

# Section 25. Development Tool Support

# **HIGHLIGHTS**

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# Note: Some development tools described in this section are not available at the time of this writing, however they are currently under development. Some of the product details may change. Please check the Microchip web site or your local Microchip sales office for the most current information and the availability of each product.

#### 25.1 Introduction

Microchip will offer a comprehensive package of development tools and libraries to support the dsPIC architecture. In addition, the company is partnering with many third party tool manufacturers for additional dsPIC device support.

#### 25.2 Microchip Hardware and Language Tools

The Microchip tools proposed include:

- MPLAB<sup>®</sup> Integrated Development Environment (IDE)
- dsPIC Language Suite, including MPLAB C30 C Compiler, Assembler, Linker and Librarian
- MPLAB SIM Software Simulator
- MPLAB ICE 4000 In-Circuit Emulator
- MPLAB ICD 2 In-Circuit Debugger
- PRO MATE<sup>®</sup> II Universal Device Programmer
- PICSTART<sup>®</sup> Plus Development Programmer

#### 25.2.1 MPLAB 6.XX Integrated Development Environment Software

Note: This product is currently available on Microchip's web site, www.microchip.com.

The MPLAB Integrated Development Environment (IDE) is available at no cost. MPLAB IDE software is a desktop development environment with tool sets for developing and debugging a microcontroller design application. MPLAB IDE allows quick changes between different development and debugging activities. Designed for use with the Windows<sup>®</sup> operating environment, it is a powerful, affordable, run-time development tool. It is also the common user interface for Microchip's development systems tools, including MPLAB Editor, MPLAB ASM30 Assembler, MPLAB SIM software simulator, MPLAB LIB30 Library, MPLAB LINK30 Linker, MPLAB ICE 4000 In-Circuit Emulators, PRO MATE II programmer and In-Circuit Debugger (ICD 2). The MPLAB IDE gives users the flexibility to edit, compile and emulate, all from a single user interface. Engineers can design and develop code for the dsPIC devices in the same design environment that they have used for PICmicro<sup>®</sup> microcontrollers.

The MPLAB IDE is a 32-bit Windows-based application. It provides many advanced features for the engineer in a modern, easy-to-use interface. MPLAB IDE integrates:

- · Full featured, color coded text editor
- Easy-to-use project manager with visual display
- Source level debugging
- Enhanced source level debugging for 'C'
  - (Structures, automatic variables, etc.)
- Customizable toolbar and key mapping
- · Dynamic status bar that displays processor condition at a glance
- · Context sensitive, interactive on-line help
- Integrated MPLAB SIM instruction simulator
- User interface for PRO MATE II and PICSTART Plus device programmers (sold separately)
- User interface for MPLAB ICE 4000 In-Circuit Emulator (sold separately)
- · User interface for MPLAB ICD 2 In-Circuit Debugger (sold separately)

The MPLAB IDE allows the engineer to:

- · Edit source files in either assembly or 'C'
- One-touch compile and download to dsPIC program memory on emulator or simulator. All project information is updated.
- Debug using:
  - Source files
  - Machine code
  - Mixed mode source and machine code

The ability to use the MPLAB IDE with multiple development and debugging targets allows users to easily switch from the cost effective simulator to a full featured emulator with minimal retraining.

#### 25.2.2 dsPIC Language Suite

**Note:** This product is currently available on Microchip's web site, www.microchip.com. The Assembler, Linker and Librarian are included with MPLAB IDE. Contact your local Microchip sales office for availability of the MPLAB C30 C compiler.

The Microchip Technology MPLAB C30 C compiler is a complete, easy-to-use language product. It allows dsPIC applications codes to be written in high level C language and then be fully converted into machine-object code for programming of the microcontroller. It simplifies development of code by removing code obstacles and allowing the designer to focus on program flow and not on program elements. Several options for compiling are available so the user can select those that will maximize the efficiency of the code characteristics.

It is a fully ANSI compliant product with standard libraries for the dsPIC family of microcontrollers. It uses the many advanced features of the dsPIC devices to provide very efficient assembly code generation.

MPLAB C30 also provides extensions that will allow for excellent support of the hardware, such as interrupts and peripherals. It is fully integrated with the MPLAB IDE for high level, source debugging. Some features include:

- · 16-bit native data types
- Efficient use of register-based, 3-operand instructions
- · Complex Addressing modes
- · Efficient multi-bit shift operations
- Efficient signed/unsigned comparisons

MPLAB C30 comes complete with its own assembler, linker and librarian. These allow the user to write mixed mode C and assembly programs and link the resulting object files into a single executable file. The compiler is sold separately. The assembler, linker and librarian is available for free with MPLAB IDE.

#### 25.2.3 MPLAB SIM Software Simulator

#### Note: This product is included with MPLAB IDE.

The MPLAB SIM software simulator allows code development in a PC-hosted environment by simulating the dsPIC device on an instruction level. On any given instruction, the data areas are able to be examined or modified. The execution is able to be performed in Single Step, Execute Until Break or Trace mode.<sup>(1)</sup>

The MPLAB SIM simulator fully supports symbolic debugging using the MPLAB C30 compiler and assembler. The software simulator offers the flexibility to develop and debug code outside of the laboratory environment, making it an excellent multi-project software development tool.

**Note 1:** Some features, including peripheral support, have not been implemented at the time of this writing. Please check Microchip's web site or your local Microchip sales office for the most current information.

# 25.2.4 MPLAB ICE 4000 In-Circuit Emulator

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

The MPLAB ICE 4000 In-Circuit Emulator will provide the product development engineer with a complete hardware design tool for the dsPIC devices. Software control of the emulator will be provided by MPLAB IDE.

The MPLAB ICE 4000 will be a full-featured emulator system with enhanced trace, trigger and data monitoring features. Interchangeable processor modules will allow the system to be easily reconfigured for emulation of different processors.

The MPLAB ICE 4000 will support the extended, high-end PICmicro microcontrollers, the PIC18CXXX and PIC18FXXX devices, as well as the dsPIC Family of digital signal controllers. The modular architecture of the MPLAB ICE 4000 in-circuit emulator will allow expansion to support new devices.

The MPLAB ICE 4000 in-circuit emulator system has been designed as a real-time emulation system, with advanced features that are generally found on more expensive development tools. Features will include:

- Full speed emulation, up to 50 MHz bus speed or 200 MHz external clock speed
- Low voltage emulation down to 1.8 volts
- · Configured with 2 Mb program emulation memory; additional modular memory up to 16 Mb
- 64K x 136-bit wide Trace Memory
- Unlimited software breakpoints
- · Complex break, trace and trigger logic
- Multi-level trigger up to 4 levels
- · Filter trigger functions to trace specific event
- · 16-bit Pass counter for triggering on sequential events
- · 16-bit Delay counter
- 48-bit time-stamp
- · Stopwatch feature
- · Time between events
- Statistical performance analysis
- Code coverage analysis
- USB and parallel printer port PC connection

#### 25.2.5 MPLAB ICD 2 In-Circuit Debugger

**Note:** This product is available, but does not provide support for dsPIC30F devices at this time. Please refer to the Microchip web site for information about product upgrades.

Microchip's In-Circuit Debugger, MPLAB ICD, will be a powerful, low cost, run-time development tool. This tool is based on the PICmicro<sup>®</sup> and dsPIC Flash devices.

The MPLAB ICD 2 will utilize the in-circuit debugging capability built into the various devices. This feature, along with Microchip's In-Circuit Serial Programming<sup>™</sup> protocol (ICSP<sup>™</sup>), will offer cost effective, in-circuit debugging from the graphical user interface of MPLAB IDE. This will enable a designer to develop and debug source code by watching variables, single-stepping and setting break points. Running at full speed enables testing hardware in real-time. Some of its features will include:

- · Full speed operation to the range of the device
- · Serial or USB PC connector
- · Serial interface externally powered
- USB powered from PC interface
- · Low noise power (VPP and VDD) for use with analog and other noise sensitive applications
- Operation down to 2.0V
- · Can be used as an ICD or inexpensive serial programmer
- · Modular application connector as MPLAB ICD
- · Limited number of breakpoints
- · "Smart watch" variable windows
- Some chip resources required (RAM, program memory and 2 pins)

#### 25.2.6 PRO MATE II Universal Device Programmer

**Note:** This product is available, but does not provide support for dsPIC30F devices at this time. Please refer to the Microchip web site for information about product upgrades.

The PRO MATE II universal device programmer will be a full-featured programmer capable of operating in Stand-alone mode, as well as PC-hosted mode.

The PRO MATE II device programmer will have programmable VDD and VPP supplies, which will allow it to verify programmed memory at VDDMIN and VDDMAX for maximum reliability when programming requires this capability. It will have an LCD display for instructions and error messages and keys to enter commands. Interchangeable optional socket modules will support all package types.

In Stand-alone mode, the PRO MATE II device programmer will be able to read, verify or program PICmicro and dsPIC30F devices. It will also be able to set code protection in this mode. PRO MATE II features will include:

- Runs under MPLAB IDE
- · Field upgradable firmware
- · DOS Command Line interface for production
- · Host, Safe and "Stand-alone" operation
- Automatic downloading of object file
- SQTP<sup>SM</sup> serialization adds an unique serial number to each device programmed
- · In-Circuit Serial Programming Kit (sold separately)
- · Interchangeable socket modules supporting all package options (sold separately)

# 25.3 Third Party Hardware/Software Tools and Application Libraries

**Note:** These products are currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

Microchip is partnering with key third party tool manufacturers for the development of quality hardware and software tools in support of the dsPIC30F Product Family. Microchip plans to offer this initial set of tools and libraries, which will enable customers to rapidly develop their dsPIC30F based application(s).

Microchip will expand this current list to provide our customers with additional value added services, (i.e., repository of skilled/certified technical applications contacts, reference designs, hardware and software developers).

Please refer to the Microchip web site (www.microchip.com) for the most current information about third party support for the dsPIC30F Device Family.

The dsPIC30F software tools and libraries will include:

- Third Party C compilers
- Floating Point and Double Precision Math Library
- DSP Algorithm Library
- · Digital Filter Design Software Utility
- Peripheral Driver Library
- CAN Library
- Real-Time Operating Systems (RTOS)
- OSEK Operating Systems
- TCP/IP Protocol Stacks
- · V.22/V.22bis and V.32 ITU Specifications

The dsPIC30F hardware development board tools include:

- General Purpose Development Board
- Motor Control Development System
- Connectivity Development Board

#### 25.3.1 Third Party C Compilers

**Note:** These products are currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of these products.

In addition to the Microchip MPLAB C30 C Compiler, the dsPIC30F will be supported by ANSI C compilers developed by IAR, HI-TECH and Custom Computer Services (CCS).

The compilers will allow dsPIC application code to be written in high level C language, and then be fully converted into machine object code for programming of the microcontroller. Each compiler tool will provide several options for compiling, so the user can select those that will maximize the efficiency of the generated code characteristics.

The multiple C compiler solutions will have different price targets and features, enabling the customer to select the compiler best suited for their application requirements.

# 25.3.2 Math Library

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

The Math Library will support several standard C functions, including, but not limited to:

- sin(), cos(), tan()
- asin(), acos(), atan(),
- log(), log10()
- sqrt(), power()
- ceil(), floor()
- fmod(), frexp()

The math function routines will be developed and optimized in dsPIC30F assembly language and will be callable from both assembly and C language. Floating point and double precision versions of each function shall be provided. The Microchip MPLAB C30 and IAR C compilers will be supported.

# 25.3.3 DSP Algorithm Library

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

The DSP library will support multiple filtering, convolution, vector and matrix functions. Some of the functions will include, but will not be limited to:

- · Cascaded Infinite Impulse Response (IIR) Filters
- Correlation
- Convolution
- Finite Impulse Response (FIR) Filters
- Windowing Functions
- FFTs
- · LMS Filter
- · Vector Addition and Subtraction
- Vector Dot Product
- Vector Power
- Matrix Addition and Subtraction
- · Matrix Multiplication

# 25.3.4 DSP Filter Design Software Utility

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

Microchip will offer a digital filter design software tool which will enable the user to develop optimized assembly code for Low-pass, High-pass, Band-pass and Band-stop IIR and FIR filters, including 16-bit fractional data size filter coefficients from a graphical user interface. The application developer will enter the required filter frequency specifications and the software tool develops the filter code and coefficients. Ideal filter frequency response and time domain plots are generated for analysis.

FIR filter lengths up to 513 taps and IIR filter lengths up to 10 cascaded sections will be supported.

All IIR and FIR routines are generated in assembly language and will be callable from both assembly and C language. The Microchip MPLAB C30 C compiler will be supported.

# 25.3.5 Peripheral Driver Library

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

Microchip will offer a peripheral driver library that will support the setup and control of dsPIC30F hardware peripherals, including, but not limited to:

- Analog-to-Digital Converter
- Motor Control PWM
- Quadrature Encoder Interface
- UART
- SPI™
- Data Converter Interface
- I<sup>2</sup>C™
- · General Purpose Timers
- Input Capture
- Output Compare/Simple PWM

# 25.3.6 CAN Library

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

Microchip will offer a CAN driver library, which will support the dsPIC30F CAN peripheral. Some of the CAN functions which will be supported are:

- Initialize CAN Module
- Set CAN Operational Mode
- Set CAN Baud Rate
- Set CAN Masks
- Set CAN Filters
- Send CAN Message
- Receive CAN Message
- Abort CAN Sequence
- Get CAN TX Error Count
- Get CAN RX Error Count

#### 25.3.7 Real-Time Operating System (RTOS)

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

Real-Time Operating System (RTOS) solutions for the dsPIC30F Product Family will be provided. These RTOS solutions will provide the necessary function calls and operating system routines to write efficient C and/or assembly code for multi-tasking applications. In addition, RTOS solutions will be provided that address those applications in which program and more importantly, data memory resources, are limited. Configurable and optimized kernels will be available to support various RTOS application requirements.

The RTOS solutions will range from a fully-true, preemptive and multi-tasking scheduler to a cooperative type scheduler, both of which will be designed to optimally run on the dsPIC30F devices. Depending on the RTOS implementation, some of the function calls provided in the system kernel will be:

- Control Tasks
- Send And Receive Messages
- Handle Events
- Control Resources
- Control Semaphores
- Regulate Timing in a Variety of Ways
- Provide Memory Management
- · Handle Interrupts and Swap Tasks

Most functions will be written in ANSI C, with the exception of time critical functions, which will be optimized in assembly, thereby reducing execution time for maximum code efficiency. The ANSI C and assembly routines will be supported by the Microchip MPLAB C30 C compiler.

Electronic documentation will accompany the RTOS, enabling the user to efficiently understand and implement the RTOS in their application.

#### 25.3.8 OSEK Operating Systems

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

Operating Systems for the vehicle software standard OSEK/VDX will be developed for support of the dsPIC30F product family. The functionality of OSEK, "Offene Systeme und deren Schnittstellen für die Elektronik im Kraftfahrzeug" (Open systems and the corresponding interfaces for automotive electronics), is harmonized with VDX "Vehicle Distributed eXecutive" yielding OSEK/VDX.

Structured and modular RTOS software implementations based on standardized interfaces and protocols will be provided. Structured and modular implementations will provide for portability and extendability for distributed control units for vehicles.

Various OSEK COM modules will be provided, such as:

- OSEK/COM Standard API
- OSEK/COM Communication API
- OSEK/COM Network API
- OSEK/COM Standard Protocols
- OSEK/COM Device Driver Interface

Microchip will also provide Internal and External CAN driver support. The physical layer will be integrated into the communication controller's hardware and will not be covered by the OSEK specifications.

Most module functions will be developed in ANSI C, with the exception of time critical functions and peripheral utilization, which will be optimized in assembly, thereby reducing execution time for maximum code efficiency. The Microchip MPLAB C30 C compiler will be supported.

#### 25.3.9 TCP/IP Protocol Stack

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

Microchip will offer various Transmission Control Protocol/Internet Protocol (TCP/IP) Stack Layer solutions for Internet connectivity solutions implemented on the dsPIC30F product family. Both reduced and full stack implementations will be provided, which will allow the user to select the optimum TCP/IP stack solution for their application.

Application protocol layers, such as FTP, TFTP and SMTP, Transport and Internet layers, such as TCP, UDP, ICMP and IP, and Network Access layers, such as PPP, SLIP, ARP and DHCP, will be provided. Various configurations, such as a minimal UDP/IP stack will be available for limited connectivity requirements.

Most stack protocol functions will be developed and optimized in Microchip's MPLAB C30 C language. Assembly language coding may be developed for specific dsPIC30F hardware peripherals and Ethernet drivers to optimize code size and execution time. These assembly language specific routines will be assembly and C callable.

Electronic documentation will accompany the TCP/IP protocol stack, enabling the user to efficiently understand and implement the protocol stack in their application.

# 25.3.10 V.22/V.22bis and V.32 Specification

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

Microchip will offer ITU compliant V.22/V.22bis (1200/2400 bps) and V.32 (non-trellis coding at 9600 bps) modem specifications to support a range of "connected" applications.

Applications which will benefit from these modem specifications will be numerous and will fall into many applications, some of which are listed here:

- · Internet enabled home security systems
- Internet connected power, gas and water meters
- · Internet connected vending machines
- Smart Appliances
- · Industrial monitoring
- POS Terminals
- Set Top Boxes
- Drop Boxes
- Fire Panels

Most ITU specification modules will be developed and optimized in Microchip's MPLAB C30 C language. Assembly language coding may be developed for specific dsPIC30F hardware peripherals, along with key transmitter and receiver filtering routines to optimize code size and execution time. These assembly language specific routines will be assembly and C callable.

Electronic documentation will accompany the modem library, enabling the user to efficiently understand and implement the library functions.

#### 25.4 dsPIC30F Hardware Development Boards

**Note:** These products are currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of these products.

Microchip will initially provide three hardware development boards, which will provide the application developer with a tool in which to quickly prototype and validate key design requirements. Each board will feature key dsPIC30F peripherals and support Microchip's MPLAB In-Circuit Debugger (ICD 2) tool for cost effective debugging and programming of the dsPIC30F device. The three initial boards to be provided are:

- · General Purpose Development Board
- Motor Control Development System
- Connectivity Development Board

# 25.4.1 General Purpose Development Board

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

The dsPIC30F general purpose development board will provide the application designer with a low cost development tool in which to become familiar with the dsPIC30F 16-bit architecture, high performance peripherals and powerful instruction set. The development board will serve as an ideal prototyping tool in which to quickly develop and validate key design requirements.

Some key features and attributes of the general purpose development board will be:

- Supports various dsPIC30F packages
- CAN communication channel
- · RS-232 and RS-485 communication channels
- Codec interface with line in/out jacks
- In-Circuit Debugger interface
- MPLAB ICE 4000 emulation support
- Microchip temperature sensor
- · Microchip Op Amp circuit, supporting user input signals
- Microchip Digital-to-Analog Converter
- 2x16 LCD
- General purpose prototyping area
- · Various LEDS, switches and potentiometers

The general purpose development board will be shipped with a 9V power supply, RS-232 I/O cable, preprogrammed dsPIC30F device, example software and appropriate documentation to enable the user to exercise the development board demonstration programs.

# 25.4.2 Motor Control Development System

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

The dsPIC30F motor control development system will initially provide the application developer with three main components for quick prototyping and validation of BLDC, PMAC and ACIM applications. The three main components will be:

- dsPIC30F Motor Control Main Board
- 3-phase Low Voltage Power Module
- · 3-phase High Voltage Power Module

The main control board will support the dsPIC30F6010 device, various peripheral interfaces, and a custom interface header system that will allow different motor power modules to be connected. The control board also will have connectors for mechanical position sensors, such as incremental rotary encoders and hall effect sensors, and a breadboard area for custom circuits. The main control board will receive its power from a standard plug-in transformer.

The low voltage power module will be optimized for 3-phase motor applications that will require a DC bus voltage less than 60 volts and will deliver up to 400W power output. The 3-phase low voltage power module is intended to power BLDC and PMAC motors.

The high voltage power module will be optimized for 3-phase motor applications that require DC bus voltages up to 400 volts and up to 1 kW power output. The high voltage module will have an active power factor correction circuit that will be controlled by the dsPIC30F device. This power module is intended for AC induction motor and power inverter applications.

Both power modules will have automatic Fault protection and electrical isolation from the control interface. Both power module boards will provide preconditioned voltage and current signals to the main control board. All position feedback devices that will be isolated from the motor control circuitry, such as incremental encoders, hall-effect sensors or tachometer sensors, will be directly connected to the main control board. Both modules will be equipped with motor braking circuits.

# 25.4.3 Connectivity Development Board

**Note:** This product is currently under development at the time of this writing. Some of the product details may change. Please refer to the Microchip web site or your local Microchip sales office for the most current information and the availability of this product.

The dsPIC30F connectivity development board will provide the application developer a basic platform for developing and evaluating various connectivity solutions, implementing TCP/IP protocol layers combined with V.22/V.22bis and V.32 (non-trellis coding) ITU specifications, across PSTN or Ethernet communication channels.

Some key features and attributes of the connectivity development board will be:

- · Supports the dsPIC30F6014 device
- · Media Access Control (MAC) and PHY interface
- PSTN interface with DAA/AFE
- · RS-232 and RS-485 communication channels
- In-Circuit Debugger interface
- MPLAB ICE 4000 emulation support
- Microchip temperature sensor
- Microchip Digital-to-Analog Converter
- 2x16 LCD
- · General purpose prototyping area
- Various LEDs, switches and potentiometers

The connectivity development board will be shipped with a 9V power supply, RS-232 I/O cable and preprogrammed dsPIC30F devices with example connectivity software and appropriate documentation to enable the user to exercise the development board connectivity demo program.

# 25.5 Related Application Notes

This section lists application notes that are related to this section of the manual. These application notes may not be written specifically for the dsPIC30F Product Family, but the concepts are pertinent and could be used with modification and possible limitations. The current application notes related to the Development Tool Support are:

#### Title

#### Application Note #

No related application notes at this time.

**Note:** Please visit the Microchip web site (www.microchip.com) for additional Application Notes and code examples for the dsPIC30F Family of devices.

# 25.6 Revision History

# **Revision A**

This is the initial released revision of the dsPIC30F Development Tool Support description.

#### **Revision B**

There were no technical content or editorial revisions to this section of the manual, however, this section was updated to reflect Revision B throughout the manual.

# **Revision C**

There were no technical content revisions to this section of the manual, however, this section was updated to reflect Revision C throughout the manual.