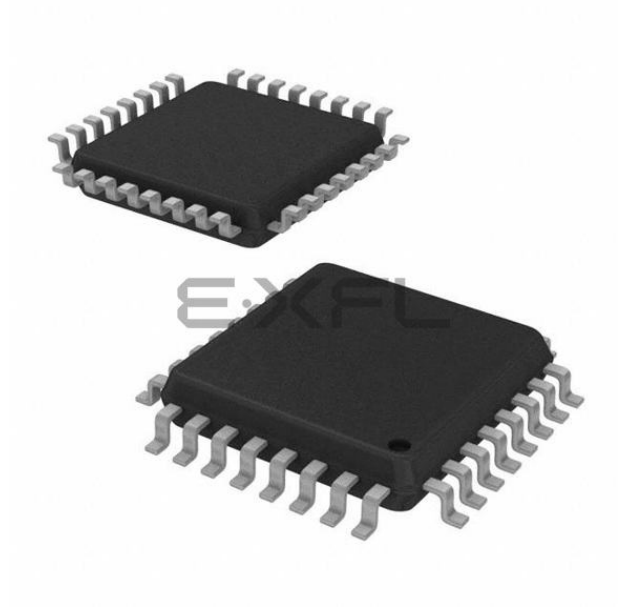

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Not For New Designs
Core Processor	8051
Core Size	8-Bit
Speed	48MHz
Connectivity	SMBus (2-Wire/I²C), SPI, UART/USART, USB
Peripherals	Brown-out Detect/Reset, POR, PWM, Temp Sensor, WDT
Number of I/O	25
Program Memory Size	32KB (32K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	2.25K x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 3.6V
Data Converters	A/D 21x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	32-LQFP
Supplier Device Package	32-LQFP (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/silicon-labs/c8051f343-gq

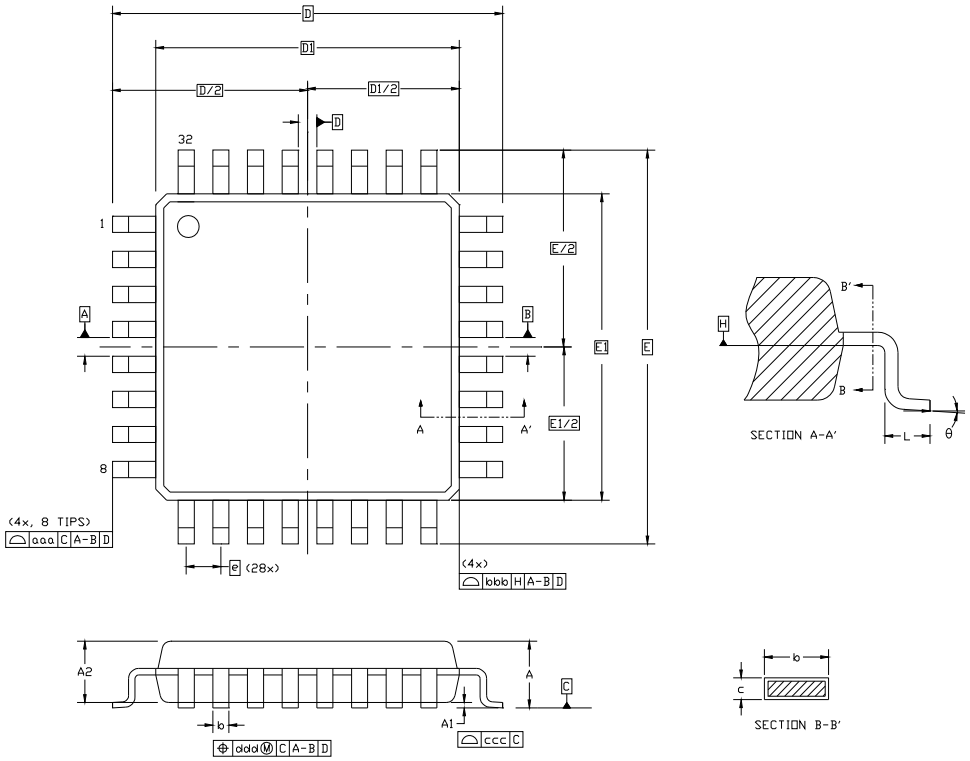

Figure 4.5. LQFP-32 Package Diagram

Table 4.4. LQFP-32 Package Dimensions

Dimension	Min	Nom	Max
A	—	—	1.60
A1	0.05	—	0.15
A2	1.35	1.40	1.45
b	0.30	0.37	0.45
c	0.09	—	0.20
D	9.00 BSC		
D1	7.00 BSC		
e	0.80 BSC		
E	9.00 BSC		
E1	7.00 BSC		
L	0.45	0.60	0.75
aaa	0.20		
bbb	0.20		
ccc	0.10		
ddd	0.20		
θ	0°	3.5°	7°

Notes:

1. All dimensions shown are in millimeters (mm) unless otherwise noted.
2. Dimensioning and Tolerancing per ANSI Y14.5M-1994.
3. This drawing conforms to JEDEC outline MS-026, variation BBA.
4. The recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.

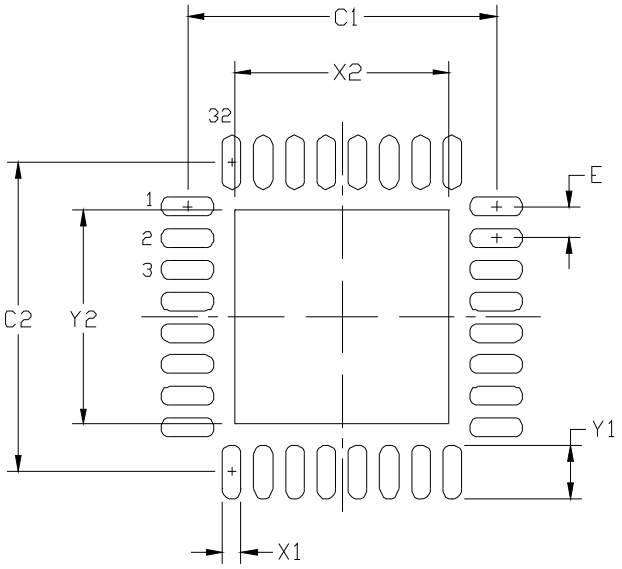

Figure 4.9. QFN-32 Recommended PCB Land Pattern

Table 4.7. QFN-32 PCB Land Pattern Dimesions

Dimension	Min	Max
C1	4.80	4.90
C2	4.80	4.90
E	0.50 BSC	
X1	0.20	0.30

Dimension	Min	Max
X2	3.20	3.40
Y1	0.75	0.85
Y2	3.20	3.40

Notes:

General:

1. All dimensions shown are in millimeters (mm) unless otherwise noted.
2. This Land Pattern Design is based on the IPC-7351 guidelines.

Solder Mask Design:

3. All metal pads are to be non-solder mask defined (NSMD). Clearance between the solder mask and the metal pad is to be 60µm minimum, all the way around the pad.

Stencil Design:

4. A stainless steel, laser-cut and electro-polished stencil with trapezoidal walls should be used to assure good solder paste release.
5. The stencil thickness should be 0.125 mm (5 mils).
6. The ratio of stencil aperture to land pad size should be 1:1 for all perimeter pins.
7. A 3x3 array of 1.0 mm openings on a 1.2mm pitch should be used for the center pad to assure the proper paste volume.

Card Assembly:

8. A No-Clean, Type-3 solder paste is recommended.
9. The recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.

5.3.2. Tracking Modes

The AD0TM bit in register ADC0CN controls the ADC0 track-and-hold mode. In its default state, the ADC0 input is continuously tracked, except when a conversion is in progress. When the AD0TM bit is logic 1, ADC0 operates in low-power track-and-hold mode. In this mode, each conversion is preceded by a tracking period of 3 SAR clocks (after the start-of-conversion signal). When the CNVSTR signal is used to initiate conversions in low-power tracking mode, ADC0 tracks only when CNVSTR is low; conversion begins on the rising edge of CNVSTR (see Figure 5.4). Tracking can also be disabled (shutdown) when the device is in low power standby or sleep modes. Low-power track-and-hold mode is also useful when AMUX settings are frequently changed, due to the settling time requirements described in **Section "5.3.3. Settling Time Requirements" on page 47**.

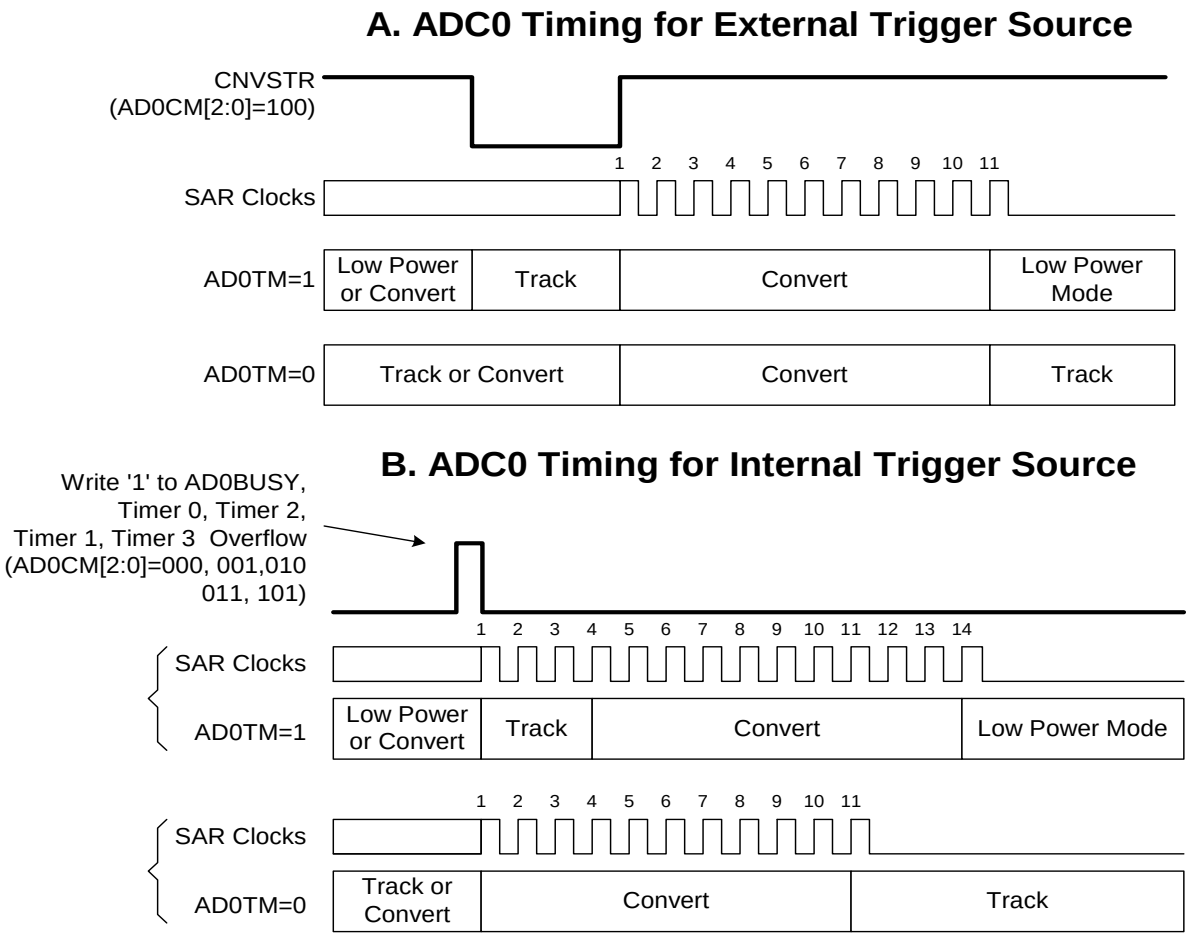

Figure 5.4. 10-Bit ADC Track and Conversion Example Timing

SFR Definition 7.5. CPT1MX: Comparator1 MUX Selection

R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	Reset Value
-	CMX1N2	CMX1N1	CMX1N0	-	CMX1P2	CMX1P1	CMX1P0	00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	SFR Address:
								0x9E

Bit7: UNUSED. Read = 0b, Write = don't care.
Bits6–4: CMX1N2–CMX1N0: Comparator1 Negative Input MUX Select.
These bits select which Port pin is used as the Comparator1 negative input.

CMX1N2	CMX1N1	CMX1N0	Negative Input (32-pin Package)	Negative Input (48-pin Package)
0	0	0	P1.3	P2.3
0	0	1	P1.7	P3.1
0	1	0	P2.3	P4.0
0	1	1	P2.7	P4.6
1	0	0	P0.5	P1.2

Bit3: UNUSED. Read = 0b, Write = don't care.
Bits2–0: CMX1P1–CMX1P0: Comparator1 Positive Input MUX Select.
These bits select which Port pin is used as the Comparator1 positive input.

CMX1P2	CMX1P1	CMX1P0	Positive Input (32-pin Package)	Positive Input (48-pin Package)
0	0	0	P1.2	P2.2
0	0	1	P1.6	P3.0
0	1	0	P2.2	P3.7
0	1	1	P2.6	P4.5
1	0	0	P0.4	P1.1

Note that the port pins used by the comparator depend on the package type (32-pin or 48-pin).

8. Voltage Regulator (REG0)

C8051F34x devices include a voltage regulator (REG0). When enabled, the REG0 output appears on the V_{DD} pin and can be used to power external devices. REG0 can be enabled/disabled by software using bit REGEN in register REG0CN. See Table 8.1 for REG0 electrical characteristics.

Note that the VBUS signal must be connected to the VBUS pin when using the device in a USB network. The VBUS signal should only be connected to the REGIN pin when operating the device as a bus-powered function. REG0 configuration options are shown in Figure 8.1–Figure 8.4.

8.1. Regulator Mode Selection

REG0 offers a low power mode intended for use when the device is in suspend mode. In this low power mode, the REG0 output remains as specified; however the REG0 dynamic performance (response time) is degraded. See Table 8.1 for normal and low power mode supply current specifications. The REG0 mode selection is controlled via the REGMOD bit in register REG0CN.

8.2. VBUS Detection

When the USB Function Controller is used (see section **Section “16. Universal Serial Bus Controller (USB0)” on page 159**), the VBUS signal should be connected to the VBUS pin. The VBSTAT bit (register REG0CN) indicates the current logic level of the VBUS signal. If enabled, a VBUS interrupt will be generated when the VBUS signal matches the polarity selected by the VBPOL bit in register REG0CN. The VBUS interrupt is level-sensitive, and has no associated interrupt pending flag. The VBUS interrupt will be active as long as the VBUS signal matches the polarity selected by VBPOL. See Table 8.1 for VBUS input parameters.

Important Note: When USB is selected as a reset source, a system reset will be generated when the VBUS signal matches the polarity selected by the VBPOL bit. See **Section “11. Reset Sources” on page 100** for details on selecting USB as a reset source

Table 8.1. Voltage Regulator Electrical Specifications

–40 to +85 °C unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Units
Input Voltage Range[1]		2.7		5.25	V
Output Voltage (V_{DD})[2]	Output Current = 1 to 100 mA	3.0	3.3	3.6	V
Output Current[2]				100	mA
VBUS Detection Input Low Voltage				1.0	V
VBUS Detection Input High Voltage		3.0			V
Bias Current	Normal Mode (REGMOD = ‘0’) Low Power Mode (REGMOD = ‘1’)		65 35	111 61	µA
Dropout Voltage (V_{DO})[3]			1		mV/mA

Notes:
1. Input range specified for regulation. When an external regulator is used, should be tied to V_{DD}.
2. Output current is total regulator output, including any current required by the C8051F34x.
3. The minimum input voltage is 2.70 V or VDD + V_{DO} (max load), whichever is greater.

9.2. Memory Organization

The memory organization of the CIP-51 System Controller is similar to that of a standard 8051. There are two separate memory spaces: program memory and data memory. Program and data memory share the same address space but are accessed via different instruction types. The CIP-51 memory organization is shown in Figure 9.2 and Figure 9.3.

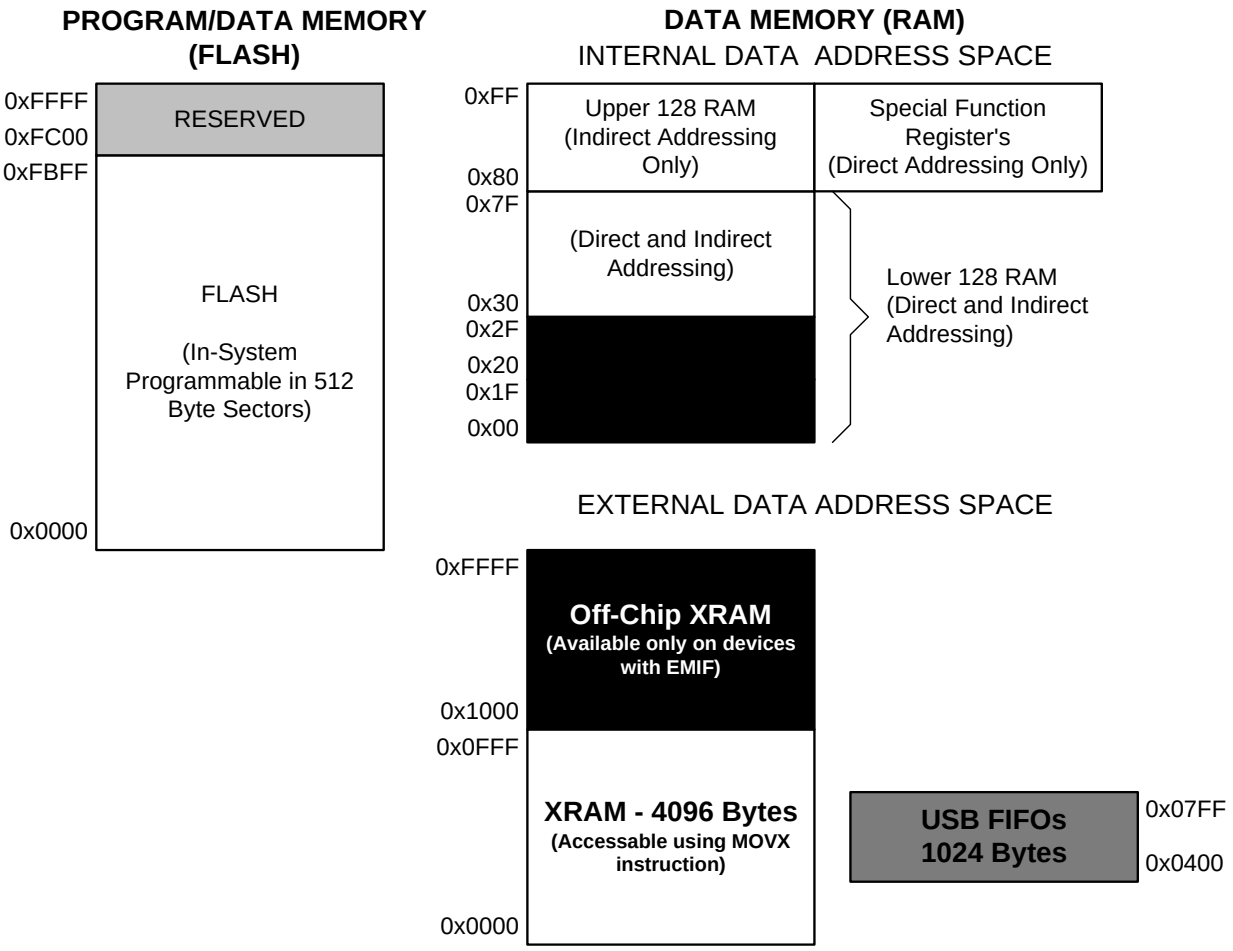

Figure 9.2. On-Chip Memory Map for 64 kB Devices

SFR Definition 9.6. B: B Register

R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	Reset Value
B.7	B.6	B.5	B.4	B.3	B.2	B.1	B.0	00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	SFR Address:
							(bit addressable)	0xF0

Bits7–0: B: B Register.
This register serves as a second accumulator for certain arithmetic operations.

9.3. Interrupt Handler

The CIP-51 includes an extended interrupt system supporting multiple interrupt sources with two priority levels. The allocation of interrupt sources between on-chip peripherals and external inputs pins varies according to the specific version of the device. Each interrupt source has one or more associated interrupt-pending flag(s) located in an SFR. When a peripheral or external source meets a valid interrupt condition, the associated interrupt-pending flag is set to logic 1.

If interrupts are enabled for the source, an interrupt request is generated when the interrupt-pending flag is set. As soon as execution of the current instruction is complete, the CPU generates an LCALL to a predetermined address to begin execution of an interrupt service routine (ISR). Each ISR must end with an RETI instruction, which returns program execution to the next instruction that would have been executed if the interrupt request had not occurred. If interrupts are not enabled, the interrupt-pending flag is ignored by the hardware and program execution continues as normal. (The interrupt-pending flag is set to logic 1 regardless of the interrupt's enable/disable state.)

Each interrupt source can be individually enabled or disabled through the use of an associated interrupt enable bit in an SFR (IE-EIE2). However, interrupts must first be globally enabled by setting the EA bit (IE.7) to logic 1 before the individual interrupt enables are recognized. Setting the EA bit to logic 0 disables all interrupt sources regardless of the individual interrupt-enable settings.

Some interrupt-pending flags are automatically cleared by the hardware when the CPU vectors to the ISR. However, most are not cleared by the hardware and must be cleared by software before returning from the ISR. If an interrupt-pending flag remains set after the CPU completes the return-from-interrupt (RETI) instruction, a new interrupt request will be generated immediately and the CPU will re-enter the ISR after the completion of the next instruction.

9.3.1. MCU Interrupt Sources and Vectors

The MCU supports multiple interrupt sources. Software can simulate an interrupt by setting any interrupt-pending flag to logic 1. If interrupts are enabled for the flag, an interrupt request will be generated and the CPU will vector to the ISR address associated with the interrupt-pending flag. MCU interrupt sources, associated vector addresses, priority order and control bits are summarized in Table 9.4 on page 90. Refer to the datasheet section associated with a particular on-chip peripheral for information regarding valid interrupt conditions for the peripheral and the behavior of its interrupt-pending flag(s).

9.3.2. External Interrupts

The $\overline{\text{INT0}}$ and $\overline{\text{INT1}}$ external interrupt sources are configurable as active high or low, edge or level sensitive. The IN0PL ($\overline{\text{INT0}}$ Polarity) and IN1PL ($\overline{\text{INT1}}$ Polarity) bits in the IT01CF register select active high or active low; the IT0 and IT1 bits in TCON (**Section “21.1. Timer 0 and Timer 1” on page 235**) select level or edge sensitive. The following table lists the possible configurations.

Table 9.4. Interrupt Summary

Interrupt Source	Interrupt Vector	Priority Order	Pending Flag	Bit addressable?	Cleared by HW?	Enable Flag	Priority Control
Reset	0x0000	Top	None	N/A	N/A	Always Enabled	Always Highest
External Interrupt 0 (INT0)	0x0003	0	IE0 (TCON.1)	Y	Y	EX0 (IE.0)	PX0 (IP.0)
Timer 0 Overflow	0x000B	1	TF0 (TCON.5)	Y	Y	ET0 (IE.1)	PT0 (IP.1)
External Interrupt 1 (INT1)	0x0013	2	IE1 (TCON.3)	Y	Y	EX1 (IE.2)	PX1 (IP.2)
Timer 1 Overflow	0x001B	3	TF1 (TCON.7)	Y	Y	ET1 (IE.3)	PT1 (IP.3)
UART0	0x0023	4	RI0 (SCON0.0) TI0 (SCON0.1)	Y	N	ES0 (IE.4)	PS0 (IP.4)
Timer 2 Overflow	0x002B	5	TF2H (TMR2CN.7) TF2L (TMR2CN.6)	Y	N	ET2 (IE.5)	PT2 (IP.5)
SPI0	0x0033	6	SPIF (SPI0CN.7) WCOL (SPI0CN.6) MODF (SPI0CN.5) RXOVRN (SPI0CN.4)	Y	N	ESPI0 (IE.6)	PSPI0 (IP.6)
SMB0	0x003B	7	SI (SMB0CN.0)	Y	N	ESMB0 (EIE1.0)	PSMB0 (EIP1.0)
USB0	0x0043	8	Special	N	N	EUSB0 (EIE1.1)	PUSB0 (EIP1.1)
ADC0 Window Compare	0x004B	9	AD0WINT (ADC0CN.3)	Y	N	EWADC0 (EIE1.2)	PWADC0 (EIP1.2)
ADC0 Conversion Complete	0x0053	10	AD0INT (ADC0CN.5)	Y	N	EADC0 (EIE1.3)	PADC0 (EIP1.3)
Programmable Counter Array	0x005B	11	CF (PCA0CN.7) CCFn (PCA0CN.n)	Y	N	EPCA0 (EIE1.4)	PPCA0 (EIP1.4)
Comparator0	0x0063	12	CP0FIF (CPT0CN.4) CP0RIF (CPT0CN.5)	N	N	ECP0 (EIE1.5)	PCP0 (EIP1.5)
Comparator1	0x006B	13	CP1FIF (CPT1CN.4) CP1RIF (CPT1CN.5)	N	N	ECP1 (EIE1.6)	PCP1 (EIP1.6)
Timer 3 Overflow	0x0073	14	TF3H (TMR3CN.7) TF3L (TMR3CN.6)	N	N	ET3 (EIE1.7)	PT3 (EIP1.7)
VBUS Level	0x007B	15	N/A	N/A	N/A	EVBUS (EIE2.0)	PVBUS (EIP2.0)
UART1	0x0083	16	RI1 (SCON1.0) TI1 (SCON1.1)	N	N	ES1 (EIE2.1)	PS1 (EIP2.1)

9.3.5. Interrupt Register Descriptions

The SFRs used to enable the interrupt sources and set their priority level are described below. Refer to the datasheet section associated with a particular on-chip peripheral for information regarding valid interrupt conditions for the peripheral and the behavior of its interrupt-pending flag(s).

SFR Definition 9.11. EIE2: Extended Interrupt Enable 2

R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	Reset Value
-	-	-	-	-	-	ES1	EVBUS	00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	SFR Address:
								0xE7

Bits7–2: UNUSED. Read = 000000b. Write = don't care.
Bit1: ES1: Enable UART1 Interrupt.
This bit sets the masking of the UART1 interrupt.
0: Disable UART1 interrupt.
1: Enable UART1 interrupt.
Bit0: EVBUS: Enable VBUS Level Interrupt.
This bit sets the masking of the VBUS interrupt.
0: Disable all VBUS interrupts.
1: Enable interrupt requests generated by VBUS level sense.

SFR Definition 9.12. EIP2: Extended Interrupt Priority 2

R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	Reset Value
-	-	-	-	-	-	PS1	PVBUS	00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	SFR Address:
								0xF7

Bits7–2: UNUSED. Read = 000000b. Write = don't care.
Bit1: PS1: UART1 Interrupt Priority Control.
This bit sets the priority of the UART1 interrupt.
0: UART1 interrupt set to low priority level.
1: UART1 interrupts set to high priority level.
Bit0: PVBUS: VBUS Level Interrupt Priority Control.
This bit sets the priority of the VBUS interrupt.
0: VBUS interrupt set to low priority level.
1: VBUS interrupt set to high priority level.

SFR Definition 9.13. IT01CF: INT0/INT1 Configuration

R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	Reset Value
IN1PL	IN1SL2	IN1SL1	IN1SL0	IN0PL	IN0SL2	IN0SL1	IN0SL0	00000001
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	SFR Address:
								0xE4

Note: Refer to SFR Definition 21.1 for INT0/1 edge- or level-sensitive interrupt selection.

Bit7: IN1PL: $\overline{\text{INT1}}$ Polarity
0: $\overline{\text{INT1}}$ input is active low.
1: $\overline{\text{INT1}}$ input is active high.

Bits6–4: IN1SL2–0: $\overline{\text{INT1}}$ Port Pin Selection Bits
These bits select which Port pin is assigned to $\overline{\text{INT1}}$. Note that this pin assignment is independent of the Crossbar; $\overline{\text{INT1}}$ will monitor the assigned Port pin without disturbing the peripheral that has been assigned the Port pin via the Crossbar. The Crossbar will not assign the Port pin to a peripheral if it is configured to skip the selected pin (accomplished by setting to '1' the corresponding bit in register P0SKIP).

IN1SL2–0	$\overline{\text{INT1}}$ Port Pin
000	P0.0
001	P0.1
010	P0.2
011	P0.3
100	P0.4
101	P0.5
110	P0.6
111	P0.7

Bit3: IN0PL: $\overline{\text{INT0}}$ Polarity
0: $\overline{\text{INT0}}$ interrupt is active low.
1: $\overline{\text{INT0}}$ interrupt is active high.

Bits2–0: INT0SL2–0: $\overline{\text{INT0}}$ Port Pin Selection Bits
These bits select which Port pin is assigned to $\overline{\text{INT0}}$. Note that this pin assignment is independent of the Crossbar. $\overline{\text{INT0}}$ will monitor the assigned Port pin without disturbing the peripheral that has been assigned the Port pin via the Crossbar. The Crossbar will not assign the Port pin to a peripheral if it is configured to skip the selected pin (accomplished by setting to '1' the corresponding bit in register P0SKIP).

IN0SL2–0	$\overline{\text{INT0}}$ Port Pin
000	P0.0
001	P0.1
010	P0.2
011	P0.3
100	P0.4
101	P0.5
110	P0.6
111	P0.7

SFR Definition 15.14. P2MDOUT: Port2 Output Mode

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:
								0xA6

Bits7–0: Output Configuration Bits for P2.7–P2.0 (respectively): ignored if corresponding bit in register P2MDIN is logic 0.
0: Corresponding P2.n Output is open-drain.
1: Corresponding P2.n Output is push-pull.

SFR Definition 15.15. P2SKIP: Port2 Skip

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:
								0xD6

Bits7–0: P2SKIP[7:0]: Port2 Crossbar Skip Enable Bits.
These bits select Port pins to be skipped by the Crossbar Decoder. Port pins used as analog inputs (for ADC or Comparator) or used as special functions (VREF input, external oscillator circuit, CNVSTR input) should be skipped by the Crossbar.
0: Corresponding P2.n pin is not skipped by the Crossbar.
1: Corresponding P2.n pin is skipped by the Crossbar.

by reads/writes of the USB0DAT register. See Figure 16.2.

Endpoint control/status registers are accessed by first writing the USB register INDEX with the target endpoint number. Once the target endpoint number is written to the INDEX register, the control/status registers associated with the target endpoint may be accessed. See the “Indexed Registers” section of Table 16.2 for a list of endpoint control/status registers.

Important Note: The USB clock must be active when accessing USB registers.

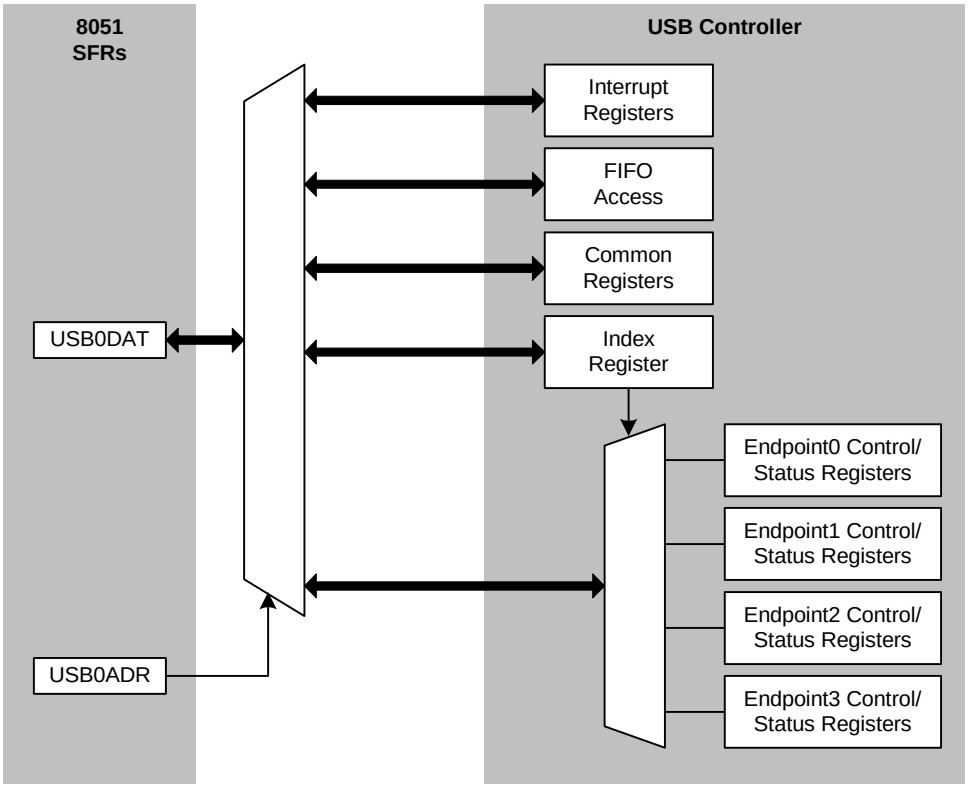

Figure 16.2. USB0 Register Access Scheme

USB Register Definition 16.18. E0CNT: USB0 Endpoint 0 Data Count

R	R	R	R	R	R	R	R	Reset Value
-	E0CNT							00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	USB Address: 0x16

Bit7: Unused. Read = 0; Write = don't care.
Bits6–0: E0CNT: Endpoint 0 Data Count
This 7-bit number indicates the number of received data bytes in the Endpoint 0 FIFO. This number is only valid while bit OPRDY is a '1'.

16.11. Configuring Endpoints1-3

Endpoints1-3 are configured and controlled through their own sets of the following control/status registers: IN registers EINCSRL and EINCSRH, and OUT registers EOUTCSRL and EOUTCSRH. Only one set of endpoint control/status registers is mapped into the USB register address space at a time, defined by the contents of the INDEX register (USB Register Definition 16.4).

Endpoints1-3 can be configured as IN, OUT, or both IN/OUT (Split Mode) as described in **Section 16.5.1**. The endpoint mode (Split/Normal) is selected via the SPLIT bit in register EINCSRH.

When SPLIT = '1', the corresponding endpoint FIFO is split, and both IN and OUT pipes are available.

When SPLIT = '0', the corresponding endpoint functions as either IN or OUT; the endpoint direction is selected by the DIRSEL bit in register EINCSRH.

16.12. Controlling Endpoints1-3 IN

Endpoints1-3 IN are managed via USB registers EINCSRL and EINCSRH. All IN endpoints can be used for Interrupt, Bulk, or Isochronous transfers. Isochronous (ISO) mode is enabled by writing '1' to the ISO bit in register EINCSRH. Bulk and Interrupt transfers are handled identically by hardware.

An Endpoint1-3 IN interrupt is generated by any of the following conditions:

1. An IN packet is successfully transferred to the host.
2. Software writes '1' to the FLUSH bit (EINCSRL.3) when the target FIFO is not empty.
3. Hardware generates a STALL condition.

16.12.1.Endpoints1-3 IN Interrupt or Bulk Mode

When the ISO bit (EINCSRH.6) = '0' the target endpoint operates in Bulk or Interrupt Mode. Once an endpoint has been configured to operate in Bulk/Interrupt IN mode (typically following an Endpoint0 SET_INTERFACE command), firmware should load an IN packet into the endpoint IN FIFO and set the INPRDY bit (EINCSRL.0). Upon reception of an IN token, hardware will transmit the data, clear the INPRDY bit, and generate an interrupt.

USB Register Definition 16.22. EOUTCSRH: USB0 OUT Endpoint Control High Byte

R/W	R/W	R/W	R/W	R	R	R	R	Reset Value
DBOEN	ISO	-	-	-	-	-	-	00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	USB Address:
								0x15

Bit7: DBOEN: Double-buffer Enable
0: Double-buffering disabled for the selected OUT endpoint.
1: Double-buffering enabled for the selected OUT endpoint.
Bit6: ISO: Isochronous Transfer Enable
This bit enables/disables isochronous transfers on the current endpoint.
0: Endpoint configured for bulk/interrupt transfers.
1: Endpoint configured for isochronous transfers.
Bits5–0: Unused. Read = 000000b; Write = don't care.

USB Register Definition 16.23. EOUTCNTL: USB0 OUT Endpoint Count Low

R	R	R	R	R	R	R	R	Reset Value
EOCL								00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	USB Address:
								0x16

Bits7–0: EOCL: OUT Endpoint Count Low Byte
EOCL holds the lower 8-bits of the 10-bit number of data bytes in the last received packet in the current OUT endpoint FIFO. This number is only valid while OPRDY = '1'.

USB Register Definition 16.24. EOUTCNTH: USB0 OUT Endpoint Count High

R	R	R	R	R	R	R	R	Reset Value
-	-	-	-	-	-	E0CH		00000000
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	USB Address:
								0x17

Bits7–2: Unused. Read = 00000. Write = don't care.
Bits1–0: EOCH: OUT Endpoint Count High Byte
EOCH holds the upper 2-bits of the 10-bit number of data bytes in the last received packet in the current OUT endpoint FIFO. This number is only valid while OPRDY = '1'.

19. UART1 (C8051F340/1/4/5/8/A/B/C Only)

UART1 is an asynchronous, full duplex serial port offering a variety of data formatting options. A dedicated baud rate generator with a 16-bit timer and selectable prescaler is included, which can generate a wide range of baud rates (details in **Section "19.1. Baud Rate Generator" on page 214**). A received data FIFO allows UART1 to receive up to three data bytes before data is lost and an overflow occurs.

UART1 has six associated SFRs. Three are used for the Baud Rate Generator (SBCON1, SBRLH1, and SBRLL1), two are used for data formatting, control, and status functions (SCON1, SMOD1), and one is used to send and receive data (SBUF1). The single SBUF1 location provides access to both the transmit holding register and the receive FIFO. **Writes to SBUF1 always access the Transmit Holding Register. Reads of SBUF1 always access the first byte of the Receive FIFO; it is not possible to read data from the Transmit Holding Register.**

With UART1 interrupts enabled, an interrupt is generated each time a transmit is completed (TI1 is set in SCON1), or a data byte has been received (RI1 is set in SCON1). The UART1 interrupt flags are not cleared by hardware when the CPU vectors to the interrupt service routine. They must be cleared manually by software, allowing software to determine the cause of the UART1 interrupt (transmit complete or receive complete). Note that if additional bytes are available in the Receive FIFO, the RI1 bit cannot be cleared by software.

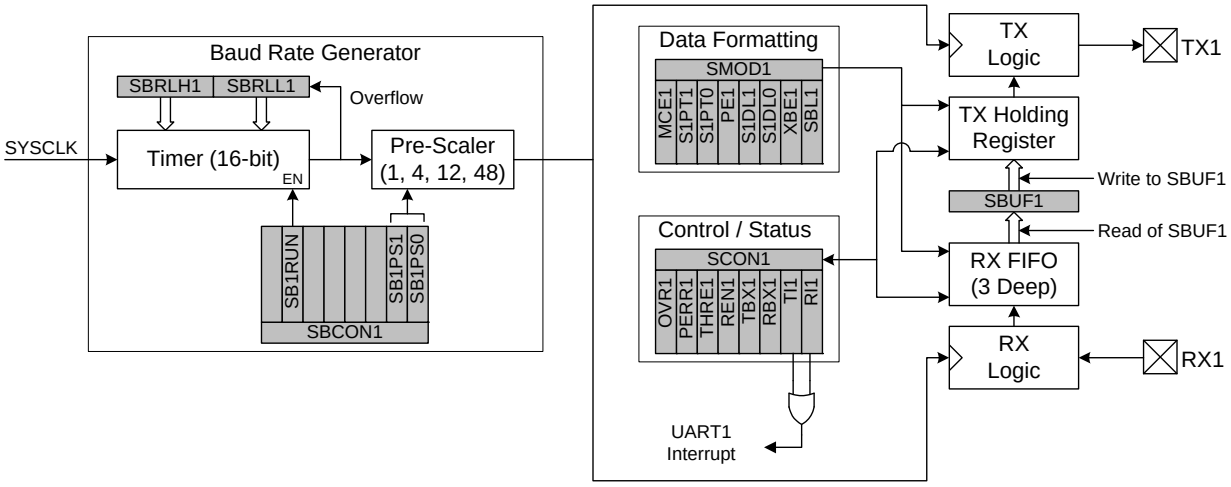

Figure 19.1. UART1 Block Diagram

20.1. Signal Descriptions

The four signals used by SPI0 (MOSI, MISO, SCK, NSS) are described below.

20.1.1. Master Out, Slave In (MOSI)

The master-out, slave-in (MOSI) signal is an output from a master device and an input to slave devices. It is used to serially transfer data from the master to the slave. This signal is an output when SPI0 is operating as a master and an input when SPI0 is operating as a slave. Data is transferred most-significant bit first. When configured as a master, MOSI is driven by the MSB of the shift register in both 3- and 4-wire mode.

20.1.2. Master In, Slave Out (MISO)

The master-in, slave-out (MISO) signal is an output from a slave device and an input to the master device. It is used to serially transfer data from the slave to the master. This signal is an input when SPI0 is operating as a master and an output when SPI0 is operating as a slave. Data is transferred most-significant bit first. The MISO pin is placed in a high-impedance state when the SPI module is disabled and when the SPI operates in 4-wire mode as a slave that is not selected. When acting as a slave in 3-wire mode, MISO is always driven by the MSB of the shift register.

20.1.3. Serial Clock (SCK)

The serial clock (SCK) signal is an output from the master device and an input to slave devices. It is used to synchronize the transfer of data between the master and slave on the MOSI and MISO lines. SPI0 generates this signal when operating as a master. The SCK signal is ignored by a SPI slave when the slave is not selected (NSS = 1) in 4-wire slave mode.

20.1.4. Slave Select (NSS)

The function of the slave-select (NSS) signal is dependent on the setting of the NSSMD1 and NSSMD0 bits in the SPI0CN register. There are three possible modes that can be selected with these bits:

1. NSSMD[1:0] = 00: 3-Wire Master or 3-Wire Slave Mode: SPI0 operates in 3-wire mode, and NSS is disabled. When operating as a slave device, SPI0 is always selected in 3-wire mode. Since no select signal is present, SPI0 must be the only slave on the bus in 3-wire mode. This is intended for point-to-point communication between a master and one slave.
2. NSSMD[1:0] = 01: 4-Wire Slave or Multi-Master Mode: SPI0 operates in 4-wire mode, and NSS is enabled as an input. When operating as a slave, NSS selects the SPI0 device. When operating as a master, a 1-to-0 transition of the NSS signal disables the master function of SPI0 so that multiple master devices can be used on the same SPI bus.
3. NSSMD[1:0] = 1x: 4-Wire Master Mode: SPI0 operates in 4-wire mode, and NSS is enabled as an output. The setting of NSSMD0 determines what logic level the NSS pin will output. This configuration should only be used when operating SPI0 as a master device.

See Figure 20.2, Figure 20.3, and Figure 20.4 for typical connection diagrams of the various operational modes. **Note that the setting of NSSMD bits affects the pinout of the device.** When in 3-wire master or 3-wire slave mode, the NSS pin will not be mapped by the crossbar. In all other modes, the NSS signal will be mapped to a pin on the device. See Section "**15. Port Input/Output**" on page **142** for general purpose port I/O and crossbar information.

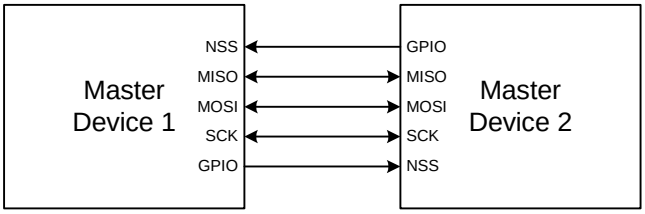

Figure 20.2. Multiple-Master Mode Connection Diagram

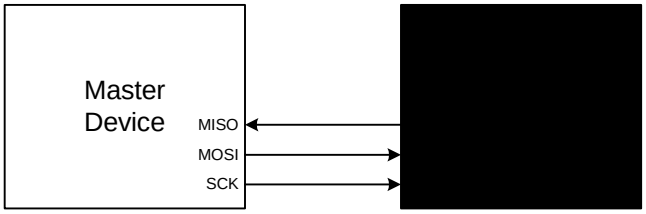

Figure 20.3. 3-Wire Single Master and Slave Mode Connection Diagram

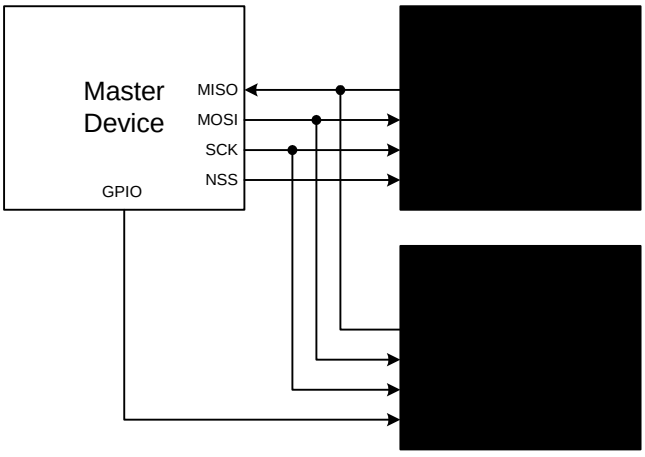

Figure 20.4. 4-Wire Single Master Mode and Slave Mode Connection Diagram

22.2.4. Frequency Output Mode

Frequency Output Mode produces a programmable-frequency square wave on the module's associated CEXn pin. The capture/compare module high byte holds the number of PCA clocks to count before the output is toggled. The frequency of the square wave is then defined by Equation 22.1.

$$F_{CEXn} = \frac{F_{PCA}}{2 \times PCA0CPHn}$$

Note: A value of 0x00 in the PCA0CPHn register is equal to 256 for this equation.

Equation 22.1. Square Wave Frequency Output

Where F_{PCA} is the frequency of the clock selected by the CPS2-0 bits in the PCA mode register, PCA0MD. The lower byte of the capture/compare module is compared to the PCA counter low byte; on a match, CEXn is toggled and the offset held in the high byte is added to the matched value in PCA0CPLn. Frequency Output Mode is enabled by setting the ECOMn, TOGn, and PWMn bits in the PCA0CPMn register.

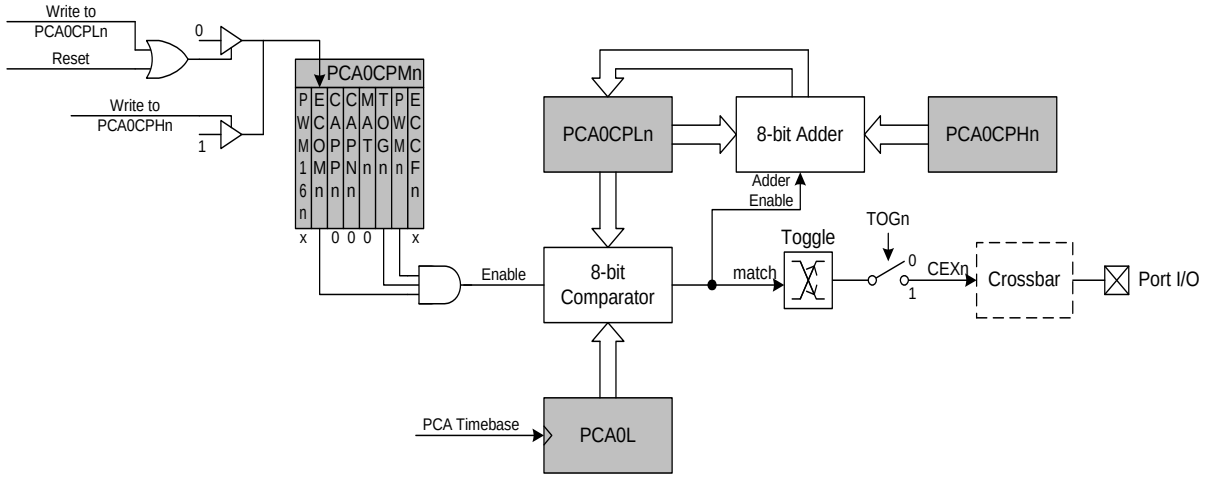

Figure 22.7. PCA Frequency Output Mode