

Welcome to E-XFL.COM

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.

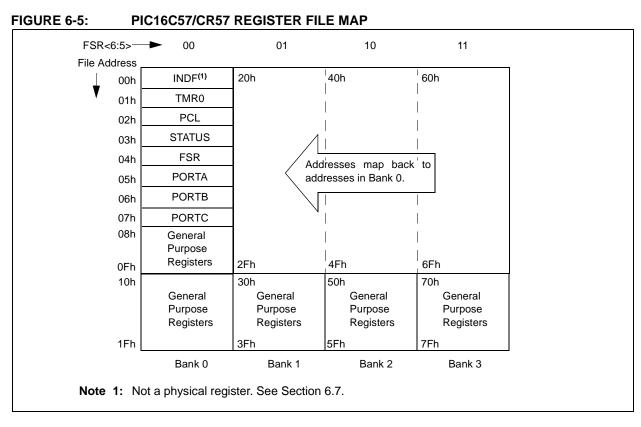
Applications of "<u>Embedded -</u> <u>Microcontrollers</u>"

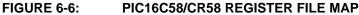
Details

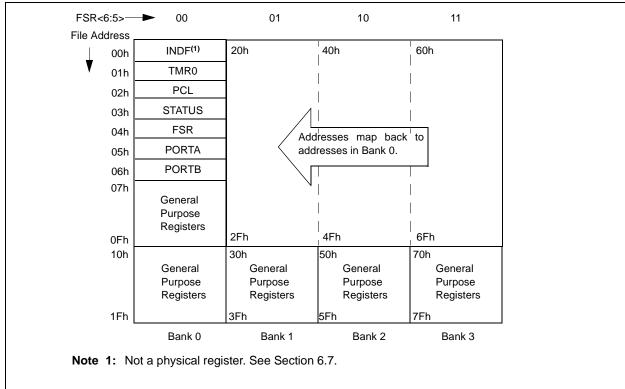
Product Status	Obsolete
Core Processor	PIC
Core Size	8-Bit
Speed	2MHz
Connectivity	-
Peripherals	POR, WDT
Number of I/O	12
Program Memory Size	768B (512 x 12)
Program Memory Type	OTP
EEPROM Size	-
RAM Size	25 x 8
Voltage - Supply (Vcc/Vdd)	2V ~ 3.8V
Data Converters	-
Oscillator Type	External
Operating Temperature	0°C ~ 70°C (TA)
Mounting Type	Surface Mount
Package / Case	18-SOIC (0.295", 7.50mm Width)
Supplier Device Package	18-SOIC
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic16lv54at-02-so

Email: info@E-XFL.COM

Address: Room A, 16/F, Full Win Commercial Centre, 573 Nathan Road, Mongkok, Hong Kong







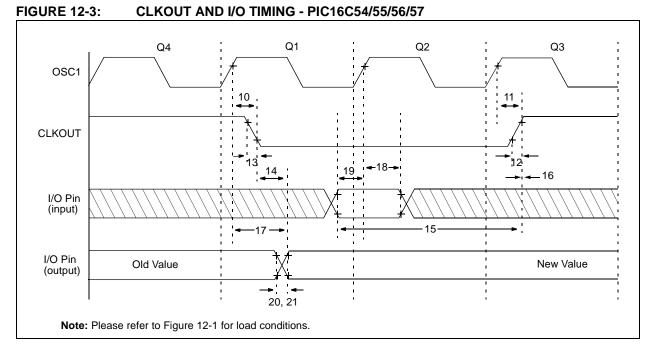


TABLE 12-2: CLKOUT AND I/O TIMING REQUIREMENTS - PIC16C54/55/56/57

AC Char	acteristics	$\begin{array}{ll} \mbox{Standard Operating Conditions (unless otherwise specified)} \\ \mbox{Operating Temperature} & 0^{\circ}C \leq TA \leq +70^{\circ}C \mbox{ for commercial} \\ -40^{\circ}C \leq TA \leq +85^{\circ}C \mbox{ for industrial} \\ -40^{\circ}C \leq TA \leq +125^{\circ}C \mbox{ for extended} \end{array}$						
Param No.	Symbol	Characteristic	Min	Тур†	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	TckH2iol	Port in hold after CLKOUT ⁽¹⁾	0*	_	_	ns		
17	TosH2ioV	OSC1↑ (Q1 cycle) to Port out valid ⁽²⁾	_		100*	ns		
18	TosH2iol	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 5.0V, 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: Please refer to Figure 12-1 for load conditions.



FIGURE 12-4: RESET, WATCHDOG TIMER, AND DEVICE RESET TIMER TIMING -PIC16C54/55/56/57

TABLE 12-3: RESET, WATCHDOG TIMER, AND DEVICE RESET TIMER - PIC16C54/55/56/57

AC Chara	cteristics	$\begin{array}{ll} \mbox{Standard Operating Conditions (u} \\ \mbox{Operating Temperature} & 0^{\circ}\mbox{C} \leq \\ & -40^{\circ}\mbox{C} \leq \\ & -40^{\circ}\mbox{C} \leq \end{array}$	TA ≤ +7 TA ≤ +8	0°C for 5°C for	comme industria	rcial al	
Param No.	Symbol	Characteristic	Min	Тур†	Max	Units	Conditions
30	TmcL	MCLR Pulse Width (low)	100*	—	—	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*	ns	

* 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.

FIGURE 14-9: VTH (INPUT THRESHOLD VOLTAGE) OF I/O PINS vs. VDD







15.2 DC Characteristics: PIC16

PIC16C54A-04E, 10E, 20E (Extended) PIC16LC54A-04E (Extended)

PIC16LC54A-04E (Extended)							tions (unless otherwise specified) $-40^{\circ}C \le TA \le +125^{\circ}C$ for extended
PIC16C (Extend	54A-04E, 10E, 20EStandard Operating Conditions (unless otherwise Operating TemperatureIded) $-40^{\circ}C \le TA \le +125^{\circ}C$ for				tions (unless otherwise specified) $-40^{\circ}C \le TA \le +125^{\circ}C$ for extended		
Param No.	Symbol	Characteristic	Min Typ† Max Units Conditions			Conditions	
	IPD	Power-down Current ⁽²⁾					
D020		PIC16LC54A	_	2.5 0.25	15 7.0	μΑ μΑ	VDD = 2.5V, WDT enabled, Extended VDD = 2.5V, WDT disabled, Extended
D020A		PIC16C54A		5.0 0.8	22 18*	μΑ μΑ	VDD = 3.5V, WDT enabled VDD = 3.5V, WDT disabled

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.
 - 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: IR = VDD/2REXT (mA) with REXT in k Ω .

© 1997-2013 Microchip Technology Inc.

15.3 DC Characteristics: PIC16LV54A-02 (Commercial) PIC16LV54A-02I (Industrial)

PIC16LV54A-02 PIC16LV54A-02I (Commercial, Industrial)				$ \begin{array}{ll} \mbox{Standard Operating Conditions (unless otherwise specified)} \\ \mbox{Operating Temperature} & 0^{\circ}\mbox{C} \leq T\mbox{A} \leq +70^{\circ}\mbox{C for commercial} \\ -20^{\circ}\mbox{C} \leq T\mbox{A} \leq +85^{\circ}\mbox{C for industrial} \\ \end{array} $					
Param No.	Symbol	Characteristic	stic Min Typ† Max Units			Conditions			
D001	Vdd	Supply Voltage RC and XT modes	2.0	_	3.8	V			
D002	Vdr	RAM Data Retention Voltage ⁽¹⁾	_	1.5*	—	V	Device in SLEEP mode		
D003	VPOR	VDD Start Voltage to ensure Power-on Reset	—	Vss	—	V	See Section 5.1 for details on Power-on Reset		
D004	Svdd	VDD Rise Rate to ensure Power-on Reset	0.05*	—	—	V/ms	See Section 5.1 for details on Power-on Reset		
D010	IDD	Supply Current⁽²⁾ RC ⁽³⁾ and XT modes LP mode, Commercial LP mode, Industrial		0.5 11 14	 27 35	mA μA μA	Fosc = 2.0 MHz, VDD = 3.0V Fosc = 32 kHz, VDD = 2.5V WDT disabled Fosc = 32 kHz, VDD = 2.5V WDT disabled		
D020	IPD	Power-down Current^(2,4) Commercial Commercial Industrial Industrial		2.5 0.25 3.5 0.3	12 4.0 14 5.0	μΑ μΑ μΑ μΑ	VDD = 2.5V, WDT enabled VDD = 2.5V, WDT disabled VDD = 2.5V, WDT enabled VDD = 2.5V, WDT disabled		

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.
 - 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: IR = VDD/2REXT (mA) with REXT in kΩ.
 - 4: The oscillator start-up time can be as much as 8 seconds for XT and LP oscillator selection on wake-up from SLEEP mode or during initial power-up.

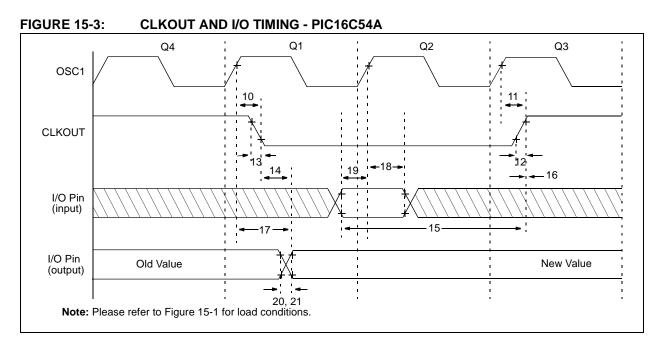


TABLE 15-2: CLKOUT AND I/O TIMING REQUIREMENTS - PIC16C54A

$\begin{tabular}{lllllllllllllllllllllllllllllllllll$						I
Param No.	Symbol	Characteristic	Min	Тур†	Мах	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	TckH2iol	Port in hold after CLKOUT ⁽¹⁾	0*	—	—	ns
17	TosH2ioV	OSC1↑ (Q1 cycle) to Port out valid ⁽²⁾	—	—	100*	ns
18	TosH2iol	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 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.

2: Please refer to Figure 15-1 for load conditions.

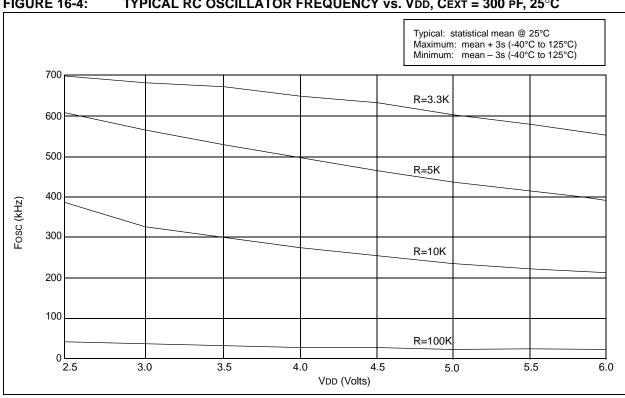


FIGURE 16-4: TYPICAL RC OSCILLATOR FREQUENCY vs. VDD, CEXT = 300 PF, 25°C

PIC16C5X



FIGURE 16-9: VIH, VIL OF MCLR, TOCKI AND OSC1 (IN RC MODE) vs. VDD

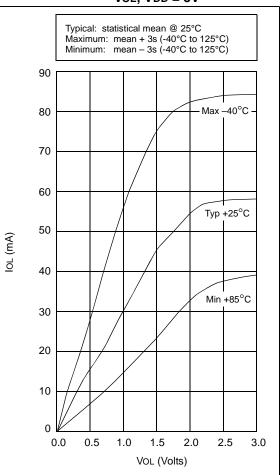


TABLE 16-2:INPUT CAPACITANCE FOR
PIC16C54A/C58A

Pin	Typical Capacitance (pF)					
FIII	18L PDIP	18L SOIC				
RA port	5.0	4.3				
RB port	5.0	4.3				
MCLR	17.0	17.0				
OSC1	4.0	3.5				
OSC2/CLKOUT	4.3	3.5				
TOCKI	3.2	2.8				

All capacitance values are typical at 25°C. A part-to-part variation of $\pm 25\%$ (three standard deviations) should be taken into account.

FIGURE 16-23: PORTA, B AND C IOL vs. VoL, VDD = 5V



17.2 DC Characteristics: PIC16C54C/C55A/C56A/C57C/C58B-04E, 20E (Extended) PIC16CR54C/CR56A/CR57C/CR58B-04E, 20E (Extended)

PIC16C54C/C55A/C56A/C57C/C58B-04E, 20E PIC16CR54C/CR56A/CR57C/CR58B-04E, 20E (Extended)			Standard Operating Conditions (unless otherwise specified)Operating Temperature $-40^{\circ}C \le TA \le +125^{\circ}C$ for extended						
Param No.	Symbol	Characteristic	Min	Тур†	Max	Units	Conditions		
D001	Vdd	Supply Voltage	3.0 4.5		5.5 5.5		RC, XT, LP, and HS mode from 0 - 10 MHz from 10 - 20 MHz		
D002	Vdr	RAM Data Retention Voltage ⁽¹⁾	—	1.5*	—	V	Device in SLEEP mode		
D003	VPOR	VDD start voltage to ensure Power-on Reset	—	Vss	—	V	See Section 5.1 for details on Power-on Reset		
D004	SVDD	VDD rise rate to ensure Power-on Reset	0.05*	—	—	V/ms	See Section 5.1 for details on Power-on Reset		
D010	IDD	Supply Current ⁽²⁾ XT and RC ⁽³⁾ modes HS mode	_	1.8 9.0	3.3 20	mA mA	Fosc = 4.0 MHz, Vdd = 5.5V Fosc = 20 MHz, Vdd = 5.5V		
D020	IPD	Power-down Current ⁽²⁾		0.3 10 12 4.8 18 26	17 50* 60* 31* 68* 90*	μΑ μΑ μΑ μΑ μΑ μΑ	VDD = 3.0V, WDT disabled VDD = 4.5V, WDT disabled VDD = 5.5V, WDT disabled VDD = 3.0V, WDT enabled VDD = 4.5V, WDT enabled VDD = 5.5V, WDT enabled		

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, TOCKI = 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: IR = VDD/2REXT (mA) with REXT in kΩ.



	ALVAUT AND VA TIMINA DEALUDENENTA DIALAASY DIALAADSY
IABLE 17-2:	CLKOUT AND I/O TIMING REQUIREMENTS - PIC16C5X, PIC16CR5X

AC Chara	acteristics	$\begin{array}{llllllllllllllllllllllllllllllllllll$						
Param No.	Symbol	Characteristic	Min	Тур†	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	TckH2iol	Port in hold after CLKOUT ⁽¹⁾	0*	—	_	ns		
17	TosH2ioV	OSC1 [↑] (Q1 cycle) to Port out valid ⁽²⁾	—	—	100*	ns		
18	TosH2iol	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.

18.0 DEVICE CHARACTERIZATION - PIC16LC54A

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 + 3σ) or (mean - 3σ) respectively, where σ is a standard deviation, over the whole temperature range.

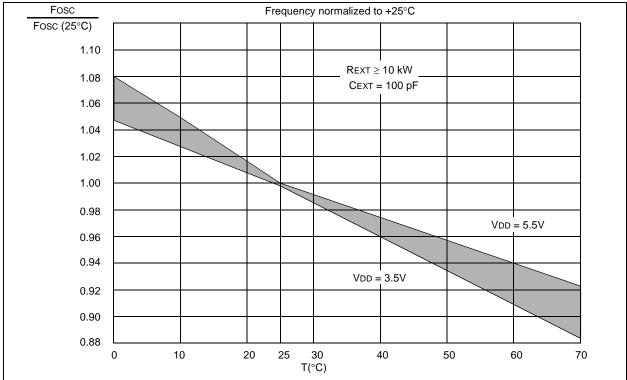


FIGURE 18-1: TYPICAL RC OSCILLATOR FREQUENCY vs. TEMPERATURE

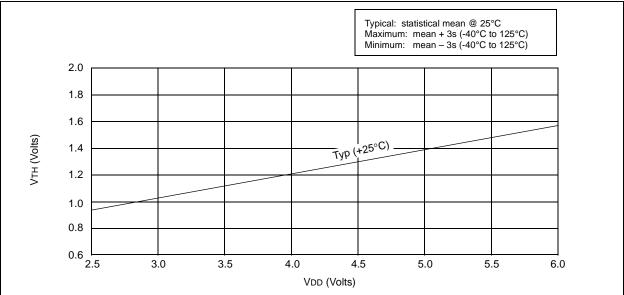
TABLE 18-1: RC OSCILLATOR FREQUENCIES

Сехт	Rext	Average Fosc @ 5V, 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	1.63 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%			

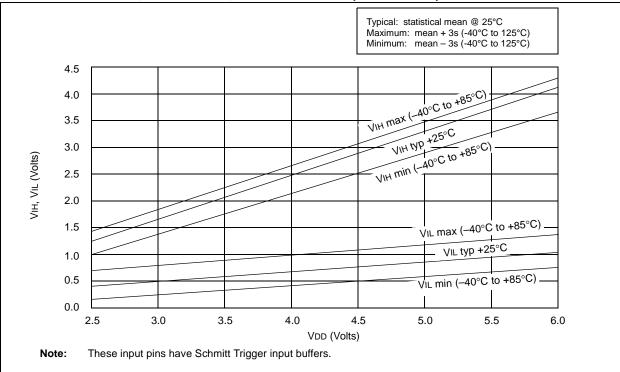
The frequencies are measured on DIP packages.

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 VDD = 5V.









© 1997-2013 Microchip Technology Inc.

PIC16C5X

FIGURE 18-10: VTH (INPUT THRESHOLD TRIP POINT VOLTAGE) OF OSC1 INPUT (IN XT, HS AND LP MODES) vs. VDD







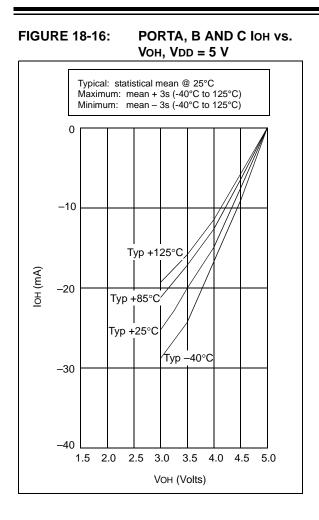


FIGURE 18-17: PORTA, B AND C IOL vs. Vol, VDD = 3 V

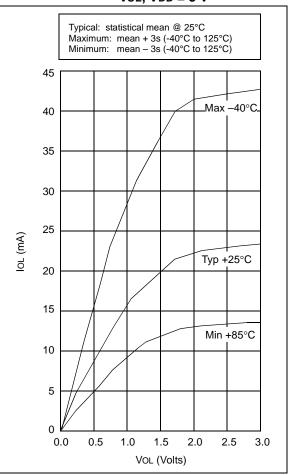


FIGURE 19-6: TIMER0 CLOCK TIMINGS - PIC16C5X-40

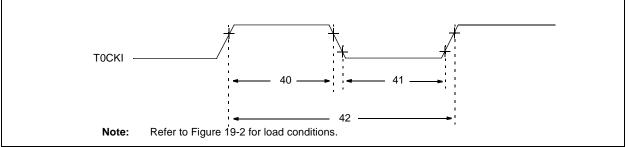


TABLE 19-4: TIMER0 CLOCK REQUIREMENTS PIC16C5X-40

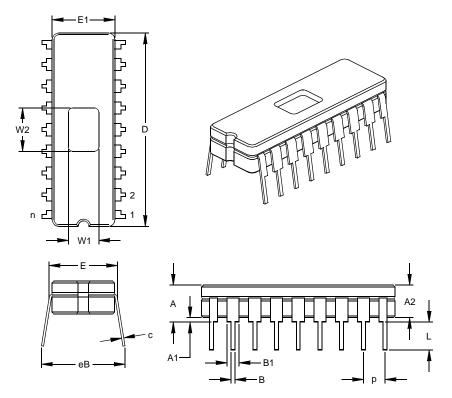
A	AC Charac	toristics	Standard Operating Conditions (unless otherwise specified)Operating Temperature $0^{\circ}C \le TA \le +70^{\circ}C$ for commercial					
Param No.	Symbol	Characteristic	Min	Тур†	Max	Units	Conditions	
40	Tt0H	T0CKI High Pulse Width						
		- No Prescaler	0.5 Tcy + 20*	—		ns		
		- With Prescaler	10*		—	ns		
41	Tt0L	T0CKI Low Pulse Width						
		- No Prescaler	0.5 TCY + 20*	—		ns		
		- With Prescaler	10*	_	—	ns		
42	Tt0P	T0CKI Period	20 or <u>Tcy + 40</u> * N	_	_	ns	Whichever is greater. N = Prescale Value (1, 2, 4,, 256)	

* 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.

18-Lead Ceramic Dual In-line with Window (JW) - 300 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		
Dimensior	n Limits	MIN	NOM	MAX	MIN	NOM	MAX		
Number of Pins	n		18			18			
Pitch	р		.100			2.54			
Top to Seating Plane	А	.170	.183	.195	4.32	4.64	4.95		
Ceramic Package Height	A2	.155	.160	.165	3.94	4.06	4.19		
Standoff	A1	.015	.023	.030	0.38	0.57	0.76		
Shoulder to Shoulder Width	Е	.300	.313	.325	7.62	7.94	8.26		
Ceramic Pkg. Width	E1	.285	.290	.295	7.24	7.37	7.49		
Overall Length	D	.880	.900	.920	22.35	22.86	23.37		
Tip to Seating Plane	L	.125	.138	.150	3.18	3.49	3.81		
Lead Thickness	С	.008	.010	.012	0.20	0.25	0.30		
Upper Lead Width	B1	.050	.055	.060	1.27	1.40	1.52		
Lower Lead Width	В	.016	.019	.021	0.41	0.47	0.53		
Overall Row Spacing §	eВ	.345	.385	.425	8.76	9.78	10.80		
Window Width	W1	.130	.140	.150	3.30	3.56	3.81		
Window Length	W2	.190	.200	.210	4.83	5.08	5.33		

* Controlling Parameter § Significant Characteristic JEDEC Equivalent: MO-036

Drawing No. C04-010

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.

NOTES: