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### What is "[Embedded - Microcontrollers](#)"?

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

### Applications of "[Embedded - Microcontrollers](#)"

#### Details

Product Status	Obsolete
Core Processor	PIC
Core Size	8-Bit
Speed	40MHz
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)	4.5V ~ 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	<a href="https://www.e-xfl.com/product-detail/microchip-technology/pic16c58b-40-p">https://www.e-xfl.com/product-detail/microchip-technology/pic16c58b-40-p</a>

# PIC16C5X

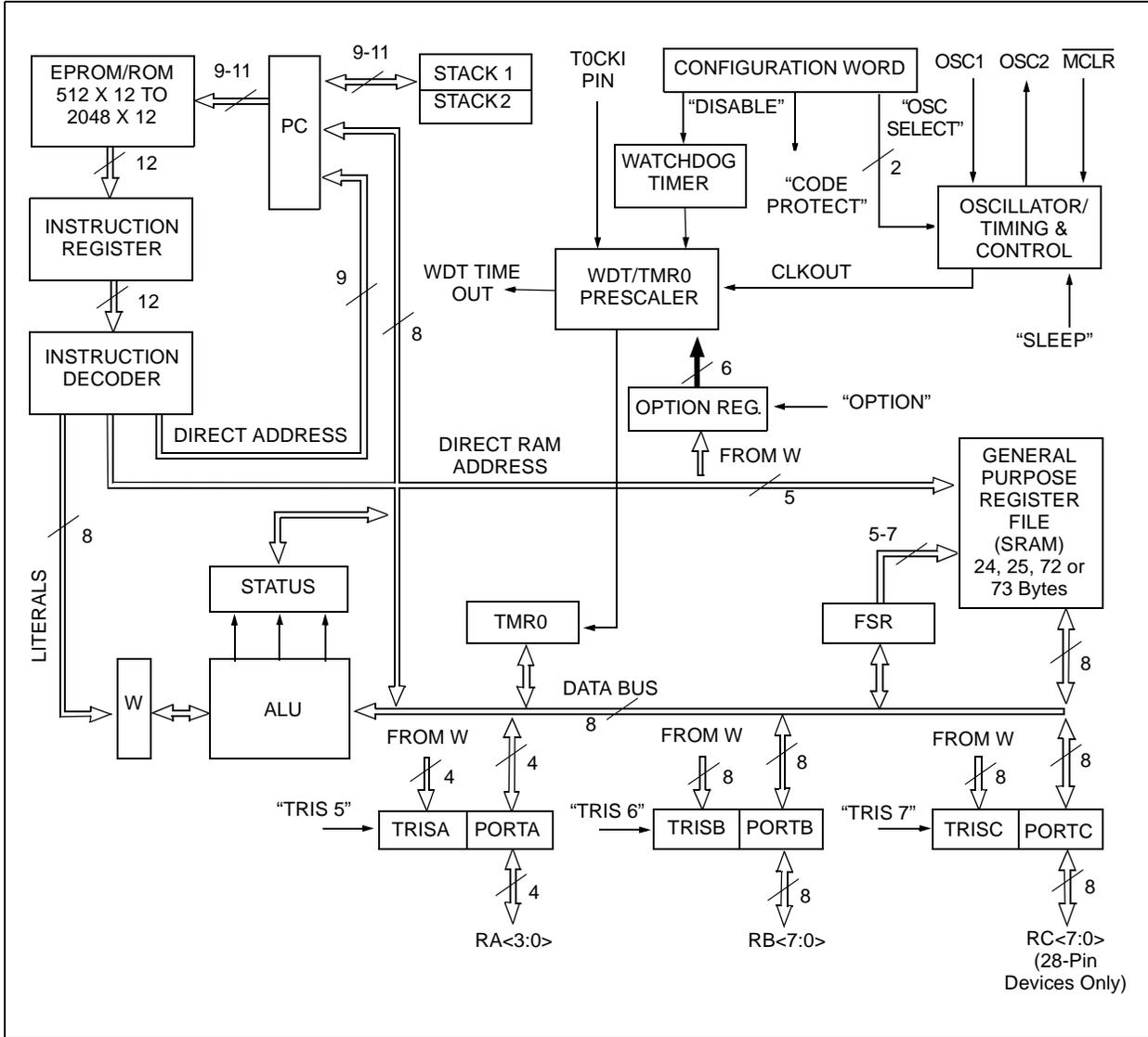
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NOTES:

# PIC16C5X

**FIGURE 3-1: PIC16C5X SERIES BLOCK DIAGRAM**



**ADDWF      Add W and f**

---

Syntax:      [ *label* ] ADDWF   f,d

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

Operation:    (W) + (f) → (dest)

Status Affected: C, DC, Z

Encoding:    

0001	11df	ffff
------	------	------

Description:    Add the contents of the W register and 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:      ADDWF   TEMP\_REG, 0

Before Instruction

W            = 0x17

TEMP\_REG   = 0xC2

After Instruction

W            = 0xD9

TEMP\_REG   = 0xC2

**ANDWF      AND W with f**

---

Syntax:      [ *label* ] ANDWF   f,d

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

Operation:    (W) .AND. (f) → (dest)

Status Affected: Z

Encoding:    

0001	01df	ffff
------	------	------

Description:    The contents of the W register are AND'ed with 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:      ANDWF   TEMP\_REG, 1

Before Instruction

W            = 0x17

TEMP\_REG   = 0xC2

After Instruction

W            = 0x17

TEMP\_REG   = 0x02

**ANDLW      AND literal with W**

---

Syntax:      [ *label* ] ANDLW   k

Operands:     $0 \leq k \leq 255$

Operation:    (W).AND. (k) → (W)

Status Affected: Z

Encoding:    

1110	kkkk	kkkk
------	------	------

Description:    The contents of the W register are AND'ed with the eight-bit literal 'k'. The result is placed in the W register.

Words:        1

Cycles:        1

Example:      ANDLW   H'5F'

Before Instruction

W            = 0xA3

After Instruction

W            = 0x03

**BCF          Bit Clear f**

---

Syntax:      [ *label* ] BCF    f,b

Operands:     $0 \leq f \leq 31$   
                    $0 \leq b \leq 7$

Operation:     $0 \rightarrow (f<b>)$

Status Affected: None

Encoding:    

0100	bbbf	ffff
------	------	------

Description:    Bit 'b' in register 'f' is cleared.

Words:        1

Cycles:        1

Example:      BCF      FLAG\_REG, 7

Before Instruction

FLAG\_REG   = 0xC7

After Instruction

FLAG\_REG   = 0x47

## 11.13 PICDEM 3 Low Cost PIC16CXXX Demonstration Board

The PICDEM 3 demonstration board is a simple demonstration board that supports the PIC16C923 and PIC16C924 in the PLCC package. It will also support future 44-pin PLCC microcontrollers with an LCD Module. 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 3 demonstration board on a PRO MATE II device programmer, or a PICSTART Plus development programmer with an adapter socket, and easily test firmware. The MPLAB ICE in-circuit emulator may also be used with the PICDEM 3 demonstration board to test firmware. A prototype area has been provided to the user for adding 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 thermistor and separate headers for connection to an external LCD module and a keypad. Also provided on the PICDEM 3 demonstration board is a LCD panel, with 4 commons and 12 segments, that is capable of displaying time, temperature and day of the week. The PICDEM 3 demonstration board provides an additional RS-232 interface and Windows software for showing the demultiplexed LCD signals on a PC. A simple serial interface allows the user to construct a hardware demultiplexer for the LCD signals.

## 11.14 PICDEM 17 Demonstration Board

The PICDEM 17 demonstration board is an evaluation board that demonstrates the capabilities of several Microchip microcontrollers, including PIC17C752, PIC17C756A, PIC17C762 and PIC17C766. All necessary hardware is included to run basic demo programs, which are supplied on a 3.5-inch disk. A programmed sample is included and the user may erase it and program it with the other sample programs using the PRO MATE II device programmer, or the PICSTART Plus development programmer, and easily debug and test the sample code. In addition, the PICDEM 17 demonstration board supports downloading of programs to and executing out of external FLASH memory on board. The PICDEM 17 demonstration board is also usable with the MPLAB ICE in-circuit emulator, or the PICMASTER emulator and all of the sample programs can be run and modified using either emulator. Additionally, a generous prototype area is available for user hardware.

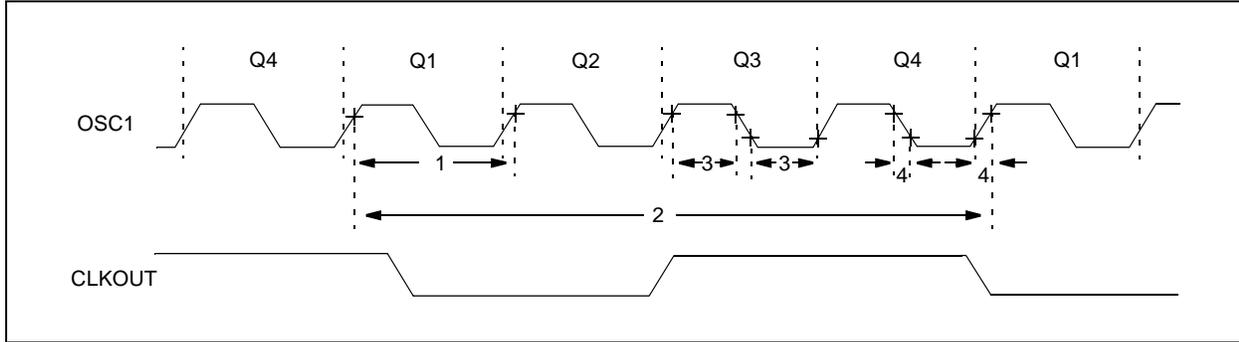
## 11.15 KEELOQ Evaluation and Programming Tools

KEELOQ evaluation and programming tools support Microchip's HCS Secure Data Products. The HCS evaluation kit includes a LCD display to show changing codes, a decoder to decode transmissions and a programming interface to program test transmitters.

# PIC16C5X

## 12.7 Timing Diagrams and Specifications

**FIGURE 12-2: EXTERNAL CLOCK TIMING - PIC16C54/55/56/57**



**TABLE 12-1: EXTERNAL CLOCK TIMING REQUIREMENTS - PIC16C54/55/56/57**

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
1A	FOSC	External CLKIN Frequency <sup>(1)</sup>	DC	—	4.0	MHz	XT osc mode
			DC	—	10	MHz	10 MHz mode
			DC	—	20	MHz	HS osc mode (Comm/Ind)
			DC	—	16	MHz	HS osc mode (Ext)
			DC	—	40	kHz	LP osc mode
		Oscillator Frequency <sup>(1)</sup>	DC	—	4.0	MHz	RC osc mode
			0.1	—	4.0	MHz	XT osc mode
			4.0	—	10	MHz	10 MHz mode
			4.0	—	20	MHz	HS osc mode (Comm/Ind)
			4.0	—	16	MHz	HS osc mode (Ext)
DC	—	40	kHz	LP osc mode			

\* These parameters are characterized but not tested.

† Data in the Typical ("Typ") column is at 5.0V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

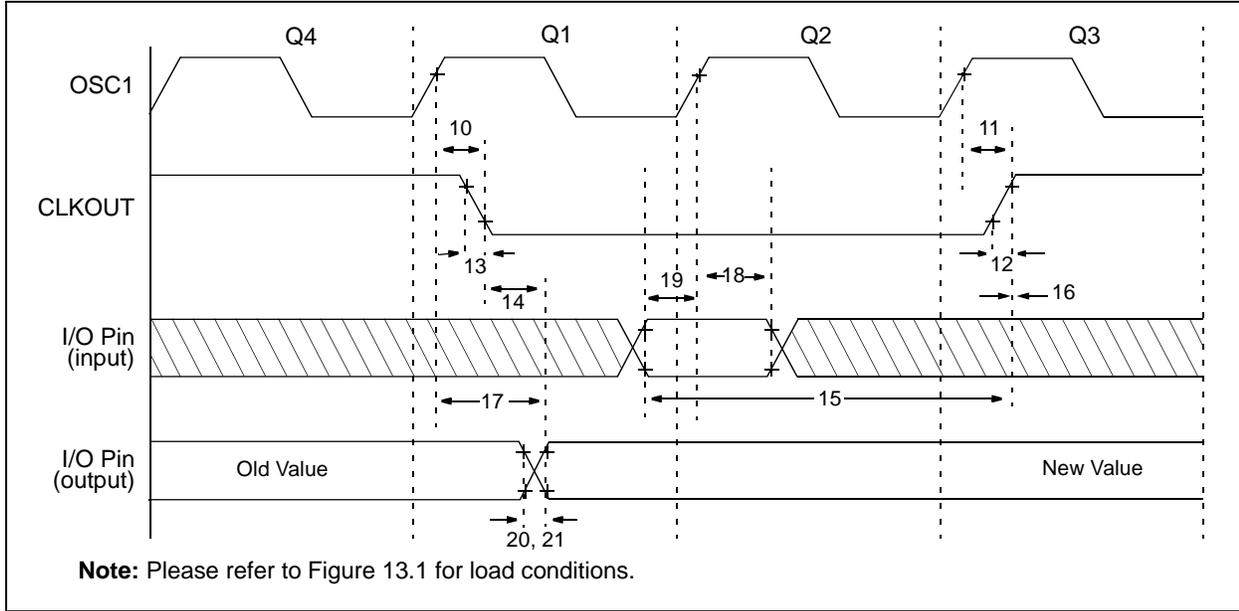
**Note 1:** All specified values are based on characterization data for that particular oscillator type under standard operating conditions with the device executing code. Exceeding these specified limits may result in an unstable oscillator operation and/or higher than expected current consumption.

When an external clock input is used, the "max" cycle time limit is "DC" (no clock) for all devices.

**2:** Instruction cycle period (TCY) equals four times the input oscillator time base period.

# PIC16C5X

**FIGURE 13-3: CLKOUT AND I/O TIMING - PIC16CR54A**



**TABLE 13-2: CLKOUT AND I/O TIMING REQUIREMENTS - PIC16CR54A**

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↓ <sup>(1)</sup>	—	15	30**	ns
11	TosH2ckH	OSC1↑ to CLKOUT↑ <sup>(1)</sup>	—	15	30**	ns
12	TckR	CLKOUT rise time <sup>(1)</sup>	—	5.0	15**	ns
13	TckF	CLKOUT fall time <sup>(1)</sup>	—	5.0	15**	ns
14	TckL2ioV	CLKOUT↓ to Port out valid <sup>(1)</sup>	—	—	40**	ns
15	TioV2ckH	Port in valid before CLKOUT↑ <sup>(1)</sup>	0.25 TCY+30*	—	—	ns
16	TckH2ioI	Port in hold after CLKOUT↑ <sup>(1)</sup>	0*	—	—	ns
17	TosH2ioV	OSC1↑ (Q1 cycle) to Port out valid <sup>(2)</sup>	—	—	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 <sup>(2)</sup>	—	10	25**	ns
21	TioF	Port output fall time <sup>(2)</sup>	—	10	25**	ns

\* These parameters are characterized but not tested.

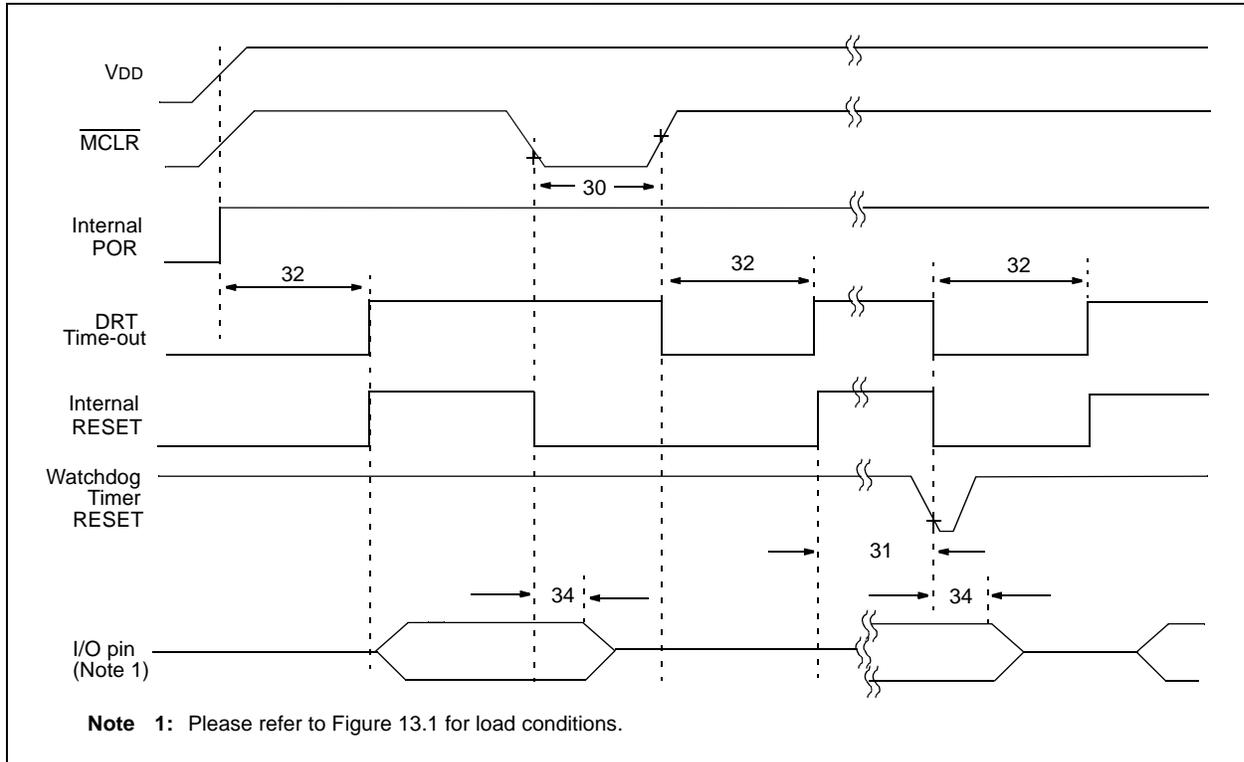
\*\* These parameters are design targets and are not tested. No characterization data available at this time.

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

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

**Note 2:** Please refer to Figure 13.1 for load conditions.

**FIGURE 13-4: RESET, WATCHDOG TIMER, AND DEVICE RESET TIMER TIMING - PIC16CR54A**



**TABLE 13-3: RESET, WATCHDOG TIMER, AND DEVICE RESET TIMER - PIC16CR54A**

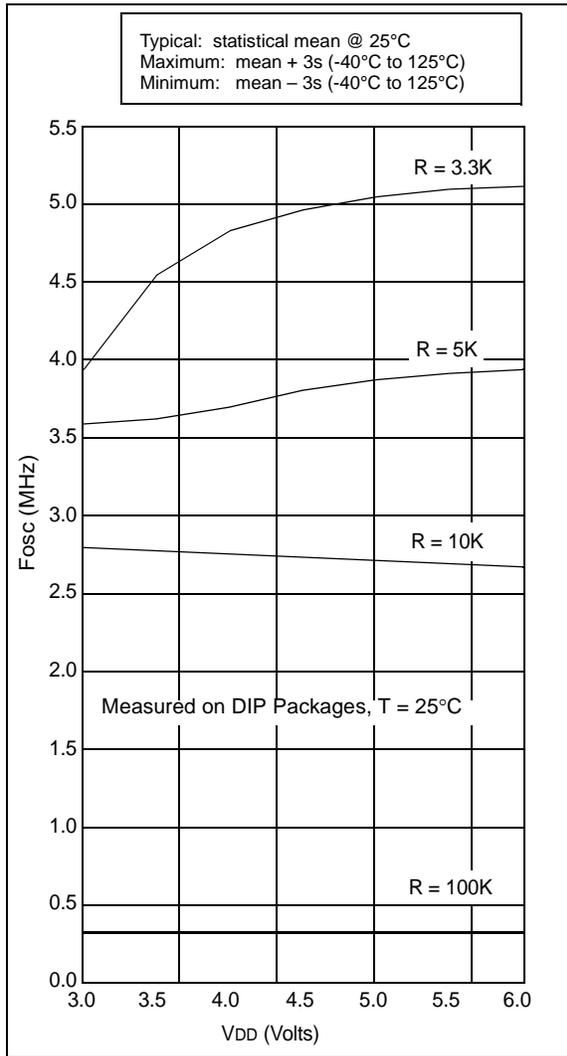
Standard Operating Conditions (unless otherwise specified)							
AC Characteristics							
		Operating Temperature		0°C ≤ TA ≤ +70°C for commercial -40°C ≤ TA ≤ +85°C for industrial -40°C ≤ TA ≤ +125°C for extended			
Param No.	Symbol	Characteristic	Min	Typ†	Max	Units	Conditions
30	Tmcl	MCLR Pulse Width (low)	1.0*	—	—	μs	VDD = 5.0V
31	Twdt	Watchdog Timer Time-out Period (No Prescaler)	7.0*	18*	40*	ms	VDD = 5.0V (Comm)
32	TDRT	Device Reset Timer Period	7.0*	18*	30*	ms	VDD = 5.0V (Comm)
34	Tioz	I/O Hi-impedance from MCLR Low	—	—	1.0*	μs	

\* These parameters are characterized but not tested.

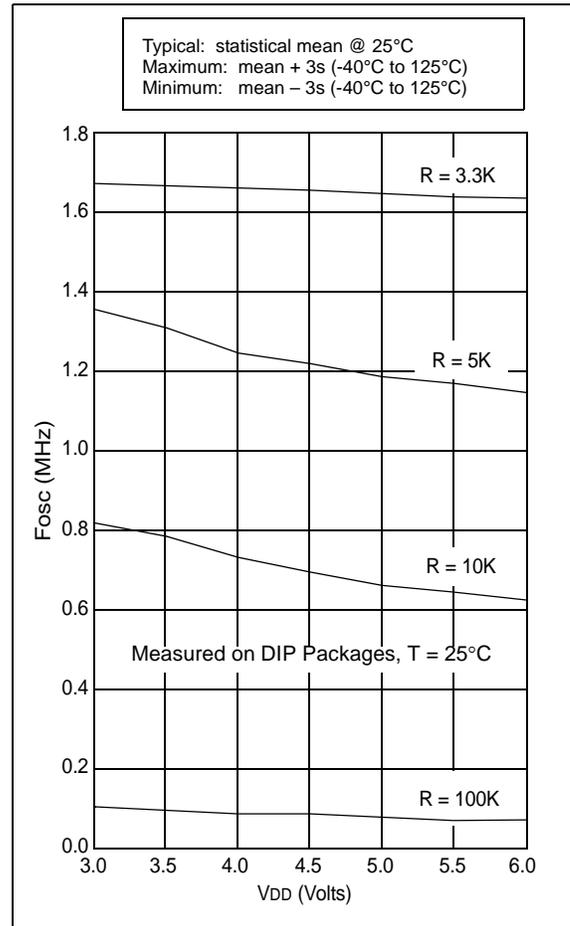
† Data in the Typical ("Typ") column is at 5.0V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

# PIC16C5X

**FIGURE 14-2: TYPICAL RC OSC FREQUENCY vs. VDD, CEXT = 20 PF**

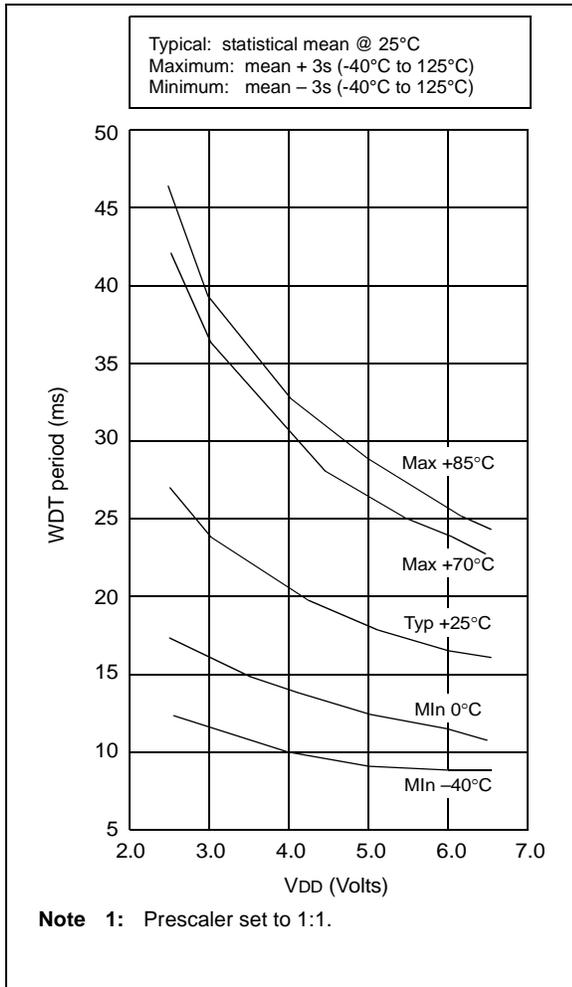


**FIGURE 14-3: TYPICAL RC OSC FREQUENCY vs. VDD, CEXT = 100 PF**

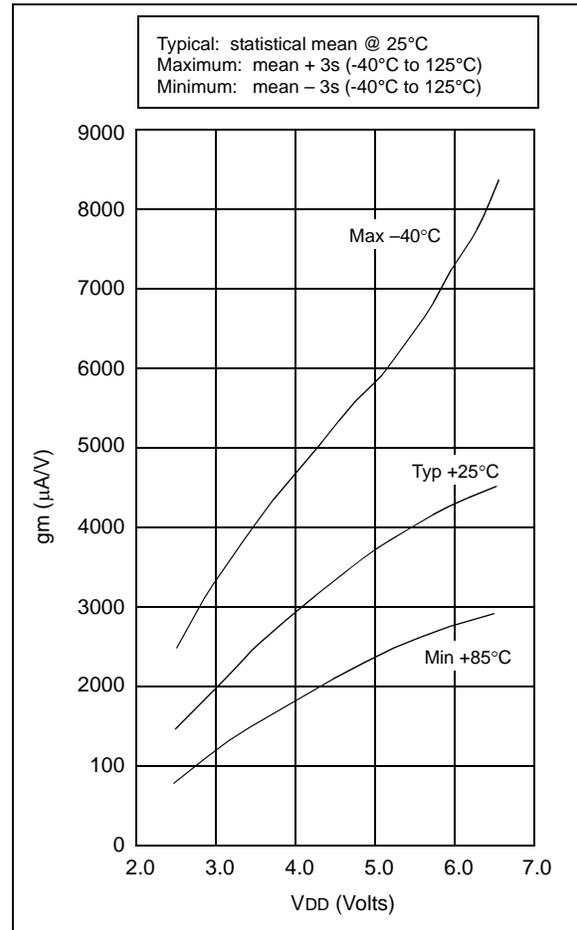


# PIC16C5X

**FIGURE 14-15: WDT TIMER TIME-OUT PERIOD vs. VDD<sup>(1)</sup>**



**FIGURE 14-16: TRANSCONDUCTANCE (gm) OF HS OSCILLATOR vs. VDD**



# PIC16C5X

## 15.2 DC Characteristics: PIC16C54A-04E, 10E, 20E (Extended) PIC16LC54A-04E (Extended)

PIC16LC54A-04E (Extended)		Standard Operating Conditions (unless otherwise specified) Operating Temperature $-40^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$ for extended					
PIC16C54A-04E, 10E, 20E (Extended)		Standard Operating Conditions (unless otherwise specified) Operating Temperature $-40^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$ for extended					
Param No.	Symbol	Characteristic	Min	Typ†	Max	Units	Conditions
D001	VDD	<b>Supply Voltage</b>					
		PIC16LC54A	3.0 2.5	— —	6.25 6.25	V V	XT and RC modes LP mode
D001A		PIC16C54A	3.5 4.5	— —	5.5 5.5	V V	RC and XT modes HS mode
D002	VDR	<b>RAM Data Retention Voltage</b> <sup>(1)</sup>	—	1.5*	—	V	Device in SLEEP mode
D003	VPOR	<b>VDD Start Voltage</b> to ensure Power-on Reset	—	VSS	—	V	See Section 5.1 for details on Power-on Reset
D004	SVDD	<b>VDD Rise Rate</b> to ensure Power-on Reset	0.05*	—	—	V/ms	See Section 5.1 for details on Power-on Reset
D010	IDD	<b>Supply Current</b> <sup>(2)</sup>					
		PIC16LC54A	—	0.5	25	mA	FOSC = 4.0 MHz, VDD = 5.5V, RC <sup>(3)</sup> and XT modes
			—	11	27	μA	FOSC = 32 kHz, VDD = 2.5V, LP mode, Commercial
			—	11	35	μA	FOSC = 32 kHz, VDD = 2.5V, LP mode, Industrial
D010A		PIC16C54A	—	1.8	3.3	mA	FOSC = 32 kHz, VDD = 2.5V, LP mode, Extended
			—	4.8	10	mA	FOSC = 4.0 MHz, VDD = 5.5V, RC <sup>(3)</sup> and XT modes
			—	9.0	20	mA	FOSC = 10 MHz, VDD = 5.5V, HS mode
						FOSC = 20 MHz, VDD = 5.5V, HS mode	

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

\* 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:** This is the limit to which VDD can be lowered in SLEEP mode without losing RAM data.

**Note 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 IDD measurements in active Operation mode are: OSC1 = external square wave, from rail-to-rail; all I/O pins tristated, pulled to VSS, T0CKI = VDD, MCLR = VDD; 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.

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

## 15.4 DC Characteristics: PIC16C54A-04, 10, 20, PIC16LC54A-04, PIC16LV54A-02 (Commercial) PIC16C54A-04I, 10I, 20I, PIC16LC54A-04I, PIC16LV54A-02I (Industrial) PIC16C54A-04E, 10E, 20E, PIC16LC54A-04E (Extended)

DC CHARACTERISTICS			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 $-20^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial-PIC16LV54A-02I $-40^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$ for extended				
Param No.	Symbol	Characteristic	Min	Typ†	Max	Units	Conditions
D030	VIL	<b>Input Low Voltage</b>					
		I/O ports	VSS	—	0.2 VDD	V	Pin at hi-impedance  RC mode only <sup>(3)</sup> XT, HS and LP modes
		MCLR (Schmitt Trigger)	VSS	—	0.15 VDD	V	
		T0CKI (Schmitt Trigger)	VSS	—	0.15 VDD	V	
		OSC1 (Schmitt Trigger)	VSS	—	0.15 VDD	V	
OSC1	VSS	—	0.3 VDD	V			
D040	VIH	<b>Input High Voltage</b>					
		I/O ports	$0.2 V_{DD} + 1$	—	VDD	V	For all VDD <sup>(4)</sup> $4.0\text{V} < V_{DD} \leq 5.5\text{V}^{(4)}$  RC mode only <sup>(3)</sup> XT, HS and LP modes
		I/O ports	2.0	—	VDD	V	
		MCLR (Schmitt Trigger)	0.85 VDD	—	VDD	V	
		T0CKI (Schmitt Trigger)	0.85 VDD	—	VDD	V	
		OSC1 (Schmitt Trigger)	0.85 VDD	—	VDD	V	
OSC1	0.7 VDD	—	VDD	V			
D050	VHYS	<b>Hysteresis of Schmitt Trigger inputs</b>	0.15 VDD*	—	—	V	
D060	IIL	<b>Input Leakage Current<sup>(1,2)</sup></b>					<b>For VDD ≤ 5.5V:</b> VSS ≤ VPIN ≤ VDD, pin at hi-impedance VPIN = VSS + 0.25V VPIN = VDD VSS ≤ VPIN ≤ VDD VSS ≤ VPIN ≤ VDD, XT, HS and LP modes
		I/O ports	-1.0	0.5	+1.0	μA	
		MCLR	-5.0	—	+5.0	μA	
		MCLR	—	0.5	+3.0	μA	
		T0CKI	-3.0	0.5	+3.0	μA	
		OSC1	-3.0	0.5	—	μA	
D080	VOL	<b>Output Low Voltage</b>					
		I/O ports	—	—	0.6	V	IOL = 8.7 mA, VDD = 4.5V IOL = 1.6 mA, VDD = 4.5V, RC mode only
OSC2/CLKOUT	—	—	0.6	V			
	VOH	<b>Output High Voltage<sup>(2)</sup></b>					
		I/O ports	VDD - 0.7	—	—	V	IOH = -5.4 mA, VDD = 4.5V IOH = -1.0 mA, VDD = 4.5V, RC mode only
OSC2/CLKOUT	VDD - 0.7	—	—	V			

\* 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.

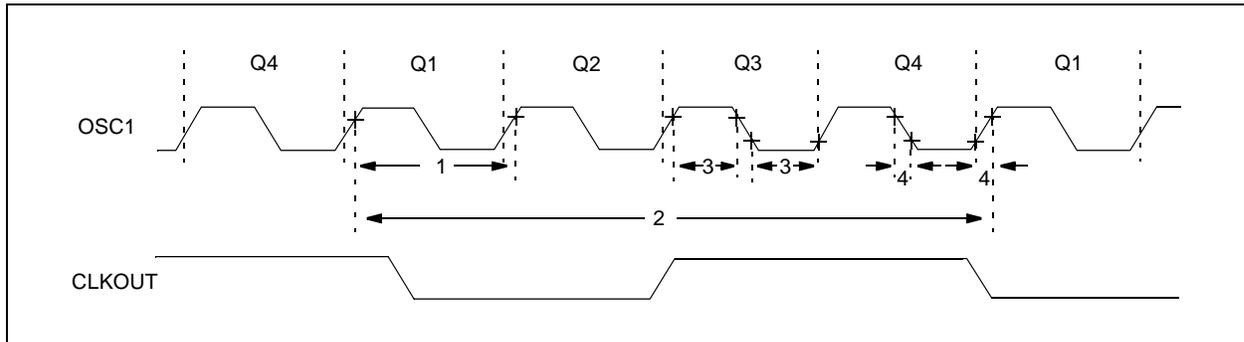
**Note 1:** The leakage current on the  $\overline{\text{MCLR}}/\text{VPP}$  pin is strongly dependent on the applied voltage level. The specified levels represent normal operating conditions. Higher leakage current may be measured at different input voltage.

**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.

## 15.6 Timing Diagrams and Specifications

**FIGURE 15-2: EXTERNAL CLOCK TIMING - PIC16C54A**



**TABLE 15-1: EXTERNAL CLOCK TIMING REQUIREMENTS - PIC16C54A**

Standard Operating Conditions (unless otherwise specified)							
AC Characteristics							
		Operating Temperature	0°C ≤ TA ≤ +70°C for commercial -40°C ≤ TA ≤ +85°C for industrial -20°C ≤ TA ≤ +85°C for industrial - PIC16LV54A-02I -40°C ≤ TA ≤ +125°C for extended				
Param No.	Symbol	Characteristic	Min	Typ†	Max	Units	Conditions
	FOSC	External CLKIN Frequency <sup>(1)</sup>	DC	—	4.0	MHz	XT osc mode
			DC	—	2.0	MHz	XT osc mode (PIC16LV54A)
			DC	—	4.0	MHz	HS osc mode (04)
			DC	—	10	MHz	HS osc mode (10)
			DC	—	20	MHz	HS osc mode (20)
			DC	—	200	kHz	LP osc mode
	Oscillator Frequency <sup>(1)</sup>	DC	—	4.0	MHz	RC osc mode	
		DC	—	2.0	MHz	RC osc mode (PIC16LV54A)	
		0.1	—	4.0	MHz	XT osc mode	
		0.1	—	2.0	MHz	XT osc mode (PIC16LV54A)	
		4.0	—	4.0	MHz	HS osc mode (04)	
		4.0	—	10	MHz	HS osc mode (10)	
		4.0	—	20	MHz	HS osc mode (20)	
		5.0	—	200	kHz	LP osc mode	

\* 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.

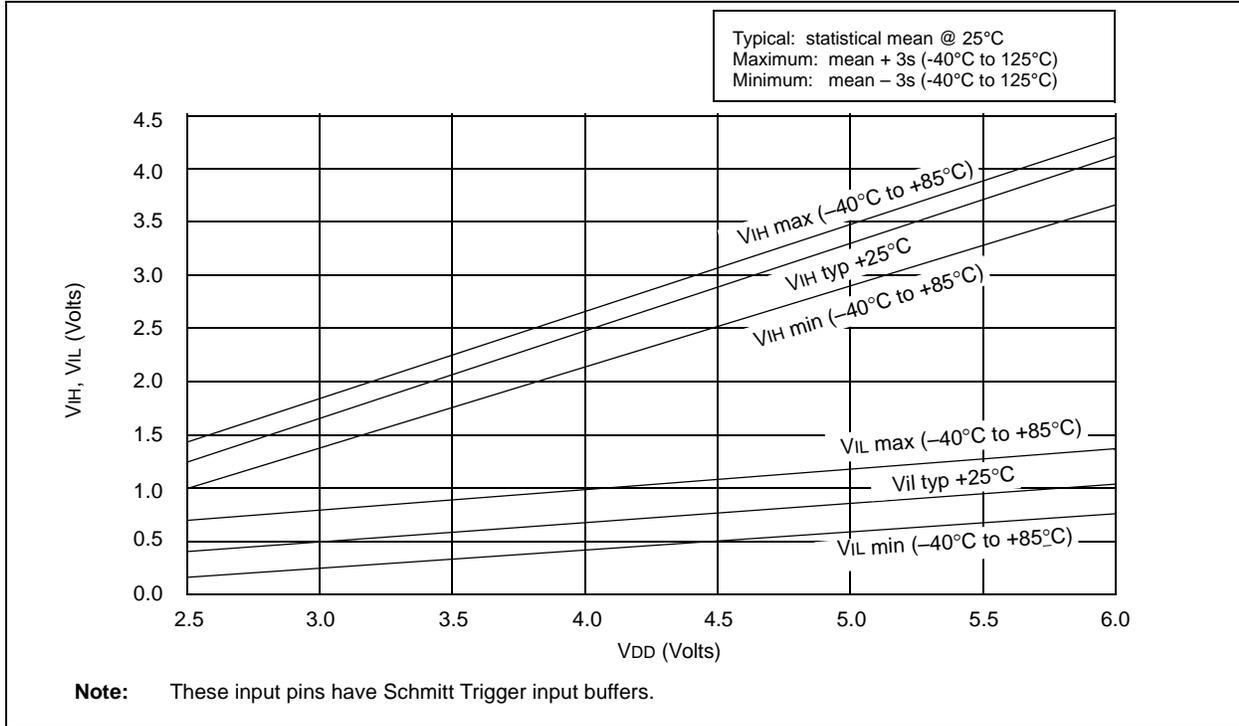
**Note 1:** All specified values are based on characterization data for that particular oscillator type under standard operating conditions with the device executing code. Exceeding these specified limits may result in an unstable oscillator operation and/or higher than expected current consumption.

When an external clock input is used, the "max" cycle time limit is "DC" (no clock) for all devices.

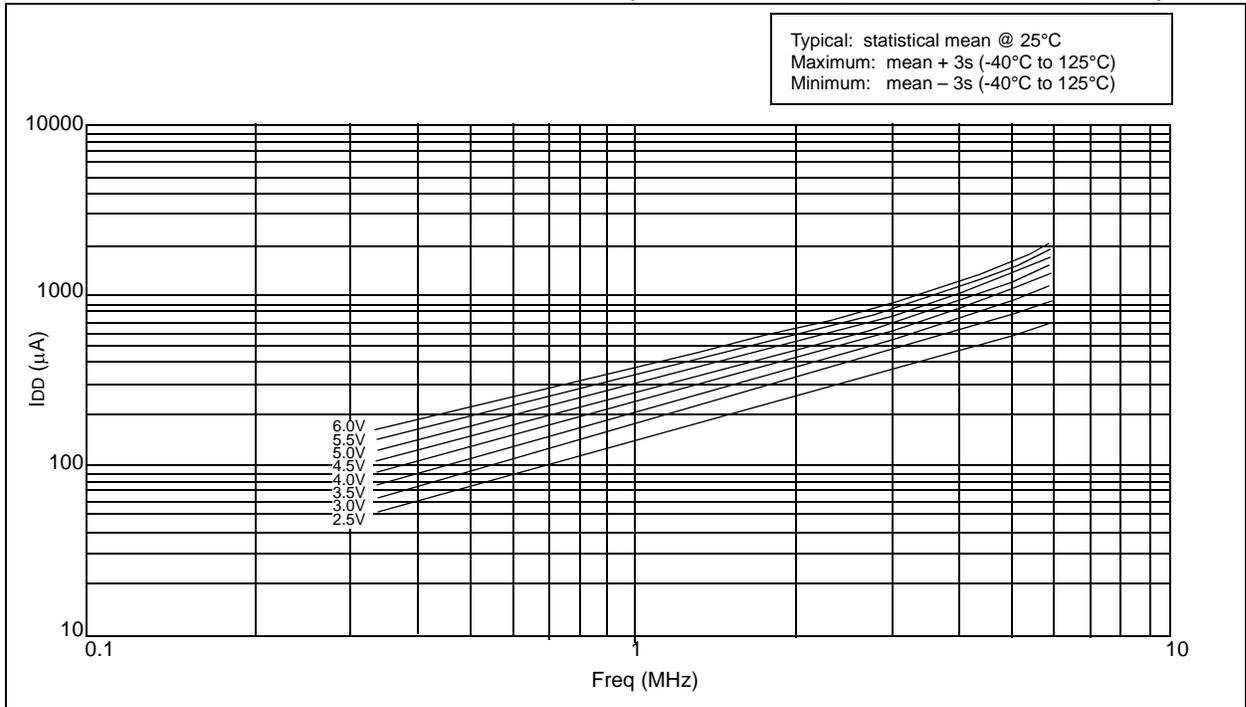
**2:** Instruction cycle period (TCY) equals four times the input oscillator time base period.

# PIC16C5X

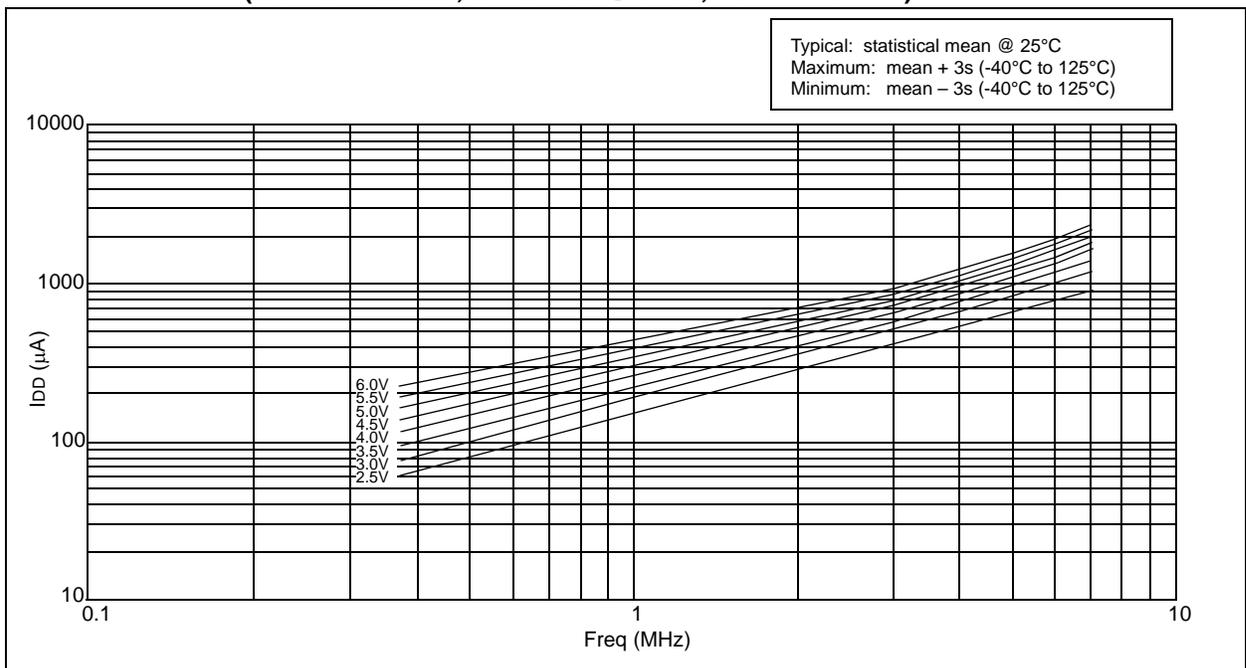
FIGURE 16-9:  $V_{IH}$ ,  $V_{IL}$  OF  $\overline{MCLR}$ ,  $T0CKI$  AND  $OSC1$  (IN RC MODE) vs.  $V_{DD}$



**FIGURE 16-10: TYPICAL  $I_{DD}$  vs. FREQUENCY (WDT DISABLED, RC MODE @ 20 pF, 25°C)**



**FIGURE 16-11: MAXIMUM  $I_{DD}$  vs. FREQUENCY (WDT DISABLED, RC MODE @ 20 pF, -40°C to +85°C)**



**17.1 DC Characteristics: PIC16C54C/C55A/C56A/C57C/C58B-04, 20 (Commercial, Industrial)**  
**PIC16LC54C/LC55A/LC56A/LC57C/LC58B-04 (Commercial, Industrial)**  
**PIC16CR54C/CR56A/CR57C/CR58B-04, 20 (Commercial, Industrial)**  
**PIC16LCR54C/LCR56A/LCR57C/LCR58B-04 (Commercial, Industrial)**

<b>PIC16LC5X</b> <b>PIC16LCR5X</b> (Commercial, Industrial)		<b>Standard Operating Conditions (unless otherwise specified)</b> Operating Temperature 0°C ≤ TA ≤ +70°C for commercial -40°C ≤ TA ≤ +85°C for industrial					
<b>PIC16C5X</b> <b>PIC16CR5X</b> (Commercial, Industrial)		<b>Standard Operating Conditions (unless otherwise specified)</b> Operating Temperature 0°C ≤ TA ≤ +70°C for commercial -40°C ≤ TA ≤ +85°C for industrial					
Param No.	Symbol	Characteristic/Device	Min	Typ†	Max	Units	Conditions
D010	IDD	<b>Supply Current<sup>(2,3)</sup></b>					
		PIC16LC5X	—	0.5	2.4	mA	FOSC = 4.0 MHz, VDD = 5.5V, XT and RC modes
			—	11	27	μA	
PIC16C5X	—	14	35	μA	FOSC = 32 kHz, VDD = 2.5V, LP mode, Commercial FOSC = 32 kHz, VDD = 2.5V, LP mode, Industrial		
D010A		PIC16C5X	—	1.8	2.4	mA	FOSC = 4 MHz, VDD = 5.5V, XT and RC modes
			—	2.6	3.6*	mA	
			—	4.5	16	mA	FOSC = 10 MHz, VDD = 3.0V, HS mode
			—	14	32	μA	FOSC = 20 MHz, VDD = 5.5V, HS mode
			—	17	40	μA	FOSC = 32 kHz, VDD = 3.0V, LP mode, Commercial FOSC = 32 kHz, VDD = 3.0V, LP mode, Industrial

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 VDD 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 IDD measurements in active Operation mode are: OSC1 = external square wave, from rail-to-rail; all I/O pins tristated, pulled to VSS, T0CKI = VDD, MCLR = VDD; 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 REXT. The current through the resistor can be estimated by the formula:

$$I_R = V_{DD}/2R_{EXT} \text{ (mA) with } R_{EXT} \text{ in } k\Omega.$$

# PIC16C5X

## 17.1 DC Characteristics: PIC16C54C/C55A/C56A/C57C/C58B-04, 20 (Commercial, Industrial) PIC16LC54C/LC55A/LC56A/LC57C/LC58B-04 (Commercial, Industrial) PIC16CR54C/CR56A/CR57C/CR58B-04, 20 (Commercial, Industrial) PIC16LCR54C/LCR56A/LCR57C/LCR58B-04 (Commercial, Industrial)

PIC16LC5X PIC16LCR5X (Commercial, Industrial)		Standard Operating Conditions (unless otherwise specified) Operating Temperature 0°C ≤ TA ≤ +70°C for commercial -40°C ≤ TA ≤ +85°C for industrial					
PIC16C5X PIC16CR5X (Commercial, Industrial)		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/Device	Min	Typ†	Max	Units	Conditions
D020	IPD	Power-down Current <sup>(2)</sup>					
		PIC16LC5X	—	0.25	2	μA	VDD = 2.5V, WDT disabled, Commercial
			—	0.25	3	μA	VDD = 2.5V, WDT disabled, Industrial
			—	1	5	μA	VDD = 2.5V, WDT enabled, Commercial
—	1.25		8	μA	VDD = 2.5V, WDT enabled, Industrial		
D020A	IPD	PIC16C5X	—	0.25	4.0	μA	VDD = 3.0V, WDT disabled, Commercial
			—	0.25	5.0	μA	VDD = 3.0V, WDT disabled, Industrial
			—	1.8	7.0*	μA	VDD = 5.5V, WDT disabled, Commercial
			—	2.0	8.0*	μA	VDD = 5.5V, WDT disabled, Industrial
			—	4	12*	μA	VDD = 3.0V, WDT enabled, Commercial
			—	4	14*	μA	VDD = 3.0V, WDT enabled, Industrial
			—	9.8	27*	μA	VDD = 5.5V, WDT enabled, Commercial
			—	12	30*	μA	VDD = 5.5V, WDT enabled, Industrial

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 VDD can be lowered in SLEEP mode without losing RAM data.

**Note 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 IDD measurements in active Operation mode are: OSC1 = external square wave, from rail-to-rail; all I/O pins tristated, pulled to VSS, T0CKI = VDD, MCLR = VDD; 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.

**Note 3:** Does not include current through REXT. The current through the resistor can be estimated by the formula: IR = VDD/2REXT (mA) with REXT in kΩ.

**TABLE 17-1: EXTERNAL CLOCK TIMING REQUIREMENTS - 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
2	Tcy	Instruction Cycle Time <sup>(2)</sup>	—	4/FOSC	—	—	
3	TosL, TosH	Clock in (OSC1) Low or High Time	50*	—	—	ns	XT oscillator
			20*	—	—	ns	HS oscillator
			2.0*	—	—	µs	LP oscillator
4	TosR, TosF	Clock in (OSC1) Rise or Fall Time	—	—	25*	ns	XT oscillator
			—	—	25*	ns	HS oscillator
			—	—	50*	ns	LP oscillator

\* 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.

**Note 1:** All specified values are based on characterization data for that particular oscillator type under standard operating conditions with the device executing code. Exceeding these specified limits may result in an unstable oscillator operation and/or higher than expected current consumption.

When an external clock input is used, the “max” cycle time limit is “DC” (no clock) for all devices.

**2:** Instruction cycle period (TCY) equals four times the input oscillator time base period.

# PIC16C5X

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## APPENDIX A: COMPATIBILITY

To convert code written for PIC16CXX to PIC16C5X, the user should take the following steps:

1. Check any `CALL`, `GOTO` or instructions that modify the PC to determine if any program memory page select operations (PA2, PA1, PA0 bits) need to be made.
2. Revisit any computed jump operations (write to PC or add to PC, etc.) to make sure page bits are set properly under the new scheme.
3. Eliminate any special function register page switching. Redefine data variables to reallocate them.
4. Verify all writes to `STATUS`, `OPTION`, and `FSR` registers since these have changed.
5. Change `RESET` vector to proper value for processor used.
6. Remove any use of the `ADDLW`, `RETURN` and `SUBLW` instructions.
7. Rewrite any code segments that use interrupts.

## APPENDIX B: REVISION HISTORY

### Revision KE (January 2013)

Added a note to each package outline drawing.

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## PRODUCT IDENTIFICATION SYSTEM

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

<u>PART NO.</u>	-	<u>XX</u>	<u>X</u>	<u>/XX</u>	<u>XXX</u>
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 <sup>(2)</sup> PIC16C54AT <sup>(2)</sup> PIC16CR54AT <sup>(2)</sup> PIC16C54CT <sup>(2)</sup> PIC16CR54CT <sup>(2)</sup> PIC16C55T <sup>(2)</sup> PIC16C55AT <sup>(2)</sup> PIC16C56T <sup>(2)</sup> PIC16C56AT <sup>(2)</sup> PIC16CR56AT <sup>(2)</sup> PIC16C57T <sup>(2)</sup> PIC16C57CT <sup>(2)</sup> PIC16CR57CT <sup>(2)</sup> PIC16C58BT <sup>(2)</sup> PIC16CR58BT <sup>(2)</sup>		
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 <sup>(4)</sup> No oscillator type for JW packages <sup>(3)</sup>			
		*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 <sup>(4)</sup> = 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 <sup>(3)</sup> 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](http://www.microchip.com))