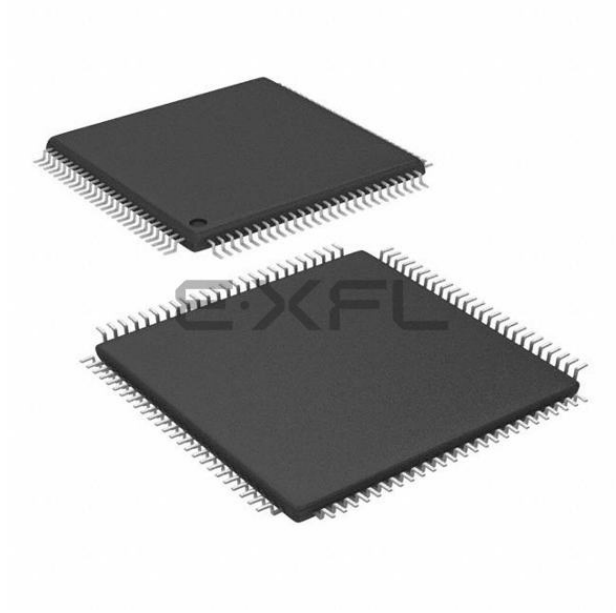
Microchip Technology - PIC24HJ64GP510T-I/PF Datasheet



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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	Obsolete
Core Processor	PIC
Core Size	16-Bit
Speed	40 MIPs
Connectivity	CANbus, I²C, IrDA, LINbus, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, DMA, POR, PWM, WDT
Number of I/O	85
Program Memory Size	64KB (22K x 24)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	8K x 8
Voltage - Supply (Vcc/Vdd)	3V ~ 3.6V
Data Converters	A/D 32x10b/12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	100-TQFP
Supplier Device Package	100-TQFP (14x14)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic24hj64gp510t-i-pf

Communication Modules:

- 3-wire SPI (up to two modules):
  - Framing supports I/O interface to simple codecs
  - Supports 8-bit and 16-bit data
  - Supports all serial clock formats and sampling modes
- I^2C™ (up to two modules):
  - Full Multi-Master Slave mode support
  - 7-bit and 10-bit addressing
  - Bus collision detection and arbitration
  - Integrated signal conditioning
  - Slave address masking
- UART (up to two modules):
  - Interrupt on address bit detect
  - Interrupt on UART error
  - Wake-up on Start bit from Sleep mode
  - 4-character TX and RX FIFO buffers
  - LIN bus support
  - IrDA® encoding and decoding in hardware
  - High-Speed Baud mode
  - Hardware Flow Control with CTS and RTS
- Enhanced CAN (ECAN™ module) 2.0B active (up to two modules):
  - Up to eight transmit and up to 32 receive buffers
  - 16 receive filters and 3 masks
  - Loopback, Listen Only and Listen All Messages modes for diagnostics and bus monitoring
  - Wake-up on CAN message
  - Automatic processing of Remote Transmission Requests
  - FIFO mode using DMA
  - DeviceNet™ addressing support

Analog-to-Digital Converters:

- Up to two Analog-to-Digital Converter (ADC) modules in a device
- 10-bit, 1.1 Msps or 12-bit, 500 ksps conversion:
  - Two, four, or eight simultaneous samples
  - Up to 32 input channels with auto-scanning
  - Conversion start can be manual or synchronized with one of four trigger sources
  - Conversion possible in Sleep mode
  - ±1 LSb max integral nonlinearity
  - ±1 LSb max differential nonlinearity

CMOS Flash Technology:

- Low-power, high-speed Flash technology
- Fully static design
- 3.3V (±10%) operating voltage
- Industrial temperature
- Low-power consumption

Packaging:

- 100-pin TQFP (14x14x1 mm and 12x12x1 mm)
- 64-pin TQFP (10x10x1 mm)

Note:	See the device variant tables for exact peripheral features per device.

Pin Diagrams (Continued)

100-Pin TQFP

■ = Pins are up to 5V tolerant

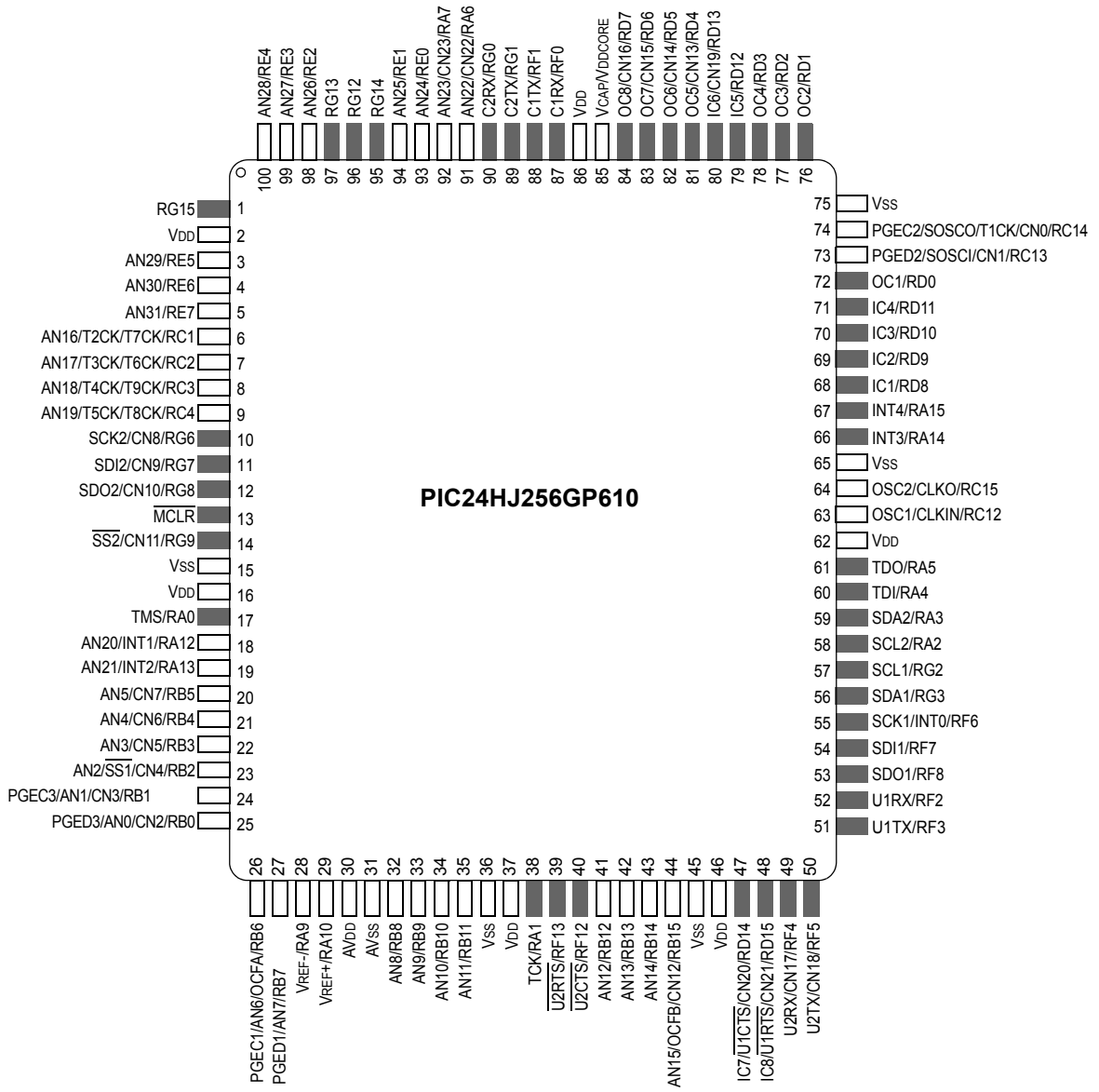


TABLE 4-2: CHANGE NOTIFICATION REGISTER MAP FOR PIC24HJXXXGPX10 DEVICES

SFR 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
CNEN1	0060	CN15IE	CN14IE	CN13IE	CN12IE	CN11IE	CN10IE	CN9IE	CN8IE	CN7IE	CN6IE	CN5IE	CN4IE	CN3IE	CN2IE	CN1IE	CN0IE	0000
CNEN2	0062	—	—	—	—	—	—	—	—	CN23IE	CN22IE	CN21IE	CN20IE	CN19IE	CN18IE	CN17IE	CN16IE	0000
CNPU1	0068	CN15PUE	CN14PUE	CN13PUE	CN12PUE	CN11PUE	CN10PUE	CN9PUE	CN8PUE	CN7PUE	CN6PUE	CN5PUE	CN4PUE	CN3PUE	CN2PUE	CN1PUE	CN0PUE	0000
CNPU2	006A	—	—	—	—	—	—	—	—	CN23PUE	CN22PUE	CN21PUE	CN20PUE	CN19PUE	CN18PUE	CN17PUE	CN16PUE	0000

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

TABLE 4-3: CHANGE NOTIFICATION REGISTER MAP FOR PIC24HJXXXGPX08 DEVICES

SFR 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
CNEN1	0060	CN15IE	CN14IE	CN13IE	CN12IE	CN11IE	CN10IE	CN9IE	CN8IE	CN7IE	CN6IE	CN5IE	CN4IE	CN3IE	CN2IE	CN1IE	CN0IE	0000
CNEN2	0062	—	—	—	—	—	—	—	—	—	—	CN21IE	CN20IE	CN19IE	CN18IE	CN17IE	CN16IE	0000
CNPU1	0068	CN15PUE	CN14PUE	CN13PUE	CN12PUE	CN11PUE	CN10PUE	CN9PUE	CN8PUE	CN7PUE	CN6PUE	CN5PUE	CN4PUE	CN3PUE	CN2PUE	CN1PUE	CN0PUE	0000
CNPU2	006A	—	—	—	—	—	—	—	—	—	—	CN21PUE	CN20PUE	CN19PUE	CN18PUE	CN17PUE	CN16PUE	0000

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

TABLE 4-4: CHANGE NOTIFICATION REGISTER MAP FOR PIC24HJXXXGPX06 DEVICES

SFR 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
CNEN1	0060	CN15IE	CN14IE	CN13IE	CN12IE	CN11IE	CN10IE	CN9IE	CN8IE	CN7IE	CN6IE	CN5IE	CN4IE	CN3IE	CN2IE	CN1IE	CN0IE	0000
CNEN2	0062	—	—	—	—	—	—	—	—	—	—	CN21IE	CN20IE	—	CN18IE	CN17IE	CN16IE	0000
CNPU1	0068	CN15PUE	CN14PUE	CN13PUE	CN12PUE	CN11PUE	CN10PUE	CN9PUE	CN8PUE	CN7PUE	CN6PUE	CN5PUE	CN4PUE	CN3PUE	CN2PUE	CN1PUE	CN0PUE	0000
CNPU2	006A	—	—	—	—	—	—	—	—	—	—	CN21PUE	CN20PUE	—	CN18PUE	CN17PUE	CN16PUE	0000

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

TABLE 4-15: ADC1 REGISTER MAP

File Name	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
ADC1BUF0	0300	ADC Data Buffer 0																xxxx
AD1CON1	0320	ADON	—	ADSIDL	ADDMABM	—	AD12B	FORM<1:0>		SSRC<2:0>			—	SIMSAM	ASAM	SAMP	DONE	0000
AD1CON2	0322	VCFG<2:0>			—	—	CSCNA	CHPS<1:0>		BUFS	—	SMPI<3:0>				BUFM	ALTS	0000
AD1CON3	0324	ADRC	—	—	SAMC<4:0>					ADCS<7:0>								0000
AD1CHS123	0326	—	—	—	—	—	CH123NB<1:0>		CH123SB	—	—	—	—	—	CH123NA<1:0>		CH123SA	0000
AD1CHS0	0328	CH0NB	—	—	CH0SB<4:0>					CH0NA	—	—	CH0SA<4:0>					0000
AD1PCFGH(1)	032A	PCFG31	PCFG30	PCFG29	PCFG28	PCFG27	PCFG26	PCFG25	PCFG24	PCFG23	PCFG22	PCFG21	PCFG20	PCFG19	PCFG18	PCFG17	PCFG16	0000
AD1PCFGL	032C	PCFG15	PCFG14	PCFG13	PCFG12	PCFG11	PCFG10	PCFG9	PCFG8	PCFG7	PCFG6	PCFG5	PCFG4	PCFG3	PCFG2	PCFG1	PCFG0	0000
AD1CSSH(1)	032E	CSS31	CSS30	CSS29	CSS28	CSS27	CSS26	CSS25	CSS24	CSS23	CSS22	CSS21	CSS20	CSS19	CSS18	CSS17	CSS16	0000
AD1CSSL	0330	CSS15	CSS14	CSS13	CSS12	CSS11	CSS10	CSS9	CSS8	CSS7	CSS6	CSS5	CSS4	CSS3	CSS2	CSS1	CSS0	0000
AD1CON4	0332	—	—	—	—	—	—	—	—	—	—	—	—	—	DMABL<2:0>			0000
Reserved	0334-033E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000

Legend: x = unknown value on Reset, — = unimplemented, read as '0'. Reset values are shown in hexadecimal for PinHigh devices.
Note 1: Not all ANx inputs are available on all devices. See the device pin diagrams for available ANx inputs.

TABLE 4-16: ADC2 REGISTER MAP

File Name	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
ADC2BUF0	0340	ADC Data Buffer 0																xxxx
AD2CON1	0360	ADON	—	ADSIDL	ADDMABM	—	AD12B	FORM<1:0>		SSRC<2:0>			—	SIMSAM	ASAM	SAMP	DONE	0000
AD2CON2	0362	VCFG<2:0>			—	—	CSCNA	CHPS<1:0>		BUFS	—	SMPI<3:0>				BUFM	ALTS	0000
AD2CON3	0364	ADRC	—	—	SAMC<4:0>					ADCS<7:0>								0000
AD2CHS123	0366	—	—	—	—	—	CH123NB<1:0>		CH123SB	—	—	—	—	—	CH123NA<1:0>		CH123SA	0000
AD2CHS0	0368	CH0NB	—	—	—	CH0SB<3:0>				CH0NA	—	—	—	CH0SA<3:0>				0000
Reserved	036A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
AD2PCFGL	036C	PCFG15	PCFG14	PCFG13	PCFG12	PCFG11	PCFG10	PCFG9	PCFG8	PCFG7	PCFG6	PCFG5	PCFG4	PCFG3	PCFG2	PCFG1	PCFG0	0000
Reserved	036E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
AD2CSSL	0370	CSS15	CSS14	CSS13	CSS12	CSS11	CSS10	CSS9	CSS8	CSS7	CSS6	CSS5	CSS4	CSS3	CSS2	CSS1	CSS0	0000
AD2CON4	0372	—	—	—	—	—	—	—	—	—	—	—	—	—	DMABL<2:0>			0000
Reserved	0374-037E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000

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

TABLE 4-24: PORTA REGISTER MAP(1)

File Name	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
TRISA	02C0	TRISA15	TRISA14	TRISA13	TRISA12	—	TRISA10	TRISA9	—	TRISA7	TRISA6	TRISA5	TRISA4	TRISA3	TRISA2	TRISA1	TRISA0	F6FF
PORTA	02C2	RA15	RA14	RA13	RA12	—	RA10	RA9	—	RA7	RA6	RA5	RA4	RA3	RA2	RA1	RA0	xxxx
LATA	02C4	LATA15	LATA14	LATA13	LATA12	—	LATA10	LATA9	—	LATA7	LATA6	LATA5	LATA4	LATA3	LATA2	LATA1	LATA0	xxxx
ODCA	06C0	ODCA15	ODCA14	—	—	—	—	—	—	—	—	ODCA5	ODCA4	ODCA3	ODCA2	ODCA1	ODCA0	0000

Legend: x = unknown value on Reset, — = unimplemented, read as '0'. Reset values are shown in hexadecimal for PinHigh devices.
Note 1: The actual set of I/O port pins varies from one device to another. Please refer to the corresponding pinout diagrams.

TABLE 4-25: PORTB REGISTER MAP(1)

File Name	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
TRISB	02C6	TRISB15	TRISB14	TRISB13	TRISB12	TRISB11	TRISB10	TRISB9	TRISB8	TRISB7	TRISB6	TRISB5	TRISB4	TRISB3	TRISB2	TRISB1	TRISB0	FFFF
PORTB	02C8	RB15	RB14	RB13	RB12	RB11	RB10	RB9	RB8	RB7	RB6	RB5	RB4	RB3	RB2	RB1	RB0	xxxx
LATB	02CA	LATB15	LATB14	LATB13	LATB12	LATB11	LATB10	LATB9	LATB8	LATB7	LATB6	LATB5	LATB4	LATB3	LATB2	LATB1	LATB0	xxxx

Legend: x = unknown value on Reset, — = unimplemented, read as '0'. Reset values are shown in hexadecimal for PinHigh devices.
Note 1: The actual set of I/O port pins varies from one device to another. Please refer to the corresponding pinout diagrams.

TABLE 4-26: PORTC REGISTER MAP(1)

File Name	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
TRISC	02CC	TRISC15	TRISC14	TRISC13	TRISC12	—	—	—	—	—	—	—	TRISC4	TRISC3	TRISC2	TRISC1	—	F01E
PORTC	02CE	RC15	RC14	RC13	RC12	—	—	—	—	—	—	—	RC4	RC3	RC2	RC1	—	xxxx
LATC	02D0	LATC15	LATC14	LATC13	LATC12	—	—	—	—	—	—	—	LATC4	LATC3	LATC2	LATC1	—	xxxx

Legend: x = unknown value on Reset, — = unimplemented, read as '0'. Reset values are shown in hexadecimal for PinHigh devices.
Note 1: The actual set of I/O port pins varies from one device to another. Please refer to the corresponding pinout diagrams.

TABLE 4-27: PORTD REGISTER MAP(1)

File Name	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
TRISD	02D2	TRISD15	TRISD14	TRISD13	TRISD12	TRISD11	TRISD10	TRISD9	TRISD8	TRISD7	TRISD6	TRISD5	TRISD4	TRISD3	TRISD2	TRISD1	TRISD0	FFFF
PORTD	02D4	RD15	RD14	RD13	RD12	RD11	RD10	RD9	RD8	RD7	RD6	RD5	RD4	RD3	RD2	RD1	RD0	xxxx
LATD	02D6	LATD15	LATD14	LATD13	LATD12	LATD11	LATD10	LATD9	LATD8	LATD7	LATD6	LATD5	LATD4	LATD3	LATD2	LATD1	LATD0	xxxx
ODCD	06D2	ODCD15	ODCD14	ODCD13	ODCD12	ODCD11	ODCD10	ODCD9	ODCD8	ODCD7	ODCD6	ODCD5	ODCD4	ODCD3	ODCD2	ODCD1	ODCD0	0000

Legend: x = unknown value on Reset, — = unimplemented, read as '0'. Reset values are shown in hexadecimal for PinHigh devices.
Note 1: The actual set of I/O port pins varies from one device to another. Please refer to the corresponding pinout diagrams.

For remapping operations, the 8-bit Program Space Visibility register (PSVPAG) is used to define a 16K word page in the program space. When the Most Significant bit of the EA is '1', PSVPAG is concatenated with the lower 15 bits of the EA to form a 23-bit program space address. Unlike table operations, this limits remapping operations strictly to the user memory area.

Table 4-35 and Figure 4-6 show how the program EA is created for table operations and remapping accesses from the data EA. Here, P<23:0> refers to a program space word, whereas D<15:0> refers to a data space word.

TABLE 4-35: PROGRAM SPACE ADDRESS CONSTRUCTION

Access Type	Access Space	Program Space Address				
		<23>	<22:16>	<15>	<14:1>	<0>
Instruction Access (Code Execution)	User	0	PC<22:1>			0
		0xxx xxxx xxxx xxxx xxxx xxx0				
TBLRD/TBLWT (Byte/Word Read/Write)	User	TBLPAG<7:0>		Data EA<15:0>		
		0xxx xxxx		xxxx xxxx xxxx xxxx		
	Configuration	TBLPAG<7:0>		Data EA<15:0>		
		1xxx xxxx		xxxx xxxx xxxx xxxx		
Program Space Visibility (Block Remap/Read)	User	0	PSVPAG<7:0>		Data EA<14:0>(1)	
		0	xxxx xxxx		xxx xxxx xxxx xxxx	

Note 1: Data EA<15> is always '1' in this case, but is not used in calculating the program space address. Bit 15 of the address is PSVPAG<0>.

4.4.3 READING DATA FROM PROGRAM MEMORY USING PROGRAM SPACE VISIBILITY

The upper 32 Kbytes of data space may optionally be mapped into any 16K word page of the program space. This option provides transparent access of stored constant data from the data space without the need to use special instructions (i.e., TBLRDL/H).

Program space access through the data space occurs if the Most Significant bit of the data space EA is '1' and program space visibility is enabled by setting the PSV bit in the Core Control register (CORCON<2>). The location of the program memory space to be mapped into the data space is determined by the Program Space Visibility Page register (PSVPAG). This 8-bit register defines any one of 256 possible pages of 16K words in program space. In effect, PSVPAG functions as the upper 8 bits of the program memory address, with the 15 bits of the EA functioning as the lower bits. Note that by incrementing the PC by 2 for each program memory word, the lower 15 bits of data space addresses directly map to the lower 15 bits in the corresponding program space addresses.

Data reads to this area add an additional cycle to the instruction being executed, since two program memory fetches are required.

Although each data space address, 8000h and higher, maps directly into a corresponding program memory address (see Figure 4-8), only the lower 16 bits of the 24-bit program word are used to contain the data. The upper 8 bits of any program space location used as data should be programmed with '1111 1111' or '0000 0000' to force a NOP. This prevents possible issues should the area of code ever be accidentally executed.

Note:	PSV access is temporarily disabled during table reads/writes.

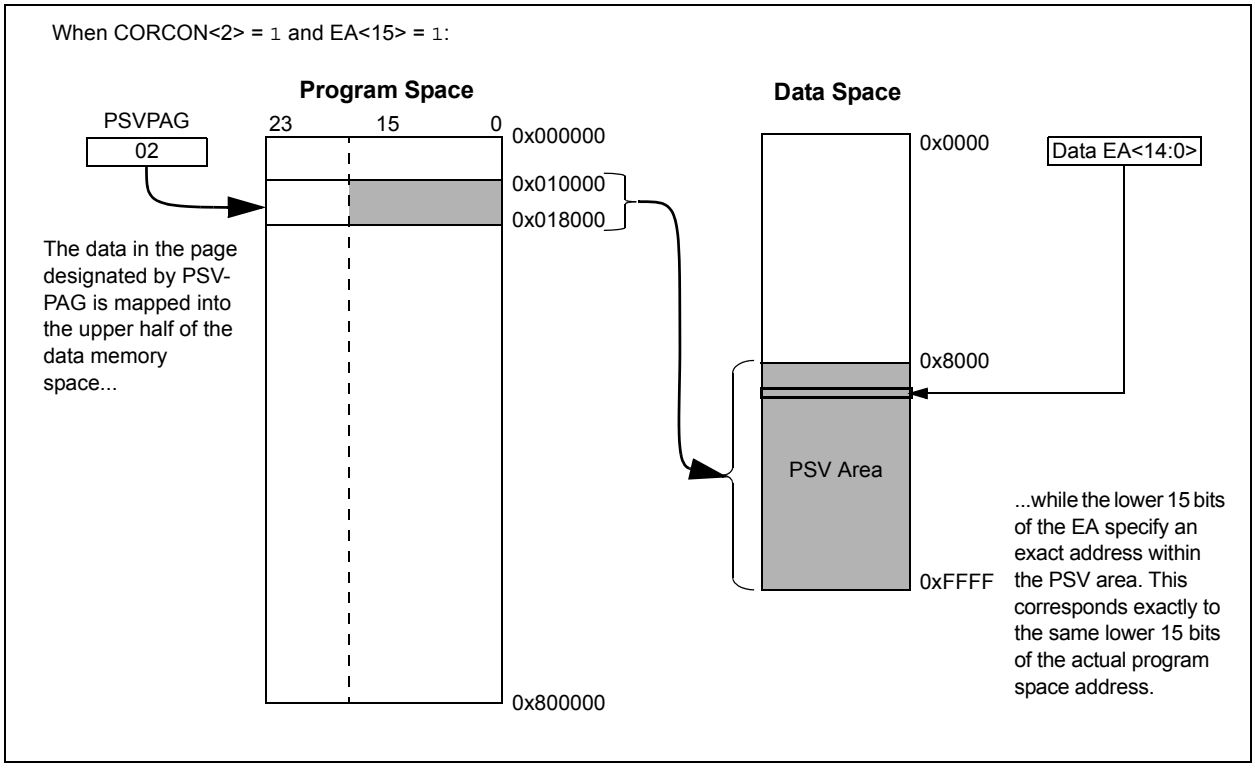
For operations that use PSV and are executed outside a REPEAT loop, the MOV and MOV.D instructions require one instruction cycle in addition to the specified execution time. All other instructions require two instruction cycles in addition to the specified execution time.

For operations that use PSV, which are executed inside a REPEAT loop, there will be some instances that require two instruction cycles in addition to the specified execution time of the instruction:

- Execution in the first iteration
- Execution in the last iteration
- Execution prior to exiting the loop due to an interrupt
- Execution upon re-entering the loop after an interrupt is serviced

Any other iteration of the REPEAT loop will allow the instruction accessing data, using PSV, to execute in a single cycle.

FIGURE 4-8: PROGRAM SPACE VISIBILITY OPERATION



REGISTER 5-1: NVMCON: FLASH MEMORY CONTROL REGISTER

R/SO-0(1)	R/W-0(1)	R/W-0(1)	U-0	U-0	U-0	U-0	U-0
WR	WREN	WRERR	—	—	—	—	—
bit 15							bit 8

U-0	R/W-0(1)	U-0	U-0	R/W-0(1)	R/W-0(1)	R/W-0(1)	R/W-0(1)
—	ERASE	—	—	NVMOP<3:0>(2)			
bit 7							bit 0

Legend:	SO = Settable only bit		
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 **WR:** Write Control bit
1 = Initiates a Flash memory program or erase operation. The operation is self-timed and the bit is cleared by hardware once operation is complete.
0 = Program or erase operation is complete and inactive

bit 14 **WREN:** Write Enable bit
1 = Enable Flash program/erase operations
0 = Inhibit Flash program/erase operations

bit 13 **WRERR:** Write Sequence Error Flag bit
1 = An improper program or erase sequence attempt or termination has occurred (bit is set automatically on any set attempt of the WR bit)
0 = The program or erase operation completed normally

bit 12-7 **Unimplemented:** Read as '0'

bit 6 **ERASE:** Erase/Program Enable bit
1 = Perform the erase operation specified by NVMOP<3:0> on the next WR command
0 = Perform the program operation specified by NVMOP<3:0> on the next WR command

bit 5-4 **Unimplemented:** Read as '0'

bit 3-0 **NVMOP<3:0>:** NVM Operation Select bits(2)
1111 = Memory bulk erase operation (ERASE = 1) or no operation (ERASE = 0)
1110 = Reserved
1101 = Erase General Segment and FGS Configuration Register (ERASE = 1) or no operation (ERASE = 0)
1100 = Erase Secure Segment and FSS Configuration Register (ERASE = 1) or no operation (ERASE = 0)
1011-0100 = Reserved
0011 = Memory word program operation (ERASE = 0) or no operation (ERASE = 1)
0010 = Memory page erase operation (ERASE = 1) or no operation (ERASE = 0)
0001 = Memory row program operation (ERASE = 0) or no operation (ERASE = 1)
0000 = Program or erase a single Configuration register byte

Note 1: These bits can only be reset on POR.

2: All other combinations of NVMOP<3:0> are unimplemented.

5.4.1 PROGRAMMING ALGORITHM FOR FLASH PROGRAM MEMORY

The user can program one row of program Flash memory at a time. To do this, it is necessary to erase the 8-row erase page that contains the desired row. The general process is:

1. Read eight rows of program memory (512 instructions) and store in data RAM.
2. Update the program data in RAM with the desired new data.
3. Erase the page (see Example 5-1):
   a) Set the NVMOP bits (NVMCON<3:0>) to '0010' to configure for block erase. Set the ERASE (NVMCON<6>) and WREN (NVMCON<14>) bits.
   b) Write the starting address of the page to be erased into the TBLPAG and W registers.
   c) Perform a dummy table write operation (TBLWTL) to any address within the page that needs to be erased.
   d) Write 0x55 to NVMKEY.
   e) Write 0xAA to NVMKEY.
   f) Set the WR bit (NVMCON<15>). The erase cycle begins and the CPU stalls for the duration of the erase cycle. When the erase is done, the WR bit is cleared automatically.
4. Write the first 64 instructions from data RAM into the program memory buffers (see Example 5-2).
5. Write the program block to Flash memory:
   a) Set the NVMOP bits to '0001' to configure for row programming. Clear the ERASE bit and set the WREN bit.
   b) Write 0x55 to NVMKEY.
   c) Write 0xAA to NVMKEY.
   d) Set the WR bit. The programming cycle begins and the CPU stalls for the duration of the write cycle. When the write to Flash memory is done, the WR bit is cleared automatically.
6. Repeat steps 4 and 5, using the next available 64 instructions from the block in data RAM by incrementing the value in TBLPAG, until all 512 instructions are written back to Flash memory.

For protection against accidental operations, the write initiate sequence for NVMKEY must be used to allow any erase or program operation to proceed. After the programming command has been executed, the user must wait for the programming time until programming is complete. The two instructions following the start of the programming sequence should be NOPs, as shown in Example 5-3.

EXAMPLE 5-1: ERASING A PROGRAM MEMORY PAGE

```
; Set up NVMCON for block erase operation
       MOV     #0x4042, W0                 ;
       MOV     W0, NVMCON                  ; Initialize NVMCON
; Init pointer to row to be ERASED
       MOV     #tblpage(PROG_ADDR), W0     ;
       MOV     W0, TBLPAG                  ; Initialize PM Page Boundary SFR
       MOV     #tbloffset(PROG_ADDR), W0   ; Initialize in-page EA<15:0> pointer
       TBLWTL  W0, [W0]                    ; Set base address of erase block
       DISI    #5                          ; Block all interrupts with priority <7
                                           ; for next 5 instructions
       MOV     #0x55, W0
       MOV     W0, NVMKEY                  ; Write the 55 key
       MOV     #0xAA, W1                   ;
       MOV     W1, NVMKEY                  ; Write the AA key
       BSET    NVMCON, #WR                 ; Start the erase sequence
       NOP                                 ; Insert two NOPs after the erase
       NOP                                 ; command is asserted
```

Note: A program memory page erase operation is set up by performing a dummy table write (TBLWTL) operation to any address within the page. This methodology is different from the page erase operation on dsPIC30F/33F devices in which the erase page was selected using a dedicated pair of registers (NVMADRU and NVMADR).

REGISTER 7-13: IEC3: INTERRUPT ENABLE CONTROL REGISTER 3

U-0	U-0	R/W-0	U-0	U-0	U-0	U-0	R/W-0
—	—	DMA5IE	—	—	—	—	C2IE
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
C2RXIE	INT4IE	INT3IE	T9IE	T8IE	MI2C2IE	SI2C2IE	T7IE
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 **DMA5IE:** DMA Channel 5 Data Transfer Complete Interrupt Enable bit
1 = Interrupt request enabled
0 = Interrupt request not enabled

bit 12-9 **Unimplemented:** Read as '0'

bit 8 **C2IE:** ECAN2 Event Interrupt Enable bit
1 = Interrupt request enabled
0 = Interrupt request not enabled

bit 7 **C2RXIE:** ECAN2 Receive Data Ready Interrupt Enable bit
1 = Interrupt request enabled
0 = Interrupt request not enabled

bit 6 **INT4IE:** External Interrupt 4 Enable bit
1 = Interrupt request enabled
0 = Interrupt request not enabled

bit 5 **INT3IE:** External Interrupt 3 Enable bit
1 = Interrupt request enabled
0 = Interrupt request not enabled

bit 4 **T9IE:** Timer9 Interrupt Enable bit
1 = Interrupt request enabled
0 = Interrupt request not enabled

bit 3 **T8IE:** Timer8 Interrupt Enable bit
1 = Interrupt request enabled
0 = Interrupt request not enabled

bit 2 **MI2C2IE:** I2C2 Master Events Interrupt Enable bit
1 = Interrupt request enabled
0 = Interrupt request not enabled

bit 1 **SI2C2IE:** I2C2 Slave Events Interrupt Enable bit
1 = Interrupt request enabled
0 = Interrupt request not enabled

bit 0 **T7IE:** Timer7 Interrupt Enable bit
1 = Interrupt request enabled
0 = Interrupt request not enabled

REGISTER 7-17: IPC2: INTERRUPT PRIORITY CONTROL REGISTER 2

U-0	R/W-1	R/W-0	R/W-0	U-0	R/W-1	R/W-0	R/W-0
—	U1RXIP<2:0>			—	SPI1IP<2:0>		
bit 15							bit 8

U-0	R/W-1	R/W-0	R/W-0	U-0	R/W-1	R/W-0	R/W-0
—	SPI1EIP<2:0>			—	T3IP<2:0>		
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 **U1RXIP<2:0>:** UART1 Receiver 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 **SPI1IP<2:0>:** SPI1 Event 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 **SPI1EIP<2:0>:** SPI1 Error Interrupt Priority bits
111 = Interrupt is priority 7 (highest priority interrupt)
•
•
•
001 = Interrupt is priority 1
000 = Interrupt source is disabled

bit 3 **Unimplemented:** Read as ‘0’

bit 2-0 **T3IP<2:0>:** Timer3 Interrupt Priority bits
111 = Interrupt is priority 7 (highest priority interrupt)
•
•
•
001 = Interrupt is priority 1
000 = Interrupt source is disabled

REGISTER 7-27: IPC12: INTERRUPT PRIORITY CONTROL REGISTER 12

U-0	R/W-1	R/W-0	R/W-0	U-0	R/W-1	R/W-0	R/W-0
—	T8IP<2:0>			—	MI2C2IP<2:0>		
bit 15							bit 8

U-0	R/W-1	R/W-0	R/W-0	U-0	R/W-1	R/W-0	R/W-0
—	SI2C2IP<2:0>			—	T7IP<2:0>		
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 **T8IP<2:0>:** Timer8 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 **MI2C2IP<2:0>:** I2C2 Master Events 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 **SI2C2IP<2:0>:** I2C2 Slave Events Interrupt Priority bits
111 = Interrupt is priority 7 (highest priority interrupt)
•
•
•
001 = Interrupt is priority 1
000 = Interrupt source is disabled

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

bit 2-0 **T7IP<2:0>:** Timer7 Interrupt Priority bits
111 = Interrupt is priority 7 (highest priority interrupt)
•
•
•
001 = Interrupt is priority 1
000 = Interrupt source is disabled

REGISTER 10-3: PMD3: PERIPHERAL MODULE DISABLE CONTROL REGISTER 3

R/W-0	R/W-0	R/W-0	R/W-0	U-0	U-0	U-0	U-0
T9MD	T8MD	T7MD	T6MD	—	—	—	—
bit 15							bit 8

U-0	U-0	U-0	U-0	U-0	U-0	R/W-0	R/W-0
—	—	—	—	—	—	I2C2MD	AD2MD
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 **T9MD:** Timer9 Module Disable bit
1 = Timer9 module is disabled
0 = Timer9 module is enabled

bit 14 **T8MD:** Timer8 Module Disable bit
1 = Timer8 module is disabled
0 = Timer8 module is enabled

bit 13 **T7MD:** Timer7 Module Disable bit
1 = Timer7 module is disabled
0 = Timer7 module is enabled

bit 12 **T6MD:** Timer6 Module Disable bit
1 = Timer6 module is disabled
0 = Timer6 module is enabled

bit 11-2 **Unimplemented:** Read as '0'

bit 1 **I2C2MD:** I2C2 Module Disable bit
1 = I2C2 module is disabled
0 = I2C2 module is enabled

bit 0 **AD2MD:** AD2 Module Disable bit
1 = AD2 module is disabled
0 = AD2 module is enabled

14.0 INPUT CAPTURE

Note:	This data sheet summarizes the features of the PIC24HJXXXGPX06/X08/X10 family of devices. However, it is not intended to be a comprehensive reference source. To complement the information in this data sheet, refer to the *"PIC24H Family Reference Manual"*, **Section 12. "Input Capture"** (DS70248), which is available from the Microchip website (www.microchip.com).

The input capture module is useful in applications requiring frequency (period) and pulse measurement. The PIC24HJXXXGPX06/X08/X10 devices support up to eight 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:

1. 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
2. Capture timer value on every edge (rising and falling)
3. 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

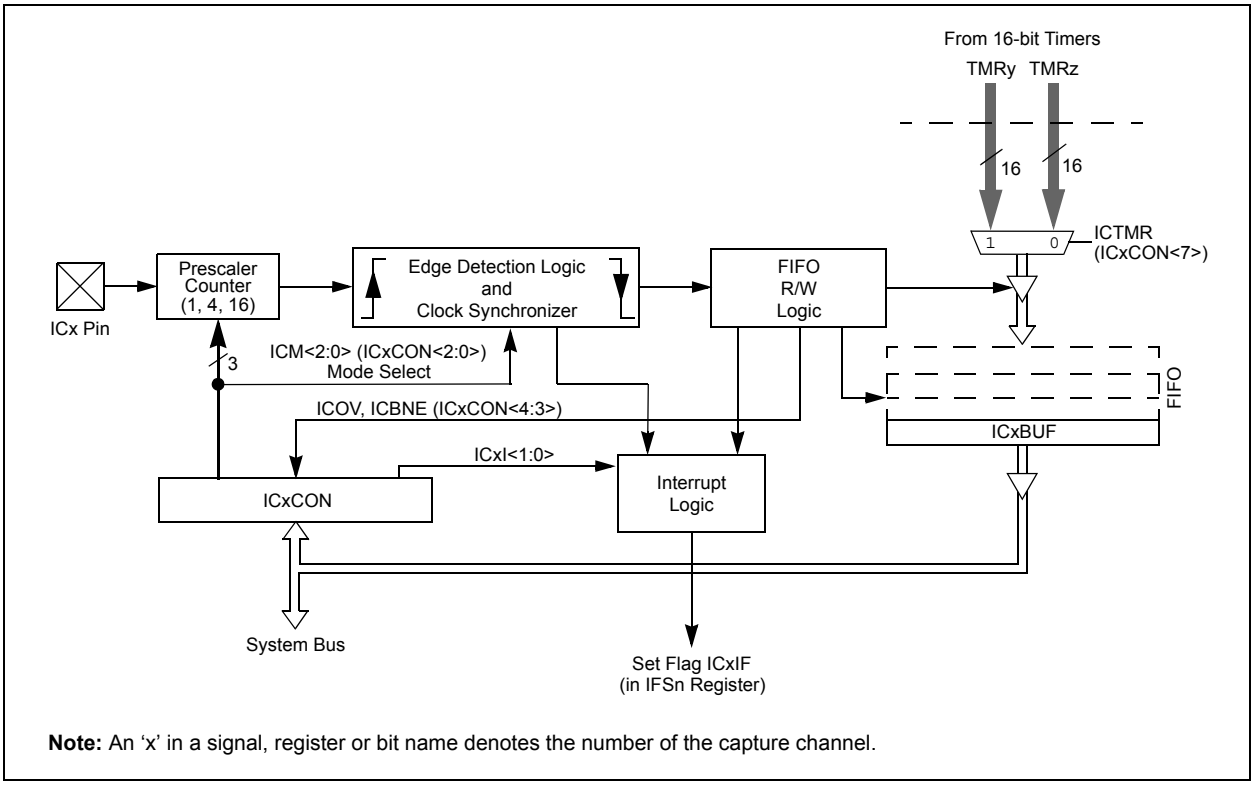
Each input capture channel can select between one of two 16-bit timers (Timer2 or Timer3) for the time base. The selected timer can use either an internal or external clock.

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
- Input capture can also be used to provide additional sources of external interrupts

Note:	Only IC1 and IC2 can trigger a DMA data transfer. If DMA data transfers are required, the FIFO buffer size must be set to 1 (ICI<1:0> = 00).

FIGURE 14-1: INPUT CAPTURE BLOCK DIAGRAM



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

REGISTER 17-1: I2CxCON: I2Cx CONTROL REGISTER

R/W-0	U-0	R/W-0	R/W-1 HC	R/W-0	R/W-0	R/W-0	R/W-0
I2CEN	—	I2CSIDL	SCLREL	IPMIEN	A10M	DISSLW	SMEN
bit 15							bit 8

R/W-0	R/W-0	R/W-0	R/W-0 HC	R/W-0 HC	R/W-0 HC	R/W-0 HC	R/W-0 HC
GCEN	STREN	ACKDT	ACKEN	RCEN	PEN	RSEN	SEN
bit 7							bit 0

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

bit 15 **I2CEN:** I2Cx Enable bit
1 = Enables the I2Cx module and configures the SDAx and SCLx pins as serial port pins
0 = Disables the I2Cx module. All I^2C pins are controlled by port functions.

bit 14 **Unimplemented:** Read as '0'

bit 13 **I2CSIDL:** Stop in Idle Mode bit
1 = Discontinue module operation when device enters an Idle mode
0 = Continue module operation in Idle mode

bit 12 **SCLREL:** SCLx Release Control bit (when operating as I^2C slave)
1 = Release SCLx clock
0 = Hold SCLx clock low (clock stretch)
If STREN = 1:
Bit is R/W (i.e., software may write '0' to initiate stretch and write '1' to release clock). Hardware clear at beginning of slave transmission. Hardware clear at end of slave reception.
If STREN = 0:
Bit is R/S (i.e., software may only write '1' to release clock). Hardware clear at beginning of slave transmission.

bit 11 **IPMIEN:** Intelligent Peripheral Management Interface (IPMI) Enable bit
1 = IPMI mode is enabled; all addresses Acknowledged
0 = IPMI mode disabled

bit 10 **A10M:** 10-bit Slave Address bit
1 = I2CxADD is a 10-bit slave address
0 = I2CxADD is a 7-bit slave address

bit 9 **DISSLW:** Disable Slew Rate Control bit
1 = Slew rate control disabled
0 = Slew rate control enabled

bit 8 **SMEN:** SMBus Input Levels bit
1 = Enable I/O pin thresholds compliant with SMBus specification
0 = Disable SMBus input thresholds

bit 7 **GCEN:** General Call Enable bit (when operating as I^2C slave)
1 = Enable interrupt when a general call address is received in the I2CxRSR (module is enabled for reception)
0 = General call address disabled

bit 6 **STREN:** SCLx Clock Stretch Enable bit (when operating as I^2C slave)
Used in conjunction with SCLREL bit.
1 = Enable software or receive clock stretching
0 = Disable software or receive clock stretching

20.0 10-BIT/12-BIT ANALOG-TO-DIGITAL CONVERTER (ADC)

Note: This data sheet summarizes the features of the PIC24HJXXXGPX06/X08/X10 family of devices. However, it is not intended to be a comprehensive reference source. To complement the information in this data sheet, refer to the *"PIC24H Family Reference Manual"*, **Section 16. "Analog-to-Digital Converter (ADC)"** (DS70225), which is available from the Microchip website (www.microchip.com).

The PIC24HJXXXGPX06/X08/X10 devices have up to 32 Analog-to-Digital input channels. These devices also have up to 2 Analog-to-Digital converter modules (ADCx, where 'x' = 1 or 2), each with its own set of Special Function Registers.

The AD12B bit (ADxCON1<10>) allows each of the ADC modules to be configured by the user as either a 10-bit, 4-sample/hold ADC (default configuration) or a 12-bit, 1-sample/hold ADC.

Note: The ADC module needs to be disabled before modifying the AD12B bit.

20.1 Key Features

The 10-bit ADC configuration has the following key features:

- Successive Approximation (SAR) conversion
- Conversion speeds of up to 1.1 Msps
- Up to 32 analog input pins
- External voltage reference input pins
- Simultaneous sampling of up to four analog input pins
- Automatic Channel Scan mode
- Selectable conversion trigger source
- Selectable Buffer Fill modes
- Two result alignment options (signed/unsigned)
- Operation during CPU Sleep and Idle modes

The 12-bit ADC configuration supports all the above features, except:

- In the 12-bit configuration, conversion speeds of up to 500 ksps are supported
- There is only 1 sample/hold amplifier in the 12-bit configuration, so simultaneous sampling of multiple channels is not supported.

Depending on the particular device pinout, the Analog-to-Digital Converter can have up to 32 analog input pins, designated AN0 through AN31. In addition, there are two analog input pins for external voltage reference connections. These voltage reference inputs may be shared with other analog input pins. The actual number of analog input pins and external voltage reference input configuration will depend on the specific device. Refer to the device data sheet for further details.

A block diagram of the Analog-to-Digital Converter is shown in Figure 20-1.

20.2 Analog-to-Digital Initialization

The following configuration steps should be performed.

1. Configure the ADC module:
   a) Select port pins as analog inputs (ADxPCFGH<15:0> or ADxPCFGL<15:0>)
   b) Select voltage reference source to match expected range on analog inputs (ADxCON2<15:13>)
   c) Select the analog conversion clock to match desired data rate with processor clock (ADxCON3<7:0>)
   d) Determine how many S/H channels will be used (ADxCON2<9:8> and ADxPCFGH<15:0> or ADxPCFGL<15:0>)
   e) Select the appropriate sample/conversion sequence (ADxCON1<7:5> and ADxCON3<12:8>)
   f) Select how conversion results are presented in the buffer (ADxCON1<9:8>)
   g) Turn on the ADC module (ADxCON1<15>)
2. Configure ADC interrupt (if required):
   a) Clear the ADxIF bit
   b) Select ADC interrupt priority

20.3 ADC and DMA

If more than one conversion result needs to be buffered before triggering an interrupt, DMA data transfers can be used. Both ADC1 and ADC2 can trigger a DMA data transfer. If ADC1 or ADC2 is selected as the DMA IRQ source, a DMA transfer occurs when the AD1IF or AD2IF bit gets set as a result of an ADC1 or ADC2 sample conversion sequence.

The SMPI<3:0> bits (ADxCON2<5:2>) are used to select how often the DMA RAM buffer pointer is incremented.

The ADDMABM bit (ADxCON1<12>) determines how the conversion results are filled in the DMA RAM buffer area being used for ADC. If this bit is set, DMA buffers are written in the order of conversion. The module will provide an address to the DMA channel that is the same as the address used for the non-DMA stand-alone buffer. If the ADDMABM bit is cleared, then DMA buffers are written in Scatter/Gather mode. The module will provide a scatter/gather address to the DMA channel, based on the index of the analog input and the size of the DMA buffer.

REGISTER 20-1: ADxCON1: ADCx CONTROL REGISTER 1 (where x = 1 or 2)

R/W-0	U-0	R/W-0	R/W-0	U-0	R/W-0	R/W-0	R/W-0
ADON	—	ADSIDL	ADDMABM	—	AD12B	FORM<1:0>	
bit 15							bit 8

R/W-0	R/W-0	R/W-0	U-0	R/W-0	R/W-0	R/W-0 HC,HS	R/C-0 HC, HS
SSRC<2:0>			—	SIMSAM	ASAM	SAMP	DONE
bit 7							bit 0

Legend:	HC = Cleared by hardware	HS = Set by hardware	
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 **ADON:** ADC Operating Mode bit
1 = ADC module is operating
0 = ADC module is off

bit 14 **Unimplemented:** Read as '0'

bit 13 **ADSIDL:** Stop in Idle Mode bit
1 = Discontinue module operation when device enters Idle mode
0 = Continue module operation in Idle mode

bit 12 **ADDMABM:** DMA Buffer Build Mode bit
1 = DMA buffers are written in the order of conversion. The module will provide an address to the DMA channel that is the same as the address used for the non-DMA stand-alone buffer
0 = DMA buffers are written in Scatter/Gather mode. The module will provide a scatter/gather address to the DMA channel, based on the index of the analog input and the size of the DMA buffer

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

bit 10 **AD12B:** 10-Bit or 12-Bit Operation Mode bit
1 = 12-bit, 1-channel ADC operation
0 = 10-bit, 4-channel ADC operation

bit 9-8 **FORM<1:0>:** Data Output Format bits
For 10-bit operation:
11 = Reserved
10 = Reserved
01 = Signed integer (DOUT = ssss sssd dddd dddd, where s = .NOT.d<9>)
00 = Integer (DOUT = 0000 00dd dddd dddd)
For 12-bit operation:
11 = Reserved
10 = Reserved
01 = Signed Integer (DOUT = ssss sddd dddd dddd, where s = .NOT.d<11>)
00 = Integer (DOUT = 0000 dddd dddd dddd)

bit 7-5 **SSRC<2:0>:** Sample Clock Source Select bits
111 = Internal counter ends sampling and starts conversion (auto-convert)
110 = Reserved
101 = Reserved
100 = Reserved
011 = Reserved
010 = GP timer (Timer3 for ADC1, Timer5 for ADC2) compare ends sampling and starts conversion
001 = Active transition on INT0 pin ends sampling and starts conversion
000 = Clearing sample bit ends sampling and starts conversion

bit 4 **Unimplemented:** Read as '0'

REGISTER 20-3: ADxCON3: ADCx CONTROL REGISTER 3

R/W-0	U-0	U-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0
ADRC	—	—	SAMC<4:0>(1)				
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
ADCS<7:0>(2)							
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 **ADRC:** ADC Conversion Clock Source bit
1 = ADC internal RC clock
0 = Clock derived from system clock

bit 14-13 **Unimplemented:** Read as '0'

bit 12-8 **SAMC<4:0>:** Auto Sample Time bits(1)
11111 = 31 TAD
•
•
•
00001 = 1 TAD
00000 = 0 TAD

bit 7-0 **ADCS<7:0>:** Analog-to-Digital Conversion Clock Select bits(2)
11111111 = Reserved
•
•
•
01000000 = Reserved
00111111 = TCY · (ADCS<7:0> + 1) = 64 · TCY = TAD
•
•
•
00000010 = TCY · (ADCS<7:0> + 1) = 3 · TCY = TAD
00000001 = TCY · (ADCS<7:0> + 1) = 2 · TCY = TAD
00000000 = TCY · (ADCS<7:0> + 1) = 1 · TCY = TAD

Note 1: This bit only used if ADxCON1<SSRC> = 1.

2: This bit is not used if ADxCON3<ADRC> = 1.

TABLE 24-39: ADC CONVERSION (10-BIT MODE) TIMING REQUIREMENTS

AC CHARACTERISTICS			Standard Operating Conditions: 3.0V to 3.6V (unless otherwise stated) Operating temperature -40°C ≤ TA ≤ +85°C for Industrial				
Param No.	Symbol	Characteristic	Min.	Typ(1)	Max.	Units	Conditions
Clock Parameters							
AD50	TAD	ADC Clock Period	76	—	—	ns	—
AD51	tRC	ADC Internal RC Oscillator Period	—	250	—	ns	—
Conversion Rate							
AD55	tCONV	Conversion Time	—	12 TAD	—	—	—
AD56	FCNV	Throughput Rate	—	—	1.1	Msps	—
AD57	TSAMP	Sample Time	2 TAD	—	—	—	—
Timing Parameters							
AD60	tPCS	Conversion Start from Sample Trigger(2)	2.0 TAD	—	3.0 TAD	—	Auto-Convert Trigger not selected
AD61	tPSS	Sample Start from Setting Sample (SAMP) bit(2)	2.0 TAD	—	3.0 TAD	—	—
AD62	tCSS	Conversion Completion to Sample Start (ASAM = 1)(2)	—	0.5 TAD	—	—	—
AD63	tDPU	Time to Stabilize Analog Stage from ADC Off to ADC On(2,3)	—	—	20	μs	—

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

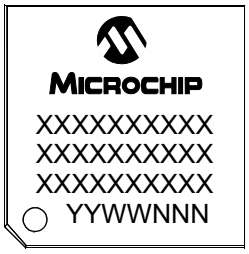
2: Because the sample caps eventually loses charge, clock rates below 10 kHz may affect linearity performance, especially at elevated temperatures.

3: tDPU is the time required for the ADC module to stabilize when it is turned on (AD1CON1<ADON> = 1). During this time, the ADC result is indeterminate.

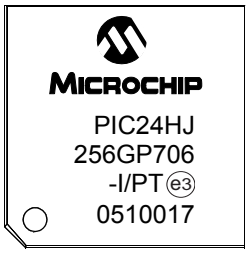
25.0 PACKAGING INFORMATION

25.1 Package Marking Information

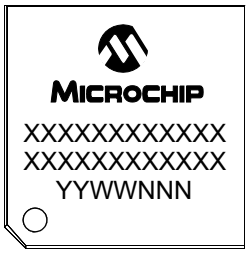
64-Lead TQFP (10x10x1 mm)



Example

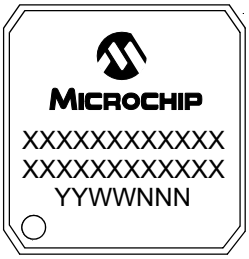


100-Lead TQFP (12x12x1 mm)



Example

100-Lead TQFP (14x14x1mm)



100-Lead TQFP (14x14x1mm)

Legend:	XX...X	Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.

Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information.