ENHANCED PIC16LV5X

EPROM-Based 8-Bit CMOS Microcontroller Series

Devices Included in this Data Sheet:

- PIC16LV54A
- PIC16LV58A

High-Performance RISC CPU:

- Only 33 single word instructions to learn
- All instructions are single cycle (2 µs) except for program branches which are two-cycle
- Operating speed: DC - 2 MHz clock input
  DC - 2 µs instruction cycle

Device	Pins	I/O	EPROM	RAM
PIC16LV54A	18	12	512	25
PIC16LV58A	18	12	2K	73

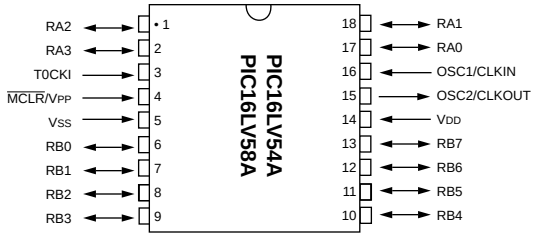
- 12-bit wide instructions
- 8-bit wide data path
- Seven special function hardware registers
- Two-level deep hardware stack
- Direct, indirect and relative addressing modes for data and instructions

Peripheral Features:

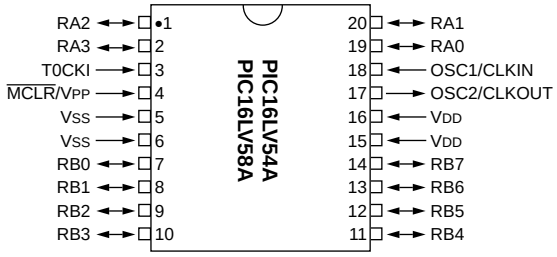
- 8-bit real time clock/counter (TMR0) with 8-bit programmable prescaler
- Power-On Reset (POR)
- Device Reset Timer (DRT)
- Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation
- Programmable code-protection
- Power saving SLEEP mode
- Selectable oscillator options:
  - RC: Low-cost RC oscillator
  - XT: Standard crystal/resonator
  - LP: Power saving, low frequency crystal

Pin Configurations

PDIP, SOIC, Windowed CERDIP



SSOP



CMOS Technology:

- Low-power, high-speed CMOS EPROM technology
- Fully static design
- Wide-operating voltage range:
  - EPROM Commercial/Industrial 2.0V to 3.8V
- Low-power consumption
  - < 1 mA typical @ 3V, 2 MHz
  - 10 µA typical @ 2V, 32 kHz
  - < 0.6 µA typical standby current (with WDT disabled) @ 3V, 0°C to 70°C

1.0 GENERAL DESCRIPTION

The Enhanced PIC16LV5X from Microchip Technology is a family of low-cost, high performance, 8-bit, fully static, EPROM-based CMOS microcontrollers. This family is pin and software compatible with the PIC16LV5X family of devices in a new enhanced process technology. It employs a RISC architecture with only 33 single word/single cycle instructions. All instructions are single cycle (2 μs) except for program branches which take two cycles. The Enhanced PIC16LV5X delivers performance an order of magnitude higher than its competitors in the same price category. The 12-bit wide instructions are highly symmetrical resulting in 2:1 code compression over other 8-bit microcontrollers in its class. The easy to use and easy to remember instruction set reduces development time significantly.

The Enhanced PIC16LV5X products are equipped with special features that reduce system cost and power requirements. The Power-On Reset (POR) and Device Reset Timer (DRT) eliminate the need for external reset circuitry. There are three oscillator configurations to choose from, including the power-saving LP (Low Power) oscillator and cost saving RC oscillator. Power saving SLEEP mode, Watchdog Timer and code protection features improve system cost, power and reliability.

The UV erasable CERDIP packaged versions are ideal for code development, while the cost-effective One-Time-Programmable (OTP) versions are suitable for production in any volume. The customer can take full advantage of Microchip's price leadership in OTP microcontrollers while benefiting from the OTP's flexibility.

The Enhanced PIC16LV5X products are supported by a full-featured macro assembler, a software simulator, an in-circuit emulator, a 'C' compiler, fuzzy logic support tools, a low-cost development programmer, and a full featured programmer. All the tools are supported on IBM® PC and compatible machines.

1.1 Applications

The Enhanced PIC16LV5X series fits perfectly in applications such as low-power remote transmitters/receivers and pointing devices. The EPROM technology makes customizing application programs (transmitter codes, receiver frequencies, etc.) extremely fast and convenient. The small footprint packages, for through hole or surface mounting, make this microcontroller series perfect for applications with space limitations. Low-cost, low-power, high performance, ease of use and I/O flexibility make the Enhanced PIC16LV5X series very versatile even in areas where no microcontroller use has been considered before (e.g., timer functions, replacement of "glue" logic in larger systems, coprocessor applications).

TABLE 1-1: ENHANCED PIC16LV5X FAMILY OF DEVICES

	Clock	Memory			Peripherals			Features
	Maximum Frequency of Operation (MHz)	EPROM Program Memory (words)	RAM Data Memory (bytes)	Timer Module(s)	I/O Pins	Voltage Range (Volts)	Number of Instructions	Packages
PIC16LV54A	20	512	25	TMR0	12	2.0-3.8	33	18-pin DIP, SOIC; 20-pin SSOP
PIC16LV58A	20	2K	73	TMR0	12	2.0-3.8	33	18-pin DIP, SOIC; 20-pin SSOP

Legend: All PIC16/17 Family devices have Power-On Reset, selectable Watchdog Timer, selectable code protect and high I/O current capability.

2.0 ENHANCED PIC16LV5X 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 Enhanced PIC16LV5X Product Identification System at the back of this data sheet to specify the correct part number.

For the Enhanced PIC16LV5X family of devices, there is one device type, as indicated in the device number:

1. **LV**, as in PIC16LV54A. These devices have EPROM program memory and operate over the standard voltage range of 2.0 to 3.8 volts.

2.1 UV Erasable Devices

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® and PRO MATE™ programmers both support programming of the Enhanced PIC16LV5X. Third party programmers also are available; refer to the Third Party Guide 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.

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.

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^{SM}) 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.

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

3.0 ARCHITECTURAL OVERVIEW

This section provides information on the architecture of the Enhanced PIC16LV5X. For information on operation of the peripherals, electrical specifications, etc., please refer to the Enhanced PIC16C5X data sheet.

FIGURE 3-1: ENHANCED PIC16LV5X SERIES BLOCK DIAGRAM

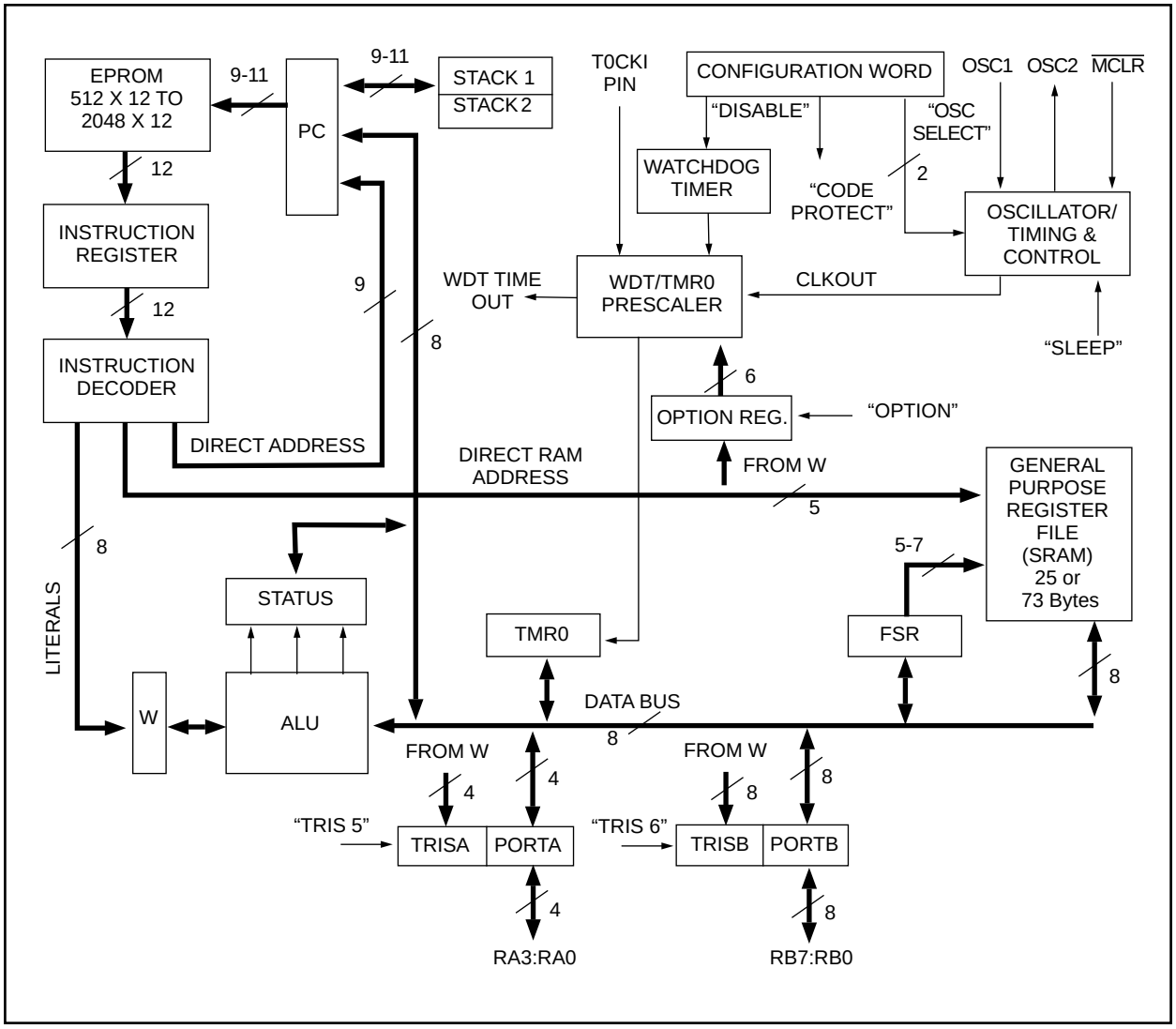


TABLE 3-1: PINOUT DESCRIPTION - PIC16LV54A, PIC16LV58A

Name	DIP, SOIC No.	SSOP No.	I/O/P Type	Input Levels	Description
RA0	17	19	I/O	TTL	Bi-directional I/O port
RA1	18	20	I/O	TTL	
RA2	1	1	I/O	TTL	
RA3	2	2	I/O	TTL	
RB0	6	7	I/O	TTL	Bi-directional I/O port
RB1	7	8	I/O	TTL	
RB2	8	9	I/O	TTL	
RB3	9	10	I/O	TTL	
RB4	10	11	I/O	TTL	
RB5	11	12	I/O	TTL	
RB6	12	13	I/O	TTL	
RB7	13	14	I/O	TTL	
T0CKI	3	3	I	ST	Clock input to Timer0. Must be tied to V_{SS} or V_{DD}, if not in use, to reduce current consumption.
$\overline{MCLR}/V_{PP}$	4	4	I	ST	Master clear (reset) input/programming voltage input. This pin is an active low reset to the device. Voltage on the $\overline{MCLR}/V_{PP}$ pin must not exceed V_{DD} to avoid unintended entering of programming mode.
OSC1/CLKIN	16	18	I	ST	Oscillator crystal input/external clock source input.
OSC2/CLKOUT	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.
V_{DD}	14	15,16	P	—	Positive supply for logic and I/O pins.
V_{SS}	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

4.0 MEMORY ORGANIZATION

FIGURE 4-1: PIC16LV54A PROGRAM MEMORY MAP AND STACK

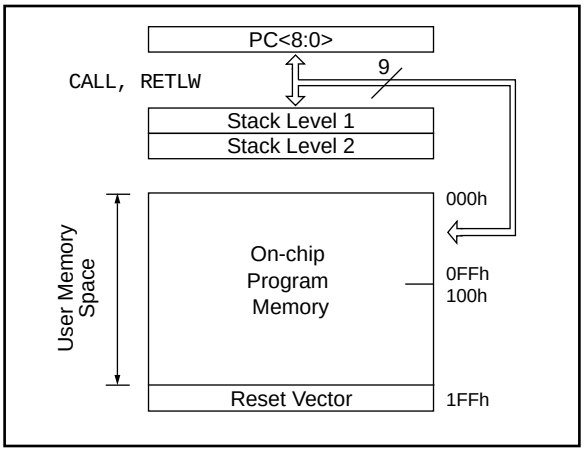


FIGURE 4-2: PIC16LV58A PROGRAM MEMORY MAP AND STACK

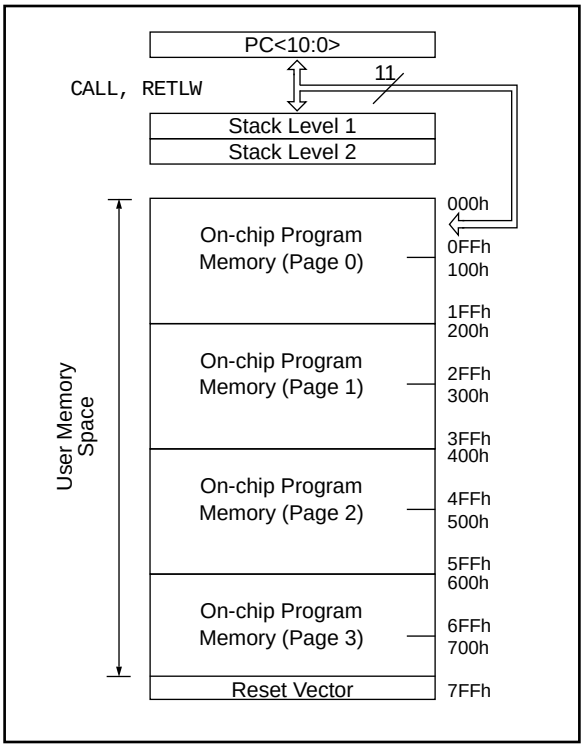
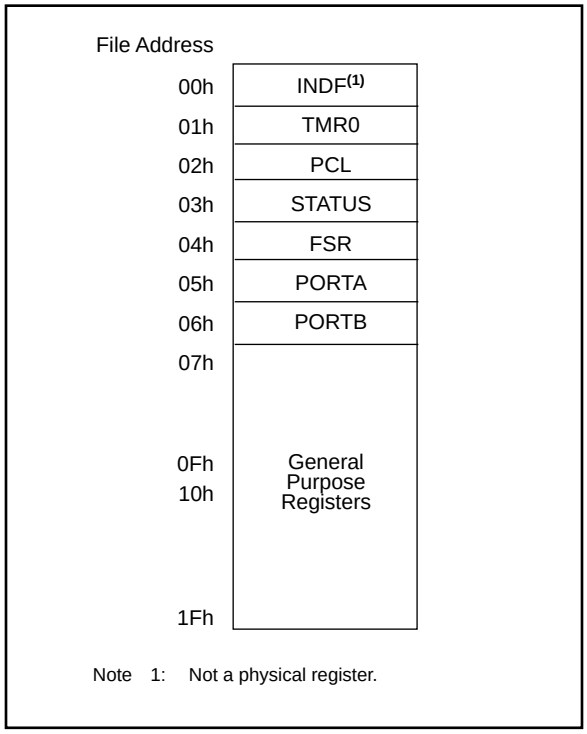
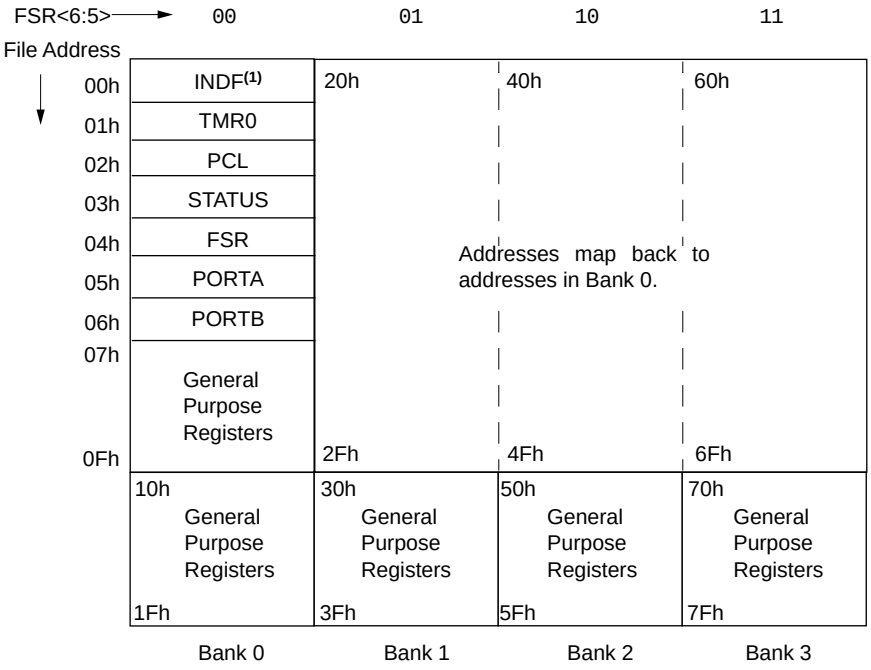


FIGURE 4-3: PIC16LV54A REGISTER FILE MAP



Note 1: Not a physical register.

FIGURE 4-4: PIC16LV58A REGISTER FILE MAP



Note 1: Not a physical register.

TABLE 4-1: SPECIAL FUNCTION REGISTER SUMMARY

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Value on Power-On Reset	Value on $\overline{MCLR}$ and WDT Reset
N/A	TRIS	I/O control registers (TRISA, TRISB, TRISC)								1111 1111	1111 1111
N/A	OPTION	Contains control bits to configure Timer0 and Timer0/WDT prescaler								--11 1111	--11 1111
00h	INDF	Uses contents of FSR to address data memory (not a physical register)								xxxx xxxx	uuuu uuuu
01h	TMR0	8-bit real-time clock/counter								xxxx xxxx	uuuu uuuu
02h(1)	PCL	Low order 8 bits of PC								1111 1111	1111 1111
03h	STATUS	PA2	PA1	PA0	$\overline{TO}$	$\overline{PD}$	Z	DC	C	0001 1xxx	000q quuu
04h	FSR	Indirect data memory address pointer								1xxx xxxx	1uuu uuuu
05h	PORTA	—	—	—	—	RA3	RA2	RA1	RA0	---- xxxx	---- uuuu
06h	PORTB	RB7	RB6	RB5	RB4	RB3	RB2	RB1	RB0	xxxx xxxx	uuuu uuuu

Legend: Shaded boxes = unimplemented or unused, – = unimplemented, read as '0' (if applicable)
x = unknown, u = unchanged, q = value depends on condition.

Note 1: The upper byte of the Program Counter is not directly accessible. See Section 4.5 of the Enhanced PIC16C5X data sheet (DS30236B) for an explanation of how to access these bits.

2: File address 07h is a general purpose register on the PIC16LV54A and PIC16LV58A.

5.0 ELECTRICAL CHARACTERISTICS - PIC16LV5XA

Absolute Maximum Ratings†

Ambient temperature under bias ..... -20°C to +85°C
Storage temperature ..... - 65°C to +150°C
Voltage on V_{DD} with respect to V_{SS} ..... 0 to +7.5V
Voltage on $\overline{MCLR}$ with respect to V_{SS} **(2)** ..... 0 to +14V
Voltage on all other pins with respect to V_{SS} ..... -0.6V to (V_{DD} + 0.6V)
Total power dissipation **(1)** ..... 800 mW
Max. current out of V_{SS} pin ..... 150 mA
Max. current into V_{DD} pin ..... 100 mA
Max. current into an input pin (T0CKI only) ..... ±500 µA
Input clamp current, I_{IK} (V_I < 0 or V_I > V_{DD}) ..... ±20 mA
Output clamp current, I_{OK} (V_0 < 0 or V_0 > V_{DD}) ..... ±20 mA
Max. output current sunk by any I/O pin ..... 25 mA
Max. output current sourced by any I/O pin ..... 20 mA
Max. output current sourced by a single I/O port (PORTA or B) ..... 40 mA
Max. output current sunk by a single I/O port (PORTA or B) ..... 50 mA

Note 1: Power dissipation is calculated as follows: $P_{dis} = V_{DD} \times \{I_{DD} - \sum I_{OH}\} + \sum \{(V_{DD}-V_{OH}) \times I_{OH}\} + \sum(V_{OL} \times I_{OL})$

Note 2: Voltage spikes below V_{SS} at the $\overline{MCLR}$ pin, inducing currents greater than 80mA, may cause latch-up. Thus, a series resistor of 50-100Ω should be used when applying a "low" level to the $\overline{MCLR}$ pin rather than pulling this pin directly to V_{SS}

† NOTICE: Stresses above those listed under "Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

5.1 DC Characteristics: PIC16LV5XA-02 (Commercial) PIC16LV5XA-02 (Industrial)

DC Characteristics Power Supply Pins		Standard Operating Conditions (unless otherwise specified) Operating Temperature 0°C ≤ TA ≤ +70°C (commercial) –20°C ≤ TA ≤ +85°C (industrial)				
Characteristic	**Sym**	**Min**	**Typ(1)**	**Max**	**Units**	**Conditions**
Supply Voltage	VDD					
XT, RC and LP options		2.0		3.8	V	
RAM Data Retention Voltage(2)	VDR		1.5*		V	Device in SLEEP mode
VDD start voltage to ensure Power-On Reset	VPOR		VSS		V	See section on Power-On Reset for details
VDD rise rate to ensure Power-On Reset	SVDD	0.05*			V/ms	See section on Power-On Reset for details
Supply Current(3)	IDD					
XT and RC(4) options			0.5		mA	FOSC = 2.0 MHz, VDD = 3.0V
LP option, Commercial			11	27	µA	FOSC = 32 kHz, VDD = 2.5V, WDT disabled
LP option, Industrial			14	35	µA	FOSC = 32 kHz, VDD = 2.5V, WDT disabled
Power Down Current(5)(6)	IPD					
Commercial			2.5	12	µA	VDD = 2.5V, WDT enabled
			0.25	4.0	µA	VDD = 2.5V, WDT disabled
Industrial			3.5	14	µA	VDD = 2.5V, WDT enabled
			0.3	5.0	µA	VDD = 2.5V, WDT disabled

* These parameters are characterized but not tested.

Note 1: 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.

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

3: 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, $\overline{MCLR}$ = VDD; WDT enabled/disabled as specified.

b) For standby current measurements, the conditions are the same, except that the device is in SLEEP mode.

4: 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.

5: The power down current in SLEEP mode does not depend on the oscillator type. Power down current is measured with the part in SLEEP mode, with all I/O pins in hi-impedance state and tied to VDD and VSS.

6: The oscillator start-up time can be as much as 8 seconds for XT and LP oscillator selection, if the SLEEP mode is entered or during initial power-up.

5.2 DC Characteristics: PIC16LV5XA-02 (Commercial) PIC16LV5XA-02 (Industrial)

DC Characteristics All Pins Except Power Supply Pins		**Standard Operating Conditions (unless otherwise specified)** Operating Temperature 0°C ≤ TA ≤ +70°C (commercial) –20°C ≤ TA ≤ +85°C (industrial) Operating Voltage VDD range is described in Section 10.1, Section 10.2 and Section 10.3 of the Enhanced PIC16C5X data sheet (DS30236B).				
Characteristic	**Sym**	**Min**	**Typ(1)**	**Max**	**Units**	**Conditions**
Input Low Voltage	VIL					
I/O ports		VSS		0.2 VDD	V	Pin at hi-impedance
$\overline{MCLR}$ (Schmitt Trigger)		VSS		0.15 VDD	V	
T0CKI (Schmitt Trigger)		VSS		0.15 VDD	V	
OSC1 (Schmitt Trigger)		VSS		0.15 VDD	V	RC option only(4)
OSC1		VSS		0.3 VDD	V	XT and LP options
Input High Voltage	VIH					
I/O ports		0.2 VDD+1V		VDD	V	For all VDD(5)
$\overline{MCLR}$ (Schmitt Trigger)		0.85 VDD		VDD	V	
T0CKI (Schmitt Trigger)		0.85 VDD		VDD	V	
OSC1 (Schmitt Trigger)		0.85 VDD		VDD	V	RC option only(4)
OSC1		0.7 VDD		VDD	V	XT and LP options
Hysteresis of Schmitt Trigger inputs	VHYS	0.15VDD*			V	
Input Leakage Current(3)	IIL					
I/O ports		-1.0	0.5	+1.0	µA	VSS ≤ VPIN ≤ VDD, Pin at hi-impedance
$\overline{MCLR}$		-5.0		+5.0	µA	VPIN = VSS +0.25V(2)
			0.5	+3.0	µA	VPIN = VDD(2)
T0CKI		-3.0	0.5	+3.0	µA	VSS ≤ VPIN ≤ VDD
OSC1		-3.0	0.5		µA	VSS ≤ VPIN ≤ VDD, XT and LP options
Output Low Voltage	VOL					
I/O ports				0.6	V	IOL = 8.7 mA, VDD = 3.8V
OSC2/CLKOUT				0.6	V	IOL = 1.6 mA, VDD = 3.8V, RC option only
Output High Voltage	VOH					
I/O ports(3)		VDD-0.7			V	IOH = -5.4 mA, VDD = 3.8V
OSC2/CLKOUT		VDD-0.7			V	IOH = -1.0 mA, VDD = 3.8V, RC option only

* These parameters are characterized but not tested.

Note 1: 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.

2: The leakage current on the $\overline{MCLR}$/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.

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

4: For the RC option, the OSC1/CLKIN pin is a Schmitt Trigger input. It is not recommended that the PIC16LV5X be driven with external clock in RC mode.

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

5.3 Timing Parameter Symbology and Load Conditions

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

1. TppS2ppS
2. TppS

T			
F	Frequency	T	Time

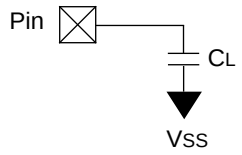
Lowercase subscripts (pp) and their meanings:

pp			
2	to	mc	$\overline{\text{MCLR}}$
ck	CLKOUT	osc	oscillator
cy	cycle time	os	OSC1
drt	device reset timer	t0	T0CKI
io	I/O port	wdt	watchdog timer

Uppercase letters and their meanings:

S			
F	Fall	P	Period
H	High	R	Rise
I	Invalid (Hi-impedance)	V	Valid
L	Low	Z	Hi-impedance

FIGURE 5-1: LOAD CONDITIONS - PIC16LV5XA



C_L = 50 pF for all pins except OSC2

15 pF for OSC2 in XT, HS or LP options when external clock is used to drive OSC1

5.4 Timing Diagrams and Specifications

FIGURE 5-2: EXTERNAL CLOCK TIMING - PIC16LV5XA

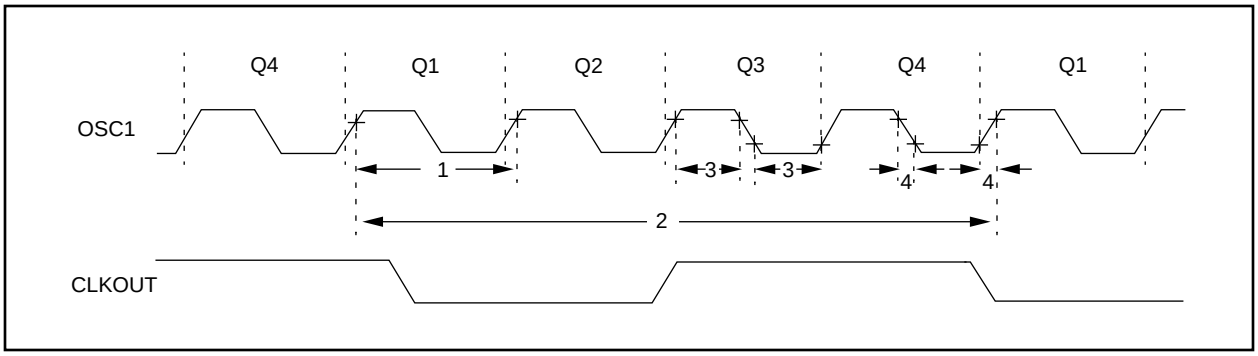


TABLE 5-1: EXTERNAL CLOCK TIMING REQUIREMENTS - PIC16LV5XA

AC Characteristics	Standard Operating Conditions (unless otherwise specified) Operating Temperature 0°C ≤ TA ≤ +70°C (commercial), –20°C ≤ TA ≤ +85°C (industrial) Operating Voltage VDD range is described in Section 10.1, Section 10.2 and Section 10.3 of the Enhanced PIC16C5X data sheet (DS30236B).

Parameter No.	Sym	Characteristic	Min	Typ(1)	Max	Units	Conditions
	FOSC	External CLKIN Frequency(2)	DC	—	2.0	MHz	RC osc mode
			DC	—	2.0	MHz	XT osc mode
			DC	—	200	kHz	LP osc mode
		Oscillator Frequency(2)	DC	—	2.0	MHz	RC osc mode
			0.1	—	2.0	MHz	XT osc mode
			5	—	200	kHz	LP osc mode
1	TOSC	External CLKIN Period(2)	500	—	—	ns	RC osc mode
			500	—	—	ns	XT osc mode
			5.0	—	—	µs	LP osc mode
		Oscillator Period(2)	500	—	—	ns	RC osc mode
			500	—	10,000	ns	XT osc mode
			5.0	—	200	µs	LP osc mode
2	TCY	Instruction Cycle Time(3)	—	4/FOSC	—	—	
3	TosL, TosH	Clock in (OSC1) Low or High Time	50*	—	—	ns	XT oscillator
			2.0*	—	—	µs	LP oscillator
4	TosR, TosF	Clock in (OSC1) Rise or Fall Time	—	—	25*	ns	XT oscillator
			—	—	50*	ns	LP oscillator

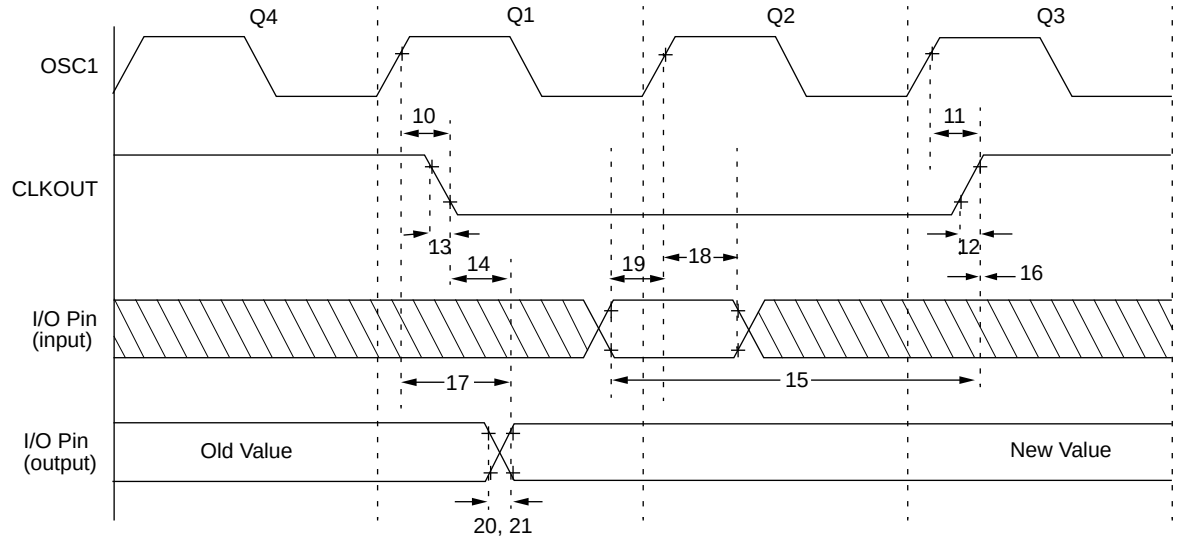
* These parameters are characterized but not tested.

Note 1: Data in the Typical ("Typ") column is at 3.8V, 25˚C unless otherwise stated. These parameters are for design guidance only and are not tested.

2: 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.

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

FIGURE 5-3: CLKOUT AND I/O TIMING - PIC16LV5XA



Note: All tests must be done with specified capacitive loads (see data sheet) 50 pF on I/O pins and CLKOUT.

TABLE 5-2: CLKOUT AND I/O TIMING REQUIREMENTS - PIC16LV5XA

AC Characteristics	**Standard Operating Conditions (unless otherwise specified)** Operating Temperature 0°C ≤ TA ≤ +70°C (commercial), –20°C ≤ TA ≤ +85°C (industrial) Operating Voltage VDD range is described in Section 10.1, Section 10.2 and Section 10.3 of the Enhanced PIC16C5X data sheet (DS30236B).					
Parameter No.	**Sym**	**Characteristic**	**Min**	**Typ(1)**	**Max**	**Units**
10	TosH2ckL	OSC1↑ to CLKOUT↓(2)	—	15	30**	ns
11	TosH2ckH	OSC1↑ to CLKOUT↑(2)	—	15	30**	ns
12	TckR	CLKOUT rise time(2)	—	5.0	15**	ns
13	TckF	CLKOUT fall time(2)	—	5.0	15**	ns
14	TckL2ioV	CLKOUT↓ to Port out valid(2)	—	—	40**	ns
15	TioV2ckH	Port in valid before CLKOUT↑(2)	0.25 TCY+30*	—	—	ns
16	TckH2ioI	Port in hold after CLKOUT↑(2)	0*	—	—	ns
17	TosH2ioV	OSC1↑ (Q1 cycle) to Port out valid(3)	—	—	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(3)	—	10	25**	ns
21	TioF	Port output fall time(3)	—	10	25**	ns

* These parameters are characterized but not tested.

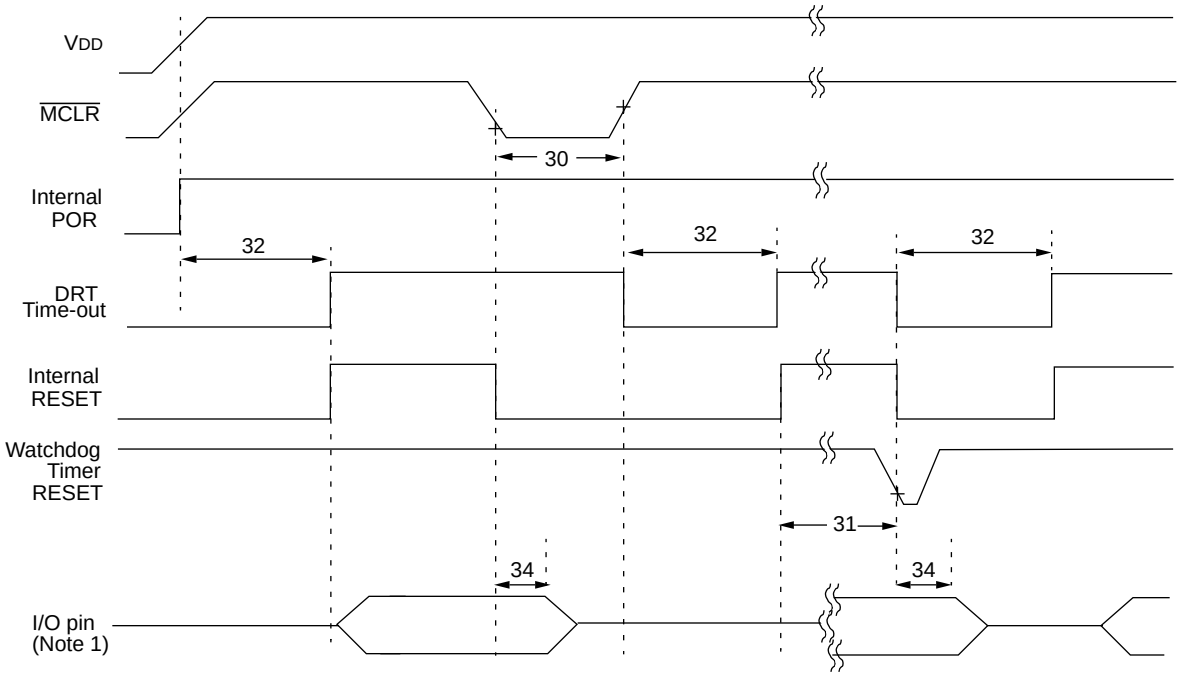
** These parameters are design targets and are not tested. No characterization data available at this time.

Note 1: Data in the Typical ("Typ") column is at 3.8V, 25˚C unless otherwise stated. These parameters are for design guidance only and are not tested.

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

3: See Figure 5-1 for loading conditions.

FIGURE 5-4: RESET, WATCHDOG TIMER, AND DEVICE RESET TIMER TIMING - PIC16LV5XA



Note 1: I/O pins must be taken out of hi-impedance mode by enabling the output drivers in software.

TABLE 5-3: RESET, WATCHDOG TIMER, AND DEVICE RESET TIMER - PIC16LV5XA

AC Characteristics	**Standard Operating Conditions (unless otherwise specified)** Operating Temperature 0°C ≤ TA ≤ +70°C (commercial), –20°C ≤ TA ≤ +85°C (industrial) Operating Voltage VDD range is described in Section 10.1, Section 10.2 and Section 10.3 of the Enhanced PIC16C5X data sheet (DS30236B).						
Parameter No.	**Sym**	**Characteristic**	**Min**	**Typ(1)**	**Max**	**Units**	**Conditions**
30	TmcL	$\overline{MCLR}$ Pulse Width (low)	100*	—	—	ns	VDD = 3.8V
31	Twdt	Watchdog Timer Time-out Period (No Prescaler)	9.0*	18*	40*	ms	VDD = 3.8V (Commercial)
32	TDRT	Device Reset Timer Period	9.0*	18*	30*	ms	VDD = 3.8V (Commercial)
34	Tioz	I/O Hi-impedance from $\overline{MCLR}$ Low	—	—	100*	ns	

* These parameters are characterized but not tested.

Note 1: Data in the Typical ("Typ") column is at 3.8V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

FIGURE 5-5: TIMER0 CLOCK TIMINGS - PIC16LV5XA

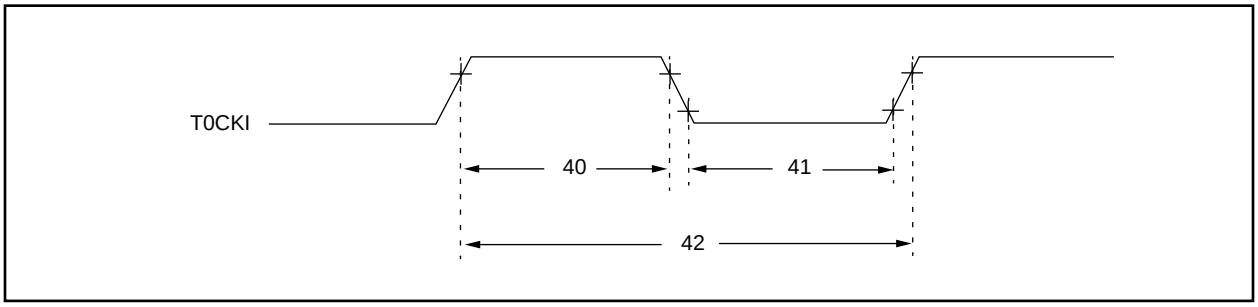


TABLE 5-4: TIMER0 CLOCK REQUIREMENTS - PIC16LV5XA

AC Characteristics			Standard Operating Conditions (unless otherwise specified) Operating Temperature 0°C ≤ TA ≤ +70°C (commercial), –20°C ≤ TA ≤ +85°C (industrial) Operating Voltage VDD range is described in the Section 10.1, Section 10.2 and Section 10.3 of the Enhanced PIC16C5X data sheet (DS30236B).				
Parameter No.	**Sym**	**Characteristic**	**Min**	**Typ(1)**	**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 $\frac{T_{CY} + 40}{N}$*	—	—	ns	Whichever is greater. N = Prescale Value (1, 2, 4,..., 256)

* These parameters are characterized but not tested.

Note 1: Data in the Typical (“Typ”) column is at 3.8V, 25˚C unless otherwise stated. These parameters are for design guidance only and are not tested.

6.0 DC AND AC CHARACTERISTICS - ENHANCED PIC16LV5X

The graphs and tables provided in this section are for design guidance and are not tested or guaranteed. In some graphs or tables the data presented are outside specified operating range (e.g., outside specified VDD range). This is for information only and devices will operate properly only within the specified range.

The data presented in this section is a statistical summary of data collected on units from different lots over a period of time. “Typical” represents the mean of the distribution while “max” or “min” represents (mean + 3σ) and (mean – 3σ) respectively, where σ is standard deviation.

Not available at this time.

CONNECTING TO MICROCHIP BBS

Connect worldwide to the Microchip BBS using the CompuServe® communications network. In most cases a local call is your only expense. The Microchip BBS connection does not use CompuServe membership services, therefore, **you do not need CompuServe membership to join Microchip's BBS**.

There is **no charge** for connecting to the BBS, except toll charge to CompuServe access number, where applicable. You do not need to be a CompuServe member to take advantage of this connection (you never actually log in to CompuServe).

The procedure to connect will vary slightly from country to country. Please check with your local CompuServe agent for details if you have a problem. CompuServe service allows multiple users at baud rates up to 14,400 bps.

The following connect procedure applies in most locations:

1. Set your modem to 8-bit, No parity, and One stop (8N1). This is not the normal CompuServe setting which is 7E1.
2. Dial your local CompuServe access number.
3. Depress **<ENTER↵>** and a garbage string will appear because CompuServe is expecting a 7E1 setting.
4. Type **+,** depress **<ENTER↵>** and `Host Name:` will appear.
5. Type **MCHIPBBS,** depress **< ENTER↵ >** and you will be connected to the Microchip BBS.

In the United States, to find CompuServe's phone number closest to you, set your modem to 7E1 and dial (800) 848-4480 for 300-2400 baud or (800) 331-7166 for 9600-14400 baud connection. After the system responds with `Host Name:`

Type, **NETWORK,** depress **< ENTER↵ >** and follow CompuServe's directions.

For voice information (or calling from overseas), you may call (614) 723-1550 for your local CompuServe number.

ACCESS TO THE INTERNET

Microchip's current WWW address is listed on the back page of this data sheet under Worldwide Sales & Service - Americas - Corporate Office.

READER RESPONSE

It is our intention to provide you with the best documentation possible to ensure successful use of your Microchip product. If you wish to provide your comments on organization, clarity, subject matter, and ways in which our documentation can better serve you, please FAX your comments to the Technical Publications Manager at (602) 786-7578.

Please list the following information, and use this outline to provide us with your comments about this Data Sheet.

To: Technical Publications Manager Total Pages Sent _____
RE: Reader Response

From: Name _____
Company _____
Address _____
City / State / ZIP / Country _____
Telephone: (_____) _____ - _____ FAX: (_____) _____ - _____

Application (optional): _____

Would you like a reply? ____ Y____ N

Device: **Enhanced PIC16LV5X** Literature Number: **DS40121A**

Questions:

1. What are the best features of this document? _____

2. How does this document meet your hardware and software development needs? _____

3. Do you find the organization of this data sheet easy to follow? If not, why? _____

4. What additions to the data sheet do you think would enhance the structure and subject? _____

5. What deletions from the data sheet could be made without affecting the overall usefulness? _____

6. Is there any incorrect or misleading information (what and where)? _____

7. How would you improve this document? _____

8. How would you improve our software, systems, and silicon products? _____

ENHANCED PIC16LV5X 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	Temperature Range	Package	Pattern

Device	PIC16LV5XA, PIC16LV5XAT(2)	
Frequency Range	02	= 2 MHz
Temperature Range	b(1)	= 0°C to +70°C (Commercial)
	I	= -20°C to +85°C (Industrial)
Package	P	= PDIP
	SO	= SOIC (Gull Wing, 300 mil body)
	SS	= SSOP (209 mil body)
Pattern	3-digit Pattern Code for QTP (blank otherwise)	

Examples:

a) PIC16LV54A -02/P 301 = Commercial temp., PDIP package, 2MHz, normal VDD limits, QTP pattern #301.

b) PIC16LV58A - 02I/SO = Industrial temp., SOIC package, 2 MHz, Extended VDD limits.

Note 1: b = blank
2: T = in tape and reel - SOIC, SSOP packages only.

Sales and Support

Products supported by a preliminary Data Sheet may possibly 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 (see below)
2. The Microchip Corporate Literature Center U.S. FAX: (602) 786-7277
3. The Microchip's Bulletin Board, via your local CompuServe number (CompuServe membership NOT required).

Please specify which device, revision of silicon and Data Sheet (include Literature #) you are using.
For latest version information and upgrade kits for Microchip Development Tools, please call 1-800-755-2345 or 1-602-786-7302.

NOTES:

NOTES:

NOTES:

WORLDWIDE SALES & SERVICE

AMERICAS

Corporate Office
Microchip Technology Inc.
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 602 786-7200 Fax: 602 786-7277
Technical Support: 602 786-7627
Web: http://www.mchip.com/microchip

Atlanta
Microchip Technology Inc.
500 Sugar Mill Road, Suite 200B
Atlanta, GA 30350
Tel: 770 640-0034 Fax: 770 640-0307

Boston
Microchip Technology Inc.
5 Mount Royal Avenue
Marlborough, MA 01752
Tel: 508 480-9990 Fax: 508 480-8575

Chicago
Microchip Technology Inc.
333 Pierce Road, Suite 180
Itasca, IL 60143
Tel: 708 285-0071 Fax: 708 285-0075

Dallas
Microchip Technology Inc.
14651 Dallas Parkway, Suite 816
Dallas, TX 75240-8809
Tel: 214 991-7177 Fax: 214 991-8588

Dayton
Microchip Technology Inc.
Suite 150
Two Prestige Place
Miamisburg, OH 45342
Tel: 513 291-1654 Fax: 513 291-9175

Los Angeles
Microchip Technology Inc.
18201 Von Karman, Suite 1090
Irvine, CA 92715
Tel: 714 263-1888 Fax: 714 263-1338

New York
Microchip Technology Inc.
150 Motor Parkway, Suite 416
Hauppauge, NY 11788
Tel: 516 273-5305 Fax: 516 273-5335

San Jose
Microchip Technology Inc.
2107 North First Street, Suite 590
San Jose, CA 95131
Tel: 408 436-7950 Fax: 408 436-7955

ASIA/PACIFIC

Hong Kong
Microchip Technology
Unit No. 3002-3004, Tower 1
Metroplaza
223 Hing Fong Road
Kwai Fong, N.T. Hong Kong
Tel: 852 2 401 1200 Fax: 852 2 401 3431

Korea
Microchip Technology
168-1, Youngbo Bldg. 3 Floor
Samsung-Dong, Kangnam-Ku,
Seoul, Korea
Tel: 82 2 554 7200 Fax: 82 2 558 5934

Singapore
Microchip Technology
200 Middle Road
#10-03 Prime Centre
Singapore 188980
Tel: 65 334 8870 Fax: 65 334 8850

Taiwan
Microchip Technology
10F-1C 207
Tung Hua North Road
Taipei, Taiwan, ROC
Tel: 886 2 717 7175 Fax: 886 2 545 0139

EUROPE

United Kingdom
Arizona Microchip Technology Ltd.
Unit 6, The Courtyard
Meadow Bank, Furlong Road
Bourne End, Buckinghamshire SL8 5AJ
Tel: 44 1628 851077 Fax: 44 1628 850259

France
Arizona Microchip Technology SARL
2 Rue du Buisson aux Fraises
91300 Massy - France
Tel: 33 1 69 53 63 20 Fax: 33 1 69 30 90 79

Germany
Arizona Microchip Technology GmbH
Gustav-Heinemann-Ring 125
D-81739 Muenchen, Germany
Tel: 49 89 627 144 0 Fax: 49 89 627 144 44

Italy
Arizona Microchip Technology SRL
Centro Direzionale Colleoni
Palazzo Pegaso Ingresso No. 2
Via Paracelso 23, 20041
Agrate Brianza (MI) Italy
Tel: 39 39 689 9939 Fax: 39 39 689 9883

JAPAN

Microchip Technology Intl. Inc.
Benex S-1 6F
3-18-20, Shin Yokohama
Kohoku-Ku, Yokohama
Kanagawa 222 Japan
Tel: 81 45 471 6166 Fax: 81 45 471 6122

01/04/96

MICROCHIP