

PIC18(L)F2X/45K50 USB Flash MCU Product Brief

Universal Serial Bus Features:

- USB V2.0 Compliant
- Crystal-less Full Speed (12 Mb/s) and Low-Speed Operation (1.5 Mb/s)
- Supports Control, Interrupt, Isochronous and Bulk Transfers
- Supports up to 32 Endpoints (16 Bidirectional)
- 1 Kbyte Dual Access RAM for USB
- On-Chip USB Transceiver

Flexible Oscillator Structure:

- 3x and 4x PLL Clock Multipliers
- Two External Clock modes, Up to 48 MHz (12 MIPS)
- Internal 31 kHz Oscillator
- Internal Oscillator, 31 kHz to 16 MHz
 - Factory calibrated to $\pm 1\%$
 - Self-tune to $\pm 0.20\%$ max. from USB or secondary oscillator
- Secondary Oscillator using Timer1 @ 32 kHz
- Fail-Safe Clock Monitor:
 - Allows for safe shutdown if any clock stops

Peripheral Highlights:

- Up to 33 I/O Pins plus 3 Input-Only Pins:
 - High-current Sink/Source 25 mA/25 mA
 - Three programmable external interrupts
 - 11 programmable Interrupt-on-Change
 - 9 programmable weak pull-ups
 - Programmable slew rate
- SR Latch
- Enhanced Capture/Compare/PWM (ECCP) module:
 - One, two or four PWM outputs
 - Selectable polarity
 - Programmable dead time
 - Auto-shutdown and auto-restart
 - Pulse steering control
- Capture/Compare/PWM (CCP) module
- Master Synchronous Serial Port (MSSP) module Supporting 3-Wire SPI (all 4 modes) and I²C™ Master and Slave modes
- Two Analog Comparators with Input Multiplexing
- 10-Bit Analog-to-Digital (A/D) Converter module:
 - Up to 25 input channels
 - Auto-acquisition capability
 - Conversion available during Sleep
- Digital-to-Analog Converter (DAC) module:
 - Fixed Voltage Reference (FVR) with 1.024V, 2.048V and 4.096V output levels
 - 5-bit rail-to-rail resistive DAC with positive and negative reference selection

- High/Low-Voltage Detect module
- Charge Time Measurement Unit (CTMU):
 - Supports capacitive touch sensing for touch screens and capacitive switches
- Enhanced USART module:
 - Supports RS-485, RS-232 and LIN/J2602
 - Auto-wake-up on Start bit
 - Auto-Baud Detect

Extreme Low-Power Management with XLP:

- Sleep mode: 20 nA, typical
- Watchdog Timer: 300 nA, typical
- Timer1 Oscillator: 800 nA @ 32 kHz
- Peripheral Module Disable

Special Microcontroller Features:

- Low-Power, High-Speed CMOS Flash Technology
- C Compiler Optimized Architecture for Re-Entrant Code
- Power Management Features:
 - Run: CPU on, peripherals on, SRAM on
 - Idle: CPU off, peripherals on, SRAM on
 - Sleep: CPU off, peripherals off, SRAM on
- Priority Levels for Interrupts
- Self-Programmable under Software Control
- 8 x 8 Single-Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT):
 - Programmable period from 4 ms to 131s
- Single-Supply In-Circuit Serial Programming™ (ICSP™) via Two Pins
- In-Circuit Debug (ICD) with Three Breakpoints via Two Pins
- Optional dedicated ICD/ICSP Port (44-Pin TQFP Package Only)
- Wide Operating Voltage Range:
 - F devices: 2.3V to 5.5V
 - LF devices: 1.8V to 3.6V
- Flash Program Memory of 10,000 Erase/Write Cycles Minimum and 20-year Data Retention

PIC18(L)F2X/45K50

PIC18(L)F2X/45K50 Family Types

Device	Program Memory		Data Memory		Pins	I/O	10-bit A/D channels	Comparators	CCP/ ECCP	BOR/LVD	CTMU	MSSP	EUSART	Timers 8-bit/16-bit	USB 2.0
	Flash (bytes)	Single Word Instructions	SRAM (bytes)	Data EEPROM (bytes)											
PIC18(L)F45K50	32K	16384	2048	256	40/44	36	25-ch	2	1/1	Yes	Yes	1	1	2/2	Yes
PIC18(L)F25K50	32K	16384	2048	256	28	25	14-ch	2	1/1	Yes	Yes	1	1	2/2	Yes
PIC18(L)F24K50	16K	8192	2048	256	28	25	14-ch	2	1/1	Yes	Yes	1	1	2/2	Yes

FIGURE 1: 28-PIN PDIP, SOIC, SSOP DIAGRAM FOR PIC18(L)F2XK50

28-PIN PDIP (300 MIL), SOIC, SSOP

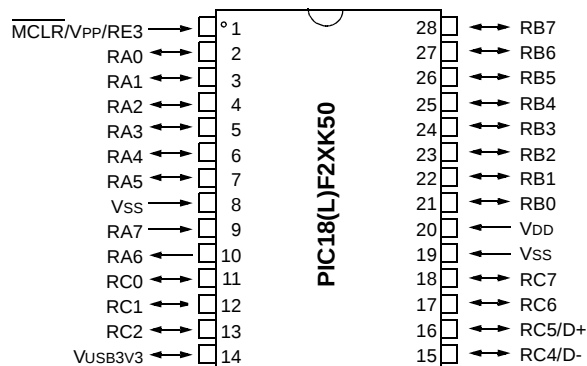


FIGURE 2: 28-PIN QFN DIAGRAM FOR PIC18(L)F2XK50

28-PIN QFN

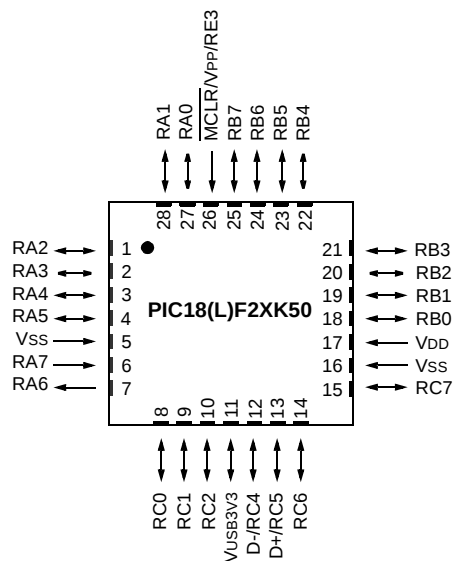


FIGURE 3: 40-PIN PDIP DIAGRAM FOR PIC18(L)F45K50

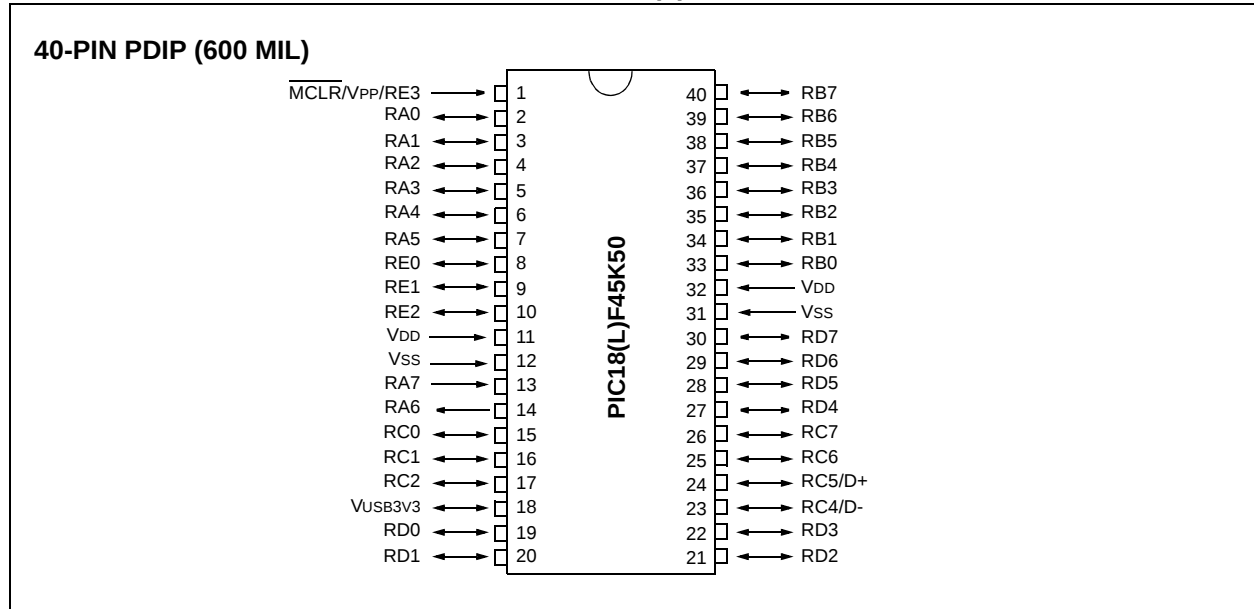
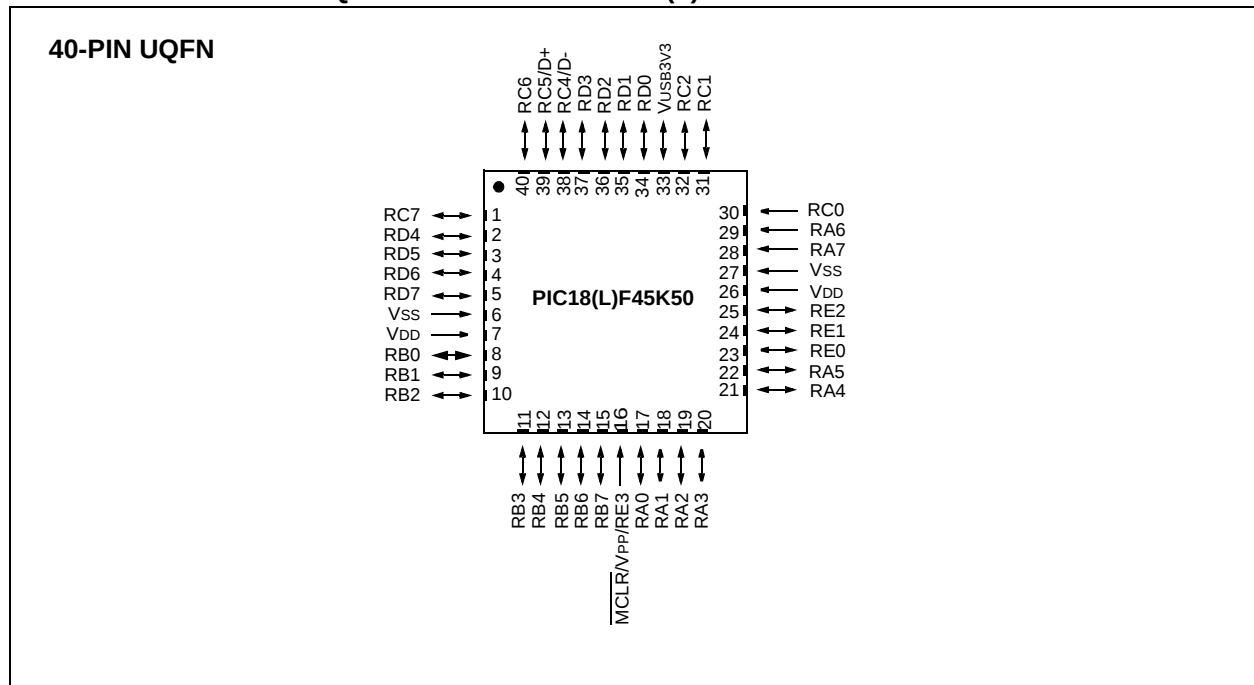


FIGURE 4: 40-PIN UQFN DIAGRAM FOR PIC18(L)F45K50



PIC18(L)F2X/45K50

FIGURE 5: 44-PIN TQFP DIAGRAM FOR PIC18(L)F45K50

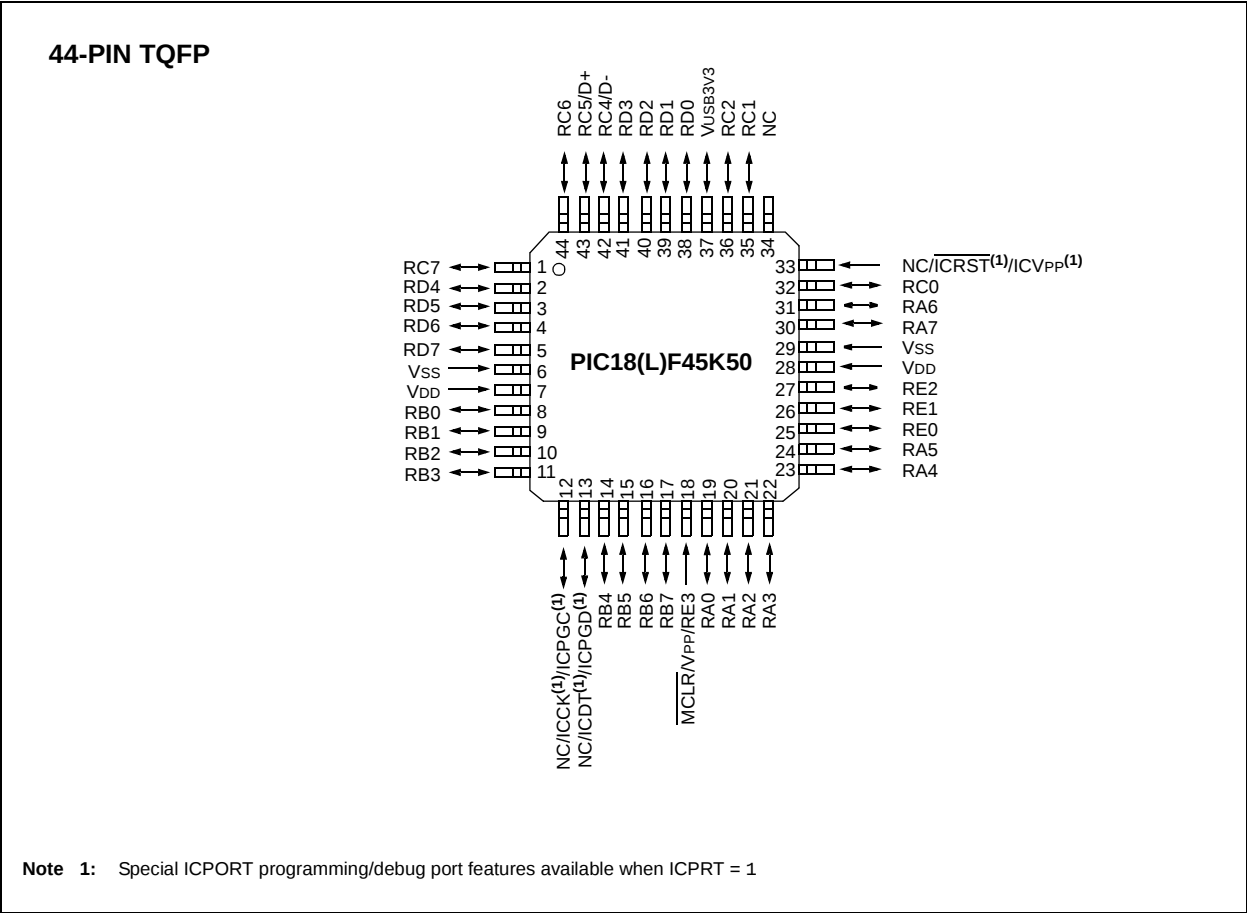


TABLE 1: PIC18(L)F2X/45K50 PIN SUMMARY

I/O	28-Pin PDIP/SSOP	28-Pin QFN	40-Pin PDIP	40-Pin UQFN	44-Pin TQFP	Analog	Comparator	CTMU	SR Latch	Reference	USB	(E)CCP	EUSART	MSSP	Timers	Interrupts	Pull-up	Basic	ICD
RA0	2	27	2	17	19	AN0	C12IN0-												
RA1	3	28	3	18	20	AN1	C12IN1-	CTCMP											
RA2	4	1	4	19	21	AN2	C2IN+			VREF- DACOUT									
RA3	5	2	5	20	22	AN3	C1IN+			VREF+									
RA4	6	3	6	21	23		C1OUT		SRQ						T0CKI				
RA5	7	4	7	22	24	AN4	C2OUT		SRNQ	LVDIN				SS					
RA6	10	7	14	29	31													OSC2 CLKO	
RA7	9	6	13	28	30													OSC1 CLKI	
RB0	21	18	33	8	8	AN12			SRI			FLT0		SDI SDA		INT0	Y		
RB1	22	19	34	9	9	AN10	C12IN3-					P1C ⁽⁵⁾		SCK SCL		INT1	Y		
RB2	23	20	35	10	10	AN8		CTED1				P1B ⁽⁵⁾				INT2	Y		
RB3	24	21	36	11	11	AN9	C12IN2-	CTED2				CCP2 ⁽¹⁾		SDO			Y		
RB4	25	22	37	12	14	AN11						P1D ⁽⁵⁾				IOCB4	Y		
RB5	26	23	38	13	15	AN13									T1G T3CKI ⁽²⁾	IOCB5	Y		
RB6	27	24	39	14	16											IOCB6	Y	PGC	
RB7	28	25	40	15	17											IOCB7	Y	PGD	

Note 1: Alternate CCP2 pin location based on Configuration bit.**Note 2:** Alternate T3CKI pin location based on Configuration bits.**Note 3:** Pins are enabled when ICPRT = 1, otherwise, they are disabled.**Note 4:** Location on 40/44-Pin parts (PIC18(L)F45K50). Function not on this pin on 28-Pin parts (PIC18(L)F2XK50).**Note 5:** Location on 28-Pin parts (PIC18(L)F2XK50). Function not on this pin on 40/44-Pin parts (PIC18(L)F45K50).**Note 6:** Alternate SDO pin location based on Configuration bits.**Note 7:** RE3, RC4 and RC5 can be used for digital input only (no output functionality).

TABLE 1: PIC18(L)F2X/45K50 PIN SUMMARY

I/O	28-Pin PDIP/SOIC/SSOP	28-Pin QFN	40-Pin PDIP	40-Pin UQFN	44-Pin TQFP	Analog	Comparator	CTMU	SR Latch	Reference	USB	(E)CCP	EUSART	MSSP	Timers	Interrupts	Pull-up	Basic	ICD
RC0	11	8	15	30	32										SOSCO T1CKI T3CKI T3G	IOCC0			
RC1	12	9	16	31	35							CCP2			SOSCI	IOCC1			
RC2	13	10	17	32	36	AN14		CTPLS				CCP1 P1A				IOCC2			
—	14	11	18	33	37	—					VUSB3V3							VDDCORE	
RC4 ⁽⁷⁾	15	12	23	38	42	—					D-					IOCC4			
RC5 ⁽⁷⁾	16	13	24	39	43	—					D+					IOCC5			
RC6	17	14	25	40	44	AN18							TX CK			IOCC6			
RC7	18	15	26	1	1	AN19							RX DT	SDO ⁽⁶⁾		IOCC7			
RD0	—	—	19	34	38	AN20													
RD1	—	—	20	35	39	AN21													
RD2	—	—	21	36	40	AN22													
RD3	—	—	22	37	41	AN23													
RD4	—	—	27	2	2	AN24													
RD5	—	—	28	3	3	AN25						P1B ⁽⁴⁾							
RD6	—	—	29	4	4	AN26						P1C ⁽⁴⁾							
RD7	—	—	30	5	5	AN27						P1D ⁽⁴⁾							
RE0	—	—	8	23	25	AN5													

Note 1: Alternate CCP2 pin location based on Configuration bit.**Note 2:** Alternate T3CKI pin location based on Configuration bits.**Note 3:** Pins are enabled when ICPRT = 1, otherwise, they are disabled.**Note 4:** Location on 40/44-Pin parts (PIC18(L)F45K50). Function not on this pin on 28-Pin parts (PIC18(L)F2XK50).**Note 5:** Location on 28-Pin parts (PIC18(L)F2XK50). Function not on this pin on 40/44-Pin parts (PIC18(L)F45K50).**Note 6:** Alternate SDO pin location based on Configuration bits.**Note 7:** RE3, RC4 and RC5 can be used for digital input only (no output functionality).

TABLE 1: PIC18(L)F2X/45K50 PIN SUMMARY

I/O	28-Pin PDIP/SOIC/SSOP	28-Pin QFN	40-Pin PDIP	40-Pin UQFN	44-Pin TQFP	Analog	Comparator	CTMU	SR Latch	Reference	USB	(E)CCP	EUSART	MSSP	Timers	Interrupts	Pull-up	Basic	ICD
RE1	—	—	9	24	26	AN6													
RE2	—	—	10	25	27	AN7													
RE3 ⁽⁷⁾	1	26	1	16	18	—											Y	MCLR VPP	
	20	17	11, 32	7, 26	7, 28													VDD	
	8, 19	5, 16	12, 31	6, 27	6, 29													VSS	
			—	—	12 ⁽³⁾													ICPGC ⁽³⁾	ICCK ⁽³⁾
			—	—	13 ⁽³⁾													ICPGD ⁽³⁾	ICDT ⁽³⁾
			—	—	33 ⁽³⁾													ICVPP ⁽³⁾	ICRST ⁽³⁾

- Note 1:** Alternate CCP2 pin location based on Configuration bit.
2: Alternate T3CKI pin location based on Configuration bits.
3: Pins are enabled when ICPRT = 1, otherwise, they are disabled.
4: Location on 40/44-Pin parts (PIC18(L)F45K50). Function not on this pin on 28-Pin parts (PIC18(L)F2XK50).
5: Location on 28-Pin parts (PIC18(L)F2XK50). Function not on this pin on 40/44-Pin parts (PIC18(L)F45K50).
6: Alternate SDO pin location based on Configuration bits.
7: RE3, RC4 and RC5 can be used for digital input only (no output functionality).

PIC18(L)F2X/45K50

NOTES:

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

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights.

Trademarks

The Microchip name and logo, the Microchip logo, dsPIC, KEELOQ, KEELOQ logo, MPLAB, PIC, PICmicro, PICSTART, PIC³² logo, rfPIC and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

FilterLab, Hampshire, HI-TECH C, Linear Active Thermistor, MXDEV, MXLAB, SEEVAL and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, Application Maestro, chipKIT, chipKIT logo, CodeGuard, dsPICDEM, dsPICDEM.net, dsPICworks, dsSPEAK, ECAN, ECONOMONITOR, FanSense, HI-TIDE, In-Circuit Serial Programming, ICSP, Mindi, MiWi, MPASM, MPLAB Certified logo, MPLIB, MPLINK, mTouch, Omniscent Code Generation, PICC, PICC-18, PICDEM, PICDEM.net, PICKit, PICtail, REAL ICE, rfLAB, Select Mode, Total Endurance, TSHARC, UniWinDriver, WiperLock and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

© 2012, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

 Printed on recycled paper.

ISBN: 9781620762592

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
= ISO/TS 16949 =

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

Worldwide Sales and Service

AMERICAS

Corporate Office
 2355 West Chandler Blvd.
 Chandler, AZ 85224-6199
 Tel: 480-792-7200
 Fax: 480-792-7277
 Technical Support:
<http://www.microchip.com/support>
 Web Address:
www.microchip.com

Atlanta
 Duluth, GA
 Tel: 678-957-9614
 Fax: 678-957-1455

Boston
 Westborough, MA
 Tel: 774-760-0087
 Fax: 774-760-0088

Chicago
 Itasca, IL
 Tel: 630-285-0071
 Fax: 630-285-0075

Cleveland
 Independence, OH
 Tel: 216-447-0464
 Fax: 216-447-0643

Dallas
 Addison, TX
 Tel: 972-818-7423
 Fax: 972-818-2924

Detroit
 Farmington Hills, MI
 Tel: 248-538-2250
 Fax: 248-538-2260

Indianapolis
 Noblesville, IN
 Tel: 317-773-8323
 Fax: 317-773-5453

Los Angeles
 Mission Viejo, CA
 Tel: 949-462-9523
 Fax: 949-462-9608

Santa Clara
 Santa Clara, CA
 Tel: 408-961-6444
 Fax: 408-961-6445

Toronto
 Mississauga, Ontario,
 Canada
 Tel: 905-673-0699
 Fax: 905-673-6509

ASIA/PACIFIC

Asia Pacific Office
 Suites 3707-14, 37th Floor
 Tower 6, The Gateway
 Harbour City, Kowloon
 Hong Kong
 Tel: 852-2401-1200
 Fax: 852-2401-3431

Australia - Sydney
 Tel: 61-2-9868-6733
 Fax: 61-2-9868-6755

China - Beijing
 Tel: 86-10-8569-7000
 Fax: 86-10-8528-2104

China - Chengdu
 Tel: 86-28-8665-5511
 Fax: 86-28-8665-7889

China - Chongqing
 Tel: 86-23-8980-9588
 Fax: 86-23-8980-9500

China - Hangzhou
 Tel: 86-571-2819-3187
 Fax: 86-571-2819-3189

China - Hong Kong SAR
 Tel: 852-2401-1200
 Fax: 852-2401-3431

China - Nanjing
 Tel: 86-25-8473-2460
 Fax: 86-25-8473-2470

China - Qingdao
 Tel: 86-532-8502-7355
 Fax: 86-532-8502-7205

China - Shanghai
 Tel: 86-21-5407-5533
 Fax: 86-21-5407-5066

China - Shenyang
 Tel: 86-24-2334-2829
 Fax: 86-24-2334-2393

China - Shenzhen
 Tel: 86-755-8203-2660
 Fax: 86-755-8203-1760

China - Wuhan
 Tel: 86-27-5980-5300
 Fax: 86-27-5980-5118

China - Xian
 Tel: 86-29-8833-7252
 Fax: 86-29-8833-7256

China - Xiamen
 Tel: 86-592-2388138
 Fax: 86-592-2388130

China - Zhuhai
 Tel: 86-756-3210040
 Fax: 86-756-3210049

ASIA/PACIFIC

India - Bangalore
 Tel: 91-80-3090-4444
 Fax: 91-80-3090-4123

India - New Delhi
 Tel: 91-11-4160-8631
 Fax: 91-11-4160-8632

India - Pune
 Tel: 91-20-2566-1512
 Fax: 91-20-2566-1513

Japan - Osaka
 Tel: 81-66-152-7160
 Fax: 81-66-152-9310

Japan - Yokohama
 Tel: 81-45-471- 6166
 Fax: 81-45-471-6122

Korea - Daegu
 Tel: 82-53-744-4301
 Fax: 82-53-744-4302

Korea - Seoul
 Tel: 82-2-554-7200
 Fax: 82-2-558-5932 or
 82-2-558-5934

Malaysia - Kuala Lumpur
 Tel: 60-3-6201-9857
 Fax: 60-3-6201-9859

Malaysia - Penang
 Tel: 60-4-227-8870
 Fax: 60-4-227-4068

Philippines - Manila
 Tel: 63-2-634-9065
 Fax: 63-2-634-9069

Singapore
 Tel: 65-6334-8870
 Fax: 65-6334-8850

Taiwan - Hsin Chu
 Tel: 886-3-5778-366
 Fax: 886-3-5770-955

Taiwan - Kaohsiung
 Tel: 886-7-536-4818
 Fax: 886-7-330-9305

Taiwan - Taipei
 Tel: 886-2-2500-6610
 Fax: 886-2-2508-0102

Thailand - Bangkok
 Tel: 66-2-694-1351
 Fax: 66-2-694-1350

EUROPE

Austria - Wels
 Tel: 43-7242-2244-39
 Fax: 43-7242-2244-393

Denmark - Copenhagen
 Tel: 45-4450-2828
 Fax: 45-4485-2829

France - Paris
 Tel: 33-1-69-53-63-20
 Fax: 33-1-69-30-90-79

Germany - Munich
 Tel: 49-89-627-144-0
 Fax: 49-89-627-144-44

Italy - Milan
 Tel: 39-0331-742611
 Fax: 39-0331-466781

Netherlands - Drunen
 Tel: 31-416-690399
 Fax: 31-416-690340

Spain - Madrid
 Tel: 34-91-708-08-90
 Fax: 34-91-708-08-91

UK - Wokingham
 Tel: 44-118-921-5869
 Fax: 44-118-921-5820