What is "**Embedded - Microcontrollers**"?

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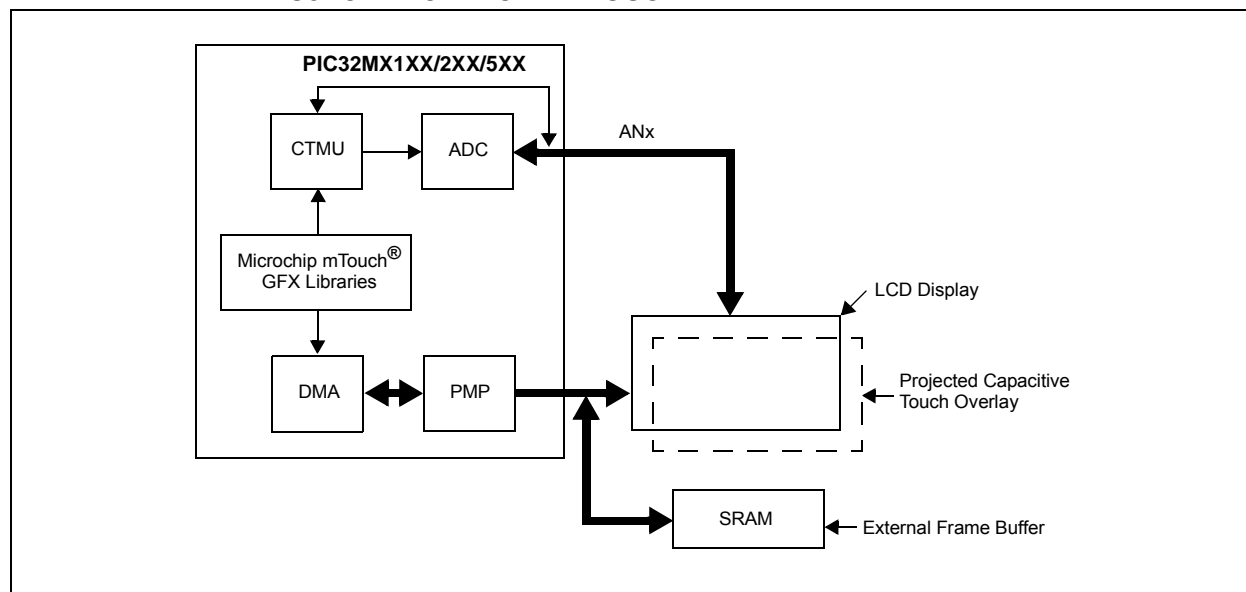
Applications of "**Embedded - Microcontrollers**"

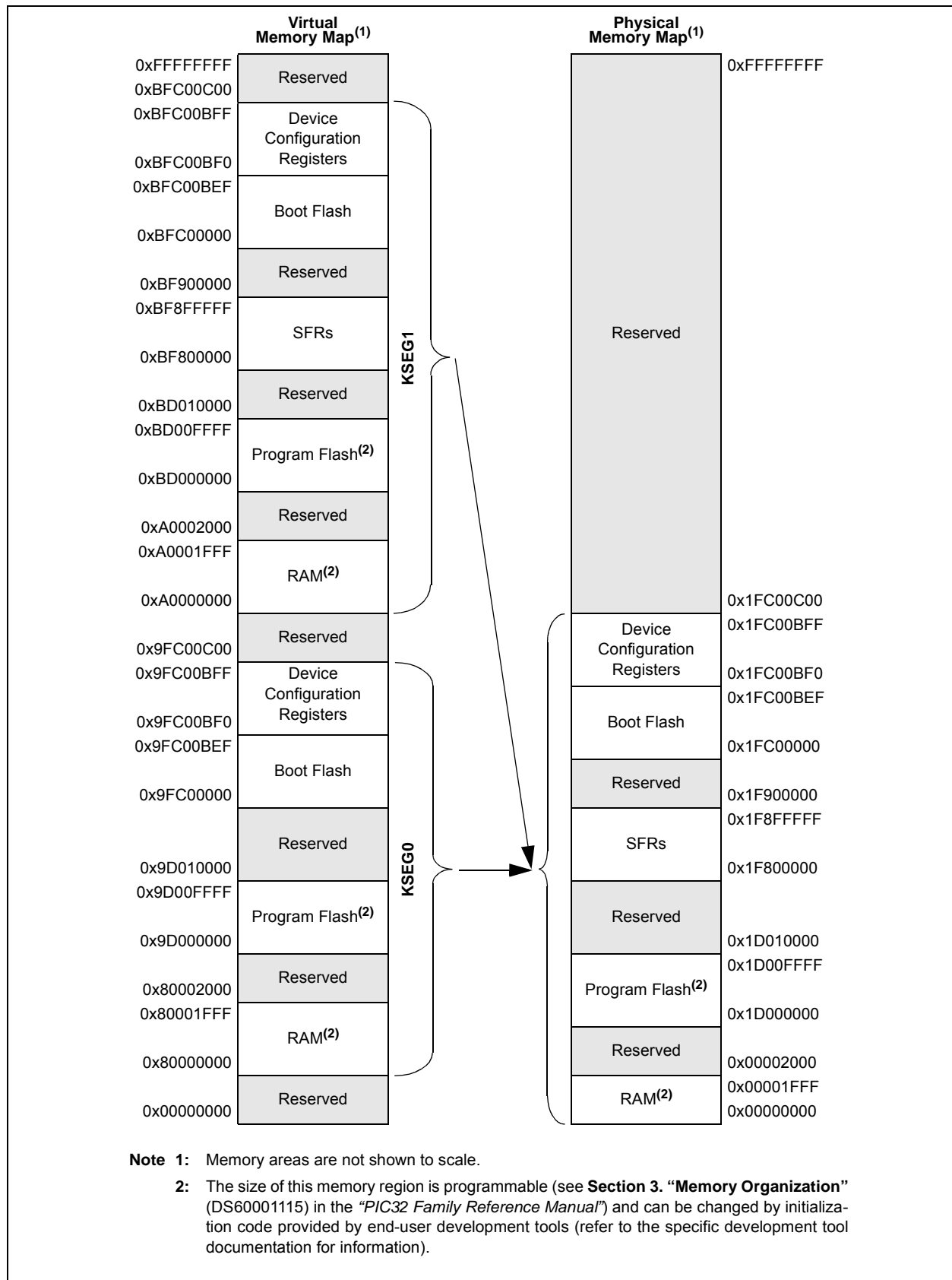| Details	
Product Status	Active
Core Processor	MIPS32® M4K™
Core Size	32-Bit Single-Core
Speed	40MHz
Connectivity	I²C, IrDA, LINbus, PMP, SPI, UART/USART, USB OTG
Peripherals	Brown-out Detect/Reset, DMA, I²S, POR, PWM, WDT
Number of I/O	81
Program Memory Size	512KB (512K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	64K x 8
Voltage - Supply (Vcc/Vdd)	2.3V ~ 3.6V
Data Converters	A/D 48x10b
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/pic32mx270f512l-i-pf

FIGURE 2-10: **LOW-COST CONTROLLERLESS (LCC) GRAPHICS APPLICATION WITH PROJECTED CAPACITIVE TOUCH**

FIGURE 4-1: MEMORY MAP FOR DEVICES WITH 64 KB OF PROGRAM MEMORY + 8 KB RAM

Note 1: Memory areas are not shown to scale.

2: The size of this memory region is programmable (see **Section 3. "Memory Organization"** (DS60001115) in the *"PIC32 Family Reference Manual"*) and can be changed by initialization code provided by end-user development tools (refer to the specific development tool documentation for information).

TABLE 4-1: **SFR MEMORY MAP**

Peripheral	Virtual Address	
	Base	Offset Start
Interrupt Controller	0xBF88	0x1000
Bus Matrix		0x2000
DMA		0x3000
USB		0x5000
PORTA-PORTG		0x6000
CAN1		0xB000
Watchdog Timer	0xBF80	0x0000
RTCC		0x0200
Timer1-Timer5		0x0600
IC1-IC5		0x2000
OC1-OC5		0x3000
I2C1-I2C2		0x5000
SPI1-SPI4		0x5800
UART1-UART5		0x6000
PMP		0x7000
ADC1		0x9000
DAC		0x9800
Comparator 1, 2, 3		0xA000
Oscillator		0xF000
Device and Revision ID		0xF200
Flash Controller		0xF400
PPS		0xFA00
Configuration	0xBFC0	0x0BF0

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

6.1 Control Registers

TABLE 6-1: FLASH CONTROLLER REGISTER MAP

Virtual Address (BF80_#)	Register Name	Bit Range	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	All Resets
F400	NVMCON[1]	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	WR	WREN	WRERR	LVDERR	LVDSTAT	—	—	—	—	—	—	—	NVMOP<3:0>				0000
F410	NVMKEY	31:16	NVMKEY<31:0>																0000
		15:0																	0000
F420	NVMADDR[1]	31:16	NVMADDR<31:0>																0000
		15:0																	0000
F430	NVMDATA	31:16	NVMDATA<31:0>																0000
		15:0																	0000
F440	NVMSRC ADDR	31:16	NVMSRCADDR<31:0>																0000
		15:0																	0000

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 their virtual addresses, plus offsets of 0x4, 0x8 and 0xC, respectively. See **Section 11.2 "CLR, SET, and INV Registers"** for more information.

TABLE 9-3: DMA CHANNEL 0 THROUGH CHANNEL 3 REGISTER MAP

Virtual Address (BF88_#)	Register Name(1)	Bit Range	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	All Resets
3060	DCH0CON	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	CHBUSY	—	—	—	—	—	—	CHCHNS	CHEN	CHAED	CHCHN	CHAEN	—	CHEDET	CHPRI<1:0>		0000
3070	DCH0ECON	31:16	—	—	—	—	—	—	—	—	CHAIRQ<7:0>								00FF
		15:0	CHSIRQ<7:0>								CFORCE	CABORT	PATEN	SIRQEN	AIRQEN	—	—	—	FFF8
3080	DCH0INT	31:16	—	—	—	—	—	—	—	—	CHSDIE	CHSHIE	CHDDIE	CHDHIE	CHBCIE	CHCCIE	CHTAIE	CHERIE	0000
		15:0	—	—	—	—	—	—	—	—	CHSDIF	CHSHIF	CHDDIF	CHDHIF	CHBCIF	CHCCIF	CHTAIF	CHERIF	0000
3090	DCH0SSA	31:16	CHSSA<31:0>																0000
		15:0																	0000
30A0	DCH0DSA	31:16	CHDSA<31:0>																0000
		15:0																	0000
30B0	DCH0SSIZ	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	CHSSIZ<15:0>																0000
30C0	DCH0DSIZ	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	CHDSIZ<15:0>																0000
30D0	DCH0SPTR	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	CHSPTR<15:0>																0000
30E0	DCH0DPTR	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	CHDPTR<15:0>																0000
30F0	DCH0CSIZ	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	CHCSIZ<15:0>																0000
3100	DCH0CPTR	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	CHCPTR<15:0>																0000
3110	DCH0DAT	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	—	—	—	—	—	—	—	—	CHPDAT<7:0>								0000
3120	DCH1CON	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	CHBUSY	—	—	—	—	—	—	CHCHNS	CHEN	CHAED	CHCHN	CHAEN	—	CHEDET	CHPRI<1:0>		0000
3130	DCH1ECON	31:16	—	—	—	—	—	—	—	—	CHAIRQ<7:0>								00FF
		15:0	CHSIRQ<7:0>								CFORCE	CABORT	PATEN	SIRQEN	AIRQEN	—	—	—	FFF8
3140	DCH1INT	31:16	—	—	—	—	—	—	—	—	CHSDIE	CHSHIE	CHDDIE	CHDHIE	CHBCIE	CHCCIE	CHTAIE	CHERIE	0000
		15:0	—	—	—	—	—	—	—	—	CHSDIF	CHSHIF	CHDDIF	CHDHIF	CHBCIF	CHCCIF	CHTAIF	CHERIF	0000
3150	DCH1SSA	31:16	CHSSA<31:0>																0000
		15:0																	0000
3160	DCH1DSA	31:16	CHDSA<31:0>																0000
		15:0																	0000

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

Note 1: All registers in this table have corresponding CLR, SET and INV registers at their virtual addresses, plus offsets of 0x4, 0x8 and 0xC, respectively. See **Section 11.2 "CLR, SET, and INV Registers"** for more information.

11.3.5 OUTPUT MAPPING

In contrast to inputs, the outputs of the peripheral pin select options are mapped on the basis of the pin. In this case, a control register associated with a particular pin dictates the peripheral output to be mapped. The RPnR registers (Register 11-2) are used to control output mapping. Like the [*pin name*]R registers, each register contains sets of 4 bit fields. The value of the bit field corresponds to one of the peripherals, and that peripheral's output is mapped to the pin (see Table 11-2 and Figure 11-3).

A null output is associated with the output register reset value of '0'. This is done to ensure that remappable outputs remain disconnected from all output pins by default.

FIGURE 11-3: EXAMPLE OF MULTIPLEXING OF REMAPPABLE OUTPUT FOR RPA0
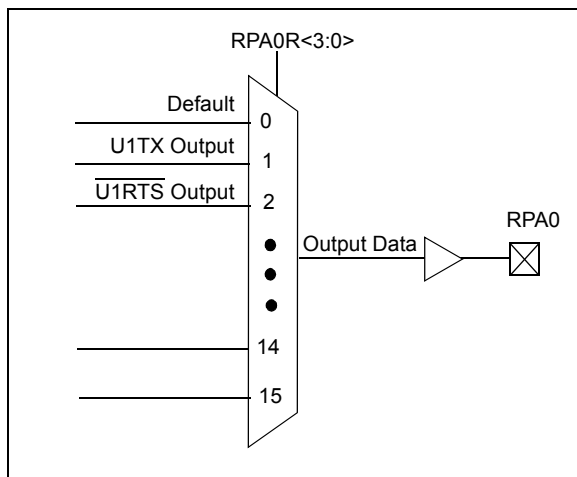
11.3.6 CONTROLLING CONFIGURATION CHANGES

Because peripheral remapping can be changed during run time, some restrictions on peripheral remapping are needed to prevent accidental configuration changes. PIC32 devices include two features to prevent alterations to the peripheral map:

• Control register lock sequence
• Configuration bit select lock

11.3.6.1 Control Register Lock

Under normal operation, writes to the RPnR and [*pin name*]R registers are not allowed. Attempted writes appear to execute normally, but the contents of the registers remain unchanged. To change these registers, they must be unlocked in hardware. The register lock is controlled by the IOLOCK Configuration bit (CFGCON<13>). Setting IOLOCK prevents writes to the control registers; clearing IOLOCK allows writes.

To set or clear the IOLOCK bit, an unlock sequence must be executed. Refer to **Section 6. "Oscillator"** (DS60001112) in the *"PIC32 Family Reference Manual"* for details.

11.3.6.2 Configuration Bit Select Lock

As an additional level of safety, the device can be configured to prevent more than one write session to the RPnR and [*pin name*]R registers. The IOL1WAY Configuration bit (DEVCFG3<29>) blocks the IOLOCK bit from being cleared after it has been set once. If IOLOCK remains set, the register unlock procedure does not execute, and the peripheral pin select control registers cannot be written to. The only way to clear the bit and re-enable peripheral remapping is to perform a device Reset.

In the default (unprogrammed) state, IOL1WAY is set, restricting users to one write session.

REGISTER 11-3: CNCONx: CHANGE NOTICE CONTROL FOR PORTx REGISTER (x = A – G)

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	U-0	U-0	U-0	U-0	U-0
	ON	—	SIDL	—	—	—	—	—
7:0	U-0	U-0	U-0	U-0	U-0	U-0	U-0	U-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:** Change Notice (CN) Control ON bit

1 = CN is enabled
0 = CN is disabled

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

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

1 = CPU Idle Mode halts CN operation
0 = CPU Idle does not affect CN operation

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

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12.0 TIMER1

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 14. "Timers"** (DS60001105) in the *"PIC32 Family Reference Manual"*, which is available from the Microchip web site (www.microchip.com/PIC32).

This family of PIC32 devices features one synchronous/asynchronous 16-bit timer that can operate as a free-running interval timer for various timing applications and counting external events. This timer can also be used with the Low-Power Secondary Oscillator (Sosc) for Real-Time Clock (RTC) applications. The following modes are supported:

- Synchronous Internal Timer
- Synchronous Internal Gated Timer
- Synchronous External Timer
- Asynchronous External Timer

12.1 Additional Supported Features

- Selectable clock prescaler
- Timer operation during CPU Idle and Sleep mode
- Fast bit manipulation using CLR, SET and INV registers
- Asynchronous mode can be used with the Sosc to function as a Real-Time Clock (RTC)

FIGURE 12-1: TIMER1 BLOCK DIAGRAM

Note: The default state of the SOSCEN (OSCCON<1>) bit during a device Reset is controlled by the FSOSCEN bit in Configuration Word, DEVCFG1.

NOTES:

REGISTER 17-1:   SPIxCON: SPI CONTROL REGISTER (CONTINUED)

bit 17   **SPIFE:** Frame Sync Pulse Edge Select bit (Framed SPI mode only)
1 = Frame synchronization pulse coincides with the first bit clock
0 = Frame synchronization pulse precedes the first bit clock

bit 16   **ENHBUF:** Enhanced Buffer Enable bit[2]
1 = Enhanced Buffer mode is enabled
0 = Enhanced Buffer mode is disabled

bit 15   **ON:** SPI Peripheral On bit[1]
1 = SPI Peripheral is enabled
0 = SPI Peripheral is disabled

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

bit 13   **SIDL:** Stop in Idle Mode bit
1 = Discontinue operation when CPU enters in Idle mode
0 = Continue operation in Idle mode

bit 12   **DISSDO:** Disable SDOx pin bit
1 = SDOx pin is not used by the module. Pin is controlled by associated PORT register
0 = SDOx pin is controlled by the module

bit 11-10 **MODE<32,16>:** 32/16-Bit Communication Select bits
When AUDEN = 1:
MODE32 MODE16 Communication
11   24-bit Data, 32-bit FIFO, 32-bit Channel/64-bit Frame
10   32-bit Data, 32-bit FIFO, 32-bit Channel/64-bit Frame
01   16-bit Data, 16-bit FIFO, 32-bit Channel/64-bit Frame
00   16-bit Data, 16-bit FIFO, 16-bit Channel/32-bit Frame

When AUDEN = 0:
MODE32 MODE16 Communication
1x   32-bit
01   16-bit
00   8-bit

bit 9   **SMP:** SPI Data Input Sample Phase bit
Master mode (MSTEN = 1):
1 = Input data sampled at end of data output time
0 = Input data sampled at middle of data output time
Slave mode (MSTEN = 0):
SMP value is ignored when SPI is used in Slave mode. The module always uses SMP = 0.

bit 8   **CKE:** SPI Clock Edge Select bit[3]
1 = Serial output data changes on transition from active clock state to Idle clock state (see CKP bit)
0 = Serial output data changes on transition from Idle clock state to active clock state (see CKP bit)

bit 7   **SSEN:** Slave Select Enable (Slave mode) bit
1 = SSx pin used for Slave mode
0 = SSx pin not used for Slave mode, pin controlled by port function.

bit 6   **CKP:** Clock Polarity Select bit[4]
1 = Idle state for clock is a high level; active state is a low level
0 = Idle state for clock is a low level; active state is a high level

bit 5   **MSTEN:** Master Mode Enable bit
1 = Master mode
0 = Slave mode

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

2: This bit can only be written when the ON bit = 0.

3: This bit is not used in the Framed SPI mode. The user should program this bit to '0' for the Framed SPI mode (FRMEN = 1).

4: When AUDEN = 1, the SPI module functions as if the CKP bit is equal to '1', regardless of the actual value of CKP.

19.0 UNIVERSAL ASYNCHRONOUS RECEIVER TRANSMITTER (UART)

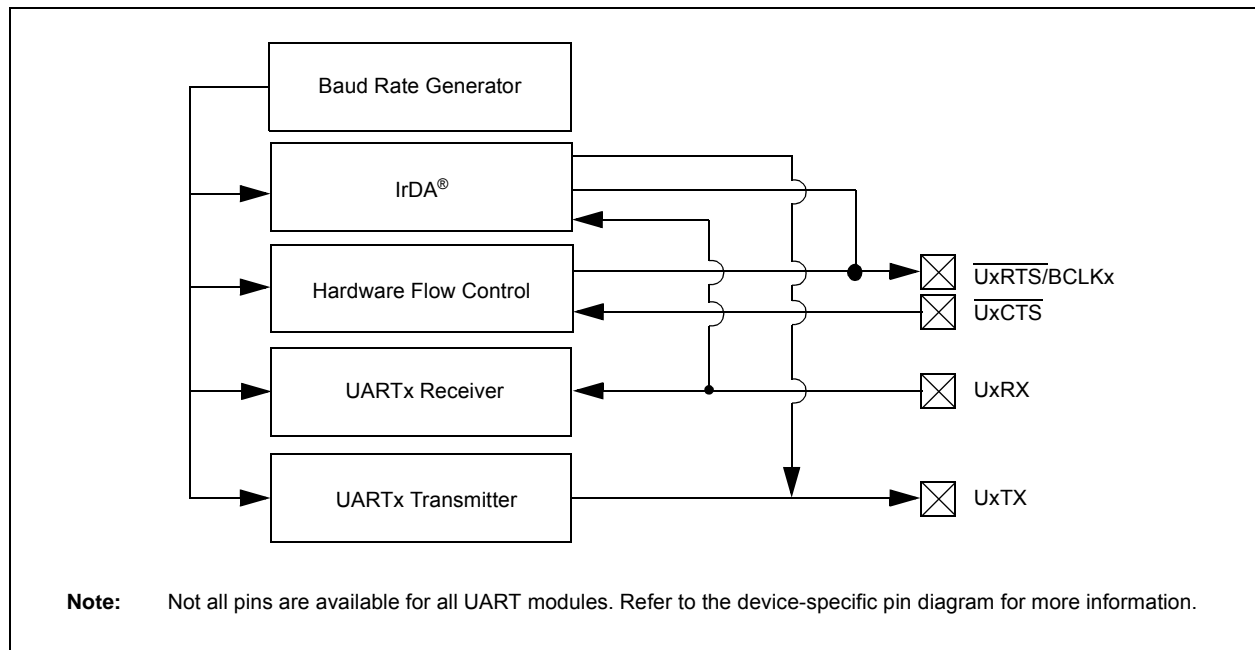| Note:	This data sheet summarizes the features of the PIC32MX1XX/2XX/5XX 64/100-pin family of devices. It is not intended to be a comprehensive reference source. To complement the information in this data sheet, refer to **Section 21. "Universal Asynchronous Receiver Transmitter (UART)"** (DS60001107) in the *"PIC32 Family Reference Manual"*, which is available from the Microchip web site (www.microchip.com/PIC32).

The UART module is one of the serial I/O modules available in PIC32MX1XX/2XX/5XX 64/100-pin family devices. The UART is a full-duplex, asynchronous communication channel that communicates with peripheral devices and personal computers through protocols, such as RS-232, RS-485, LIN and IrDA®. The module also supports the hardware flow control option, with $\overline{UxCTS}$ and $\overline{UxRTS}$ pins, and also includes an IrDA encoder and decoder.

The primary features of the UART module are:

- Full-duplex, 8-bit or 9-bit data transmission
- Even, odd or no parity options (for 8-bit data)
- One or two Stop bits
- Hardware auto-baud feature
- Hardware flow control option
- Fully integrated Baud Rate Generator (BRG) with 16-bit prescaler
- Baud rates ranging from 38 bps to 12.5 Mbps at 50 MHz
- 8-level deep First-In-First-Out (FIFO) transmit data buffer
- 8-level deep FIFO receive data buffer
- Parity, framing and buffer overrun error detection
- Support for interrupt-only on address detect (9th bit = 1)
- Separate transmit and receive interrupts
- Loopback mode for diagnostic support
- LIN Protocol support
- IrDA encoder and decoder with 16x baud clock output for external IrDA encoder/decoder support

Figure 19-1 illustrates a simplified block diagram of the UART.

FIGURE 19-1: UART SIMPLIFIED BLOCK DIAGRAM

Note: Not all pins are available for all UART modules. Refer to the device-specific pin diagram for more information.

REGISTER 22-4: **AD1CHS: ADC INPUT SELECT REGISTER (CONTINUED)**

bit 21-16 **CH0SA<5:0>:** Positive Input Select bits for Sample A Multiplexer Setting

For 64-pin devices:

`011110` = Channel 0 positive input is Open[1]
`011101` = Channel 0 positive input is CTMU temperature sensor (CTMUT)[2]
`011100` = Channel 0 positive input is IV$_{REF}$[3]
`011011` = Channel 0 positive input is AN27

   •
   •
   •

`000001` = Channel 0 positive input is AN1
`000000` = Channel 0 positive input is AN0

For 100-pin devices:

`110010` = Channel 0 positive input is Open[1]
`110001` = Channel 0 positive input is CTMU temperature sensor (CTMUT)[2]
`110000` = Channel 0 positive input is IV$_{REF}$[3]
`101111` = Channel 0 positive input is AN47

   •
   •
   •

`0000001` = Channel 0 positive input is AN1
`0000000` = Channel 0 positive input is AN0

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

Note 1: This selection is only used with CTMU capacitive and time measurement.
    2: See **Section 26.0 "Charge Time Measurement Unit (CTMU)"** for more information.
    3: Internal precision 1.2V reference. See **Section 24.0 "Comparator"** for more information.

REGISTER 23-2: C1CFG: CAN BAUD RATE 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	R/W-0	U-0	U-0	U-0	R/W-0	R/W-0	R/W-0
	—	WAKFIL	—	—	—	SEG2PH<2:0>[1,4]		
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
	SEG2PHTS[1]	SAM[2]	SEG1PH<2:0>			PRSEG<2:0>		
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
	SJW<1:0>[3]		BRP<5:0>					

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 31-23 **Unimplemented:** Read as '0'

bit 22 **WAKFIL:** CAN Bus Line Filter Enable bit
1 = Use CAN bus line filter for wake-up
0 = CAN bus line filter is not used for wake-up

bit 21-19 **Unimplemented:** Read as '0'

bit 18-16 **SEG2PH<2:0>:** Phase Buffer Segment 2 bits[1,4]
111 = Length is 8 x T_Q
•
•
•
000 = Length is 1 x T_Q

bit 15 **SEG2PHTS:** Phase Segment 2 Time Select bit[1]
1 = Freely programmable
0 = Maximum of SEG1PH or Information Processing Time, whichever is greater

bit 14 **SAM:** Sample of the CAN Bus Line bit[2]
1 = Bus line is sampled three times at the sample point
0 = Bus line is sampled once at the sample point

bit 13-11 **SEG1PH<2:0>:** Phase Buffer Segment 1 bits[4]
111 = Length is 8 x T_Q
•
•
•
000 = Length is 1 x T_Q

Note 1: SEG2PH ≤ SEG1PH. If SEG2PHTS is clear, SEG2PH will be set automatically.
2: 3 Time bit sampling is not allowed for BRP < 2.
3: SJW ≤ SEG2PH.
4: The Time Quanta per bit must be greater than 7 (that is, T_{QBIT} > 7).

Note: This register can only be modified when the CAN module is in Configuration mode (OPMOD<2:0> (C1CON<23:21>) = 100).

REGISTER 23-4: C1VEC: CAN INTERRUPT CODE 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	R-0	R-0	R-0	R-0	R-0
	—	—	—	FILHIT<4:0>				
7:0	U-0	R-1	R-0	R-0	R-0	R-0	R-0	R-0
	—	ICODE<6:0>[1]						

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 31-13 **Unimplemented:** Read as '0'

bit 12-8 **FILHIT<4:0>:** Filter Hit Number bit

11111 = Reserved
•
•
•
10000 = Reserved
01111 = Filter 15
•
•
•
00000 = Filter 0

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

bit 6-0 **ICODE<6:0>:** Interrupt Flag Code bits[1]

1111111 = Reserved
•
•
•
1001001 = Reserved
1001000 = Invalid message received (IVRIF)
1000111 = CAN module mode change (MODIF)
1000110 = CAN timestamp timer (CTMRIF)
1000101 = Bus bandwidth error (SERRIF)
1000100 = Address error interrupt (SERRIF)
1000011 = Receive FIFO overflow interrupt (RBOVIF)
1000010 = Wake-up interrupt (WAKIF)
1000001 = Error Interrupt (CERRIF)
1000000 = No interrupt
0111111 = Reserved
•
•
•
0010000 = Reserved
0001111 = FIFO15 Interrupt (C1FSTAT<15> set)
•
•
•
0000000 = FIFO0 Interrupt (C1FSTAT<0> set)

Note 1: These bits are only updated for enabled interrupts.

REGISTER 26-1: CTMUCON: CTMU 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	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0
	EDG1MOD	EDG1POL	EDG1SEL<3:0>				EDG2STAT	EDG1STAT
23:16	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	U-0	U-0
	EDG2MOD	EDG2POL	EDG2SEL<3:0>				—	—
15:8	R/W-0	U-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0
	ON	—	CTMUSIDL	TGEN[1]	EDGEN	EDGSEQEN	IDISSEN[2]	CTTRIG
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
	ITRIM<5:0>						IRNG<1:0>	

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 **EDG1MOD:** Edge 1 Edge Sampling Select bit

1 = Input is edge-sensitive
0 = Input is level-sensitive

bit 30 **EDG1POL:** Edge 1 Polarity Select bit

1 = Edge 1 programmed for a positive edge response
0 = Edge 1 programmed for a negative edge response

bit 29-26 **EDG1SEL<3:0>:** Edge 1 Source Select bits

1111 = IC4 Capture Event is selected
1110 = C2OUT pin is selected
1101 = C1OUT pin is selected
1100 = IC3 Capture Event is selected
1011 = IC2 Capture Event is selected
1010 = IC1 Capture Event is selected
1001 = CTED8 pin is selected
1000 = CTED7 pin is selected
0111 = CTED6 pin is selected
0110 = CTED5 pin is selected
0101 = CTED4 pin is selected
0100 = CTED3 pin is selected
0011 = CTED1 pin is selected
0010 = CTED2 pin is selected
0001 = OC1 Compare Event is selected
0000 = Timer1 Event is selected

bit 25 **EDG2STAT:** Edge 2 Status bit

Indicates the status of Edge 2 and can be written to control edge source

1 = Edge 2 has occurred
0 = Edge 2 has not occurred

Note 1: When this bit is set for Pulse Delay Generation, the EDG2SEL<3:0> bits must be set to '1110' to select C2OUT.

2: The ADC module Sample and Hold capacitor is not automatically discharged between sample/conversion cycles. Software using the ADC as part of a capacitive measurement, must discharge the ADC capacitor before conducting the measurement. The IDISSEN bit, when set to '1', performs this function. The ADC module must be sampling while the IDISSEN bit is active to connect the discharge sink to the capacitor array.

3: Refer to the CTMU Current Source Specifications (Table 31-41) in **Section 31.0 "40 MHz Electrical Characteristics"** for current values.

4: This bit setting is not available for the CTMU temperature diode.

TABLE 31-8: DC CHARACTERISTICS: I/O PIN INPUT SPECIFICATIONS

DC CHARACTERISTICS			Standard Operating Conditions: 2.3V to 3.6V (unless otherwise stated) Operating temperature -40°C ≤ TA ≤ +85°C for Industrial -40°C ≤ TA ≤ +105°C for V-temp				
Param. No.	Symbol	Characteristics	Min.	Typical(1)	Max.	Units	Conditions
DI10	VIL	**Input Low Voltage** I/O Pins with PMP	Vss	—	0.15 VDD	V	
		I/O Pins	Vss	—	0.2 VDD	V	
DI18		SDAx, SCLx	Vss	—	0.3 VDD	V	SMBus disabled **(Note 4)**
DI19		SDAx, SCLx	Vss	—	0.8	V	SMBus enabled **(Note 4)**
DI20	VIH	**Input High Voltage** I/O Pins not 5V-tolerant(5)	0.65 VDD	—	VDD	V	**(Note 4,6)**
		I/O Pins 5V-tolerant with PMP(5)	0.25 VDD + 0.8V	—	5.5	V	**(Note 4,6)**
		I/O Pins 5V-tolerant(5)	0.65 VDD	—	5.5	V	
DI28		SDAx, SCLx	0.65 VDD	—	5.5	V	SMBus disabled **(Note 4,6)**
DI29		SDAx, SCLx	2.1	—	5.5	V	SMBus enabled, 2.3V ≤ VPIN ≤ 5.5 **(Note 4,6)**
DI30	ICNPU	**Change Notification Pull-up Current**	—	-200	-50	µA	VDD = 3.3V, VPIN = VSS **(Note 3,6)**
DI31	ICNPD	**Change Notification Pull-down Current(4)**	50	200	—	µA	VDD = 3.3V, VPIN = VDD
	IIL	**Input Leakage Current (Note 3)**					
DI50		I/O Ports	—	—	±1	µA	VSS ≤ VPIN ≤ VDD, Pin at high-impedance
DI51		Analog Input Pins	—	—	±1	µA	VSS ≤ VPIN ≤ VDD, Pin at high-impedance
DI55		$\overline{MCLR}$(2)	—	—	±1	µA	VSS ≤ VPIN ≤ VDD
DI56		OSC1	—	—	±1	µA	VSS ≤ VPIN ≤ VDD, XT and HS modes

Note 1: Data in "Typical" column is at 3.3V, 25°C unless otherwise stated. Parameters are for design guidance only and are not tested.

2: The leakage current on the $\overline{MCLR}$ pin is strongly dependent on the applied voltage level. The specified levels represent normal operating conditions. Higher leakage current may be measured at different input voltages.

3: Negative current is defined as current sourced by the pin.

4: This parameter is characterized, but not tested in manufacturing.

5: See the **"Device Pin Tables"** section for the 5V-tolerant pins.

6: The VIH specifications are only in relation to externally applied inputs, and not with respect to the user-selectable internal pull-ups. External open drain input signals utilizing the internal pull-ups of the PIC32 device are guaranteed to be recognized only as a logic "high" internally to the PIC32 device, provided that the external load does not exceed the minimum value of ICNPU. For External "input" logic inputs that require a pull-up source, to guarantee the minimum VIH of those components, it is recommended to use an external pull-up resistor rather than the internal pull-ups of the PIC32 device.

TABLE 31-13: COMPARATOR SPECIFICATIONS

DC CHARACTERISTICS			Standard Operating Conditions (see Note 4): 2.3V to 3.6V (unless otherwise stated) Operating temperature -40°C ≤ TA ≤ +85°C for Industrial -40°C ≤ TA ≤ +105°C for V-temp				
Param. No.	Symbol	Characteristics	Min.	Typ.	Max.	Units	Comments
D300	V_{IOFF}	Input Offset Voltage	—	±7.5	±25	mV	AV_{DD} = V_{DD}, AV_{SS} = V_{SS}
D301	V_{ICM}[2]	Input Common Mode Voltage	0	—	V_{DD}	V	AV_{DD} = V_{DD}, AV_{SS} = V_{SS}
D302	$CMRR$[2]	Common Mode Rejection Ratio	55	—	—	dB	Max V_{ICM} = (V_{DD} - 1)V
D303	T_{RESP}[1,2]	Response Time	—	150	400	ns	AV_{DD} = V_{DD}, AV_{SS} = V_{SS}
D304	$ON2OV$[2]	Comparator Enabled to Output Valid	—	—	10	μs	Comparator module is configured before setting the comparator ON bit
D305	IV_{REF}	Internal Voltage Reference	1.14	1.2	1.26	V	—

Note 1: Response time measured with one comparator input at (V_{DD} – 1.5)/2, while the other input transitions from V_{SS} to V_{DD}.

2: These parameters are characterized but not tested.

3: Settling time measured while CVRR = `1` and CVR<3:0> transitions from '`0000`' to '`1111`'. This parameter is characterized, but not tested in manufacturing.

4: The Comparator module is functional at V_{BORMIN} < V_{DD} < V_{DDMIN}, but with degraded performance. Unless otherwise stated, module functionality is tested, but not characterized.

TABLE 31-37: PARALLEL SLAVE PORT REQUIREMENTS

Para m.No.	Symbol	Characteristics[1]	Min.	Typ.	Max.	Units	Conditions
	AC CHARACTERISTICS		**Standard Operating Conditions: 2.3V to 3.6V (unless otherwise stated)** Operating temperature -40°C ≤ TA ≤ +85°C for Industrial -40°C ≤ TA ≤ +105°C for V-temp					
PS1	TdtV2wrH	Data In Valid before WR or CS Inactive (setup time)	20	—	—	ns	—
PS2	TwrH2dtI	WR or CS Inactive to Data-In Invalid (hold time)	40	—	—	ns	—
PS3	TrdL2dtV	RD and CS Active to Data-Out Valid	—	—	60	ns	—
PS4	TrdH2dtI	RD Active or CS Inactive to Data-Out Invalid	0	—	10	ns	—
PS5	Tcs	CS Active Time	TPB + 40	—	—	ns	—
PS6	TWR	WR Active Time	TPB + 25	—	—	ns	—
PS7	TRD	RD Active Time	TPB + 25	—	—	ns	—

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

FIGURE 31-21: PARALLEL MASTER PORT READ TIMING DIAGRAM

Preliminary

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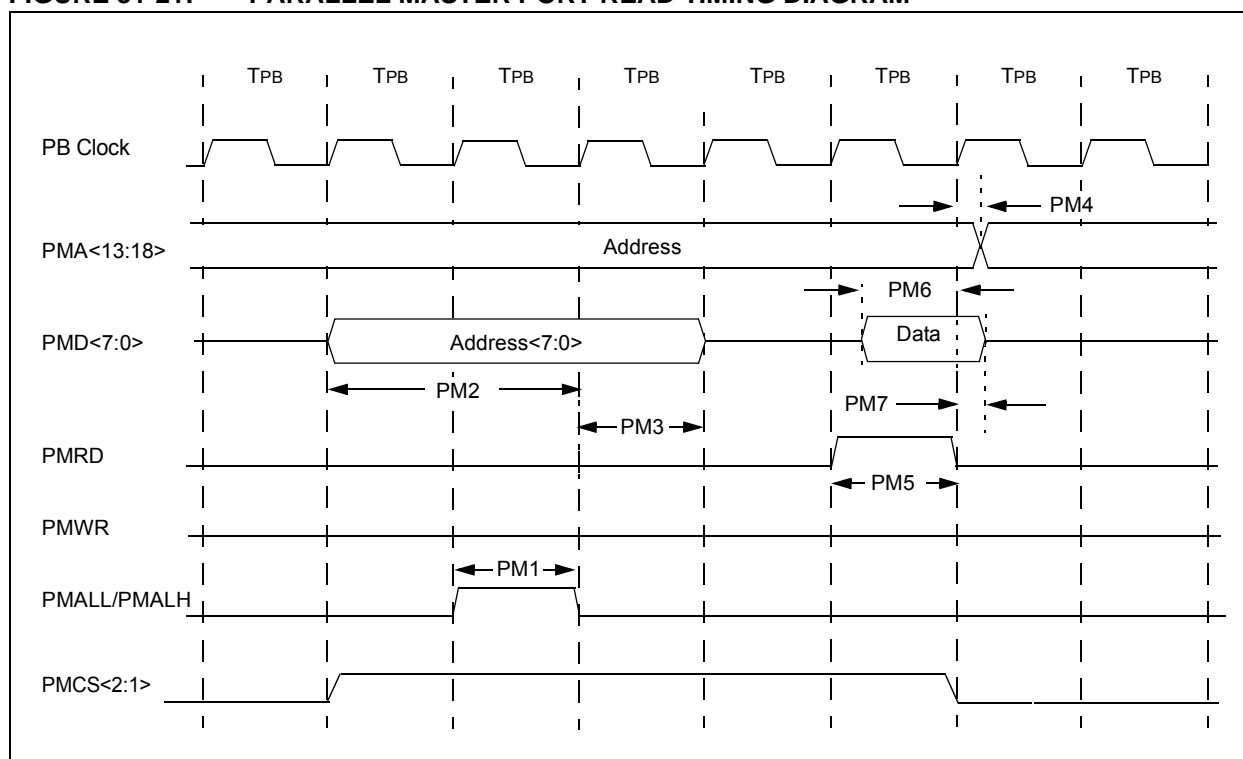
FIGURE 33-5: **TYPICAL CTMU TEMPERATURE DIODE FORWARD VOLTAGE**
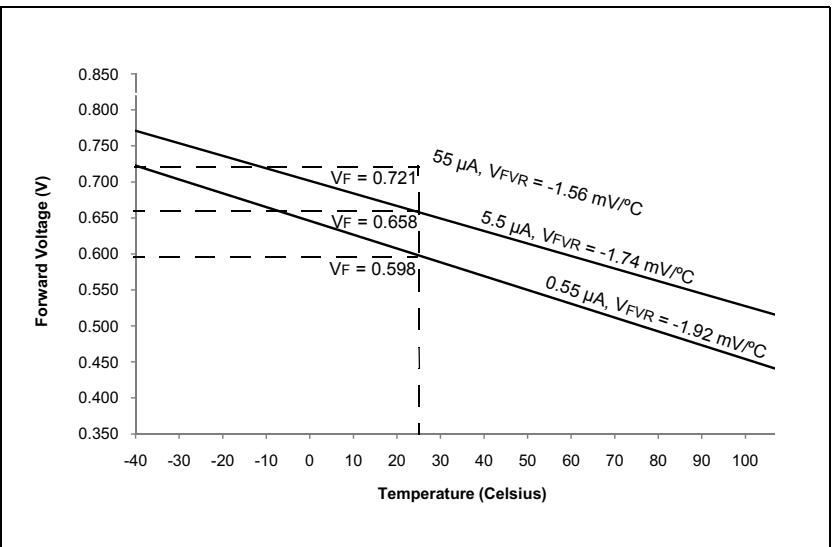
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