

## Capacitance to Digital Converter

- Supports buttons, sliders, wheels, and capacitive proximity sensing
- Fast 40  $\mu$ s per channel conversion time
- 16-bit resolution
- Up to 14 input channels
- Auto-accumulate up to 64x samples

## Ultra-Low Power

- 150  $\mu$ A/MHz active current from 1.8–3.6 V @ 25 MHz
- 10 nA sleep current with data retention; BOD disabled
- 50 nA sleep current with data retention; BOD enabled
- 300 nA sleep current with smaRTClock (internal oscillator)
- 600 nA sleep current with smaRTClock (external crystal)
- 2  $\mu$ s wake up from sleep

## Supply Voltage 1.8 to 3.6 V

- Built-in brown-out detector
- On-chip LDO regulator for core supply

## Analog to Digital Converter

- 75 ksp/s with 12-bit resolution (F990/6)
- 330 ksp/s with 8-bit resolution
- Up to 10-channels
- Autonomous burst mode with 16-bit averaging accumulator
- VREF from external pin, VDD, or internal regulator
- Built-in temperature sensor

## Internal 6-Bit Current Reference

- 2 ranges: source or sink capability
- Up to 14-bit resolution via PWM interpolation

## Comparator

- Programmable hysteresis and response time
- Configurable as interrupt or reset source
- Low current (< 0.4  $\mu$ A)

## Development Kit: C8051F996DK

## High-Speed 8051 $\mu$ C Core

- Pipe-lined instruction architecture; executes 70% of instructions in 1 or 2 system clocks
- 25 MIPS peak throughput with 25 MHz clock
- Expanded interrupt handler

## Memory

- 512 bytes internal data RAM (256 + 256)
- 8 kB Flash; In-system programmable in 512 byte sectors; Full read/write/erase functionality over the entire supply range

## On-Chip Debug

- On-chip debug circuitry facilitates full speed, non-intrusive in-system debug

## Digital Peripherals

- 17 port I/O; Programmable drive strength
- Hardware enhanced UART, SPI and SMBus™ serial ports
- CRC block provides 16-Bit CCITT polynomial calculation
- Four general purpose 16-bit counter/timers
- 16-bit programmable counter array (PCA) with three capture/compare modules and enhanced PWM functionality

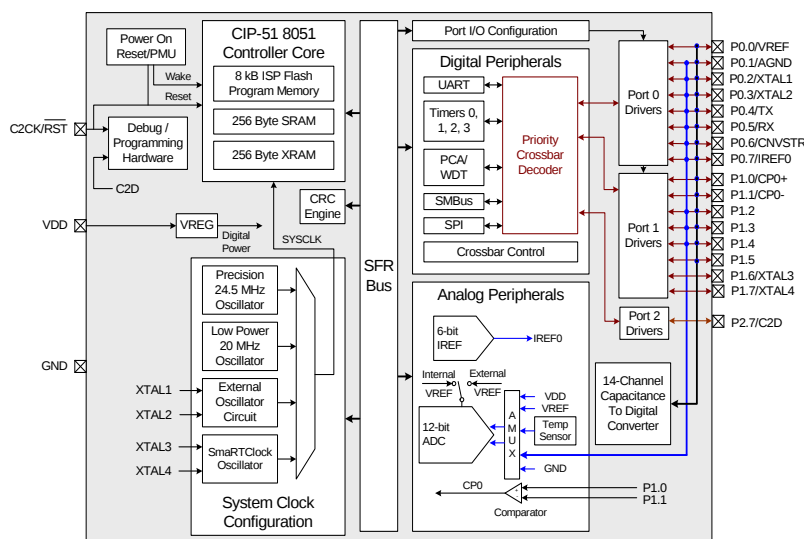
## Clock Sources

- 24.5 MHz  $\pm$ 2% oscillator; supports crystal-less UART operation
- Low power internal oscillator: 20 MHz
- External oscillator: Crystal, RC, C, CMOS clock
- Can switch clock sources on-the-fly; useful for power saving modes

## Temperature Range: -40 to +85 °C

## Package Options

- 24-pin QFN (4x4 mm), RoHS compliant
- 24-pin QSOP (easy to hand solder) RoHS compliant
- 20-pin QFN (3x3 mm), RoHS compliant





# C8051F99x

## 25 MIPS, 8 kB Flash, Ultra Low Power, Capacitive Sensing MCU

### Selected Electrical Specifications

(At 25 C°)

| Parameter                                               | Conditions                                              | Min | Typ  | Max    | Units  |
|---------------------------------------------------------|---------------------------------------------------------|-----|------|--------|--------|
| Supply Input Voltage                                    |                                                         | 1.8 | —    | 3.6    | V      |
| Supply Current with CPU Active                          | Clock = 24.5 MHz<br>(±2% internal precision oscillator) | —   | 150  | —      | μA/MHz |
| Supply Current (shutdown)<br>(V <sub>BAT</sub> = 1.8 V) | Sleep mode; BOD off                                     | —   | .010 | —      | μA     |
|                                                         | Sleep mode; BOD on                                      | —   | .050 | —      | μA     |
|                                                         | Sleep mode; smartClock running                          | —   | .300 | —      | μA     |
| Clock Frequency Range                                   |                                                         | DC  | —    | 25     | MHz    |
| Wakeup Time                                             |                                                         | —   | 2    | —      | μs     |
| Analog Settling Time                                    |                                                         | —   | 1.5  | —      | μs     |
| <b>Internal Oscillator</b>                              |                                                         |     |      |        |        |
| Frequency                                               | Precision oscillator                                    | 24  | 24.5 | 25     | MHz    |
|                                                         | Low power oscillator                                    | 18  | 20   | 22     | MHz    |
| <b>A/D Converter</b>                                    |                                                         |     |      |        |        |
| Resolution                                              |                                                         |     |      | 12/10  | bits   |
| Throughput Rate                                         |                                                         | —   | —    | 75/300 | ksps   |
| <b>Capacitive to Digital Converter</b>                  |                                                         |     |      |        |        |
| Resolution                                              |                                                         | —   | —    | 16     | bits   |
| CDC Conversion Time                                     |                                                         | —   | 40   | —      | μs     |

### C8051F9xx Ultra Low Power Product Family

| Part #    | Flash Mem. | RAM (Bytes) | MIPS (Peak) | Digital I/O | Communications                      | ADC    | Sensing Channels | Operating Voltage | Package      | Dev kit     |
|-----------|------------|-------------|-------------|-------------|-------------------------------------|--------|------------------|-------------------|--------------|-------------|
| C8051F930 | 64 kB      | 4352        | 25          | 24          | EMIF, I <sup>2</sup> C, 2xSPI, UART | 10-bit | —                | 0.9–3.6 V         | QFN32/LQFP32 | C8051F930DK |
| C8051F931 | 64 kB      | 4352        | 25          | 16          | I <sup>2</sup> C, 2xSPI, UART       | 10-bit | —                | 0.9–3.6 V         | QFN24        | C8051F930DK |
| C8051F920 | 32 kB      | 4352        | 25          | 24          | EMIF, I <sup>2</sup> C, 2xSPI, UART | 10-bit | —                | 0.9–3.6 V         | QFN32/LQFP32 | C8051F930DK |
| C8051F921 | 32 kB      | 4352        | 25          | 16          | I <sup>2</sup> C, 2xSPI, UART       | 10-bit | —                | 0.9–3.6 V         | QFN24        | C8051F930DK |
| C8051F911 | 16 kB      | 768         | 25          | 16          | I <sup>2</sup> C, 2xSPI, UART       | 10-bit | —                | 0.9–3.6 V         | QFN24/QSOP24 | C8051F912DK |
| C8051F912 | 16 kB      | 768         | 25          | 16          | I <sup>2</sup> C, 2xSPI, UART       | 12-bit | —                | 0.9–3.6 V         | QFN24/QSOP24 | C8051F912DK |
| C8051F901 | 8 kB       | 768         | 25          | 16          | I <sup>2</sup> C, 2xSPI, UART       | 10-bit | —                | 0.9–3.6 V         | QFN24/QSOP24 | C8051F912DK |
| C8051F902 | 8 kB       | 768         | 25          | 16          | I <sup>2</sup> C, 2xSPI, UART       | 12-bit | —                | 0.9–3.6 V         | QFN24/QSOP24 | C8051F912DK |
| C8051F980 | 8 kB       | 512         | 25          | 16          | I <sup>2</sup> C, SPI, UART         | 12-bit | —                | 1.8–3.6 V         | QFN20        | C8051F996DK |
| C8051F981 | 8 kB       | 512         | 25          | 16          | I <sup>2</sup> C, SPI, UART         | —      | —                | 1.8–3.6 V         | QFN20        | C8051F996DK |
| C8051F982 | 4 kB       | 512         | 25          | 16          | I <sup>2</sup> C, SPI, UART         | 10-bit | —                | 1.8–3.6 V         | QFN20        | C8051F996DK |
| C8051F983 | 4 kB       | 512         | 25          | 16          | I <sup>2</sup> C, SPI, UART         | —      | —                | 1.8–3.6 V         | QFN20        | C8051F996DK |
| C8051F985 | 2 kB       | 512         | 25          | 16          | I <sup>2</sup> C, SPI, UART         | —      | —                | 1.8–3.6 V         | QFN20        | C8051F996DK |
| C8051F986 | 8 kB       | 512         | 25          | 17          | I <sup>2</sup> C, SPI, UART         | 12-bit | —                | 1.8–3.6 V         | QFN24/QSOP24 | C8051F996DK |
| C8051F987 | 8 kB       | 512         | 25          | 17          | I <sup>2</sup> C, SPI, UART         | —      | —                | 1.8–3.6 V         | QFN24/QSOP24 | C8051F996DK |
| C8051F988 | 4 kB       | 512         | 25          | 17          | I <sup>2</sup> C, SPI, UART         | 10-bit | —                | 1.8–3.6 V         | QFN24/QSOP24 | C8051F996DK |
| C8051F989 | 4 kB       | 512         | 25          | 17          | I <sup>2</sup> C, SPI, UART         | —      | —                | 1.8–3.6 V         | QFN24/QSOP24 | C8051F996DK |
| C8051F990 | 8 kB       | 512         | 25          | 16          | I <sup>2</sup> C, SPI, UART         | 12-bit | 13               | 1.8–3.6 V         | QFN20        | C8051F996DK |
| C8051F991 | 8 kB       | 512         | 25          | 16          | I <sup>2</sup> C, SPI, UART         | —      | 13               | 1.8–3.6 V         | QFN20        | C8051F996DK |
| C8051F996 | 8 kB       | 512         | 25          | 17          | I <sup>2</sup> C, SPI, UART         | 12-bit | 14               | 1.8–3.6 V         | QFN24/QSOP24 | C8051F996DK |
| C8051F997 | 8 kB       | 512         | 25          | 17          | I <sup>2</sup> C, SPI, UART         | —      | 14               | 1.8–3.6 V         | QFN24/QSOP24 | C8051F996DK |

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