Section 1. Introduction

HIGHLIGHTS

This section of the manual contains the following topics:

1.1 INTRODUCTION

Microchip offers two 16-bit microcontroller (MCU) families plus two 16-bit digital signal controller (DSC) families that provide compatible options across a wide spectrum of price, performance and feature sets. These families are:

- Highly Cost-Effective, 16-bit MCUs – PIC24F
- Highest Performance, 16-bit MCUs – PIC24H
- Versatile, 5V, 16-Bit DSCs – dsPIC30F
- High-Performance, Cost-Effective, 3.3V, 16-Bit DSCs – dsPIC33F

Common attributes among all 16-bit MCU and DSC families are:

- Pinout compatibility
- Software compatibility
- Peripheral compatibility
- Common development tools

1.2 MANUAL OBJECTIVE

This manual describes the PIC24F family of 16-bit microcontrollers. It explains the PIC24F family architecture and operation of the peripheral modules, but does not cover the specifics of each device in the family. Users should refer to the respective device's data sheet for device-specific details, such as:

- Pinout and packaging details
- Memory map
- List of peripherals included on the device, including multiple occurrences of peripherals
- Device-specific electrical specifications and characteristics

Code examples are given throughout this manual. These examples sometimes need to be written as device-specific as opposed to family-generic, though such code examples are valid for most of the PIC24F family's devices. Some modifications may be required for devices with variations in register file mappings.

1.3 DEVICE STRUCTURE

Each part of the PIC24F microcontroller can be placed into one of three groups:

- CPU core
- System integration
- Peripherals

1.3.1 CPU Core

The CPU core consists of the basic features that are essential to a microcontroller. The sections of this manual related to the CPU core include:

- CPU
- Data Memory
- Program Memory
- Interrupts

1.3.2 System Integration

System integration consists of a core set of modules and features that tie the CPU core and peripheral modules into a single operational unit. System integration features also provide these advantages:

- Decrease system cost by bringing traditionally off-chip functions into the microcontroller
- Increase design flexibility by adding a wider range of operating modes
- Increase system reliability by enhancing the ability to recover from unexpected events

The following sections of the manual discuss PIC24F system integration functions:

- Oscillator
- Reset
- Watchdog Timer (WDT)
- Power-Saving Features
- Flash Memory Programming
- High-Level Device Integration (Configuration and Voltage Regulation)
- Device Programming, Emulation and In-Circuit Testing

1.3.3 Peripherals

PIC24F devices have many peripherals that allow the device to interface with the external world. The peripherals discussed in this manual include:

- I/O Ports
- Parallel Master Port (PMP)
- Timers
- Input Capture Module
- Output Compare/Pulse-Width Modulation (PWM) Module
- UART Module
- SPI Module
- I^2C™ Module
- Real-Time Clock/Calendar Module
- Programmable Cyclic Redundancy Check (CRC) Generator Module
- 10-Bit A/D Converter
- Dual Comparator Module
- Comparator Voltage Reference Module

1.3.4 Memory Technology

PIC24F devices use enhanced Flash program memory technology. This allows program memory to be electrically erased or programmed under software control during normal device operation.

1.4 DEVELOPMENT SUPPORT

Microchip offers a wide range of development tools that allow users to efficiently develop and debug application code. Microchip's development tools can be broken down into four categories:

- Code Generation Tools, Compilers, Libraries, Application Maestro Software, etc.
- Hardware/Software Debugging
- Device Programmer
- Product Evaluation Boards

A full description of each of Microchip's development tools is given in **Section 34. "Development Tool Support"**. As new tools are developed, the latest product briefs and user guides can be obtained from the Microchip web site (www.microchip.com) or from local Microchip sales offices.

Microchip offers other references and support to speed the development cycle. These include:

- Application notes
- Reference designs
- Microchip web site
- Local sales offices with field application support
- Corporate support line

The Microchip web site lists other sites that may be useful references.

1.5 STYLE AND SYMBOL CONVENTIONS

Throughout this document, certain style and font format conventions are used to indicate specific distinctions for the affected text. Table 1-1 lists these conventions and the MCU industry symbols, and non-conventional word definitions/abbreviations used in this document.

1.5.1 Document Conventions

Table 1-1 defines some of the symbols, terms and typographic conventions used in this manual.

Table 1-1: Document Conventions

Convention	Description
Symbol and Term Conventions:	
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 forced to '0' (such as interrupt enable bits), while others will be forced to '1' (such as the I/O data direction bits).
R-M-W	Read-Modify-Write. This is when a register or port is read, then 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 BSET) or a sequence of instructions.
: (colon)	Specifies a range or concatenation of registers/bits/pins. Concatenation order (left to right) usually specifies a positional relationship (MSb to LSb, higher to lower). For example, TMR3:TMR2 indicates the concatenation of two 16-bit registers to form a 32-bit timer value, with the value of TMR3 representing the most significant word of the value.
< >	Specifies a bit location or range of locations within a particular register or field of similarly named bits. For example, PTCON<2:0> specifies the range of the 3 Least Significant bits of the register, PTCON.
MSb, LSb	Most Significant bit and Least Significant bit.
MSB, msw, LSB, lsw	Most Significant Byte, most significant word, Least Significant Byte and least significant word.
0xnn	Designates the number 'nn' in the hexadecimal number system. This convention is used in code examples, and is equivalent to the notation 'nnh' used in text. For example, 0x13 is equivalent to 13h.
Font Conventions:	
Arial Font	The standard font used for all text, figures and tables within this manual. Other fonts, as described below, are used to set off mathematical and logical expressions, or device instruction code, from descriptive text.
Courier New Font	Within text, this font is used for contrast with the standard text font and specifically denotes the following: 1. An instruction set mnemonic or assembler code fragment. 2. The binary value of a bit, range of bits or a register. 3. The logical state of a digital signal. Within code examples, this font is used exclusively to denote an assembly language or high-level language instruction sequence.
Times New Roman Font	The standard font for mathematical expressions and variables.
Graphic Conventions:	
Note	A Note presents information that requires additional emphasis, either to help users avoid a common pitfall, or make them aware of operating differences between some device family members. A Note is always in a shaded box (as below) unless used as a table or diagram footnote.
	Note: This is a Note in a shaded note box.

1.5.2 Electrical Specifications

Throughout this manual, there are references to electrical specifications and their parameter numbers. Table 1-2 shows the parameter numbering convention for PIC24F devices. A parameter number represents a unique set of characteristics and conditions that is consistent between every data sheet, though the actual parameter value may vary from device to device.

This manual describes a family of devices and, therefore, does not specify the parameter values. To determine the parameter values for a specific device, users should refer to the “Electrical Specifications” section of that device’s data sheet.

Table 1-2: Electrical Specification Parameter Numbering Convention

Parameter Number Format	Comment
DXXX	DC Specification
AXXX	DC Specification for Analog Peripherals
XXX	Timing (AC) Specification
PDXXX	Device Programming DC Specification
PXXX	Device Programming Timing (AC) Specification

Legend: XXX represents a parameter number.

1.6 RELATED DOCUMENTS

Microchip, as well as other sources, offers additional documentation which can aid in your development with PIC24F-based applications. These lists contain the most common documentation, but other documents may also be available. Please check the Microchip web site (www.microchip.com) for the latest published technical documentation.

1.6.1 Microchip Documentation

The following PIC24F documentation currently is available from Microchip. Many of these documents provide application-specific information that gives actual examples of using, programming and designing with PIC24F microcontrollers.

1. *“dsPIC30F/33F Programmer’s Reference Manual”* (DS70157)

   The Programmer’s Reference Manual provides detailed information about the programmer’s model and instruction set for dsPIC30F and dsPIC33F devices. The PIC24F instruction set is a subset of this. A description of each instruction and syntax examples are provided in this document.

2. *PIC24F Data Sheets*

   The data sheets contain device-specific information, such as pinout and packaging details, electrical specifications and memory maps.

3. *PIC24F Programming Specifications*

   The programming specifications contain detailed descriptions of, and electrical and timing specifications for, the programming process. Both In-Circuit Serial Programming (ICSP) and Enhanced ICSP are described in detail.

1.6.2 Third-Party Documentation

Several third-party documents about Microchip PIC24F devices are available. Microchip does not review these documents for technical accuracy, but these references may be helpful for understanding the devices’ operation. The Microchip web site has information on these third-party documents.

1.7 REVISION HISTORY

Revision A (January 2007)

This is the initial version of this document.

NOTES:

