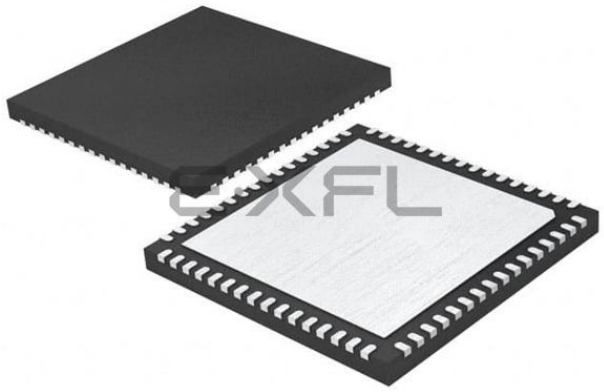


Welcome to E-XFL.COM

What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	PIC
Core Size	8-Bit
Speed	20MHz
Connectivity	I²C, LINbus, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, POR, PWM, WDT
Number of I/O	54
Program Memory Size	28KB (16K x 14)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	1.5K x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 3.6V
Data Converters	A/D 30x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	64-VFQFN Exposed Pad
Supplier Device Package	64-VQFN (9x9)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic16lf1527-e-mr

PIC16(L)F151X/152X Family Types

Device	Data Sheet Index	Program Memory Flash (words)	Data SRAM (bytes)	High-Endurance Flash (bytes)	I/O's(2)	ADC		Timers (8/16-bit)	EUSART	MSSP (I^2C/SPI)	CCP	Debug(1)	XLP
						10-bit (ch)	Advanced Control						
PIC16(L)F1512	(1)	2048	128	128	25	17	Y	2/1	1	1	2	I	Y
PIC16(L)F1513	(1)	4096	256	128	25	17	Y	2/1	1	1	2	I	Y
PIC16(L)F1516	(2)	8192	512	128	25	17	N	2/1	1	1	2	I	Y
PIC16(L)F1517	(2)	8192	512	128	36	28	N	2/1	1	1	2	I	Y
PIC16(L)F1518	(2)	16384	1024	128	25	17	N	2/1	1	1	2	I	Y
PIC16(L)F1519	(2)	16384	1024	128	36	28	N	2/1	1	1	2	I	Y
PIC16(L)F1526	(3)	8192	768	128	54	30	N	6/3	2	2	10	I	Y
PIC16(L)F1527	(3)	16384	1536	128	54	30	N	6/3	2	2	10	I	Y

Note 1: I - Debugging, Integrated on Chip; H - Debugging, available using Debug Header.

2: One pin is input-only.

Data Sheet Index: (Unshaded devices are described in this document.)

1: DS41624 PIC16(L)F1512/13 Data Sheet, 28-Pin Flash, 8-bit Microcontrollers.

2: DS41452 PIC16(L)F1516/7/8/9 Data Sheet, 28/40/44-Pin Flash, 8-bit MCUs.

3: DS41458 PIC16(L)F1526/7 Data Sheet, 64-Pin Flash, 8-bit MCUs.

Note: For other small form-factor package availability and marking information, please visit **http://www.microchip.com/packaging** or contact your local sales office.

2.0 ENHANCED MID-RANGE CPU

This family of devices contain an enhanced mid-range 8-bit CPU core. The CPU has 49 instructions. Interrupt capability includes automatic context saving. The hardware stack is 16 levels deep and has Overflow and Underflow Reset capability. Direct, Indirect, and Relative Addressing modes are available. Two File Select Registers (FSRs) provide the ability to read program and data memory.

- Automatic Interrupt Context Saving
- 16-level Stack with Overflow and Underflow
- File Select Registers
- Instruction Set

FIGURE 2-1: CORE BLOCK DIAGRAM

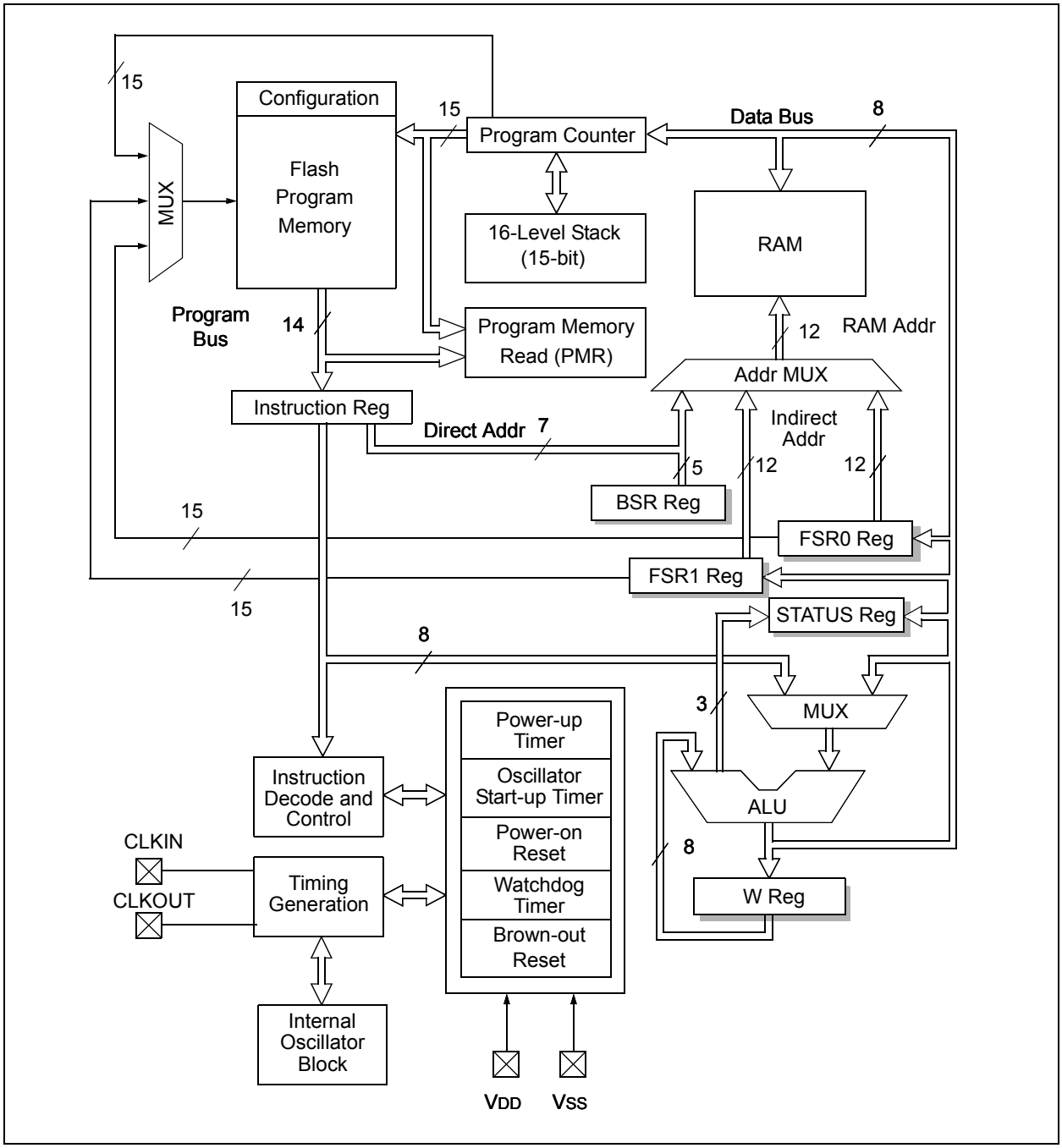


TABLE 3-3: PIC16(L)F1526/7 MEMORY MAP

	BANK 0		BANK 1		BANK 2		BANK 3		BANK 4		BANK 5		BANK 6		BANK 7	
000h	Core Registers (Table 3-2)	080h	Core Registers (Table 3-2)	100h	Core Registers (Table 3-2)	180h	Core Registers (Table 3-2)	200h	Core Registers (Table 3-2)	280h	Core Registers (Table 3-2)	300h	Core Registers (Table 3-2)	380h	Core Registers (Table 3-2)
00Bh		08Bh		10Bh		18Bh		20Bh		28Bh		30Bh		38Bh	
00Ch	PORTA	08Ch	TRISA	10Ch	LATA	18Ch	ANSELA	20Ch	—	28Ch	PORTF	30Ch	TRISF	38Ch	LATF
00Dh	PORTB	08Dh	TRISB	10Dh	LATB	18Dh	ANSELB	20Dh	WPUB	28Dh	PORTG	30Dh	TRISG	38Dh	LATG
00Eh	PORTC	08Eh	TRISC	10Eh	LATC	18Eh	—	20Eh	—	28Eh	—	30Eh	—	38Eh	—
00Fh	PORTD	08Fh	TRISD	10Fh	LATD	18Fh	ANSELD	20Fh	WPUD	28Fh	—	30Fh	—	38Fh	—
010h	PORTE	090h	TRISE	110h	LATE	190h	ANSELE	210h	WPUE	290h	—	310h	—	390h	—
011h	PIR1	091h	PIE1	111h	—	191h	PMADRL	211h	SSP1BUF	291h	CCPR1L	311h	CCPR3L	391h	—
012h	PIR2	092h	PIE2	112h	—	192h	PMADRH	212h	SSP1ADD	292h	CCPR1H	312h	CCPR3H	392h	—
013h	PIR3	093h	PIE3	113h	—	193h	PMDATL	213h	SSP1MSK	293h	CCP1CON	313h	CCP3CON	393h	—
014h	PIR4	094h	PIE4	114h	—	194h	PMDATH	214h	SSP1STAT	294h	—	314h	—	394h	IOCBP
015h	TMR0	095h	OPTION_REG	115h	—	195h	PMCON1	215h	SSP1CON1	295h	—	315h	—	395h	IOCBN
016h	TMR1L	096h	PCON	116h	BORCON	196h	PMCON2	216h	SSP1CON2	296h	—	316h	—	396h	IOCBF
017h	TMR1H	097h	WDTCON	117h	FVRCON	197h	VREGCON(1)	217h	SSP1CON3	297h	—	317h	—	397h	—
018h	T1CON	098h	—	118h	—	198h	—	218h	—	298h	CCPR2L	318h	CCPR4L	398h	—
019h	T1GCON	099h	OSCCON	119h	—	199h	RC1REG	219h	SSP2BUF	299h	CCPR2H	319h	CCPR4H	399h	—
01Ah	TMR2	09Ah	OSCSTAT	11Ah	—	19Ah	TX1REG	21Ah	SSP2ADD	29Ah	CCP2CON	31Ah	CCP4CON	39Ah	—
01Bh	PR2	09Bh	ADRESL	11Bh	—	19Bh	SP1BRG	21Bh	SSP2MSK	29Bh	—	31Bh	—	39Bh	—
01Ch	T2CON	09Ch	ADRESH	11Ch	—	19Ch	SP1BRGH	21Ch	SSP2STAT	29Ch	—	31Ch	CCPR5L	39Ch	—
01Dh	—	09Dh	ADCON0	11Dh	APFCON	19Dh	RC1STA	21Dh	SSP2CON1	29Dh	CCPTMRS0	31Dh	CCPR5H	39Dh	—
01Eh	—	09Eh	ADCON1	11Eh	—	19Eh	TX1STA	21Eh	SSP2CON2	29Eh	CCPTMRS1	31Eh	CCP5CON	39Eh	—
01Fh	—	09Fh	—	11Fh	—	19Fh	BAUD1CON	21Fh	SSP2CON3	29Fh	CCPTMRS2	31Fh	—	39Fh	—
020h	General Purpose Register 80 Bytes	0A0h	General Purpose Register 80 Bytes	120h	General Purpose Register 80 Bytes	1A0h	General Purpose Register 80 Bytes	220h	General Purpose Register 80 Bytes	2A0h	General Purpose Register 80 Bytes	320h	General Purpose Register 80 Bytes	3A0h	General Purpose Register 80 Bytes
06Fh		0EFh		16Fh		1EFh		26Fh		2EFh		36Fh		3EFh	
070h	Common RAM	0F0h	Common RAM (Accesses 70h – 7Fh)	170h	Common RAM (Accesses 70h – 7Fh)	1F0h	Common RAM (Accesses 70h – 7Fh)	270h	Common RAM (Accesses 70h – 7Fh)	2F0h	Common RAM (Accesses 70h – 7Fh)	370h	Common RAM (Accesses 70h – 7Fh)	3F0h	Common RAM (Accesses 70h – 7Fh)
07Fh		0FFh		17Fh		1FFh		27Fh		2FFh		37Fh		3FFh	

Legend: = Unimplemented data memory locations, read as '0'.

Note 1: PIC16F1526/7 only.

3.5.4 CORE FUNCTION REGISTERS SUMMARY

The Core Function registers listed in Table 3-4 can be addressed from any Bank.

TABLE 3-4: CORE FUNCTION REGISTERS SUMMARY

Addr	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Value on POR, BOR	Value on all other Resets
Bank 0-31											
x00h or x80h	INDF0	Addressing this location uses contents of FSR0H/FSR0L to address data memory (not a physical register)								xxxx xxxx	uuuu uuuu
x01h or x81h	INDF1	Addressing this location uses contents of FSR1H/FSR1L to address data memory (not a physical register)								xxxx xxxx	uuuu uuuu
x02h or x82h	PCL	Program Counter (PC) Least Significant Byte								0000 0000	0000 0000
x03h or x83h	STATUS	—	—	—	$\overline{TO}$	$\overline{PD}$	Z	DC	C	---1 1000	---q quuu
x04h or x84h	FSR0L	Indirect Data Memory Address 0 Low Pointer								0000 0000	uuuu uuuu
x05h or x85h	FSR0H	Indirect Data Memory Address 0 High Pointer								0000 0000	0000 0000
x06h or x86h	FSR1L	Indirect Data Memory Address 1 Low Pointer								0000 0000	uuuu uuuu
x07h or x87h	FSR1H	Indirect Data Memory Address 1 High Pointer								0000 0000	0000 0000
x08h or x88h	BSR	—	—	—	BSR4	BSR3	BSR2	BSR1	BSR0	---0 0000	---0 0000
x09h or x89h	WREG	Working Register								0000 0000	uuuu uuuu
x0Ah or x8Ah	PCLATH	—	Write Buffer for the upper 7 bits of the Program Counter							-000 0000	-000 0000
x0Bh or x8Bh	INTCON	GIE	PEIE	TMR0IE	INTE	IOCIE	TMR0IF	INTF	IOCIF	0000 0000	0000 0000

Legend: x = unknown, u = unchanged, q = value depends on condition, - = unimplemented, read as '0', r = reserved. Shaded locations are unimplemented, read as '0'.

4.6 Device ID and Revision ID

The memory location 8006h is where the Device ID and Revision ID are stored. The upper nine bits hold the Device ID. The lower five bits hold the Revision ID. See **Section 11.5 "User ID, Device ID and Configuration Word Access"** for more information on accessing these memory locations.

Development tools, such as device programmers and debuggers, may be used to read the Device ID and Revision ID.

REGISTER 4-3: DEVID: DEVICE ID REGISTER

R	R	R	R	R	R
DEV<8:3>					
bit 13					bit 8

R	R	R	R	R	R	R	R
DEV<2:0>			REV<4:0>				
bit 7							bit 0

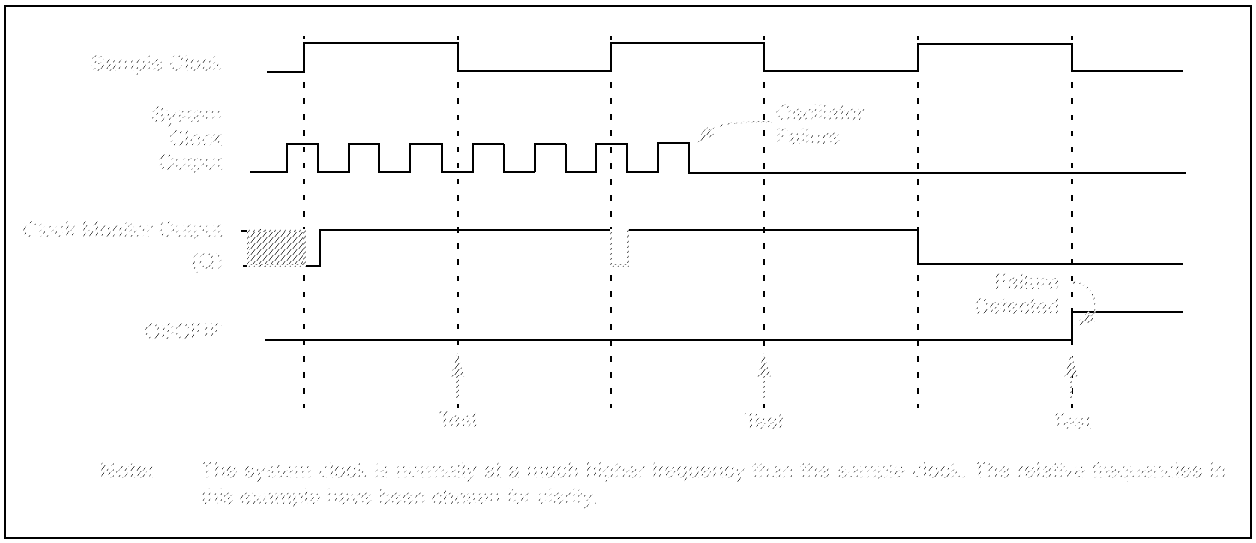
Legend:		
R = Readable bit		U = Unimplemented bit, read as '1'
'1' = Bit is set	'0' = Bit is cleared	-n/n = Value at POR and BOR/Value at all other Resets

bit 13-5 **DEV<8:0>:** Device ID bits

Device	DEVID<13:0> Values	
	DEV<8:0>	REV<4:0>
PIC16F1526	01 0101 100	x xxxx
PIC16F1527	01 0101 101	x xxxx
PIC16LF1526	01 0101 110	x xxxx
PIC16LF1527	01 0101 111	x xxxx

bit 4-0 **REV<4:0>:** Revision ID bits
These bits are used to identify the revision (see Table under DEV<8:0> above).

FIGURE 5-10: FSCM TIMING DIAGRAM



Note: The system clock is normally at a much higher frequency than the sample clock. The relative frequencies in this example have been chosen for clarity.

6.12 Determining the Cause of a Reset

Upon any Reset, multiple bits in the STATUS and PCON register are updated to indicate the cause of the Reset. Table 6-3 and Table 6-4 show the Reset conditions of these registers.

TABLE 6-3: RESET STATUS BITS AND THEIR SIGNIFICANCE

STKOVF	STKUNF	$\overline{\text{RWDT}}$	$\overline{\text{RMCLR}}$	$\overline{\text{RI}}$	$\overline{\text{POR}}$	$\overline{\text{BOR}}$	$\overline{\text{TO}}$	$\overline{\text{PD}}$	Condition
0	0	1	1	1	0	x	1	1	Power-on Reset
0	0	1	1	1	0	x	0	x	Illegal, $\overline{\text{TO}}$ is set on $\overline{\text{POR}}$
0	0	1	1	1	0	x	x	0	Illegal, $\overline{\text{PD}}$ is set on $\overline{\text{POR}}$
0	0	u	1	1	u	0	1	1	Brown-out Reset
u	u	0	u	u	u	u	0	u	WDT Reset
u	u	u	u	u	u	u	0	0	WDT Wake-up from Sleep
u	u	u	u	u	u	u	1	0	Interrupt Wake-up from Sleep
u	u	u	0	u	u	u	u	u	$\overline{\text{MCLR}}$ Reset during normal operation
u	u	u	0	u	u	u	1	0	$\overline{\text{MCLR}}$ Reset during Sleep
u	u	u	u	0	u	u	u	u	RESET Instruction Executed
1	u	u	u	u	u	u	u	u	Stack Overflow Reset (STVREN = 1)
u	1	u	u	u	u	u	u	u	Stack Underflow Reset (STVREN = 1)

TABLE 6-4: RESET CONDITION FOR SPECIAL REGISTERS

Condition	Program Counter	STATUS Register	PCON Register
Power-on Reset	0000h	---1 1000	00-1 110x
$\overline{\text{MCLR}}$ Reset during normal operation	0000h	---u uuuu	uu-u 0uuu
$\overline{\text{MCLR}}$ Reset during Sleep	0000h	---1 0uuu	uu-u 0uuu
WDT Reset	0000h	---0 uuuu	uu-0 uuuu
WDT Wake-up from Sleep	PC + 1	---0 0uuu	uu-u uuuu
Brown-out Reset	0000h	---1 1uuu	00-1 11u0
Interrupt Wake-up from Sleep	PC + 1(1)	---1 0uuu	uu-u uuuu
RESET Instruction Executed	0000h	---u uuuu	uu-u u0uu
Stack Overflow Reset (STVREN = 1)	0000h	---u uuuu	1u-u uuuu
Stack Underflow Reset (STVREN = 1)	0000h	---u uuuu	u1-u uuuu

Legend: u = unchanged, x = unknown, - = unimplemented bit, reads as '0'.

Note 1: When the wake-up is due to an interrupt and Global Enable bit (GIE) is set, the return address is pushed on the stack and PC is loaded with the interrupt vector (0004h) after execution of PC + 1.

REGISTER 7-9: PIR4: PERIPHERAL INTERRUPT REQUEST REGISTER 4

R/W-0/0	R/W-0/0	R-0/0	R-0/0	R/W-0/0	R/W-0/0	R/W-0/0	R/W-0/0
CCP10IF	CCP9IF	RC2IF	TX2IF	CCP8IF	CCP7IF	BCL2IF	SSP2IF
bit 7							bit 0

Legend:		
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as ‘0’
u = Bit is unchanged	x = Bit is unknown	-n/n = Value at POR and BOR/Value at all other Resets
‘1’ = Bit is set	‘0’ = Bit is cleared	

bit 7 **CCP10IF:** CCP10 Interrupt Flag bit
1 = Interrupt is pending
0 = Interrupt is not pending

bit 6 **CCP9IF:** CCP9 Interrupt Flag bit
1 = Interrupt is pending
0 = Interrupt is not pending

bit 5 **RC2IF:** USART2 Receive Interrupt Flag bit
1 = Interrupt is pending
0 = Interrupt is not pending

bit 4 **TX2IF:** USART2 Transmit Interrupt Flag bit
1 = Interrupt is pending
0 = Interrupt is not pending

bit 3 **CCP8IF:** CCP8 Interrupt Flag bit
1 = Interrupt is pending
0 = Interrupt is not pending

bit 2 **CCP7IF:** CCP7 Interrupt Flag bit
1 = Interrupt is pending
0 = Interrupt is not pending

bit 1 **BCL2IF:** MSSP2 Bus Collision Interrupt Flag bit
1 = Interrupt is pending
0 = Interrupt is not pending

bit 0 **SSP2IF:** Synchronous Serial Port (MSSP2) Interrupt Flag bit
1 = Interrupt is pending
0 = Interrupt is not pending

Note: Interrupt flag bits are set when an interrupt condition occurs, regardless of the state of its corresponding enable bit or the Global Enable bit, GIE, of the INTCON register. User software should ensure the appropriate interrupt flag bits are clear prior to enabling an interrupt.

REGISTER 12-9: ANSELB: PORTB ANALOG SELECT REGISTER

U-0	U-0	R/W-1/1	R/W-1/1	R/W-1/1	R/W-1/1	R/W-1/1	R/W-1/1
—	—	ANSB5	ANSB4	ANSB3	ANSB2	ANSB1	ANSB0
bit 7							bit 0

Legend:		
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'
u = Bit is unchanged	x = Bit is unknown	-n/n = Value at POR and BOR/Value at all other Resets
'1' = Bit is set	'0' = Bit is cleared	

bit 7-6 **Unimplemented:** Read as '0'

bit 5-0 **ANSB<5:0>**: Analog Select between Analog or Digital Function on pins RB<5:0>, respectively
1 = Analog input. Pin is assigned as analog input(1). Digital input buffer disabled.
0 = Digital I/O. Pin is assigned to port or digital special function.

Note 1: When setting a pin to an analog input, the corresponding TRIS bit must be set to Input mode in order to allow external control of the voltage on the pin.

REGISTER 12-10: WPUB: WEAK PULL-UP PORTB REGISTER

R/W-1/1	R/W-1/1	R/W-1/1	R/W-1/1	R/W-1/1	R/W-1/1	R/W-1/1	R/W-1/1
WPUB7	WPUB6	WPUB5	WPUB4	WPUB3	WPUB2	WPUB1	WPUB0
bit 7							bit 0

Legend:		
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'
u = Bit is unchanged	x = Bit is unknown	-n/n = Value at POR and BOR/Value at all other Resets
'1' = Bit is set	'0' = Bit is cleared	

bit 7-0 **WPUB<7:0>**: Weak Pull-up Register bits
1 = Pull-up enabled
0 = Pull-up disabled

Note 1: Global $\overline{\text{WPUEN}}$ bit of the OPTION_REG register must be cleared for individual pull-ups to be enabled.
2: The weak pull-up device is automatically disabled if the pin is in configured as an output.

TABLE 12-6: SUMMARY OF REGISTERS ASSOCIATED WITH PORTB

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Register on Page
APFCON	—	—	—	—	—	—	T3CKISEL	CCP2SEL	118
ANSELB	—	—	ANSB5	ANSB4	ANSB3	ANSB2	ANSB1	ANSB0	118
LATB	LATB7	LATB6	LATB5	LATB4	LATB3	LATB2	LATB1	LATB0	117
PORTB	RB7	RB6	RB5	RB4	RB3	RB2	RB1	RB0	117
TRISB	TRISB7	TRISB6	TRISB5	TRISB4	TRISB3	TRISB2	TRISB1	TRISB0	117
WPUB	WPUB7	WPUB6	WPUB5	WPUB4	WPUB3	WPUB2	WPUB1	WPUB0	118

Legend: x = unknown, u = unchanged, - = unimplemented locations read as '0'. Shaded cells are not used by PORTB.

FIGURE 13-1: INTERRUPT-ON-CHANGE BLOCK DIAGRAM

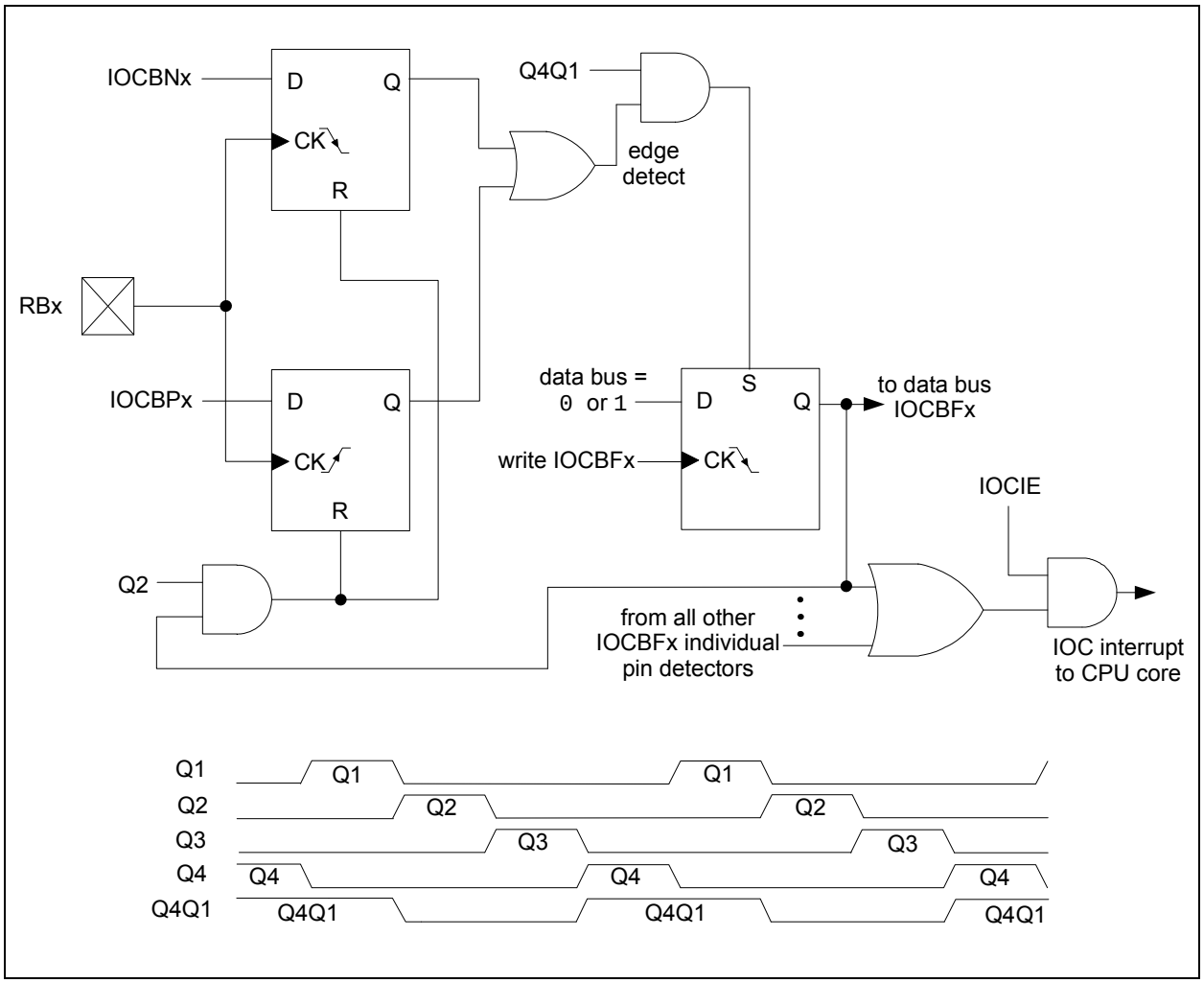
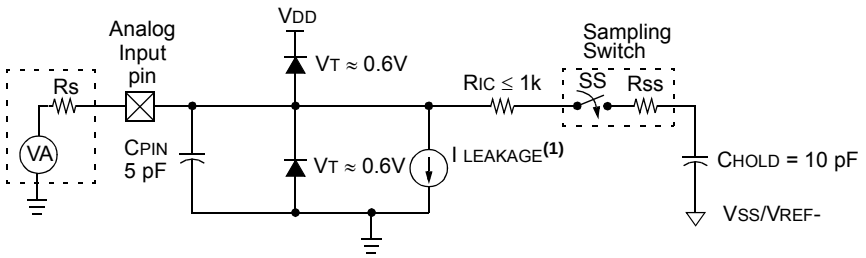
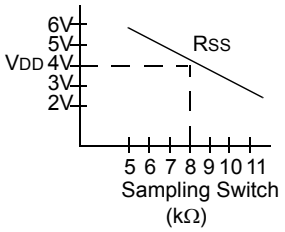


FIGURE 16-4: ANALOG INPUT MODEL





Legend:

CHOLD	=	Sample/Hold Capacitance
CPIN	=	Input Capacitance
I LEAKAGE	=	Leakage current at the pin due to various junctions
RIC	=	Interconnect Resistance
RSS	=	Resistance of Sampling Switch
SS	=	Sampling Switch
VT	=	Threshold Voltage

Note 1: Refer to **Section 25.0 "Electrical Specifications"**.

FIGURE 16-5: ADC TRANSFER FUNCTION

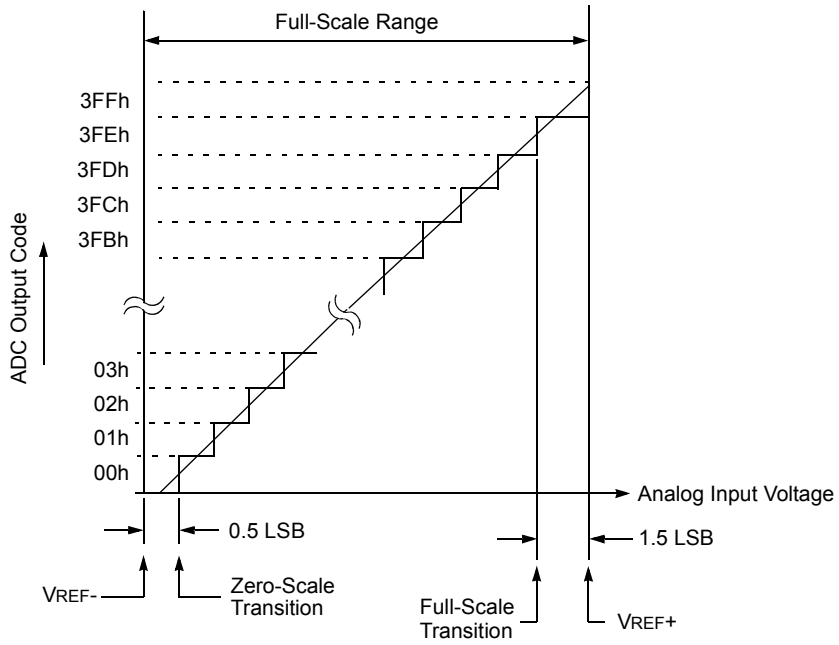


TABLE 19-1: SUMMARY OF REGISTERS ASSOCIATED WITH TIMER2/4/6/8/10

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Register on Page
CCP1CON	—	—	DC1B<1:0>		CCP1M<3:0>				189
CCP2CON	—	—	DC2B<1:0>		CCP2M<3:0>				189
CCP3CON	—	—	DC3B<1:0>		CCP3M<3:0>				189
CCP4CON	—	—	DC4B<1:0>		CCP4M<3:0>				189
CCP5CON	—	—	DC5B<1:0>		CCP5M<3:0>				189
CCP6CON	—	—	DC6B<1:0>		CCP6M<3:0>				189
CCP7CON	—	—	DC7B<1:0>		CCP7M<3:0>				189
CCP8CON	—	—	DC8B<1:0>		CCP8M<3:0>				189
CCP9CON	—	—	DC9B<1:0>		CCP9M<3:0>				189
CCP10CON	—	—	DC10B<1:0>		CCP10M<3:0>				189
INTCON	GIE	PEIE	TMR0IE	INTE	IOCIE	TMR0IF	INTF	IOCIF	76
PIE1	TMR1GIE	ADIE	RC1IE	TX1IE	SSP1IE	CCP1IE	TMR2IE	TMR1IE	77
PIE2	OSFIE	TMR5GIE	TMR3GIE	—	BCL1IE	TMR10IE	TMR8IE	CCP2IE	78
PIE3	CCP6IE	CCP5IE	CCP4IE	CCP3IE	TMR6IE	TMR5IE	TMR4IE	TMR3IE	79
PIR1	TMR1GIF	ADIF	RC1IF	TX1IF	SSP1IF	CCP1IF	TMR2IF	TMR1IF	81
PIR2	OSFIF	TMR5GIF	TMR3GIF	—	BCL1IF	TMR10IF	TMR8IF	CCP2IF	82
PIR3	CCP6IF	CCP5IF	CCP4IF	CCP3IF	TMR6IF	TMR5IF	TMR4IF	TMR3IF	83
PR2	Timer2 Module Period Register								213*
PR4	Timer4 Module Period Register								213*
PR6	Timer6 Module Period Register								213*
PR8	Timer8 Module Period Register								213*
PR10	Timer10 Module Period Register								213*
T2CON	—	T2OUTPS<3:0>				TMR2ON	T2CKPS1	T2CKPS0	215
T4CON	—	T4OUTPS<3:0>				TMR4ON	T4CKPS1	T4CKPS0	215
T6CON	—	T6OUTPS<3:0>				TMR6ON	T6CKPS1	T6CKPS0	215
T8CON	—	T8OUTPS<3:0>				TMR8ON	T8CKPS1	T8CKPS0	215
T10CON	—	T10OUTPS<3:0>				TMR10ON	T10CKPS1	T10CKPS0	215
TMR2	Holding Register for the 8-bit TMR2 Register								213*
TMR4	Holding Register for the 8-bit TMR4 Register(1)								213*
TMR6	Holding Register for the 8-bit TMR6 Register(1)								213*
TMR8	Holding Register for the 8-bit TMR8 Register(1)								213*
TMR10	Holding Register for the 8-bit TMR10 Register(1)								213*

Legend: — = unimplemented location, read as '0'. Shaded cells are not used for Timer2/4/6/8/10 module.

* Page provides register information.

TABLE 22-5: BAUD RATES FOR ASYNCHRONOUS MODES

BAUD RATE	SYNC = 0, BRGH = 0, BRG16 = 0											
	Fosc = 20.000 MHz			Fosc = 18.432 MHz			Fosc = 16.000 MHz			Fosc = 11.0592 MHz		
	Actual Rate	% Error	SPBRG value (decimal)	Actual Rate	% Error	SPBRG value (decimal)	Actual Rate	% Error	SPBRG value (decimal)	Actual Rate	% Error	SPBRG value (decimal)
300	—	—	—	—	—	—	—	—	—	—	—	—
1200	1221	1.73	255	1200	0.00	239	1202	0.16	207	1200	0.00	143
2400	2404	0.16	129	2400	0.00	119	2404	0.16	103	2400	0.00	71
9600	9470	-1.36	32	9600	0.00	29	9615	0.16	25	9600	0.00	17
10417	10417	0.00	29	10286	-1.26	27	10417	0.00	23	10165	-2.42	16
19.2k	19.53k	1.73	15	19.20k	0.00	14	19.23k	0.16	12	19.20k	0.00	8
57.6k	—	—	—	57.60k	0.00	7	—	—	—	57.60k	0.00	2
115.2k	—	—	—	—	—	—	—	—	—	—	—	—

BAUD RATE	SYNC = 0, BRGH = 0, BRG16 = 0											
	Fosc = 8.000 MHz			Fosc = 4.000 MHz			Fosc = 3.6864 MHz			Fosc = 1.000 MHz		
	Actual Rate	% Error	SPBRG value (decimal)	Actual Rate	% Error	SPBRG value (decimal)	Actual Rate	% Error	SPBRG value (decimal)	Actual Rate	% Error	SPBRG value (decimal)
300	—	—	—	300	0.16	207	300	0.00	191	300	0.16	51
1200	1202	0.16	103	1202	0.16	51	1200	0.00	47	1202	0.16	12
2400	2404	0.16	51	2404	0.16	25	2400	0.00	23	—	—	—
9600	9615	0.16	12	—	—	—	9600	0.00	5	—	—	—
10417	10417	0.00	11	10417	0.00	5	—	—	—	—	—	—
19.2k	—	—	—	—	—	—	19.20k	0.00	2	—	—	—
57.6k	—	—	—	—	—	—	57.60k	0.00	0	—	—	—
115.2k	—	—	—	—	—	—	—	—	—	—	—	—

BAUD RATE	SYNC = 0, BRGH = 1, BRG16 = 0											
	Fosc = 20.000 MHz			Fosc = 18.432 MHz			Fosc = 16.000 MHz			Fosc = 11.0592 MHz		
	Actual Rate	% Error	SPBRG value (decimal)	Actual Rate	% Error	SPBRG value (decimal)	Actual Rate	% Error	SPBRG value (decimal)	Actual Rate	% Error	SPBRG value (decimal)
300	—	—	—	—	—	—	—	—	—	—	—	—
1200	—	—	—	—	—	—	—	—	—	—	—	—
2400	—	—	—	—	—	—	—	—	—	—	—	—
9600	9615	0.16	129	9600	0.00	119	9615	0.16	103	9600	0.00	71
10417	10417	0.00	119	10378	-0.37	110	10417	0.00	95	10473	0.53	65
19.2k	19.23k	0.16	64	19.20k	0.00	59	19.23k	0.16	51	19.20k	0.00	35
57.6k	56.82k	-1.36	21	57.60k	0.00	19	58.82k	2.12	16	57.60k	0.00	11
115.2k	113.64k	-1.36	10	115.2k	0.00	9	111.1k	-3.55	8	115.2k	0.00	5

FIGURE 22-7: AUTO-WAKE-UP BIT (WUE) TIMING DURING NORMAL OPERATION

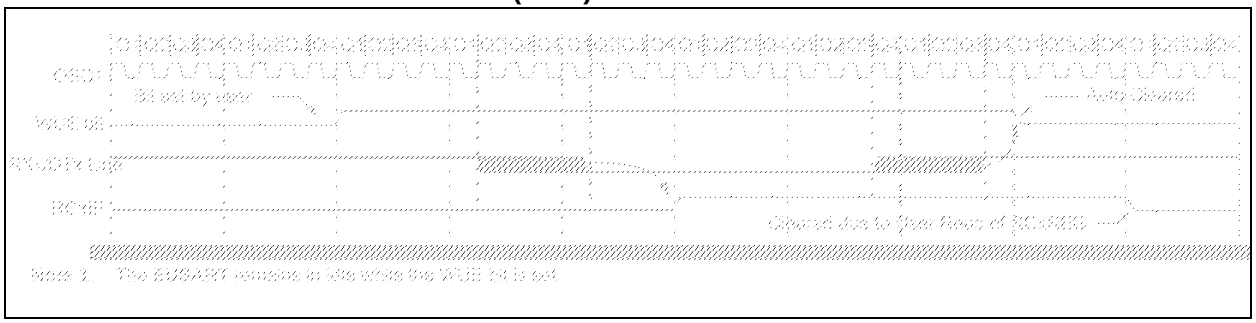


FIGURE 22-8: AUTO-WAKE-UP BIT (WUE) TIMINGS DURING SLEEP

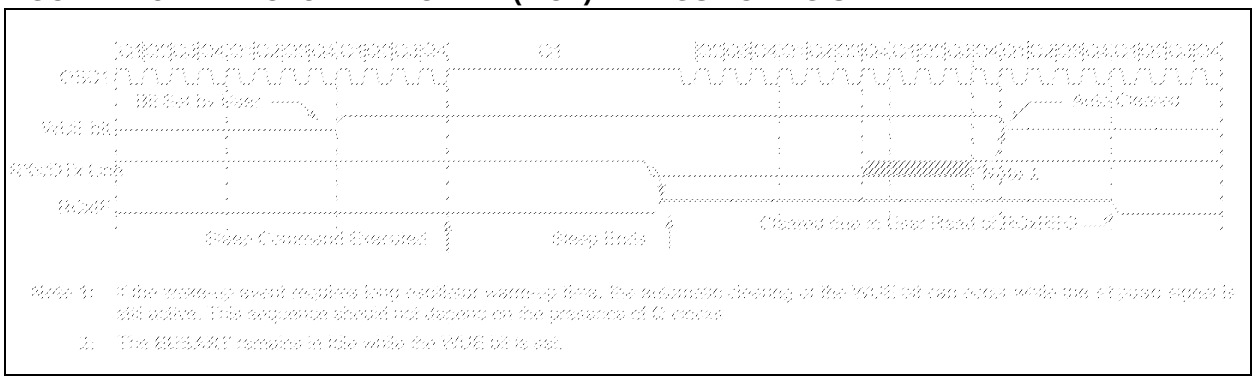


TABLE 24-3: INSTRUCTION SET (CONTINUED)

Mnemonic, Operands		Description	Cycles	14-Bit Opcode MSb LSb	Status Affected	Notes
CONTROL OPERATIONS						
BRA	k	Relative Branch	2	11 001k kkkk kkkk		
BRW	–	Relative Branch with W	2	00 0000 0000 1011		
CALL	k	Call Subroutine	2	10 0kkk kkkk kkkk		
CALLW	–	Call Subroutine with W	2	00 0000 0000 1010		
GOTO	k	Go to address	2	10 1kkk kkkk kkkk		
RETFIE	k	Return from interrupt	2	00 0000 0000 1001		
RETLW	k	Return with literal in W	2	11 0100 kkkk kkkk		
RETURN	–	Return from Subroutine	2	00 0000 0000 1000		
INHERENT OPERATIONS						
CLRWDT	–	Clear Watchdog Timer	1	00 0000 0110 0100	$\overline{TO}$, $\overline{PD}$	
NOP	–	No Operation	1	00 0000 0000 0000		
OPTION	–	Load OPTION_REG register with W	1	00 0000 0110 0010		
RESET	–	Software device Reset	1	00 0000 0000 0001		
SLEEP	–	Go into Standby mode	1	00 0000 0110 0011	$\overline{TO}$, $\overline{PD}$	
TRIS	f	Load TRIS register with W	1	00 0000 0110 0fff		
C-COMPILER OPTIMIZED						
ADDFSR	n, k	Add Literal k to FSRn	1	11 0001 0nkk kkkk		
MOVIW	n mm	Move Indirect FSRn to W with pre/post inc/dec modifier, mm	1	00 0000 0001 0nmm	Z	**2, 3**
	k[n]	Move INDFn to W, Indexed Indirect.	1	11 1111 0nkk kkkk	Z	**2**
MOVWI	n mm	Move W to Indirect FSRn with pre/post inc/dec modifier, mm	1	00 0000 0001 1nmm		**2, 3**
	k[n]	Move W to INDFn, Indexed Indirect.	1	11 1111 1nkk kkkk		**2**

Note 1: If the Program Counter (PC) is modified, or a conditional test is true, the instruction requires two cycles. The second cycle is executed as a NOP.

2: If this instruction addresses an INDF register and the MSb of the corresponding FSR is set, this instruction will require one additional instruction cycle.

3: See Table in the MOVIW and MOVWI instruction descriptions.

SWAPF **Swap Nibbles in f**

Syntax:	[*label*] SWAPF f,d
Operands:	$0 \le f \le 127$ $d \in [0,1]$
Operation:	(f<3:0>) → (destination<7:4>), (f<7:4>) → (destination<3:0>)
Status Affected:	None
Description:	The upper and lower nibbles of register ‘f’ are exchanged. If ‘d’ is ‘0’, the result is placed in the W register. If ‘d’ is ‘1’, the result is placed in register ‘f’.

TRIS **Load TRIS Register with W**

Syntax:	[*label*] TRIS f
Operands:	$5 \le f \le 7$
Operation:	(W) → TRIS register ‘f’
Status Affected:	None
Description:	Move data from W register to TRIS register. When ‘f’ = 5, TRISA is loaded. When ‘f’ = 6, TRISB is loaded. When ‘f’ = 7, TRISC is loaded.

XORLW **Exclusive OR literal with W**

Syntax:	[*label*] XORLW k
Operands:	$0 \le k \le 255$
Operation:	(W) .XOR. k → (W)
Status Affected:	Z
Description:	The contents of the W register are XOR’ed with the 8-bit literal ‘k’. The result is placed in the W register.

XORWF **Exclusive OR W with f**

Syntax:	[*label*] XORWF f,d
Operands:	$0 \le f \le 127$ $d \in [0,1]$
Operation:	(W) .XOR. (f) → (destination)
Status Affected:	Z
Description:	Exclusive OR the contents of the W register with register ‘f’. If ‘d’ is ‘0’, the result is stored in the W register. If ‘d’ is ‘1’, the result is stored back in register ‘f’.

25.2 DC Characteristics: Supply Current (IDD) (Continued)

PIC16LF1526/7		**Standard Operating Conditions (unless otherwise stated)** Operating temperature -40°C ≤ TA ≤ +85°C for industrial -40°C ≤ TA ≤ +125°C for extended					
PIC16F1526/7		**Standard Operating Conditions (unless otherwise stated)** Operating temperature -40°C ≤ TA ≤ +85°C for industrial -40°C ≤ TA ≤ +125°C for extended					
Param No.	**Device Characteristics**	**Min.**	**Typ†**	**Max.**	**Units**	**Conditions**	
						VDD	**Note**
	Supply Current (IDD)(1, 2, 3)						
D018		—	0.9	1.4	mA	1.8	FOSC = 16 MHz HFINTOSC
		—	1.5	1.8	mA	3.0	
D018		—	1.0	1.5	mA	2.3	FOSC = 16 MHz HFINTOSC
		—	1.5	1.8	mA	3.0	
		—	1.7	1.9	mA	5.0	
D020		—	1.7	2.0	mA	3.0	FOSC = 20 MHz HS Oscillator
		—	2.1	2.5	mA	3.6	
D020		—	1.8	2.1	mA	3.0	FOSC = 20 MHz HS Oscillator
		—	2.2	2.7	mA	5.0	
D021		—	190	240	µA	1.8	FOSC = 4 MHz EXTRC **(Note 4)**
		—	340	400	µA	3.0	
D021		—	250	350	µA	2.3	FOSC = 4 MHz EXTRC **(Note 4)**
		—	340	440	µA	3.0	
		—	425	525	µA	5.0	

* These parameters are characterized but not tested.

† Data in "Typ" column is at 3.0V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

Note 1: The test conditions for all IDD measurements in active operation mode are: OSC1 = external square wave, from rail-to-rail; all I/O pins tri-stated, pulled to VDD; $\overline{MCLR}$ = VDD; WDT disabled.

2: The supply current is mainly a function of the operating voltage and frequency. Other factors, such as I/O pin loading and switching rate, oscillator type, internal code execution pattern and temperature, also have an impact on the current consumption.

3: 0.1 µF capacitor on VCAP pin (PIC16F1526/7).

4: For RC oscillator configurations, current through REXT is not included. The current through the resistor can be extended by the formula IR = VDD/2REXT (mA) with REXT in kΩ.

FIGURE 25-10: TIMER0 AND TIMER1 EXTERNAL CLOCK TIMINGS

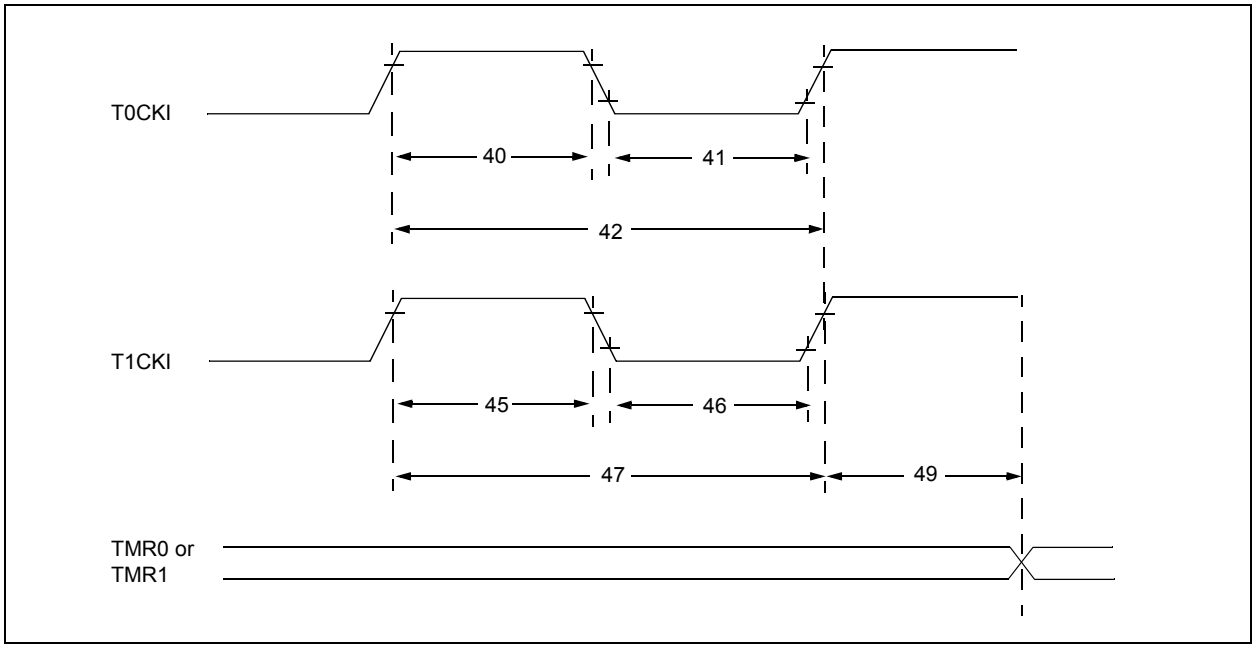


TABLE 25-5: TIMER0 AND TIMER1 EXTERNAL CLOCK REQUIREMENTS

Standard Operating Conditions (unless otherwise stated) Operating Temperature -40°C ≤ TA ≤ +125°C								
Param No.	**Sym.**	**Characteristic**		**Min.**	**Typ†**	**Max.**	**Units**	**Conditions**
40*	TT0H	T0CKI High Pulse Width	No Prescaler	0.5 TCY + 20	—	—	ns	
			With Prescaler	10	—	—	ns	
41*	TT0L	T0CKI Low Pulse Width	No Prescaler	0.5 TCY + 20	—	—	ns	
			With Prescaler	10	—	—	ns	
42*	TT0P	T0CKI Period		Greater of: 20 or TCY + 40 / N	—	—	ns	N = prescale value
45*	TT1H	T1CKI High Time	Synchronous, No Prescaler	0.5 TCY + 20	—	—	ns	
			Synchronous, with Prescaler	15	—	—	ns	
			Asynchronous	30	—	—	ns	
46*	TT1L	T1CKI Low Time	Synchronous, No Prescaler	0.5 TCY + 20	—	—	ns	
			Synchronous, with Prescaler	15	—	—	ns	
			Asynchronous	30	—	—	ns	
47*	TT1P	T1CKI Input Period	Synchronous	Greater of: 30 or TCY + 40 / N	—	—	ns	N = prescale value
			Asynchronous	60	—	—	ns	
48	FT1	Timer1 Oscillator Input Frequency Range (oscillator enabled by setting bit SOSCEN)		32.4	32.768	33.1	kHz	
49*	TCKEZTMR1	Delay from External Clock Edge to Timer Increment		2 TOSC	—	7 TOSC	—	Timers in Sync mode

* These parameters are characterized but not tested.

† Data in "Typ" column is at 3.0V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

27.11 Demonstration/Development Boards, Evaluation Kits, and Starter Kits

A wide variety of demonstration, development and evaluation boards for various PIC MCUs and dsPIC DSCs allows quick application development on fully functional systems. Most boards include prototyping areas for adding custom circuitry and provide application firmware and source code for examination and modification.

The boards support a variety of features, including LEDs, temperature sensors, switches, speakers, RS-232 interfaces, LCD displays, potentiometers and additional EEPROM memory.

The demonstration and development boards can be used in teaching environments, for prototyping custom circuits and for learning about various microcontroller applications.

In addition to the PICDEM™ and dsPICDEM™ demonstration/development board series of circuits, Microchip has a line of evaluation kits and demonstration software for analog filter design, KEELOQ® security ICs, CAN, IrDA®, PowerSmart battery management, SEEVAL® evaluation system, Sigma-Delta ADC, flow rate sensing, plus many more.

Also available are starter kits that contain everything needed to experience the specified device. This usually includes a single application and debug capability, all on one board.

Check the Microchip web page (www.microchip.com) for the complete list of demonstration, development and evaluation kits.

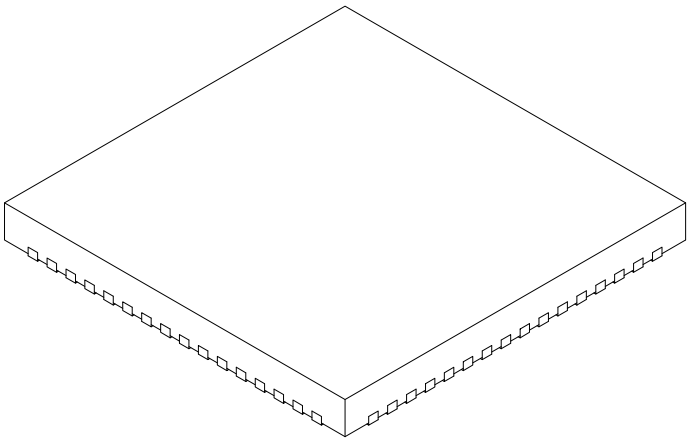
27.12 Third-Party Development Tools

Microchip also offers a great collection of tools from third-party vendors. These tools are carefully selected to offer good value and unique functionality.

- Device Programmers and Gang Programmers from companies, such as SoftLog and CCS
- Software Tools from companies, such as Gimpel and Trace Systems
- Protocol Analyzers from companies, such as Saleae and Total Phase
- Demonstration Boards from companies, such as MikroElektronika, Digilent® and Olimex
- Embedded Ethernet Solutions from companies, such as EZ Web Lynx, WIZnet and IPLogika®

64-Lead Plastic Quad Flat, No Lead Package (MR) – 9x9x0.9 mm Body with 5.40 x 5.40 Exposed Pad [QFN]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		64	
Pitch	e		0.50 BSC	
Overall Height	A	0.80	0.90	1.00
Standoff	A1	0.00	0.02	0.05
Contact Thickness	A3		0.20 REF	
Overall Width	E		9.00 BSC	
Exposed Pad Width	E2	5.30	5.40	5.50
Overall Length	D		9.00 BSC	
Exposed Pad Length	D2	5.30	5.40	5.50
Contact Width	b	0.20	0.25	0.30
Contact Length	L	0.30	0.40	0.50
Contact-to-Exposed Pad	K	0.20	-	-

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package is saw singulated.
3. Dimensioning and tolerancing per ASME Y14.5M.

BSC: Basic Dimension. Theoretically exact value shown without tolerances.
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-154A Sheet 2 of 2