Section 1. Introduction

HIGHLIGHTS

This section of the manual contains the following major topics:

1.1 INTRODUCTION

Microchip is a leading provider of microcontrollers (MCUs) and analog semiconductors. The company's focus is on developing products that meet the needs of the embedded control market. Microchip is a leading supplier of the following products:

- 8-bit general purpose microcontrollers (PIC® MCUs)
- 16-bit microcontrollers and 32-bit microcontrollers
- dsPIC® 16-bit Digital Signal Controllers (DSCs)
- Specialty and standard non-volatile memory devices
- Security devices (KEELOQ®)
- Application-specific standard products

For a listing of the products Microchip offers, request a Microchip Product Line Card. This literature can be obtained from your local Microchip sales office or downloaded from the Microchip Web site (www.microchip.com).

Part 1 of this manual describes the following 16-bit dsPIC33E/PIC24E devices:

- dsPIC33EP256MU806
- dsPIC33EP256MU810
- dsPIC33EP256MU814
- dsPIC33EP512MU810
- dsPIC33EP512MU814
- PIC24EP256GU810
- PIC24EP256GU814
- PIC24EP512GU810
- PIC24EP512GU814

This manual explains the operation of the dsPIC33E/PIC24E family architecture and peripheral modules, but does not cover the specifics of each device. For device specific information, refer to the data sheet. The information available in the data sheet includes the following:

- Device memory map
- Device pinout and packaging details
- Device electrical specifications
- List of peripherals included in the device

Code examples are provided throughout this manual. These examples are for reference purposes only and may need to be modified to suit a specific processor or MPLAB® tools version.

1.2 DEVICE STRUCTURE

Each part of the dsPIC DSC device can be placed into one of the following groups:

- CPU Core
- System Integration
- Peripherals

1.2.1 CPU Core

The CPU core pertains to the basic features required to make the device operate. The following sections of Part I of the manual relate to the CPU core:

- **Section 2. “CPU”**
- **Section 3. “Data Memory”**
- **Section 4. “Program Memory”**
- **Section 6. “Interrupts”**

1.2.2 System Integration

System integration functions help to accomplish the following:

- Decrease system cost
- Increase system reliability
- Increase design flexibility

The following sections of Part I of the manual discuss dsPIC33E/PIC24E system integration functions:

- **Section 5. “Flash Programming”**
- **Section 7. “Oscillator”**
- **Section 8. “Reset”**
- **Section 9. “Watchdog Timer and Power-Saving Modes”**
- **Section 23. “CodeGuard™ Security”**
- **Section 24. “Programming and Diagnostics”**
- **Section 30. “Device Configuration”**

1.2.3 Peripherals

The dsPIC33E/PIC24E device has many peripherals that allow it to be interfaced to external circuitry. The following sections of the manual discuss peripherals:

- **Section 10. “I/O Ports”**
- **Section 11. “Timers”**
- **Section 12. “Input Capture”**
- **Section 13. “Output Compare”**
- **Section 14. “High-Speed PWM”**
- **Section 15. “Quadrature Encoder Interface (QEI)”**
- **Section 16. “Analog-to-Digital Converter (ADC)”**
- **Section 17. “UART”**
- **Section 18. “Serial Peripheral Interface (SPI)”**
- **Section 19. “Inter-Integrated Circuit™ (I^2C™)”**
- **Section 20. “Data Converter Interface (DCI)”**
- **Section 21. “Enhanced Controller Area Network (ECAN™)”**
- **Section 22. “Direct Memory Access (DMA)”**
- **Section 25. “USB On-The-Go (OTG)”**
- **Section 26. “Comparator”**
- **Section 27. “32-bit Programmable Cyclic Redundancy Check (CRC)”**
- **Section 28. “Parallel Master Port (PMP)”**
- **Section 29. “Real-Time Clock and Calendar (RTCC)”**

1.3 DEVELOPMENT SUPPORT

Microchip offers a wide range of development tools that allow you to efficiently develop and debug application code. The development tools generally fall into the following categories:

- Code generation
- Hardware and software debugging
- Device programming
- Product development boards

A full description of each of Microchip's development tools is provided in **Section 31. "Development Tool Support"**. As new tools are developed, the latest product briefs and user's guides can be obtained from your local Microchip sales office or downloaded from the Microchip Web site (www.microchip.com).

Microchip offers comprehensive development support in the following forms:

- Application notes
- Reference designs
- Microchip Web site
- Local sales offices with Field Application Engineer (FAE) support
- Corporate support line

The Microchip Web site (www.microchip.com) also lists additional Web sites that may be useful references.

1.4 STYLE AND SYMBOL CONVENTIONS

Throughout this document, certain style and font format conventions are used. Most format conventions imply that a distinction should be made for the emphasized text.

Table 1-1 defines some of the symbols and terms used throughout this manual.

Table 1-1: Document Conventions

Symbol or Term	Description
set	To force a bit/register to a value of logic '1'.
clear	To force a bit/register to a value of logic '0'.
Reset	1) To force a register/bit to its default state. 2) A condition in which the device places itself after a device Reset occurs. Some bits will be set to '0' (such as interrupt enable bits), while others will be set to '1' (such as the I/O data direction bits).
0xnn or nnh	Designates the number 'nn' in the hexadecimal number system. These conventions are used in the code examples. For example, the designation 0x13F or 13Fh may be used.
B'bbbbbbbb'	Designates the number 'bbbbbbbb' in the binary number system. This convention is used in the text and in figures and tables. For example, the designation B'10100000' may be used.
R-M-W	Read-Modify-Write. This occurs when a register or port is read, the value is modified, and that value is then written back to the register or port. This action can occur from a single instruction (such as bit set, BSET) or a sequence of instructions.
: (colon)	Used to specify a range or the concatenation of registers/bits/pins. One example is TMR3:TMR2, which is the concatenation of two 16-bit registers to form a 32-bit timer value. Concatenation order (left-right) usually specifies a positional relationship (MSb to LSb, higher to lower).
< >	Specifies bit(s) locations in a particular register. One example is SRxMPT (SPIxSTAT<5>), which specifies the abbreviation of bit and the register name, and associated bits or bit positions.
MSb, LSb	Indicates the Least/Most Significant bit in a field.
MSB, LSB	Indicates the Least/Most Significant Byte in a field of bits.
msw, lsw	Indicates the least/most significant word in a field of bits.
Courier New Font	Used for code examples, binary numbers and for instruction mnemonics that appear in the text.
Times New Roman Font (Italics)	Used for equations.
Note	A Note presents information that we want to re-emphasize, either to help you avoid a common pitfall or to make you aware of operating differences between some device family members. A Note can be in a box, or when used in a table or figure, it is located at the bottom of the table or figure.

1.5 RELATED DOCUMENTS

Microchip and other third party sources, offer additional documentation that can aid in your development with dsPIC33E/PIC24E devices. The following lists contain the most common documentation, but other documents may also be available.

1.5.1 Microchip Documentation

Documentation related to dsPIC33E/PIC24E devices is available from Microchip. Many of these documents provide application-specific information that includes many examples of using and programming dsPIC33E DSCs and PIC24E MCUs, which can help you when designing an application using one of our devices. For the latest published technical documentation, check the Microchip Web site (www.microchip.com).

1.5.2 Third-Party Documentation

There are many documents available from third-party sources around the world. Microchip does not review these documents for technical accuracy. However, they may be a helpful source for understanding the operation of Microchip's dsPIC33E/PIC24E devices. For third-party documentation related to the dsPIC33E/PIC24E, refer to the Microchip Web site (www.microchip.com).

1.6 REVISION HISTORY

Revision A (December 2008)

This is the initial released version of this document.

Revision B (April 2011)

This revision includes the following updates:

- The device list was updated (see **1.1 “Introduction”**)
- PIC24E references were added
- Additional minor updates to text and formatting were made throughout the document

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.

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Microchip received ISO/TS-16949:2002 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.

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