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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, POR, PWM, WDT
Number of I/O	53
Program Memory Size	32KB (32K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	8K x 8
Voltage - Supply (Vcc/Vdd)	2.3V ~ 3.6V
Data Converters	A/D 16x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	64-VFQFN Exposed Pad
Supplier Device Package	64-VQFN (9x9)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic32mx320f032ht-40v-mr

PIC32MX3XX/4XX

TABLE 3: PIN NAMES: PIC32MX320F128L, PIC32MX340F128L, PIC32MX360F128L, AND PIC32MX360F512L DEVICES

Pin Number	Full Pin Name
A1	PMD4/RE4
A2	PMD3/RE3
A3	TRD0/RG13
A4	PMD0/RE0
A5	PMD8/RG0
A6	PMD10/RF1
A7	ENVREG
A8	Vss
A9	IC5/PMD12/RD12
A10	OC3/RD2
A11	OC2/RD1
B1	No Connect (NC)
B2	RG15
B3	PMD2/RE2
B4	PMD1/RE1
B5	TRD3/RA7
B6	PMD11/RF0
B7	VCAP/VCORE
B8	PMRD/CN14/RD5
B9	OC4/RD3
B10	Vss
B11	SOSCO/T1CK/CN0/RC14
C1	PMD6/RE6
C2	VDD
C3	TRD1/RG12
C4	TRD2/RG14
C5	TRCLK/RA6
C6	No Connect (NC)
C7	PMD15/CN16/RD7
C8	OC5/PMWR/CN13/RD4
C9	VDD
C10	SOSCI/CN1/RC13
C11	IC4/PMCS1/PMA14/RD11
D1	T2CK/RC1
D2	PMD7/RE7
D3	PMD5/RE5
D4	Vss
D5	Vss
D6	No Connect (NC)
D7	PMD14/CN15/RD6
D8	PMD13/CN19/RD13
D9	OC1/RD0
D10	No Connect (NC)
D11	IC3/PMCS2/PMA15/RD10
E1	T5CK/RC4
E2	T4CK/RC3
E3	SCK2/PMA5/CN8/RG6
E4	T3CK/RC2
E5	VDD
E6	PMD9/RG1
E7	Vss

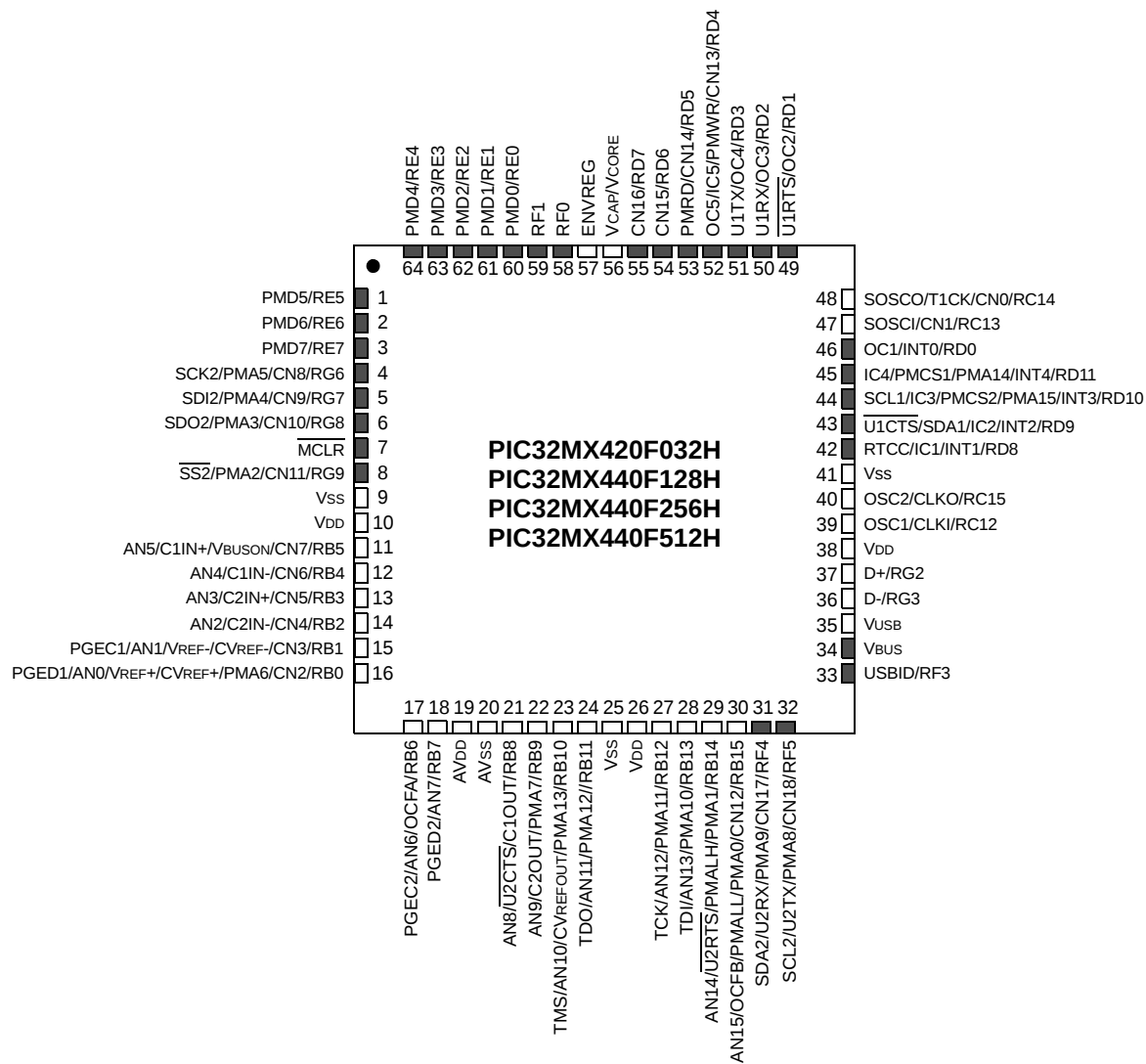
Pin Number	Full Pin Name
E8	INT4/RA15
E9	RTCC/IC1/RD8
E10	IC2/RD9
E11	INT3/RA14
F1	MCLR
F2	SDO2/PMA3/CN10/RG8
F3	SS2/PMA2/CN11/RG9
F4	SDI2/PMA4/CN9/RG7
F5	Vss
F6	No Connect (NC)
F7	No Connect (NC)
F8	VDD
F9	OSC1/CLKI/RC12
F10	Vss
F11	OSC2/CLKO/RC15
G1	INT1/RE8
G2	INT2/RE9
G3	TMS/RA0
G4	No Connect (NC)
G5	VDD
G6	Vss
G7	Vss
G8	No Connect (NC)
G9	TDO/RA5
G10	SDA2/RA3
G11	TDI/RA4
H1	AN5/C1IN+/CN7/RB5
H2	AN4/C1IN-/CN6/RB4
H3	Vss
H4	VDD
H5	No Connect (NC)
H6	VDD
H7	No Connect (NC)
H8	SDI1/RF7
H9	SCK1/INT0/RF6
H10	SCL1/RG2
H11	SCL2/RA2
J1	AN3/C2IN+/CN5/RB3
J2	AN2/C2IN-/SS1/CN4/RB2
J3	PGED2/AN7/RB7
J4	AVDD
J5	AN11/PMA12/RB11
J6	TCK/RA1
J7	AN12/PMA11/RB12
J8	No Connect (NC)
J9	No Connect (NC)
J10	SDO1/RF8
J11	SDA1/RG3
K1	PGEC1/AN1/CN3/RB1
K2	PGED1/AN0/CN2/RB0
K3	VREF+/CVREF+/PMA6/RA10

PIC32MX3XX/4XX

Pin Diagrams (Continued)

64-Pin QFN (USB)

■ = Pins are up to 5V tolerant



Note: The metal plane at the bottom of the device is not connected to any pins and is recommended to be connected to V_{SS} externally.

PIC32MX3XX/4XX

TABLE 1-1: PINOUT I/O DESCRIPTIONS

Pin Name	Pin Number ⁽¹⁾			Pin Type	Buffer Type	Description
	64-pin QFN/TQFP	100-pin TQFP	121-pin XBGA			
AN0	16	25	K2	I	Analog	Analog input channels.
AN1	15	24	K1	I	Analog	
AN2	14	23	J2	I	Analog	
AN3	13	22	J1	I	Analog	
AN4	12	21	H2	I	Analog	
AN5	11	20	H1	I	Analog	
AN6	17	26	L1	I	Analog	
AN7	18	27	J3	I	Analog	
AN8	21	32	K4	I	Analog	
AN9	22	33	L4	I	Analog	
AN10	23	34	L5	I	Analog	
AN11	24	35	J5	I	Analog	
AN12	27	41	J7	I	Analog	
AN13	28	42	L7	I	Analog	
AN14	29	43	K7	I	Analog	
AN15	30	44	L8	I	Analog	
CLKI	39	63	F9	I	ST/CMOS	External clock source input. Always associated with OSC1 pin function.
CLKO	40	64	F11	O	—	Oscillator crystal output. Connects to crystal or resonator in Crystal Oscillator mode. Optionally functions as CLKO in RC and EC modes. Always associated with OSC2 pin function.
OSC1	39	63	F9	I	ST/CMOS	Oscillator crystal input. ST buffer when configured in RC mode; CMOS otherwise.
OSC2	40	64	F11	I/O	—	Oscillator crystal output. Connects to crystal or resonator in Crystal Oscillator mode. Optionally functions as CLKO in RC and EC modes.
SOSCI	47	73	C10	I	ST/CMOS	32.768 kHz low-power oscillator crystal input; CMOS otherwise.
SOSCO	48	74	B11	O	—	32.768 kHz low-power oscillator crystal output.

Legend: CMOS = CMOS compatible input or output
ST = Schmitt Trigger input with CMOS levels
TTL = TTL input buffer

Analog = Analog input P = Power
O = Output I = Input

Note 1: Pin numbers are provided for reference only. See the “Pin Diagrams” section for device pin availability.

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

Pin Name	Pin Number ⁽¹⁾			Pin Type	Buffer Type	Description
	64-pin QFN/TQFP	100-pin TQFP	121-pin XBGA			
TMS	23	17	G3	I	ST	JTAG Test mode select pin.
TCK	27	38	J6	I	ST	JTAG test clock input pin.
TDI	28	60	G11	I	ST	JTAG test data input pin.
TDO	24	61	G9	O	—	JTAG test data output pin.
RTCC	42	68	E9	O	—	Real-Time Clock Alarm Output.
CVREF-	15	28	L2	I	Analog	Comparator Voltage Reference (low).
CVREF+	16	29	K3	I	Analog	Comparator Voltage Reference (high).
CVREFOUT	23	34	L5	O	Analog	Comparator Voltage Reference Output.
C1IN-	12	21	H2	I	Analog	Comparator 1 Negative Input.
C1IN+	11	20	H1	I	Analog	Comparator 1 Positive Input.
C1OUT	21	32	K4	O	—	Comparator 1 Output.
C2IN-	14	23	J2	I	Analog	Comparator 2 Negative Input.
C2IN+	13	22	J1	I	Analog	Comparator 2 Positive Input.
C2OUT	22	33	L4	O	—	Comparator 2 Output.
PMA0	30	44	L8	I/O	TTL/ST	Parallel Master Port Address Bit 0 Input (Buffered Slave modes) and Output (Master modes).
PMA1	29	43	K7	I/O	TTL/ST	Parallel Master Port Address Bit 1 Input (Buffered Slave modes) and Output (Master modes).
PMA2	8	14	F3	O	—	Parallel Master Port Address (De-multiplexed Master Modes).
PMA3	6	12	F2	O	—	
PMA4	5	11	F4	O	—	
PMA5	4	10	E3	O	—	
PMA6	16	29	K3	O	—	
PMA7	22	28	L2	O	—	
PMA8	32	50	L11	O	—	
PMA9	31	49	L10	O	—	
PMA10	28	42	L7	O	—	
PMA11	27	41	J7	O	—	
PMA12	24	35	J5	O	—	
PMA13	23	34	L5	O	—	
PMA14	45	71	C11	O	—	
PMA15	44	70	D11	O	—	
PMCS1	45	71	C11	O	—	Parallel Master Port Chip Select 1 Strobe.
PMCS2	44	70	D11	O	—	Parallel Master Port Chip Select 2 Strobe.

Legend: CMOS = CMOS compatible input or output
ST = Schmitt Trigger input with CMOS levels
TTL = TTL input buffer

Analog = Analog input P = Power
O = Output I = Input

Note 1: Pin numbers are provided for reference only. See the “Pin Diagrams” section for device pin availability.

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

Pin Name	Pin Number ⁽¹⁾			Pin Type	Buffer Type	Description
	64-pin QFN/TQFP	100-pin TQFP	121-pin XBGA			
PGED2	18	27	J3	I/O	ST	Data I/O pin for programming/debugging communication channel 2.
PGEC2	17	26	L1	I	ST	Clock input pin for programming/debugging communication channel 2.
MCLR	7	13	F1	I/P	ST	Master Clear (Reset) input. This pin is an active-low Reset to the device.
AVDD	19	30	J4	P	P	Positive supply for analog modules. This pin must be connected at all times.
AVSS	20	31	L3	P	P	Ground reference for analog modules.
VDD	10, 26, 38	2, 16, 37, 46, 62	C2, C9, E5, F8, G5, H4, H6, K8	P	—	Positive supply for peripheral logic and I/O pins.
VCORE/ VCAP	56	85	B7	P	—	Capacitor for Internal Voltage Regulator.
VSS	9, 25, 41	15, 36, 45, 65, 75	A8, B10, D4, D5, E7, F10, F5, G6, G7, H3	P	—	Ground reference for logic and I/O pins.
VREF+	16	29	K3	I	Analog	Analog voltage reference (high) input.
VREF-	15	28	L2	I	Analog	Analog voltage reference (low) input.

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

Note 1: Pin numbers are provided for reference only. See the “Pin Diagrams” section for device pin availability.

TABLE 3-1: MIPS® M4K® PROCESSOR CORE HIGH-PERFORMANCE INTEGER MULTIPLY/DIVIDE UNIT LATENCIES AND REPEAT RATES

Opcode	Operand Size (mul <i>rt</i>) (div <i>rs</i>)	Latency	Repeat Rate
MULT/MULTU, MADD/MADDU, MSUB/MSUBU	16 bits	1	1
	32 bits	2	2
MUL	16 bits	2	1
	32 bits	3	2
DIV/DIVU	8 bits	12	11
	16 bits	19	18
	24 bits	26	25
	32 bits	33	32

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
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
11	Compare ⁽¹⁾	Timer interrupt control
12	Status ⁽¹⁾	Processor status and control
12	IntCtl ⁽¹⁾	Interrupt system status and control
12	SRSCtl ⁽¹⁾	Shadow register set status and control
12	SRSMap ⁽¹⁾	Provides mapping from vectored interrupt to a shadow set
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

TABLE 4-11: UART1-2 REGISTERS 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
6000	U1MODE ⁽¹⁾	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000	
		15:0	ON	—	SIDL	IREN	RTSMO	—	UEN<1:0>		WAKE	LPBACK	ABAUO	RXINV	BRGH	PDSEL<1:0>		STSEL	0000
6010	U1STA ⁽¹⁾	31:16	—	—	—	—	—	—	—	ADM_EN	ADDR<7:0>								0000
		15:0	UTXISEL<1:0>		UTXINV	URXEN	UTXBRK	UTXEN	UTXBF	TRMT	URXISEL<1:0>		ADDEN	RIDLE	PERR	FERR	OERR	URXDA	0110
6020	U1TXREG	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000	
		15:0	—	—	—	—	—	—	—	TX8	Transmit Register								0000
6030	U1RXREG	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000	
		15:0	—	—	—	—	—	—	—	RX8	Receive Register								0000
6040	U1BRG ⁽¹⁾	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000	
		15:0	BRG<15:0>																0000
6200	U2MODE ⁽¹⁾	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000	
		15:0	ON	—	SIDL	IREN	RTSMO	—	UEN<1:0>		WAKE	LPBACK	ABAUO	RXINV	BRGH	PDSEL<1:0>		STSEL	0000
6210	U2STA ⁽¹⁾	31:16	—	—	—	—	—	—	—	ADM_EN	ADDR<7:0>								0000
		15:0	UTXISEL<1:0>		UTXINV	URXEN	UTXBRK	UTXEN	UTXBF	TRMT	URXISEL<1:0>		ADDEN	RIDLE	PERR	FERR	OERR	URXDA	0110
6220	U2TXREG	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000	
		15:0	—	—	—	—	—	—	—	TX8	Transmit Register								0000
6230	U2RXREG	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000	
		15:0	—	—	—	—	—	—	—	RX8	Receive Register								0000
6240	U2BRG ⁽¹⁾	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000	
		15:0	BRG<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 its virtual address, plus an offset of 0x4, 0x8 and 0xC, respectively. See **Section 12.1.1 “CLR, SET and INV Registers”** for more information.

TABLE 4-13: ADC REGISTERS MAP (CONTINUED)

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	
9110	ADC1BUFA	31:16	ADC Result Word A (ADC1BUFA<31:0>)																0000
		15:0																	0000
9120	ADC1BUFB	31:16	ADC Result Word B (ADC1BUFB<31:0>)																0000
		15:0																	0000
9130	ADC1BUFC	31:16	ADC Result Word C (ADC1BUFC<31:0>)																0000
		15:0																	0000
9140	ADC1BUFD	31:16	ADC Result Word D (ADC1BUFD<31:0>)																0000
		15:0																	0000
9150	ADC1BUFE	31:16	ADC Result Word E (ADC1BUFE<31:0>)																0000
		15:0																	0000
9160	ADC1BUFF	31:16	ADC Result Word F (ADC1BUFF<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 its virtual address, plus an offset of 0x4, 0x8 and 0xC, respectively. See **Section 12.1.1 “CLR, SET and INV Registers”** for more information.

TABLE 4-21: PORTA REGISTERS MAP FOR PIC32MX320F128L, PIC32MX340F128L, PIC32MX360F256L, PIC32MX360F512L, PIC32MX440F128L, PIC32MX460F256L AND PIC32MX460F512L DEVICES ONLY⁽¹⁾

Virtual Address (BF88_#)	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	
6000	TRISA	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	TRISA15	TRISA14	—	—	—	TRISA10	TRISA9	—	TRISA7	TRISA6	TRISA5	TRISA4	TRISA3	TRISA2	TRISA1	TRISA0	C6FF
6010	PORTA	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	RA15	RA14	—	—	—	RA10	RA9	—	RA7	RA6	RA5	RA4	RA3	RA2	RA1	RA0	xxxx
6020	LATA	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	LATA15	LATA14	—	—	—	LATA10	LATA9	—	LATA7	LATA6	LATA5	LATA4	LATA3	LATA2	LATA1	LATA0	xxxx
6030	ODCA	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	ODCA15	ODCA14	—	—	—	ODCA10	ODCA9	—	ODCA7	ODCA6	ODCA5	ODCA4	ODCA3	ODCA2	ODCA1	ODCA0	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 12.1.1 “CLR, SET and INV Registers”** for more information.

TABLE 4-22: PORTB REGISTERS MAP⁽¹⁾

Virtual Address (BF88_#)	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	
6040	TRISB	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	TRISB15	TRISB14	TRISB13	TRISB12	TRISB11	TRISB10	TRISB9	TRISB8	TRISB7	TRISB6	TRISB5	TRISB4	TRISB3	TRISB2	TRISB1	TRISB0	FFFF
6050	PORTB	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	RB15	RB14	RB13	RB12	RB11	RB10	RB9	RB8	RB7	RB6	RB5	RB4	RB3	RB2	RB1	RB0	xxxx
6060	LATB	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	LATB15	LATB14	LATB13	LATB12	LATB11	LATB10	LATB9	LATB8	LATB7	LATB6	LATB5	LATB4	LATB3	LATB2	LATB1	LATB0	xxxx
6070	ODCB	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	ODCB15	ODCB14	ODCB13	ODCB12	ODCB11	ODCB10	ODCB9	ODCB8	ODCB7	ODCB6	ODCB5	ODCB4	ODCB3	ODCB2	ODCB1	ODCB0	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 12.1.1 “CLR, SET and INV Registers”** for more information.

TABLE 4-40: RTCC REGISTERS MAP⁽¹⁾

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	
0200	RTCCON	31:16	—	—	—	—	—	—	CAL<11:0>										0000
		15:0	ON	—	SIDL	—	—	—	—	—	RTSECSEL	RTCCLKON	—	—	RTCWREN	RTCSYNC	HALFSEC	RTC0E	0000
0210	RTCALRM	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0000
		15:0	ALRMEN	CHIME	PIV	ALRMSYNC	AMASK<3:0>					ARPT<7:0>							0000
0220	RTCTIME	31:16	HR10<3:0>				HR01<3:0>				MIN10<3:0>				MIN01<3:0>				xxxx
		15:0	SEC10<3:0>				SEC01<3:0>				—	—	—	—	—	—	—	—	xx00
0230	RTCDATE	31:16	YEAR10<3:0>				YEAR01<3:0>				MONTH10<3:0>				MONTH01<3:0>				xxxx
		15:0	DAY10<3:0>				DAY01<3:0>				—	—	—	—	WDAY01<3:0>				xx0x
0240	ALRMTIME	31:16	MIN10<3:0>				MIN01<3:0>				MIN10<3:0>				MIN01<3:0>				xxxx
		15:0	SEC10<3:0>				SEC01<3:0>				—	—	—	—	—	—	—	—	xx00
0250	ALRMDATE	31:16	—	—	—	—	—	—	—	—	MONTH10<3:0>				MONTH01<3:0>				00xx
		15:0	DAY10<3:0>				DAY01<3:0>				—	—	—	—	WDAY01<3:0>				xx0x

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 12.1.1 “CLR, SET and INV Registers”** for more information.

TABLE 4-41: DEVCFG: DEVICE CONFIGURATION WORD SUMMARY

Virtual Address (BFC0_#)	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		
2FF0	DEVCFG3	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	xxxx	
		15:0	USERID15	USERID14	USERID13	USERID12	USERID11	USERID10	USERID9	USERID8	USERID7	USERID6	USERID5	USERID4	USERID3	USERID2	USERID1	USERID0	xxxx	
2FF4	DEVCFG2	31:16	—	—	—	—	—	—	—	—	—	—	—	—	—	FPLLODIV<2:0>			xxxx	
		15:0	UPLLEN ⁽¹⁾		—	—	—	UPLLDIV<2:0> ⁽¹⁾				—	FPLLMUL<2:0>				—	FPLLDIV<2:0>		xxxx
2FF8	DEVCFG1	31:16	—	—	—	—	—	—	—	—	FWDTEN	—	—	WDTPS<4:0>						xxxx
		15:0	FCKSM<1:0>			FPBDIV<1:0>		—	OSCIOFNC	POSCMOD<1:0>		IESO	—	FSOSCEN	—	—	FNOSC<2:0>			xxxx
2FFC	DEVCFG0	31:16	—	—	—	CP	—	—	—	BWP	—	—	—	—	PWP19	PWP18	PWP17	PWP16	xxxx	
		15:0	PWP15	PWP14	PWP13	PWP12	—	—	—	—	—	—	—	—	ICESEL	—	DEBUG<1:0>			xxxx

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

Note 1: These bits are only available on PIC32MX4XX devices.

PIC32MX3XX/4XX

TABLE 7-1: INTERRUPT IRQ AND VECTOR LOCATION

Interrupt Source ⁽¹⁾	IRQ	Vector Number	Interrupt Bit Location			
Highest Natural Order Priority			Flag	Enable	Priority	Subpriority
CT – Core Timer Interrupt	0	0	IFS0<0>	IEC0<0>	IPC0<4:2>	IPC0<1:0>
CS0 – Core Software Interrupt 0	1	1	IFS0<1>	IEC0<1>	IPC0<12:10>	IPC0<9:8>
CS1 – Core Software Interrupt 1	2	2	IFS0<2>	IEC0<2>	IPC0<20:18>	IPC0<17:16>
INT0 – External Interrupt 0	3	3	IFS0<3>	IEC0<3>	IPC0<28:26>	IPC0<25:24>
T1 – Timer1	4	4	IFS0<4>	IEC0<4>	IPC1<4:2>	IPC1<1:0>
IC1 – Input Capture 1	5	5	IFS0<5>	IEC0<5>	IPC1<12:10>	IPC1<9:8>
OC1 – Output Compare 1	6	6	IFS0<6>	IEC0<6>	IPC1<20:18>	IPC1<17:16>
INT1 – External Interrupt 1	7	7	IFS0<7>	IEC0<7>	IPC1<28:26>	IPC1<25:24>
T2 – Timer2	8	8	IFS0<8>	IEC0<8>	IPC2<4:2>	IPC2<1:0>
IC2 – Input Capture 2	9	9	IFS0<9>	IEC0<9>	IPC2<12:10>	IPC2<9:8>
OC2 – Output Compare 2	10	10	IFS0<10>	IEC0<10>	IPC2<20:18>	IPC2<17:16>
INT2 – External Interrupt 2	11	11	IFS0<11>	IEC0<11>	IPC2<28:26>	IPC2<25:24>
T3 – Timer3	12	12	IFS0<12>	IEC0<12>	IPC3<4:2>	IPC3<1:0>
IC3 – Input Capture 3	13	13	IFS0<13>	IEC0<13>	IPC3<12:10>	IPC3<9:8>
OC3 – Output Compare 3	14	14	IFS0<14>	IEC0<14>	IPC3<20:18>	IPC3<17:16>
INT3 – External Interrupt 3	15	15	IFS0<15>	IEC0<15>	IPC3<28:26>	IPC3<25:24>
T4 – Timer4	16	16	IFS0<16>	IEC0<16>	IPC4<4:2>	IPC4<1:0>
IC4 – Input Capture 4	17	17	IFS0<17>	IEC0<17>	IPC4<12:10>	IPC4<9:8>
OC4 – Output Compare 4	18	18	IFS0<18>	IEC0<18>	IPC4<20:18>	IPC4<17:16>
INT4 – External Interrupt 4	19	19	IFS0<19>	IEC0<19>	IPC4<28:26>	IPC4<25:24>
T5 – Timer5	20	20	IFS0<20>	IEC0<20>	IPC5<4:2>	IPC5<1:0>
IC5 – Input Capture 5	21	21	IFS0<21>	IEC0<21>	IPC5<12:10>	IPC5<9:8>
OC5 – Output Compare 5	22	22	IFS0<22>	IEC0<22>	IPC5<20:18>	IPC5<17:16>
SPI1E – SPI1 Fault	23	23	IFS0<23>	IEC0<23>	IPC5<28:26>	IPC5<25:24>
SPI1TX – SPI1 Transfer Done	24	23	IFS0<24>	IEC0<24>	IPC5<28:26>	IPC5<25:24>
SPI1RX – SPI1 Receive Done	25	23	IFS0<25>	IEC0<25>	IPC5<28:26>	IPC5<25:24>
U1E – UART1 Error	26	24	IFS0<26>	IEC0<26>	IPC6<4:2>	IPC6<1:0>
U1RX – UART1 Receiver	27	24	IFS0<27>	IEC0<27>	IPC6<4:2>	IPC6<1:0>
U1TX – UART1 Transmitter	28	24	IFS0<28>	IEC0<28>	IPC6<4:2>	IPC6<1:0>
I2C1B – I2C1 Bus Collision Event	29	25	IFS0<29>	IEC0<29>	IPC6<12:10>	IPC6<9:8>
I2C1S – I2C1 Slave Event	30	25	IFS0<30>	IEC0<30>	IPC6<12:10>	IPC6<9:8>
I2C1M – I2C1 Master Event	31	25	IFS0<31>	IEC0<31>	IPC6<12:10>	IPC6<9:8>
CN – Input Change Interrupt	32	26	IFS1<0>	IEC1<0>	IPC6<20:18>	IPC6<17:16>
AD1 – ADC1 Convert Done	33	27	IFS1<1>	IEC1<1>	IPC6<28:26>	IPC6<25:24>
PMP – Parallel Master Port	34	28	IFS1<2>	IEC1<2>	IPC7<4:2>	IPC7<1:0>
CMP1 – Comparator Interrupt	35	29	IFS1<3>	IEC1<3>	IPC7<12:10>	IPC7<9:8>
CMP2 – Comparator Interrupt	36	30	IFS1<4>	IEC1<4>	IPC7<20:18>	IPC7<17:16>

Note 1: Not all interrupt sources are available on all devices. See **TABLE 1: “PIC32MX General Purpose – Features”** and **TABLE 2: “PIC32MX USB – Features”** for available peripherals.

PIC32MX3XX/4XX

NOTES:

12.0 I/O PORTS

Note 1: This data sheet summarizes the features of the PIC32MX3XX/4XX family of devices. It is not intended to be a comprehensive reference source. To complement the information in this data sheet, refer to **Section 12. “I/O Ports”** (DS61120) of the “PIC32 Family Reference Manual”, which is available from the Microchip web site (www.microchip.com/PIC32).

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

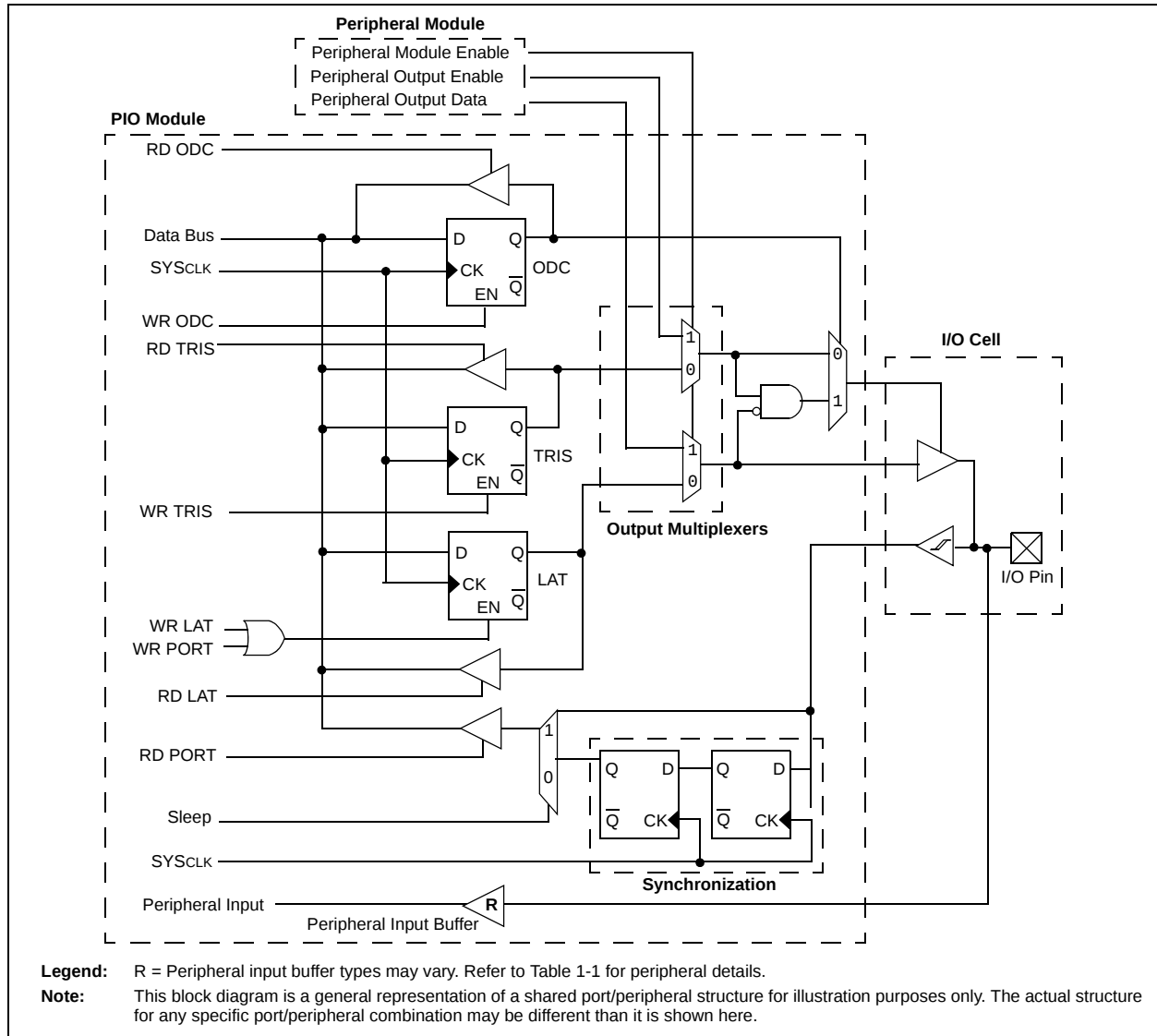
General purpose I/O pins are the simplest of peripherals. They allow the PIC® MCU to monitor and control other devices. To add flexibility and functionality, some pins are multiplexed with alternate function(s). These functions depend on which peripheral features are on the device. In general, when a peripheral is functioning, that pin may not be used as a general purpose I/O pin.

Following are some of the key features of this module:

- Individual Output Pin Open-drain Enable/Disable
- Individual Input Pin Weak Pull-up Enable/Disable
- Monitor Selective Inputs and Generate Interrupt when Change in Pin State is Detected
- Operation during CPU Sleep and Idle modes
- Fast Bit Manipulation using CLR, SET and INV Registers

Figure 12-1 illustrates a block diagram of a typical multiplexed I/O port.

FIGURE 12-1: BLOCK DIAGRAM OF A TYPICAL MULTIPLEXED PORT STRUCTURE



19.0 UNIVERSAL ASYNCHRONOUS RECEIVER TRANSMITTER (UART)

Note 1: This data sheet summarizes the features of the PIC32MX3XX/4XX 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)”** (DS61107) of the “PIC32 Family Reference Manual”, which is available from the Microchip web site (www.microchip.com/PIC32).

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

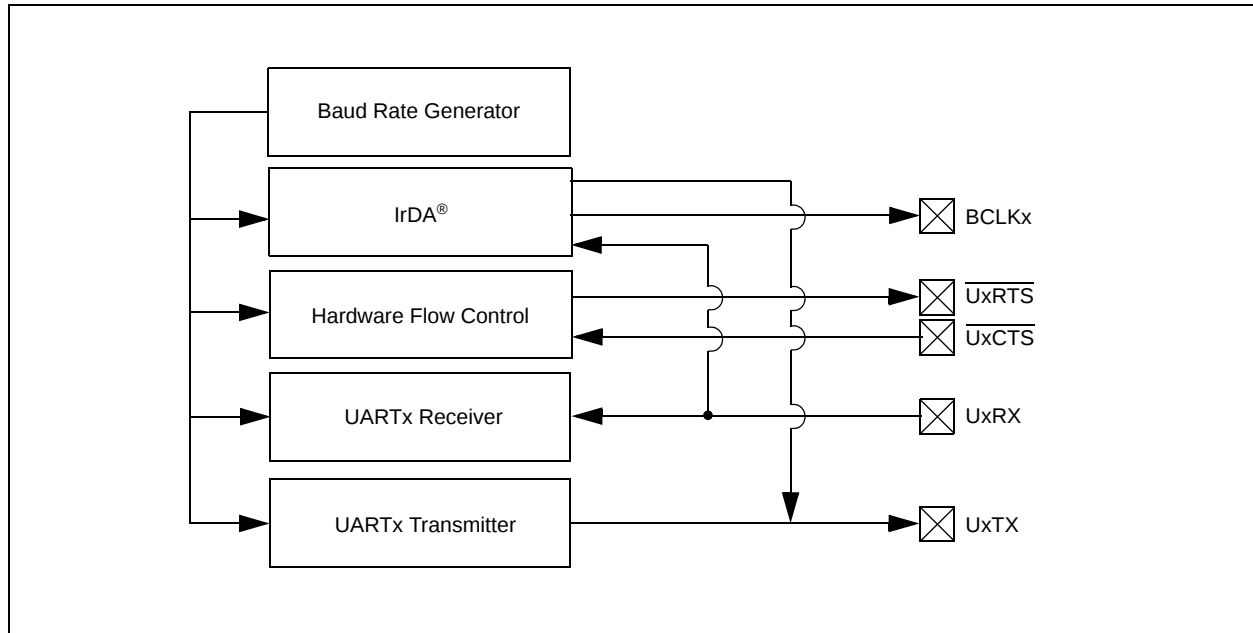
The UART module is one of the serial I/O modules available in PIC32MX3XX/4XX family devices. The UART is a full-duplex, asynchronous communication channel that communicates with peripheral devices and personal computers through protocols such as RS-232, RS-485, LIN 1.2 and IrDA®. The module also supports the hardware flow control option, with UxCTS and 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 76 bps to 20 Mbps at 80 MHz
- 4-level-deep First-In-First-Out (FIFO) Transmit Data Buffer
- 4-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



PIC32MX3XX/4XX

FIGURE 29-11: SPIx MODULE MASTER MODE (CKE = 1) TIMING CHARACTERISTICS

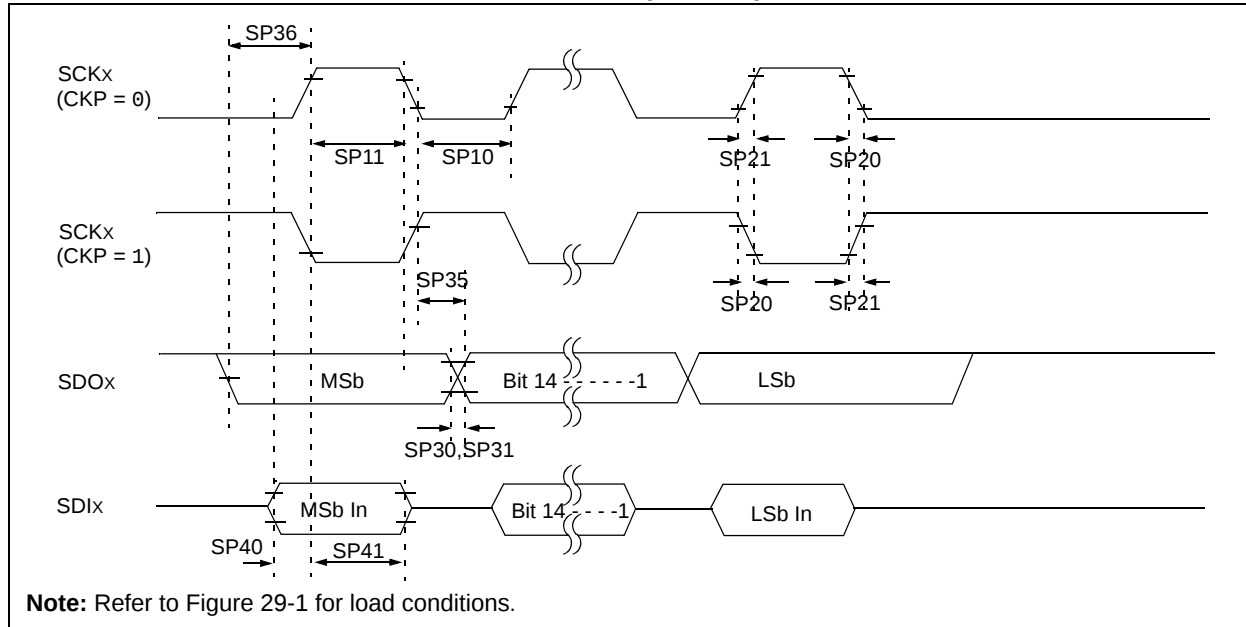


TABLE 29-29: SPIx MODULE MASTER MODE (CKE = 1) TIMING REQUIREMENTS

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				
Param. No.	Symbol	Characteristics ⁽¹⁾	Min.	Typical ⁽²⁾	Max.	Units	Conditions
SP10	TsCL	SCKx Output Low Time ⁽³⁾	Tsck/2	—	—	ns	—
SP11	TsCH	SCKx Output High Time ⁽³⁾	Tsck/2	—	—	ns	—
SP20	TscF	SCKx Output Fall Time ⁽⁴⁾	—	—	—	ns	See parameter DO32
SP21	TscR	SCKx Output Rise Time ⁽⁴⁾	—	—	—	ns	See parameter DO31
SP30	TdOF	SDOx Data Output Fall Time ⁽⁴⁾	—	—	—	ns	See parameter DO32
SP31	TdOR	SDOx Data Output Rise Time ⁽⁴⁾	—	—	—	ns	See parameter DO31
SP35	TsCH2doV, TsCL2doV	SDOx Data Output Valid after SCKx Edge	—	—	15	ns	VDD > 2.7V
			—	—	20	ns	VDD < 2.7V
SP36	TdoV2sc, TdoV2sCL	SDOx Data Output Setup to First SCKx Edge	15	—	—	ns	—
SP40	TdiV2sCH, TdiV2sCL	Setup Time of SDIx Data Input to SCKx Edge	15	—	—	ns	VDD > 2.7V
			20	—	—	ns	VDD < 2.7V
SP41	TsCH2diL, TsCL2diL	Hold Time of SDIx Data Input to SCKx Edge	15	—	—	ns	VDD > 2.7V
			20	—	—	ns	VDD < 2.7V

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

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

3: The minimum clock period for SCKx is 40 ns. Therefore, the clock generated in Master mode must not violate this specification.

4: Assumes 50 pF load on all SPIx pins.

TABLE 29-35: 10-BIT ADC CONVERSION RATE PARAMETERS⁽²⁾

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					
ADC Speed	TAD Minimum	Sampling Time Min	Rs Max	VDD	ADC Channels Configuration
1 MIPS to 400 ksp ⁽¹⁾	65 ns	132 ns	500Ω	3.0V to 3.6V	
Up to 400 ksp	200 ns	200 ns	5.0 kΩ	2.5V to 3.6V	
Up to 300 ksp	200 ns	200 ns	5.0 kΩ	2.5V to 3.6V	

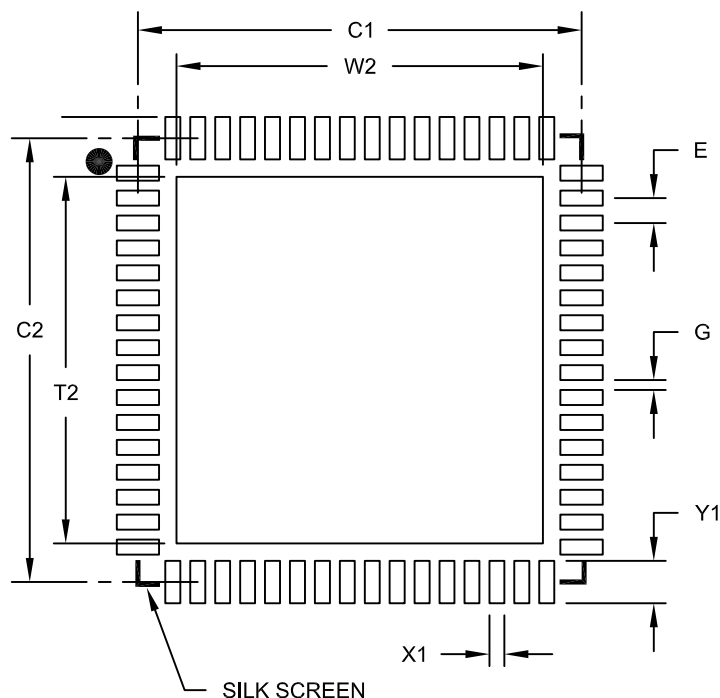
Note 1: External VREF- and VREF+ pins must be used for correct operation.

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

PIC32MX3XX/4XX

64-Lead Plastic Quad Flat, No Lead Package (MR) – 9x9x0.9 mm Body [QFN]
With 0.40 mm Contact Length

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



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.50 BSC		
Optional Center Pad Width	W2			7.35
Optional Center Pad Length	T2			7.35
Contact Pad Spacing	C1		8.90	
Contact Pad Spacing	C2		8.90	
Contact Pad Width (X64)	X1			0.30
Contact Pad Length (X64)	Y1			0.85
Distance Between Pads	G	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

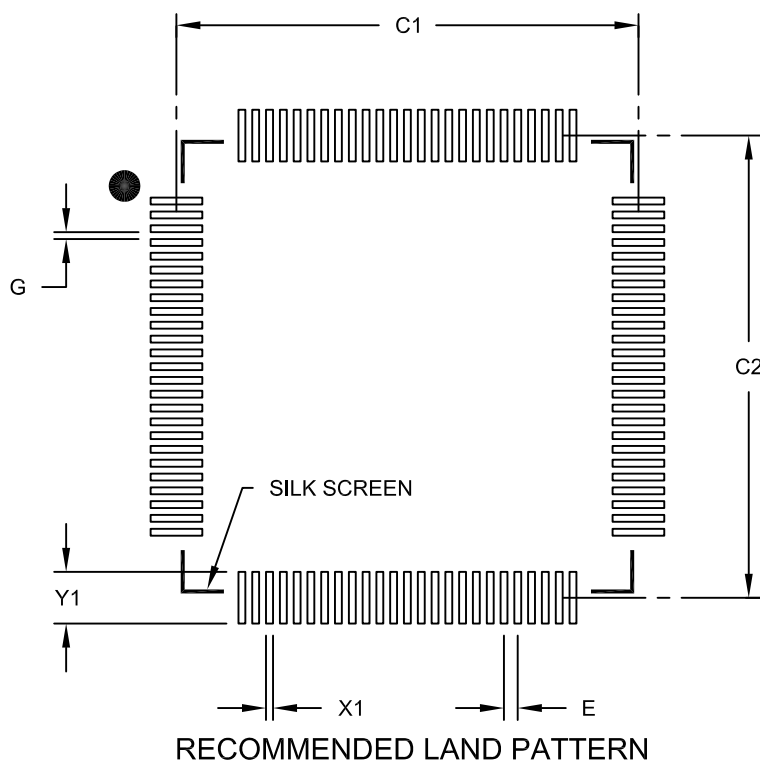
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2149A

PIC32MX3XX/4XX

100-Lead Plastic Thin Quad Flatpack (PT)-12x12x1mm Body, 2.00 mm Footprint [TQFP]

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



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.40 BSC		
Contact Pad Spacing	C1		13.40	
Contact Pad Spacing	C2		13.40	
Contact Pad Width (X100)	X1			0.20
Contact Pad Length (X100)	Y1			1.50
Distance Between Pads	G	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2100B

Product Identification System

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

	PIC32	MX	3XX	F	512	H	T	- 80	I / PT	- XXX
Microchip Brand										
Architecture										
Product Groups										
Flash Memory Family										
Program Memory Size (KB)										
Pin Count										
Tape and Reel Flag (if applicable)										
Speed										
Temperature Range										
Package										
Pattern										

Examples:

PIC32MX320F032H-40I/PT:
General purpose PIC32MX,
32 KB program memory,
64-pin, Industrial temperature,
TQFP package.

PIC32MX360F256L-80I/PT:
General purpose PIC32MX,
256 KB program memory,
100-pin, Industrial temperature,
TQFP package.

Flash Memory Family	
Architecture	MX = 32-bit RISC MCU core
Product Groups	3XX = General purpose microcontroller family 4XX = USB
Flash Memory Family	F = Flash program memory
Program Memory Size	32 = 32K 64 = 64K 128 = 128K 256 = 256K 512 = 512K
Speed	40 = 40 MHz 80 = 80 MHz
Pin Count	H = 64-pin L = 100-pin
Temperature Range	I = -40° C to +85° C (Industrial) V = -40° C to +105° C (V-Temp)
Package	PT = 64-Lead (10x10x1 mm) TQFP (Thin Quad Flatpack) PT = 100-Lead (12x12x1 mm) TQFP (Thin Quad Flatpack) MR = 64-Lead (9x9x0.9 mm) QFN (Plastic Quad Flat) BG = 121-Lead (10x10x1.1 mm) XBGA (Plastic Thin Profile Ball Grid Array)
Pattern	Three-digit QTP, SQTP, Code or Special Requirements (blank otherwise) ES = Engineering Sample