



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

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NOTES:

## Table Of Contents

<b>1. System Overview</b> .....	<b>17</b>
1.1. CIP-51™ Microcontroller Core.....	27
1.1.1. Fully 8051 Compatible.....	27
1.1.2. Improved Throughput.....	27
1.1.3. Additional Features .....	28
1.2. On-Chip Memory.....	29
1.3. On-Chip Debug Circuitry.....	30
1.4. Programmable Digital I/O and Crossbar .....	31
1.5. Serial Ports .....	32
1.6. Programmable Counter Array.....	32
1.7. 10-Bit Analog to Digital Converter.....	33
1.8. Comparators .....	34
<b>2. Absolute Maximum Ratings</b> .....	<b>35</b>
<b>3. Global DC Electrical Characteristics</b> .....	<b>36</b>
<b>4. Pinout and Package Definitions</b> .....	<b>39</b>
<b>5. 10-Bit ADC (ADC0, C8051F310/1/2/3/6 only)</b> .....	<b>51</b>
5.1. Analog Multiplexer .....	51
5.2. Temperature Sensor .....	52
5.3. Modes of Operation .....	54
5.3.1. Starting a Conversion.....	54
5.3.2. Tracking Modes.....	55
5.3.3. Settling Time Requirements .....	56
5.4. Programmable Window Detector .....	61
5.4.1. Window Detector In Single-Ended Mode .....	63
5.4.2. Window Detector In Differential Mode.....	64
<b>6. Voltage Reference (C8051F310/1/2/3/6 only)</b> .....	<b>67</b>
<b>7. Comparators</b> .....	<b>69</b>
<b>8. CIP-51 Microcontroller</b> .....	<b>79</b>
8.1. Instruction Set.....	80
8.1.1. Instruction and CPU Timing .....	80
8.1.2. MOVX Instruction and Program Memory .....	81
8.2. Memory Organization.....	85
8.2.1. Program Memory.....	85
8.2.2. Data Memory.....	86
8.2.3. General Purpose Registers .....	86
8.2.4. Bit Addressable Locations.....	86
8.2.5. Stack .....	86
8.2.6. Special Function Registers.....	87
8.2.7. Register Descriptions .....	90
8.3. Interrupt Handler .....	93
8.3.1. MCU Interrupt Sources and Vectors .....	94
8.3.2. External Interrupts .....	95
8.3.3. Interrupt Priorities.....	95

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

---

8.3.4. Interrupt Latency .....	95
8.3.5. Interrupt Register Descriptions .....	97
8.4. Power Management Modes .....	102
8.4.1. Idle Mode .....	102
8.4.2. Stop Mode .....	103
<b>9. Reset Sources .....</b>	<b>105</b>
9.1. Power-On Reset .....	106
9.2. Power-Fail Reset / $V_{DD}$ Monitor .....	106
9.3. External Reset .....	107
9.4. Missing Clock Detector Reset .....	108
9.5. Comparator0 Reset .....	108
9.6. PCA Watchdog Timer Reset .....	108
9.7. Flash Error Reset .....	108
9.8. Software Reset .....	108
<b>10. Flash Memory .....</b>	<b>111</b>
10.1. Programming The Flash Memory .....	111
10.1.1. Flash Lock and Key Functions .....	111
10.1.2. Flash Erase Procedure .....	111
10.1.3. Flash Write Procedure .....	112
10.2. Non-volatile Data Storage .....	112
10.3. Security Options .....	113
10.4. Flash Write and Erase Guidelines .....	115
10.4.1. $V_{DD}$ Maintenance and the $V_{DD}$ Monitor .....	115
10.4.2. PSWE Maintenance .....	115
10.4.3. System Clock .....	116
<b>11. External RAM .....</b>	<b>119</b>
<b>12. Oscillators .....</b>	<b>121</b>
12.1. Programmable Internal Oscillator .....	121
12.2. External Oscillator Drive Circuit .....	124
12.3. System Clock Selection .....	124
12.4. External Crystal Example .....	126
12.5. External RC Example .....	127
12.6. External Capacitor Example .....	127
<b>13. Port Input/Output .....</b>	<b>129</b>
13.1. Priority Crossbar Decoder .....	131
13.2. Port I/O Initialization .....	133
13.3. General Purpose Port I/O .....	135
<b>14. SMBus .....</b>	<b>145</b>
14.1. Supporting Documents .....	146
14.2. SMBus Configuration .....	146
14.3. SMBus Operation .....	146
14.3.1. Arbitration .....	147
14.3.2. Clock Low Extension .....	148
14.3.3. SCL Low Timeout .....	148
14.3.4. SCL High (SMBus Free) Timeout .....	148

---

14.4.Using the SMBus.....	149
14.4.1.SMBus Configuration Register.....	150
14.4.2.SMB0CN Control Register.....	153
14.4.3.Data Register.....	156
14.5.SMBus Transfer Modes.....	157
14.5.1.Master Transmitter Mode.....	157
14.5.2.Master Receiver Mode.....	158
14.5.3.Slave Receiver Mode.....	159
14.5.4.Slave Transmitter Mode.....	160
14.6.SMBus Status Decoding.....	161
<b>15. UART0.....</b>	<b>163</b>
15.1.Enhanced Baud Rate Generation.....	164
15.2.Operational Modes.....	165
15.2.1.8-Bit UART.....	165
15.2.2.9-Bit UART.....	166
15.3.Multiprocessor Communications.....	167
<b>16. Enhanced Serial Peripheral Interface (SPI0).....</b>	<b>173</b>
16.1.Signal Descriptions.....	174
16.1.1.Master Out, Slave In (MOSI).....	174
16.1.2.Master In, Slave Out (MISO).....	174
16.1.3.Serial Clock (SCK).....	174
16.1.4.Slave Select (NSS).....	174
16.2.SPI0 Master Mode Operation.....	175
16.3.SPI0 Slave Mode Operation.....	177
16.4.SPI0 Interrupt Sources.....	177
16.5.Serial Clock Timing.....	178
16.6.SPI Special Function Registers.....	180
<b>17. Timers.....</b>	<b>187</b>
17.1.Timer 0 and Timer 1.....	187
17.1.1.Mode 0: 13-bit Counter/Timer.....	187
17.1.2.Mode 1: 16-bit Counter/Timer.....	189
17.1.3.Mode 2: 8-bit Counter/Timer with Auto-Reload.....	189
17.1.4.Mode 3: Two 8-bit Counter/Timers (Timer 0 Only).....	190
17.2.Timer 2.....	195
17.2.1.16-bit Timer with Auto-Reload.....	195
17.2.2.8-bit Timers with Auto-Reload.....	196
17.3.Timer 3.....	199
17.3.1.16-bit Timer with Auto-Reload.....	199
17.3.2.8-bit Timers with Auto-Reload.....	200
<b>18. Programmable Counter Array.....</b>	<b>203</b>
18.1.PCA Counter/Timer.....	204
18.2.Capture/Compare Modules.....	205
18.2.1.Edge-triggered Capture Mode.....	206
18.2.2.Software Timer (Compare) Mode.....	207

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

---

18.2.3.High-Speed Output Mode .....	208
18.2.4.Frequency Output Mode .....	209
18.2.5.8-Bit Pulse Width Modulator Mode.....	210
18.2.6.16-Bit Pulse Width Modulator Mode.....	211
18.3.Watchdog Timer Mode .....	212
18.3.1.Watchdog Timer Operation .....	212
18.3.2.Watchdog Timer Usage .....	213
18.4.Register Descriptions for PCA.....	215
<b>19.Revision Specific Behavior .....</b>	<b>221</b>
19.1.Revision Identification.....	221
19.2.Reset Behavior .....	221
19.2.1.Weak Pullups on GPIO Pins .....	221
19.2.2.V <sub>DD</sub> Monitor and the $\overline{\text{RST}}$ Pin .....	221
19.3.PCA Counter .....	222
<b>20.C2 Interface .....</b>	<b>223</b>
20.1.C2 Interface Registers.....	223
20.2.C2 Pin Sharing .....	225
<b>Document Change List.....</b>	<b>226</b>
<b>Contact Information.....</b>	<b>228</b>

## List of Figures

### 1. System Overview

Figure 1.1. C8051F310 Block Diagram .....	19
Figure 1.2. C8051F311 Block Diagram .....	20
Figure 1.3. C8051F312 Block Diagram .....	21
Figure 1.4. C8051F313 Block Diagram .....	22
Figure 1.5. C8051F314 Block Diagram .....	23
Figure 1.6. C8051F315 Block Diagram .....	24
Figure 1.7. C8051F316 Block Diagram .....	25
Figure 1.8. C8051F317 Block Diagram .....	26
Figure 1.9. Comparison of Peak MCU Execution Speeds .....	27
Figure 1.10. On-Chip Clock and Reset.....	28
Figure 1.11. On-Board Memory Map.....	29
Figure 1.12. Development/In-System Debug Diagram.....	30
Figure 1.13. Digital Crossbar Diagram .....	31
Figure 1.14. PCA Block Diagram.....	32
Figure 1.15. 10-Bit ADC Block Diagram.....	33
Figure 1.16. Comparator0 Block Diagram .....	34

### 2. Absolute Maximum Ratings

### 3. Global DC Electrical Characteristics

### 4. Pinout and Package Definitions

Figure 4.1. LQFP-32 Pinout Diagram (Top View) .....	41
Figure 4.2. LQFP-32 Package Diagram .....	42
Figure 4.3. QFN-28 Pinout Diagram (Top View) .....	43
Figure 4.4. QFN-28 Package Drawing .....	44
Figure 4.5. Typical QFN-28 Landing Diagram.....	45
Figure 4.6. QFN-28 Solder Paste Recommendation.....	46
Figure 4.7. QFN-24 Pinout Diagram (Top View) .....	47
Figure 4.8. QFN-24 Package Drawing .....	48
Figure 4.9. Typical QFN-24 Landing Diagram.....	49
Figure 4.10. QFN-24 Solder Paste Recommendation.....	50

### 5. 10-Bit ADC (ADC0, C8051F310/1/2/3/6 only)

Figure 5.1. ADC0 Functional Block Diagram.....	51
Figure 5.2. Typical Temperature Sensor Transfer Function.....	52
Figure 5.3. Temperature Sensor Error with 1-Point Calibration .....	53
Figure 5.4. 10-Bit ADC Track and Conversion Example Timing .....	55
Figure 5.5. ADC0 Equivalent Input Circuits.....	56
Figure 5.6. ADC Window Compare Example: Right-Justified Single-Ended Data ...	63
Figure 5.7. ADC Window Compare Example: Left-Justified Single-Ended Data .....	63
Figure 5.8. ADC Window Compare Example: Right-Justified Differential Data .....	64
Figure 5.9. ADC Window Compare Example: Left-Justified Differential Data .....	64

### 6. Voltage Reference (C8051F310/1/2/3/6 only)

Figure 6.1. Voltage Reference Functional Block Diagram .....	67
--	----

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

---

<b>7. Comparators</b>	
Figure 7.1. Comparator0 Functional Block Diagram .....	69
Figure 7.2. Comparator1 Functional Block Diagram .....	70
Figure 7.3. Comparator Hysteresis Plot .....	71
<b>8. CIP-51 Microcontroller</b>	
Figure 8.1. CIP-51 Block Diagram.....	79
Figure 8.2. Memory Map .....	85
<b>9. Reset Sources</b>	
Figure 9.1. Reset Sources.....	105
Figure 9.2. Power-On and $V_{DD}$ Monitor Reset Timing .....	106
<b>10. Flash Memory</b>	
Figure 10.1. Flash Program Memory Map.....	113
<b>11. External RAM</b>	
<b>12. Oscillators</b>	
Figure 12.1. Oscillator Diagram.....	121
Figure 12.2. 32.768 kHz External Crystal Example.....	126
<b>13. Port Input/Output</b>	
Figure 13.1. Port I/O Functional Block Diagram .....	129
Figure 13.2. Port I/O Cell Block Diagram .....	130
Figure 13.3. Crossbar Priority Decoder with No Pins Skipped.....	131
Figure 13.4. Crossbar Priority Decoder with Crystal Pins Skipped .....	132
<b>14. SMBus</b>	
Figure 14.1. SMBus Block Diagram .....	145
Figure 14.2. Typical SMBus Configuration .....	146
Figure 14.3. SMBus Transaction .....	147
Figure 14.4. Typical SMBus SCL Generation.....	151
Figure 14.5. Typical Master Transmitter Sequence.....	157
Figure 14.6. Typical Master Receiver Sequence.....	158
Figure 14.7. Typical Slave Receiver Sequence.....	159
Figure 14.8. Typical Slave Transmitter Sequence.....	160
<b>15. UART0</b>	
Figure 15.1. UART0 Block Diagram .....	163
Figure 15.2. UART0 Baud Rate Logic.....	164
Figure 15.3. UART Interconnect Diagram .....	165
Figure 15.4. 8-Bit UART Timing Diagram.....	165
Figure 15.5. 9-Bit UART Timing Diagram.....	166
Figure 15.6. UART Multi-Processor Mode Interconnect Diagram .....	167
<b>16. Enhanced Serial Peripheral Interface (SPI0)</b>	
Figure 16.1. SPI Block Diagram .....	173
Figure 16.2. Multiple-Master Mode Connection Diagram .....	176
Figure 16.3. 3-Wire Single Master and Slave Mode Connection Diagram .....	176
Figure 16.4. 4-Wire Single Master and Slave Mode Connection Diagram .....	176
Figure 16.5. Master Mode Data/Clock Timing.....	178
Figure 16.6. Slave Mode Data/Clock Timing (CKPHA = 0) .....	179
Figure 16.7. Slave Mode Data/Clock Timing (CKPHA = 1) .....	179



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Figure 16.8. SPI Master Timing (CKPHA = 0).....	183
Figure 16.9. SPI Master Timing (CKPHA = 1).....	183
Figure 16.10. SPI Slave Timing (CKPHA = 0).....	184
Figure 16.11. SPI Slave Timing (CKPHA = 1).....	184
<b>17. Timers</b>	
Figure 17.1. T0 Mode 0 Block Diagram.....	188
Figure 17.2. T0 Mode 2 Block Diagram.....	189
Figure 17.3. T0 Mode 3 Block Diagram.....	190
Figure 17.4. Timer 2 16-Bit Mode Block Diagram .....	195
Figure 17.5. Timer 2 8-Bit Mode Block Diagram .....	196
Figure 17.6. Timer 3 16-Bit Mode Block Diagram .....	199
Figure 17.7. Timer 3 8-Bit Mode Block Diagram .....	200
<b>18. Programmable Counter Array</b>	
Figure 18.1. PCA Block Diagram.....	203
Figure 18.2. PCA Counter/Timer Block Diagram.....	204
Figure 18.3. PCA Interrupt Block Diagram .....	205
Figure 18.4. PCA Capture Mode Diagram.....	206
Figure 18.5. PCA Software Timer Mode Diagram .....	207
Figure 18.6. PCA High Speed Output Mode Diagram.....	208
Figure 18.7. PCA Frequency Output Mode .....	209
Figure 18.8. PCA 8-Bit PWM Mode Diagram .....	210
Figure 18.9. PCA 16-Bit PWM Mode.....	211
Figure 18.10. PCA Module 4 with Watchdog Timer Enabled .....	212
<b>19. Revision Specific Behavior</b>	
Figure 19.1. Reading Package Marking .....	221
<b>20. C2 Interface</b>	
Figure 20.1. Typical C2 Pin Sharing.....	225

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

---

NOTES:

---

## List of Tables

<b>1. System Overview</b>	
Table 1.1. Product Selection Guide .....	18
<b>2. Absolute Maximum Ratings</b>	
Table 2.1. Absolute Maximum Ratings .....	35
<b>3. Global DC Electrical Characteristics</b>	
Table 3.1. Global DC Electrical Characteristics .....	36
Table 3.2. Electrical Characteristics Quick Reference .....	38
<b>4. Pinout and Package Definitions</b>	
Table 4.1. Pin Definitions for the C8051F31x .....	39
Table 4.2. LQFP-32 Package Dimensions .....	42
Table 4.3. QFN-28 Package Dimensions .....	44
Table 4.4. QFN-24 Package Dimensions .....	48
<b>5. 10-Bit ADC (ADC0, C8051F310/1/2/3/6 only)</b>	
Table 5.1. ADC0 Electrical Characteristics .....	65
<b>6. Voltage Reference (C8051F310/1/2/3/6 only)</b>	
Table 6.1. External Voltage Reference Circuit Electrical Characteristics .....	68
<b>7. Comparators</b>	
Table 7.1. Comparator Electrical Characteristics .....	78
<b>8. CIP-51 Microcontroller</b>	
Table 8.1. CIP-51 Instruction Set Summary .....	81
Table 8.2. Special Function Register (SFR) Memory Map .....	87
Table 8.3. Special Function Registers .....	88
Table 8.4. Interrupt Summary .....	96
<b>9. Reset Sources</b>	
Table 9.1. Reset Electrical Characteristics .....	110
<b>10. Flash Memory</b>	
Table 10.1. Flash Electrical Characteristics .....	112
Table 10.2. Flash Security Summary .....	114
<b>11. External RAM</b>	
<b>12. Oscillators</b>	
Table 12.1. Internal Oscillator Electrical Characteristics .....	123
<b>13. Port Input/Output</b>	
Table 13.1. Port I/O DC Electrical Characteristics .....	143
<b>14. SMBus</b>	
Table 14.1. SMBus Clock Source Selection .....	150
Table 14.2. Minimum SDA Setup and Hold Times .....	151
Table 14.3. Sources for Hardware Changes to SMB0CN .....	155
Table 14.4. SMBus Status Decoding .....	161

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

---

## 15. UART0

Table 15.1. Timer Settings for Standard Baud Rates Using the Internal Oscillator .....	170
Table 15.2. Timer Settings for Standard Baud Rates Using an External 25 MHz Oscillator .....	170
Table 15.3. Timer Settings for Standard Baud Rates Using an External 22.1184 MHz Oscillator .....	171
Table 15.4. Timer Settings for Standard Baud Rates Using an External 18.432 MHz Oscillator .....	171
Table 15.5. Timer Settings for Standard Baud Rates Using an External 11.0592 MHz Oscillator .....	172
Table 15.6. Timer Settings for Standard Baud Rates Using an External 3.6864 MHz Oscillator .....	172

## 16. Enhanced Serial Peripheral Interface (SPI0)

Table 16.1. SPI Slave Timing Parameters .....	185
---	-----

## 17. Timers

## 18. Programmable Counter Array

Table 18.1. PCA Timebase Input Options .....	204
Table 18.2. PCA0CPM Register Settings for PCA Capture/Compare Modules ....	205
Table 18.3. Watchdog Timer Timeout Intervals .....	214

## 19. Revision Specific Behavior

## 20. C2 Interface

## List of Registers

SFR Definition 5.1. AMX0P: AMUX0 Positive Channel Select	57
SFR Definition 5.2. AMX0N: AMUX0 Negative Channel Select	58
SFR Definition 5.3. ADC0CF: ADC0 Configuration	59
SFR Definition 5.4. ADC0H: ADC0 Data Word MSB	59
SFR Definition 5.5. ADC0L: ADC0 Data Word LSB	59
SFR Definition 5.6. ADC0CN: ADC0 Control	60
SFR Definition 5.7. ADC0GTH: ADC0 Greater-Than Data High Byte	61
SFR Definition 5.8. ADC0GTL: ADC0 Greater-Than Data Low Byte	61
SFR Definition 5.9. ADC0LTH: ADC0 Less-Than Data High Byte	62
SFR Definition 5.10. ADC0LTL: ADC0 Less-Than Data Low Byte	62
SFR Definition 6.1. REF0CN: Reference Control	68
SFR Definition 7.1. CPT0CN: Comparator0 Control	72
SFR Definition 7.2. CPT0MX: Comparator0 MUX Selection	73
SFR Definition 7.3. CPT0MD: Comparator0 Mode Selection	74
SFR Definition 7.4. CPT1CN: Comparator1 Control	75
SFR Definition 7.5. CPT1MX: Comparator1 MUX Selection	76
SFR Definition 7.6. CPT1MD: Comparator1 Mode Selection	77
SFR Definition 8.1. DPL: Data Pointer Low Byte	90
SFR Definition 8.2. DPH: Data Pointer High Byte	91
SFR Definition 8.3. SP: Stack Pointer	91
SFR Definition 8.4. PSW: Program Status Word	92
SFR Definition 8.5. ACC: Accumulator	92
SFR Definition 8.6. B: B Register	93
SFR Definition 8.7. IE: Interrupt Enable	97
SFR Definition 8.8. IP: Interrupt Priority	98
SFR Definition 8.9. EIE1: Extended Interrupt Enable 1	99
SFR Definition 8.10. EIP1: Extended Interrupt Priority 1	100
SFR Definition 8.11. IT01CF: INT0/INT1 Configuration	101
SFR Definition 8.12. PCON: Power Control	103
SFR Definition 9.1. VDM0CN: $V_{DD}$ Monitor Control	107
SFR Definition 9.2. RSTSRC: Reset Source	109
SFR Definition 10.1. PSCTL: Program Store R/W Control	116
SFR Definition 10.2. FLKEY: Flash Lock and Key	117
SFR Definition 10.3. FLSCCL: Flash Scale	117
SFR Definition 11.1. EMI0CN: External Memory Interface Control	119
SFR Definition 12.1. OSCICL: Internal Oscillator Calibration	122
SFR Definition 12.2. OSCICN: Internal Oscillator Control	122
SFR Definition 12.3. CLKSEL: Clock Select	123
SFR Definition 12.4. OSCXCN: External Oscillator Control	125
SFR Definition 13.1. XBR0: Port I/O Crossbar Register 0	134
SFR Definition 13.2. XBR1: Port I/O Crossbar Register 1	135
SFR Definition 13.3. P0: Port0	136
SFR Definition 13.4. P0MDIN: Port0 Input Mode	136

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

---

SFR Definition 13.5. P0MDOUT: Port0 Output Mode	137
SFR Definition 13.6. P0SKIP: Port0 Skip	137
SFR Definition 13.7. P1: Port1	138
SFR Definition 13.8. P1MDIN: Port1 Input Mode	138
SFR Definition 13.9. P1MDOUT: Port1 Output Mode	139
SFR Definition 13.10. P1SKIP: Port1 Skip	139
SFR Definition 13.11. P2: Port2	140
SFR Definition 13.12. P2MDIN: Port2 Input Mode	140
SFR Definition 13.13. P2MDOUT: Port2 Output Mode	141
SFR Definition 13.14. P2SKIP: Port2 Skip	141
SFR Definition 13.15. P3: Port3	142
SFR Definition 13.16. P3MDIN: Port3 Input Mode	142
SFR Definition 13.17. P3MDOUT: Port3 Output Mode	143
SFR Definition 14.1. SMB0CF: SMBus Clock/Configuration	152
SFR Definition 14.2. SMB0CN: SMBus Control	154
SFR Definition 14.3. SMB0DAT: SMBus Data	156
SFR Definition 15.1. SCON0: Serial Port 0 Control	168
SFR Definition 15.2. SBUF0: Serial (UART0) Port Data Buffer	169
SFR Definition 16.1. SPI0CFG: SPI0 Configuration	180
SFR Definition 16.2. SPI0CN: SPI0 Control	181
SFR Definition 16.3. SPI0CKR: SPI0 Clock Rate	182
SFR Definition 16.4. SPI0DAT: SPI0 Data	182
SFR Definition 17.1. TCON: Timer Control	191
SFR Definition 17.2. TMOD: Timer Mode	192
SFR Definition 17.3. CKCON: Clock Control	193
SFR Definition 17.4. TL0: Timer 0 Low Byte	194
SFR Definition 17.5. TL1: Timer 1 Low Byte	194
SFR Definition 17.6. TH0: Timer 0 High Byte	194
SFR Definition 17.7. TH1: Timer 1 High Byte	194
SFR Definition 17.8. TMR2CN: Timer 2 Control	197
SFR Definition 17.9. TMR2RLL: Timer 2 Reload Register Low Byte	198
SFR Definition 17.10. TMR2RLH: Timer 2 Reload Register High Byte	198
SFR Definition 17.11. TMR2L: Timer 2 Low Byte	198
SFR Definition 17.12. TMR2H: Timer 2 High Byte	198
SFR Definition 17.13. TMR3CN: Timer 3 Control	201
SFR Definition 17.14. TMR3RLL: Timer 3 Reload Register Low Byte	202
SFR Definition 17.15. TMR3RLH: Timer 3 Reload Register High Byte	202
SFR Definition 17.16. TMR3L: Timer 3 Low Byte	202
SFR Definition 17.17. TMR3H: Timer 3 High Byte	202
SFR Definition 18.1. PCA0CN: PCA Control	215
SFR Definition 18.2. PCA0MD: PCA Mode	216
SFR Definition 18.3. PCA0CPMn: PCA Capture/Compare Mode Registers	217
SFR Definition 18.4. PCA0L: PCA Counter/Timer Low Byte	218
SFR Definition 18.5. PCA0H: PCA Counter/Timer High Byte	218
SFR Definition 18.6. PCA0CPLn: PCA Capture Module Low Byte	218

---

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

---

SFR Definition 18.7. PCA0CPHn: PCA Capture Module High Byte .....	219
C2 Register Definition 20.1. C2ADD: C2 Address .....	223
C2 Register Definition 20.2. DEVICEID: C2 Device ID .....	223
C2 Register Definition 20.3. REVID: C2 Revision ID .....	224
C2 Register Definition 20.4. FPCTL: C2 Flash Programming Control .....	224
C2 Register Definition 20.5. FPDAT: C2 Flash Programming Data .....	224

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

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NOTES:



## 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 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.

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

**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

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

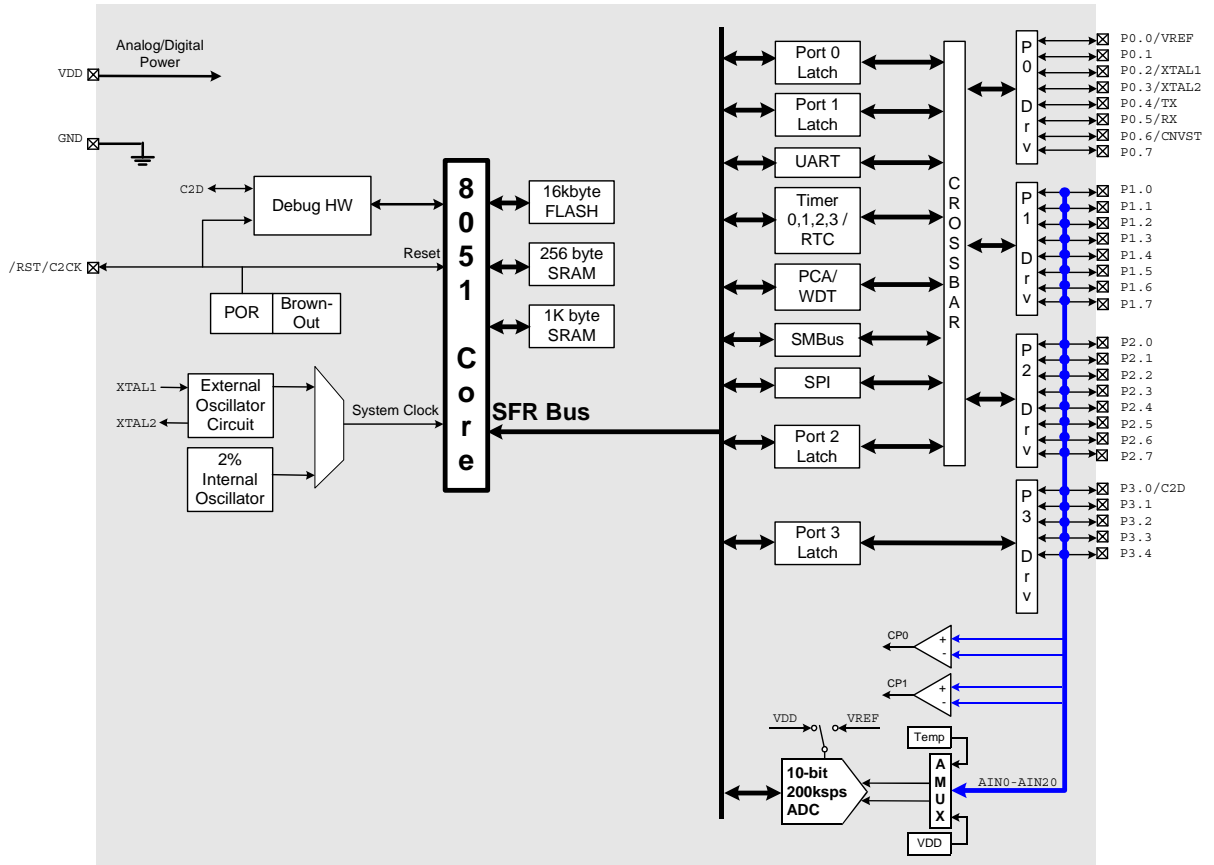


Figure 1.1. C8051F310 Block Diagram

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

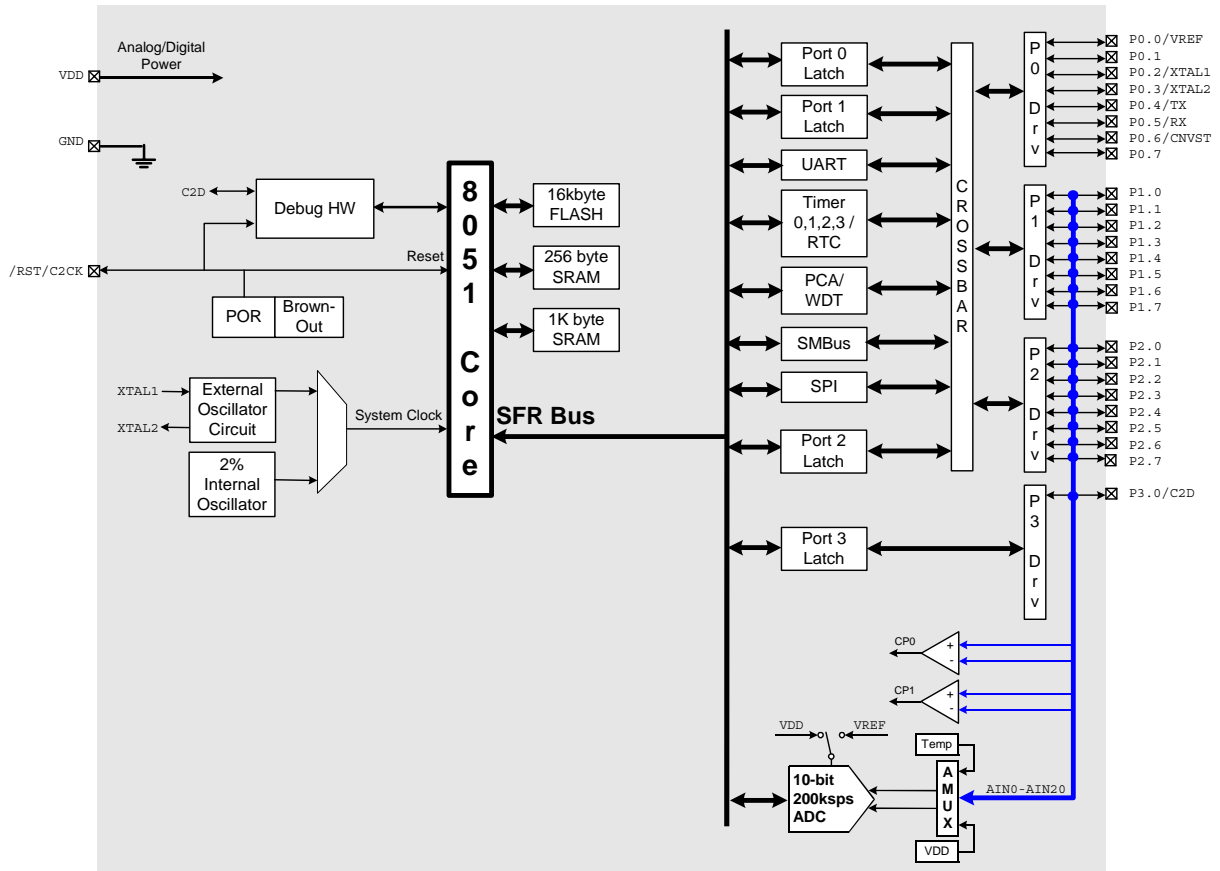


Figure 1.2. C8051F311 Block Diagram

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

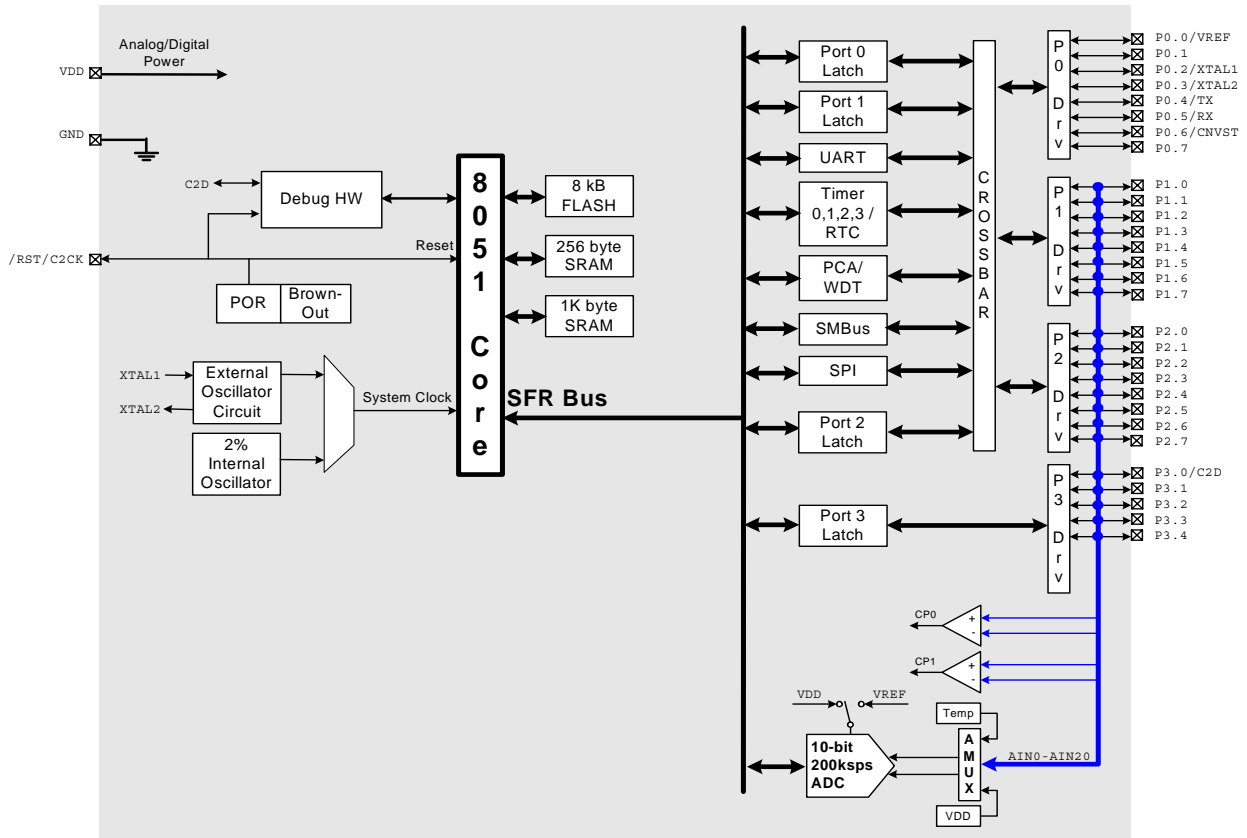


Figure 1.3. C8051F312 Block Diagram

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

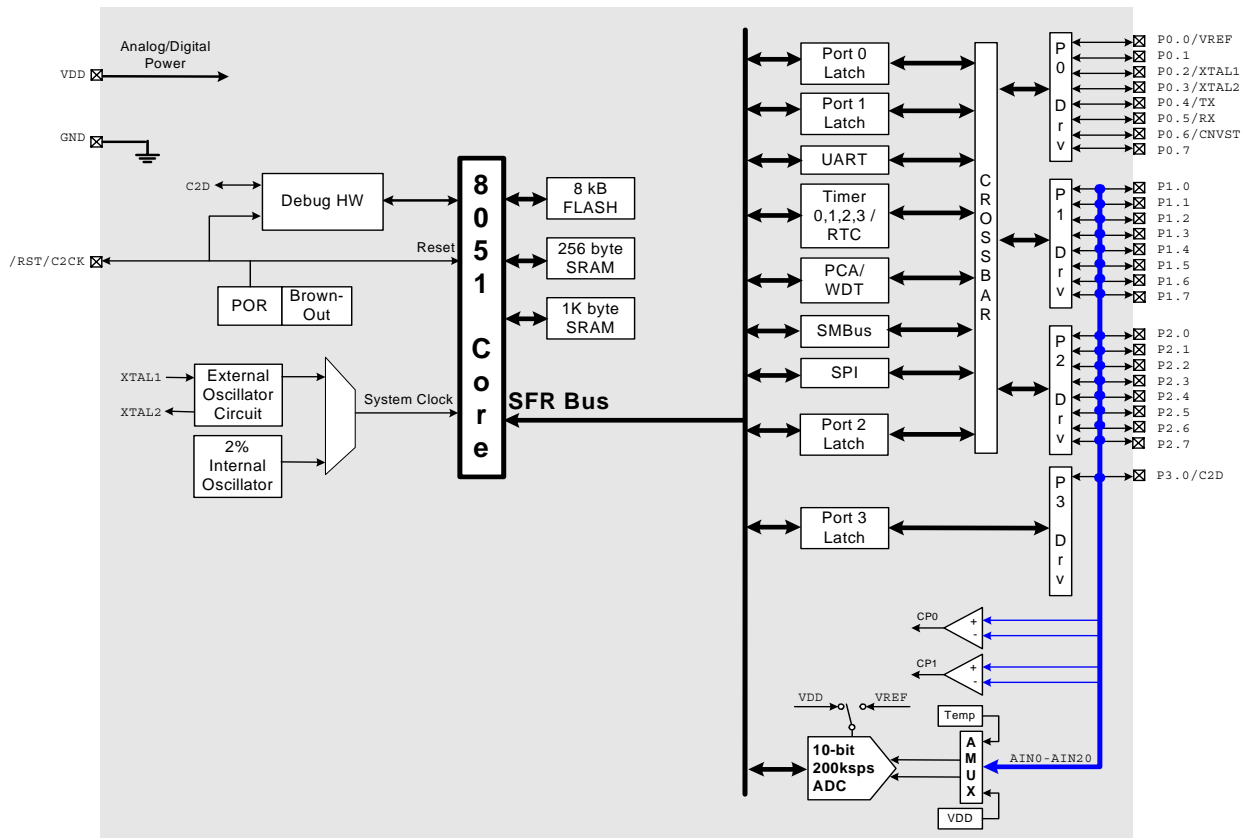


Figure 1.4. C8051F313 Block Diagram

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

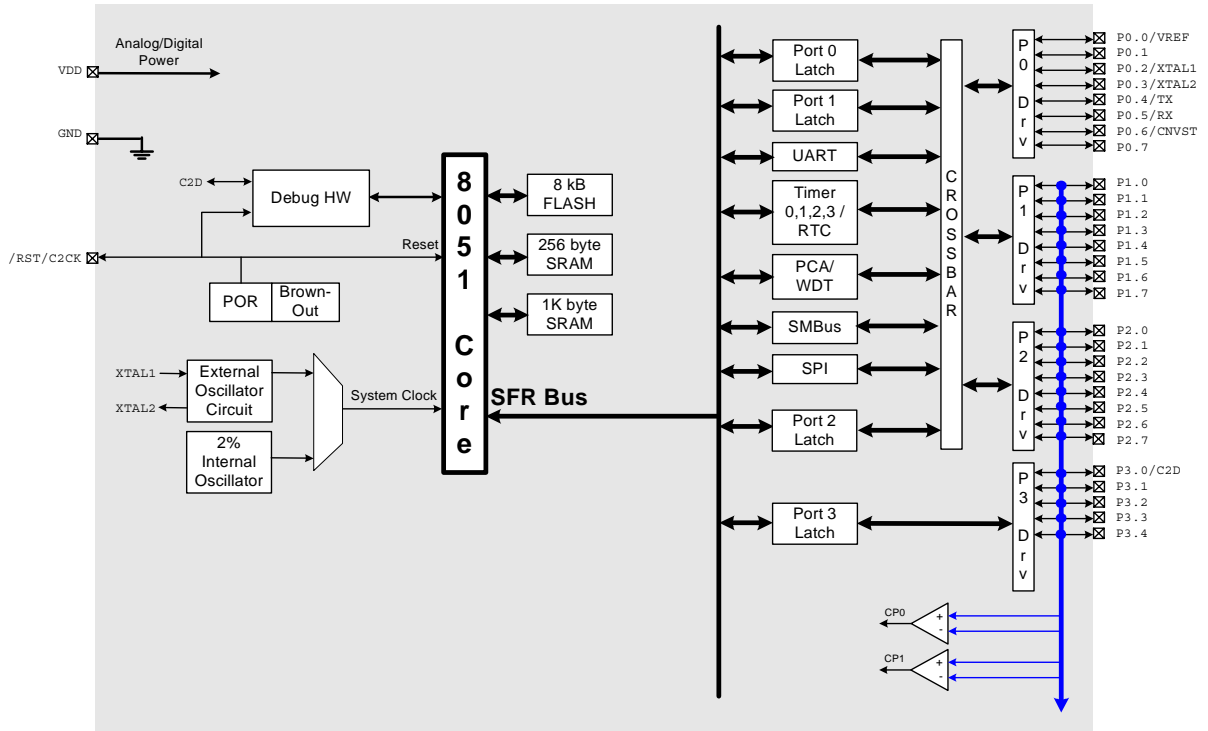


Figure 1.5. C8051F314 Block Diagram

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

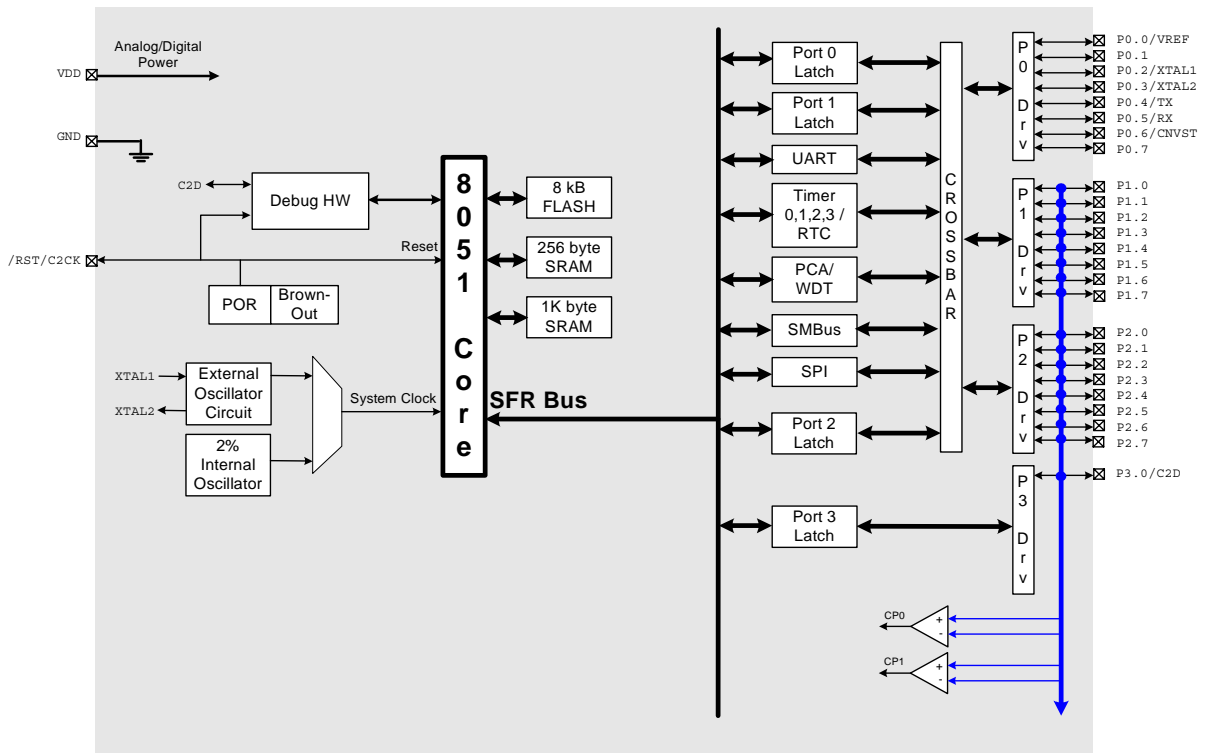


Figure 1.6. C8051F315 Block Diagram



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

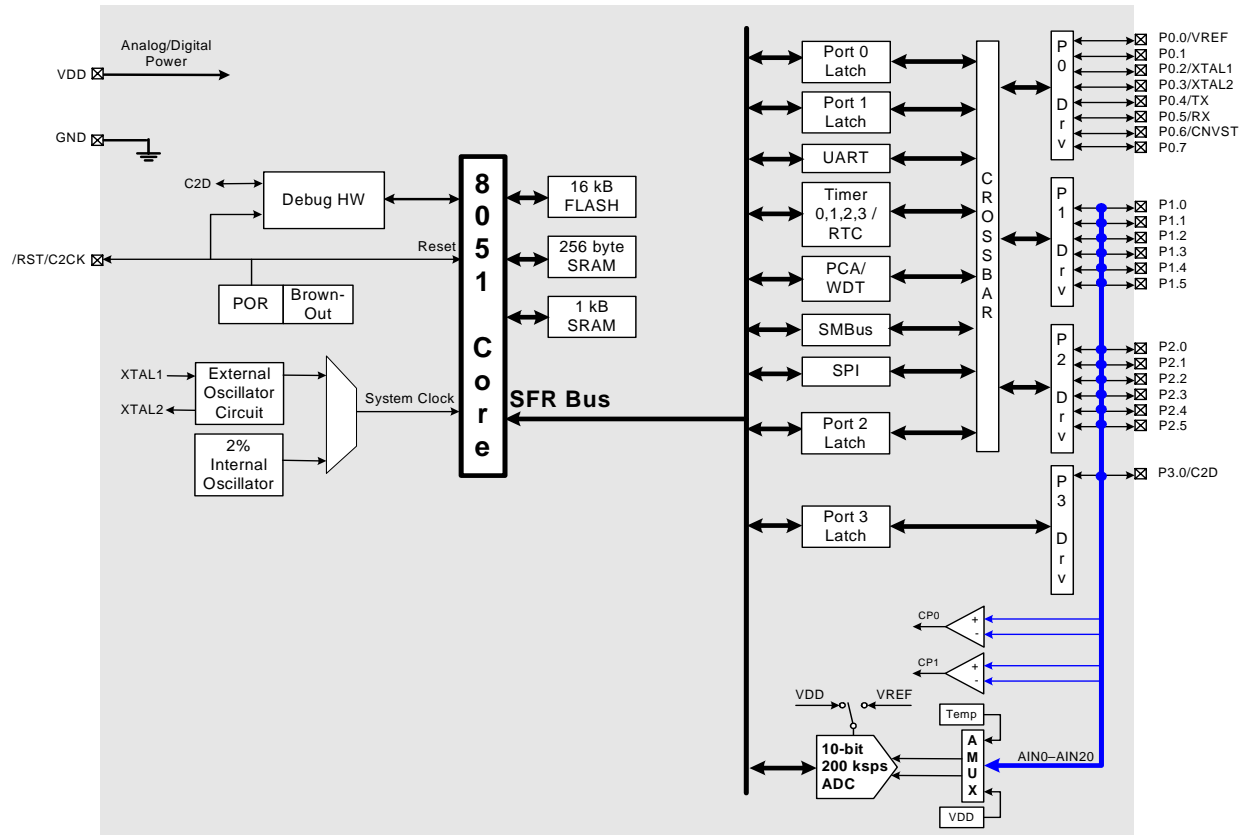


Figure 1.7. C8051F316 Block Diagram

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

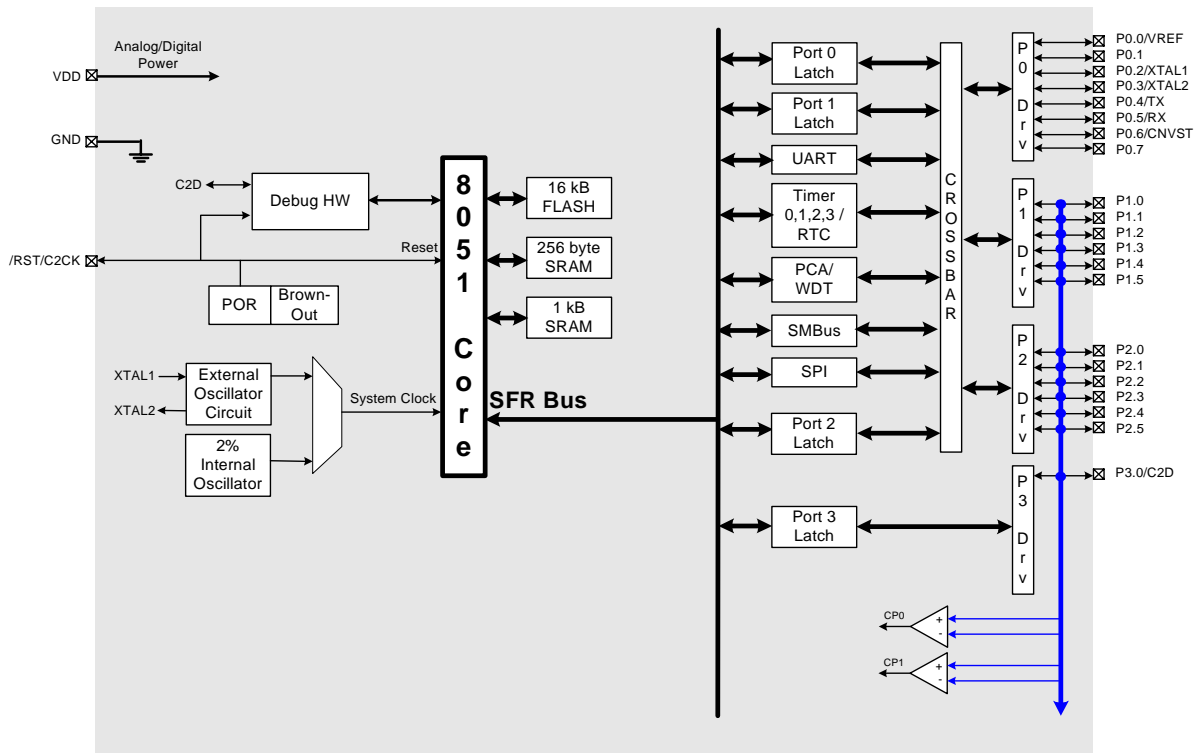


Figure 1.8. C8051F317 Block Diagram

## 1.1. CIP-51™ Microcontroller Core

### 1.1.1. Fully 8051 Compatible

The C8051F31x family utilizes Silicon Laboratories' proprietary CIP-51 microcontroller core. The CIP-51 is fully compatible with the MCS-51™ instruction set; standard 803x/805x assemblers and compilers can be used to develop software. The CIP-51 core offers all the peripherals included with a standard 8052, including four 16-bit counter/timers, a full-duplex UART with extended baud rate configuration, an enhanced SPI port, 1280 bytes of internal RAM, 128 byte Special Function Register (SFR) address space, and 29/25/21 I/O pins.

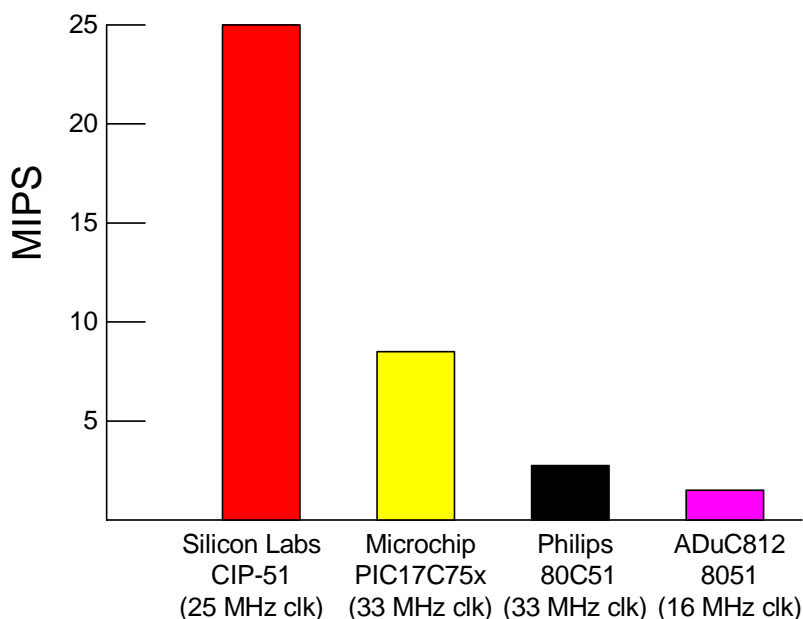
### 1.1.2. Improved Throughput

The CIP-51 employs a pipelined architecture that greatly increases its instruction throughput over the standard 8051 architecture. In a standard 8051, all instructions except for MUL and DIV take 12 or 24 system clock cycles to execute with a maximum system clock of 12-to-24 MHz. By contrast, the CIP-51 core executes 70% of its instructions in one or two system clock cycles, with only four instructions taking more than four system clock cycles.

The CIP-51 has a total of 109 instructions. The table below shows the total number of instructions that require each execution time.

Clocks to Execute	1	2	2/3	3	3/4	4	4/5	5	8
Number of Instructions	26	50	5	14	7	3	1	2	1

With the CIP-51's maximum system clock at 25 MHz, it has a peak throughput of 25 MIPS. Figure 1.9 shows a comparison of peak throughputs for various 8-bit microcontroller cores with their maximum system clocks.



**Figure 1.9. Comparison of Peak MCU Execution Speeds**

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

## 1.1.3. Additional Features

The C8051F31x SoC family includes several key enhancements to the CIP-51 core and peripherals to improve performance and ease of use in end applications.

The extended interrupt handler provides 14 interrupt sources into the CIP-51 (as opposed to 7 for the standard 8051), allowing numerous analog and digital peripherals to interrupt the controller. An interrupt driven system requires less intervention by the MCU, giving it more effective throughput. The extra interrupt sources are very useful when building multi-tasking, real-time systems.

Eight reset sources are available: power-on reset circuitry (POR), an on-chip  $V_{DD}$  monitor (forces reset when power supply voltage drops below  $V_{RST}$  as given in Table 9.1 on page 110), a Watchdog Timer, a Missing Clock Detector, a voltage level detection from Comparator0, a forced software reset, an external reset pin, and an errant Flash read/write protection circuit. Each reset source except for the POR, Reset Input Pin, or Flash error may be disabled by the user in software. The WDT may be permanently enabled in software after a power-on reset during MCU initialization.

The internal oscillator is factory calibrated to 24.5 MHz  $\pm 2\%$ . An external oscillator drive circuit is also included, allowing an external crystal, ceramic resonator, capacitor, RC, or CMOS clock source to generate the system clock. If desired, the system clock source may be switched on-the-fly between the internal and external oscillator circuits. An external oscillator can be extremely useful in low power applications, allowing the MCU to run from a slow (power saving) external crystal source, while periodically switching to the fast internal oscillator as needed.

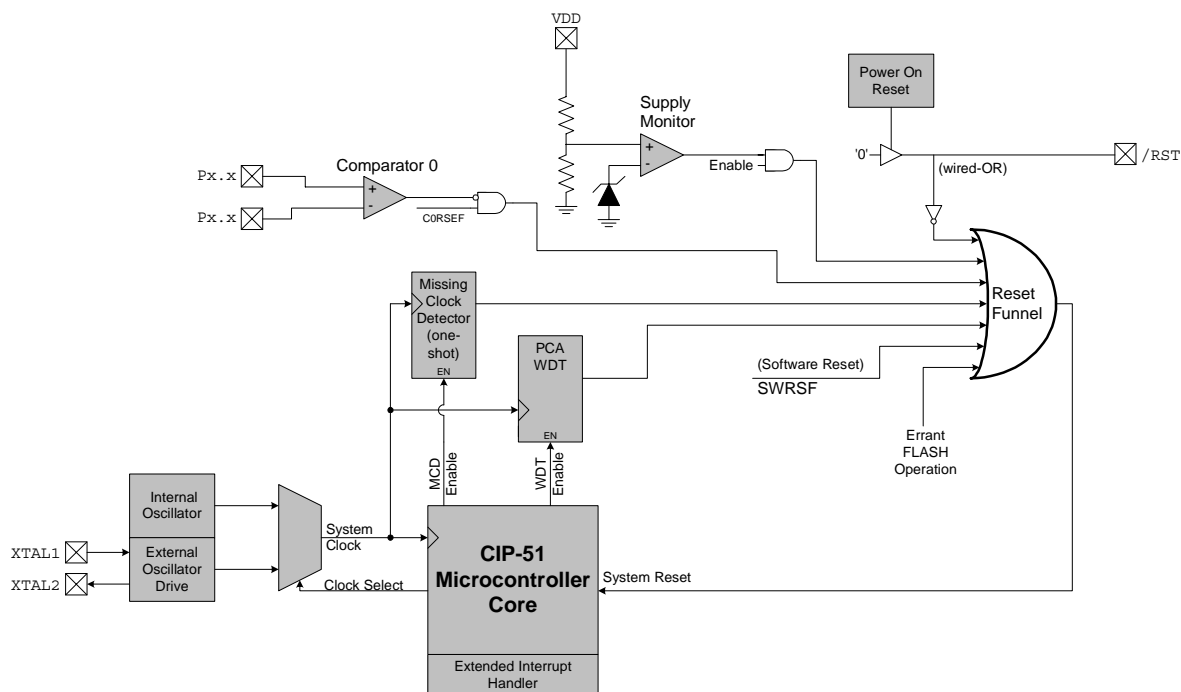


Figure 1.10. On-Chip Clock and Reset

## 1.2. On-Chip Memory

The CIP-51 has a standard 8051 program and data address configuration. It includes 256 bytes of data RAM, with the upper 128 bytes dual-mapped. Indirect addressing accesses the upper 128 bytes of general purpose RAM, and direct addressing accesses the 128 byte SFR address space. The lower 128 bytes of RAM are accessible via direct and indirect addressing. The first 32 bytes are addressable as four banks of general purpose registers, and the next 16 bytes can be byte addressable or bit addressable.

Program memory consists of 8 or 16 kB of Flash. This memory may be reprogrammed in-system in 512 byte sectors, and requires no special off-chip programming voltage. See Figure 1.11 for the MCU system memory map.

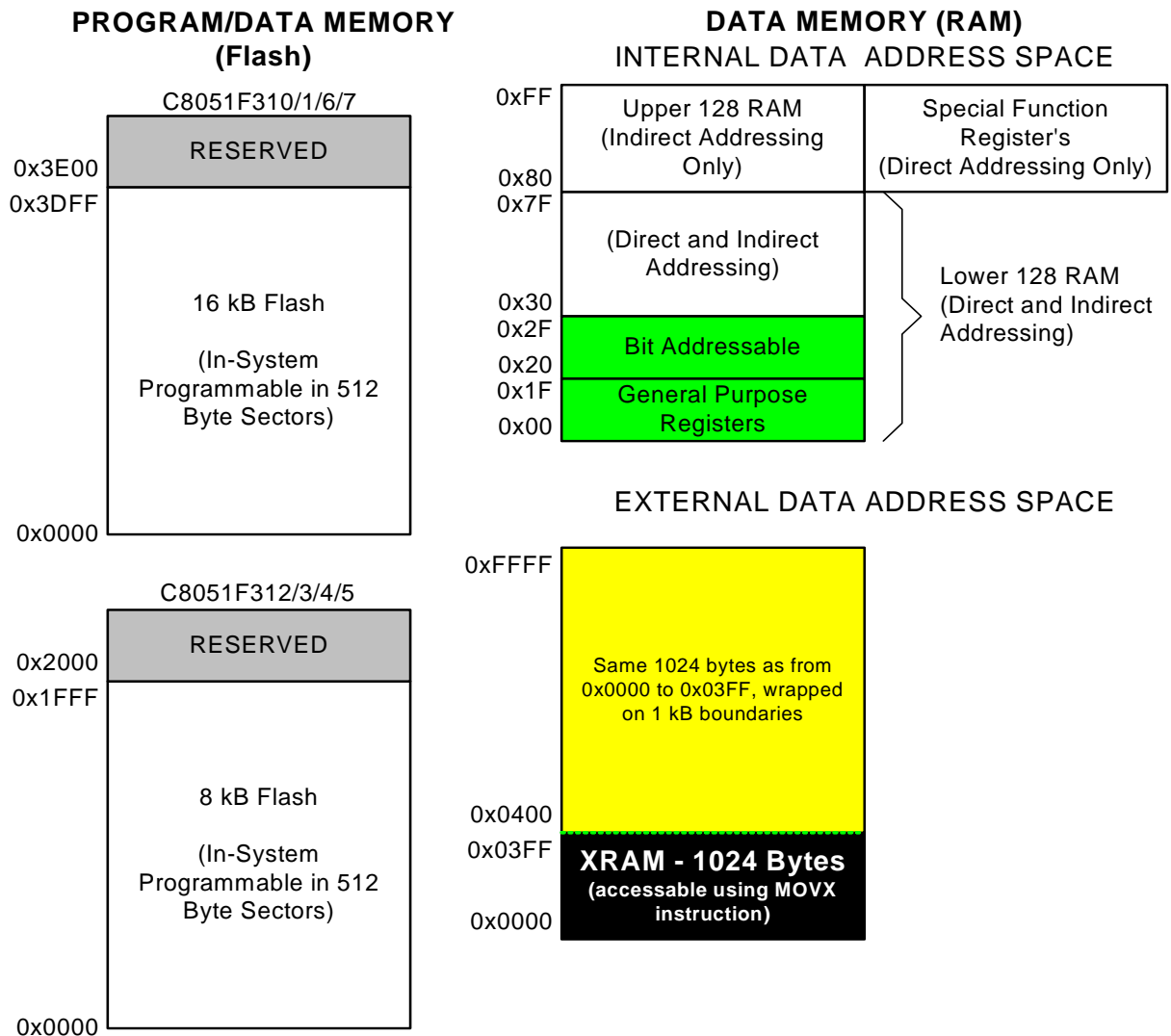


Figure 1.11. On-Board Memory Map

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

## 1.3. On-Chip Debug Circuitry

The C8051F31x devices include on-chip Silicon Labs 2-Wire (C2) debug circuitry that provides non-intrusive, full speed, in-circuit debugging of the production part *installed in the end application*.

Silicon Labs' debugging system supports inspection and modification of memory and registers, breakpoints, and single stepping. No additional target RAM, program memory, timers, or communications channels are required. All the digital and analog peripherals are functional and work correctly while debugging. All the peripherals (except for the ADC and SMBus) are stalled when the MCU is halted, during single stepping, or at a breakpoint in order to keep them synchronized.

The C8051F310DK development kit provides all the hardware and software necessary to develop application code and perform in-circuit debugging with the C8051F31x MCUs. The kit includes software with a developer's studio and debugger, an integrated 8051 assembler, a debug adapter, a target application board with the associated MCU installed, and the required cables and wall-mount power supply.

The Silicon Labs IDE interface is a vastly superior developing and debugging configuration, compared to standard MCU emulators that use on-board "ICE Chips" and require the MCU in the application board to be socketed. Silicon Labs' debug paradigm increases ease of use and preserves the performance of the precision analog peripherals.

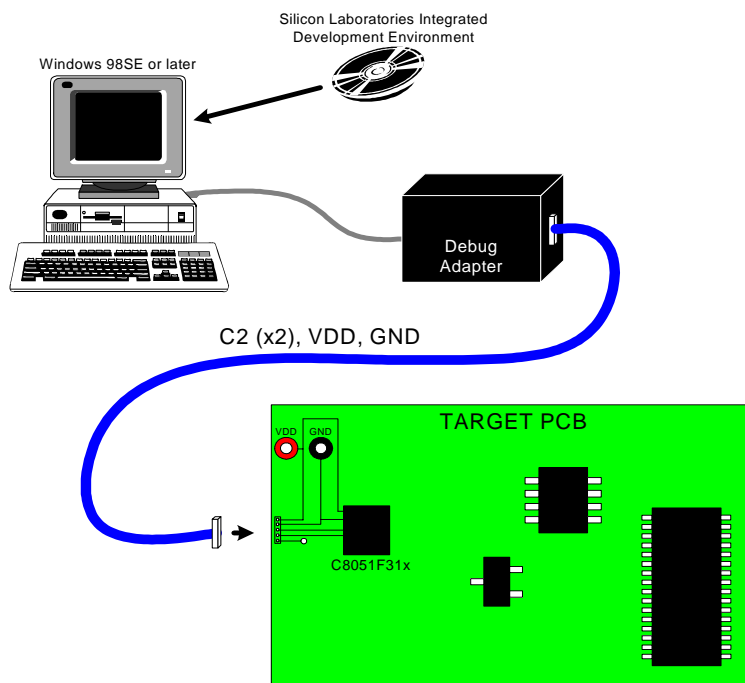


Figure 1.12. Development/In-System Debug Diagram

## 1.4. Programmable Digital I/O and Crossbar

C8051F310/2/4 devices include 29 I/O pins (three byte-wide Ports and one 5-bit-wide Port); C8051F311/3/5 devices include 25 I/O pins (three byte-wide Ports and one 1-bit-wide Port); C8051F316/7 devices include 21 I/O pins (one byte-wide Port, two 6-bit-wide Ports and one 1-bit-wide Port). The C8051F31x Ports behave like typical 8051 Ports with a few enhancements. Each Port pin may be configured as an analog input or a digital I/O pin. Pins selected as digital I/Os may additionally be configured for push-pull or open-drain output. The “weak pullups” that are fixed on typical 8051 devices may be globally disabled, providing power savings capabilities.

The Digital Crossbar allows mapping of internal digital system resources to Port I/O pins (See Figure 1.13). On-chip counter/timers, serial buses, HW interrupts, comparator output, and other digital signals in the controller can be configured to appear on the Port I/O pins specified in the Crossbar Control registers. This allows the user to select the exact mix of general purpose Port I/O and digital resources needed for the particular application.

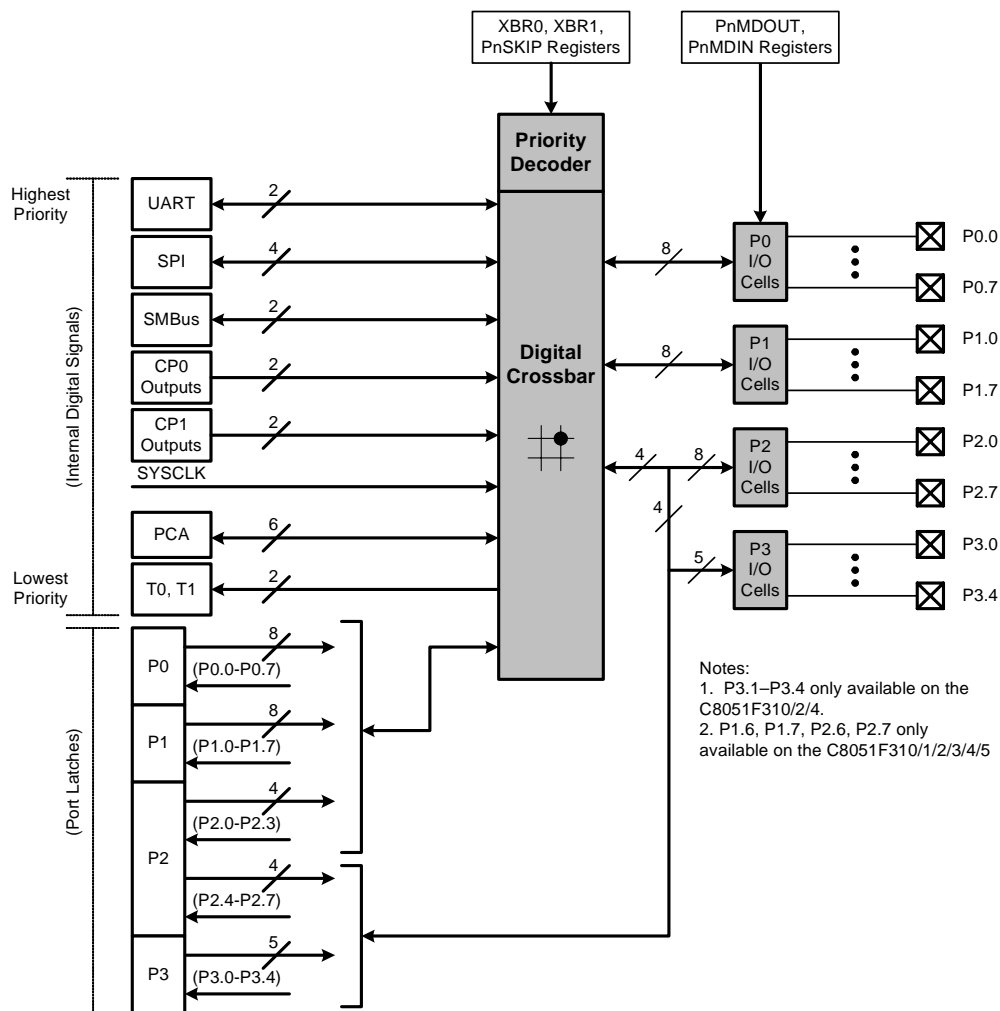


Figure 1.13. Digital Crossbar Diagram

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

## 1.5. Serial Ports

The C8051F31x Family includes an SMBus/I2C interface, a full-duplex UART with enhanced baud rate configuration, and an Enhanced SPI interface. Each of the serial buses is fully implemented in hardware and makes extensive use of the CIP-51's interrupts, thus requiring very little CPU intervention.

## 1.6. Programmable Counter Array

An on-chip Programmable Counter/Timer Array (PCA) is included in addition to the four 16-bit general purpose counter/timers. The PCA consists of a dedicated 16-bit counter/timer time base with five programmable capture/compare modules. The PCA clock is derived from one of six sources: the system clock divided by 12, the system clock divided by 4, Timer 0 overflows, an External Clock Input (ECI), the system clock, or the external oscillator clock source divided by 8. The external clock source selection is useful for real-time clock functionality, where the PCA is clocked by an external source while the internal oscillator drives the system clock.

Each capture/compare module can be configured to operate in one of six modes: Edge-Triggered Capture, Software Timer, High Speed Output, 8- or 16-bit Pulse Width Modulator, or Frequency Output. Additionally, Capture/Compare Module 4 offers watchdog timer (WDT) capabilities. Following a system reset, Module 4 is configured and enabled in WDT mode. The PCA Capture/Compare Module I/O and External Clock Input may be routed to Port I/O via the Digital Crossbar.

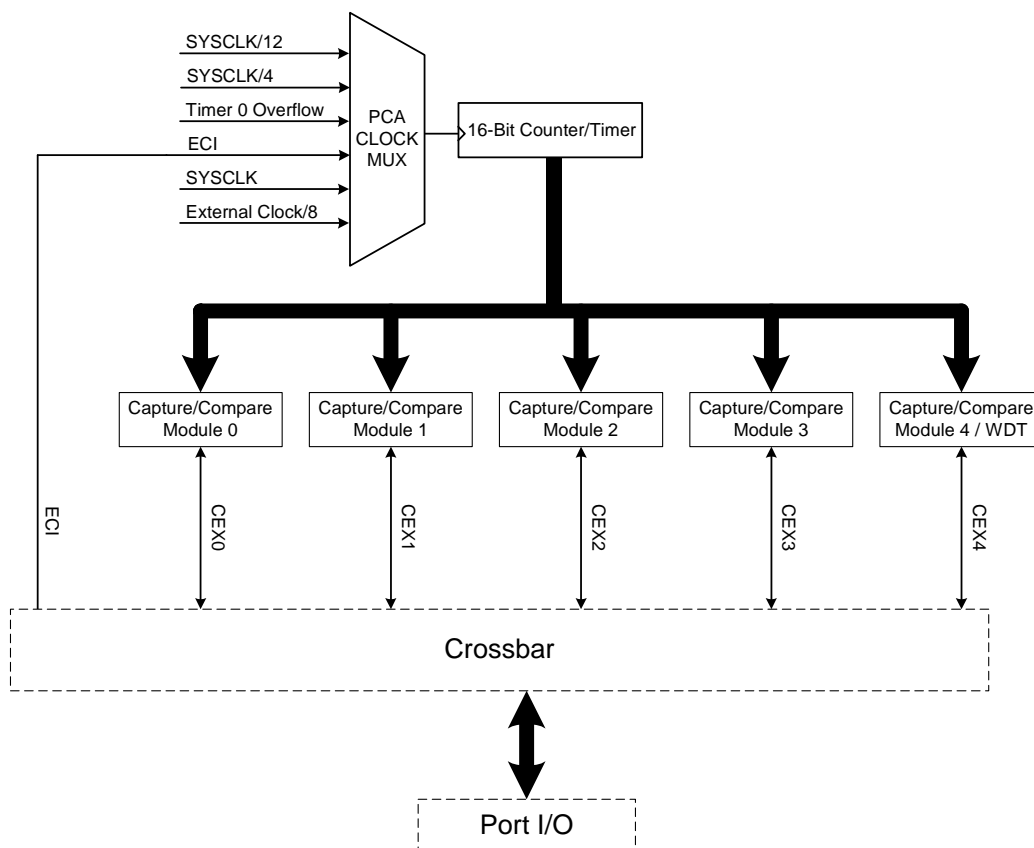


Figure 1.14. PCA Block Diagram



## 1.7. 10-Bit Analog to Digital Converter

The C8051F310/1/2/3/6 devices include an on-chip 10-bit SAR ADC with a 25-channel differential input multiplexer. With a maximum throughput of 200 ksps, the ADC offers true 10-bit accuracy with an INL of  $\pm 1$ LSB. The ADC system includes a configurable analog multiplexer that selects both positive and negative ADC inputs. Ports 1-3 are available as an ADC inputs; additionally, the on-chip Temperature Sensor output and the power supply voltage ( $V_{DD}$ ) are available as ADC inputs. User firmware may shut down the ADC to save power.

Conversions can be started in six ways: a software command, an overflow of Timer 0, 1, 2, or 3, or an external convert start signal. This flexibility allows the start of conversion to be triggered by software events, a periodic signal (timer overflows), or external HW signals. Conversion completions are indicated by a status bit and an interrupt (if enabled). The resulting 10-bit data word is latched into the ADC data SFRs upon completion of a conversion.

Window compare registers for the ADC data can be configured to interrupt the controller when ADC data is either within or outside of a specified range. The ADC can monitor a key voltage continuously in background mode, but not interrupt the controller unless the converted data is within/outside the specified range.

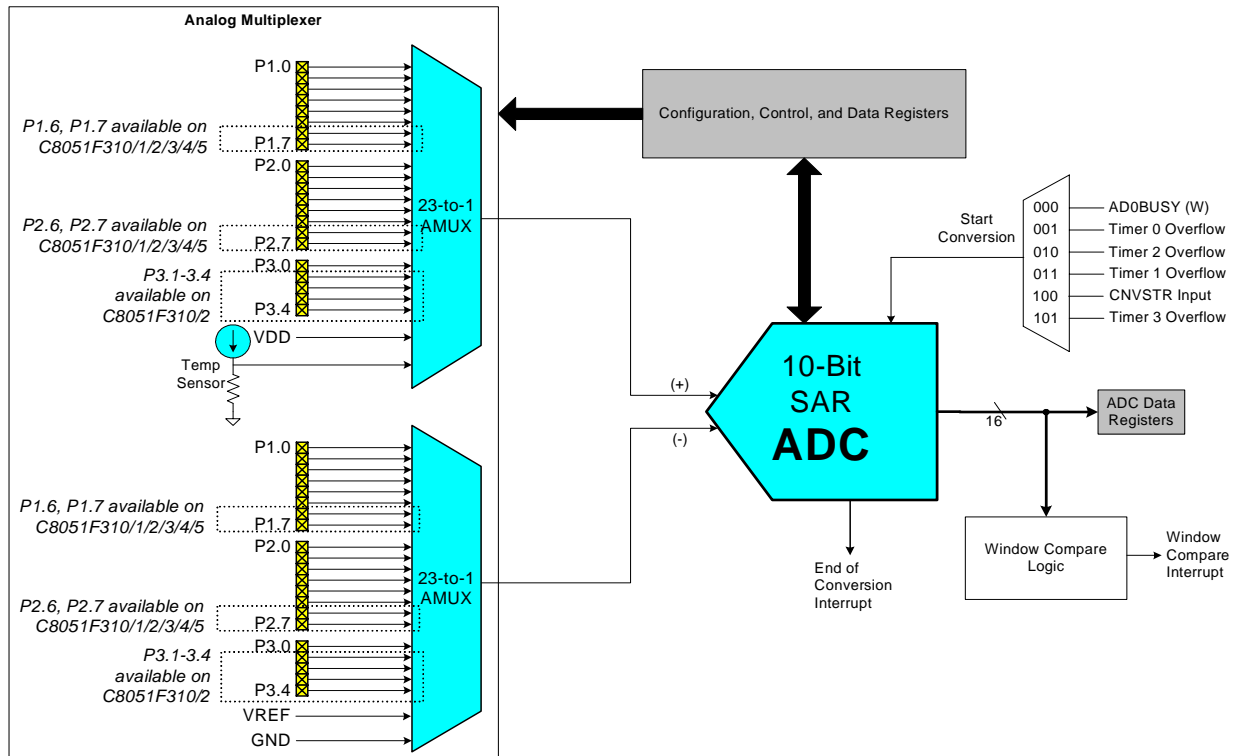


Figure 1.15. 10-Bit ADC Block Diagram

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

## 1.8. Comparators

C8051F31x devices include two on-chip voltage comparators that are enabled/disabled and configured via user software. Port I/O pins may be configured as comparator inputs via a selection mux. Two comparator outputs may be routed to a Port pin if desired: a latched output and/or an unlatched (asynchronous) output. Comparator response time is programmable, allowing the user to select between high-speed and low-power modes. Positive and negative hysteresis are also configurable.

Comparator interrupts may be generated on rising, falling, or both edges. When in IDLE mode, these interrupts may be used as a “wake-up” source. Comparator0 may also be configured as a reset source. Figure 1.16 shows the Comparator0 block diagram.

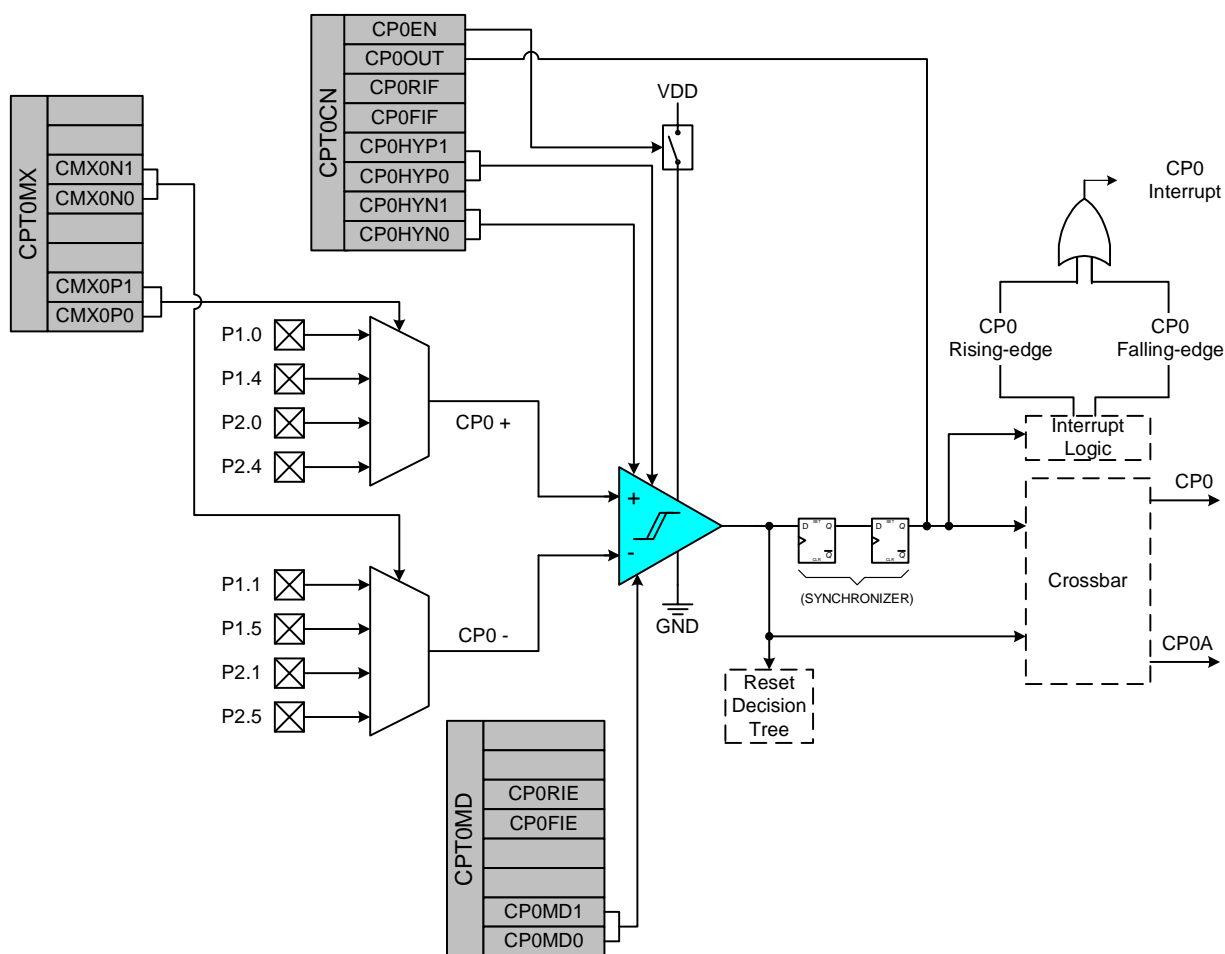


Figure 1.16. Comparator0 Block Diagram

## 2. Absolute Maximum Ratings

**Table 2.1. Absolute Maximum Ratings\***

Parameter	Conditions	Min	Typ	Max	Units
Ambient temperature under bias		-55	—	125	°C
Storage Temperature		-65	—	150	°C
Voltage on any Port I/O Pin or $\overline{\text{RST}}$ with respect to GND		-0.3	—	5.8	V
Voltage on $V_{DD}$ with respect to GND		-0.3	—	4.2	V
Maximum Total current through $V_{DD}$ and GND		—	—	500	mA
Maximum output current sunk by $\overline{\text{RST}}$ or any Port pin		—	—	100	mA
<p><b>*Note:</b> Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the devices at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.</p>					

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

## 3. Global DC Electrical Characteristics

**Table 3.1. Global DC Electrical Characteristics**

–40°C to +85°C, 25 MHz System Clock unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Units
Digital Supply Voltage		$V_{RST}^1$	3.0	3.6	V
Digital Supply RAM Data Retention Voltage		—	1.5	—	V
Specified Operating Temperature Range		–40	—	+85	°C
SYSCLK (system clock frequency)		0 <sup>2</sup>	—	25	MHz
Tsysl (SYSCLK low time)		18	—	—	ns
Tsysh (SYSCLK high time)		18	—	—	ns
<b>Digital Supply Current—CPU Active (Normal Mode, fetching instructions from Flash)</b>					
$I_{DD}$ (Note 3)	$V_{DD} = 3.0\text{ V}, F = 25\text{ MHz}$	—	7.8	8.6	mA
	$V_{DD} = 3.0\text{ V}, F = 1\text{ MHz}$	—	0.38	—	mA
	$V_{DD} = 3.0\text{ V}, F = 80\text{ kHz}$	—	31	—	μA
	$V_{DD} = 3.6\text{ V}, F = 25\text{ MHz}$	—	10.7	12.1	mA
$I_{DD}$ Supply Sensitivity (Note 3, Note 4)	$F = 25\text{ MHz}$	—	67	—	%/V
	$F = 1\text{ MHz}$	—	62	—	%/V
$I_{DD}$ Frequency Sensitivity (Note 3, Note 5)	$V_{DD} = 3.0\text{ V}, F \leq 15\text{ MHz}, T = 25\text{ °C}$	—	0.39	—	mA/MHz
	$V_{DD} = 3.0\text{ V}, F > 15\text{ MHz}, T = 25\text{ °C}$	—	0.21	—	mA/MHz
	$V_{DD} = 3.6\text{ V}, F \leq 15\text{ MHz}, T = 25\text{ °C}$	—	0.55	—	mA/MHz
	$V_{DD} = 3.6\text{ V}, F > 15\text{ MHz}, T = 25\text{ °C}$	—	0.27	—	mA/MHz

**Notes:**

- Given in Table 9.1 on page 110.
- SYSCLK must be at least 32 kHz to enable debugging.
- Based on device characterization data, not production tested.
- Active and Inactive  $I_{DD}$  at voltages and frequencies other than those specified can be calculated using the  $I_{DD}$  Supply Sensitivity. For example, if the  $V_{DD}$  is 3.3 V instead of 3.0 V at 25 MHz:  $I_{DD} = 7.8\text{ mA}$  typical at 3.0 V and  $f = 25\text{ MHz}$ . From this,  $I_{DD} = 7.8\text{ mA} + 0.67 \times (3.3\text{ V} - 3.0\text{ V}) = 8\text{ mA}$  at 3.3 V and  $f = 25\text{ MHz}$ .
- $I_{DD}$  can be estimated for frequencies  $\leq 15\text{ MHz}$  by multiplying the frequency of interest by the frequency sensitivity number for that range. When using these numbers to estimate  $I_{DD}$  for  $> 15\text{ MHz}$ , the estimate should be the current at 25 MHz minus the difference in current indicated by the frequency sensitivity number. For example:  
 $V_{DD} = 3.0\text{ V}; F = 20\text{ MHz}, I_{DD} = 7.8\text{ mA} - (25\text{ MHz} - 20\text{ MHz}) \times 0.21\text{ mA/MHz} = 6.75\text{ mA}$ .
- Idle  $I_{DD}$  can be estimated for frequencies  $\leq 1\text{ MHz}$  by multiplying the frequency of interest by the frequency sensitivity number for that range. When using these numbers to estimate Idle  $I_{DD}$  for  $> 1\text{ MHz}$ , the estimate should be the current at 25 MHz minus the difference in current indicated by the frequency sensitivity number. For example:  
 $V_{DD} = 3.0\text{ V}; F = 5\text{ MHz}, \text{Idle } I_{DD} = 4.8\text{ mA} - (25\text{ MHz} - 5\text{ MHz}) \times 0.15\text{ mA/MHz} = 1.8\text{ mA}$ .

**Table 3.1. Global DC Electrical Characteristics (Continued)**

–40°C to +85°C, 25 MHz System Clock unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Units
<b>Digital Supply Current—CPU Inactive (Idle Mode, not fetching instructions from Flash)</b>					
I <sub>DD</sub> (Note 3)	V <sub>DD</sub> = 3.0 V, F = 25 MHz	—	3.8	4.3	mA
	V <sub>DD</sub> = 3.0 V, F = 1 MHz	—	0.20	—	mA
	V <sub>DD</sub> = 3.0 V, F = 80 kHz	—	16	—	μA
	V <sub>DD</sub> = 3.6 V, F = 25 MHz	—	4.8	5.3	mA
I <sub>DD</sub> Supply Sensitivity (Note 3, Note 4)	F = 25 MHz	—	44	—	%/V
	F = 1 MHz	—	56	—	%/V
I <sub>DD</sub> Frequency Sensitivity (Note 3, Note 6)	V <sub>DD</sub> = 3.0 V, F ≤ 1 MHz, T = 25 °C	—	0.21	—	mA/MHz
	V <sub>DD</sub> = 3.0 V, F > 1 MHz, T = 25 °C	—	0.15	—	mA/MHz
	V <sub>DD</sub> = 3.6 V, F ≤ 1 MHz, T = 25 °C	—	0.28	—	mA/MHz
	V <sub>DD</sub> = 3.6 V, F > 1 MHz, T = 25 °C	—	0.19	—	mA/MHz
Digital Supply Current (Stop Mode, shutdown)	Oscillator not running, V <sub>DD</sub> Monitor Disabled	—	< 0.1	—	μA

**Notes:**

1. Given in Table 9.1 on page 110.
2. SYSCLK must be at least 32 kHz to enable debugging.
3. Based on device characterization data, not production tested.
4. Active and Inactive I<sub>DD</sub> at voltages and frequencies other than those specified can be calculated using the I<sub>DD</sub> Supply Sensitivity. For example, if the V<sub>DD</sub> is 3.3 V instead of 3.0 V at 25 MHz: I<sub>DD</sub> = 7.8 mA typical at 3.0 V and f = 25 MHz. From this, I<sub>DD</sub> = 7.8 mA + 0.67 x (3.3 V – 3.0 V) = 8 mA at 3.3 V and f = 25 MHz.
5. I<sub>DD</sub> can be estimated for frequencies ≤ 15 MHz by multiplying the frequency of interest by the frequency sensitivity number for that range. When using these numbers to estimate I<sub>DD</sub> for > 15 MHz, the estimate should be the current at 25 MHz minus the difference in current indicated by the frequency sensitivity number. For example:  
V<sub>DD</sub> = 3.0 V; F = 20 MHz, I<sub>DD</sub> = 7.8 mA – (25 MHz – 20 MHz) x 0.21 mA/MHz = 6.75 mA.
6. Idle I<sub>DD</sub> can be estimated for frequencies ≤ 1 MHz by multiplying the frequency of interest by the frequency sensitivity number for that range. When using these numbers to estimate Idle I<sub>DD</sub> for > 1 MHz, the estimate should be the current at 25 MHz minus the difference in current indicated by the frequency sensitivity number. For example:  
V<sub>DD</sub> = 3.0 V; F = 5 MHz, Idle I<sub>DD</sub> = 4.8 mA – (25 MHz – 5 MHz) x 0.15 mA/MHz = 1.8 mA.

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

Other electrical characteristics tables are found in the data sheet section corresponding to the associated peripherals. For more information on electrical characteristics for a specific peripheral, refer to the page indicated in Table 3.2.

**Table 3.2. Electrical Characteristics Quick Reference**

<b>Peripheral Electrical Characteristics</b>	<b>Page No.</b>
ADC0 Electrical Characteristics	65
External Voltage Reference Circuit Electrical Characteristics	68
Comparator Electrical Characteristics	78
Reset Electrical Characteristics	110
Flash Electrical Characteristics	112
Internal Oscillator Electrical Characteristics	123
Port I/O DC Electrical Characteristics	143

## 4. Pinout and Package Definitions

**Table 4.1. Pin Definitions for the C8051F31x**

Name	Pin Numbers			Type	Description
	'F310/2/4	'F311/3/5	'F316/7		
V <sub>DD</sub>	4	4	4		Power Supply Voltage.
GND	3	3	3		Ground.
RST/  C2CK	5	5	5	D I/O  D I/O	Device Reset. Open-drain output of internal POR. An external source can initiate a system reset by driving this pin low for at least 10 $\mu$ s.  Clock signal for the C2 Debug Interface.
P3.0/  C2D	6	6	6	D I/O  D I/O	Port 3.0. See <a href="#">Section 13</a> for a complete description.  Bi-directional data signal for the C2 Debug Interface.
P0.0/  VREF	2	2	2	D I/O  A In	Port 0.0. See <a href="#">Section 13</a> for a complete description.  External VREF input. ('F310/1/2/3 only)
P0.1	1	1	1	D I/O	Port 0.1. See <a href="#">Section 13</a> for a complete description.
P0.2/  XTAL1	32	28	24	D I/O  A In	Port 0.2. See <a href="#">Section 13</a> for a complete description.  External Clock Input. This pin is the external oscillator return for a crystal or resonator.
P0.3/  XTAL2	31	27	23	D I/O  A Out or D In	Port 0.3. See <a href="#">Section 13</a> for a complete description.  External Clock Output. For an external crystal or resonator, this pin is the excitation driver. This pin is the external clock input for CMOS, capacitor, or RC oscillator configurations.
P0.4	30	26	22	D I/O	Port 0.4. See <a href="#">Section 13</a> for a complete description.
P0.5	29	25	21	D I/O	Port 0.5. See <a href="#">Section 13</a> for a complete description.
P0.6/  CNVSTR	28	24	20		Port 0.6. See <a href="#">Section 13</a> for a complete description.  ADC0 External Convert Start Input. ('F310/1/2/3 only)
P0.7	27	23	19	D I/O	Port 0.7. See <a href="#">Section 13</a> for a complete description.
P1.0	26	22	18	D I/O or A In	Port 1.0. See <a href="#">Section 13</a> for a complete description.
P1.1	25	21	17	D I/O or A In	Port 1.1. See <a href="#">Section 13</a> for a complete description.
P1.2	24	20	16	D I/O or A In	Port 1.2. See <a href="#">Section 13</a> for a complete description.
P1.3	23	19	15	D I/O or A In	Port 1.3. See <a href="#">Section 13</a> for a complete description.
P1.4	22	18	14	D I/O or A In	Port 1.4. See <a href="#">Section 13</a> for a complete description.

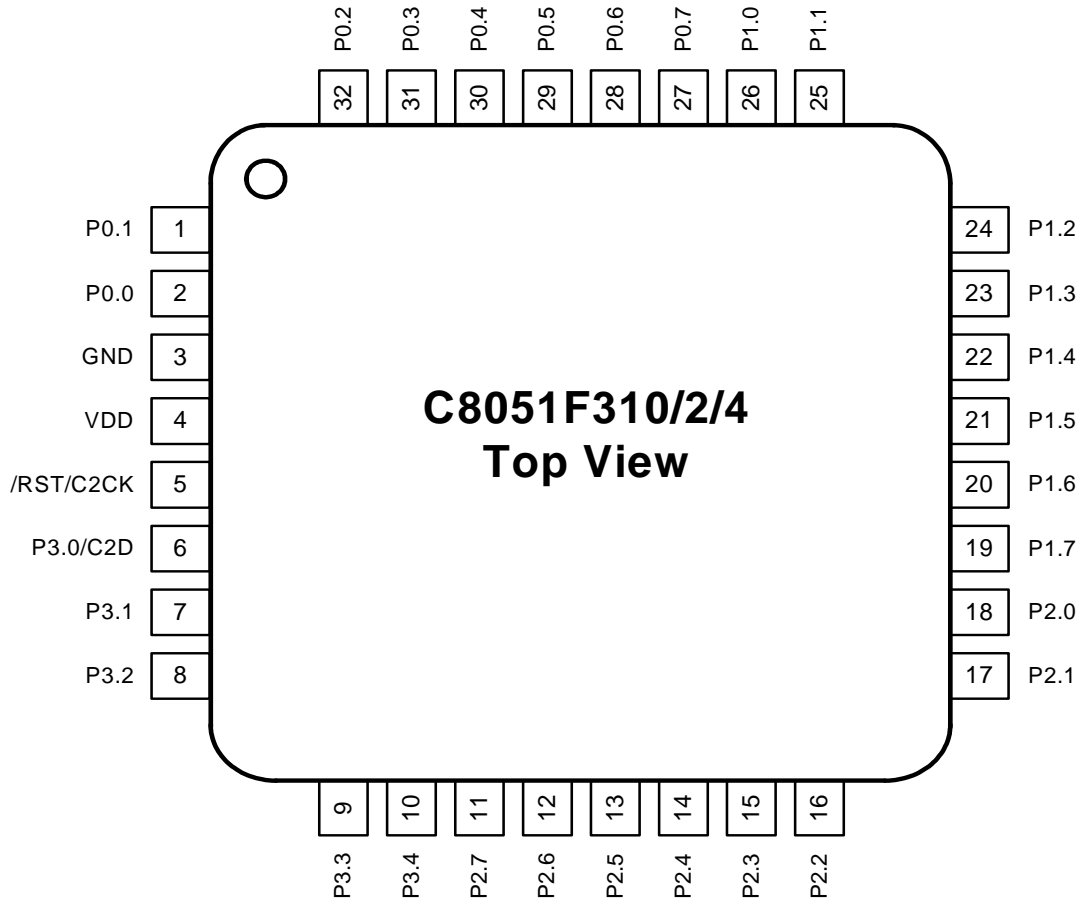
# C8051F310/1/2/3/4/5/6/7

**Table 4.1. Pin Definitions for the C8051F31x (Continued)**

Name	Pin Numbers			Type	Description
	'F310/2/4	'F311/3/5	'F316/7		
P1.5	21	17	13	D I/O or A In	Port 1.5. See <a href="#">Section 13</a> for a complete description.
P1.6	20	16		D I/O or A In	Port 1.6. See <a href="#">Section 13</a> for a complete description.
P1.7	19	15		D I/O or A In	Port 1.7. See <a href="#">Section 13</a> for a complete description.
P2.0	18	14	12	D I/O or A In	Port 2.0. See <a href="#">Section 13</a> for a complete description.
P2.1	17	13	11	D I/O or A In	Port 2.1. See <a href="#">Section 13</a> for a complete description.
P2.2	16	12	10	D I/O or A In	Port 2.2. See <a href="#">Section 13</a> for a complete description.
P2.3	15	11	9	D I/O or A In	Port 2.3. See <a href="#">Section 13</a> for a complete description.
P2.4	14	10	8	D I/O or A In	Port 2.4. See <a href="#">Section 13</a> for a complete description.
P2.5	13	9	7	D I/O or A In	Port 2.5. See <a href="#">Section 13</a> for a complete description.
P2.6	12	8		D I/O or A In	Port 2.6. See <a href="#">Section 13</a> for a complete description.
P2.7	11	7		D I/O or A In	Port 2.7. See <a href="#">Section 13</a> for a complete description.
P3.1	7			D I/O or A In	Port 3.1. See <a href="#">Section 13</a> for a complete description.
P3.2	8			D I/O or A In	Port 3.2. See <a href="#">Section 13</a> for a complete description.
P3.3	9			D I/O or A In	Port 3.3. See <a href="#">Section 13</a> for a complete description.
P3.4	10			D I/O or A In	Port 3.4. See <a href="#">Section 13</a> for a complete description.



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



**Figure 4.1. LQFP-32 Pinout Diagram (Top View)**



































































































































































































































































































































































































































