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"[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 | MIPS32® M4K™ |
| Core Size | 32-Bit Single-Core |
| Speed | 40MHz |
| Connectivity | I ² C, IrDA, LINbus, PMP, SPI, UART/USART |
| Peripherals | Brown-out Detect/Reset, DMA, I ² S, POR, PWM, WDT |
| Number of I/O | 53 |
| Program Memory Size | 128KB (128K x 8) |
| Program Memory Type | FLASH |
| EEPROM Size | - |
| RAM Size | 16K x 8 |
| Voltage - Supply (Vcc/Vdd) | 2.3V ~ 3.6V |
| Data Converters | A/D 28x10b |
| Oscillator Type | Internal |
| Operating Temperature | -40°C ~ 85°C (TA) |
| Mounting Type | Surface Mount |
| Package / Case | 64-TQFP |
| Supplier Device Package | 64-TQFP (10x10) |
| Purchase URL | https://www.e-xfl.com/product-detail/microchip-technology/pic32mx130f128h-i-pt |

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

Table of Contents

| | | |
|------|--|-----|
| 1.0 | Device Overview | 13 |
| 2.0 | Guidelines for Getting Started with 32-bit MCUs..... | 25 |
| 3.0 | CPU | 35 |
| 4.0 | Memory Organization | 39 |
| 5.0 | Interrupt Controller | 53 |
| 6.0 | Flash Program Memory | 63 |
| 7.0 | Resets | 69 |
| 8.0 | Oscillator Configuration | 73 |
| 9.0 | Direct Memory Access (DMA) Controller | 85 |
| 10.0 | USB On-The-Go (OTG)..... | 105 |
| 11.0 | I/O Ports | 129 |
| 12.0 | Timer1 | 159 |
| 13.0 | Timer2/3, Timer4/5 | 163 |
| 14.0 | Watchdog Timer (WDT) | 169 |
| 15.0 | Input Capture..... | 173 |
| 16.0 | Output Compare | 177 |
| 17.0 | Serial Peripheral Interface (SPI)..... | 181 |
| 18.0 | Inter-Integrated Circuit (I ² C)..... | 191 |
| 19.0 | Universal Asynchronous Receiver Transmitter (UART) | 199 |
| 20.0 | Parallel Master Port (PMP)..... | 207 |
| 21.0 | Real-Time Clock and Calendar (RTCC)..... | 221 |
| 22.0 | 10-bit Analog-to-Digital Converter (ADC) | 231 |
| 23.0 | Controller Area Network (CAN) | 243 |
| 24.0 | Comparator | 271 |
| 25.0 | Comparator Voltage Reference (CVREF) | 275 |
| 26.0 | Charge Time Measurement Unit (CTMU) | 279 |
| 27.0 | Power-Saving Features | 285 |
| 28.0 | Special Features | 291 |
| 29.0 | Instruction Set | 303 |
| 30.0 | Development Support..... | 305 |
| 31.0 | 40 MHz Electrical Characteristics..... | 309 |
| 32.0 | 50 MHz Electrical Characteristics..... | 353 |
| 33.0 | DC and AC Device Characteristics Graphs..... | 359 |
| 34.0 | Packaging Information..... | 361 |
| | The Microchip Web Site | 377 |
| | Customer Change Notification Service | 377 |
| | Customer Support..... | 377 |
| | Product Identification System | 378 |

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

TABLE 1-1: PINOUT I/O DESCRIPTIONS (CONTINUED)

| Pin Name | Pin Number | | Pin Type | Buffer Type | Description |
|----------|-------------------|-------------------|----------|-------------|-----------------------------------|
| | 64-pin QFN/TQFP | 100-pin TQFP | | | |
| RF0 | 58 | 87 | I/O | ST | PORTF is a bidirectional I/O port |
| RF1 | 59 | 88 | I/O | ST | |
| RF2 | 34 ⁽³⁾ | 52 | I/O | ST | |
| RF3 | 33 | 51 | I/O | ST | |
| RF4 | 31 | 49 | I/O | ST | |
| RF5 | 32 | 50 | I/O | ST | |
| RF6 | 35 ⁽¹⁾ | 55 ⁽¹⁾ | I/O | ST | |
| RF7 | — | 54 ⁽⁴⁾ | I/O | ST | |
| RF8 | — | 53 | I/O | ST | |
| RF12 | — | 40 | I/O | ST | |
| RF13 | — | 39 | I/O | ST | |
| RG0 | — | 90 | I/O | ST | PORTG is a bidirectional I/O port |
| RG1 | — | 89 | I/O | ST | |
| RG2 | 37 ⁽¹⁾ | 57 ⁽¹⁾ | I/O | ST | |
| RG3 | 36 ⁽¹⁾ | 56 ⁽¹⁾ | I/O | ST | |
| RG6 | 4 | 10 | I/O | ST | |
| RG7 | 5 | 11 | I/O | ST | |
| RG8 | 6 | 12 | I/O | ST | |
| RG9 | 8 | 14 | I/O | ST | |
| RG12 | — | 96 | I/O | ST | |
| RG13 | — | 97 | I/O | ST | |
| RG14 | — | 95 | I/O | ST | |
| RG15 | — | 1 | I/O | ST | |
| T1CK | 48 | 74 | I | ST | Timer1 External Clock Input |
| T2CK | PPS | PPS | I | ST | Timer2 External Clock Input |
| T3CK | PPS | PPS | I | ST | Timer3 External Clock Input |
| T4CK | PPS | PPS | I | ST | Timer4 External Clock Input |
| T5CK | PPS | PPS | I | ST | Timer5 External Clock Input |
| U1CTS | PPS | PPS | I | ST | UART1 Clear to Send |
| U1RTS | PPS | PPS | O | — | UART1 Ready to Send |
| U1RX | PPS | PPS | I | ST | UART1 Receive |
| U1TX | PPS | PPS | O | — | UART1 Transmit |
| U2CTS | PPS | PPS | I | ST | UART2 Clear to Send |
| U2RTS | PPS | PPS | O | — | UART2 Ready to Send |
| U2RX | PPS | PPS | I | ST | UART2 Receive |
| U2TX | PPS | PPS | O | — | UART2 Transmit |

Legend: CMOS = CMOS compatible input or output Analog = Analog input I = Input O = Output
ST = Schmitt Trigger input with CMOS levels TTL = TTL input buffer P = Power

- Note 1:** This pin is only available on devices without a USB module.
2: This pin is only available on devices with a USB module.
3: This pin is not available on 64-pin devices with a USB module.
4: This pin is only available on 100-pin devices without a USB module.

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

The MIPS architecture defines that the result of a multiply or divide operation be placed in the HI and LO registers. Using the Move-From-HI (MFHI) and Move-From-LO (MFLO) instructions, these values can be transferred to the General Purpose Register file.

In addition to the HI/LO targeted operations, the MIPS32® architecture also defines a multiply instruction, MUL, which places the least significant results in the primary register file instead of the HI/LO register pair. By avoiding the explicit MFLO instruction required when using the LO register, and by supporting multiple destination registers, the throughput of multiply-intensive operations is increased.

Two other instructions, Multiply-Add (MADD) and Multiply-Subtract (MSUB), are used to perform the multiply-accumulate and multiply-subtract operations. The MADD instruction multiplies two numbers and then adds the product to the current contents of the HI and LO registers. Similarly, the MSUB instruction multiplies two operands and then subtracts the product from the HI and LO registers. The MADD and MSUB operations are commonly used in DSP algorithms.

3.2.3 SYSTEM CONTROL COPROCESSOR (CP0)

In the MIPS architecture, CP0 is responsible for the virtual-to-physical address translation, the exception control system, the processor's diagnostics capability, the operating modes (Kernel, User and Debug) and whether interrupts are enabled or disabled. Configuration information, such as presence of options like MIPS16e®, is also available by accessing the CP0 registers, listed in Table 3-2.

TABLE 3-2: COPROCESSOR 0 REGISTERS

| Register Number | Register Name | Function |
|-----------------|-------------------------|--|
| 0-6 | Reserved | Reserved in the PIC32MX1XX/2XX/5XX 64/100-pin family core. |
| 7 | HWREna | Enables access via the RDHWR instruction to selected hardware registers. |
| 8 | BadVAddr ⁽¹⁾ | Reports the address for the most recent address-related exception. |
| 9 | Count ⁽¹⁾ | Processor cycle count. |
| 10 | Reserved | Reserved in the PIC32MX1XX/2XX/5XX 64/100-pin family core. |
| 11 | Compare ⁽¹⁾ | Timer interrupt control. |
| 12 | Status ⁽¹⁾ | Processor status and control. |
| 12 | IntCtl ⁽¹⁾ | Interrupt system status and control. |
| 13 | Cause ⁽¹⁾ | Cause of last general exception. |
| 14 | EPC ⁽¹⁾ | Program counter at last exception. |
| 15 | PRId | Processor identification and revision. |
| 15 | EBASE | Exception vector base register. |
| 16 | Config | Configuration register. |
| 16 | Config1 | Configuration register 1. |
| 16 | Config2 | Configuration register 2. |
| 16 | Config3 | Configuration register 3. |
| 17-22 | Reserved | Reserved in the PIC32MX1XX/2XX/5XX 64/100-pin family core. |
| 23 | Debug ⁽²⁾ | Debug control and exception status. |
| 24 | DEPC ⁽²⁾ | Program counter at last debug exception. |
| 25-29 | Reserved | Reserved in the PIC32MX1XX/2XX/5XX 64/100-pin family core. |
| 30 | ErrorEPC ⁽¹⁾ | Program counter at last error. |
| 31 | DESAVE ⁽²⁾ | Debug handler scratchpad register. |

Note 1: Registers used in exception processing.

2: Registers used during debug.

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

4.3 Control Registers

Register 4-1 through Register 4-8 are used for setting the RAM and Flash memory partitions for data and code.

REGISTER 4-1: BMXCON: BUS MATRIX CONFIGURATION REGISTER

| Bit Range | Bit 31/23/15/7 | Bit 30/22/14/6 | Bit 29/21/13/5 | Bit 28/20/12/4 | Bit 27/19/11/3 | Bit 26/18/10/2 | Bit 25/17/9/1 | Bit 24/16/8/0 |
|-----------|----------------|----------------|----------------|----------------|----------------|----------------|---------------|---------------|
| 31:24 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 |
| 23:16 | U-0 | U-0 | U-0 | R/W-1 | R/W-1 | R/W-1 | R/W-1 | R/W-1 |
| 15:8 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 |
| 7:0 | U-0 | R/W-1 | U-0 | U-0 | U-0 | R/W-0 | R/W-0 | R/W-1 |
| | — | BMX WSDRM | — | — | — | BMXARB<2:0> | | |

Legend:

R = Readable bit
-n = Value at POR

W = Writable bit
'1' = Bit is set

U = Unimplemented bit, read as '0'
'0' = Bit is cleared

- bit 31-21 **Unimplemented:** Read as '0'
- bit 20 **BMXERRIXI:** Enable Bus Error from IXI bit
 - 1 = Enable bus error exceptions for unmapped address accesses initiated from IXI shared bus
 - 0 = Disable bus error exceptions for unmapped address accesses initiated from IXI shared bus
- bit 19 **BMXERRICD:** Enable Bus Error from ICD Debug Unit bit
 - 1 = Enable bus error exceptions for unmapped address accesses initiated from ICD
 - 0 = Disable bus error exceptions for unmapped address accesses initiated from ICD
- bit 18 **BMXERRDMA:** Bus Error from DMA bit
 - 1 = Enable bus error exceptions for unmapped address accesses initiated from DMA
 - 0 = Disable bus error exceptions for unmapped address accesses initiated from DMA
- bit 17 **BMXERRDS:** Bus Error from CPU Data Access bit (disabled in Debug mode)
 - 1 = Enable bus error exceptions for unmapped address accesses initiated from CPU data access
 - 0 = Disable bus error exceptions for unmapped address accesses initiated from CPU data access
- bit 16 **BMXERRIS:** Bus Error from CPU Instruction Access bit (disabled in Debug mode)
 - 1 = Enable bus error exceptions for unmapped address accesses initiated from CPU instruction access
 - 0 = Disable bus error exceptions for unmapped address accesses initiated from CPU instruction access
- bit 15-7 **Unimplemented:** Read as '0'
- bit 6 **BMXWSDRM:** CPU Instruction or Data Access from Data RAM Wait State bit
 - 1 = Data RAM accesses from CPU have one wait state for address setup
 - 0 = Data RAM accesses from CPU have zero wait states for address setup
- bit 5-3 **Unimplemented:** Read as '0'
- bit 2-0 **BMXARB<2:0>:** Bus Matrix Arbitration Mode bits
 - 111 = Reserved (using these configuration modes will produce undefined behavior)
 - .
 - .
 - .
 - 011 = Reserved (using these configuration modes will produce undefined behavior)
 - 010 = Arbitration Mode 2
 - 001 = Arbitration Mode 1 (default)
 - 000 = Arbitration Mode 0

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

REGISTER 4-7: BMXPFMSZ: PROGRAM FLASH (PFM) SIZE REGISTER

| Bit Range | Bit 31/23/15/7 | Bit 30/22/14/6 | Bit 29/21/13/5 | Bit 28/20/12/4 | Bit 27/19/11/3 | Bit 26/18/10/2 | Bit 25/17/9/1 | Bit 24/16/8/0 |
|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------|---------------|
| 31:24 | R | R | R | R | R | R | R | R |
| BMXPFMSZ<31:24> | | | | | | | | |
| 23:16 | R | R | R | R | R | R | R | R |
| BMXPFMSZ<23:16> | | | | | | | | |
| 15:8 | R | R | R | R | R | R | R | R |
| BMXPFMSZ<15:8> | | | | | | | | |
| 7:0 | R | R | R | R | R | R | R | R |
| BMXPFMSZ<7:0> | | | | | | | | |

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 31-0 **BMXPFMSZ<31:0>**: Program Flash Memory (PFM) Size bits

Static value that indicates the size of the PFM in bytes:

0x00010000 = Device has 64 KB Flash

0x00020000 = Device has 128 KB Flash

0x00040000 = Device has 256 KB Flash

0x00080000 = Device has 512 KB Flash

REGISTER 4-8: BMXBOOTSZ: BOOT FLASH (IFM) SIZE REGISTER

| Bit Range | Bit 31/23/15/7 | Bit 30/22/14/6 | Bit 29/21/13/5 | Bit 28/20/12/4 | Bit 27/19/11/3 | Bit 26/18/10/2 | Bit 25/17/9/1 | Bit 24/16/8/0 |
|------------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------|---------------|
| 31:24 | R | R | R | R | R | R | R | R |
| BMXBOOTSZ<31:24> | | | | | | | | |
| 23:16 | R | R | R | R | R | R | R | R |
| BMXBOOTSZ<23:16> | | | | | | | | |
| 15:8 | R | R | R | R | R | R | R | R |
| BMXBOOTSZ<15:8> | | | | | | | | |
| 7:0 | R | R | R | R | R | R | R | R |
| BMXBOOTSZ<7:0> | | | | | | | | |

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 31-0 **BMXBOOTSZ<31:0>**: Boot Flash Memory (BFM) Size bits

Static value that indicates the size of the Boot PFM in bytes:

0x00000C00 = Device has 3 KB Boot Flash

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

7.0 RESETS

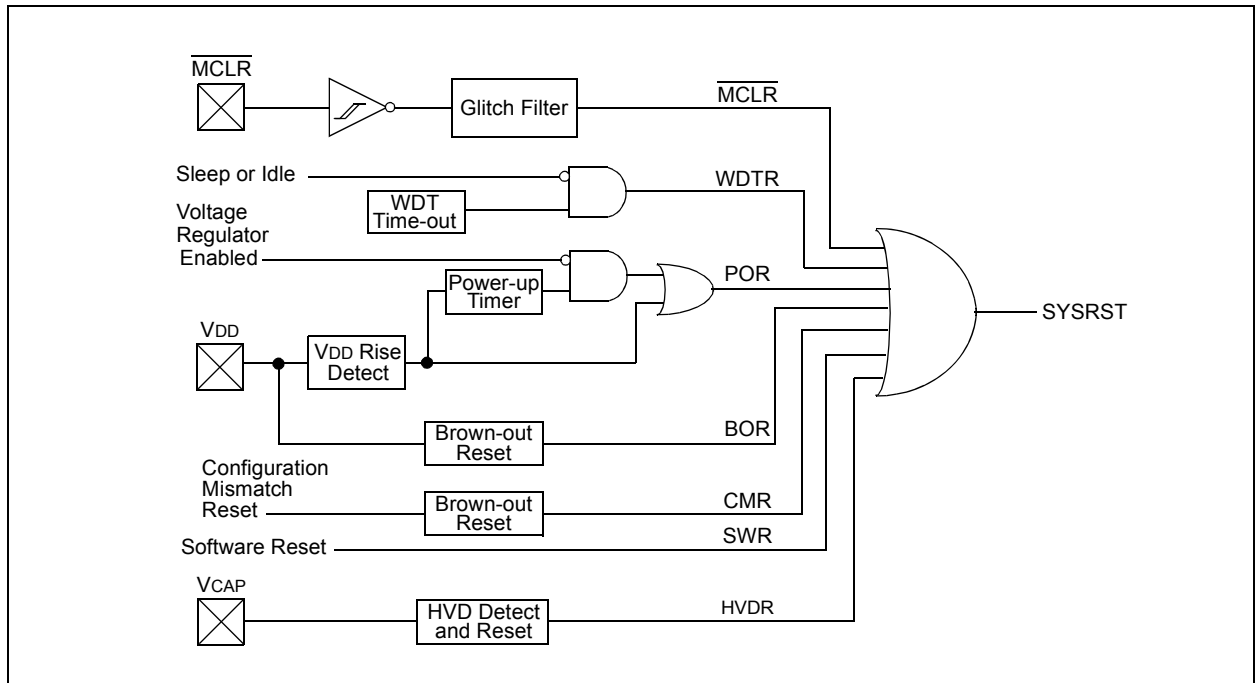
Note: This data sheet summarizes the features of the PIC32MX1XX/2XX/5XX 64/100-pin family of devices. It is not intended to be a comprehensive reference source. To complement the information in this data sheet, refer to **Section 7. “Resets”** (DS60001118) in the “PIC32 Family Reference Manual”, which is available from the Microchip web site (www.microchip.com/PIC32).

The Reset module combines all Reset sources and controls the device Master Reset signal, SYSRST. The following is a list of device Reset sources:

- POR: Power-on Reset
- MCLR: Master Clear Reset pin
- SWR: Software Reset
- WDTR: Watchdog Timer Reset
- BOR: Brown-out Reset
- CMR: Configuration Mismatch Reset
- HVDR: High Voltage Detect Reset

A simplified block diagram of the Reset module is illustrated in Figure 7-1.

FIGURE 7-1: SYSTEM RESET BLOCK DIAGRAM



PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

8.0 OSCILLATOR CONFIGURATION

Note: This data sheet summarizes the features of the PIC32MX1XX/2XX/5XX 64/100-pin family of devices. It is not intended to be a comprehensive reference source. To complement the information in this data sheet, refer to **Section 6. “Oscillator Configuration”** (DS60001112) in the *“PIC32 Family Reference Manual”*, which is available from the Microchip web site (www.microchip.com/PIC32).

The PIC32MX1XX/2XX/5XX 64/100-pin oscillator system has the following modules and features:

- A Total of four external and internal oscillator options as clock sources
- On-Chip PLL with user-selectable input divider, multiplier and output divider to boost operating frequency on select internal and external oscillator sources
- On-Chip user-selectable divisor postscaler on select oscillator sources
- Software-controllable switching between various clock sources
- A Fail-Safe Clock Monitor (FSCM) that detects clock failure and permits safe application recovery or shutdown
- Dedicated On-Chip PLL for USB peripheral

A block diagram of the oscillator system is provided in Figure 8-1.

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

REGISTER 10-21: U1EP0-U1EP15: USB ENDPOINT CONTROL REGISTER

| Bit Range | Bit 31/23/15/7 | Bit 30/22/14/6 | Bit 29/21/13/5 | Bit 28/20/12/4 | Bit 27/19/11/3 | Bit 26/18/10/2 | Bit 25/17/9/1 | Bit 24/16/8/0 |
|-----------|----------------|----------------|----------------|----------------|----------------|----------------|---------------|---------------|
| 31:24 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 |
| | — | — | — | — | — | — | — | — |
| 23:16 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 |
| | — | — | — | — | — | — | — | — |
| 15:8 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 |
| | — | — | — | — | — | — | — | — |
| 7:0 | R/W-0 | R/W-0 | U-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 |
| | LSPD | RETRYDIS | — | EPCONDIS | EPRXEN | EPTXEN | EPSTALL | EPHSK |

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 31-8 **Unimplemented:** Read as '0'

bit 7 **LSPD:** Low-Speed Direct Connection Enable bit (Host mode and U1EP0 only)

1 = Direct connection to a low-speed device enabled

0 = Direct connection to a low-speed device disabled; hub required with PRE_PID

bit 6 **RETRYDIS:** Retry Disable bit (Host mode and U1EP0 only)

1 = Retry NAKed transactions disabled

0 = Retry NAKed transactions enabled; retry done in hardware

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

bit 4 **EPCONDIS:** Bidirectional Endpoint Control bit

If EPTXEN = 1 and EPRXEN = 1:

1 = Disable Endpoint n from Control transfers; only TX and RX transfers allowed

0 = Enable Endpoint n for Control (SETUP) transfers; TX and RX transfers also allowed

Otherwise, this bit is ignored.

bit 3 **EPRXEN:** Endpoint Receive Enable bit

1 = Endpoint n receive enabled

0 = Endpoint n receive disabled

bit 2 **EPTXEN:** Endpoint Transmit Enable bit

1 = Endpoint n transmit enabled

0 = Endpoint n transmit disabled

bit 1 **EPSTALL:** Endpoint Stall Status bit

1 = Endpoint n was stalled

0 = Endpoint n was not stalled

bit 0 **EPHSK:** Endpoint Handshake Enable bit

1 = Endpoint Handshake enabled

0 = Endpoint Handshake disabled (typically used for isochronous endpoints)

TABLE 11-18: PERIPHERAL PIN SELECT OUTPUT REGISTER MAP

| Virtual Address (BF80_#) | Register Name | Bit Range | Bits | | | | | | | | | | | | | | | | All Resets |
|-----------------------------|------------------|-----------|-------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------------|------|------|------|------------|
| | | | 31/15 | 30/14 | 29/13 | 28/12 | 27/11 | 26/10 | 25/9 | 24/8 | 23/7 | 22/6 | 21/5 | 20/4 | 19/3 | 18/2 | 17/1 | 16/0 | |
| FB38 | RPA14R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPA14<3:0> | | | | 0000 |
| FB3C | RPA15R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPA15<3:0> | | | | 0000 |
| FB40 | RPB0R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPB0<3:0> | | | | 0000 |
| FB44 | RPB1R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPB1<3:0> | | | | 0000 |
| FB48 | RPB2R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPB2<3:0> | | | | 0000 |
| FB4C | RPB3R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPB3<3:0> | | | | 0000 |
| FB54 | RPB5R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPB5<3:0> | | | | 0000 |
| FB58 | RPB6R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPB6<3:0> | | | | 0000 |
| FB5C | RPB7R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPB7<3:0> | | | | 0000 |
| FB60 | RPB8R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPB8<3:0> | | | | 0000 |
| FB64 | RPB9R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPB9<3:0> | | | | 0000 |
| FB68 | RPB10R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPB10<3:0> | | | | 0000 |
| FB78 | RPB14R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPB14<3:0> | | | | 0000 |
| FB7C | RPB15R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPB15<3:0> | | | | 0000 |
| FB84 | RPC1R | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | — | — | — | — | — | — | — | — | — | — | — | — | RPC1<3:0> | | | | 0000 |

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

Note 1: This register is not available if the associated RPx function is not present on the device. Refer to the pin table for the specific device to determine availability.

15.1 Control Registers

TABLE 15-1: INPUT CAPTURE 1 THROUGH INPUT CAPTURE 5 REGISTER MAP

| Virtual Address (BF80..#) | Register Name | Bit Range | Bits | | | | | | | | | | | | | | | All Resets | |
|------------------------------|-----------------------|-----------|--------------|-------|-------|-------|-------|-------|-------|------|-------|----------|------|------|-------|----------|------|------------|------|
| | | | 31/15 | 30/14 | 29/13 | 28/12 | 27/11 | 26/10 | 25/9 | 24/8 | 23/7 | 22/6 | 21/5 | 20/4 | 19/3 | 18/2 | 17/1 | | 16/0 |
| 2000 | IC1CON ⁽¹⁾ | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | ON | — | SIDL | — | — | — | FEDGE | C32 | ICTMR | ICI<1:0> | | ICOV | ICBNE | ICM<2:0> | | | 0000 |
| 2010 | IC1BUF | 31:16 | IC1BUF<31:0> | | | | | | | | | | | | | | | xxxx | |
| | | 15:0 | IC1BUF<31:0> | | | | | | | | | | | | | | | xxxx | |
| 2200 | IC2CON ⁽¹⁾ | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | ON | — | SIDL | — | — | — | FEDGE | C32 | ICTMR | ICI<1:0> | | ICOV | ICBNE | ICM<2:0> | | | 0000 |
| 2210 | IC2BUF | 31:16 | IC2BUF<31:0> | | | | | | | | | | | | | | | xxxx | |
| | | 15:0 | IC2BUF<31:0> | | | | | | | | | | | | | | | xxxx | |
| 2400 | IC3CON ⁽¹⁾ | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | ON | — | SIDL | — | — | — | FEDGE | C32 | ICTMR | ICI<1:0> | | ICOV | ICBNE | ICM<2:0> | | | 0000 |
| 2410 | IC3BUF | 31:16 | IC3BUF<31:0> | | | | | | | | | | | | | | | xxxx | |
| | | 15:0 | IC3BUF<31:0> | | | | | | | | | | | | | | | xxxx | |
| 2600 | IC4CON ⁽¹⁾ | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | ON | — | SIDL | — | — | — | FEDGE | C32 | ICTMR | ICI<1:0> | | ICOV | ICBNE | ICM<2:0> | | | 0000 |
| 2610 | IC4BUF | 31:16 | IC4BUF<31:0> | | | | | | | | | | | | | | | xxxx | |
| | | 15:0 | IC4BUF<31:0> | | | | | | | | | | | | | | | xxxx | |
| 2800 | IC5CON ⁽¹⁾ | 31:16 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 0000 |
| | | 15:0 | ON | — | SIDL | — | — | — | FEDGE | C32 | ICTMR | ICI<1:0> | | ICOV | ICBNE | ICM<2:0> | | | 0000 |
| 2810 | IC5BUF | 31:16 | IC5BUF<31:0> | | | | | | | | | | | | | | | xxxx | |
| | | 15:0 | IC5BUF<31:0> | | | | | | | | | | | | | | | xxxx | |

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

Note 1: This register has corresponding CLR, SET and INV registers at its virtual address, plus an offset of 0x4, 0x8 and 0xC, respectively. See **Section 11.2 “CLR, SET, and INV Registers”** for more information.

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

REGISTER 19-1: UxMODE: UARTx MODE REGISTER

| Bit Range | Bit 31/23/15/7 | Bit 30/22/14/6 | Bit 29/21/13/5 | Bit 28/20/12/4 | Bit 27/19/11/3 | Bit 26/18/10/2 | Bit 25/17/9/1 | Bit 24/16/8/0 |
|-----------|-------------------|----------------|----------------|----------------|----------------|----------------|---------------|---------------|
| 31:24 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 |
| | — | — | — | — | — | — | — | — |
| 23:16 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 |
| | — | — | — | — | — | — | — | — |
| 15:8 | R/W-0 | U-0 | R/W-0 | R/W-0 | R/W-0 | U-0 | R/W-0 | R/W-0 |
| | ON ⁽¹⁾ | — | SIDL | IREN | RTSMD | — | UEN<1:0> | |
| 7:0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 |
| | WAKE | LPBACK | ABAUD | RXINV | BRGH | PDSEL<1:0> | | STSEL |

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 31-16 **Unimplemented:** Read as '0'

bit 15 **ON:** UARTx Enable bit⁽¹⁾

1 = UARTx is enabled. UARTx pins are controlled by UARTx as defined by UEN<1:0> and UTXEN control bits

0 = UARTx is disabled. All UARTx pins are controlled by corresponding bits in the PORTx, TRISx and LATx registers; UARTx power consumption is minimal

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

bit 13 **SIDL:** Stop in Idle Mode bit

1 = Discontinue operation when device enters Idle mode

0 = Continue operation in Idle mode

bit 12 **IREN:** IrDA Encoder and Decoder Enable bit

1 = IrDA is enabled

0 = IrDA is disabled

bit 11 **RTSMD:** Mode Selection for $\overline{\text{UxRTS}}$ Pin bit

1 = $\overline{\text{UxRTS}}$ pin is in Simplex mode

0 = $\overline{\text{UxRTS}}$ pin is in Flow Control mode

bit 10 **Unimplemented:** Read as '0'

bit 9-8 **UEN<1:0>:** UARTx Enable bits

11 = UxTX, UxRX and UxBCLK pins are enabled and used; $\overline{\text{UxCTS}}$ pin is controlled by corresponding bits in the PORTx register

10 = UxTX, UxRX, $\overline{\text{UxCTS}}$ and $\overline{\text{UxRTS}}$ pins are enabled and used

01 = UxTX, UxRX and $\overline{\text{UxRTS}}$ pins are enabled and used; $\overline{\text{UxCTS}}$ pin is controlled by corresponding bits in the PORTx register

00 = UxTX and UxRX pins are enabled and used; $\overline{\text{UxCTS}}$ and $\overline{\text{UxRTS}}$ /UxBCLK pins are controlled by corresponding bits in the PORTx register

bit 7 **WAKE:** Enable Wake-up on Start bit Detect During Sleep Mode bit

1 = Wake-up enabled

0 = Wake-up disabled

bit 6 **LPBACK:** UARTx Loopback Mode Select bit

1 = Loopback mode is enabled

0 = Loopback mode is disabled

Note 1: When using 1:1 PBCLK divisor, the user software should not read/write the peripheral SFRs in the SYSCLK cycle immediately following the instruction that clears the module's ON bit.

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

22.0 10-BIT ANALOG-TO-DIGITAL CONVERTER (ADC)

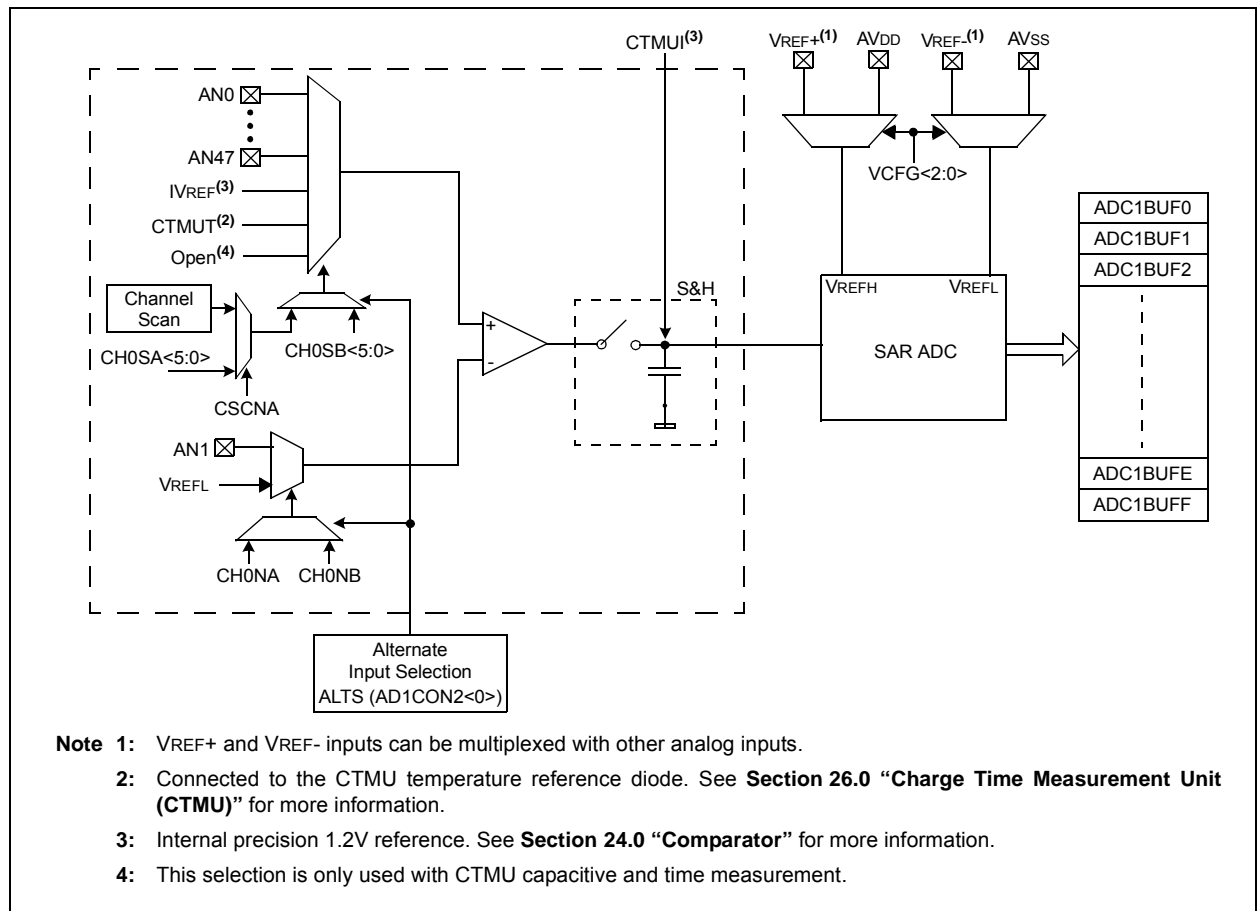
Note: This data sheet summarizes the features of the PIC32MX1XX/2XX/5XX 64/100-pin family of devices. It is not intended to be a comprehensive reference source. To complement the information in this data sheet, refer to **Section 17. “10-bit Analog-to-Digital Converter (ADC)”** (DS60001104) in the “PIC32 Family Reference Manual”, which is available from the Microchip web site (www.microchip.com/PIC32).

The 10-bit Analog-to-Digital Converter (ADC) includes the following features:

- Successive Approximation Register (SAR) conversion
- Up to 1 Msps conversion speed
- Up to 48 analog input pins
- External voltage reference input pins
- One unipolar, differential Sample and Hold Amplifier (SHA)
- Automatic Channel Scan mode
- Selectable conversion trigger source
- 16-word conversion result buffer
- Selectable buffer fill modes
- Eight conversion result format options
- Operation during CPU Sleep and Idle modes

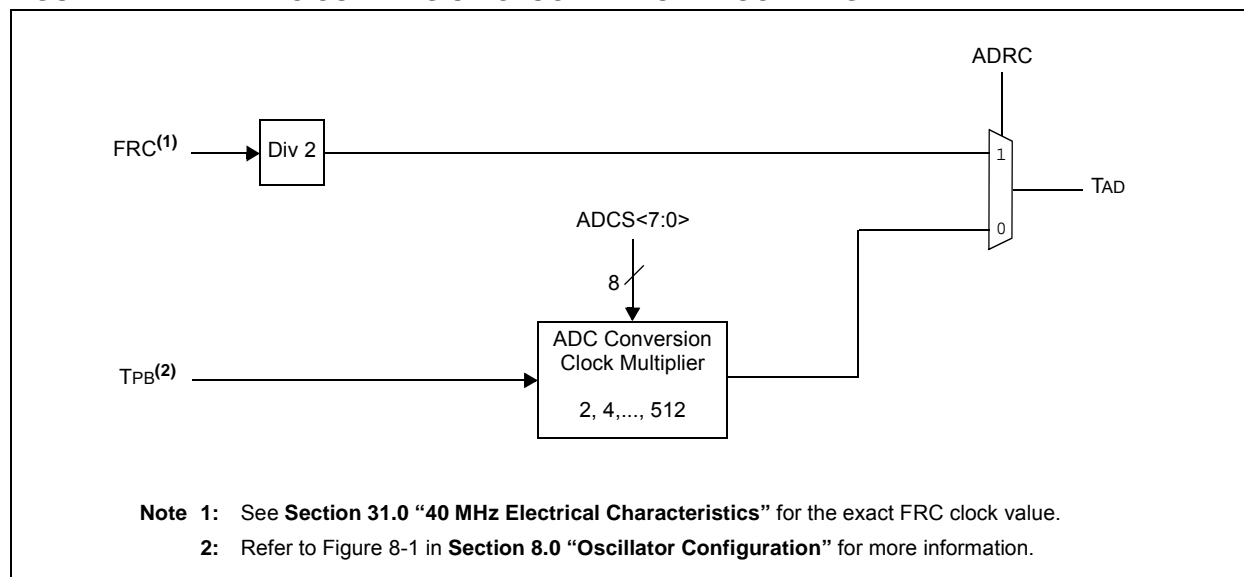
A block diagram of the 10-bit ADC is illustrated in Figure 22-1. The 10-bit ADC has up to 28 analog input pins, designated AN0-AN27. In addition, there are two analog input pins for external voltage reference connections. These voltage reference inputs may be shared with other analog input pins and may be common to other analog module references.

FIGURE 22-1: ADC1 MODULE BLOCK DIAGRAM



PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

FIGURE 22-2: ADC CONVERSION CLOCK PERIOD BLOCK DIAGRAM



PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

REGISTER 23-1: C1CON: CAN MODULE CONTROL REGISTER

| Bit Range | Bit 31/23/15/7 | Bit 30/22/14/6 | Bit 29/21/13/5 | Bit 28/20/12/4 | Bit 27/19/11/3 | Bit 26/18/10/2 | Bit 25/17/9/1 | Bit 24/16/8/0 |
|-----------|-------------------|----------------|----------------|----------------|----------------|----------------|---------------|---------------|
| 31:24 | U-0 | U-0 | U-0 | U-0 | S/HC-0 | R/W-1 | R/W-0 | R/W-0 |
| | — | — | — | — | ABAT | REQOP<2:0> | | |
| 23:16 | R-1 | R-0 | R-0 | R/W-0 | U-0 | U-0 | U-0 | U-0 |
| | OPMOD<2:0> | | | CANCAP | — | — | — | — |
| 15:8 | R/W-0 | U-0 | R/W-0 | U-0 | R-0 | U-0 | U-0 | U-0 |
| | ON ⁽¹⁾ | — | SIDLE | — | CANBUSY | — | — | — |
| 7:0 | U-0 | U-0 | U-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 |
| | — | — | — | DNCNT<4:0> | | | | |

| | | |
|-------------------|---------------------|--|
| Legend: | HC = Hardware Clear | S = Settable 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 31-28 **Unimplemented:** Read as '0'

bit 27 **ABAT:** Abort All Pending Transmissions bit
 1 = Signal all transmit buffers to abort transmission
 0 = Module will clear this bit when all transmissions aborted

bit 26-24 **REQOP<2:0>:** Request Operation Mode bits
 111 = Set Listen All Messages mode
 110 = Reserved
 101 = Reserved
 100 = Set Configuration mode
 011 = Set Listen Only mode
 010 = Set Loopback mode
 001 = Set Disable mode
 000 = Set Normal Operation mode

bit 23-21 **OPMOD<2:0>:** Operation Mode Status bits
 111 = Module is in Listen All Messages mode
 110 = Reserved
 101 = Reserved
 100 = Module is in Configuration mode
 011 = Module is in Listen Only mode
 010 = Module is in Loopback mode
 001 = Module is in Disable mode
 000 = Module is in Normal Operation mode

bit 20 **CANCAP:** CAN Message Receive Time Stamp Timer Capture Enable bit
 1 = CANTMR value is stored on valid message reception and is stored with the message
 0 = Disable CAN message receive time stamp timer capture and stop CANTMR to conserve power

bit 19-16 **Unimplemented:** Read as '0'

bit 15 **ON:** CAN On bit⁽¹⁾
 1 = CAN module is enabled
 0 = CAN module is disabled

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

Note 1: If the user application clears this bit, it may take a number of cycles before the CAN module completes the current transaction and responds to this request. The user application should poll the CANBUSY bit to verify that the request has been honored.

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

REGISTER 23-12: C1FLTCON2: CAN FILTER CONTROL REGISTER 2

| Bit Range | Bit 31/23/15/7 | Bit 30/22/14/6 | Bit 29/21/13/5 | Bit 28/20/12/4 | Bit 27/19/11/3 | Bit 26/18/10/2 | Bit 25/17/9/1 | Bit 24/16/8/0 |
|-----------|----------------|----------------|----------------|----------------|----------------|----------------|---------------|---------------|
| 31:24 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 |
| | FLTEN11 | MSEL11<1:0> | | FSEL11<4:0> | | | | |
| 23:16 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 |
| | FLTEN10 | MSEL10<1:0> | | FSEL10<4:0> | | | | |
| 15:8 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 |
| | FLTEN9 | MSEL9<1:0> | | FSEL9<4:0> | | | | |
| 7:0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 |
| | FLTEN8 | MSEL8<1:0> | | FSEL8<4:0> | | | | |

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 31 **FLTEN11:** Filter 11 Enable bit

- 1 = Filter is enabled
- 0 = Filter is disabled

bit 30-29 **MSEL11<1:0>:** Filter 11 Mask Select bits

- 11 = Acceptance Mask 3 selected
- 10 = Acceptance Mask 2 selected
- 01 = Acceptance Mask 1 selected
- 00 = Acceptance Mask 0 selected

bit 28-24 **FSEL11<4:0>:** FIFO Selection bits

- 11111 = Reserved
- .
- .
- .
- 10000 = Reserved
- 01111 = Message matching filter is stored in FIFO buffer 15
- .
- .
- .
- 00000 = Message matching filter is stored in FIFO buffer 0

bit 23 **FLTEN10:** Filter 10 Enable bit

- 1 = Filter is enabled
- 0 = Filter is disabled

bit 22-21 **MSEL10<1:0>:** Filter 10 Mask Select bits

- 11 = Acceptance Mask 3 selected
- 10 = Acceptance Mask 2 selected
- 01 = Acceptance Mask 1 selected
- 00 = Acceptance Mask 0 selected

Note: The bits in this register can only be modified if the corresponding filter enable (FLTENn) bit is '0'.

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

REGISTER 25-1: CVRCON: COMPARATOR VOLTAGE REFERENCE CONTROL REGISTER

| Bit Range | Bit 31/23/15/7 | Bit 30/22/14/6 | Bit 29/21/13/5 | Bit 28/20/12/4 | Bit 27/19/11/3 | Bit 26/18/10/2 | Bit 25/17/9/1 | Bit 24/16/8/0 |
|-----------|-------------------|----------------|----------------|----------------|----------------|----------------|---------------|---------------|
| 31:24 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 |
| | — | — | — | — | — | — | — | — |
| 23:16 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 |
| | — | — | — | — | — | — | — | — |
| 15:8 | R/W-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 | U-0 |
| | ON ⁽¹⁾ | — | — | — | — | — | — | — |
| 7:0 | U-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 | R/W-0 |
| | — | CVROE | CVRR | CVRSS | CVR<3:0> | | | |

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 31-16 **Unimplemented:** Read as '0'

bit 15 **ON:** Comparator Voltage Reference On bit⁽¹⁾

1 = Module is enabled

Setting this bit does not affect other bits in the register.

0 = Module is disabled and does not consume current

Clearing this bit does not affect the other bits in the register.

bit 14-7 **Unimplemented:** Read as '0'

bit 6 **CVROE:** CVREFOUT Enable bit

1 = Voltage level is output on CVREFOUT pin

0 = Voltage level is disconnected from CVREFOUT pin

bit 5 **CVRR:** CVREF Range Selection bit

1 = 0 to 0.625 CVRSRC, with CVRSRC/24 step size

0 = 0.25 CVRSRC to 0.719 CVRSRC, with CVRSRC/32 step size

bit 4 **CVRSS:** CVREF Source Selection bit

1 = Comparator voltage reference source, CVRSRC = (VREF+) – (VREF-)

0 = Comparator voltage reference source, CVRSRC = AVDD – AVSS

bit 3-0 **CVR<3:0>:** CVREF Value Selection $0 \leq \text{CVR<3:0>} \leq 15$ bits

When CVRR = 1:

$$\text{CVREF} = (\text{CVR<3:0>}/24) \cdot (\text{CVRSRC})$$

When CVRR = 0:

$$\text{CVREF} = 1/4 \cdot (\text{CVRSRC}) + (\text{CVR<3:0>}/32) \cdot (\text{CVRSRC})$$

Note 1: When using 1:1 PBCLK divisor, the user's software should not read/write the peripheral's SFRs in the SYSCLK cycle immediately following the instruction that clears the module's ON bit.

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

TABLE 31-39: PARALLEL MASTER PORT WRITE TIMING REQUIREMENTS

| AC CHARACTERISTICS | | | Standard Operating Conditions: 2.3V to 3.6V (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for Industrial $-40^{\circ}\text{C} \leq T_A \leq +105^{\circ}\text{C}$ for V-temp | | | | |
|--------------------|---------|---|---|-------|------|-------|------------|
| Param. No. | Symbol | Characteristics ⁽¹⁾ | Min. | Typ. | Max. | Units | Conditions |
| PM11 | TWR | PMWR Pulse Width | — | 1 TPB | — | — | — |
| PM12 | TDVSU | Data Out Valid before PMWR or PMENB goes Inactive (data setup time) | — | 2 TPB | — | — | — |
| PM13 | TDVHOLD | PMWR or PMEMB Invalid to Data Out Invalid (data hold time) | — | 1 TPB | — | — | — |

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

TABLE 31-40: OTG ELECTRICAL SPECIFICATIONS

| AC CHARACTERISTICS | | | Standard Operating Conditions: 2.3V to 3.6V (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for Industrial $-40^{\circ}\text{C} \leq T_A \leq +105^{\circ}\text{C}$ for V-temp | | | | |
|--------------------|---------|-----------------------------------|---|------|------|----------|--|
| Param. No. | Symbol | Characteristics ⁽¹⁾ | Min. | Typ. | Max. | Units | Conditions |
| USB313 | VUSB3V3 | USB Voltage | 3.0 | — | 3.6 | V | Voltage on VUSB3V3 must be in this range for proper USB operation |
| USB315 | VILUSB | Input Low Voltage for USB Buffer | — | — | 0.8 | V | — |
| USB316 | VIHUSB | Input High Voltage for USB Buffer | 2.0 | — | — | V | — |
| USB318 | VDIFS | Differential Input Sensitivity | — | — | 0.2 | V | The difference between D+ and D- must exceed this value while VCM is met |
| USB319 | VCM | Differential Common Mode Range | 0.8 | — | 2.5 | V | — |
| USB320 | ZOUT | Driver Output Impedance | 28.0 | — | 44.0 | Ω | — |
| USB321 | VoL | Voltage Output Low | 0.0 | — | 0.3 | V | 1.425 k Ω load connected to VUSB3V3 |
| USB322 | VoH | Voltage Output High | 2.8 | — | 3.6 | V | 1.425 k Ω load connected to ground |

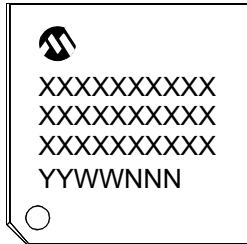
Note 1: These parameters are characterized, but not tested in manufacturing.

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

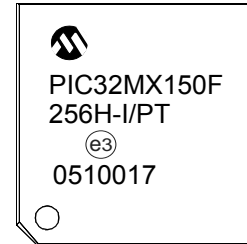
34.0 PACKAGING INFORMATION

34.1 Package Marking Information

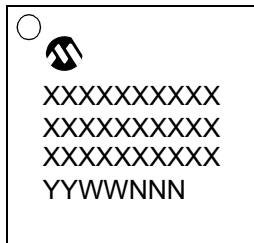
64-Lead TQFP (10x10x1 mm)



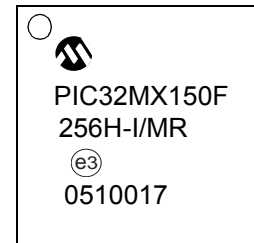
Example



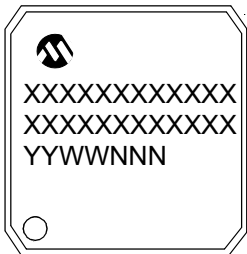
64-Lead QFN (9x9x0.9 mm)



Example



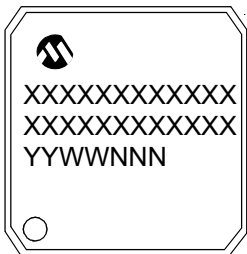
100-Lead TQFP (14x14x1 mm)



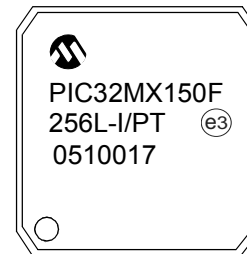
Example



100-Lead TQFP (12x12x1 mm)



Example



| | | |
|----------------|--------|--|
| 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 |
| | * | 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.

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

W

WWW Address 377

WWW, On-Line Support..... 9

PIC32MX1XX/2XX/5XX 64/100-PIN FAMILY

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