Accelerating Designs With a Complete Embedded Design Ecosystem
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Abstract

Being competitive in the electronics industry means bringing new solutions with innovative features to the market as rapidly as possible. Designing innovative features and having a swift time to market largely depends on the complexity of the hardware and software tools used to prototype and produce new devices. Spending engineering resources on building a toolchain and integrating solutions from multiple suppliers can add undesirable overhead to an already complex process. With a fully featured ecosystem of tools and resources that lowers the engineering burden during each of the product development phases, Microchip offers hardware and software solutions that enable designers to spend more time innovating and less time working with design logistics.

Introduction

The uniqueness and innovation associated with electronic devices is often a product of raw creativity and a substantial investment of engineering resources that brings to life what was initially only an idea. Unfortunately, an excessive amount of effort and engineering resources are typically required for an engineering team to reach a point in product development when they are able to start innovating. The process may be further complicated by the need to rely on a wide range of suppliers and software tools, many of which are neither straightforward to use nor out-of-the-box compatible with each other, to bring a product from prototype to production.

Generally, an engineering team or development team will need to start with embedded controller development boards, accessories, and peripherals to experiment with features and produce a proof-of-concept. The next step is determining the hardware and software tools necessary to develop a prototype that will be more representative of a production model. At this stage, an entirely new set of hardware and software tools may be required, leaving the hardware and software development expense for the proof of concept behind. This means the team will have to reinvest resources in creating a new design process. During the prototyping and testing phase, additional hardware and software changes are likely to be made, often prolonging the early product development process as engineers and developers spend additional resources familiarizing themselves with and working out a toolchain for the new hardware.

Additional hardware and software changes are also likely as a design team ramps up from engineering volumes to production volumes. Sometimes this may require another round of updates to both the hardware and software, or a sacrifice in performance and/or features in the end product to avoid the time and costs associated with a redesign. Compliance testing and early customer feedback may necessitate yet more updates to the design and software.

Moreover, this process will likely have to be repeated for the next design cycle for future generations of a device or the expansion of a product line. Much of the effort in building up a toolchain and familiarization with a hardware platform may also have to be reworked as the performance and feature requirements of the next product may not overlap adequately with the previously developed products. The time and costs of investing engineering resources in learning a hardware platform and building a toolchain are likely to be ongoing unless a design team selects a semiconductor supplier with a comprehensive support ecosystem to enable code reuse and ease the burden of changing requirements during the product design phase, as well as when it’s time to update the product to meet new design requirements.

This white paper provides insight into Microchip’s ecosystem of microcontrollers (MCUs), microprocessors (MPUs), accessories, peripherals, and design solutions that are built from the ground up to aid designers in effortlessly achieving an enterprise-grade design infrastructure for creating the latest electronic devices.
Design Environment

During the proof-of-concept and prototyping phase of product development, a significant amount of effort is often spent working with development and evaluation platforms. Much time is spent in familiarizing the engineering and design team with the hardware and software platforms that may be able to deliver the performance and feature requirements for the product description. In many cases, it is challenging to find compatible accessories or peripherals to add a feature to a selected hardware platform. As a result, additional engineering resources may be required to develop the hardware required to implement this feature in a design.

In the case of Microchip’s embedded design ecosystem, much of the burden of selecting and experimenting with the company’s products is removed. Microchip’s low-cost and low-learning-curve Curiosity Development Boards are compatible with hundreds of MikroElektronika’s Click boards™ to add application-specific features and functionality. Microchip’s Explorer Development Boards are more fully featured development boards that are extensible through a range of common interfaces, enabling the addition of processor-specific Plug-in Modules (PIMs) for swapping MCUs, Click boards, and PIcTail™ Plus Daughter Boards for evaluating and developing a diverse range of applications. Microchip also offers an array of extensible and easy-to-use evaluation boards, such as the Xplained boards specifically for AVR® and Arm®-based SAM MCUs, for evaluating and designing applications.

Reference Designs and Application-Specific Hardware

Building a solid proof of concept or prototype sometimes involves developing application-specific hardware from the ground up. Also, depending on the application, there may be many common functions and hardware aspects that are similar within a realm of applications. Often, design teams have to reinvent the wheel during the early design stages, which could extend the product design cycle undesirably. Fortunately, Microchip’s design ecosystem includes application-specific hardware that is compatible with Microchip’s development boards.

Microchip also offers fully functional and rigorously tested reference designs for key applications. These include examples like the Solar Microinverter and Vibrating Mesh Nebulizer, which include complete and detailed circuit diagrams, functional models, circuit boards, and tested code. These reference designs enable a developer to rapidly test out ideas and implement features with development hardware and software solutions, thus eliminating the need to invest resources in a proof of concept and even a prototype for key applications.

Moreover, Microchip offers hundreds of application-specific hardware boards and cards for almost 50 state-of-the-art application categories ranging from motor control to touch control. These boards and cards are compatible with Microchip’s development and evaluation boards and include code examples to enable designers to rapidly adapt pre-existing solutions to their needs. Among the hardware boards are also starter kits, such as the BLDC High Voltage Motor Control Kit and MPLAB® Starter Kit for Digital Power, which enable out-of-the-box prototyping with an on-board programmer/debugger and the hardware and functionality of the latest commercial solutions.
Proven Tools and Production-Ready Software

The previous sections established the expansive hardware foundations of Microchip’s ecosystem, but there is another equally significant component to modern-day electronics product development: software development tools. Alongside Microchip’s hardware ecosystem is a complementary and compatible software design ecosystem, which includes easy-to-use and easy-to-learn graphical programming software, fully featured and free development environments, embedded software development frameworks, compilers, APIs, and design software capable of high-end code optimization.

Featured Microchip Software Design Tools

- **MPLAB X IDE**
  - Fully featured Integrated Development Environment (IDE) for code development for embedded microcontrollers
  - Based on open-source NetBeans IDE from Apache Software Foundation
  - Extensible architecture
  - Fully supports Microchip’s PIC® MCUs and dsPIC® Digital Signal Controllers (DSCs)
  - Support for many AVR and SAM devices

- **MPLAB Xpress Cloud-Based IDE**
  - Free online development environment with no installation or system configuration necessary
  - Includes the most popular features of MPLAB X IDE
  - Easy to transition between MPLAB Xpress and MPLAB X IDE; ideal for new users of PIC MCUs
  - Incorporates MPLAB Code Configurator
  - Compatible with MPLAB Xpress evaluation boards, curiosity boards, Explorer 16/32 Board, and PICkit™ 4 Programmer/Debugger
  - Community features enable sharing, exchange, and use of a shared code repository

- **MPLAB Code Configurator (MCC)**
  - Free, graphical programming environment that generates easy-to-understand C code that can be readily used in various projects
  - Can be used to configure a wide range of peripherals and functions
  - Supports 8-, 16-, and 32-bit PIC MCUs and MikroElektronica Click boards
  - Incorporated into both MPLAB Xpress IDE and MPLAB X IDE

- **MPLAB Harmony**
  - Flexible, abstracted, and fully integrated embedded software development framework
  - Supports 32-bit PIC MCUs
  - Modular, object-oriented, and enables use of a Real-time Operating System (RTOS)
  - Works with MPLAB X IDE
  - Includes WYSIWYG editor with MPLAB Harmony Graphics Suite (MHGS)

- **MPLAB XC Compilers**
  - Comprehensive solution for software development compiling
  - Support for all PIC and AVR devices in MPLAB XC8, support for all 16-bit PIC and dsPIC DSCs in MPLAB XC16 and support for all 32-bit PIC and SAM devices in MPLAB XC32
  - Free version includes optimization functions for code size reduction and speed enhancements
  - PRO license available for designs that require maximum code reduction and best performance; flexible purchasing options available, including by monthly subscription

- **Atmel Studio IDP (Atmel Studio 7)**
  - Integrated Development Platform (IDP) for developing and debugging all AVR and SAM MCUs
  - Includes Atmel Gallery, an online app store with plug-ins developed by Microchip and third-party tool suppliers

- **Atmel START**
  - Free web-based tool for selecting and configuring software components for embedded applications using AVR and SAM MCUs
  - Includes selection of drivers, middleware, devices, IDEs, etc.
  - Extensive set of example libraries to learn or start from
Code Examples and Professionally Tested Software Libraries

Alongside the hardware platforms and software tools, Microchip also offers a multitude of professionally developed and tested code examples and software libraries, which are readily accessible and downloadable online. Examples of these libraries are the MPLAB Harmony TCP/IP Stack and the MCC USB Stack. The Harmony TCP/IP Stack, which includes modules for several commonly used application layers such as HTTP, SMTP, SNMP, Telnet, TFTP, and others, provides a foundation for creating embedded network applications. The USB Stack inside MCC provides embedded application developers with a framework to easily develop USB devices and functionality. It supports various USB device classes, instances, configurations and USB peripherals and readily facilitates an RTOS environment.

Design Support at Every Stage of Product Development

In the world of logic design, it not uncommon for a designer to waste countless hours lost in documentation and troubleshooting. Often, a designer may have a hard time reaching technical support or engineers with their device supplier, which usually adds to the frustration and loss of valuable engineering resources. Microchip circumvents these problems by supporting an incredibly active and engineer-backed user forum, as well as by providing a technical support portal to enable customers to work directly with Microchip’s support staff. Microchip’s IDEs also feature links to helpful forum pages and other support resources directly within their menus. As the scope and complexity of electronics and logic devices continues to increase, access to and support from a professional engineering community can be a pivotal aspect in overcoming design and product development hurdles without spending the countless hours and sleepless nights all too common amongst designers and developers trying to meet a deadline.

Conclusion

Just like consumers and end users of products, design engineers and developers are also seeking more options, flexibility and support from their hardware and software tool suppliers. This can be accomplished by offering a diverse ecosystem of logic devices, accessories, peripherals, software tools, and development support, which Microchip makes readily accessible through their professional, industry-leading hardware and software tools, communities and other support resources.