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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	PIC
Core Size	8-Bit
Speed	4MHz
Connectivity	-
Peripherals	POR, WDT
Number of I/O	12
Program Memory Size	3KB (2K x 12)
Program Memory Type	OTP
EEPROM Size	-
RAM Size	73 x 8
Voltage - Supply (Vcc/Vdd)	2.5V ~ 5.5V
Data Converters	-
Oscillator Type	External
Operating Temperature	0°C ~ 70°C (TA)
Mounting Type	Through Hole
Package / Case	18-DIP (0.300", 7.62mm)
Supplier Device Package	18-PDIP
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic16lc58b-04-p

TABLE 3-1: PINOUT DESCRIPTION - PIC16C54, PIC16CR54, PIC16C56, PIC16CR56, PIC16C58, PIC16CR58

Pin Name	Pin Number			Pin Type	Buffer Type	Description
	DIP	SOIC	SSOP			
RA0	17	17	19	I/O	TTL	Bi-directional I/O port
RA1	18	18	20	I/O	TTL	
RA2	1	1	1	I/O	TTL	
RA3	2	2	2	I/O	TTL	
RB0	6	6	7	I/O	TTL	Bi-directional I/O port
RB1	7	7	8	I/O	TTL	
RB2	8	8	9	I/O	TTL	
RB3	9	9	10	I/O	TTL	
RB4	10	10	11	I/O	TTL	
RB5	11	11	12	I/O	TTL	
RB6	12	12	13	I/O	TTL	
RB7	13	13	14	I/O	TTL	
T0CKI	3	3	3	I	ST	Clock input to Timer0. Must be tied to Vss or VDD, if not in use, to reduce current consumption.
MCLR/VPP	4	4	4	I	ST	Master clear (RESET) input/programming voltage input. This pin is an active low RESET to the device. Voltage on the MCLR/VPP pin must not exceed VDD to avoid unintended entering of Programming mode.
OSC1/CLKIN	16	16	18	I	ST	Oscillator crystal input/external clock source input.
OSC2/CLKOUT	15	15	17	O	—	Oscillator crystal output. Connects to crystal or resonator in crystal Oscillator mode. In RC mode, OSC2 pin outputs CLKOUT, which has 1/4 the frequency of OSC1 and denotes the instruction cycle rate.
VDD	14	14	15,16	P	—	Positive supply for logic and I/O pins.
Vss	5	5	5,6	P	—	Ground reference for logic and I/O pins.

Legend: I = input, O = output, I/O = input/output, P = power, — = Not Used, TTL = TTL input, ST = Schmitt Trigger input

PIC16C5X

NOTES:

PIC16C5X

TABLE 10-2: INSTRUCTION SET SUMMARY

Mnemonic, Operands		Description	Cycles	12-Bit Opcode			Status Affected	Notes
				MSb	LSb			
ADDWF	f, d	Add W and f	1	0001	11df	ffff	C, DC, Z	1, 2, 4
ANDWF	f, d	AND W with f	1	0001	01df	ffff	Z	2, 4
CLRF	f	Clear f	1	0000	011f	ffff	Z	4
CLRW	—	Clear W	1	0000	0100	0000	Z	
COMF	f, d	Complement f	1	0010	01df	ffff	Z	
DECF	f, d	Decrement f	1	0000	11df	ffff	Z	2, 4
DECFSZ	f, d	Decrement f, Skip if 0	1 (2)	0010	11df	ffff	None	2, 4
INCF	f, d	Increment f	1	0010	10df	ffff	Z	2, 4
INCFSZ	f, d	Increment f, Skip if 0	1 (2)	0011	11df	ffff	None	2, 4
IORWF	f, d	Inclusive OR W with f	1	0001	00df	ffff	Z	2, 4
MOVF	f, d	Move f	1	0010	00df	ffff	Z	2, 4
MOVWF	f	Move W to f	1	0000	001f	ffff	None	1, 4
NOP	—	No Operation	1	0000	0000	0000	None	
RLF	f, d	Rotate left f through Carry	1	0011	01df	ffff	C	2, 4
RRF	f, d	Rotate right f through Carry	1	0011	00df	ffff	C	2, 4
SUBWF	f, d	Subtract W from f	1	0000	10df	ffff	C, DC, Z	1, 2, 4
SWAPF	f, d	Swap f	1	0011	10df	ffff	None	2, 4
XORWF	f, d	Exclusive OR W with f	1	0001	10df	ffff	Z	2, 4
BIT-ORIENTED FILE REGISTER OPERATIONS								
BCF	f, b	Bit Clear f	1	0100	bbbf	ffff	None	2, 4
BSF	f, b	Bit Set f	1	0101	bbbf	ffff	None	2, 4
BTFSC	f, b	Bit Test f, Skip if Clear	1 (2)	0110	bbbf	ffff	None	
BTFSS	f, b	Bit Test f, Skip if Set	1 (2)	0111	bbbf	ffff	None	
LITERAL AND CONTROL OPERATIONS								
ANDLW	k	AND literal with W	1	1110	kkkk	kkkk	Z	1
CALL	k	Call subroutine	2	1001	kkkk	kkkk	None	
CLRWDT	k	Clear Watchdog Timer	1	0000	0000	0100	TO, PD	
GOTO	k	Unconditional branch	2	101k	kkkk	kkkk	None	
IORLW	k	Inclusive OR Literal with W	1	1101	kkkk	kkkk	Z	
MOVLW	k	Move Literal to W	1	1100	kkkk	kkkk	None	
OPTION	k	Load OPTION register	1	0000	0000	0010	None	
RETLW	k	Return, place Literal in W	2	1000	kkkk	kkkk	None	
SLEEP	—	Go into standby mode	1	0000	0000	0011	TO, PD	
TRIS	f	Load TRIS register	1	0000	0000	0fff	None	3
XORLW	k	Exclusive OR Literal to W	1	1111	kkkk	kkkk	Z	

Note 1: The 9th bit of the program counter will be forced to a '0' by any instruction that writes to the PC except for GOTO (see Section 6.5 for more on program counter).

- When an I/O register is modified as a function of itself (e.g. `MOVF PORTB, 1`), the value used will be that value present on the pins themselves. For example, if the data latch is '1' for a pin configured as input and is driven low by an external device, the data will be written back with a '0'.
- The instruction `TRIS f`, where $f = 5, 6$ or 7 causes the contents of the W register to be written to the tristate latches of PORTA, B or C respectively. A '1' forces the pin to a hi-impedance state and disables the output buffers.
- If this instruction is executed on the TMR0 register (and, where applicable, $d = 1$), the prescaler will be cleared (if assigned to TMR0).

PIC16C5X

COMF Complement f

Syntax: [*label*] COMF f,d

Operands: $0 \leq f \leq 31$
 $d \in [0,1]$

Operation: $(f) \rightarrow (dest)$

Status Affected: Z

Encoding:

0010	01df	ffff
------	------	------

Description: The contents of register 'f' are complemented. If 'd' is 0 the result is stored in the W register. If 'd' is 1 the result is stored back in register 'f'.

Words: 1

Cycles: 1

Example: COMF REG1, 0

Before Instruction

REG1 = 0x13

After Instruction

REG1 = 0x13

W = 0xEC

DECf Decrement f

Syntax: [*label*] DECf f,d

Operands: $0 \leq f \leq 31$
 $d \in [0,1]$

Operation: $(f) - 1 \rightarrow (dest)$

Status Affected: Z

Encoding:

0000	11df	ffff
------	------	------

Description: Decrement register 'f'. If 'd' is 0 the result is stored in the W register. If 'd' is 1 the result is stored back in register 'f'.

Words: 1

Cycles: 1

Example: DECf CNT, 1

Before Instruction

CNT = 0x01

Z = 0

After Instruction

CNT = 0x00

Z = 1

DECFSZ Decrement f, Skip if 0

Syntax: [*label*] DECFSZ f,d

Operands: $0 \leq f \leq 31$
 $d \in [0,1]$

Operation: $(f) - 1 \rightarrow d$; skip if result = 0

Status Affected: None

Encoding:

0010	11df	ffff
------	------	------

Description: The contents of register 'f' are decremented. If 'd' is 0 the result is placed in the W register. If 'd' is 1 the result is placed back in register 'f'.
 If the result is 0, the next instruction, which is already fetched, is discarded and a NOP is executed instead making it a two-cycle instruction.

Words: 1

Cycles: 1(2)

Example: HERE DECFSZ CNT, 1

GOTO LOOP

CONTINUE •

•

•

Before Instruction

PC = address (HERE)

After Instruction

CNT = CNT - 1;

if CNT = 0,

PC = address (CONTINUE);

if CNT \neq 0,

PC = address (HERE+1)

PIC16C5X

IORLW Inclusive OR literal with W

Syntax: [*label*] IORLW *k*
Operands: $0 \leq k \leq 255$
Operation: (W).OR. (*k*) → (W)
Status Affected: Z
Encoding:

1101	kkkk	kkkk
------	------	------

Description: The contents of the W register are OR'ed with the eight bit literal 'k'. The result is placed in the W register.
Words: 1
Cycles: 1
Example: IORLW 0x35

Before Instruction
W = 0x9A
After Instruction
W = 0xBF
Z = 0

IORWF Inclusive OR W with f

Syntax: [*label*] IORWF *f*,*d*
Operands: $0 \leq f \leq 31$
 $d \in [0,1]$
Operation: (W).OR. (*f*) → (*dest*)
Status Affected: Z
Encoding:

0001	00df	ffff
------	------	------

Description: Inclusive OR the W register with register 'f'. If 'd' is 0 the result is placed in the W register. If 'd' is 1 the result is placed back in register 'f'.
Words: 1
Cycles: 1
Example: IORWF RESULT, 0

Before Instruction
RESULT = 0x13
W = 0x91
After Instruction
RESULT = 0x13
W = 0x93
Z = 0

MOVF Move f

Syntax: [*label*] MOVF *f*,*d*
Operands: $0 \leq f \leq 31$
 $d \in [0,1]$
Operation: (*f*) → (*dest*)
Status Affected: Z
Encoding:

0010	00df	ffff
------	------	------

Description: The contents of register 'f' is moved to destination 'd'. If 'd' is 0, destination is the W register. If 'd' is 1, the destination is file register 'f'. 'd' is 1 is useful to test a file register since status flag Z is affected.
Words: 1
Cycles: 1
Example: MOVF FSR, 0

After Instruction
W = value in FSR register

MOVLW Move Literal to W

Syntax: [*label*] MOVLW *k*
Operands: $0 \leq k \leq 255$
Operation: *k* → (W)
Status Affected: None
Encoding:

1100	kkkk	kkkk
------	------	------

Description: The eight bit literal 'k' is loaded into the W register.
Words: 1
Cycles: 1
Example: MOVLW 0x5A

After Instruction
W = 0x5A

11.8 MPLAB ICD In-Circuit Debugger

Microchip's In-Circuit Debugger, MPLAB ICD, is a powerful, low cost, run-time development tool. This tool is based on the FLASH PIC MCUs and can be used to develop for this and other PIC microcontrollers. The MPLAB ICD utilizes the in-circuit debugging capability built into the FLASH devices. This feature, along with Microchip's In-Circuit Serial Programming™ protocol, offers cost-effective in-circuit FLASH debugging from the graphical user interface of the MPLAB Integrated Development Environment. This enables a designer to develop and debug source code by watching variables, single-stepping and setting break points. Running at full speed enables testing hardware in real-time.

11.9 PRO MATE II Universal Device Programmer

The PRO MATE II universal device programmer is a full-featured programmer, capable of operating in Stand-alone mode, as well as PC-hosted mode. The PRO MATE II device programmer is CE compliant.

The PRO MATE II device programmer has programmable VDD and VPP supplies, which allow it to verify programmed memory at VDD min and VDD max for maximum reliability. It has an LCD display for instructions and error messages, keys to enter commands and a modular detachable socket assembly to support various package types. In Stand-alone mode, the PRO MATE II device programmer can read, verify, or program PIC devices. It can also set code protection in this mode.

11.10 PICSTART Plus Entry Level Development Programmer

The PICSTART Plus development programmer is an easy-to-use, low cost, prototype programmer. It connects to the PC via a COM (RS-232) port. MPLAB Integrated Development Environment software makes using the programmer simple and efficient.

The PICSTART Plus development programmer supports all PIC devices with up to 40 pins. Larger pin count devices, such as the PIC16C92X and PIC17C76X, may be supported with an adapter socket. The PICSTART Plus development programmer is CE compliant.

11.11 PICDEM 1 Low Cost PIC MCU Demonstration Board

The PICDEM 1 demonstration board is a simple board which demonstrates the capabilities of several of Microchip's microcontrollers. The microcontrollers supported are: PIC16C5X (PIC16C54 to PIC16C58A), PIC16C61, PIC16C62X, PIC16C71, PIC16C8X, PIC17C42, PIC17C43 and PIC17C44. All necessary hardware and software is included to run basic demo programs. The user can program the sample microcontrollers provided with the PICDEM 1 demonstration board on a PRO MATE II device programmer, or a PICSTART Plus development programmer, and easily test firmware. The user can also connect the PICDEM 1 demonstration board to the MPLAB ICE in-circuit emulator and download the firmware to the emulator for testing. A prototype area is available for the user to build some additional hardware and connect it to the microcontroller socket(s). Some of the features include an RS-232 interface, a potentiometer for simulated analog input, push button switches and eight LEDs connected to PORTB.

11.12 PICDEM 2 Low Cost PIC16CXX Demonstration Board

The PICDEM 2 demonstration board is a simple demonstration board that supports the PIC16C62, PIC16C64, PIC16C65, PIC16C73 and PIC16C74 microcontrollers. All the necessary hardware and software is included to run the basic demonstration programs. The user can program the sample microcontrollers provided with the PICDEM 2 demonstration board on a PRO MATE II device programmer, or a PICSTART Plus development programmer, and easily test firmware. The MPLAB ICE in-circuit emulator may also be used with the PICDEM 2 demonstration board to test firmware. A prototype area has been provided to the user for adding additional hardware and connecting it to the microcontroller socket(s). Some of the features include a RS-232 interface, push button switches, a potentiometer for simulated analog input, a serial EEPROM to demonstrate usage of the I²C™ bus and separate headers for connection to an LCD module and a keypad.

13.1 DC Characteristics: PIC16CR54A-04, 10, 20, PIC16LCR54A-04 (Commercial) PIC16CR54A-04I, 10I, 20I, PIC16LCR54A-04I (Industrial)

PIC16LCR54A-04 PIC16LCR54A-04I (Commercial, Industrial)			Standard Operating Conditions (unless otherwise specified) Operating Temperature $0^{\circ}\text{C} \leq T_A \leq +70^{\circ}\text{C}$ for commercial $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial				
PIC16CR54A-04, 10, 20 PIC16CR54A-04I, 10I, 20I (Commercial, Industrial)			Standard Operating Conditions (unless otherwise specified) Operating Temperature $0^{\circ}\text{C} \leq T_A \leq +70^{\circ}\text{C}$ for commercial $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial				
Param No.	Symbol	Characteristic/Device	Min	Typ†	Max	Units	Conditions
	IPD	Power-down Current⁽²⁾					
D006		PIC16LCR54A-Commercial	—	1.0	6.0	μA	V _{DD} = 2.5V, WDT disabled
			—	2.0	8.0*	μA	V _{DD} = 4.0V, WDT disabled
			—	3.0	15	μA	V _{DD} = 6.0V, WDT disabled
			—	5.0	25	μA	V _{DD} = 6.0V, WDT enabled
D006A		PIC16CR54A-Commercial	—	1.0	6.0	μA	V _{DD} = 2.5V, WDT disabled
			—	2.0	8.0*	μA	V _{DD} = 4.0V, WDT disabled
			—	3.0	15	μA	V _{DD} = 6.0V, WDT disabled
			—	5.0	25	μA	V _{DD} = 6.0V, WDT enabled
D007		PIC16LCR54A-Industrial	—	1.0	8.0	μA	V _{DD} = 2.5V, WDT disabled
			—	2.0	10*	μA	V _{DD} = 4.0V, WDT disabled
			—	3.0	20*	μA	V _{DD} = 4.0V, WDT enabled
			—	3.0	18	μA	V _{DD} = 6.0V, WDT disabled
			—	5.0	45	μA	V _{DD} = 6.0V, WDT enabled
D007A		PIC16CR54A-Industrial	—	1.0	8.0	μA	V _{DD} = 2.5V, WDT disabled
			—	2.0	10*	μA	V _{DD} = 4.0V, WDT disabled
			—	3.0	20*	μA	V _{DD} = 4.0V, WDT enabled
			—	3.0	18	μA	V _{DD} = 6.0V, WDT disabled
			—	5.0	45	μA	V _{DD} = 6.0V, WDT enabled

Legend: Rows with standard voltage device data only are shaded for improved readability.

* These parameters are characterized but not tested.

† Data in "Typ" column is at 5V, 25°C, unless otherwise stated. These parameters are for design guidance only, and are not tested.

Note 1: This is the limit to which V_{DD} can be lowered in SLEEP mode without losing RAM data.

2: The supply current is mainly a function of the operating voltage and frequency. Other factors such as bus loading, oscillator type, bus rate, internal code execution pattern and temperature also have an impact on the current consumption.

a) The test conditions for all I_{DD} measurements in active Operation mode are: OSC1 = external square wave, from rail-to-rail; all I/O pins tristated, pulled to V_{SS}, T_{0CKI} = V_{DD}, MCLR = V_{DD}; WDT enabled/disabled as specified.

b) For standby current measurements, the conditions are the same, except that the device is in SLEEP mode. The power-down current in SLEEP mode does not depend on the oscillator type.

3: Does not include current through R_{EXT}. The current through the resistor can be estimated by the formula: I_R = V_{DD}/2R_{EXT} (mA) with R_{EXT} in kΩ.

13.3 DC Characteristics: PIC16CR54A-04, 10, 20, PIC16LCR54A-04 (Commercial) PIC16CR54A-04I, 10I, 20I, PIC16LCR54A-04I (Industrial)

DC CHARACTERISTICS			Standard Operating Conditions (unless otherwise specified) Operating Temperature 0°C ≤ TA ≤ +70°C for commercial -40°C ≤ TA ≤ +85°C for industrial				
Param No.	Symbol	Characteristic	Min	Typ†	Max	Units	Conditions
D030	V _{IL}	Input Low Voltage I/O ports MCLR (Schmitt Trigger) T0CKI (Schmitt Trigger) OSC1 (Schmitt Trigger) OSC1	V _{SS} V _{SS} V _{SS} V _{SS} V _{SS}	— — — — —	0.2 V _{DD} 0.15 V _{DD} 0.15 V _{DD} 0.15 V _{DD} 0.15 V _{DD}	V V V V V	Pin at hi-impedance RC mode only ⁽³⁾ XT, HS and LP modes
D040	V _{IH}	Input High Voltage I/O ports I/O ports MCLR (Schmitt Trigger) T0CKI (Schmitt Trigger) OSC1 (Schmitt Trigger) OSC1	2.0 0.6 V _{DD} 0.85 V _{DD} 0.85 V _{DD} 0.85 V _{DD} 0.85 V _{DD}	— — — — — —	V _{DD} V _{DD} V _{DD} V _{DD} V _{DD} V _{DD}	V V V V V V	V _{DD} = 3.0V to 5.5V ⁽⁴⁾ Full V _{DD} range ⁽⁴⁾ RC mode only ⁽³⁾ XT, HS and LP modes
D050	V _{HYS}	Hysteresis of Schmitt Trigger inputs	0.15 V _{DD} *	—	—	V	
D060	I _{IL}	Input Leakage Current^(1,2) I/O ports MCLR MCLR T0CKI OSC1	-1.0 -5.0 — -3.0 -3.0	— — 0.5 0.5 0.5	+1.0 — +5.0 +3.0 +3.0	μA μA μA μA μA	For V_{DD} ≤ 5.5V: V _{SS} ≤ V _{PIN} ≤ V _{DD} , pin at hi-impedance V _{PIN} = V _{SS} + 0.25V V _{PIN} = V _{DD} V _{SS} ≤ V _{PIN} ≤ V _{DD} V _{SS} ≤ V _{PIN} ≤ V _{DD} , XT, HS and LP modes
D080	V _{OL}	Output Low Voltage I/O ports OSC2/CLKOUT	— —	— —	0.5 0.5	V V	I _{OL} = 10 mA, V _{DD} = 6.0V I _{OL} = 1.9 mA, V _{DD} = 6.0V, RC mode only
D090	V _{OH}	Output High Voltage⁽²⁾ I/O ports OSC2/CLKOUT	V _{DD} - 0.5 V _{DD} - 0.5	— —	— —	V V	I _{OH} = -4.0 mA, V _{DD} = 6.0V I _{OH} = -0.8 mA, V _{DD} = 6.0V, RC mode only

* These parameters are characterized but not tested.

† Data in the Typical ("Typ") column is based on characterization results at 25°C. This data is for design guidance only and is not tested.

Note 1: The leakage current on the MCLR/VPP 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 voltage.

2: Negative current is defined as coming out of the pin.

3: For the RC mode, the OSC1/CLKIN pin is a Schmitt Trigger input. It is not recommended that the PIC16C5X be driven with external clock in RC mode.

4: The user may use the better of the two specifications.

FIGURE 14-9: V_{TH} (INPUT THRESHOLD VOLTAGE) OF I/O PINS vs. V_{DD}

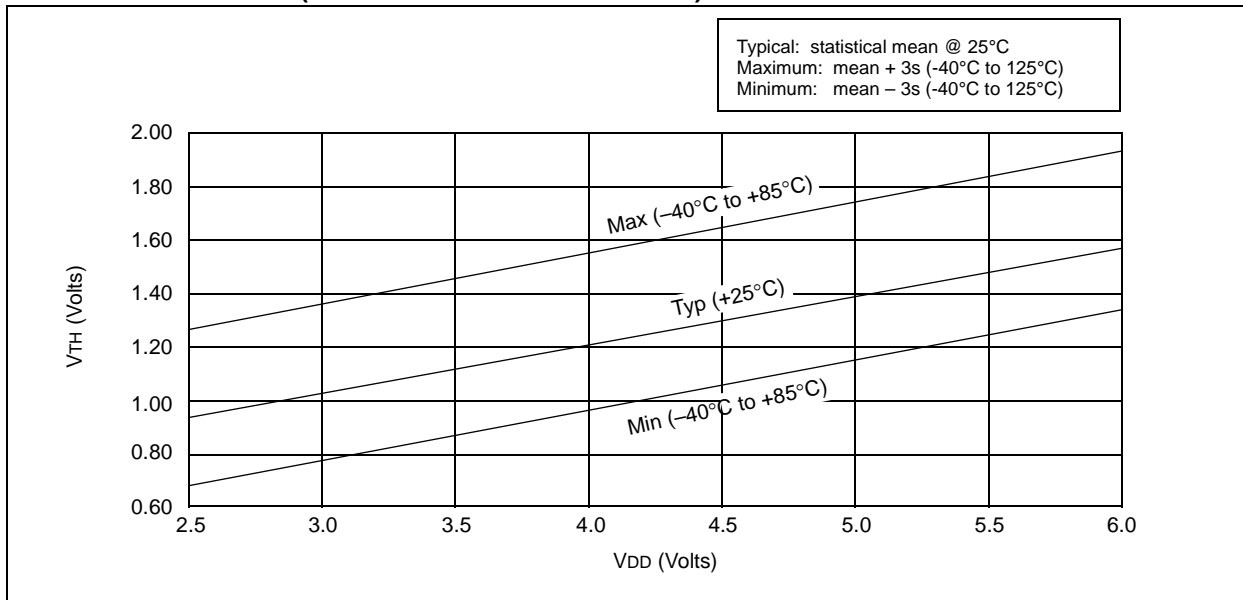
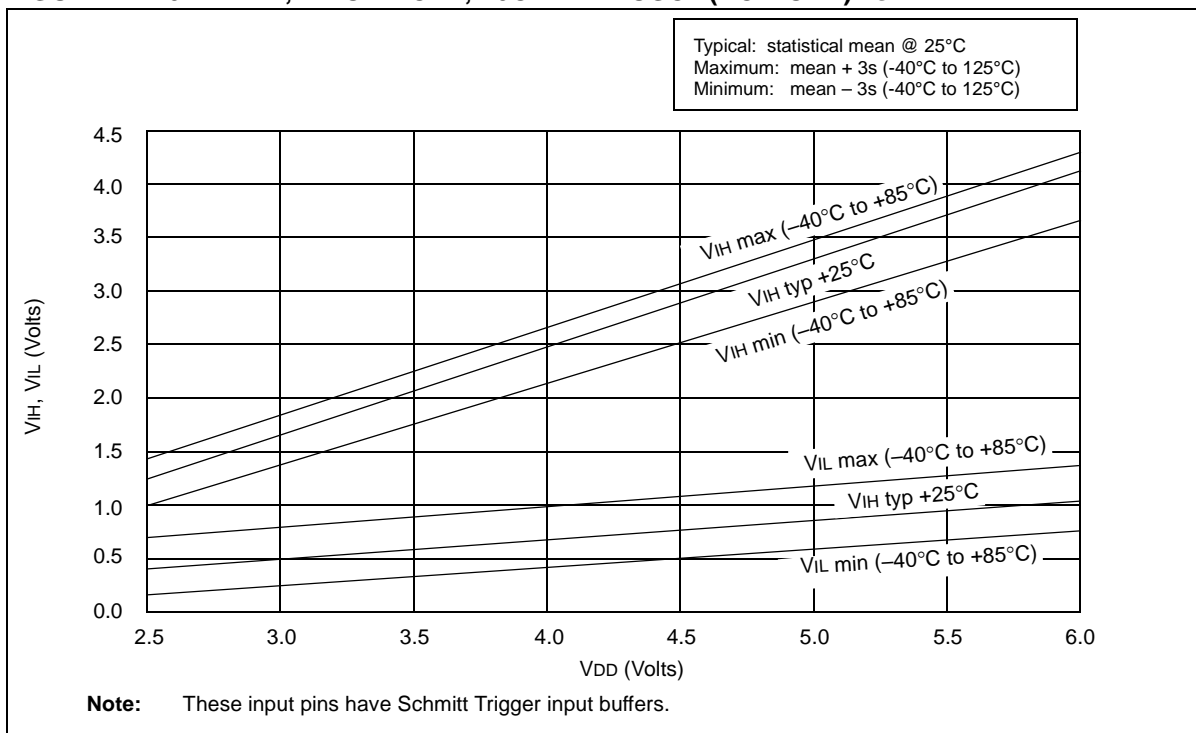


FIGURE 14-10: V_{IH} , V_{IL} OF MCLR, T0CKI AND OSC1 (RC MODE) vs. V_{DD}



16.0 DEVICE CHARACTERIZATION - PIC16C54A

The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

“Typical” represents the mean of the distribution at 25°C. “Maximum” or “minimum” represents (mean + 3 σ) or (mean – 3 σ) respectively, where σ is a standard deviation, over the whole temperature range.

FIGURE 16-1: TYPICAL RC OSCILLATOR FREQUENCY vs. TEMPERATURE

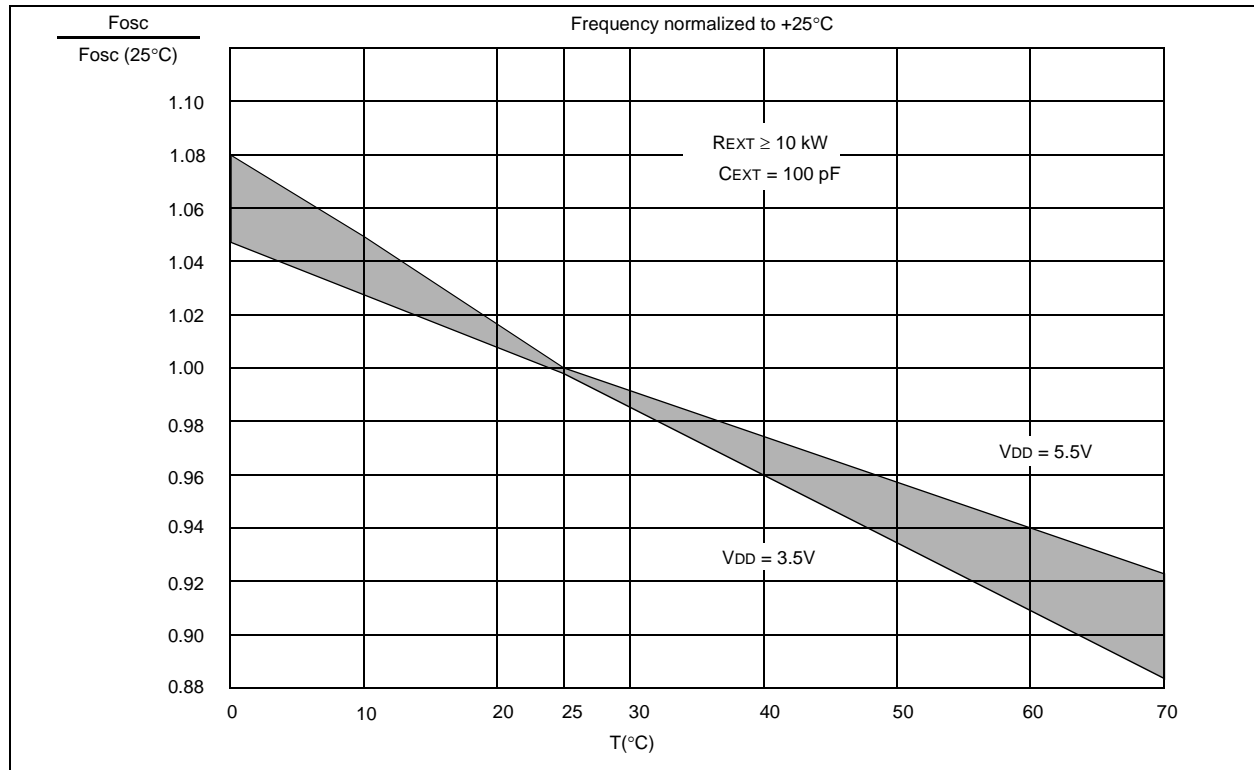


TABLE 16-1: RC OSCILLATOR FREQUENCIES

C_{EXT}	R_{EXT}	Average F_{osc} @ 5 V, 25°C	
20 pF	3.3K	5 MHz	± 27%
	5K	3.8 MHz	± 21%
	10K	2.2 MHz	± 21%
	100K	262 kHz	± 31%
100 pF	3.3K	1.6 MHz	± 13%
	5K	1.2 MHz	± 13%
	10K	684 kHz	± 18%
	100K	71 kHz	± 25%
300 pF	3.3K	660 kHz	± 10%
	5.0K	484 kHz	± 14%
	10K	267 kHz	± 15%
	100K	29 kHz	± 19%

The frequencies are measured on DIP packages.

The percentage variation indicated here is part-to-part variation due to normal process distribution. The variation indicated is ± 3 standard deviation from average value for $V_{DD} = 5\text{V}$.

FIGURE 16-7: V_{TH} (INPUT THRESHOLD VOLTAGE) OF I/O PINS - V_{DD}

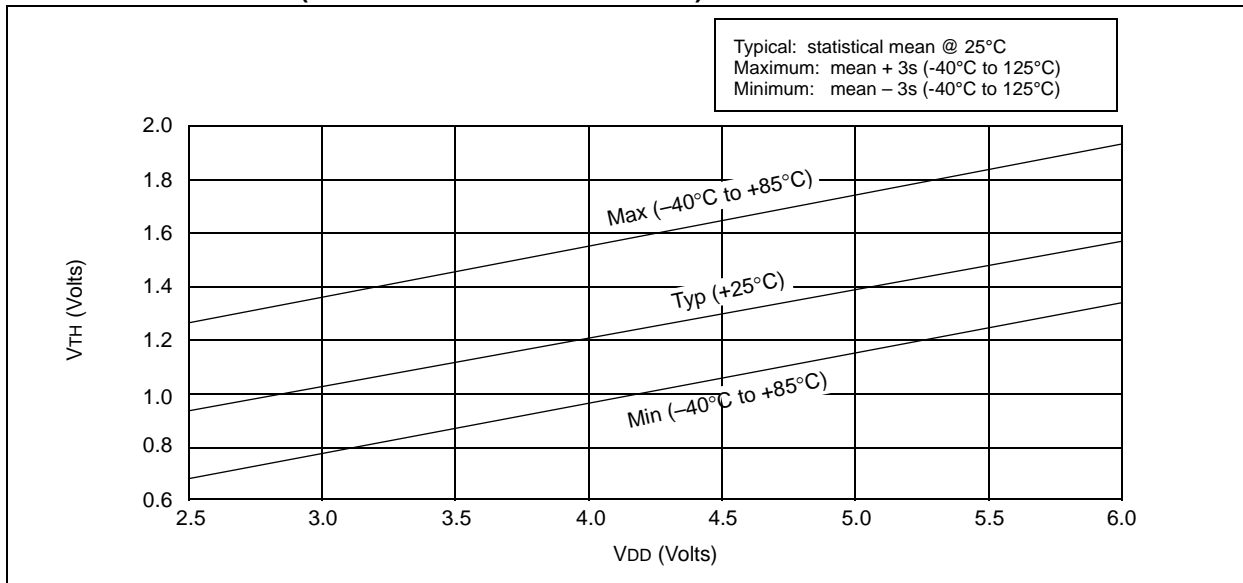
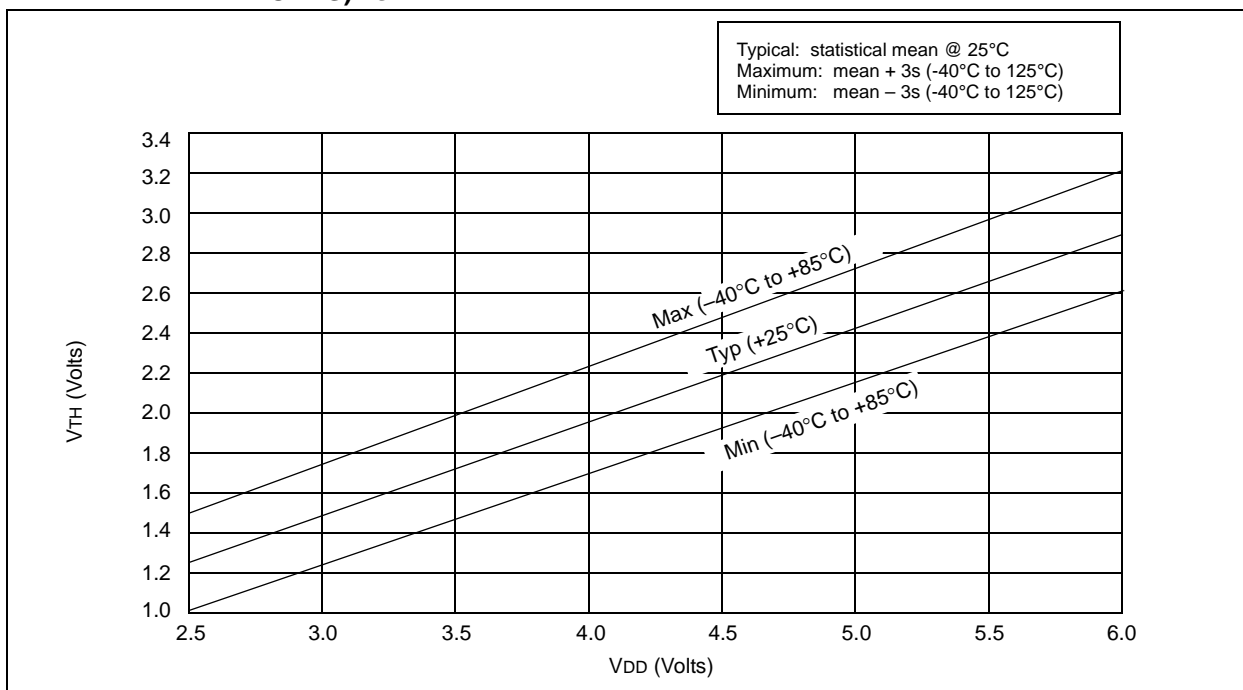


FIGURE 16-8: V_{TH} (INPUT THRESHOLD VOLTAGE) OF OSC1 INPUT (IN XT, HS, AND LP MODES) vs. V_{DD}



PIC16C5X

FIGURE 17-7: CLKOUT AND I/O TIMING - PIC16C5X, PIC16CR5X

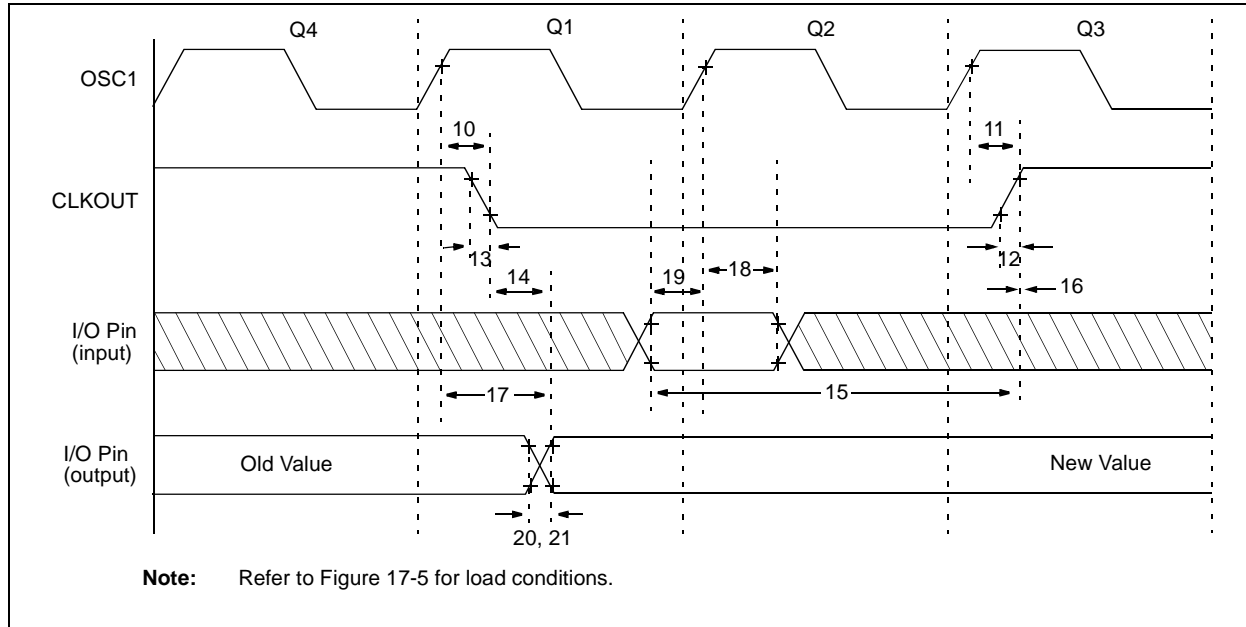


TABLE 17-2: CLKOUT AND I/O TIMING REQUIREMENTS - PIC16C5X, PIC16CR5X

AC Characteristics		Standard Operating Conditions (unless otherwise specified)				
		Operating Temperature				
		0°C ≤ TA ≤ +70°C for commercial				
		-40°C ≤ TA ≤ +85°C for industrial				
		-40°C ≤ TA ≤ +125°C for extended				
Param No.	Symbol	Characteristic	Min	Typ†	Max	Units
10	TosH2ckL	OSC1↑ to CLKOUT↓ ⁽¹⁾	—	15	30**	ns
11	TosH2ckH	OSC1↑ to CLKOUT↑ ⁽¹⁾	—	15	30**	ns
12	TckR	CLKOUT rise time ⁽¹⁾	—	5.0	15**	ns
13	TckF	CLKOUT fall time ⁽¹⁾	—	5.0	15**	ns
14	TckL2ioV	CLKOUT↓ to Port out valid ⁽¹⁾	—	—	40**	ns
15	TioV2ckH	Port in valid before CLKOUT↑ ⁽¹⁾	0.25 TCY+30*	—	—	ns
16	TckH2ioI	Port in hold after CLKOUT↑ ⁽¹⁾	0*	—	—	ns
17	TosH2ioV	OSC1↑ (Q1 cycle) to Port out valid ⁽²⁾	—	—	100*	ns
18	TosH2ioI	OSC1↑ (Q2 cycle) to Port input invalid (I/O in hold time)	TBD	—	—	ns
19	TioV2osH	Port input valid to OSC1↑ (I/O in setup time)	TBD	—	—	ns
20	TioR	Port output rise time ⁽²⁾	—	10	25**	ns
21	TioF	Port output fall time ⁽²⁾	—	10	25**	ns

* These parameters are characterized but not tested.

** These parameters are design targets and are not tested. No characterization data available at this time.

† Data in the Typical ("Typ") column is at 5V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

Note 1: Measurements are taken in RC Mode where CLKOUT output is 4 x TOSC.

2: Refer to Figure 17-5 for load conditions.

FIGURE 17-8: RESET, WATCHDOG TIMER, AND DEVICE RESET TIMER TIMING - PIC16C5X, PIC16CR5X

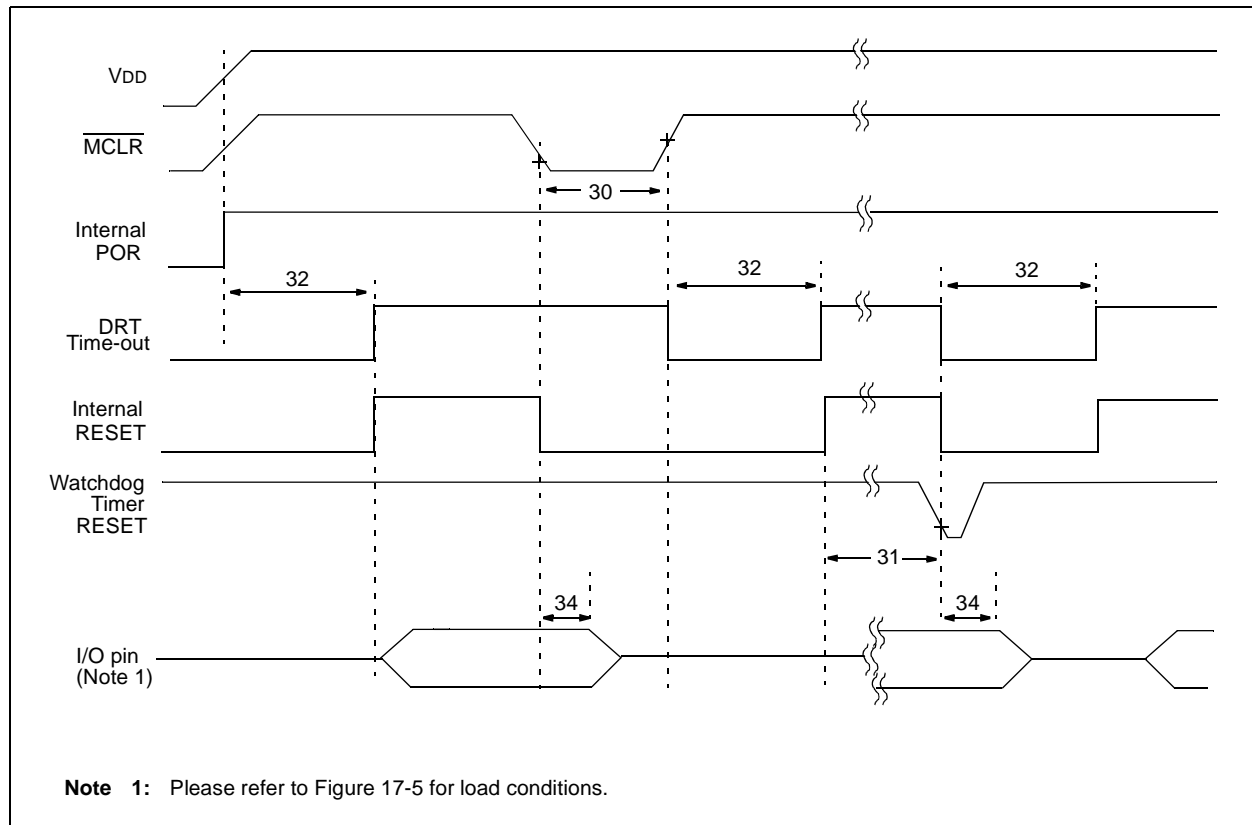


TABLE 17-3: RESET, WATCHDOG TIMER, AND DEVICE RESET TIMER - PIC16C5X, PIC16CR5X

Standard Operating Conditions (unless otherwise specified)							
AC Characteristics		Operating Temperature					
		0°C ≤ TA ≤ +70°C for commercial					
		-40°C ≤ TA ≤ +85°C for industrial					
		-40°C ≤ TA ≤ +125°C for extended					
Param No.	Symbol	Characteristic	Min	Typ†	Max	Units	Conditions
30	TmcL	MCLR Pulse Width (low)	1000*	—	—	ns	VDD = 5.0V
31	Twdt	Watchdog Timer Time-out Period (No Prescaler)	9.0*	18*	30*	ms	VDD = 5.0V (Comm)
32	TDRT	Device Reset Timer Period	9.0*	18*	30*	ms	VDD = 5.0V (Comm)
34	Tioz	I/O Hi-impedance from MCLR Low	100*	300*	1000*	ns	

* These parameters are characterized but not tested.

† Data in the Typical ("Typ") column is at 5V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

19.3 Timing Parameter Symbolology and Load Conditions

The timing parameter symbols have been created with one of the following formats:

- 1. TppS2ppS
- 2. TppS

T			
F	Frequency	T	Time
Lowercase letters (pp) and their meanings:			
pp		mc	MCLR
2	to	osc	oscillator
ck	CLKOUT	os	OSC1
cy	cycle time	t0	T0CKI
drt	device reset timer	wdt	watchdog timer
io	I/O port		
Uppercase letters and their meanings:			
S		P	Period
F	Fall	R	Rise
H	High	V	Valid
I	Invalid (Hi-impedance)	Z	Hi-impedance
L	Low		

FIGURE 19-2: LOAD CONDITIONS FOR DEVICE TIMING SPECIFICATIONS - PIC16C54C/C55A/C56A/C57C/C58B-40

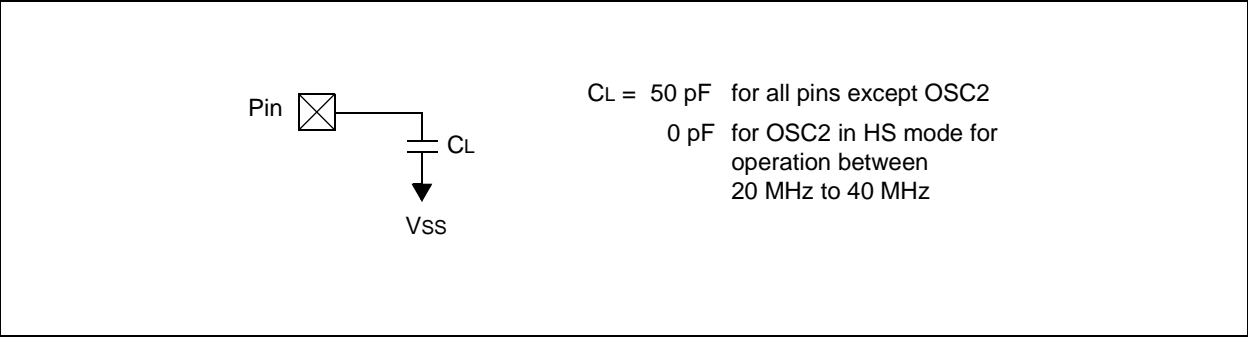


FIGURE 20-2: TYPICAL IPD vs. VDD, WATCHDOG ENABLED (25°C)

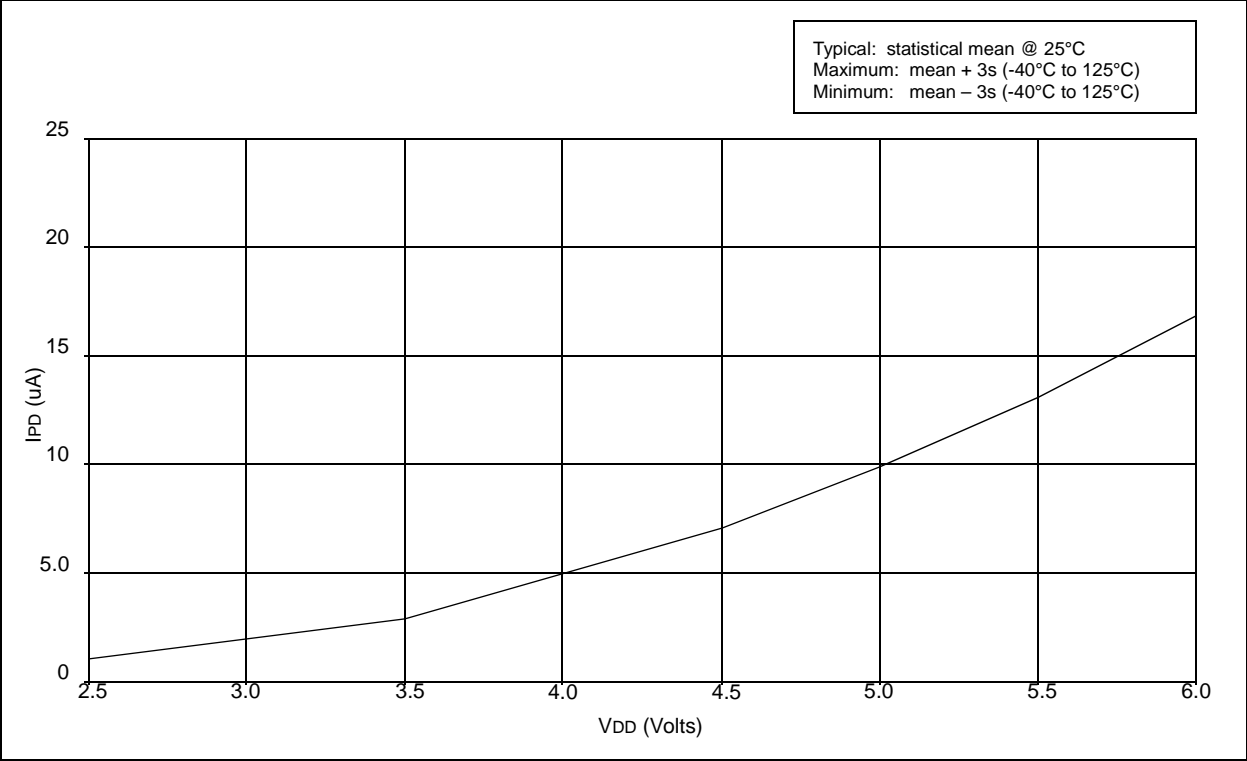


FIGURE 20-3: TYPICAL IPD vs. VDD, WATCHDOG ENABLED (-40°C, 85°C)

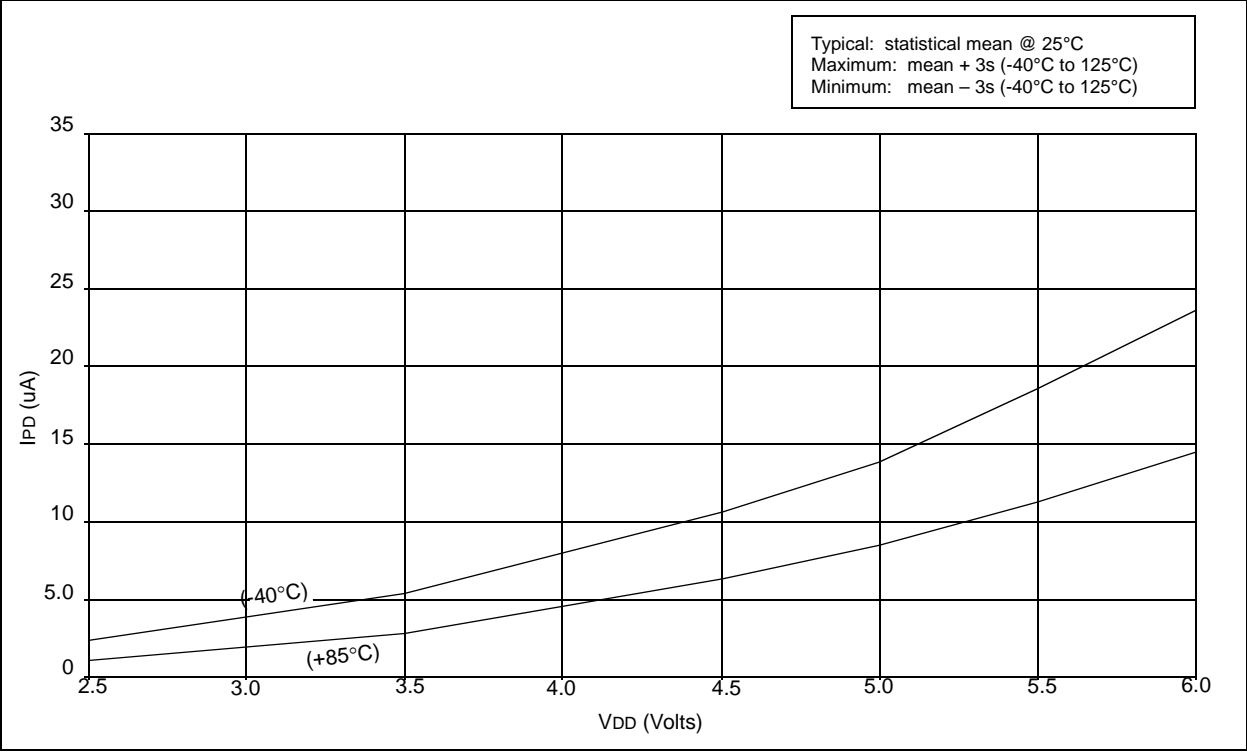


FIGURE 20-4: V_{TH} (INPUT THRESHOLD TRIP POINT VOLTAGE) OF I/O PINS vs. V_{DD}

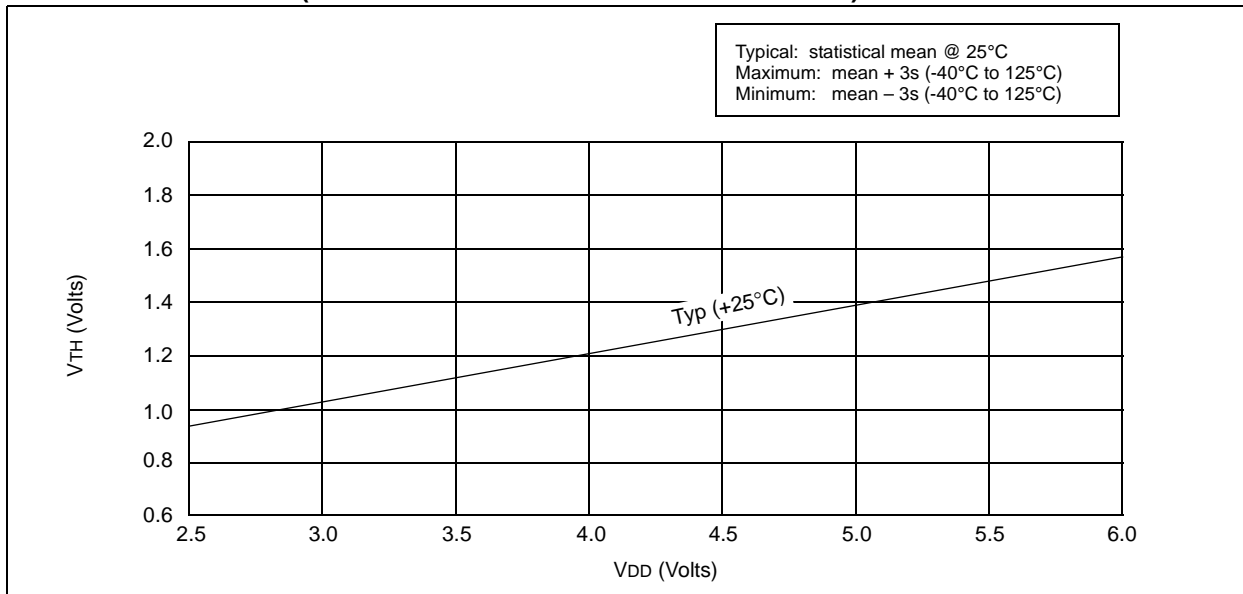
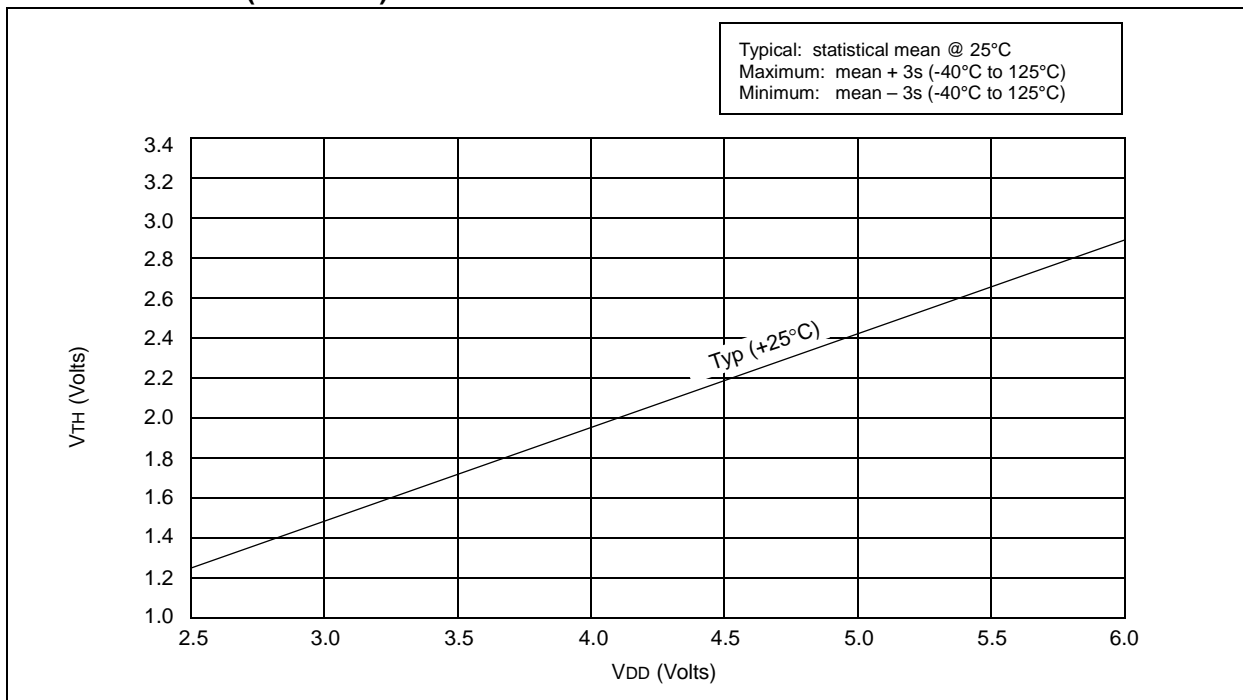


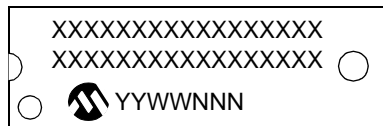
FIGURE 20-5: V_{TH} (INPUT THRESHOLD TRIP POINT VOLTAGE) OF OSC1 INPUT (HS MODE) vs. V_{DD}



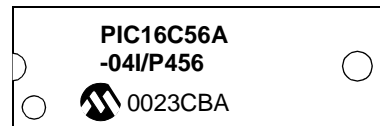
21.0 PACKAGING INFORMATION

21.1 Package Marketing Information

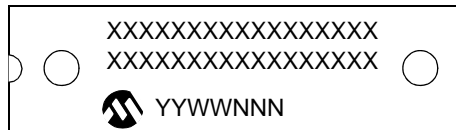
18-Lead PDIP



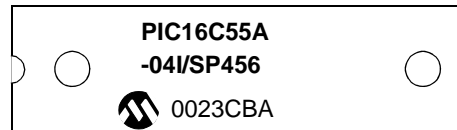
Example



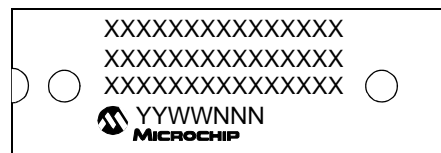
28-Lead Skinny PDIP (.300")



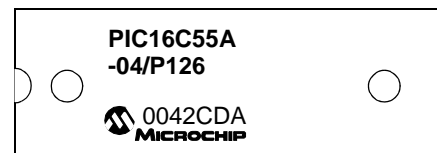
Example



28-Lead PDIP (.600")



Example



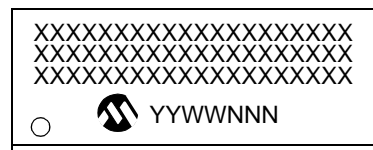
18-Lead SOIC



Example



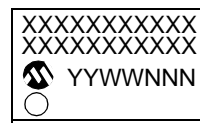
28-Lead SOIC



Example



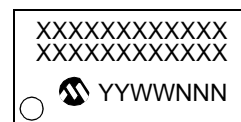
20-Lead SSOP



Example



28-Lead SSOP

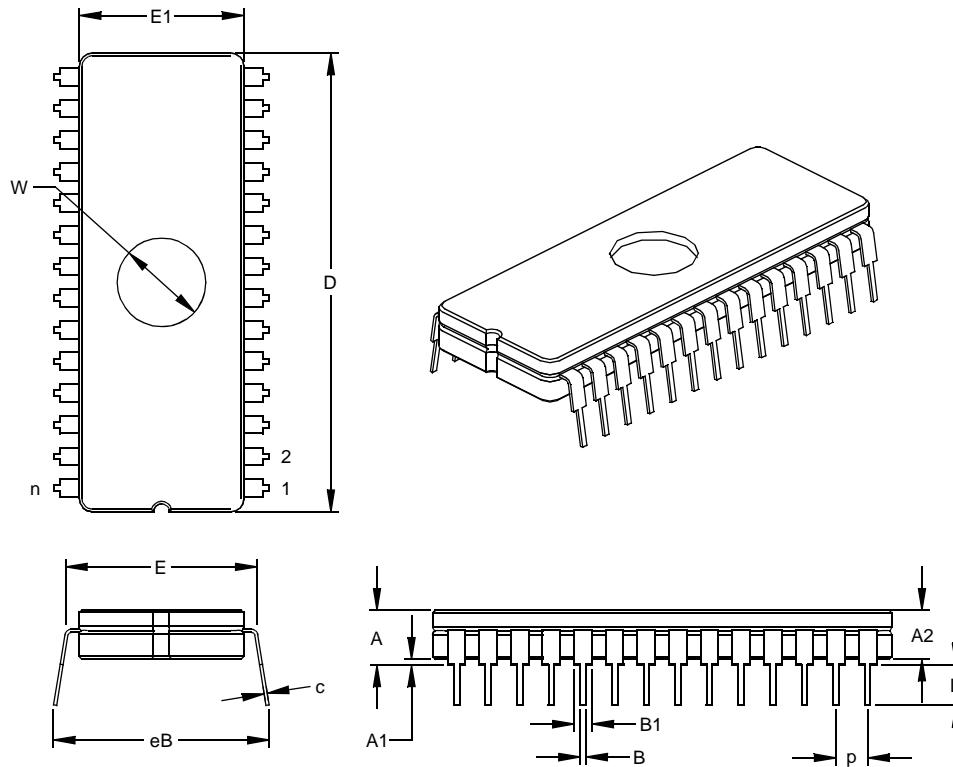


Example



28-Lead Ceramic Dual In-line with Window (JW) – 600 mil (CERDIP)

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



Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		28			28	
Pitch	p		.100			2.54	
Top to Seating Plane	A	.195	.210	.225	4.95	5.33	5.72
Ceramic Package Height	A2	.155	.160	.165	3.94	4.06	4.19
Standoff	A1	.015	.038	.060	0.38	0.95	1.52
Shoulder to Shoulder Width	E	.595	.600	.625	15.11	15.24	15.88
Ceramic Pkg. Width	E1	.514	.520	.526	13.06	13.21	13.36
Overall Length	D	1.430	1.460	1.490	36.32	37.08	37.85
Tip to Seating Plane	L	.125	.138	.150	3.18	3.49	3.81
Lead Thickness	c	.008	.010	.012	0.20	0.25	0.30
Upper Lead Width	B1	.050	.058	.065	1.27	1.46	1.65
Lower Lead Width	B	.016	.020	.023	0.41	0.51	0.58
Overall Row Spacing	§	eB	.610	.660	15.49	16.76	18.03
Window Diameter	W	.270	.280	.290	6.86	7.11	7.37

* Controlling Parameter
 § Significant Characteristic
 JEDEC Equivalent: MO-103
 Drawing No. C04-013

PRODUCT IDENTIFICATION SYSTEM

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

PART NO.	-	XX	X	/XX	XXX
Device		Frequency Range/OSC Type	Temperature Range	Package	Pattern
Device		PIC16C54 PIC16C54A PIC16CR54A PIC16C54C PIC16CR54C PIC16C55 PIC16C55A PIC16C56 PIC16C56A PIC16CR56A PIC16C57 PIC16C57C PIC16CR57C PIC16C58B PIC16CR58B	PIC16C54T ⁽²⁾ PIC16C54AT ⁽²⁾ PIC16CR54AT ⁽²⁾ PIC16C54CT ⁽²⁾ PIC16CR54CT ⁽²⁾ PIC16C55T ⁽²⁾ PIC16C55AT ⁽²⁾ PIC16C56T ⁽²⁾ PIC16C56AT ⁽²⁾ PIC16CR56AT ⁽²⁾ PIC16C57T ⁽²⁾ PIC16C57CT ⁽²⁾ PIC16CR57CT ⁽²⁾ PIC16C58BT ⁽²⁾ PIC16CR58BT ⁽²⁾		
Frequency Range/ Oscillator Type		RC Resistor Capacitor LP Low Power Crystal XT Standard Crystal/Resonator HS High Speed Crystal 02 200 KHz (LP) or 2 MHz (XT and RC) 04 200 KHz (LP) or 4 MHz (XT and RC) 10 10 MHz (HS only) 20 20 MHz (HS only) 40 40 MHz (HS only) b ⁽⁴⁾ No oscillator type for JW packages ⁽³⁾			
		*RC/LP/XT/HS are for 16C54/55/56/57 devices only -02 is available for 16LV54A only -04/10/20 options are available for all other devices -40 is available for 16C54C/55A/56A/57C/58B devices only			
Temperature Range		b ⁽⁴⁾ = 0°C to +70°C I = -40°C to +85°C E = -40°C to +125°C			
Package		S = Die in Waffle Pack JW = 28-pin 600 mil/18-pin 300 mil windowed CER-DIP ⁽³⁾ P = 28-pin 600 mil/18-pin 300 mil PDIP SO = 300 mil SOIC SS = 209 mil SSOP SP = 28-pin 300 mil Skinny PDIP			
		*See Section 21 for additional package information.			
Pattern		QTP, SQTP, ROM code (factory specified) or Special Requirements. Blank for OTP and Windowed devices.			

Examples:

- PIC16C55A - 04/P 301 = Commercial Temp., PDIP package, 4 MHz, standard VDD limits, QTP pattern #301
- PIC16LC54C - 04I/SO Industrial Temp., SOIC package, 200 kHz, extended VDD limits
- PIC16C57 - RC/SP = RC Oscillator, commercial temp, skinny PDIP package, 4 MHz, standard VDD limits
- PIC16C58BT -40/SS 123 = commercial temp, SSOP package in tape and reel, 4 MHz, extended VDD limits, ROM pattern #123

- Note**
- 1: C = normal voltage range
LC = extended
 - 2: T = in tape and reel - SOIC and SSOP packages only
 - 3: JW Devices are UV erasable and can be programmed to any device configuration. JW Devices meet the electrical requirements of each oscillator type, including LC devices.
 - 4: b = Blank

Sales and Support

Data Sheets

Products supported by a preliminary Data Sheet may have an errata sheet describing minor operational differences and recommended workarounds. To determine if an errata sheet exists for a particular device, please contact one of the following:

1. Your local Microchip sales office
2. The Microchip Worldwide Site (www.microchip.com)