWM etc.). Therefore, the number of GPIO
　　　ports depends on the peripheral functions used.
● A/D Converter
　　10-bit A/D converter with up to four analog input ports
　　Can generates an end of conversion interrupt and an out of range interrupt.
　　Outputs an out of range signal to the IGBT circuit in the 16-bit multi-function timer module.
● Operating Voltage
　　HVDD (for I/O): 1.65 to 3.60 V
　　LVDD (for Core): 1.65 to 1.95 V
　　AVDD (for ADC): 2.70 to 3.60 V (1.65 to 3.60 V*)
　　* The AVDD voltage range can be changed to 1.65 to 3.60 V only when the ADC is not used and the P0x pins are used
　　　as digital signal input pins, not analog input pins. However, the high and low level input voltages of the digital signals
　　　must be AVDD and GND, respectively.
● Operating Temperatures
　　-40 to 85° C
● Current Consumption
　　During SLEEP: 1.8 μ A (typ.) 32 kHz/1.8 V, RTC = On
　　During HALT: 1.3 mA (typ.) 20 MHz/1.8 V
　　During execution: 3.8 mA (typ.) 20 MHz/1.8 V
　　* By controlling the clocks through the Clock-Gear (CMU), power consumption can be reduced.
● Shipping Form
　　TQFP12-64pin (7 mm × 7 mm × 1.2 mm, 0.4 mm pin pitch)
　　WCSP-48 (3.124 mm × 3.124 mm × 0.78 mm, 0.4 mm ball pitch)
　　Bare chip

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■ Block Diagram

TEST, **#RESET**

CPU Core S1C17

DCLK, DSIO, DST2

IRAM (8K bytes)

Multiplier/Divider (DSP)

Mask ROM (128K bytes)

I/O 1 (0x4000-)
- Prescaler
- Clock generator
- UART
- SPI
- I²C
- Interrupt controller

HV_DD, **LV_DD**, **AV_DD**, **Vss**

SIN0, SOUT0, #SCLK0

SPI_SDI0, SPI_SDO0, SPI_SCK0, #SPI_SSIO

I2CM_SDA, I2CM_SCL, I2CS_SDA, I2CS_SCL, #I2CS_RST

SRAM controller

Interrupt system

SPI_SDI1, SPI_SDO1, SPI_CLK1, #SPI_SSI1

Extended SPI

Clock management unit

OSC1-2, OSC3-4, CMU_CLK

EXCL0, TM0, #TM0, PWMPRT0

16-bit multi-function timer

Watchdog timer

WDT_CLK. #WDT_NMI

8-bit timer

8-bit OSC1 timer

AIN0-4, #ADTRG

A/D converter

RTC

REMC_IN, REMC_OUT

Remote controller

I/O port/ I/O MUX

I/O 2 (0x4400-)

P00-03, P10-16, P20-27, P30-32, P35-37, P40-44, P50-53

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