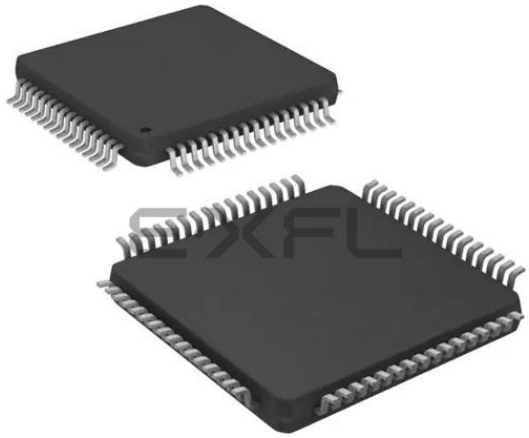

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Obsolete
Core Processor	8051
Core Size	8-Bit
Speed	25MHz
Connectivity	CANbus, SMBus (2-Wire/I²C), SPI, UART/USART
Peripherals	Brown-out Detect/Reset, POR, PWM, Temp Sensor, WDT
Number of I/O	24
Program Memory Size	64KB (64K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	4.25K x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 3.6V
Data Converters	A/D 2x16b, 8x10b; D/A 2x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	64-TQFP
Supplier Device Package	64-TQFP (10x10)
Purchase URL	https://www.e-xfl.com/product-detail/silicon-labs/c8051f063r

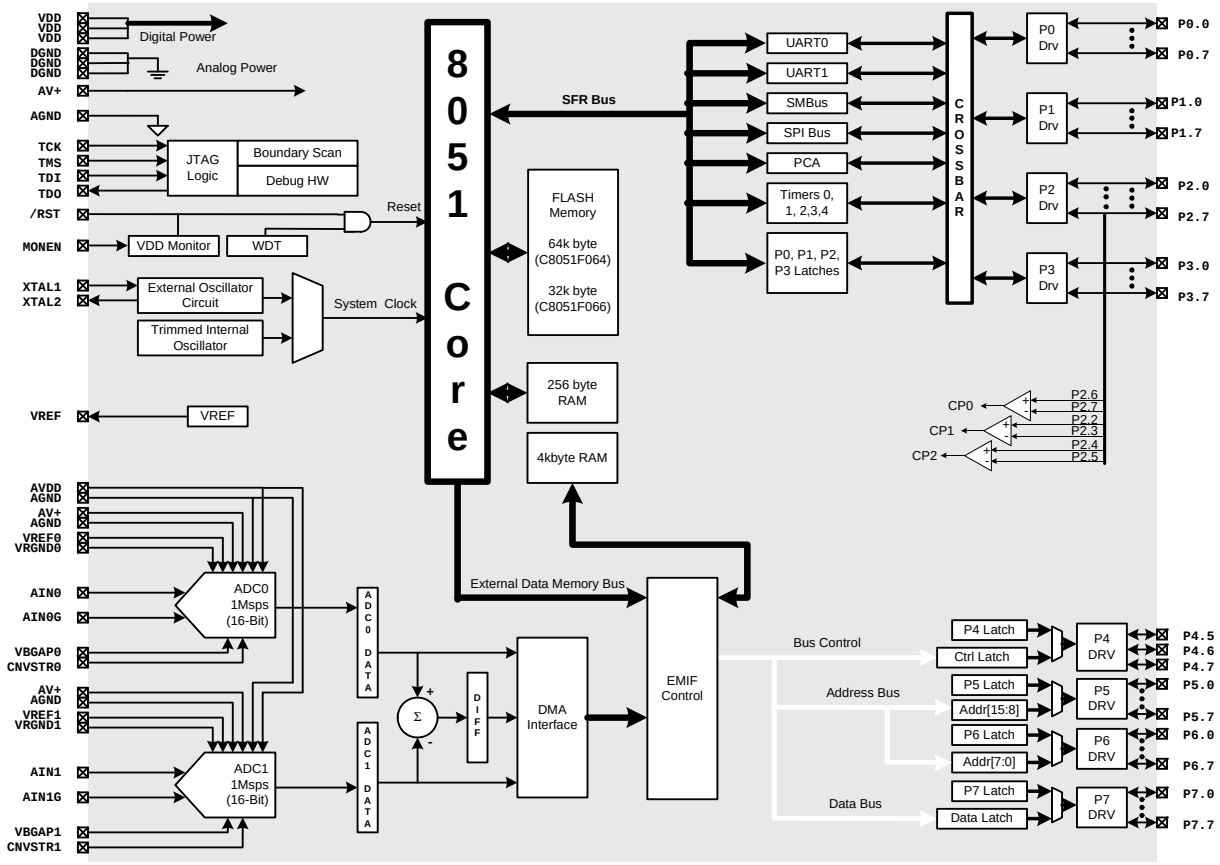


Figure 1.3. C8051F064 / C8051F066 Block Diagram

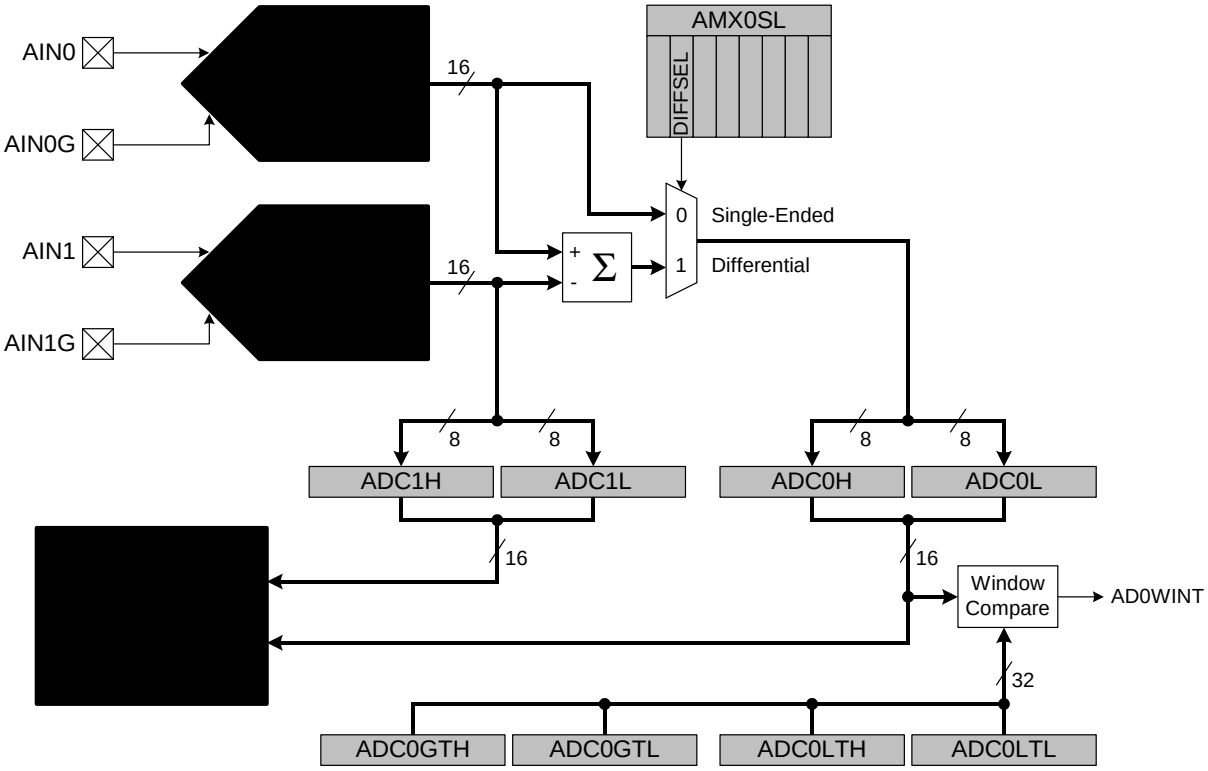


Figure 5.2. 16-bit ADC0 and ADC1 Data Path Diagram

5.1. Single-Ended or Differential Operation

ADC0 and ADC1 can be programmed to operate independently as single-ended ADCs, or together to accept a differential input. In single-ended mode, the ADCs can be configured to sample simultaneously, or to use different conversion speeds. In differential mode, ADC1 is a slave to ADC0, and its configuration is based on ADC0 settings, except during offset or gain calibrations. The DIFFSEL bit in the Channel Select Register AMX0SL (Figure 5.6) selects between single-ended and differential mode.

5.1.1. Pseudo-Differential Inputs

The inputs to the ADCs are pseudo-differential. The actual voltage measured by each ADC is equal to the voltage between the AINn pin and the AINnG pin. AINnG must be a DC signal between -0.2 and 0.6 V. In most systems, AINnG will be connected to AGND. If not tied to AGND, the AINnG signal can be used to negate a limited amount of fixed offset, but it is recommended that the internal offset calibration features of the device be used for this purpose. When operating in differential mode, AIN0G and AIN1G should be tied together. AINn must remain above AINnG in both modes for accurate conversion results.

5.3. ADC Modes of Operation

ADC0 and ADC1 have a maximum conversion speed of 1 Msps. The conversion clocks for the ADCs are derived from the system clock. The ADCnSC bits in the ADCnCF register determine how many system clocks (from 1 to 16) are used for each conversion clock.

5.3.1. Starting a Conversion

For ADC0, conversions can be initiated in one of four ways, depending on the programmed states of the ADC0 Start of Conversion Mode bits (AD0CM1, AD0CM0) in ADC0CN. For ADC0, conversions may be initiated by:

1. Writing a '1' to the AD0BUSY bit of ADC0CN;
2. A Timer 3 overflow (i.e. timed continuous conversions);
3. A rising edge detected on the external ADC convert start signal, CNVSTR0;
4. A Timer 2 overflow (i.e. timed continuous conversions).

ADC1 conversions can be initiated in five different ways, according to the ADC1 Start of Conversion Mode bits (AD1CM2-AD1CM0) in ADC1CN. For ADC1, conversions may be initiated by:

1. Writing a '1' to the AD1BUSY bit of ADC1CN;
2. A Timer 3 overflow (i.e. timed continuous conversions);
3. A rising edge detected on the external ADC convert start signal, CNVSTR1;
4. A Timer 2 overflow (i.e. timed continuous conversions);
5. Writing a '1' to the AD0BUSY bit of ADC0CN.

The ADnBUSY bit is set to logic 1 during conversion and restored to logic 0 when conversion is complete. The falling edge of ADnBUSY triggers an interrupt (when enabled) and sets the ADnINT interrupt flag (ADCnCN.5). In single-ended mode, the converted data for ADCn is available in the ADCn data word MSB and LSB registers, ADCnH, ADCnL. In differential mode, the converted data (combined from ADC0 and ADC1) is available in the ADC0 data word MSB and LSB registers, ADC0H, ADC0L.

When initiating conversions by writing a '1' to ADnBUSY, the ADnINT bit should be polled to determine when a conversion has completed (ADCn interrupts may also be used). The recommended polling procedure is shown below.

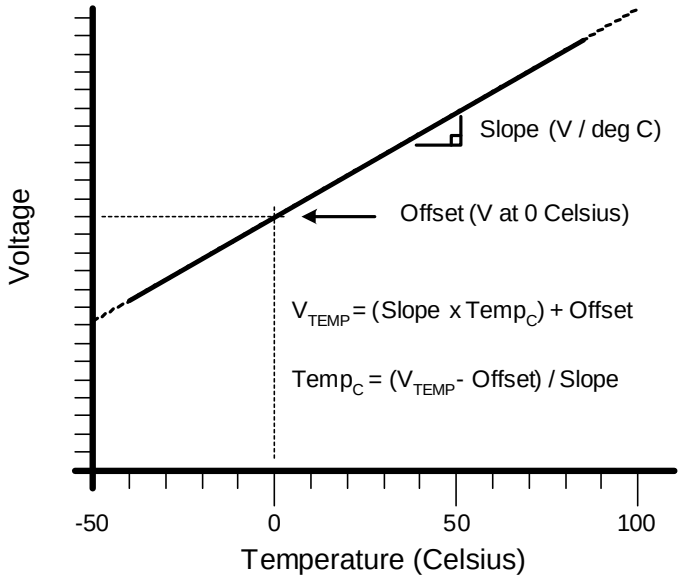
Step 1. Write a '0' to ADnINT;
Step 2. Write a '1' to ADnBUSY;
Step 3. Poll ADnINT for '1';
Step 4. Process ADCn data.

When an external start-of-conversion source is required in differential mode the two pins (CNVSTR0 and CNVSTR1) should be tied together.

5.3.2. Tracking Modes

The ADnTM bit in register ADCnCN controls the ADCn track-and-hold mode. When the ADC is enabled, the ADC input is continuously tracked when a conversion is not in progress. When the ADnTM bit is logic 1, each conversion is preceded by a tracking period (after the start-of-conversion signal). When the CNVSTRn signal is used to initiate conversions, the ADC will track until a rising edge occurs on the CNVSTRn pin (see Figure 5.4 and Table 5.1 for conversion timing parameters). Setting ADnTM to 1 can be useful to ensure that settling time requirements are met when an external multiplexer is used on the analog input (see Section "5.3.3. Settling Time Requirements" on page 56).

Figure 7.2. Temperature Sensor Transfer Function



7.2. Modes of Operation

ADC2 has a maximum conversion speed of 200 ksps. The ADC2 conversion clock is a divided version of the system clock, determined by the AD2SC bits in the ADC2CF register (system clock divided by (AD2SC + 1) for 0 ≤ AD2SC ≤ 31). The ADC2 conversion clock should be no more than 3 MHz.

7.2.1. Starting a Conversion

A conversion can be initiated in one of four ways, depending on the programmed states of the ADC2 Start of Conversion Mode bits (AD2CM1-0) in register ADC2CN. Conversions may be initiated by one of the following:

1. Writing a ‘1’ to the AD2BUSY bit of register ADC2CN
2. A Timer 3 overflow (i.e. timed continuous conversions)
3. A rising edge on the CNVSTR2 input signal (Assigned by the crossbar)
4. A Timer 2 overflow

When CNVSTR2 is used as a conversion start source, it must be enabled in the crossbar, and the corresponding pin must be set to open-drain, high-impedance mode (see Section “18. Port Input/Output” on page 203 for more details on Port I/O configuration).

Writing a ‘1’ to AD2BUSY provides software control of ADC2 whereby conversions are performed "on-demand". During conversion, the AD2BUSY bit is set to logic 1 and reset to logic 0 when the conversion is complete. The falling edge of AD2BUSY triggers an interrupt (when enabled) and sets the ADC2 interrupt flag (AD2INT). Note: When polling for ADC conversion completions, the ADC2 interrupt flag (AD2INT) should be used. Converted data is available in the ADC2 data registers, ADC2H and ADC2L, when bit AD2INT is logic 1. Note that when Timer 2 or Timer 3 overflows are used as the conversion source, low byte overflows are used if the timer is in 8-bit mode; and high byte overflows are used if the timer is in 16-bit mode. See Section “24. Timers” on page 287 for timer configuration.

Figure 7.7. ADC2CF: ADC2 Configuration Register

SFR Page: 2
SFR Address: 0xBC

R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	Reset Value
AD2SC4	AD2SC3	AD2SC2	AD2SC1	AD2SC0	-	-	-	11111000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	

Bits7-3: AD2SC4-0: ADC2 SAR Conversion Clock Period Bits.
SAR Conversion clock is derived from system clock by the following equation, where *ADSC* refers to the 5-bit value held in bits AD2SC4-AD2SC0. SAR Conversion clock requirements are given in Table 7.1.

$$ADSC = \frac{SYSCLK}{CLK_{SAR}} - 1$$

Bits2-0: UNUSED. Read = 000b; Write = don't care.

11. Voltage Reference 2 (C8051F064/5/6/7)

The internal voltage reference circuit consists of a 1.2 V, temperature stable bandgap voltage reference generator and a gain-of-two output buffer amplifier. The internal reference may be routed to the VREF pin as shown in Figure 11.1. The maximum load seen by the VREF pin must be less than 200 µA to AGND. Bypass capacitors of 0.1 µF and 4.7 µF are recommended from the VREF pin to AGND, as shown in Figure 11.1.

The Reference Control Register 2, REF2CN (defined in Figure 11.2) enables/disables the internal reference generator. The BIASE bit in REF2CN enables the on-board reference generator while the REFBE bit enables the gain-of-two buffer amplifier which drives the VREF pin. When disabled, the supply current drawn by the bandgap and buffer amplifier falls to less than 1 µA (typical) and the output of the buffer amplifier enters a high impedance state. If the internal bandgap is used as the reference voltage generator, BIASE and REFBE must both be set to logic 1. If the internal reference is not used, REFBE may be set to logic 0. The electrical specifications for the Voltage Reference are given in Table 11.1.

Figure 11.1. Voltage Reference Functional Block Diagram

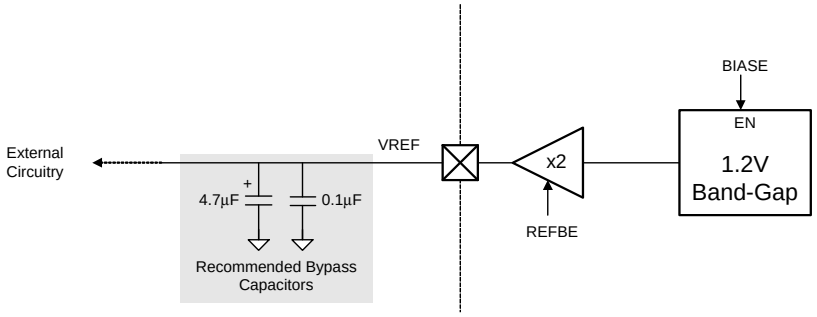


Figure 12.3. CPTnCN: Comparator 0, 1, and 2 Control Register

R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	Reset Value
CPnEN	CPnOUT	CPnRIF	CPnFIF	CPnHYP1	CPnHYP0	CPnHYN1	CPnHYN0	00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Bit Addressable

SFR Address: CPT0CN: 0x88; CPT1CN: 0x88; CPT2CN: 0x88
SFR Pages: CPT0CN: page 1; CPT1CN: page 2; CPT2CN: page 3

Bit7: CPnEN: Comparator Enable Bit. **(Please see note below.)**
0: Comparator Disabled.
1: Comparator Enabled.

Bit6: CPnOUT: Comparator Output State Flag.
0: Voltage on CPn+ < CPn-.
1: Voltage on CPn+ > CPn-.

Bit5: CPnRIF: Comparator Rising-Edge Interrupt Flag.
0: No Comparator Rising Edge Interrupt has occurred since this flag was last cleared.
1: Comparator Rising Edge Interrupt has occurred. Must be cleared by software.

Bit4: CPnFIF: Comparator Falling-Edge Interrupt Flag.
0: No Comparator Falling-Edge Interrupt has occurred since this flag was last cleared.
1: Comparator Falling-Edge Interrupt has occurred. Must be cleared by software.

Bits3-2: CPnHYP1-0: Comparator Positive Hysteresis Control Bits.
00: Positive Hysteresis Disabled.
01: Positive Hysteresis = 5 mV.
10: Positive Hysteresis = 10 mV.
11: Positive Hysteresis = 20 mV.

Bits1-0: CPnHYN1-0: Comparator Negative Hysteresis Control Bits.
00: Negative Hysteresis Disabled.
01: Negative Hysteresis = 5 mV.
10: Negative Hysteresis = 10 mV.
11: Negative Hysteresis = 20 mV.

NOTE: Upon enabling a comparator, the output of the comparator is not immediately valid. Before using a comparator as an interrupt or reset source, software should wait for a minimum of the specified “Power-up time” as specified in Table 12.1, “Comparator Electrical Characteristics,” on page 122.

Notes on Registers, Operands and Addressing Modes:

Rn - Register R0-R7 of the currently selected register bank.

@Ri - Data RAM location addressed indirectly through R0 or R1.

rel - 8-bit, signed (two's complement) offset relative to the first byte of the following instruction. Used by SJMP and all conditional jumps.

direct - 8-bit internal data location's address. This could be a direct-access Data RAM location (0x00-0x7F) or an SFR (0x80-0xFF).

#data - 8-bit constant

#data16 - 16-bit constant

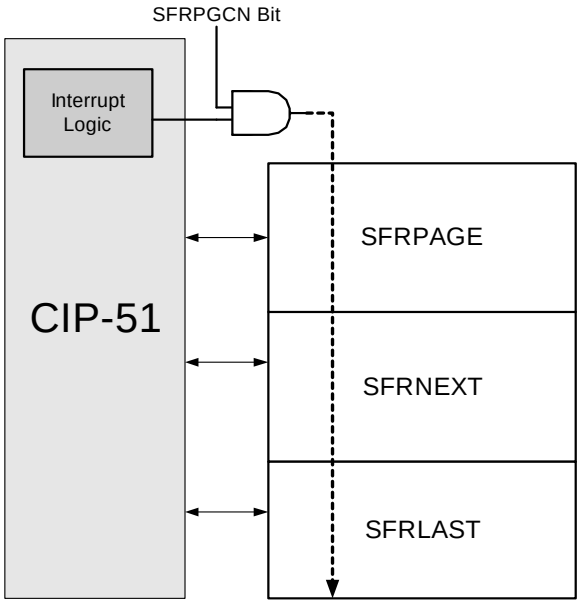
bit - Direct-accessed bit in Data RAM or SFR

addr11 - 11-bit destination address used by ACALL and AJMP. The destination must be within the same 2K-byte page of program memory as the first byte of the following instruction.

addr16 - 16-bit destination address used by LCALL and LJMP. The destination may be anywhere within the 64K-byte program memory space.

There is one unused opcode (0xA5) that performs the same function as NOP.

Figure 13.3. SFR Page Stack



Automatic hardware switching of the SFR Page on interrupts may be enabled or disabled as desired using the SFR Automatic Page Control Enable Bit located in the SFR Page Control Register (SFRPGCN). This function defaults to ‘enabled’ upon reset. In this way, the autoswitching function will be enabled unless disabled in software.

A summary of the SFR locations (address and SFR page) is provided in Table 13.2. in the form of an SFR memory map. Each memory location in the map has an SFR page row, denoting the page in which that SFR resides. Note that certain SFRs are accessible from ALL SFR pages, and are denoted by the “**(ALL PAGES)**” designation. For example, the Port I/O registers P0, P1, P2, and P3 all have the “**(ALL PAGES)**” designation, indicating these SFRs are accessible from all SFR pages regardless of the SFRPAGE register value.

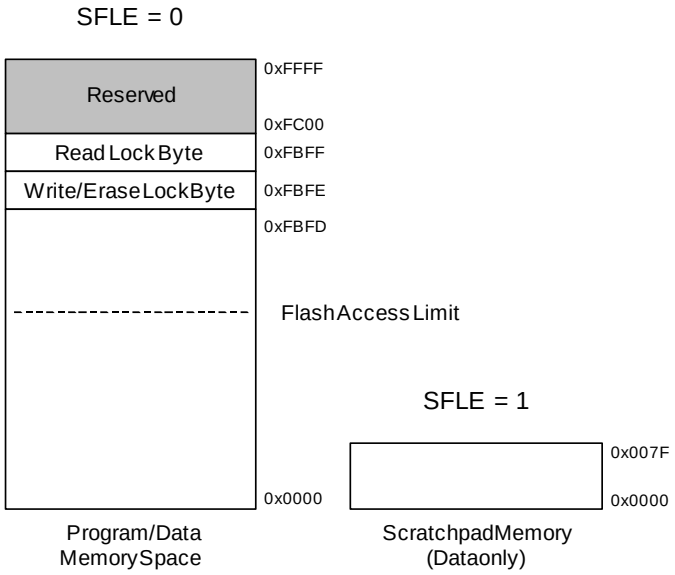
Table 13.2. Special Function Register (SFR) Memory Map

ADDRESS	SFR PAGE	0(8)	1(9)	2(A)	3(B)	4(C)	5(D)	6(E)	7(F)
F8	0 1 2 3 F	SPI0CN CAN0CN DMA0CF P7	PCA0L DMA0CTL	PCA0H DMA0CTH	PCA0CPL0 DMA0CSL	PCA0CPH0 DMA0CSH	PCA0CPL1 DMA0BND	PCA0CPH1 DMA0ISW	WDTCN **(ALL PAGES)**
F0	0 1 2 3 F	B **(ALL PAGES)**						EIP1 **(ALL PAGES)**	EIP2 **(ALL PAGES)**
E8	0 1 2 3 F	ADC0CN ADC1CN ADC2CN P6	PCA0CPL2	PCA0CPH2	PCA0CPL3	PCA0CPH3	PCA0CPL4	PCA0CPH4	RSTSRC
E0	0 1 2 3 F	ACC **(ALL PAGES)**	PCA0CPL5 XBR0	PCA0CPH5 XBR1	XBR2	XBR3		EIE1 **(ALL PAGES)**	EIE2 **(ALL PAGES)**
D8	0 1 2 3 F	PCA0CN CAN0DATL DMA0CN P5	PCA0MD CAN0DATH DMA0DAL	PCA0CPM0 CAN0ADR DMA0DAH	PCA0CPM1 CAN0TST DMA0DSL	PCA0CPM2 DMA0DSH	PCA0CPM3 DMA0IPT	PCA0CPM4 DMA0IDT	PCA0CPM5
D0	0 1 2 3 F	PSW **(ALL PAGES)**	REF0CN REF1CN REF2CN	DAC0L DAC1L	DAC0H DAC1H	DAC0CN DAC1CN			
C8	0 1 2 3 F	TMR2CN TMR3CN TMR4CN P4	TMR2CF TMR3CF TMR4CF	RCAP2L RCAP3L RCAP4L	RCAP2H RCAP3H RCAP4H	TMR2L TMR3L TMR4L	TMR2H TMR3H TMR4H		SMB0CR
C0	0 1 2 3 F	SMB0CN CAN0STA	SMB0STA	SMB0DAT	SMB0ADR	ADC0GTL ADC2GTL	ADC0GTH ADC2GTH	ADC0LTL ADC2LTL	ADC0LTH ADC2LTH
B8	0 1 2 3 F	IP **(ALL PAGES)**	SADEN0	AMX2CF ADC0CPT	AMX0SL AMX2SL ADC0CCF	ADC0CF ADC1CF ADC2CF		ADC0L ADC1L ADC2L	ADC0H ADC1H ADC2H
		0(8)	1(9)	2(A)	3(B)	4(C)	5(D)	6(E)	7(F)

Figure 16.1. C8051F060/1/2/3/4/5 Flash Program Memory Map and Security Bytes

Read and Write/Erase Security Bits
(Bit 7 is MSB)

Bit	Memory Block
7	0xE000-0xFBFD
6	0xC000-0xDFFF
5	0xA000-0xBFFF
4	0x8000-0x9FFF
3	0x6000-0x7FFF
2	0x4000-0x5FFF
1	0x2000-0x3FFF
0	0x0000-0x1FFF



Flash Read Lock Byte

Bits7-0: Each bit locks a corresponding block of memory. (Bit7 is MSB).

0: Read operations are locked (disabled) for corresponding block across the JTAG interface.

1: Read operations are unlocked (enabled) for corresponding block across the JTAG interface.

Flash Write/Erase Lock Byte

Bits7-0: Each bit locks a corresponding block of memory.

0: Write/Erase operations are locked (disabled) for corresponding block across the JTAG interface.

1: Write/Erase operations are unlocked (enabled) for corresponding block across the JTAG interface.

NOTE: When the block containing the security bytes is locked, the security bytes may be written but not erased.

Flash Access Limit

The Flash Access Limit is defined by the setting of the FLACL register, as described in Figure 16.3. Firmware running at or above this address is prohibited from using the MOVX and MOVC instructions to read, write, or erase Flash locations below this address.

Figure 18.8. XBR3: Port I/O Crossbar Register 3

R	R	R	R/W	R/W	R/W	R/W	R/W	Reset Value
CTXOUT	-	-		CP2E	CNVST2E	T3EXE	T3E	00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	

SFR Address: 0xE4
SFR Page: F

Bit7: CTXOUT: CAN Transmit Pin (CTX) Output Mode.
0: CTX pin output mode is configured as open-drain.
1: CTX pin output mode is configured as push-pull.
Bit6-4: Reserved
Bit3: CP2E: CP2 Output Enable Bit.
0: CP2 unavailable at Port pin.
1: CP2 routed to Port pin.
Bit2: CNVST2E: ADC2 External Convert Start Input Enable Bit.
0: CNVST2 for ADC2 unavailable at Port pin.
1: CNVST2 for ADC2 routed to Port pin.
Bit1: T3EXE: T3EX Input Enable Bit.
0: T3EX unavailable at Port pin.
1: T3EX routed to Port pin.
Bit0: T3E: T3 Input Enable Bit.
0: T3 unavailable at Port pin.
1: T3 routed to Port pin.

20.4.2. Clock Rate Register

Figure 20.9. SMB0CR: SMBus0 Clock Rate Register

R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	Reset Value
								00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	

SFR Address: 0xCF
SFR Page: 0

Bits7-0: SMB0CR.[7:0]: SMBus0 Clock Rate Preset.
The SMB0CR Clock Rate register controls the frequency of the serial clock SCL in master mode. The 8-bit word stored in the SMB0CR Register preloads a dedicated 8-bit timer. The timer counts up, and when it rolls over to 0x00, the SCL logic state toggles.

The SMB0CR setting should be bounded by the following equation , where *SMB0CR* is the unsigned 8-bit value in register SMB0CR, and *SYSCLK* is the system clock frequency in Hz:

$$SMB0CR < ((288 - 0.85 \cdot SYSCLK) / (1.125 \cdot 10^6))$$

The resulting SCL signal high and low times are given by the following equations:

$$T_{LOW} = (256 - SMB0CR) / SYSCLK$$

$$T_{HIGH} \cong (258 - SMB0CR) / SYSCLK + 625ns$$

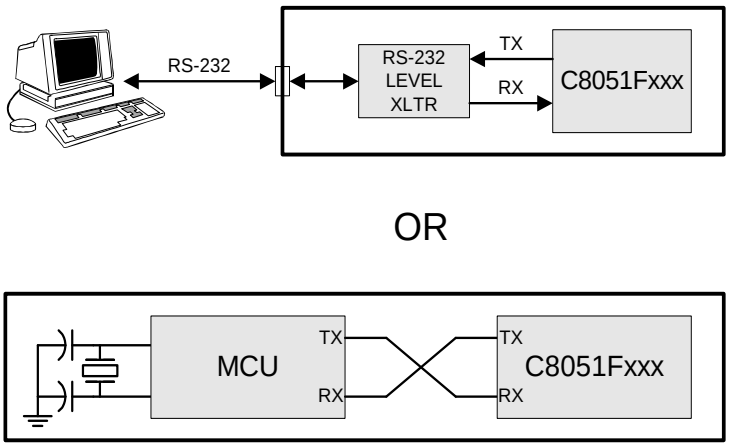
Using the same value of SMB0CR from above, the Bus Free Timeout period is given in the following equation:

$$T_{BFT} \cong 10 \times \frac{(256 - SMB0CR) + 1}{SYSCLK}$$

23.2. Operational Modes

UART1 provides standard asynchronous, full duplex communication. The UART mode (8-bit or 9-bit) is selected by the S1MODE bit (SCON1.7). Typical UART connection options are shown below.

Figure 23.3. UART Interconnect Diagram



23.2.1. 8-Bit UART

8-Bit UART mode uses a total of 10 bits per data byte: one start bit, eight data bits (LSB first), and one stop bit. Data are transmitted LSB first from the TX1 pin and received at the RX1 pin. On receive, the eight data bits are stored in SBUF1 and the stop bit goes into RB81 (SCON1.2).

Data transmission begins when software writes a data byte to the SBUF1 register. The TI1 Transmit Interrupt Flag (SCON1.1) is set at the end of the transmission (the beginning of the stop-bit time). Data reception can begin any time after the REN1 Receive Enable bit (SCON1.4) is set to logic 1. After the stop bit is received, the data byte will be loaded into the SBUF1 receive register if the following conditions are met: RI1 must be logic 0, and if MCE1 is logic 1, the stop bit must be logic 1. In the event of a receive data overrun, the first received 8 bits are latched into the SBUF1 receive register and the following overrun data bits are lost.

If these conditions are met, the eight bits of data is stored in SBUF1, the stop bit is stored in RB81 and the RI1 flag is set. If these conditions are not met, SBUF1 and RB81 will not be loaded and the RI1 flag will not be set. An interrupt will occur if enabled when either TI1 or RI1 is set.

Figure 23.4. 8-Bit UART Timing Diagram

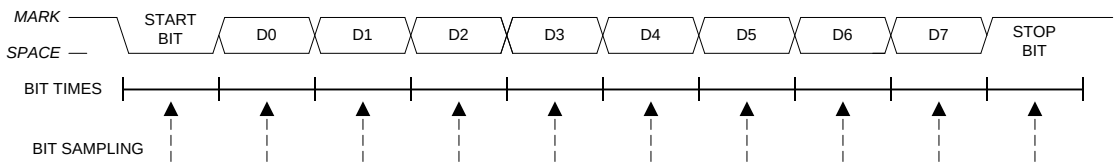


Figure 24.6. CKCON: Clock Control Register

R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	Reset Value
-	-	-	T1M	T0M	-	SCA1	SCA0	00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	

SFR Address: 0x8E
SFR Page: 0

Bits7-5: UNUSED. Read = 000b, Write = don't care.
Bit4: T1M: Timer 1 Clock Select.
This select the clock source supplied to Timer 1. T1M is ignored when C/T1 is set to logic 1.
0: Timer 1 uses the clock defined by the prescale bits, SCA1-SCA0.
1: Timer 1 uses the system clock.
Bit3: T0M: Timer 0 Clock Select.
This bit selects the clock source supplied to Timer 0. T0M is ignored when C/T0 is set to logic 1.
0: Counter/Timer 0 uses the clock defined by the prescale bits, SCA1-SCA0.
1: Counter/Timer 0 uses the system clock.
Bit2: UNUSED. Read = 0b, Write = don't care.
Bits1-0: SCA1-SCA0: Timer 0/1 Prescale Bits
These bits control the division of the clock supplied to Timer 0 and/or Timer 1 if configured to use prescaled clock inputs.

SCA1	SCA0	Prescaled Clock
0	0	System clock divided by 12
0	1	System clock divided by 4
1	0	System clock divided by 48
1	1	External clock divided by 8†

†Note: External clock divided by 8 is synchronized with the system clock, and external clock must be less than or equal to the system clock frequency to operate the timer in this mode.

24.2. Timer 2, Timer 3, and Timer 4

Timers 2, 3, and 4 are 16-bit counter/timers, each formed by two 8-bit SFRs: TMRnL (low byte) and TMRnH (high byte) where n = 2, 3, and 4 for timers 2, 3, and 4 respectively. These timers feature auto-reload, capture, and toggle output modes with the ability to count up or down. Capture Mode and Auto-reload mode are selected using bits in the Timer 2, 3, and 4 Control registers (TMRnCN). Toggle output mode is selected using the Timer 2, 3, and 4 Configuration registers (TMRnCF). These timers may also be used to generate a square-wave at an external pin. Timers 2, 3, and 4 can use either the system clock (divided by one, two, or twelve), external clock (divided by eight) or transitions on an external input pin as its clock source. Timer 2 and 3 can be used to start an ADC Data Conversion and Timers 2, 3, and 4 can schedule DAC outputs. Timers 1, 2, 3, or 4 may be used to generate baud rates for UART 0. Only Timer 1 can be used to generate baud rates for UART 1.

The Counter/Timer Select bit C/Tn bit (TMRnCN.1) configures the peripheral as a counter or timer. Clearing C/Tn configures the Timer to be in a timer mode (i.e., the selected timer clock source as the input for the timer). When C/Tn is set to 1, the timer is configured as a counter (i.e., high-to-low transitions at the Tn input pin increment (or decrement) the counter/timer register. Refer to Section “18.1. Ports 0 through 3 and the Priority Crossbar Decoder” on page 205 for information on selecting and configuring external I/O pins for digital peripherals, such as the Tn pin.

Timer 2, 3, and 4 can use either SYSCLK, SYSCLK divided by 2, SYSCLK divided by 12, an external clock divided by 8, or high-to-low transitions on the Tn input pin as its clock source when operating in Counter/Timer with Capture mode. Clearing the C/Tn bit (TnCON.1) selects the system clock/external clock as the input for the timer. The Timer Clock Select bits TnM0 and TnM1 in TMRnCF can be used to select the system clock undivided, system clock divided by two, system clock divided by 12, or an external clock provided at the XTAL1/XTAL2 pins divided by 8 (see Figure 24.14). When C/Tn is set to logic 1, a high-to-low transition at the Tn input pin increments the counter/timer register (i.e., configured as a counter).

24.2.1. Configuring Timer 2, 3, and 4 to Count Down

Timers 2, 3, and 4 have the ability to count down. When the timer’s respective Decrement Enable Bit (DCENn) in the Timer Configuration Register (See Figure 24.14) is set to ‘1’, the timer can then count *up* or *down*. When DCENn = 1, the direction of the timer’s count is controlled by the TnEX pin’s logic level. When TnEX = 1, the counter/timer will count up; when TnEX = 0, the counter/timer will count down. To use this feature, TnEX must be enabled in the digital crossbar and configured as a digital input.

Note: When DCENn = 1, other functions of the TnEX input (i.e., capture and auto-reload) are not available. TnEX will only control the direction of the timer when DCENn = 1.

Figure 24.18. TMRnH: Timer 2, 3, and 4 High Byte

R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	Reset Value
								00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	

SFR Address: TMR2H: 0xCD; TMR3H: 0xCD; TMR4H: 0xCD

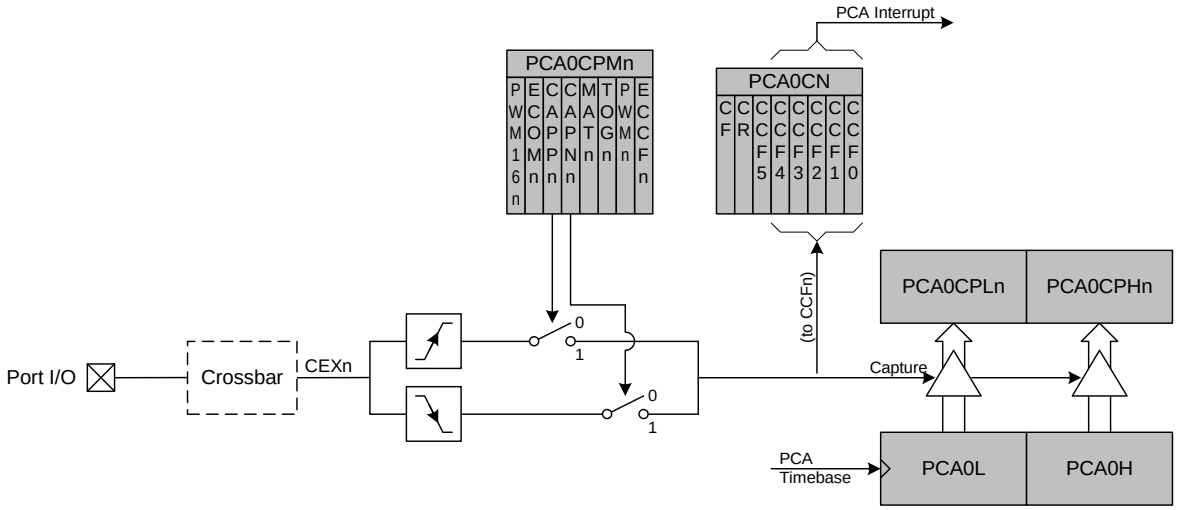
SFR Page: TMR2H: page 0; TMR3H: page 1; TMR4H: page 2

Bits 7-0: TH2, 3, and 4: Timer 2, 3, and 4 High Byte.
The TH2, 3, and 4 register contains the high byte of the 16-bit Timer 2, 3, and 4

25.2.1. Edge-triggered Capture Mode

In this mode, a valid transition on the CEXn pin causes PCA0 to capture the value of the PCA0 counter/timer and load it into the corresponding module's 16-bit capture/compare register (PCA0CPLn and PCA0CPHn). The CAPPn and CAPNn bits in the PCA0CPMn register are used to select the type of transition that triggers the capture: low-to-high transition (positive edge), high-to-low transition (negative edge), or either transition (positive or negative edge). When a capture occurs, the Capture/Compare Flag (CCFn) in PCA0CN is set to logic 1 and an interrupt request is generated if CCF interrupts are enabled. The CCFn bit is not automatically cleared by hardware when the CPU vectors to the interrupt service routine, and must be cleared by software.

Figure 25.4. PCA Capture Mode Diagram



Note: The signal at CEXn must be high or low for at least 2 system clock cycles in order to be valid.