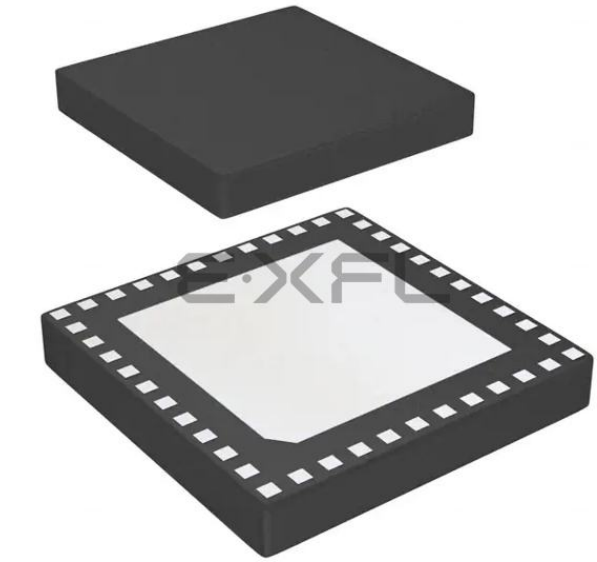
Microchip Technology - DSPIC33FJ16GS404-50I/TL Datasheet



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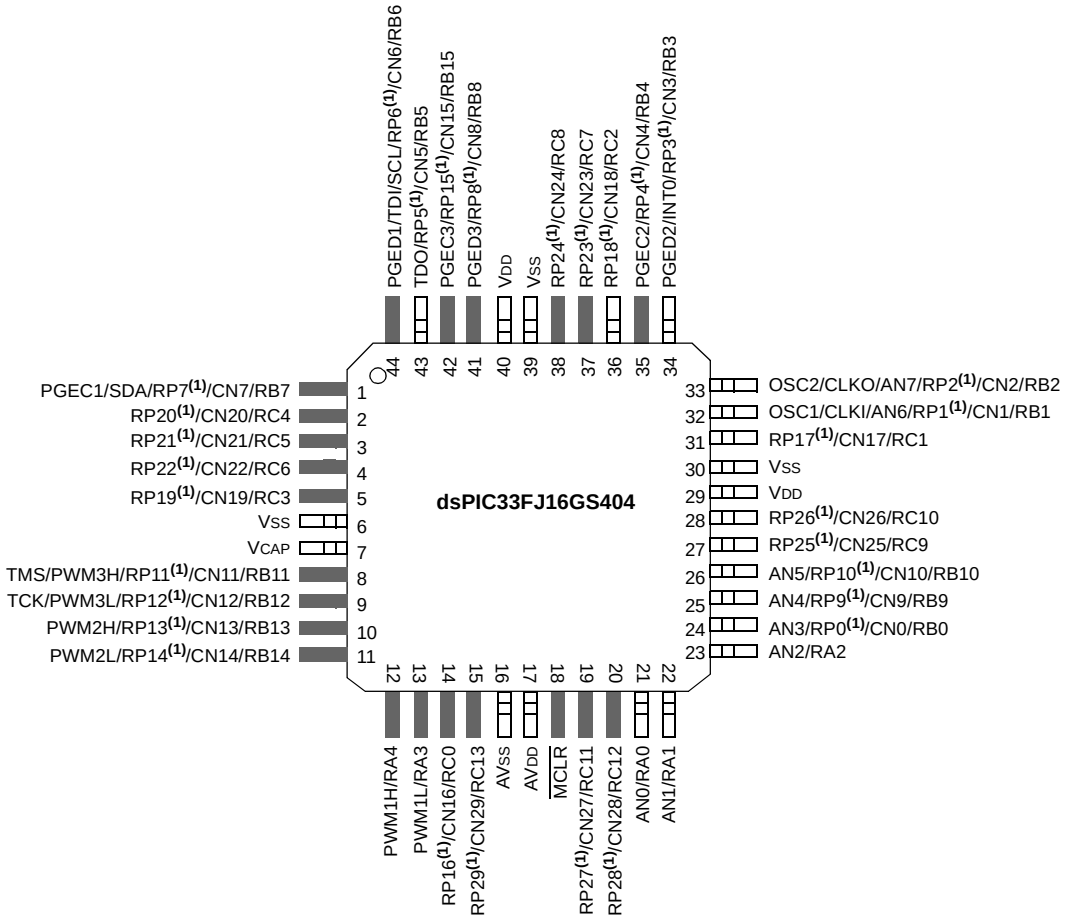
Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	dsPIC
Core Size	16-Bit
Speed	50 MIPs
Connectivity	I²C, IrDA, LINbus, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, POR, PWM, WDT
Number of I/O	35
Program Memory Size	16KB (16K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	2K x 8
Voltage - Supply (Vcc/Vdd)	3V ~ 3.6V
Data Converters	A/D 8x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	44-VFTLA Exposed Pad
Supplier Device Package	44-VTLA (6x6)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/dspic33fj16gs404-50i-tl

Pin Diagrams (Continued)

44-Pin TQFP

■ = Pins are up to 5V tolerant



Note 1: The RPn pins can be used by any remappable peripheral. See **Table 1** for the list of available peripherals.

4.1.1 PROGRAM MEMORY ORGANIZATION

The program memory space is organized in word-addressable blocks. Although it is treated as 24 bits wide, it is more appropriate consider each address of the program memory as a lower and upper word, with the upper byte of the upper word being unimplemented. The lower word always has an even address, while the upper word has an odd address (see Figure 4-2).

Program memory addresses are always word-aligned on the lower word, and addresses are incremented or decremented by two during the code execution. This arrangement provides compatibility with data memory space addressing and makes data in the program memory space accessible.

4.1.2 INTERRUPT AND TRAP VECTORS

All dsPIC33FJ06GS101/X02 and dsPIC33FJ16GSX02/X04 devices reserve the addresses between 0x00000 and 0x000200 for hard-coded program execution vectors. A hardware Reset vector is provided to redirect code execution from the default value of the PC on device Reset to the actual start of code. A `GOTO` instruction is programmed by the user application at 0x000000, with the actual address for the start of code at 0x000002.

The dsPIC33FJ06GS101/X02 and dsPIC33FJ16GSX02/X04 devices also have two interrupt vector tables, located from 0x000004 to 0x0000FF and 0x000100 to 0x0001FF. These vector tables allow each of the device interrupt sources to be handled by separate Interrupt Service Routines (ISRs). A more detailed discussion of the interrupt vector tables is provided in **Section 7.1 "Interrupt Vector Table"**.

FIGURE 4-2: PROGRAM MEMORY ORGANIZATION

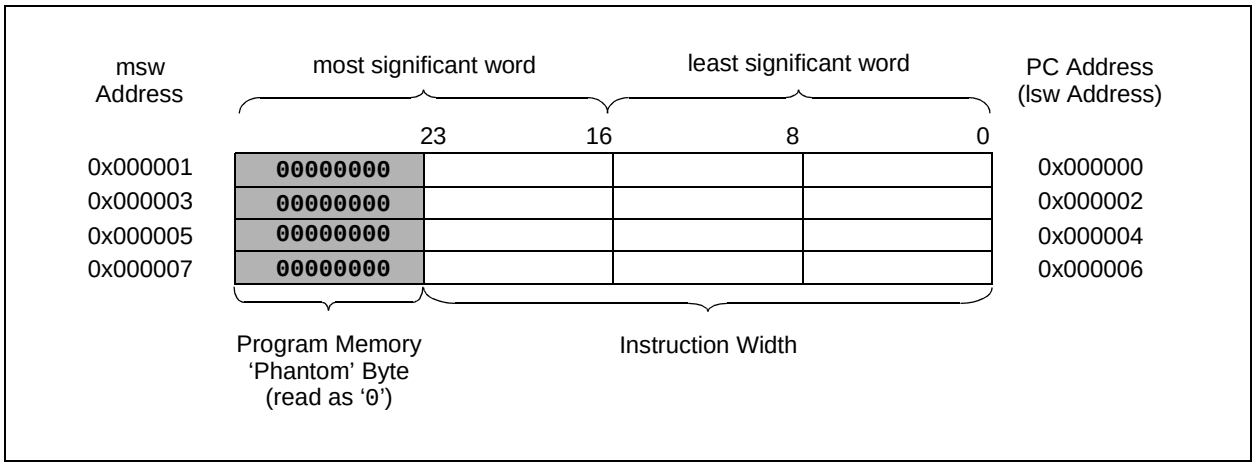


TABLE 4-22: I2C1 REGISTER MAP

File Name	SFR Addr	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	All Resets
I2C1RCV	0200	—	—	—	—	—	—	—	—	I2C1 Receive Register								0000
I2C1TRN	0202	—	—	—	—	—	—	—	—	I2C1 Transmit Register								00FF
I2C1BRG	0204	—	—	—	—	—	—	—	Baud Rate Generator Register									0000
I2C1CON	0206	I2CEN	—	I2CSIDL	SCLREL	IPMIEN	A10M	DISSLW	SMEN	GCEN	STREN	ACKDT	ACKEN	RCEN	PEN	RSEN	SEN	1000
I2C1STAT	0208	ACKSTAT	TRSTAT	—	—	—	BCL	GCSTAT	ADD10	IWCOL	I2COV	D_A	P	S	R_W	RBF	TBF	0000
I2C1ADD	020A	—	—	—	—	—	—	I2C1 Address Register										0000
I2C1MSK	020C	—	—	—	—	—	—	AMSK<9:0>										0000

Legend: x = unknown value on Reset, — = unimplemented, read as '0'. Reset values are shown in hexadecimal.

TABLE 4-23: UART1 REGISTER MAP

File Name	SFR Addr	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	All Resets
U1MODE	0220	UARTEN	—	USIDL	IREN	RTSMD	—	UEN1	UEN0	WAKE	LPBACK	ABAUD	URXINV	BRGH	PDSEL1	PDSEL0	STSEL	0000
U1STA	0222	UTXISEL1	UTXINV	UTXISEL0	—	UTXBRK	UTXEN	UTXBF	TRMT	URXISEL1	URXISEL0	ADDEN	RIDLE	PERR	FERR	OERR	URXDA	0110
U1TXREG	0224	—	—	—	—	—	—	—	UART1 Transmit Register									xxxx
U1RXREG	0226	—	—	—	—	—	—	—	UART1 Receive Register									0000
U1BRG	0228	Baud Rate Generator Prescaler																0000

Legend: x = unknown value on Reset, — = unimplemented, read as '0'. Reset values are shown in hexadecimal.

TABLE 4-24: SPI1 REGISTER MAP

File Name	SFR Addr	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	All Resets
SPI1STAT	0240	SPIEN	—	SPISIDL	—	—	—	—	—	—	SPIROV	—	—	—	—	SPITBF	SPIRBF	0000
SPI1CON1	0242	—	—	—	DISSCK	DISSDO	MODE16	SMP	CKE	SSEN	CKP	MSTEN	SPRE2	SPRE1	SPRE0	PPRE1	PPRE0	0000
SPI1CON2	0244	FRMEN	SPIFSD	FRMPOL	—	—	—	—	—	—	—	—	—	—	—	FRMDLY	—	0000
SPI1BUF	0248	SPI1 Transmit and Receive Buffer Register																0000

Legend: x = unknown value on Reset, — = unimplemented, read as '0'. Reset values are shown in hexadecimal.

REGISTER 7-5: IFS0: INTERRUPT FLAG STATUS REGISTER 0

U-0	U-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0
—	—	ADIF	U1TXIF	U1RXIF	SPI1IF	SPI1EIF	T3IF
bit 15							bit 8

R/W-0	R/W-0	R/W-0	U-0	R/W-0	R/W-0	R/W-0	R/W-0
T2IF	OC2IF	IC2IF	—	T1IF	OC1IF	IC1IF	INT0IF
bit 7							bit 0

Legend:			
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as ‘0’	
-n = Value at POR	‘1’ = Bit is set	‘0’ = Bit is cleared	x = Bit is unknown

bit 15-14 **Unimplemented:** Read as ‘0’

bit 13 **ADIF:** ADC Group Conversion Complete Interrupt Flag Status bit
1 = Interrupt request has occurred
0 = Interrupt request has not occurred

bit 12 **U1TXIF:** UART1 Transmitter Interrupt Flag Status bit
1 = Interrupt request has occurred
0 = Interrupt request has not occurred

bit 11 **U1RXIF:** UART1 Receiver Interrupt Flag Status bit
1 = Interrupt request has occurred
0 = Interrupt request has not occurred

bit 10 **SPI1IF:** SPI1 Event Interrupt Flag Status bit
1 = Interrupt request has occurred
0 = Interrupt request has not occurred

bit 9 **SPI1EIF:** SPI1 Fault Interrupt Flag Status bit
1 = Interrupt request has occurred
0 = Interrupt request has not occurred

bit 8 **T3IF:** Timer3 Interrupt Flag Status bit
1 = Interrupt request has occurred
0 = Interrupt request has not occurred

bit 7 **T2IF:** Timer2 Interrupt Flag Status bit
1 = Interrupt request has occurred
0 = Interrupt request has not occurred

bit 6 **OC2IF:** Output Compare Channel 2 Interrupt Flag Status bit
1 = Interrupt request has occurred
0 = Interrupt request has not occurred

bit 5 **IC2IF:** Input Capture Channel 2 Interrupt Flag Status bit
1 = Interrupt request has occurred
0 = Interrupt request has not occurred

bit 4 **Unimplemented:** Read as ‘0’

bit 3 **T1IF:** Timer1 Interrupt Flag Status bit
1 = Interrupt request has occurred
0 = Interrupt request has not occurred

bit 2 **OC1IF:** Output Compare Channel 1 Interrupt Flag Status bit
1 = Interrupt request has occurred
0 = Interrupt request has not occurred

REGISTER 7-20: IPC1: INTERRUPT PRIORITY CONTROL REGISTER 1

U-0	R/W-1	R/W-0	R/W-0	U-0	R/W-1	R/W-0	R/W-0
—	T2IP2	T2IP1	T2IP0	—	OC2IP2	OC2IP1	OC2IP0
bit 15							bit 8

U-0	R/W-1	R/W-0	R/W-0	U-0	U-0	U-0	U-0
—	IC2IP2	IC2IP1	IC2IP0	—	—	—	—
bit 7							bit 0

Legend:			
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'	
-n = Value at POR	'1' = Bit is set	'0' = Bit is cleared	x = Bit is unknown

bit 15 **Unimplemented:** Read as '0'

bit 14-12 **T2IP<2:0>:** Timer2 Interrupt Priority bits
111 = Interrupt is Priority 7 (highest priority interrupt)
•
•
•
001 = Interrupt is Priority 1
000 = Interrupt source is disabled

bit 11 **Unimplemented:** Read as '0'

bit 10-8 **OC2IP<2:0>:** Output Compare Channel 2 Interrupt Priority bits
111 = Interrupt is Priority 7 (highest priority interrupt)
•
•
•
001 = Interrupt is Priority 1
000 = Interrupt source is disabled

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

bit 6-4 **IC2IP<2:0>:** Input Capture Channel 2 Interrupt Priority bits
111 = Interrupt is Priority 7 (highest priority interrupt)
•
•
•
001 = Interrupt is Priority 1
000 = Interrupt source is disabled

bit 3-0 **Unimplemented:** Read as '0'

8.0 OSCILLATOR CONFIGURATION

Note 1: This data sheet summarizes the features of the dsPIC33FJ06GS101/X02 and dsPIC33FJ16GSX02/X04 families of devices. It is not intended to be a comprehensive reference source. To complement the information in this data sheet, refer to **"Oscillator (Part IV)"** (DS70307) in the *"dsPIC33F/PIC24H Family Reference Manual"*, which is available from the Microchip web site (www.microchip.com).

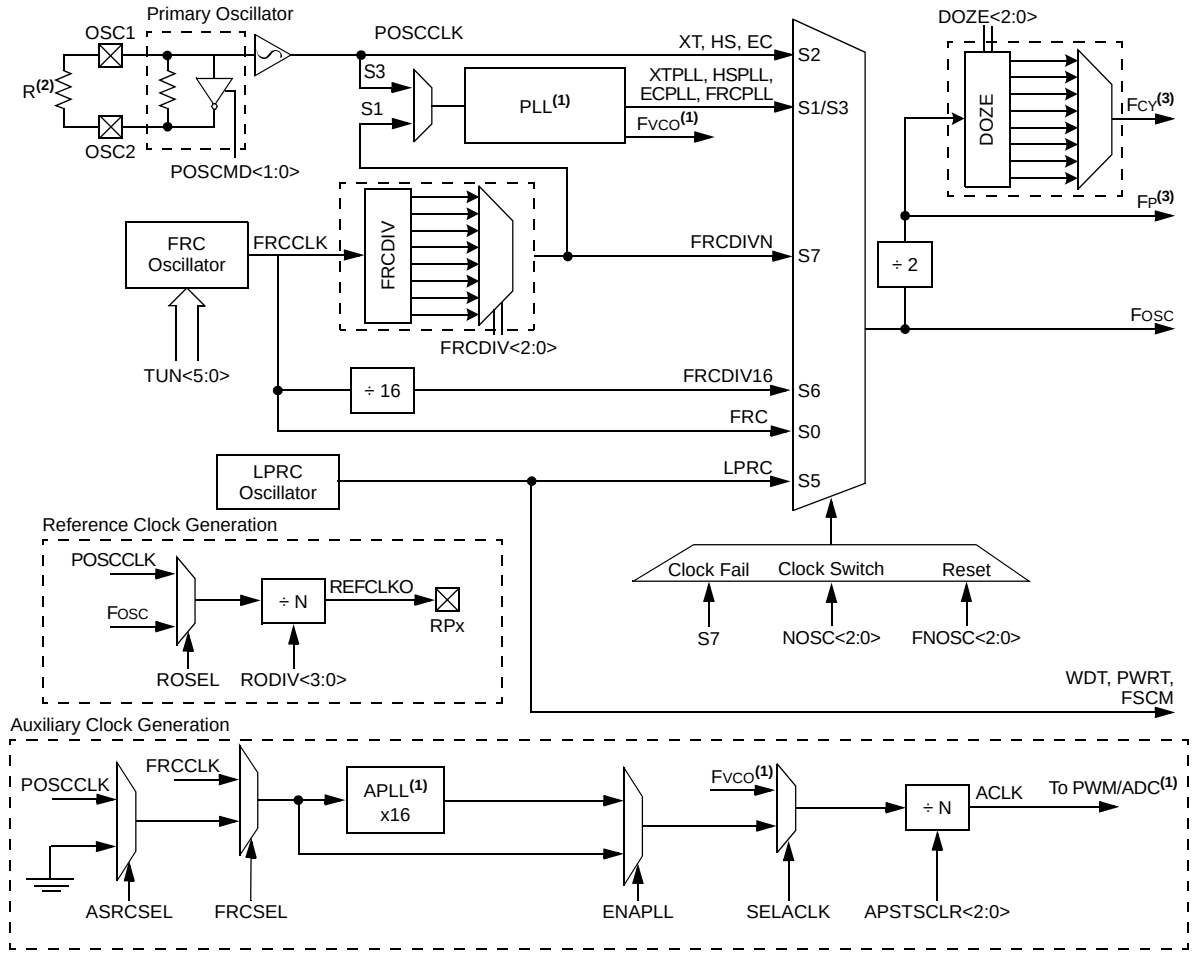
2: Some registers and associated bits described in this section may not be available on all devices. Refer to **Section 4.0 "Memory Organization"** in this data sheet for device-specific register and bit information.

The oscillator system provides:

- External and internal oscillator options as clock sources
- An on-chip Phase-Locked Loop (PLL) to scale the internal operating frequency to the required system clock frequency
- An internal FRC oscillator that can also be used with the PLL, thereby allowing full-speed operation without any external clock generation hardware
- Clock switching between various clock sources
- Programmable clock postscaler for system power savings
- A Fail-Safe Clock Monitor (FSCM) that detects clock failure and takes fail-safe measures
- A Clock Control register (OSCCON)
- Nonvolatile Configuration bits for main oscillator selection
- Auxiliary PLL for ADC and PWM

A simplified diagram of the oscillator system is shown in Figure 8-1.

FIGURE 8-1: OSCILLATOR SYSTEM DIAGRAM



Note 1: See **Section 8.1.3 "PLL Configuration"** and **Section 8.2 "Auxiliary Clock Generation"** for configuration restrictions.

2: If the oscillator is used with XT or HS modes, an external parallel resistor with the value of 1 MΩ must be connected.

3: The term, FP, refers to the clock source for all the peripherals, while FCY refers to the clock source for the CPU. Throughout this document, FCY and FP are used interchangeably, except in the case of Doze mode. FP and FCY will be different when Doze mode is used in any ratio other than 1:1, which is the default.

REGISTER 8-2: CLKDIV: CLOCK DIVISOR REGISTER(1)

R/W-0	R/W-0	R/W-1	R/W-1	R/W-0	R/W-0	R/W-0	R/W-0
ROI	DOZE2	DOZE1	DOZE0	DOZEN(2)	FRCDIV2	FRCDIV1	FRCDIV0
bit 15							bit 8

R/W-0	R/W-1	U-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0
PLLPOST1	PLLPOST0	—	PLLPRE4	PLLPRE3	PLLPRE2	PLLPRE1	PLLPRE0
bit 7							bit 0

Legend:			
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'	
-n = Value at POR	'1' = Bit is set	'0' = Bit is cleared	x = Bit is unknown

bit 15 **ROI:** Recover on Interrupt bit
1 = Interrupts will clear the DOZEN bit and the processor clock/peripheral clock ratio is set to 1:1
0 = Interrupts have no effect on the DOZEN bit

bit 14-12 **DOZE<2:0>:** Processor Clock Reduction Select bits
111 = FCY/128
110 = FCY/64
101 = FCY/32
100 = FCY/16
011 = FCY/8 (default)
010 = FCY/4
001 = FCY/2
000 = FCY/1

bit 11 **DOZEN:** Doze Mode Enable bit(2)
1 = DOZE<2:0> field specifies the ratio between the peripheral clocks and the processor clocks
0 = Processor clock/peripheral clock ratio forced to 1:1

bit 10-8 **FRCDIV<2:0>:** Internal Fast RC Oscillator Postscaler bits
111 = FRC divide-by-256
110 = FRC divide-by-64
101 = FRC divide-by-32
100 = FRC divide-by-16
011 = FRC divide-by-8
010 = FRC divide-by-4
001 = FRC divide-by-2
000 = FRC divide-by-1 (default)

bit 7-6 **PLLPOST<1:0>:** PLL VCO Output Divider Select bits (also denoted as 'N2', PLL postscaler)
11 = Output/8
10 = Reserved
01 = Output/4 (default)
00 = Output/2

bit 5 **Unimplemented:** Read as '0'

bit 4-0 **PLLPRE<4:0>:** PLL Phase Detector Input Divider bits (also denoted as 'N1', PLL prescaler)
11111 = Input/33
•
•
•
00001 = Input/3
00000 = Input/2 (default)

Note 1: This register is reset only on a Power-on Reset (POR).
2: This bit is cleared when the ROI bit is set and an interrupt occurs.

9.0 POWER-SAVING FEATURES

Note 1: This data sheet summarizes the features of the dsPIC33FJ06GS101/X02 and dsPIC33FJ16GSX02/X04 families of devices. It is not intended to be a comprehensive reference source. To complement the information in this data sheet, refer to **"Watchdog Timer and Power-Saving Modes"** (DS70196) in the *"dsPIC33F/PIC24H Family Reference Manual"*, which is available from the Microchip web site (www.microchip.com).

2: Some registers and associated bits described in this section may not be available on all devices. Refer to **Section 4.0 "Memory Organization"** in this data sheet for device-specific register and bit information.

The dsPIC33FJ06GS101/X02 and dsPIC33FJ16GSX02/X04 devices provide the ability to manage power consumption by selectively managing clocking to the CPU and the peripherals. In general, a lower clock frequency and a reduction in the number of circuits being clocked constitutes lower consumed power. dsPIC33FJ06GS101/X02 and dsPIC33FJ16GSX02/X04 devices can manage power consumption in four different ways:

- Clock Frequency
- Instruction-Based Sleep and Idle modes
- Software-Controlled Doze mode
- Selective Peripheral Control in Software

Combinations of these methods can be used to selectively tailor an application's power consumption while still maintaining critical application features, such as timing-sensitive communications.

9.1 Clock Frequency and Clock Switching

The dsPIC33FJ06GS101/X02 and dsPIC33FJ16GSX02/X04 devices allow a wide range of clock frequencies to be selected under application control. If the system clock configuration is not locked, users can choose low-power or high-precision oscillators by simply changing the NOSC<2:0> bits (OSCCON<10:8>). The process of changing a system clock during operation, as well as limitations to the process, are discussed in more detail in **Section 8.0 "Oscillator Configuration"**.

9.2 Instruction-Based Power-Saving Modes

The dsPIC33FJ06GS101/X02 and dsPIC33FJ16GSX02/X04 devices have two special power-saving modes that are entered through the execution of a special PWRSAV instruction. Sleep mode stops clock operation and halts all code execution. Idle mode halts the CPU and code execution, but allows peripheral modules to continue operation. The assembler syntax of the PWRSAV instruction is shown in Example 9-1.

Note: SLEEP_MODE and IDLE_MODE are constants defined in the assembler include file for the selected device.

Sleep and Idle modes can be exited as a result of an enabled interrupt, WDT time-out or a device Reset. When the device exits these modes, it is said to wake-up.

9.2.1 SLEEP MODE

The following occur in Sleep mode:

- The system clock source is shut down. If an on-chip oscillator is used, it is turned off
- The device current consumption is reduced to a minimum, provided that no I/O pin is sourcing current
- The Fail-Safe Clock Monitor does not operate, since the system clock source is disabled
- The LPRC clock continues to run in Sleep mode if the WDT is enabled
- The WDT, if enabled, is automatically cleared prior to entering Sleep mode
- Some device features or peripherals may continue to operate. This includes the items such as the Input Change Notification on the I/O ports or peripherals that use an external clock input.
- Any peripheral that requires the system clock source for its operation is disabled

The device will wake-up from Sleep mode on any of these events:

- Any interrupt source that is individually enabled
- Any form of device Reset
- A WDT time-out

On wake-up from Sleep mode, the processor restarts with the same clock source that was active when Sleep mode was entered.

EXAMPLE 9-1: PWRSAV INSTRUCTION SYNTAX

```
PWRSAV  #SLEEP_MODE    ; Put the device into SLEEP mode
PWRSAV  #IDLE_MODE     ; Put the device into IDLE mode
```

13.0 INPUT CAPTURE

Note 1: This data sheet summarizes the features of the dsPIC33FJ06GS101/X02 and dsPIC33FJ16GSX02/X04 families of devices. It is not intended to be a comprehensive reference source. To complement the information in this data sheet, refer to **"Input Capture"** (DS70198) in the *"dsPIC33F/PIC24H Family Reference Manual"*, which is available on the Microchip web site (www.microchip.com).

2: Some registers and associated bits described in this section may not be available on all devices. Refer to **Section 4.0 "Memory Organization"** in this data sheet for device-specific register and bit information.

The input capture module is useful in applications requiring frequency (period) and pulse measurement. dsPIC33FJ06GS101/X02 and dsPIC33FJ16GSX02/X04 devices support up to two input capture channels.

The input capture module captures the 16-bit value of the selected Time Base register when an event occurs at the ICx pin. The events that cause a capture event are listed below in three categories:

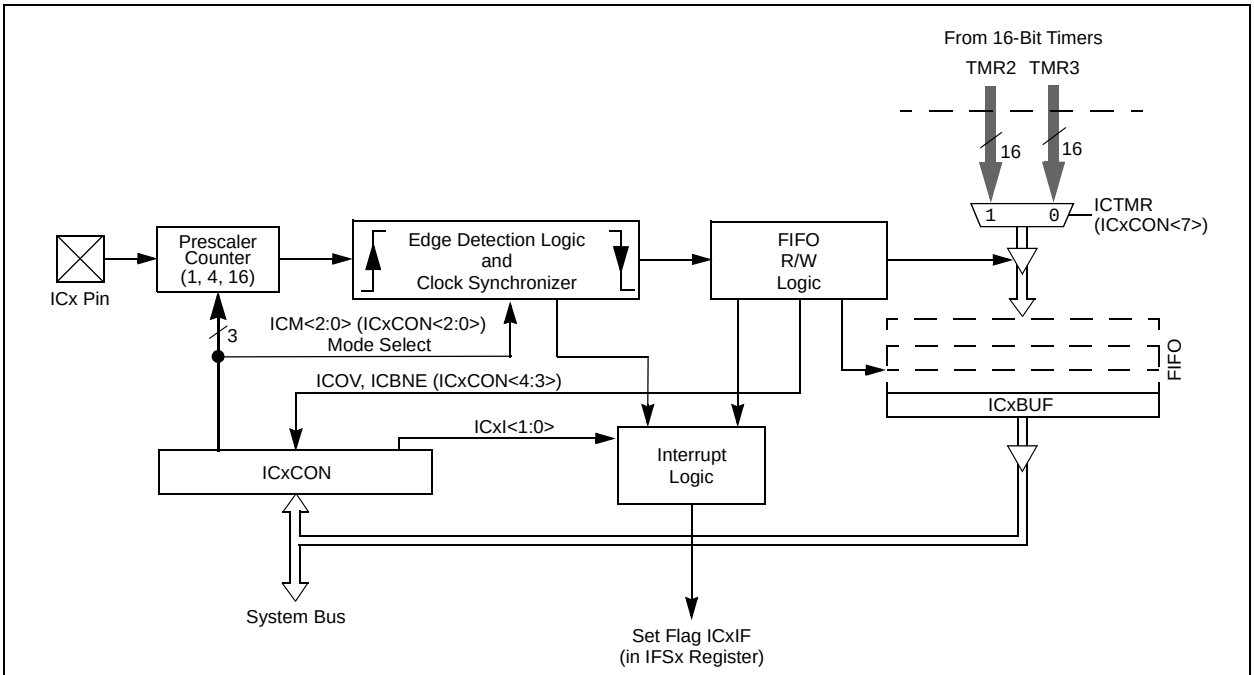
- Simple Capture Event modes:
  - Capture timer value on every falling edge of input at ICx pin
  - Capture timer value on every rising edge of input at ICx pin
- Capture timer value on every edge (rising and falling)
- Prescaler Capture Event modes:
  - Capture timer value on every 4th rising edge of input at ICx pin
  - Capture timer value on every 16th rising edge of input at ICx pin

Each input capture channel can select one of the two 16-bit timers (Timer2 or Timer3) for the time base. The selected timer can use either an internal or external clock.

Other operational features include:

- Device wake-up from capture pin during CPU Sleep and Idle modes
- Interrupt on input capture event
- 4-word FIFO buffer for capture values
  - Interrupt optionally generated after 1, 2, 3 or 4 buffer locations are filled
- Use of input capture to provide additional sources of external interrupts

FIGURE 13-1: INPUT CAPTURE x BLOCK DIAGRAM



Note 1: An 'x' in a signal, register or bit name denotes the number of the capture channel.

NOTES:

REGISTER 15-14: IOCONx: PWMx I/O CONTROL REGISTER

R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0
PENH	PENL	POLH	POLL	PMOD1(1)	PMOD0(1)	OVRENH	OVRENL
bit 15							bit 8

R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0
OVRDAT1	OVRDAT0	FLTDAT1(2)	FLTDAT0(2)	CLDAT1(2)	CLDAT0(2)	SWAP	OSYNC
bit 7							bit 0

Legend:			
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'	
-n = Value at POR	'1' = Bit is set	'0' = Bit is cleared	x = Bit is unknown

bit 15 **PENH:** PWMH Output Pin Ownership bit
1 = PWM module controls the PWMxH pin
0 = GPIO module controls the PWMxH pin

bit 14 **PENL:** PWML Output Pin Ownership bit
1 = PWM module controls the PWMxL pin
0 = GPIO module controls the PWMxL pin

bit 13 **POLH:** PWMH Output Pin Polarity bit
1 = PWMxH pin is active-low
0 = PWMxH pin is active-high

bit 12 **POLL:** PWML Output Pin Polarity bit
1 = PWMxL pin is active-low
0 = PWMxL pin is active-high

bit 11-10 **PMOD<1:0>:** PWM # I/O Pin Mode bits(1)
11 = PWM I/O pin pair is in the True Independent Output mode
10 = PWM I/O pin pair is in the Push-Pull Output mode
01 = PWM I/O pin pair is in the Redundant Output mode
00 = PWM I/O pin pair is in the Complementary Output mode

bit 9 **OVRENH:** Override Enable for PWMxH Pin bit
1 = OVRDAT<1> provides data for output on the PWMxH pin
0 = PWM generator provides data for the PWMxH pin

bit 8 **OVRENL:** Override Enable for PWMxL Pin bit
1 = OVRDAT<0> provides data for output on the PWMxL pin
0 = PWM generator provides data for the PWMxL pin

bit 7-6 **OVRDAT<1:0>:** Data for PWMxH and PWMxL Pins if Override is Enabled bits
If OVERENH = 1, then OVRDAT<1> provides data for PWMxH
If OVERENL = 1, then OVRDAT<0> provides data for PWMxL

bit 5-4 **FLTDAT<1:0>:** State for PWMxH and PWMxL Pins if FLTMOD is Enabled bits(2)
FCLCONx<IFLTMOD> = 0: Normal Fault mode:
If Fault is active, then FLTDAT<1> provides the state for PWMxH
If Fault is active, then FLTDAT<0> provides the state for PWMxL
FCLCONx<IFLTMOD> = 1: Independent Fault mode:
If current-limit is active, then FLTDAT<1> provides data for PWMxH
If Fault is active, then FLTDAT<0> provides the state for PWMxL

Note 1: These bits should be changed only when PTEN = 0. Changing the clock selection during operation will yield unpredictable results.

2: The state represents the active/inactive state of the PWM module depending on the POLH and POLL bit settings.

REGISTER 15-14: IOCONx: PWMx I/O CONTROL REGISTER (CONTINUED)

bit 3-2 **CLDAT<1:0>:** State for PWMxH and PWMxL Pins if CLMODE is Enabled bits(2)

FCLCONx<IFLTMOD> = 0: Normal Fault mode:
If current-limit is active, then CLDAT<1> provides the state for PWMxH
If current-limit is active, then CLDAT<0> provides the state for PWMxL

FCLCONx<IFLTMOD> = 1: Independent Fault mode:
CLDAT<1:0> bits are ignored.

bit 1 **SWAP<1:0>:** Swap PWMxH and PWMxL pins

1 = PWMxH output signal is connected to the PWMxL pin and the PWMxL signal is connected to the PWMxH pins
0 = PWMxH and PWMxL pins are mapped to their respective pins

bit 0 **OSYNC:** Output Override Synchronization bit

1 = Output overrides via the OVRDAT<1:0> bits are synchronized to the PWM time base
0 = Output overrides via the OVDDAT<1:0> bits occur on the next CPU clock boundary

Note 1: These bits should be changed only when PTEN = 0. Changing the clock selection during operation will yield unpredictable results.

2: The state represents the active/inactive state of the PWM module depending on the POLH and POLL bit settings.

REGISTER 18-1: UxMODE: UARTx MODE REGISTER (CONTINUED)

bit 4 **URXINV:** UARTx Receive Polarity Inversion bit
1 = UxRX Idle state is '0'
0 = UxRX Idle state is '1'

bit 3 **BRGH:** High Baud Rate Enable bit
1 = BRG generates 4 clocks per bit period (4x baud clock, High-Speed mode)
0 = BRG generates 16 clocks per bit period (16x baud clock, Standard mode)

bit 2-1 **PDSEL<1:0>:** Parity and Data Selection bits
11 = 9-bit data, no parity
10 = 8-bit data, odd parity
01 = 8-bit data, even parity
00 = 8-bit data, no parity

bit 0 **STSEL:** Stop Bit Selection bit
1 = Two Stop bits
0 = One Stop bit

Note 1: Refer to **"UART"** (DS70188) in the *"dsPIC33F/PIC24H Family Reference Manual"* for information on enabling the UART module for receive or transmit operation.

2: This feature is only available for the 16x BRG mode (BRGH = 0).

REGISTER 19-6: ADCPC1: ANALOG-TO-DIGITAL CONVERT PAIR CONTROL REGISTER 1 (CONTINUED)

bit 4-0 **TRGSRC2<4:0>:** Trigger 2 Source Selection bits(2)

Selects trigger source for conversion of Analog Channels AN5 and AN4.

11111 = Timer2 period match
•
•
•
11011 = Reserved
11010 = PWM Generator 4 current-limit ADC trigger
11001 = PWM Generator 3 current-limit ADC trigger
11000 = PWM Generator 2 current-limit ADC trigger
10111 = PWM Generator 1 current-limit ADC trigger
10110 = Reserved
•
•
•
10010 = Reserved
10001 = PWM Generator 4 secondary trigger is selected
10000 = PWM Generator 3 secondary trigger is selected
01111 = PWM Generator 2 secondary trigger is selected
01110 = PWM Generator 1 secondary trigger is selected
01101 = Reserved
01100 = Timer1 period match
•
•
•
01000 = Reserved
00111 = PWM Generator 4 primary trigger is selected
00110 = PWM Generator 3 primary trigger is selected
00101 = PWM Generator 2 primary trigger is selected
00100 = PWM Generator 1 primary trigger is selected
00011 = PWM Special Event Trigger is selected
00010 = Global software trigger is selected
00001 = Individual software trigger is selected
00000 = No conversion is enabled

Note 1: These bits are available in the dsPIC33FJ16GS402/404, dsPIC33FJ16GS504, dsPIC33FJ16GS502 and dsPIC33FJ06GS101 devices only.

2: These bits are available in the dsPIC33FJ16GS502, dsPIC33FJ16GS504, dsPIC33FJ06GS102, dsPIC33FJ06GS202 and dsPIC33FJ16GS402/404 devices only.

3: The trigger source must be set as a global software trigger prior to setting this bit to ‘1’. If other conversions are in progress, then the conversion will be performed when the conversion resources are available.

TABLE 21-2: dsPIC33F CONFIGURATION BITS DESCRIPTION (CONTINUED)

Bit Field	Register	RTSP Effect	Description
POSCMD<1:0>	FOSC	Immediate	Primary Oscillator Mode Select bits 11 = Primary Oscillator is disabled 10 = HS Crystal Oscillator mode 01 = XT Crystal Oscillator mode 00 = EC (External Clock) mode
FWDTEN	FWDT	Immediate	Watchdog Timer Enable bit 1 = Watchdog Timer is always enabled (LPRC oscillator cannot be disabled; clearing the SWDTEN bit in the RCON register will have no effect) 0 = Watchdog Timer is enabled/disabled by user software (LPRC can be disabled by clearing the SWDTEN bit in the RCON register)
WINDIS	FWDT	Immediate	Watchdog Timer Window Enable bit 1 = Watchdog Timer in Non-Window mode 0 = Watchdog Timer in Window mode
WDTPRE	FWDT	Immediate	Watchdog Timer Prescaler bit 1 = 1:128 0 = 1:32
WDTPOST<3:0>	FWDT	Immediate	Watchdog Timer Postscaler bits 1111 = 1:32,768 1110 = 1:16,384 • • • 0001 = 1:2 0000 = 1:1
FPWRT<2:0>	FPOR	Immediate	Power-on Reset Timer Value Select bits 111 = PWRT = 128 ms 110 = PWRT = 64 ms 101 = PWRT = 32 ms 100 = PWRT = 16 ms 011 = PWRT = 8 ms 010 = PWRT = 4 ms 001 = PWRT = 2 ms 000 = PWRT = Disabled
JTAGEN	FICD	Immediate	JTAG Enable bit 1 = JTAG is enabled 0 = JTAG is disabled
ICS<1:0>	FICD	Immediate	ICD Communication Channel Select Enable bits 11 = Communicates on PGEC1 and PGED1 10 = Communicates on PGEC2 and PGED2 01 = Communicates on PGEC3 and PGED3 00 = Reserved, do not use.

TABLE 25-9: SPIx MASTER MODE (CKE = 0) TIMING REQUIREMENTS

AC CHARACTERISTICS		Standard Operating Conditions: 3.0V to 3.6V (unless otherwise stated) Operating temperature -40°C ≤ TA ≤ +150°C for High Temperature					
Param No.	Symbol	Characteristic(1)	Min	Typ	Max	Units	Conditions
HSP35	TscH2doV, TscL2doV	SDOx Data Output Valid after SCKx Edge	—	10	25	ns	
HSP40	TdiV2scH, TdiV2scL	Setup Time of SDIx Data Input to SCKx Edge	28	—	—	ns	
HSP41	TscH2diL, TscL2diL	Hold Time of SDIx Data Input to SCKx Edge	35	—	—	ns	

Note 1: These parameters are characterized but not tested in manufacturing.

TABLE 25-10: SPIx MODULE MASTER MODE (CKE = 1) TIMING REQUIREMENTS

AC CHARACTERISTICS		Standard Operating Conditions: 3.0V to 3.6V (unless otherwise stated) Operating temperature -40°C ≤ TA ≤ +150°C for High Temperature					
Param No.	Symbol	Characteristic(1)	Min	Typ	Max	Units	Conditions
HSP35	TscH2doV, TscL2doV	SDOx Data Output Valid after SCKx Edge	—	10	25	ns	
HSP36	TdoV2sc, TdoV2scL	SDOx Data Output Setup to First SCKx Edge	35	—	—	ns	
HSP40	TdiV2scH, TdiV2scL	Setup Time of SDIx Data Input to SCKx Edge	28	—	—	ns	
HSP41	TscH2diL, TscL2diL	Hold Time of SDIx Data Input to SCKx Edge	35	—	—	ns	

Note 1: These parameters are characterized but not tested in manufacturing.

TABLE A-4: MAJOR SECTION UPDATES (CONTINUED)

Section Name	Update Description
Section 24.0 "Electrical Characteristics"	Updated the Absolute Maximum Ratings. Updated the Operating MIPS vs. Voltage (see Table 24-1). Updated Parameter DC10 and Note 4, and removed Parameter DC18 from the DC Temperature and Voltage Specifications (see Table 24-4). Updated Note 2 in the IDD Operating Current specification (see Table 24-5). Updated all Typical values and Note 2 in the IIDLE Operating Current specification (see Table 24-6). Updated Typical values for Parameters DC60d, DC60a, DC60b, and DC60c, and Note 2 in the IPD Operating Current specification (see Table 24-7). Added all Typical values and Note 2 in the IDOZE Operating Current specification (see Table 24-8). Updated Parameters DI19 and DI50, added Parameters DI128, DI129, DI60a, DI60b, and DI60c, and removed Parameter DI57 in the I/O Pin Input Specifications (see Table 24-9). Revised all I/O Pinout Output Specifications (see Table 24-10). Added Notes 2 and 3 to the BOR Electrical Characteristics (see Table 24-11). Added Note 1 to Internal Voltage Regulator Specifications (see Table 24-13). Updated the External Clock Timing diagram (see Figure 24-2). Added Note 2 to the PLL Clock Timing Specifications (see Table 24-17). Removed Note 2 from the Internal FRC Accuracy (see Table 24-19). Updated Parameters DO31 and DO32 in the I/O Timing Requirements (see Table 24-21). Updated the External Clock Timing Requirements for Timer1, Timer2, and Timer3 (see Table 24-23, Table 24-24, and Table 24-25, respectively). Updated Parameters OC15 and OC20 in the Simple OC/PWM Mode Timing Requirements (see Table 24-28). Revised all SPIx Module Timing Characteristics diagrams and all Timing Requirements (see Figure 24-11 through Figure 24-18 and Table 24-30 through Table 24-37, respectively). Added Note 2 to the 10-bit High-Speed ADC Module Specifications (see Table 24-40). Added Note 2 to the 10-bit High-Speed ADC Module Timing Requirements (see Table 24-41). Added Note 2 to the Comparator Module Specifications (see Table 24-42). Added Parameter DA08 and Note 2 in the DAC Module Specifications (see Table 24-43). Updated Parameter DA16 and Note 2 in the DAC Output Buffer DC Specifications (see Table 24-44).

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PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

dsPIC 33 FJ 06 GS1 02 T - 50 E / SP - XXX

- **Microchip Trademark**
- **Architecture**
- **Flash Memory Family**
- **Program Memory Size (Kbyte)**
- **Product Group**
- **Pin Count**
- **Tape and Reel Flag (if applicable)**
- **Speed (if applicable)**
- **Temperature Range**
- **Package**
- **Pattern**

Architecture:	33	=	16-bit Digital Signal Controller
Flash Memory Family:	FJ	=	Flash program memory, 3.3V
Product Group:	GS1	=	Switch Mode Power Supply (SMPS) family
	GS2	=	Switch Mode Power Supply (SMPS) family
	GS4	=	Switch Mode Power Supply (SMPS) family
	GS5	=	Switch Mode Power Supply (SMPS) family
Pin Count:	01	=	18-pin
	02	=	28-pin
	04	=	44-pin
Speed	50	=	50 MIPS
Temperature Range:	I	=	-40°C to+85°C (Industrial)
	E	=	-40°C to+125°C (Extended)
	H	=	-40°C to+150°C (High)
Package:	PT	=	Plastic Thin Quad Flatpack - 10x10x1 mm body (TQFP)
	ML	=	Plastic Quad Flat, No Lead Package - 8x8 mm body (QFN)
	MM	=	Plastic Quad Flat, No Lead Package - 6x6x0.9 mm body (QFN-S)
	SO	=	Plastic Small Outline - Wide - 7.50 mm body (SOIC)
	SP	=	Skinny Plastic Dual In-Line - 300 mil body (SPDIP)
	TL	=	Very Thin Leadless Array - 6x6 mm body (VTLA)

Examples:

a) dsPIC33FJ06GS102-E/SP: SMPS dsPIC33, 6-Kbyte program memory, 28-pin, Extended temperature, SPDIP package.