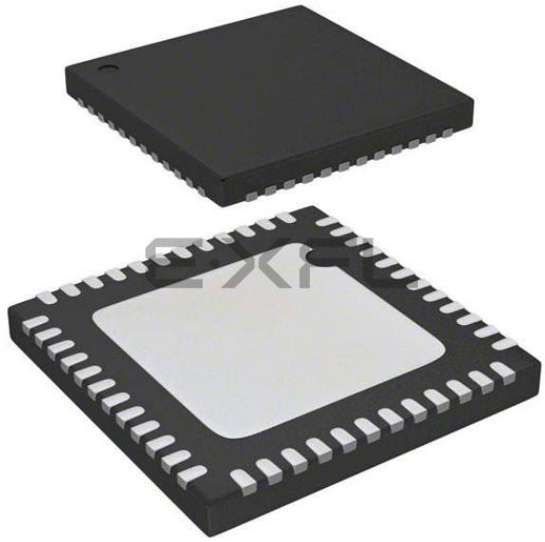

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	8051
Core Size	8-Bit
Speed	50MHz
Connectivity	EBI/EMI, SMBus (2-Wire/I²C), CANbus, LINbus, SPI, UART/USART
Peripherals	POR, PWM, Temp Sensor, WDT
Number of I/O	40
Program Memory Size	64KB (64K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	4.25K x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 5.25V
Data Converters	A/D 32x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	48-VFQFN Exposed Pad
Supplier Device Package	48-QFN (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/silicon-labs/c8051f500-im

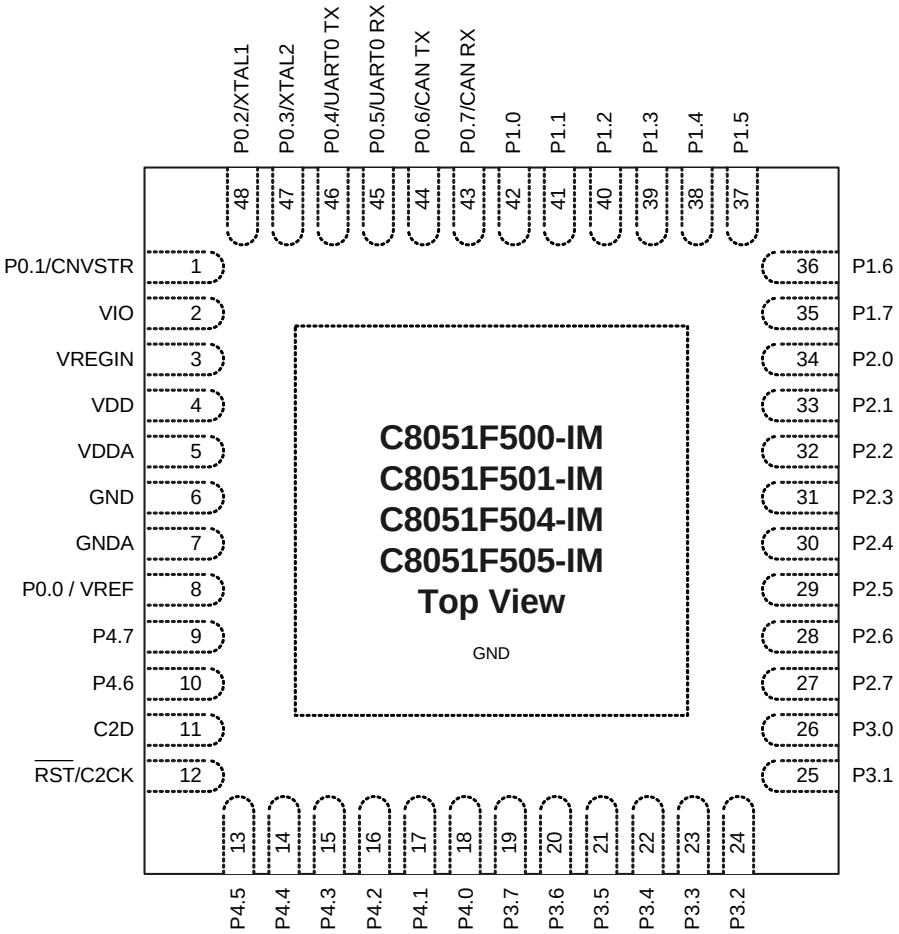

Figure 3.2. QFN-48 Pinout Diagram (Top View)

4. Package Specifications

4.1. QFP-48 Package Specifications

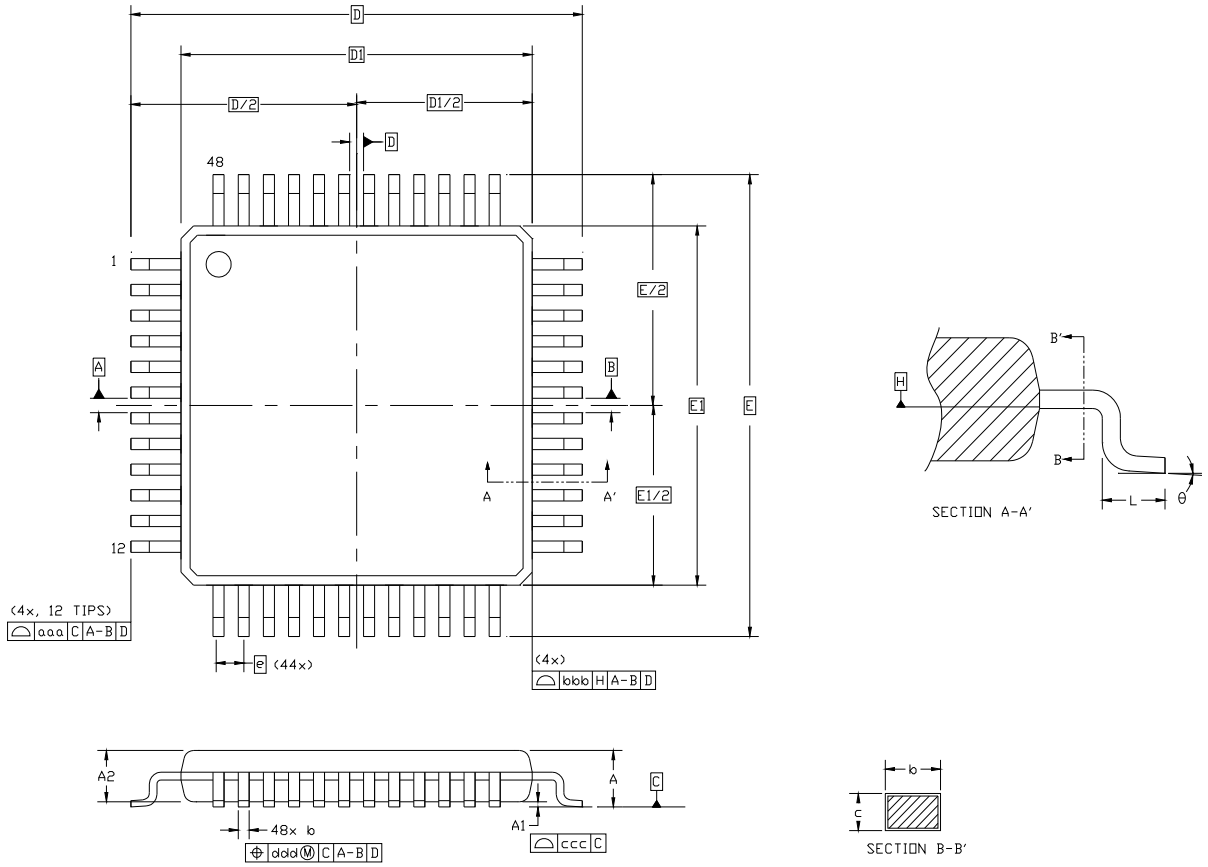

Figure 4.1. QFP-48 Package Drawing

Table 4.1. QFP-48 Package Dimensions

Dimension	Min	Typ	Max	Dimension	Min	Typ	Max
A	—	—	1.20	E	9.00 BSC.		
A1	0.05	—	0.15	E1	7.00 BSC.		
A2	0.95	1.00	1.05	L	0.45	0.60	0.75
b	0.17	0.22	0.27	aaa	0.20		
c	0.09	—	0.20	bbb	0.20		
D	9.00 BSC.			ccc	0.08		
D1	7.00 BSC.			ddd	0.08		
e	0.50 BSC.			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 the JEDEC outline MS-026, variation ABC.
4. Recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.

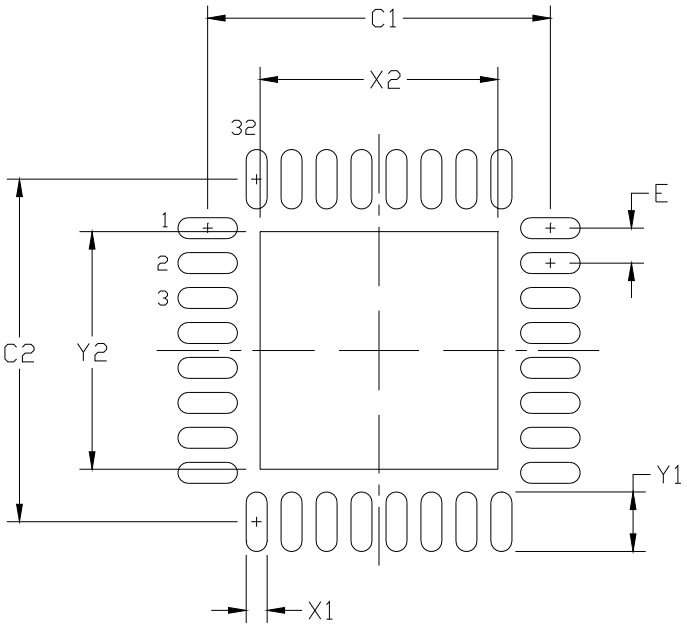

Figure 4.10. QFN-32 Package Drawing

Table 4.10. QFN-32 Landing Diagram Dimensions

Dimension	Min	Max	Dimension	Min	Max
C1	4.80	4.90	X2	3.20	3.40
C2	4.80	4.90	Y1	0.75	0.85
e	0.50 BSC		Y2	3.20	3.40
X1	0.20	0.30			

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 0.125mm (5 mils).
6. The ratio of stencil aperture to land pad size should be 1:1 for all perimeter pads.
7. A 3x3 array of 1.0 mm openings on a 1.20 mm pitch should be used for the center ground pad.

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.

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 2 kB 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 64 kB program memory space. There is one unused opcode (0xA5) that performs the same function as NOP. All mnemonics copyrighted © Intel Corporation 1980.

11.3. CIP-51 Register Descriptions

Following are descriptions of SFRs related to the operation of the CIP-51 System Controller. Reserved bits should not be set to logic l. Future product versions may use these bits to implement new features in which case the reset value of the bit will be logic 0, selecting the feature's default state. Detailed descriptions of the remaining SFRs are included in the sections of the datasheet associated with their corresponding system function.

12.1. Program Memory

The CIP-51 core has a 64 kB program memory space. The C8051F50x/F51x devices implement 64 kB or 32 kB of this program memory space as in-system, re-programmable Flash memory, organized in a contiguous block from addresses 0x0000 to 0xFFFF in 64 kB devices and addresses 0x0000 to 0x7FFF in 32 kB devices. The address 0xFBFF in 64 kB devices and 0x7FFF in 32 kB devices serves as the security lock byte for the device. Addresses above 0xFDFF are reserved in the 64 kB devices.

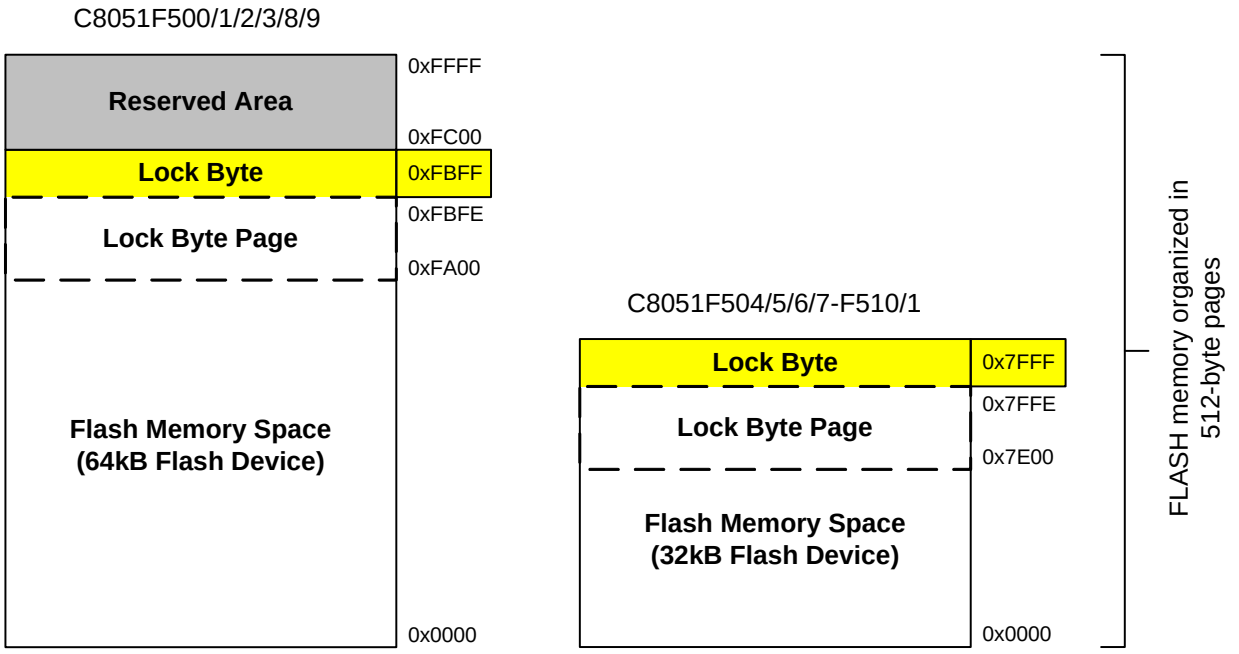

Figure 12.2. Flash Program Memory Map

12.1.1. MOVX Instruction and Program Memory

The MOVX instruction in an 8051 device is typically used to access external data memory. On the C8051F50x/F51x devices, the MOVX instruction is normally used to read and write on-chip XRAM, but can be re-configured to write and erase on-chip Flash memory space. MOVC instructions are always used to read Flash memory, while MOVX write instructions are used to erase and write Flash. This Flash access feature provides a mechanism for the C8051F50x/F51x to update program code and use the program memory space for non-volatile data storage. Refer to Section “15. Flash Memory” on page 129 for further details.

12.2. Data Memory

The C8051F50x/F51x devices include 4352 bytes of RAM data memory. 256 bytes of this memory is mapped into the internal RAM space of the 8051. The other 4096 bytes of this memory is on-chip “external” memory. The data memory map is shown in Figure 12.1 for reference.

12.2.1. Internal RAM

There are 256 bytes of internal RAM mapped into the data memory space from 0x00 through 0xFF. The lower 128 bytes of data memory are used for general purpose registers and scratch pad memory. Either direct or indirect addressing may be used to access the lower 128 bytes of data memory. Locations 0x00 through 0x1F are addressable as four banks of general purpose registers, each bank consisting of eight

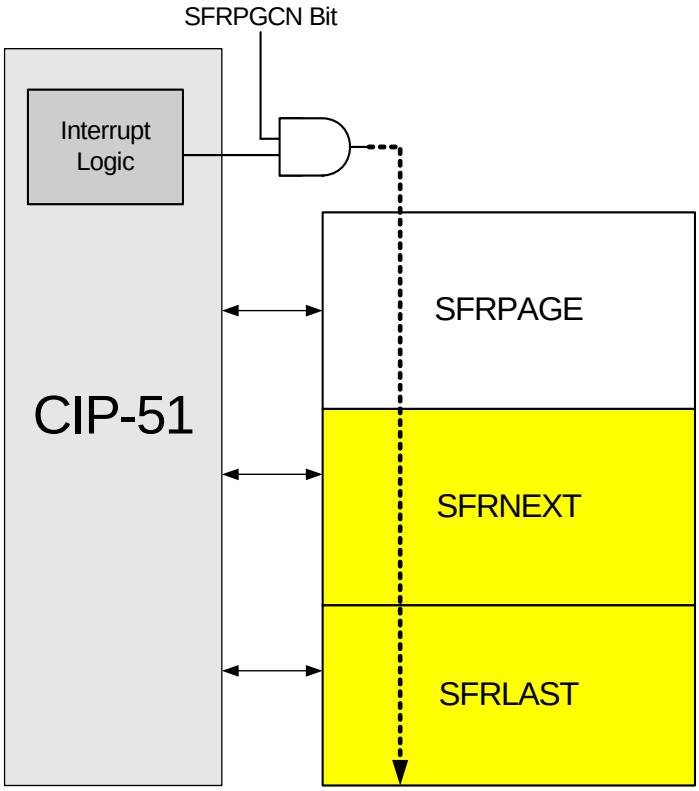

Figure 13.1. SFR Page Stack

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 (SFR0CN). 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) are provided in Table 13.3 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. 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.

13.3. SFR Page Stack Example

The following is an example that shows the operation of the SFR Page Stack during interrupts. In this example, the SFR Control register is left in the default enabled state (i.e., SFRPGEN = 1), and the CIP-51 is executing in-line code that is writing values to SPI Data Register (SFR “SPI0DAT”, located at address 0xA3 on SFR Page 0x00). The device is also using the CAN peripheral (CAN0) and the Programmable Counter Array (PCA0) peripheral to generate a PWM output. The PCA is timing a critical control function in its interrupt service round so its associated ISR that is set to low priority. At this point, the SFR page is set to access the SPI0DAT SFR (SFRPAGE = 0x00). See Figure 13.2.

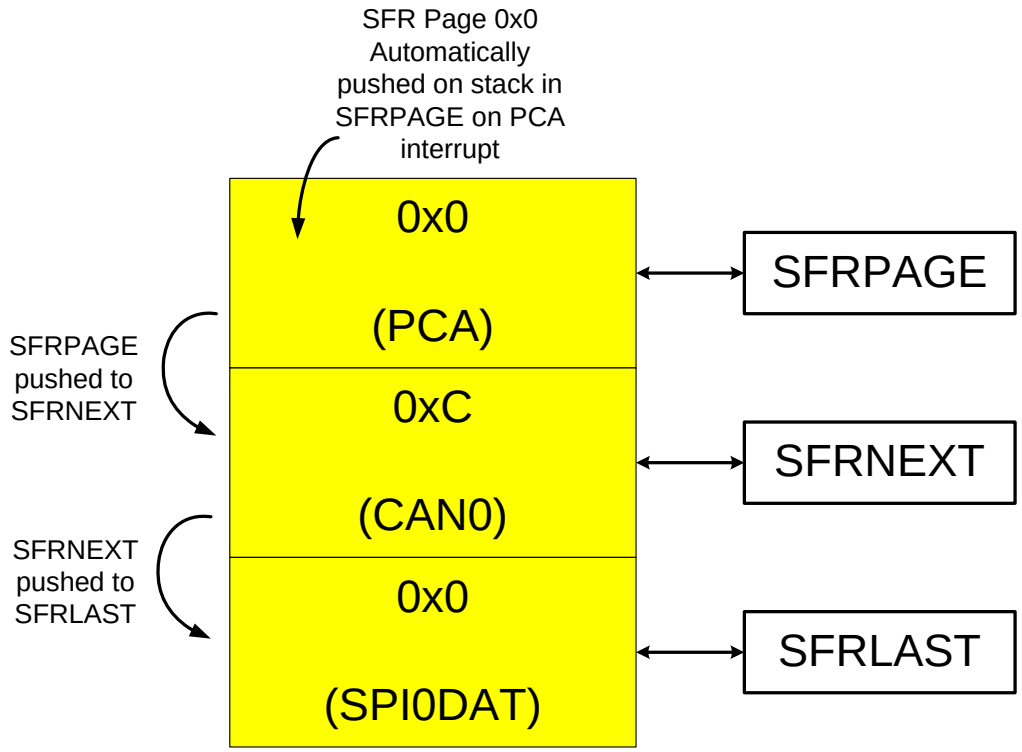

Figure 13.4. SFR Page Stack Upon PCA Interrupt Occurring During a CAN0 ISR

On exit from the PCA interrupt service routine, the CIP-51 will return to the CAN0 ISR. On execution of the RETI instruction, SFR Page 0x00 used to access the PCA registers will be automatically popped off of the SFR Page Stack, and the contents of the SFRNEXT register will be moved to the SFRPAGE register. Software in the CAN0 ISR can continue to access SFRs as it did prior to the PCA interrupt. Likewise, the contents of SFRLAST are moved to the SFRNEXT register. Recall this was the SFR Page value 0x00 being used to access SPI0DAT before the CAN0 interrupt occurred. See Figure 13.5.

Table 13.3. Special Function Registers

SFRs are listed in alphabetical order. All undefined SFR locations are reserved

Register	Address	Description	Page
ACC	0xE0	Accumulator	94
ADC0CF	0xBC	ADC0 Configuration	63
ADC0CN	0xE8	ADC0 Control	65
ADC0GTH	0xC4	ADC0 Greater-Than Compare High	67
ADC0GTL	0xC3	ADC0 Greater-Than Compare Low	67
ADC0H	0xBE	ADC0 High	64
ADC0L	0xBD	ADC0 Low	64
ADC0LTH	0xC6	ADC0 Less-Than Compare Word High	68
ADC0LTL	0xC5	ADC0 Less-Than Compare Word Low	68
ADC0MX	0xBB	ADC0 Mux Configuration	71
ADC0TK	0xBA	ADC0 Tracking Mode Select	66
B	0xF0	B Register	94
CCH0CN	0xE3	Cache Control	137
CKCON	0x8E	Clock Control	266
CLKMUL	0x97	Clock Multiplier	171
CLKSEL	0x8F	Clock Select	166
CPT0CN	0x9A	Comparator0 Control	77
CPT0MD	0x9B	Comparator0 Mode Selection	78
CPT0MX	0x9C	Comparator0 MUX Selection	82
CPT1CN	0x9D	Comparator1 Control	77
CPT1MD	0x9E	Comparator1 Mode Selection	78
CPT1MX	0x9F	Comparator1 MUX Selection	82
DPH	0x83	Data Pointer High	93
DPL	0x82	Data Pointer Low	93
EIE1	0xE6	Extended Interrupt Enable 1	123
EIE2	0xE7	Extended Interrupt Enable 2	123
EIP1	0xF6	Extended Interrupt Priority 1	124
EIP2	0xF7	Extended Interrupt Priority 2	125
EMI0CF	0xB2	External Memory Interface Configuration	152
EMI0CN	0xAA	External Memory Interface Control	151
EMI0TC	0xAA	External Memory Interface Timing Control	157
FLKEY	0xB7	Flash Lock and Key	135
FLSCL	0xB6	Flash Scale	136
IE	0xA8	Interrupt Enable	121
IP	0xB8	Interrupt Priority	122

14.2. Interrupt Register Descriptions

The SFRs used to enable the interrupt sources and set their priority level are described in this section. Refer to the data sheet 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 20.10. P3MASK: Port 3 Mask Register

Bit	7	6	5	4	3	2	1	0
Name	P3MASK[7:0]							
Type	R/W							
Reset	0	0	0	0	0	0	0	0

SFR Address = 0xAF; SFR Page = 0x00

Bit	Name	Function
7:0	P3MASK[7:0]	**Port 1 Mask Value.** Selects P3 pins to be compared to the corresponding bits in P3MAT. 0: P3.n pin logic value is ignored and cannot cause a Port Mismatch event. 1: P3.n pin logic value is compared to P3MAT.n.
Note: P3.1–P3.7 are only available on the 48-pin and 40-pin packages		

SFR Definition 20.11. P3MAT: Port 3 Match Register

Bit	7	6	5	4	3	2	1	0
Name	P3MAT[7:0]							
Type	R/W							
Reset	1	1	1	1	1	1	1	1

SFR Address = 0xAE; SFR Page = 0x00

Bit	Name	Function
7:0	P3MAT[7:0]	**Port 3 Match Value.** Match comparison value used on Port 3 for bits in P3MAT which are set to 1. 0: P3.n pin logic value is compared with logic LOW. 1: P3.n pin logic value is compared with logic HIGH.
Note: P3.1–P3.7 are only available on the 48-pin and 40-pin packages		

Table 21.2 includes the configuration values required for the typical system clocks and baud rates:

Table 21.2. Manual Baud Rate Parameters Examples

	Baud (bits/sec)														
	20 K			19.2 K			9.6 K			4.8 K			1 K		
SYSCLK (MHz)	Mult.	Pres.	Div.	Mult.	Pres.	Div.	Mult.	Pres.	Div.	Mult.	Pres.	Div.	Mult.	Pres.	Div.
25	0	1	312	0	1	325	1	1	325	3	1	325	19	1	312
24.5	0	1	306	0	1	319	1	1	319	3	1	319	19	1	306
24	0	1	300	0	1	312	1	1	312	3	1	312	19	1	300
22.1184	0	1	276	0	1	288	1	1	288	3	1	288	19	1	276
16	0	1	200	0	1	208	1	1	208	3	1	208	19	1	200
12.25	0	0	306	0	0	319	1	0	319	3	0	319	19	0	306
12	0	0	300	0	0	312	1	0	312	3	0	312	19	0	300
11.0592	0	0	276	0	0	288	1	0	288	3	0	288	19	0	276
8	0	0	200	0	0	208	1	0	208	3	0	208	19	0	200

21.2.4. Baud Rate Calculations—Automatic Mode

If the LIN controller is configured for slave mode, only the prescaler and divider need to be calculated:

$$\text{prescaler} = \ln\left[\frac{\text{SYSCLK}}{4000000}\right] \times \frac{1}{\ln 2} - 1$$

$$\text{divider} = \frac{\text{SYSCLK}}{2^{(\text{prescaler}+1)} \times 20000}$$

The following example calculates the values of these variables for a 24 MHz system clock:

$$\text{prescaler} = \ln\left[\frac{24000000}{4000000}\right] \times \frac{1}{\ln 2} - 1 = 1.585 \cong 1$$

$$\text{divider} = \frac{24000000}{2^{(1+1)} \times 20000} = 300$$

Table 21.3 presents some typical values of system clock and baud rate along with their factors.

SFR Definition 21.3. LIN0CF: LIN0 Control Mode Register

Bit	7	6	5	4	3	2	1	0
Name	LINEN	MODE	ABAUD					
Type	R/W	R/W	R/W	R	R	R	R	R
Reset	0	1	1	0	0	0	0	0

SFR Address = 0xC9; SFR Page = 0x0F

Bit	Name	Function
7	LINEN	**LIN Interface Enable Bit.** 0: LIN0 is disabled. 1: LIN0 is enabled.
6	MODE	**LIN Mode Selection Bit.** 0: LIN0 operates in slave mode. 1: LIN0 operates in master mode.
5	ABAUD	**LIN Mode Automatic Baud Rate Selection.** This bit only has an effect when the MODE bit is configured for slave mode. 0: Manual baud rate selection is enabled. 1: Automatic baud rate selection is enabled.
4:0	Unused	Read = 00000b; Write = Don't Care

SFR Definition 23.1. SMB0CF: SMBus Clock/Configuration

Bit	7	6	5	4	3	2	1	0
Name	ENSMB	INH	BUSY	EXTHOLD	SMBTOE	SMBFTE	SMBCS[1:0]	
Type	R/W	R/W	R	R/W	R/W	R/W	R/W	
Reset	0	0	0	0	0	0	0	0

SFR Address = 0xC1; SFR Page = 0x00

Bit	Name	Function
7	ENSMB	**SMBus Enable.** This bit enables the SMBus interface when set to 1. When enabled, the interface constantly monitors the SDA and SCL pins.
6	INH	**SMBus Slave Inhibit.** When this bit is set to logic 1, the SMBus does not generate an interrupt when slave events occur. This effectively removes the SMBus slave from the bus. Master Mode interrupts are not affected.
5	BUSY	**SMBus Busy Indicator.** This bit is set to logic 1 by hardware when a transfer is in progress. It is cleared to logic 0 when a STOP or free-timeout is sensed.
4	EXTHOLD	**SMBus Setup and Hold Time Extension Enable.** This bit controls the SDA setup and hold times according to Table 23.2. 0: SDA Extended Setup and Hold Times disabled. 1: SDA Extended Setup and Hold Times enabled.
3	SMBTOE	**SMBus SCL Timeout Detection Enable.** This bit enables SCL low timeout detection. If set to logic 1, the SMBus forces Timer 3 to reload while SCL is high and allows Timer 3 to count when SCL goes low. If Timer 3 is configured to Split Mode, only the High Byte of the timer is held in reload while SCL is high. Timer 3 should be programmed to generate interrupts at 25 ms, and the Timer 3 interrupt service routine should reset SMBus communication.
2	SMBFTE	**SMBus Free Timeout Detection Enable.** When this bit is set to logic 1, the bus will be considered free if SCL and SDA remain high for more than 10 SMBus clock source periods.
1:0	SMBCS[1:0]	**SMBus Clock Source Selection.** These two bits select the SMBus clock source, which is used to generate the SMBus bit rate. The selected device should be configured according to Equation 23.1. 00: Timer 0 Overflow 01: Timer 1 Overflow 10:Timer 2 High Byte Overflow 11: Timer 2 Low Byte Overflow

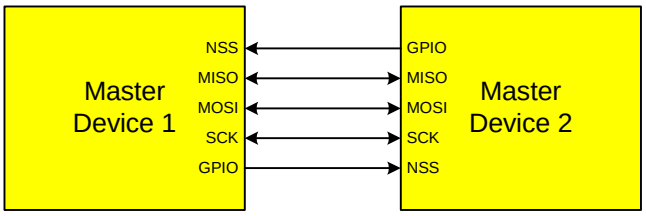

Figure 25.2. Multiple-Master Mode Connection Diagram

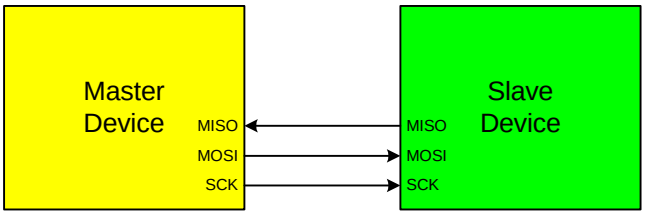

Figure 25.3. 3-Wire Single Master and 3-Wire Single Slave Mode Connection Diagram

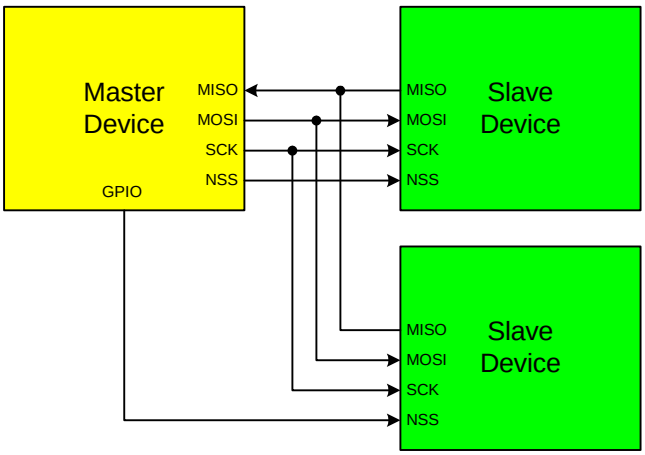

Figure 25.4. 4-Wire Single Master Mode and 4-Wire Slave Mode Connection Diagram

SFR Definition 25.2. SPI0CN: SPI0 Control

Bit	7	6	5	4	3	2	1	0
Name	SPIF	WCOL	MODF	RXOVRN	NSSMD[1:0]		TXBMT	SPIEN
Type	R/W	R/W	R/W	R/W	R/W		R	R/W
Reset	0	0	0	0	0	1	1	0

SFR Address = 0xF8; Bit-Addressable; SFR Page = 0x00

Bit	Name	Function
7	SPIF	**SPI0 Interrupt Flag.** This bit is set to logic 1 by hardware at the end of a data transfer. If interrupts are enabled, setting this bit causes the CPU to vector to the SPI0 interrupt service routine. This bit is not automatically cleared by hardware. It must be cleared by software.
6	WCOL	**Write Collision Flag.** This bit is set to logic 1 by hardware (and generates a SPI0 interrupt) to indicate a write to the SPI0 data register was attempted while a data transfer was in progress. It must be cleared by software.
5	MODF	**Mode Fault Flag.** This bit is set to logic 1 by hardware (and generates a SPI0 interrupt) when a master mode collision is detected (NSS is low, MSTEN = 1, and NSSMD[1:0] = 01). This bit is not automatically cleared by hardware. It must be cleared by software.
4	RXOVRN	**Receive Overrun Flag (valid in slave mode only).** This bit is set to logic 1 by hardware (and generates a SPI0 interrupt) when the receive buffer still holds unread data from a previous transfer and the last bit of the current transfer is shifted into the SPI0 shift register. This bit is not automatically cleared by hardware. It must be cleared by software.
3:2	NSSMD[1:0]	**Slave Select Mode.** Selects between the following NSS operation modes: (See Section 25.2 and Section 25.3). 00: 3-Wire Slave or 3-Wire Master Mode. NSS signal is not routed to a port pin. 01: 4-Wire Slave or Multi-Master Mode (Default). NSS is an input to the device. 1x: 4-Wire Single-Master Mode. NSS signal is mapped as an output from the device and will assume the value of NSSMD0.
1	TXBMT	**Transmit Buffer Empty.** This bit will be set to logic 0 when new data has been written to the transmit buffer. When data in the transmit buffer is transferred to the SPI shift register, this bit will be set to logic 1, indicating that it is safe to write a new byte to the transmit buffer.
0	SPIEN	**SPI0 Enable.** 0: SPI disabled. 1: SPI enabled.

Table 25.1. SPI Slave Timing Parameters

Parameter	Description	Min	Max	Units
Master Mode Timing* (See Figure 25.8 and Figure 25.9)				
T_{MCKH}	SCK High Time	1 x T_{SYSCLK}	—	ns
T_{MCKL}	SCK Low Time	1 x T_{SYSCLK}	—	ns
T_{MIS}	MISO Valid to SCK Shift Edge	1 x T_{SYSCLK} + 20	—	ns
T_{MIH}	SCK Shift Edge to MISO Change	0	—	ns
Slave Mode Timing* (See Figure 25.10 and Figure 25.11)				
T_{SE}	NSS Falling to First SCK Edge	2 x T_{SYSCLK}	—	ns
T_{SD}	Last SCK Edge to NSS Rising	2 x T_{SYSCLK}	—	ns
T_{SEZ}	NSS Falling to MISO Valid	—	4 x T_{SYSCLK}	ns
T_{SDZ}	NSS Rising to MISO High-Z	—	4 x T_{SYSCLK}	ns
T_{CKH}	SCK High Time	5 x T_{SYSCLK}	—	ns
T_{CKL}	SCK Low Time	5 x T_{SYSCLK}	—	ns
T_{SIS}	MOSI Valid to SCK Sample Edge	2 x T_{SYSCLK}	—	ns
T_{SIH}	SCK Sample Edge to MOSI Change	2 x T_{SYSCLK}	—	ns
T_{SOH}	SCK Shift Edge to MISO Change	—	4 x T_{SYSCLK}	ns
T_{SLH}	Last SCK Edge to MISO Change (CKPHA = 1 ONLY)	6 x T_{SYSCLK}	8 x T_{SYSCLK}	ns

***Note:** T_{SYSCLK} is equal to one period of the device system clock (SYSCLK).

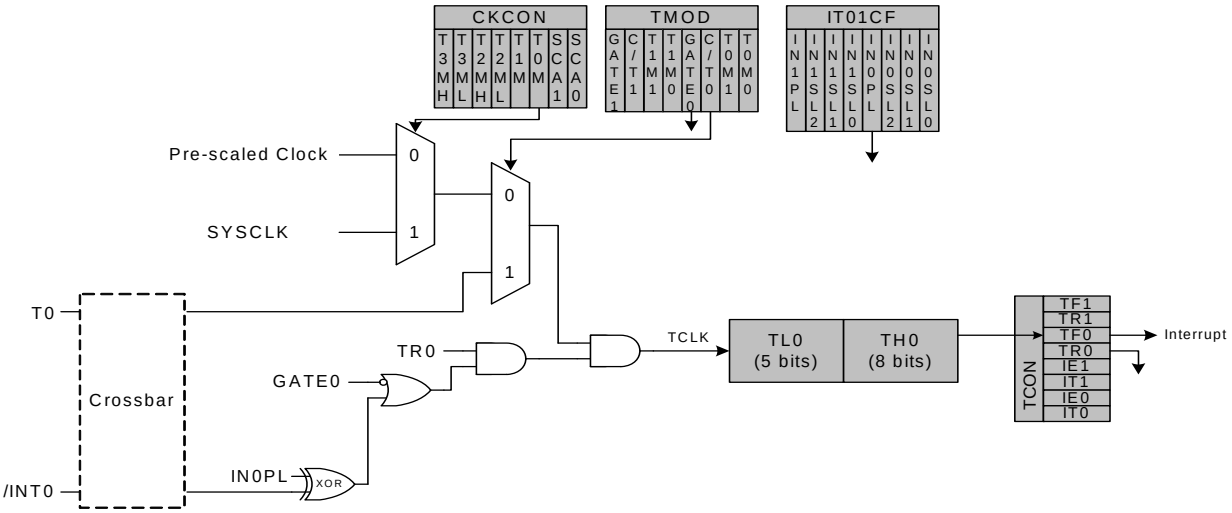

Figure 26.1. T0 Mode 0 Block Diagram

26.1.2. Mode 1: 16-bit Counter/Timer

Mode 1 operation is the same as Mode 0, except that the counter/timer registers use all 16 bits. The counter/timers are enabled and configured in Mode 1 in the same manner as for Mode 0.

26.1.3. Mode 2: 8-bit Counter/Timer with Auto-Reload

Mode 2 configures Timer 0 and Timer 1 to operate as 8-bit counter/timers with automatic reload of the start value. TL0 holds the count and TH0 holds the reload value. When the counter in TL0 overflows from all ones to 0x00, the timer overflow flag TF0 (TCON.5) is set and the counter in TL0 is reloaded from TH0. If Timer 0 interrupts are enabled, an interrupt will occur when the TF0 flag is set. The reload value in TH0 is not changed. TL0 must be initialized to the desired value before enabling the timer for the first count to be correct. When in Mode 2, Timer 1 operates identically to Timer 0.

Both counter/timers are enabled and configured in Mode 2 in the same manner as Mode 0. Setting the TR0 bit (TCON.4) enables the timer when either GATE0 (TMOD.3) is logic 0 or when the input signal INT0 is active as defined by bit IN0PL in register IT01CF (see Section “14.3. External Interrupts INT0 and INT1” on page 126 for details on the external input signals INT0 and INT1).

27.5. Register Descriptions for PCA0

Following are detailed descriptions of the special function registers related to the operation of the PCA.

SFR Definition 27.1. PCA0CN: PCA Control

Bit	7	6	5	4	3	2	1	0
Name	CF	CR	CCF5	CCF4	CCF3	CCF2	CCF1	CCF0
Type	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Reset	0	0	0	0	0	0	0	0

SFR Address = 0xD8; Bit-Addressable; SFR Page = 0x00

Bit	Name	Function
7	CF	**PCA Counter/Timer Overflow Flag.** Set by hardware when the PCA Counter/Timer overflows from 0xFFFF to 0x0000. When the Counter/Timer Overflow (CF) interrupt is enabled, setting this bit causes the CPU to vector to the PCA interrupt service routine. This bit is not automatically cleared by hardware and must be cleared by software.
6	CR	**PCA Counter/Timer Run Control.** This bit enables/disables the PCA Counter/Timer. 0: PCA Counter/Timer disabled. 1: PCA Counter/Timer enabled.
5	CCF5	**PCA Module 5 Capture/Compare Flag.** This bit is set by hardware when a match or capture occurs. When the CCF5 interrupt is enabled, setting this bit causes the CPU to vector to the PCA interrupt service routine. This bit is not automatically cleared by hardware and must be cleared by software.
4	CCF4	**PCA Module 4 Capture/Compare Flag.** This bit is set by hardware when a match or capture occurs. When the CCF4 interrupt is enabled, setting this bit causes the CPU to vector to the PCA interrupt service routine. This bit is not automatically cleared by hardware and must be cleared by software.
3	CCF3	**PCA Module 3 Capture/Compare Flag.** This bit is set by hardware when a match or capture occurs. When the CCF3 interrupt is enabled, setting this bit causes the CPU to vector to the PCA interrupt service routine. This bit is not automatically cleared by hardware and must be cleared by software.
2	CCF2	**PCA Module 2 Capture/Compare Flag.** This bit is set by hardware when a match or capture occurs. When the CCF2 interrupt is enabled, setting this bit causes the CPU to vector to the PCA interrupt service routine. This bit is not automatically cleared by hardware and must be cleared by software.
1	CCF1	**PCA Module 1 Capture/Compare Flag.** This bit is set by hardware when a match or capture occurs. When the CCF1 interrupt is enabled, setting this bit causes the CPU to vector to the PCA interrupt service routine. This bit is not automatically cleared by hardware and must be cleared by software.
0	CCF0	**PCA Module 0 Capture/Compare Flag.** This bit is set by hardware when a match or capture occurs. When the CCF0 interrupt is enabled, setting this bit causes the CPU to vector to the PCA interrupt service routine. This bit is not automatically cleared by hardware and must be cleared by software.

SFR Definition 27.4. PCA0CPMn: PCA Capture/Compare Mode

Bit	7	6	5	4	3	2	1	0
Name	PWM16n	ECOMn	CAPPn	CAPNn	MATn	TOGn	PWMn	ECCFn
Type	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Reset	0	0	0	0	0	0	0	0

SFR Addresses: PCA0CPM0 = 0xDA, PCA0CPM1 = 0xDB, PCA0CPM2 = 0xDC; PCA0CPM3 = 0xDD, PCA0CPM4 = 0xDE, PCA0CPM5 = 0xDF, SFR Page (all registers) = 0x00

Bit	Name	Function
7	PWM16n	**16-bit Pulse Width Modulation Enable.** This bit enables 16-bit mode when Pulse Width Modulation mode is enabled. 0: 8 to 11-bit PWM selected. 1: 16-bit PWM selected.
6	ECOMn	**Comparator Function Enable.** This bit enables the comparator function for PCA module n when set to 1.
5	CAPPn	**Capture Positive Function Enable.** This bit enables the positive edge capture for PCA module n when set to 1.
4	CAPNn	**Capture Negative Function Enable.** This bit enables the negative edge capture for PCA module n when set to 1.
3	MATn	**Match Function Enable.** This bit enables the match function for PCA module n when set to 1. When enabled, matches of the PCA counter with a module's capture/compare register cause the CCFn bit in PCA0MD register to be set to logic 1.
2	TOGn	**Toggle Function Enable.** This bit enables the toggle function for PCA module n when set to 1. When enabled, matches of the PCA counter with a module's capture/compare register cause the logic level on the CEXn pin to toggle. If the PWMn bit is also set to logic 1, the module operates in Frequency Output Mode.
1	PWMn	**Pulse Width Modulation Mode Enable.** This bit enables the PWM function for PCA module n when set to 1. When enabled, a pulse width modulated signal is output on the CEXn pin. 8 to 11-bit PWM is used if PWM16n is cleared; 16-bit mode is used if PWM16n is set to logic 1. If the TOGn bit is also set, the module operates in Frequency Output Mode.
0	ECCFn	**Capture/Compare Flag Interrupt Enable.** This bit sets the masking of the Capture/Compare Flag (CCFn) interrupt. 0: Disable CCFn interrupts. 1: Enable a Capture/Compare Flag interrupt request when CCFn is set.

Note: When the WDTE bit is set to 1, the PCA0CPM5 register cannot be modified, and module 5 acts as the watchdog timer. To change the contents of the PCA0CPM5 register or the function of module 5, the Watchdog Timer must be disabled.

C2 Register Definition 28.4. FPCTL: C2 Flash Programming Control

Bit	7	6	5	4	3	2	1	0
Name	FPCTL[7:0]							
Type	R/W							
Reset	0	0	0	0	0	0	0	0

C2 Address: 0x02

Bit	Name	Function
7:0	FPCTL[7:0]	**Flash Programming Control Register.** This register is used to enable Flash programming via the C2 interface. To enable C2 Flash programming, the following codes must be written in order: 0x02, 0x01. Note that once C2 Flash programming is enabled, a system reset must be issued to resume normal operation.

C2 Register Definition 28.5. FPDAT: C2 Flash Programming Data

Bit	7	6	5	4	3	2	1	0
Name	FPDAT[7:0]							
Type	R/W							
Reset	0	0	0	0	0	0	0	0

C2 Address: 0xB4

Bit	Name	Function	
7:0	FPDAT[7:0]	**C2 Flash Programming Data Register.** This register is used to pass Flash commands, addresses, and data during C2 Flash accesses. Valid commands are listed below.	
		Code	**Command**
		0x06	Flash Block Read
		0x07	Flash Block Write
		0x08	Flash Page Erase
		0x03	Device Erase