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

#### Details

Product Status	Active
Core Processor	PIC
Core Size	8-Bit
Speed	20MHz
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)	3V ~ 5.5V
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/pic16c54c-20-so

Email: info@E-XFL.COM

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

### **Pin Diagrams**



## **Device Differences**

Device	Voltage Range	Oscillator Selection (Program)	Oscillator	Process Technology (Microns)	ROM Equivalent	MCLR Filter
PIC16C54	2.5-6.25	Factory	See Note 1	1.2	PIC16CR54A	No
PIC16C54A	2.0-6.25	User	See Note 1	0.9	—	No
PIC16C54C	2.5-5.5	User	See Note 1	0.7	PIC16CR54C	Yes
PIC16C55	2.5-6.25	Factory	See Note 1	1.7	_	No
PIC16C55A	2.5-5.5	User	See Note 1	0.7	—	Yes
PIC16C56	2.5-6.25	Factory	See Note 1	1.7	—	No
PIC16C56A	2.5-5.5	User	See Note 1	0.7	PIC16CR56A	Yes
PIC16C57	2.5-6.25	Factory	See Note 1	1.2	—	No
PIC16C57C	2.5-5.5	User	See Note 1	0.7	PIC16CR57C	Yes
PIC16C58B	2.5-5.5	User	See Note 1	0.7	PIC16CR58B	Yes
PIC16CR54A	2.5-6.25	Factory	See Note 1	1.2	N/A	Yes
PIC16CR54C	2.5-5.5	Factory	See Note 1	0.7	N/A	Yes
PIC16CR56A	2.5-5.5	Factory	See Note 1	0.7	N/A	Yes
PIC16CR57C	2.5-5.5	Factory	See Note 1	0.7	N/A	Yes
PIC16CR58B	2.5-5.5	Factory	See Note 1	0.7	N/A	Yes

Note 1: If you change from this device to another device, please verify oscillator characteristics in your application.

**Note:** The table shown above shows the generic names of the PIC16C5X devices. For device varieties, please refer to Section 2.0.

# 2.0 PIC16C5X DEVICE VARIETIES

A variety of frequency ranges and packaging options are available. Depending on application and production requirements, the proper device option can be selected using the information in this section. When placing orders, please use the PIC16C5X Product Identification System at the back of this data sheet to specify the correct part number.

For the PIC16C5X family of devices, there are four device types, as indicated in the device number:

- 1. **C**, as in PIC16**C**54C. These devices have EPROM program memory and operate over the standard voltage range.
- LC, as in PIC16LC54A. These devices have EPROM program memory and operate over an extended voltage range.
- 3. **CR**, as in PIC16**CR**54A. These devices have ROM program memory and operate over the standard voltage range.
- 4. LCR, as in PIC16LCR54A. These devices have ROM program memory and operate over an extended voltage range.

# 2.1 UV Erasable Devices (EPROM)

The UV erasable versions offered in CERDIP packages, are optimal for prototype development and pilot programs.

UV erasable devices can be programmed for any of the four oscillator configurations. Microchip's

PICSTART<sup>®</sup> Plus<sup>(1)</sup> and PRO MATE<sup>®</sup> programmers both support programming of the PIC16C5X. Third party programmers also are available. Refer to the Third Party Guide (DS00104) for a list of sources.

# 2.2 One-Time-Programmable (OTP) Devices

The availability of OTP devices is especially useful for customers expecting frequent code changes and updates, or small volume applications.

The OTP devices, packaged in plastic packages, permit the user to program them once. In addition to the program memory, the configuration bits must be programmed.

Note 1: PIC16LC54C and PIC16C54A devices require OSC2 not to be connected while programming with PICSTART<sup>®</sup> Plus programmer.

# 2.3 Quick-Turnaround-Production (QTP) Devices

Microchip offers a QTP Programming Service for factory production orders. This service is made available for users who choose not to program a medium to high quantity of units and whose code patterns have stabilized. The devices are identical to the OTP devices but with all EPROM locations and configuration bit options already programmed by the factory. Certain code and prototype verification procedures apply before production shipments are available. Please contact your Microchip Technology sales office for more details.

# 2.4 Serialized Quick-Turnaround-Production (SQTP<sup>SM</sup>) Devices

Microchip offers the unique programming service where a few user defined locations in each device are programmed with different serial numbers. The serial numbers may be random, pseudo-random or sequential. The devices are identical to the OTP devices but with all EPROM locations and configuration bit options already programmed by the factory.

Serial programming allows each device to have a unique number which can serve as an entry code, password or ID number.

# 2.5 Read Only Memory (ROM) Devices

Microchip offers masked ROM versions of several of the highest volume parts, giving the customer a low cost option for high volume, mature products. NOTES:

# 10.0 INSTRUCTION SET SUMMARY

Each PIC16C5X instruction is a 12-bit word divided into an OPCODE, which specifies the instruction type and one or more operands which further specify the operation of the instruction. The PIC16C5X instruction set summary in Table 10-2 groups the instructions into byte-oriented, bit-oriented, and literal and control operations. Table 10-1 shows the opcode field descriptions.

For **byte-oriented** instructions, 'f' represents a file register designator and 'd' represents a destination designator. The file register designator is used to specify which one of the 32 file registers in that bank is to be used by the instruction.

The destination designator specifies where the result of the operation is to be placed. If 'd' is '0', the result is placed in the W register. If 'd' is '1', the result is placed in the file register specified in the instruction.

For **bit-oriented** instructions, 'b' represents a bit field designator which selects the number of the bit affected by the operation, while 'f' represents the number of the file in which the bit is located.

For **literal and control** operations, 'k' represents an 8 or 9-bit constant or literal value.

TABLE 10-1:	OPCODE FIELD
	DESCRIPTIONS

Field	Description			
f	Register file address (0x00 to 0x1F)			
W	Working register (accumulator)			
b	b Bit address within an 8-bit file register			
k	Literal field, constant data or label			
x	Don't care location (= 0 or 1)			
	The assembler will generate code with $x = 0$ .			
	It is the recommended form of use for com-			
	patibility with all Microchip software tools.			
d	Destination select;			
	d = 0 (store result in W)			
	d = 1 (store result in file register 'f')			
	Default is d = 1			
label	Label name			
TOS	Top of Stack			
PC	Program Counter			
WDT	Watchdog Timer Counter			
TO	Time-out bit			
PD	Power-down bit			
dest	Destination, either the W register or the			
	specified register file location			
[ ]	Options			
( )	Contents			
$\rightarrow$	Assigned to			
< >	Register bit field			
E	In the set of			
italics	User defined term (font is courier)			

All instructions are executed within one single instruction cycle, unless a conditional test is true or the program counter is changed as a result of an instruction. In this case, the execution takes two instruction cycles. One instruction cycle consists of four oscillator periods. Thus, for an oscillator frequency of 4 MHz, the normal instruction execution time would be 1  $\mu$ s. If a conditional test is true or the program counter is changed as a result of an instruction, the instruction execution time would be 2  $\mu$ s.

Figure 10-1 shows the three general formats that the instructions can have. All examples in the figure use the following format to represent a hexadecimal number:

0xhhh

where 'h' signifies a hexadecimal digit.

# FIGURE 10-1: GENERAL FORMAT FOR INSTRUCTIONS

Byte-oriented file register operations						
<u>11 6</u>	5	4 0				
OPCODE	d	f (FILE #)				
d = 0 for destination d = 1 for destination f = 5-bit file registe	d = 0 for destination W d = 1 for destination f f = 5-bit file register address					
Bit-oriented file register	r ope	erations				
11 8	7	5 4 0				
OPCODE	b (Bl	IT #) f (FILE #)				
Literal and control ope	ratio	ns (except GOTO)				
<u>11</u>	8	7 0				
OPCODE		k (literal)				
k = 8-bit immediate value						
Literal and control operations - GOTO instruction						
11	11 9 8 0					
OPCODE k (literal)						
k = 9-bit immediate value						

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# 11.0 DEVELOPMENT SUPPORT

The PIC<sup>®</sup> microcontrollers are supported with a full range of hardware and software development tools:

- Integrated Development Environment
  - MPLAB<sup>®</sup> IDE Software
- Assemblers/Compilers/Linkers
  - MPASM<sup>™</sup> Assembler
  - MPLAB C17 and MPLAB C18 C Compilers
  - MPLINK™ Object Linker/
  - MPLIB<sup>™</sup> Object Librarian
- Simulators
  - MPLAB SIM Software Simulator
- Emulators
  - MPLAB ICE 2000 In-Circuit Emulator
  - ICEPIC<sup>™</sup> In-Circuit Emulator
- In-Circuit Debugger
- MPLAB ICD
- Device Programmers
  - PRO MATE<sup>®</sup> II Universal Device Programmer
- PICSTART<sup>®</sup> Plus Entry-Level Development Programmer
- Low Cost Demonstration Boards
  - PICDEM<sup>™</sup>1 Demonstration Board
  - PICDEM 2 Demonstration Board
  - PICDEM 3 Demonstration Board
  - PICDEM 17 Demonstration Board
  - KEELOQ<sup>®</sup> Demonstration Board

# 11.1 MPLAB Integrated Development Environment Software

The MPLAB IDE software brings an ease of software development previously unseen in the 8-bit microcontroller market. The MPLAB IDE is a Windows<sup>®</sup>-based application that contains:

- An interface to debugging tools
  - simulator
  - programmer (sold separately)
  - emulator (sold separately)
  - in-circuit debugger (sold separately)
- A full-featured editor
- A project manager
- Customizable toolbar and key mapping
- A status bar
- On-line help

The MPLAB IDE allows you to:

- Edit your source files (either assembly or 'C')
- One touch assemble (or compile) and download to PIC MCU emulator and simulator tools (automatically updates all project information)
- Debug using:
  - source files
  - absolute listing file
  - machine code

The ability to use MPLAB IDE with multiple debugging tools allows users to easily switch from the cost-effective simulator to a full-featured emulator with minimal retraining.

# 11.2 MPASM Assembler

The MPASM assembler is a full-featured universal macro assembler for all PIC MCUs.

The MPASM assembler has a command line interface and a Windows shell. It can be used as a stand-alone application on a Windows 3.x or greater system, or it can be used through MPLAB IDE. The MPASM assembler generates relocatable object files for the MPLINK object linker, Intel<sup>®</sup> standard HEX files, MAP files to detail memory usage and symbol reference, an absolute LST file that contains source lines and generated machine code, and a COD file for debugging.

The MPASM assembler features include:

- Integration into MPLAB IDE projects.
- User-defined macros to streamline assembly code.
- Conditional assembly for multi-purpose source files.
- Directives that allow complete control over the assembly process.

# 11.3 MPLAB C17 and MPLAB C18 C Compilers

The MPLAB C17 and MPLAB C18 Code Development Systems are complete ANSI 'C' compilers for Microchip's PIC17CXXX and PIC18CXXX family of microcontrollers, respectively. These compilers provide powerful integration capabilities and ease of use not found with other compilers.

For easier source level debugging, the compilers provide symbol information that is compatible with the MPLAB IDE memory display.

## 12.3 DC Characteristics: PIC16C54/55/56/57-RCE, XTE, 10E, HSE, LPE (Extended)

PIC16C54/55/56/57-RCE, XTE, 10E, HSE, LPE (Extended)		Standard Operating Conditions (unless otherwise specified) Operating Temperature $-40^{\circ}C \le TA \le +125^{\circ}C$ for extended					
Param No.	Symbol	Characteristic/Device	Min	Тур†	Max	Units	Conditions
D001	Vdd	Supply Voltage PIC16C5X-RCE PIC16C5X-XTE PIC16C5X-10E PIC16C5X-HSE PIC16C5X-LPE	3.25 3.25 4.5 4.5 2.5		6.0 6.0 5.5 5.5 6.0	V V V V V	
D002	Vdr	RAM Data Retention Voltage <sup>(1)</sup>	—	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 <sup>(2)</sup> PIC16C5X-RCE <sup>(3)</sup> PIC16C5X-XTE PIC16C5X-10E PIC16C5X-HSE PIC16C5X-HSE PIC16C5X-LPE		1.8 1.8 4.8 9.0 19	3.3 3.3 10 10 20 55	mA mA mA mA μA	Fosc = 4 MHz, VDD = $5.5V$ Fosc = 4 MHz, VDD = $5.5V$ Fosc = 10 MHz, VDD = $5.5V$ Fosc = 10 MHz, VDD = $5.5V$ Fosc = 16 MHz, VDD = $5.5V$ Fosc = $32$ kHz, VDD = $3.25V$ , WDT disabled
D020	IPD	Power-down Current <sup>(2)</sup>	_	5.0 0.8	22 18	μΑ μΑ	VDD = 3.25V, WDT enabled VDD = 3.25V, WDT disabled

\* These parameters are characterized but not tested.

† Data in "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 $\Omega$ .

#### FIGURE 12-5: TIMER0 CLOCK TIMINGS - PIC16C54/55/56/57



#### TABLE 12-4: TIMER0 CLOCK REQUIREMENTS - PIC16C54/55/56/57

AC Ch	AC CharacteristicsStandard Operating Conditions (unless otherwise specified)Operating Temperature $0^{\circ}C \le TA \le +70^{\circ}C$ for commercial $-40^{\circ}C \le TA \le +85^{\circ}C$ for industrial $-40^{\circ}C \le TA \le +125^{\circ}C$ for extended						
Param No.	Symbol	Characteristic	Min	Тур†	Max	Units	Conditions
40	Tt0H	TOCKI High Pulse Width - No Prescaler - With Prescaler	0.5 Tcy + 20* 10*		_	ns ns	
41	TtOL	T0CKI Low Pulse Width - No Prescaler - With Prescaler	0.5 Tcy + 20* 10*		_	ns 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 5.0V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

# 14.0 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 +  $3\sigma$ ) or (mean -  $3\sigma$ ) respectively, where  $\sigma$  is a standard deviation, over the whole temperature range.





## TABLE 14-1: RC OSCILLATOR FREQUENCIES

Сехт	Rext	Average Fosc @ 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  $\pm 3$  standard deviations from the average value for VDD = 5V.

#### FIGURE 14-6: MAXIMUM IPD vs. VDD, WATCHDOG DISABLED



# FIGURE 14-7: TYPICA

#### TYPICAL IPD vs. VDD, WATCHDOG ENABLED



#### FIGURE 14-8: MAXIMUM IPD vs. VDD, WATCHDOG ENABLED



IPD, with WDT enabled, has two components: The leakage current, which increases with higher temperature, and the operating current of the WDT logic, which increases with lower temperature. At  $-40^{\circ}$ C, the latter dominates explaining the apparently anomalous behavior.

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







# PIC16C5X











#### FIGURE 14-22: PORTA, B AND C IOL vs. VoL, VDD = 5 V



# 15.2 DC Characteristics: PIC16

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

PIC16L (Extend	<b>C54A-04E</b> ded)	1	Standa Opera	ard Ope ting Terr	rating	<b>j Condi</b> ure	tions (unless otherwise specified) $-40^{\circ}C \le TA \le +125^{\circ}C$ for extended
PIC16C54A-04E, 10E, 20E (Extended)			Stand: Opera	<b>ard Ope</b> ting Terr	<b>rating</b>	<b>j Condi</b> ure	tions (unless otherwise specified) $-40^{\circ}C \le TA \le +125^{\circ}C$ for extended
Param No.	Symbol	Characteristic	Min	Тур†	Max	Units	Conditions
	IPD	Power-down Current <sup>(2)</sup>					
D020		PIC16LC54A	—	2.5	15	μΑ	VDD = 2.5V, WDT enabled,
			_	0.25	7.0	μA	Extended VDD = 2.5V, WDT disabled, Extended
D020A		PIC16C54A	—	5.0	22	μA	VDD = 3.5V, WDT enabled
				0.8	18^	μΑ	VDD = $3.5V$ , VVD I 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 $\Omega$ .

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## 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	Min	Тур†	Max	Units	Conditions
D001	Vdd	Supply Voltage RC and XT modes	2.0	_	3.8	v	
D002	Vdr	RAM Data Retention Voltage <sup>(1)</sup>	—	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	<b>Supply Current<sup>(2)</sup></b> RC <sup>(3)</sup> 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 <sup>(2,4)</sup> Commercial Commercial Industrial Industrial		2.5 0.25 3.5 0.3	12 4.0 14 5.0	μΑ μΑ μΑ	VDD = 2.5V, WDT enabled VDD = 2.5V, WDT disabled VDD = 2.5V, WDT enabled VDD = 2.5V, WDT enabled

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.

# PIC16C5X



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

# 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) PIC16C5X PIC16CR5X (Commercial, Industrial)			Stand Opera Stand Opera	ard Ope ting Terr ard Ope ting Terr	erating aperatu erating aperatu	Condit ire Condit ire	$\begin{array}{l} \text{ions (unless otherwise specified)} \\ 0^\circ\text{C} \leq \text{TA} \leq +70^\circ\text{C} \text{ for commercial} \\ -40^\circ\text{C} \leq \text{TA} \leq +85^\circ\text{C} \text{ for industrial} \\ \end{array}$
Param No.	Symbol	Characteristic/Device	Min Typ† Max Units Condition			Conditions	
	Vdd	Supply Voltage					
D001		PIC16LC5X	2.5 2.7 2.5		5.5 5.5 5.5	V V V	$\begin{array}{l} -40^{\circ}C \leq TA \leq +\ 85^{\circ}C,\ 16LCR5X \\ -40^{\circ}C \leq TA \leq 0^{\circ}C,\ 16LC5X \\ 0^{\circ}C \leq TA \leq +\ 85^{\circ}C\ 16LC5X \end{array}$
D001A		PIC16C5X	3.0 4.5		5.5 5.5	V V	RC, XT, LP and HS mode from 0 - 10 MHz from 10 - 20 MHz
D002	Vdr	RAM Data Retention Volt- age <sup>(1)</sup>	-	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

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: IR = VDD/2REXT (mA) with REXT in k $\Omega$ .

# 17.4 Timing Parameter Symbology and Load Conditions

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

1. TppS2ppS

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

## FIGURE 17-5: LOAD CONDITIONS FOR DEVICE TIMING SPECIFICATIONS -PIC16C54C/CR54C/C55A/C56A/CR56A/C57C/CR57C/C58B/CR58B-04, 20











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#### 18-Lead Plastic Small Outline (SO) - Wide, 300 mil (SOIC)

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



	Units INCHES*				MILLIMETERS		
Dimension	Limits	MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		18			18	
Pitch	р		.050			1.27	
Overall Height	Α	.093	.099	.104	2.36	2.50	2.64
Molded Package Thickness	A2	.088	.091	.094	2.24	2.31	2.39
Standoff §	A1	.004	.008	.012	0.10	0.20	0.30
Overall Width	E	.394	.407	.420	10.01	10.34	10.67
Molded Package Width	E1	.291	.295	.299	7.39	7.49	7.59
Overall Length	D	.446	.454	.462	11.33	11.53	11.73
Chamfer Distance	h	.010	.020	.029	0.25	0.50	0.74
Foot Length	L	.016	.033	.050	0.41	0.84	1.27
Foot Angle	¢	0	4	8	0	4	8
Lead Thickness	С	.009	.011	.012	0.23	0.27	0.30
Lead Width	В	.014	.017	.020	0.36	0.42	0.51
Mold Draft Angle Top	α	0	12	15	0	12	15
Mold Draft Angle Bottom	β	0	12	15	0	12	15

\* Controlling Parameter § Significant Characteristic

Notes:

Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side. JEDEC Equivalent: MS-013 Drawing No. C04-051

#### Note the following details of the code protection feature on Microchip devices:

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