Section 1. Introduction

HIGHLIGHTS

This section of the manual contains the following topics:

Note:	This family reference manual section is meant to serve as a complement to device data sheets. Depending on the device variant, this manual section may not apply to all PIC32 devices. Please consult the note at the beginning of the **"Device Overview"** chapter in the current device data sheet to check whether this document supports the device you are using. Device data sheets and family reference manual sections are available for download from the Microchip Worldwide Web site at: http://www.microchip.com

1.1 INTRODUCTION

Microchip's PIC32 series of 32-bit microcontrollers are designed to fulfill a customer's requirements for enhanced features and performance for their MCU-based applications.

Common attributes among all devices in the PIC32 series are:

- Pin, peripheral and source code compatibility
- Common software and hardware development tools

1.2 FAMILY REFERENCE MANUAL SECTIONS

The collective PIC32 family reference manual sections describe the PIC32 family series of 32-bit microcontrollers. All sections that comprise the PIC32 Family Reference Manual are available from the Microchip web site: www.microchip.com. These individual sections explain the PIC32 family architecture and operation of the peripheral modules, but do not cover the specifics of each device in a particular family. Users should refer to the respective product data sheet for device-specific details, such as:

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

1.3 DEVICE STRUCTURE

The PIC32 architecture has been broken down into the following functional blocks:

- MCU Core
- System Memory
- System Integration
- Peripherals

1.3.1 MCU Core

The PIC32 MCU core is discussed in **Section 2. "CPU"** (DS61113).

1.3.2 System Memory

The system memory provides on-chip nonvolatile Flash memory and volatile SRAM memory, featuring user and protected kernel-segment-partitioning for real-time operating systems.

Refer to the specific device data sheet for the list of applicable family reference manual sections for this topic.

1.3.3 System Integration

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

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

Refer to the specific device data sheet for the list of applicable family reference manual sections for this topic.

1.3.4 Peripherals

The PIC32 devices have many peripherals that allow it to interface with the external world.

Refer to the specific device data sheet for the list of applicable family reference manual sections for this topic.

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 divided into four categories:

- Code generation
- Hardware/software debug
- Device programmer
- Product evaluation boards

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 your local Microchip Sales office.

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

- Application notes
- Reference designs
- Local sales offices with field application support
- Corporate applications support line
- Getting started guides
- "How to" brochures
- MASTERs conferences
- Webinars
- Design centers

These can all be found on the Microchip web site (www.microchip.com). Also, the Microchip web site lists other sites that may provide useful references.

1.5 STYLE AND SYMBOL CONVENTIONS

Throughout the individual family reference manual sections, certain style, format, and font conventions are used to signal particular distinctions for the affected text. Table 1-1 lists these conventions, specific symbols, and non-conventional word definitions and abbreviations.

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

Symbol or Term	Description
Set	To force a bit or register to a value of logic '1'.
Clear	To force a bit or 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, 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.
mshw, lshw	Most Significant half-word and lease significant half-word. A half-word is 16 bits wide.
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.
Register cells	A bit reference that appears in a gray shaded cell of a register, signifies that the bit is either unimplemented (instead of a name an EM dash (—) is present) or is not relevant to the particular peripheral module.

1.5.2 Electrical Specifications

The individual family reference manual sections contain references to electrical specifications and their parameter numbers. Table 1-2 shows the parameter numbering convention for PIC32 devices. A parameter number represents a unique set of characteristics and conditions that is consistent between every data sheet, although the actual parameter value may vary from device to device.

To determine the parameter values for a specific device, users should refer to the **"Electrical Specifications"** section of the specific device 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 DOCUMENTATION

Microchip, as well as other sources, offers additional documentation to aid you as you develop PIC32-based applications. The list below contains 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 PIC32 documentation is available from Microchip. These documents provide application-specific information that gives actual examples of using, programming, and designing with PIC32 microcontrollers.

- *PIC32 Family Reference Manual Sections*

  The individual family reference manual sections describe the PIC32 family architecture and operation of the peripheral modules, but do not cover the specifics of each device in the family.

- PIC32MX Product Data Sheets

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

- *PIC32MX Programming Specification* (DS61145)

  The programming specification contains 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

Microchip does not review third-party documentation for technical accuracy; however, these references may be helpful to understand operation of the devices. Refer to the Microchip web site for available information on third-party documentation.

1.7 REVISION HISTORY

Revision A (September 2007)

This is the initial version of this document.

Revision B (October 2007)

Updated document to remove Confidential status.

Revision C (April 2008)

Revised status to Preliminary; Revised Section 1.1.

Revision D (September 2011)

This revision includes the following updates:

- Removed the Preliminary status in the footer
- Added a note box with information on related family reference manual sections
- Updated the bulleted list in **1.1 “Introduction”**
- Removed the feature list from **1.3.1 “MCU Core”**
- Updated the family reference manual section information in these sections:
  - **1.3.2 “System Memory”**
  - **1.3.3 “System Integration”**
  - **1.3.4 “Peripherals”**
- Updated the Document Conventions in Table 1-1
- In addition, updates to formatting and minor text edits were incorporated throughout the document

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.
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