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C8051F310/1/2/3/4/5/6/7

8/16 kB ISP Flash MCU Family

Analog Peripherals
- **10-Bit ADC (C8051F310/1/2/3/6 only)**
  - Up to 200 ksps
  - Up to 21, 17, or 13 external single-ended or differential inputs
  - VREF from external pin or V_{DD}
  - Built-in temperature sensor
  - External conversion start input
- **Comparators**
  - Programmable hysteresis and response time
  - Configurable as interrupt or reset source (Comparator0)
  - Low current (< 0.5 µA)

On-Chip Debug
- On-chip debug circuitry facilitates full speed, non-intrusive in-system debug (no emulator required)
- Provides breakpoints, single stepping, inspect/modify memory and registers
- Superior performance to emulation systems using ICE-Chips, target pods, and sockets
- Complete development kit

Supply Voltage 2.7 to 3.6 V
- Typical operating current: 5 mA at 25 MHz; 11 µA at 32 kHz
- Typical stop mode current: 0.1 µA
- Temperature range: –40 to +85 °C

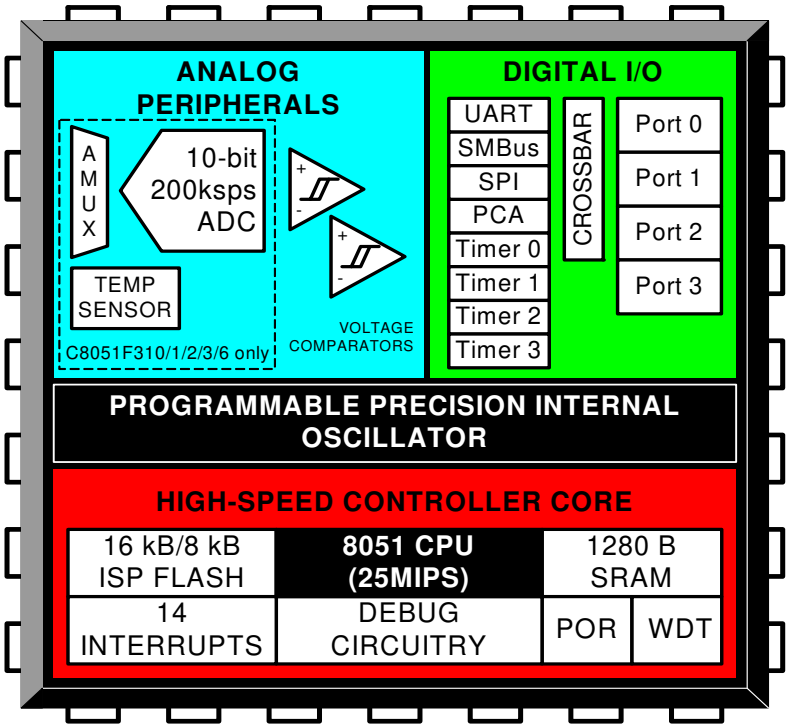
High Speed 8051 µC Core
- Pipelined instruction architecture; executes 70% of instructions in 1 or 2 system clocks
- Up to 25 MIPS throughput with 25 MHz clock
- Expanded interrupt handler

Memory
- 1280 bytes internal data RAM (1024 + 256)
- 16 kB (C8051F310/1/6/7) or 8 kB (C8051F312/3/4/5) Flash; In-system programmable in 512-byte sectors

Digital Peripherals
- 29/25/21 Port I/O; All 5 V tolerant with high sink current
- Hardware enhanced UART, SMBus™, and SPI™ serial ports
- Four general purpose 16-bit counter/timers
- 16-bit programmable counter array (PCA) with five capture/compare modules
- Real time clock capability using PCA or timer and external clock source

Clock Sources
- Internal oscillator: 24.5 MHz with ±2% accuracy supports crystal-less UART operation
- External oscillator: Crystal, RC, C, or clock (1 or 2 pin modes)
- Can switch between clock sources on-the-fly; useful in power saving modes

Packages
- 32-pin LQFP (C8051F310/2/4)
- 28-pin QFN (C8051F311/3/5)
- 24-pin QFN (C8051F316/7)



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1. System Overview

C8051F31x devices are fully integrated mixed-signal System-on-a-Chip MCUs. Highlighted features are listed below. Refer to Table 1.1 for specific product feature selection.

- High-speed pipelined 8051-compatible microcontroller core (up to 25 MIPS)
- In-system, full-speed, non-intrusive debug interface (on-chip)
- True 10-bit 200 ksps 25-channel single-ended/differential ADC with analog multiplexer (C8051F310/1/2/3/6)
- Precision programmable 25 MHz internal oscillator
- 16 kB (C8051F310/1/6/7) or 8 kB (C8051F312/3/4/5) of on-chip Flash memory
- 1280 bytes of on-chip RAM
- SMBus/I2C, Enhanced UART, and Enhanced SPI serial interfaces implemented in hardware
- Four general-purpose 16-bit timers
- Programmable Counter/Timer Array (PCA) with five capture/compare modules and Watchdog Timer function
- On-chip Power-On Reset, V_{DD} Monitor, and Temperature Sensor
- On-chip Voltage Comparators (2)
- 29/25/21 Port I/O (5 V tolerant)

With on-chip Power-On Reset, V_{DD} monitor, Watchdog Timer, and clock oscillator, the C8051F31x devices are truly stand-alone System-on-a-Chip solutions. The Flash memory can be reprogrammed even in-circuit, providing non-volatile data storage, and also allowing field upgrades of the 8051 firmware. User software has complete control of all peripherals, and may individually shut down any or all peripherals for power savings.

The on-chip Silicon Labs 2-Wire (C2) Development Interface allows non-intrusive (uses no on-chip resources), full speed, in-circuit debugging using the production MCU installed in the final application. This debug logic supports inspection and modification of memory and registers, setting breakpoints, single stepping, run and halt commands. All analog and digital peripherals are fully functional while debugging using C2. The two C2 interface pins can be shared with user functions, allowing in-system programming and debugging without occupying package pins.

Each device is specified for 2.7-to-3.6 V operation over the industrial temperature range (–45 to +85 °C). The Port I/O and $\overline{\text{RST}}$ pins are tolerant of input signals up to 5 V. The C8051F31x are available in 32-pin LQFP, 28-pin QFN, and 24-pin QFN packages. See Table 1.1 for ordering part numbers. Note: QFN packages are also referred to as MLP or MLF packages.

Table 1.1. Product Selection Guide

Ordering Part Number	MIPS (Peak)	Flash Memory	RAM	Calibrated Internal 24.5 MHz Oscillator	SMBus/I2C	Enhanced SPI	UART	Timers (16-bit)	Programmable Counter Array	Digital Port I/Os	10-bit 200 ksps ADC	Temperature Sensor	Analog Comparators	Lead-free (RoHS Compliant)	Package
C8051F310	25	16	1280	✓	✓	✓	✓	✓	✓	29	✓	✓	2	-	LQFP-32
C8051F310-GQ	25	16	1280	✓	✓	✓	✓	✓	✓	29	✓	✓	2	✓	LQFP-32
C8051F311	25	16	1280	✓	✓	✓	✓	✓	✓	25	✓	✓	2	-	QFN-28
C8051F311-GM	25	16	1280	✓	✓	✓	✓	✓	✓	25	✓	✓	2	✓	QFN-28
C8051F312	25	8	1280	✓	✓	✓	✓	✓	✓	29	✓	✓	2	-	LQFP-32
C8051F312-GQ	25	8	1280	✓	✓	✓	✓	✓	✓	29	✓	✓	2	✓	LQFP-32
C8051F313	25	8	1280	✓	✓	✓	✓	✓	✓	25	✓	✓	2	-	QFN-28
C8051F313-GM	25	8	1280	✓	✓	✓	✓	✓	✓	25	✓	✓	2	✓	QFN-28
C8051F314	25	8	1280	✓	✓	✓	✓	✓	✓	29	-	-	2	-	LQFP-32
C8051F314-GQ	25	8	1280	✓	✓	✓	✓	✓	✓	29	-	-	2	✓	LQFP-32
C8051F315	25	8	1280	✓	✓	✓	✓	✓	✓	25	-	-	2	-	QFN-28
C8051F315-GM	25	8	1280	✓	✓	✓	✓	✓	✓	25	-	-	2	✓	QFN-28
C8051F316-GM	25	16	1280	✓	✓	✓	✓	✓	✓	21	✓	✓	2	✓	QFN-24
C8051F317-GM	25	16	1280	✓	✓	✓	✓	✓	✓	21	-	-	2	✓	QFN-24

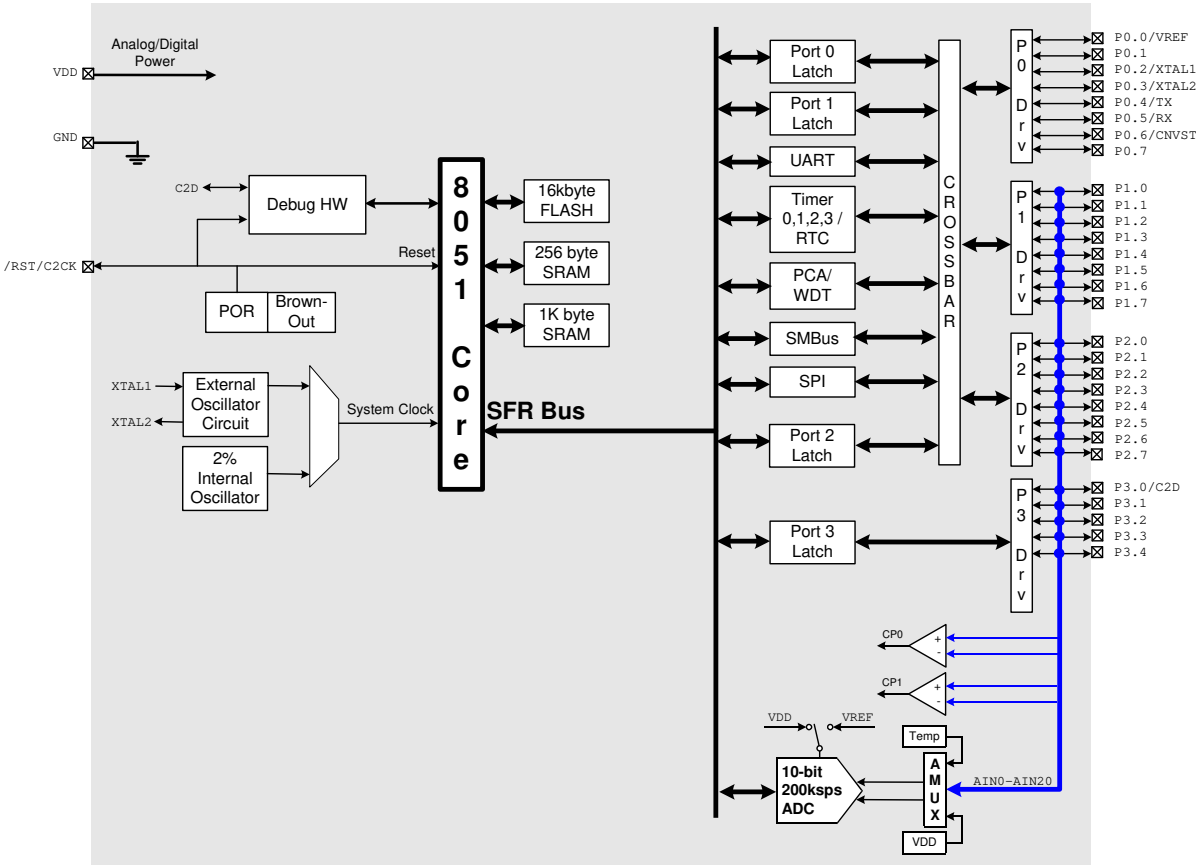

Figure 1.1. C8051F310 Block Diagram

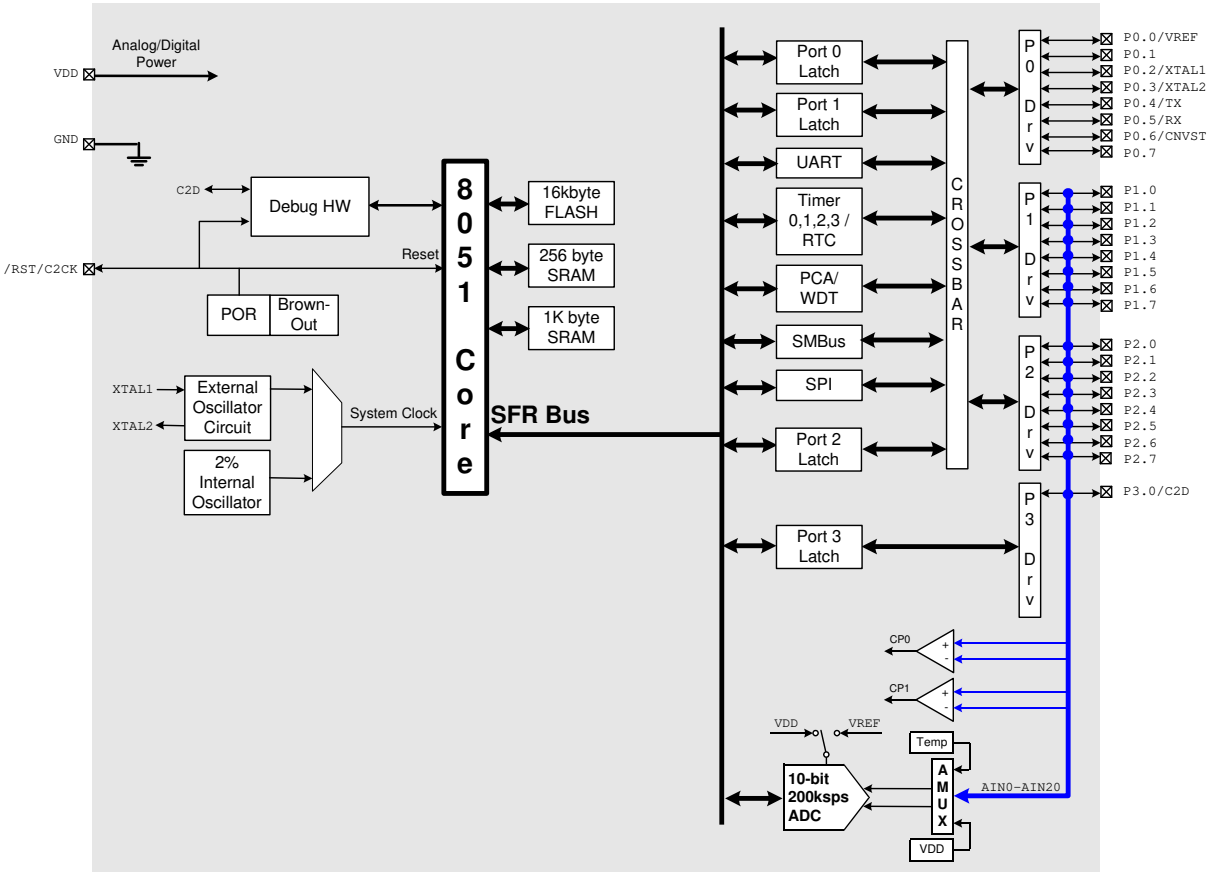

Figure 1.2. C8051F311 Block Diagram

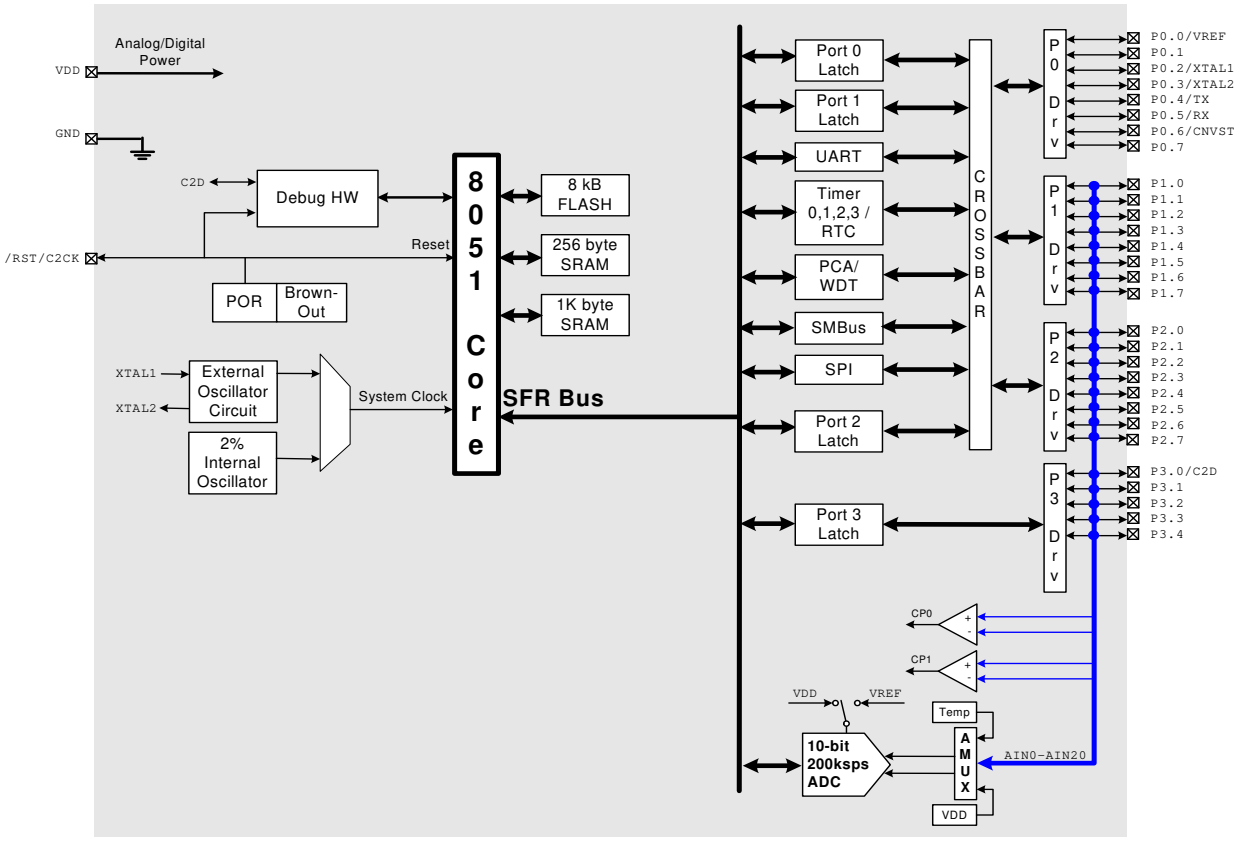

Figure 1.3. C8051F312 Block Diagram

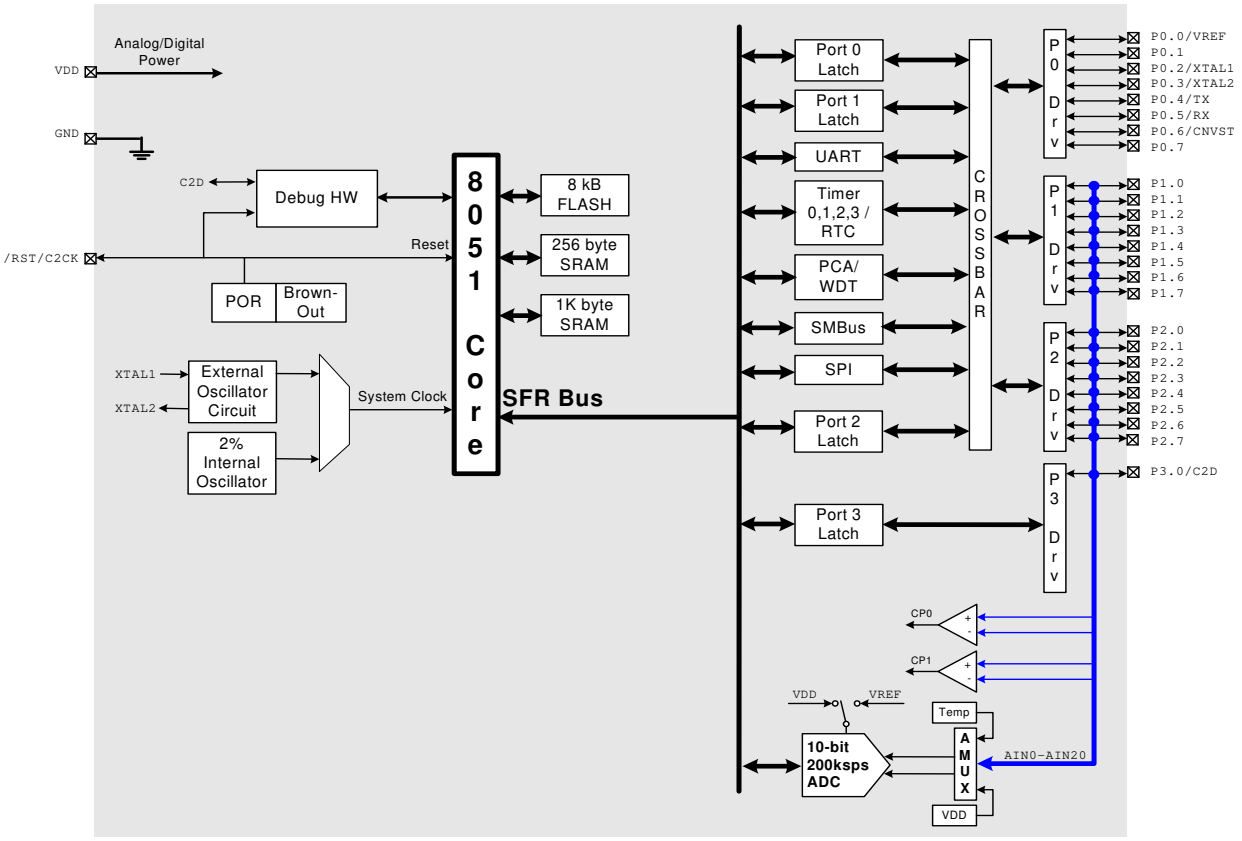

Figure 1.4. C8051F313 Block Diagram

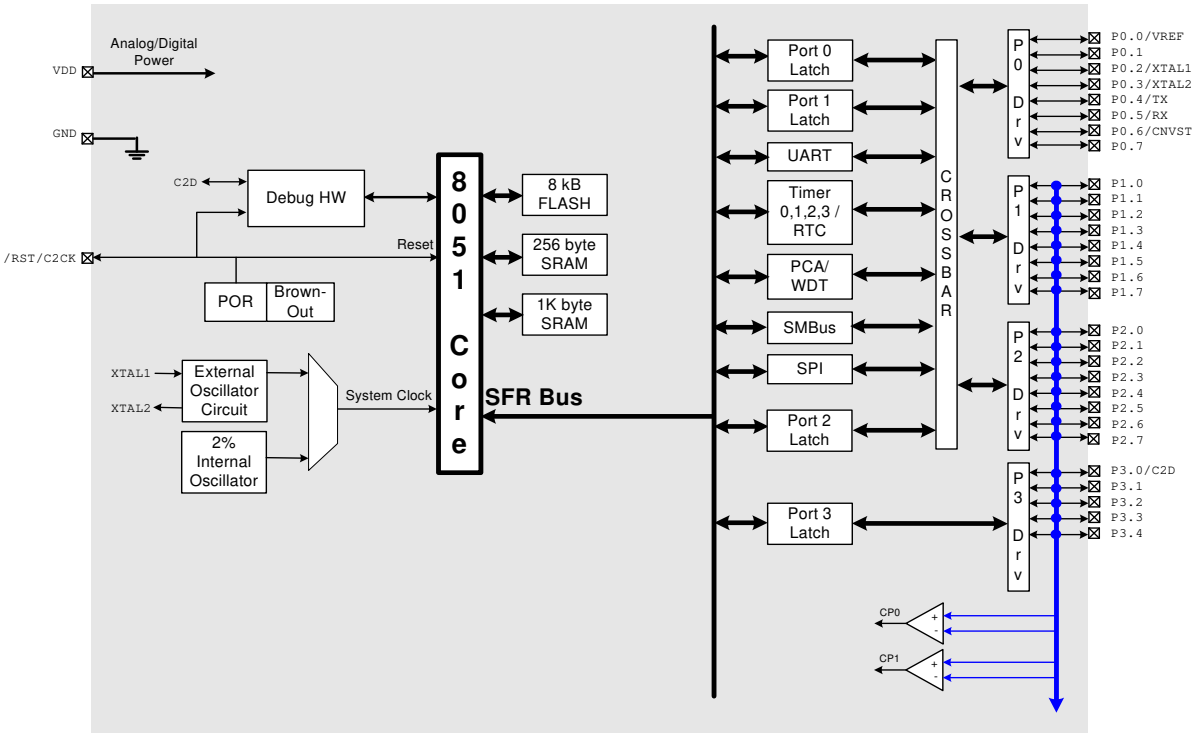

Figure 1.5. C8051F314 Block Diagram

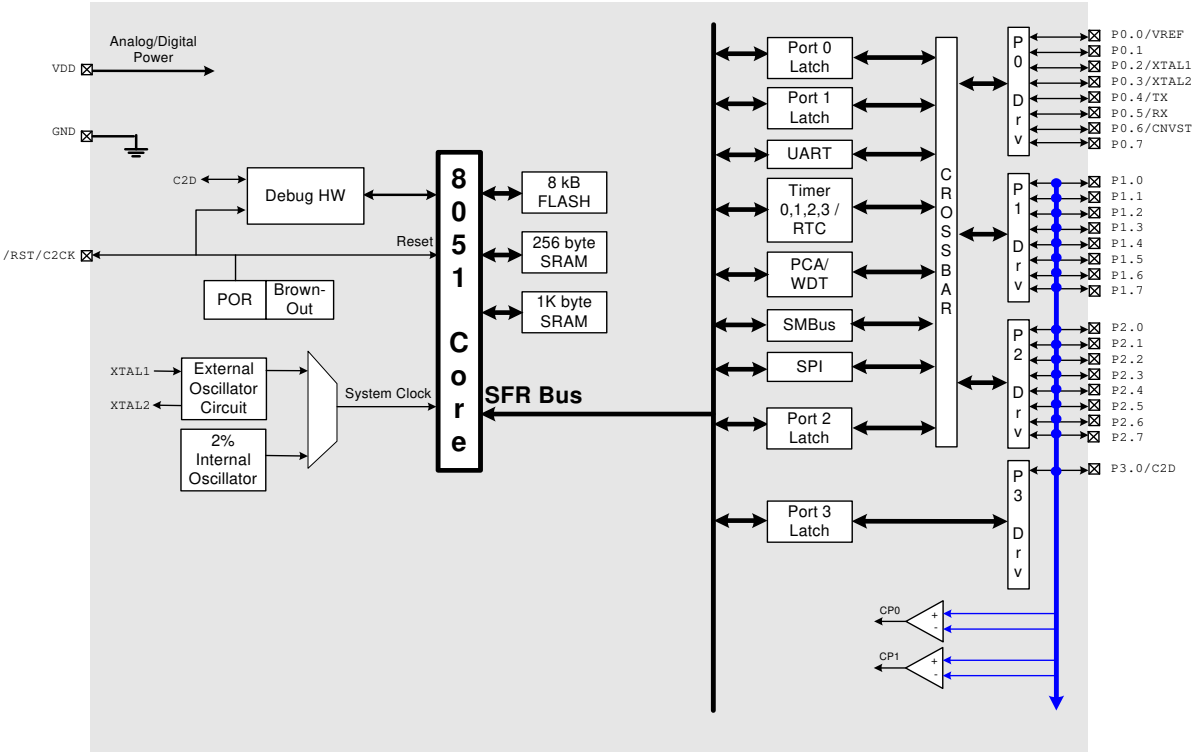

Figure 1.6. C8051F315 Block Diagram

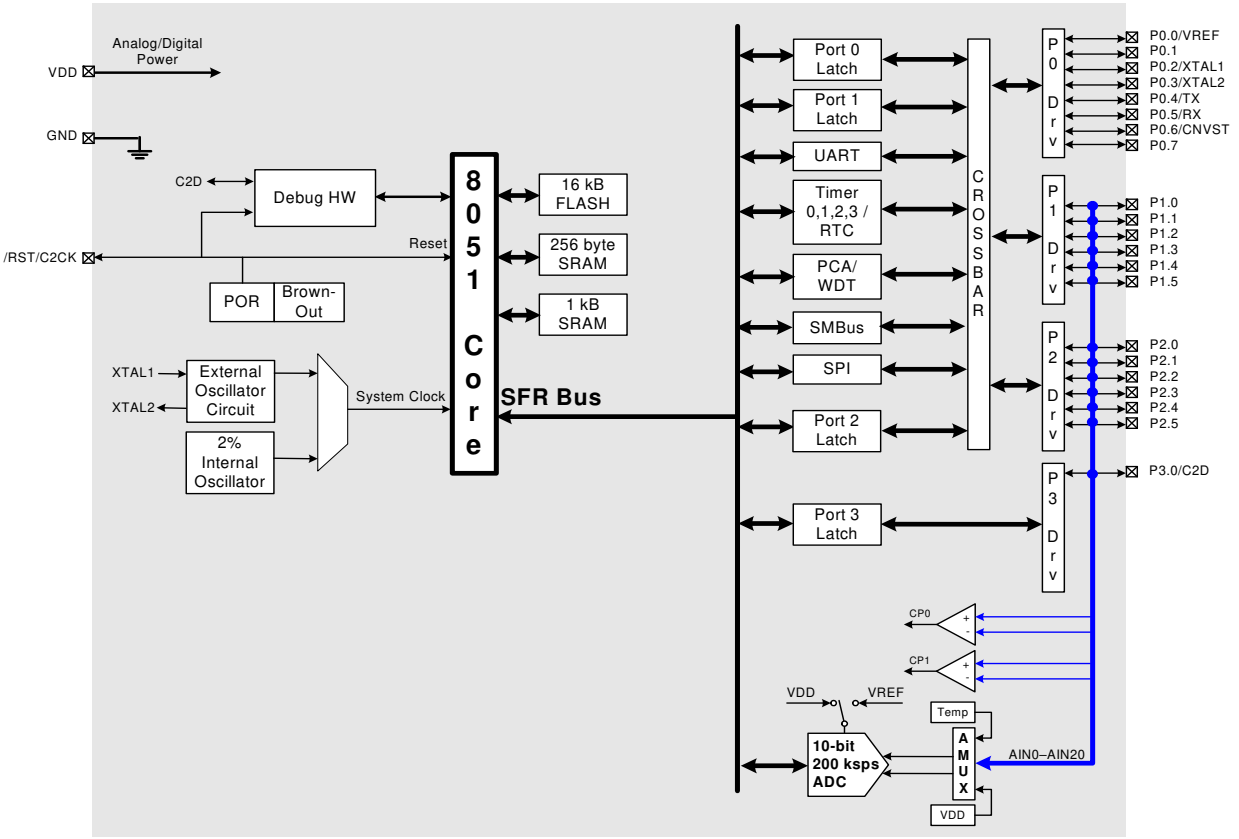

Figure 1.7. C8051F316 Block Diagram