

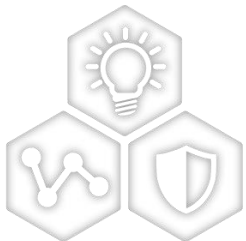
SAM9X60 ARM926EJ-S

Microprocessor & Embedded Linux

LNx1001-Introduction v1.10



A Leading Provider of Smart, Connected and Secure Embedded Control Solutions



SMART | CONNECTED | SECURE

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CAE Taiwan
Microchip Technology Inc.
September 11, 2025

Course Outline

- [SAM9X60 ARM926EJ-S Microprocessor Introduction](#)
- [SAM9X60 Evaluation Kit Introduction](#)
- [Embedded Linux Development Tools of MPU Introduction](#)
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 - [Microchip University \(MU\)](#)
 - [Microchip Taiwan](#)

SAM9X60 ARM926EJ-S

Microprocessor Introduction

Microchip MPUs at a Glance

Entry Level, Low-Power ARM9, Cortex-A5 and A7 up to 1GHz

Low-Cost/Crossover

SAM9X75, 800MHz
MIPI CSI/DSI, LVDS,
GigE w/ TSN, SRAM PUF
512Mb, 1Gb, 2Gb SIPs!

SAM9X60
Up to 600MHz
Secure Boot
LCD + 2D HW Accel
I2S, Class D
Dual Ethernet and QSPI
AEC-Q100

System in Package (SIP)
D6K - 64Mb SDRAM
D5M - 512Mb DDR2
D1G - 1Gb DDR2

System on Module (SOM)
SAM9X60D1G-I/LZB

ARM926 up to 600MHz / 660 DMIPS
Low-cost, low-power graphics,
camera and connectivity

SAMA5D2, 500MHz

Up to 500MHz
DDR3 support
PCI security
10/100 Ethernet
Up to 128 I/O
CAN, USB, QSPI
AEC-Q100

System in Package (SIP)
D1M - 128Mb DDR2
D5M - 512Mb DDR2
D1G - 1Gb DDR2
LD1G - 1Gb LPDDR2
LD2G - 2Gb LPDDR2

System on Module (SOM)
SOM1 - EMAC
WLSOM1 - EMAC + WLS

Cortex-A5, up to 600MHz / 940 DMIPS
Low-power, TrustZone security, display, camera,
audio sub-system and connectivity, GigE, 10/100

SAMA5D3
Connectivity

Up to 536MHz
10/100 Ethernet
GigE MAC
Up to 160 I/O
CAN, USB

SAMA5D29
SAMA5D27 w/ fully compliant
CAN-FD and 1588

SAMA5D2 for Automotive

System in Package (SIP)
High Security Module (HSM)

SAMA5D4
Video decode

Up to 600MHz
720p video decoder
Dual 10/100 MAC
Up to 152 I/O
USB

SAMA7D65, 1GHz
MIPI DSI, LVDS, 2D GPU
Dual GigE w/ TSN, SRAM PUF

SAMA7G54, 1GHz
533MHz DDR3 Support
GigE + 10/100 Ethernet
MIPI Camera
4ch ASRC
6x CAN-FD
USB, QSPI, Octal SPI
AEC-Q100
Up to 136 I/O

System in Package (SIP)
D1G - 1Gb DDR3L
D2G - 2Gb DDR3L
D4G - 4Gb DDR3L

System on Module (SOM)
SOMs RTP Jun '24

Cortex-A7, up to 1GHz
TrustZone security, GigE,
display, camera,
audio sub-system

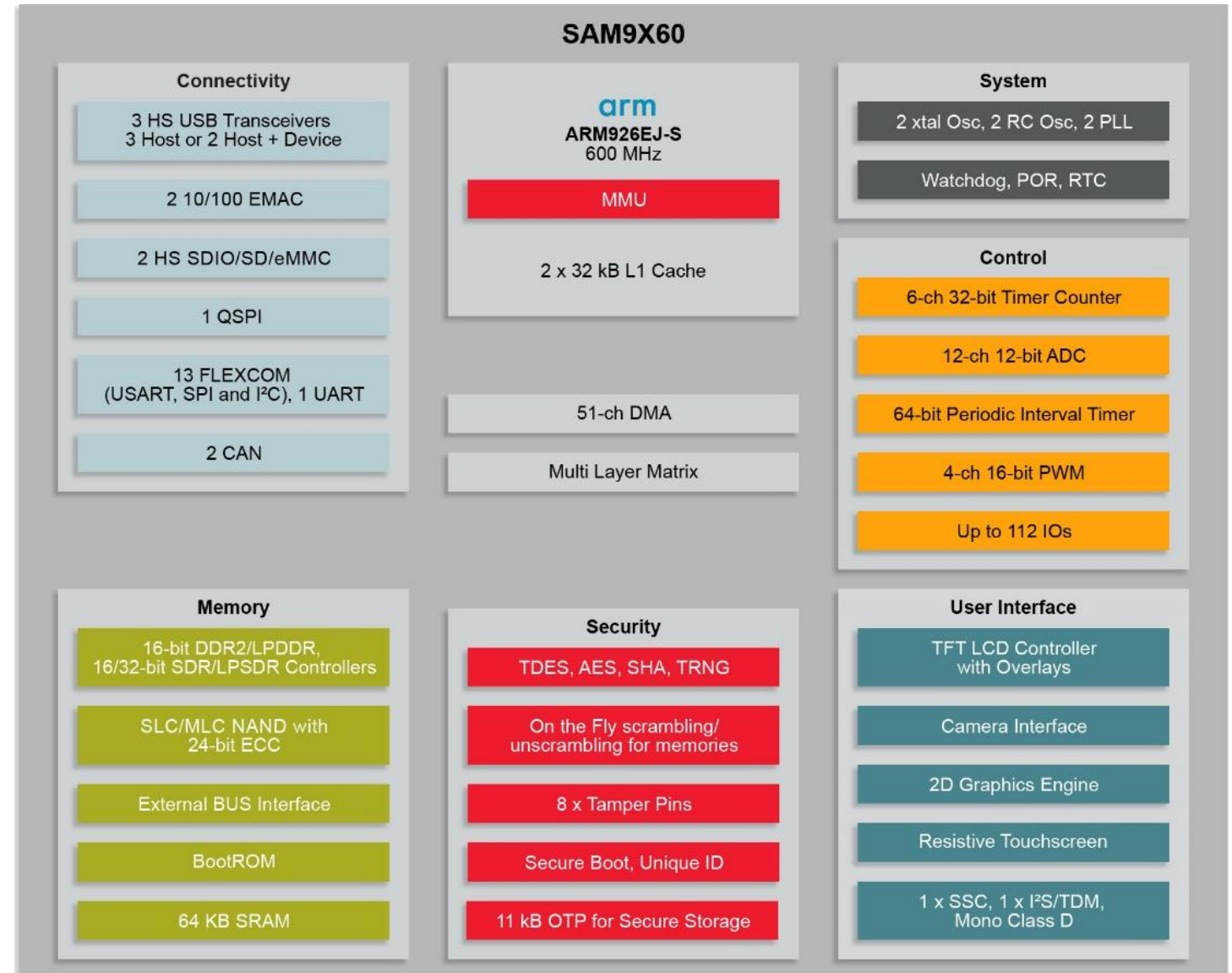
Microchip 32-bit Microprocessors (MPUs)

- **SAM9 Series (Arm926EJ-S™ core)**
 - Step up from a MCU based solution to a higher level of performance.
 - Provides a rich set of peripherals, HMI and security features for transportation, industrial, home appliance and consumer applications.
- **SAMA5 Series (Arm® Cortex®-A5 processor core)**
 - The SAMA5 family is a step up in performance compared to our SAM9 family.
 - Provides up to 940 DMIPS, a rich set of peripherals, HMI and security features for transportation, industrial, home appliance and consumer applications.
- **SAMA7 Series (Arm® Cortex®-A7 processor core)**
 - The SAMA7 family has higher processing capabilities, suitable for Artificial Intelligence (AI) / Machine Learning (ML) or advanced connectivity for gateway.
 - Designed for consumer and industrial applications, provides up to 1 GHz (1900 DMIPS), a rich set of peripherals including MIPI CSI-2®, Audio Subsystems, Dual Ethernet, CAN FD, and Robust Security features to simplify your design.

SAM9X60 Microprocessor (MPU)

Key Features

- **ARM926EJ-S Core**
 - Up to 600MHz, 2x 32kB L1 cache
- **Memory type support**
 - 16-bit LPDDR / DDR2
 - 16/32-bit LPSDR / SDRAM
 - Raw MLC/SLC NAND with 24-bit ECC
 - QSPI, 2x SD 2.0 / eMMC 4.41
- **Connectivity**
 - Dual 10/100 EMAC, Dual CAN
 - Three HS USB Host or Two Host + Device
- **User Interface**
 - 24-bit LCD Interface with 4 overlays
 - 2D Graphics Engine (GPU)
 - Camera Interface
 - I2S/TDM, Mono Class D controller
- **Security**
 - Secure Boot, Unique ID
 - HW Crypto Engine (AES, SHA, TDES, TRNG)
 - Secure Key Storage (OTP)
 - Tamper pins

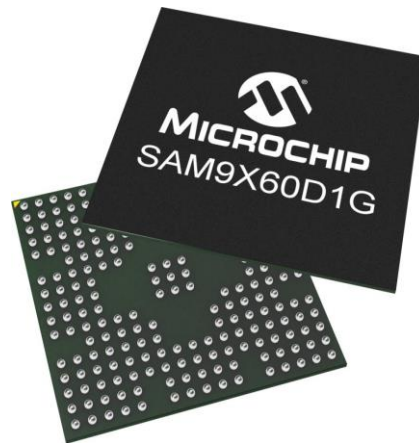


SAM9X60 Package Summary

- Even developers with expertise in the design of an industrial-grade MPU-based system spend a lot of time on PCB layout to guarantee signal integrity for the high-speed interfaces, DDR memories and Ethernet Physical Layers (PHYs) of MPUs.
- Microchip produces Arm[®] processor-based System in Package (SiP) and System on Module (SOM) to reduce the more complex hardware design of these devices that raises concerns.



SAM9X60 MPU



SAM9X60 SiP

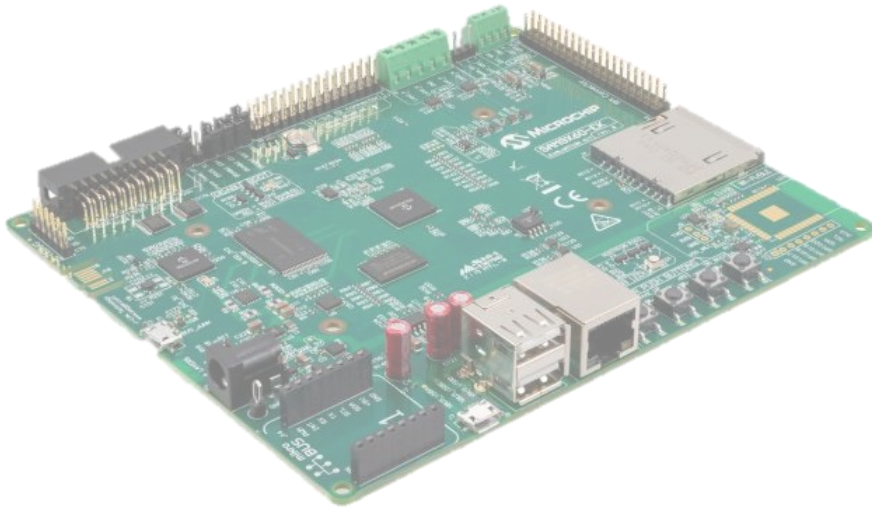


SAM9X60 SOM

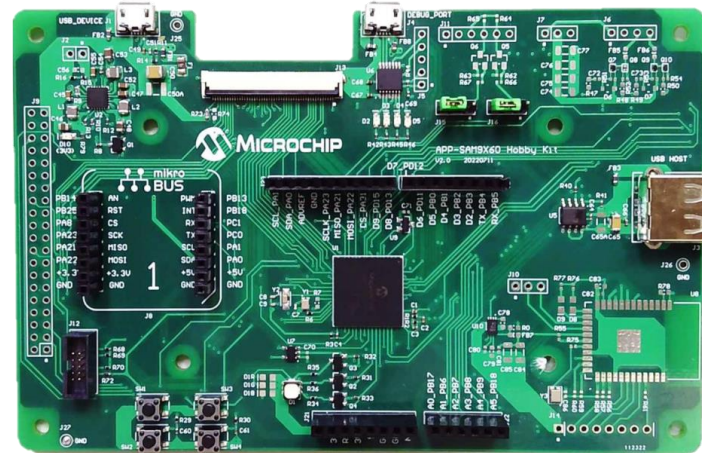
SAM9X60 Evaluation Kit Introduction

SAM9X60 Evaluation Kit Summary

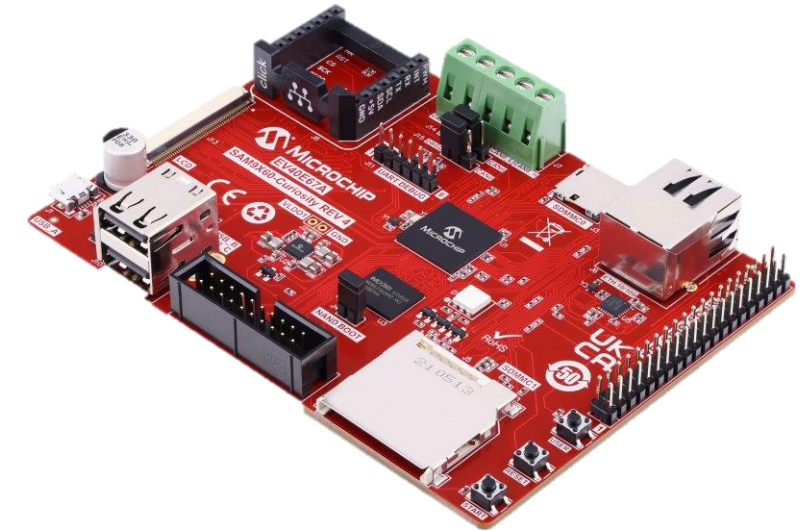
- The SAM9X60 related applications can be evaluated in the SAM9X60 Evaluation Kit, Curiosity Board and Hobby Kit.
- They are designed for evaluation of all variants of the SAM9X60 MPU, including SiP variants and SOMs, built on a common set of components to reduce time to market by simplifying hardware design and software development.



SAM9X60 Evaluation Kit
(No Longer Being Manufactured)



SAM9X60 Hobby Kit
(Taiwan Event Board)

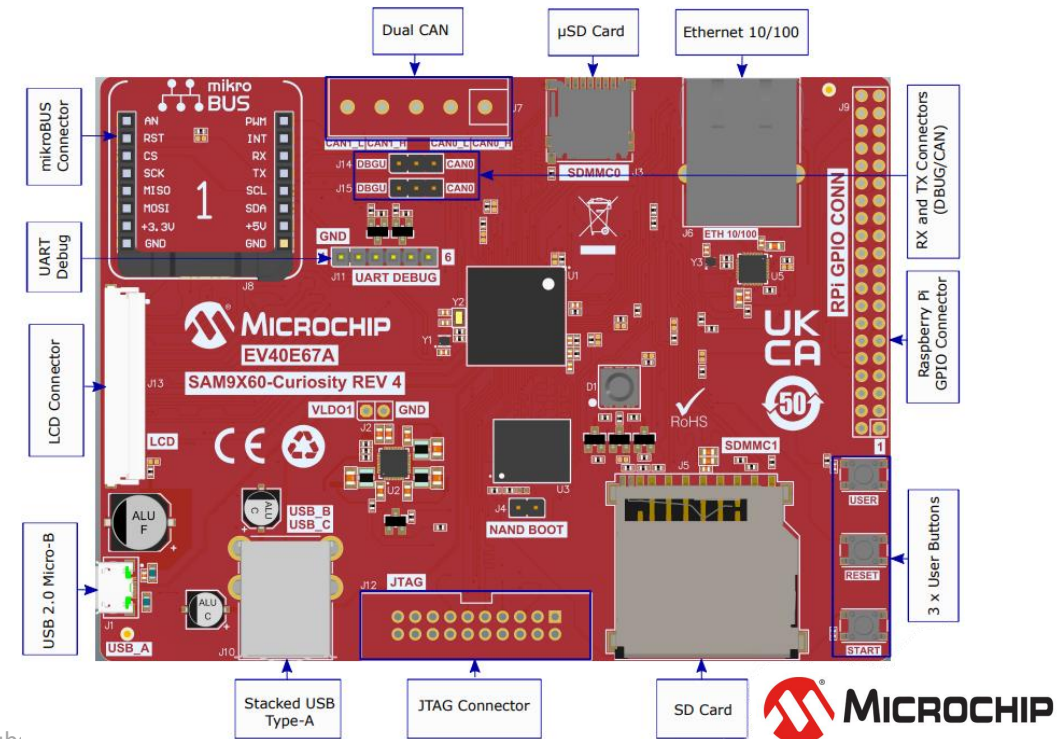
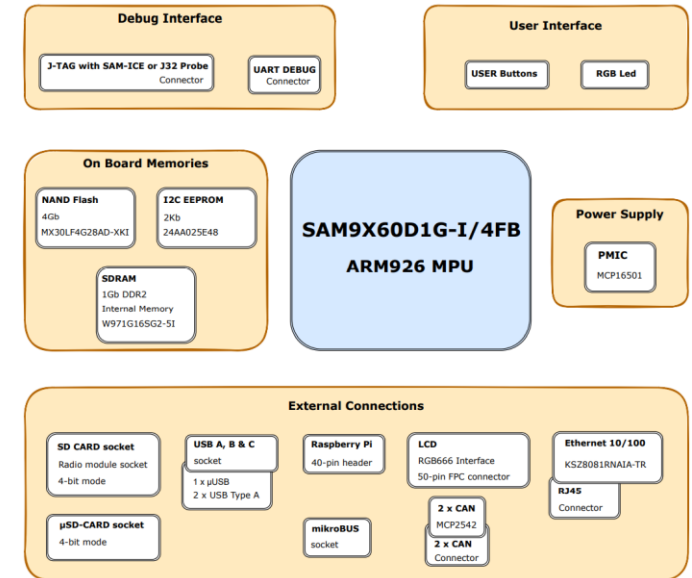


SAM9X60 Curiosity Board

Evaluation Kit - SAM9X60 Curiosity Board

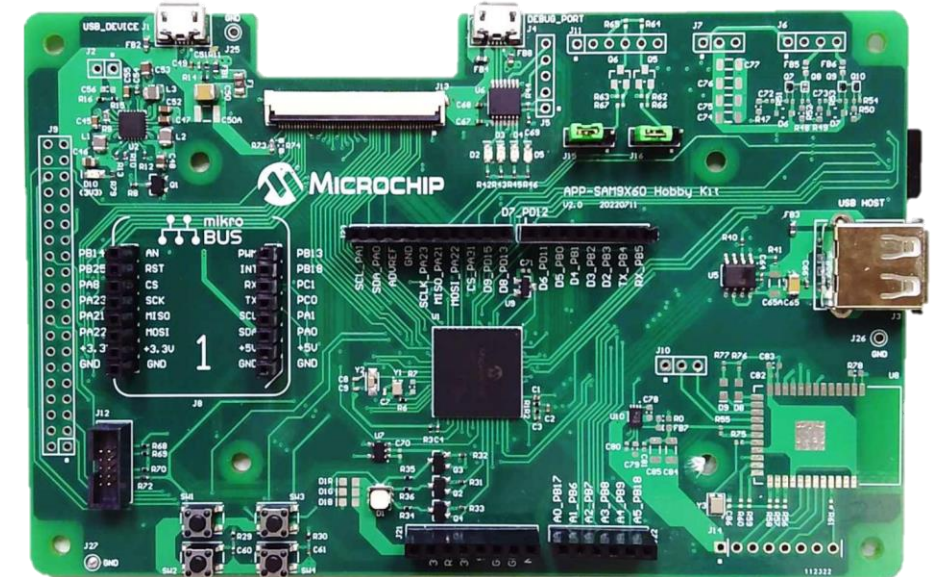
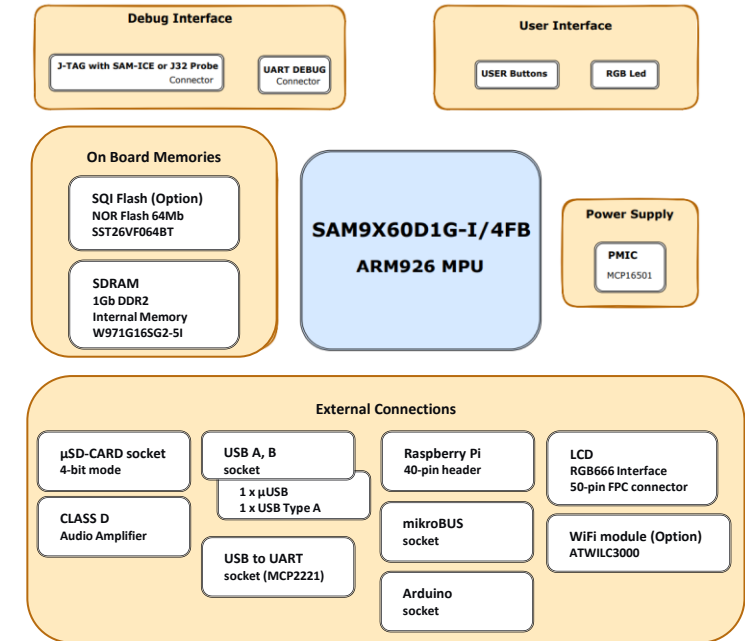
- SAM9X60D1G, System in Package (SiP), 600MHz ARM926EJ-S Core
- 1-Gbit integrated DDR2 SDRAM
- 4-Gbit NAND Flash
- 2-Kbit I²C Serial EEPROM
- One 10/100 Ethernet Port with Microchip KSZ8081 PHY
- 24-bit LCD Controller with RGB666 Interface
- Dual CAN with Microchip MCP2542 CAN FD Transceiver IC
- Microchip MCP16501 Power Management IC
- Option SDMMC Interface to connected ATWILC3000-SD EK
- Dual SD Card/eMMC Slot
- Three High-speed USB Ports
- mikroBUS Socket
- Raspberry Pi Expansion Header

<https://www.microchip.com/en-us/development-tool/EV40E67A>



Evaluation Kit - SAM9X60 Hobby Kit

- **Modified from SAM9X60 Curiosity Board**
- **SAM9X60D1G, System in Package (SiP), 600MHz ARM926EJ-S Core**
- **1-Gbit integrated DDR2 SDRAM**
- **64 Mb SQI Flash (Option)**
- **24-bit LCD Controller with RGB666 Interface**
- **Microchip MCP16501 Power Management IC**
- **eMMC Slot**
- **Two High-speed USB Ports**
- **mikroBUS Socket**
- **Raspberry Pi Expansion Header**
- **Arduino Shield**
- **USB Bridge to Debug Port**
- **Audio Class D Amplifier**
- **Option to connected onboard ATWILC3000**



[APP-SAM9X60 Hobby Kit Dev. Resource Introduction](#)

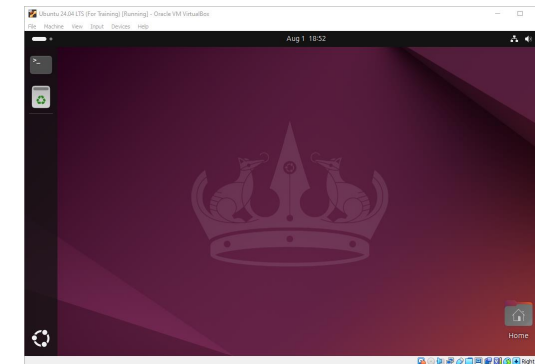
Embedded Linux Development Tools of MPU Introduction

Development Tools

- We need a high-performance PC to compile the resource for Embedded Linux system and run it on the evaluation kit of the target MPU.
- The following Development Tools are the tools we need to prepare :
 - **Hardware :**
 - A computer with High performance and enough drive space
 - Microchip Evaluation Kit
 - microSD Card (>1GB)
 - Micro-USB Cables
 - USB CDC Bridge
 - USB Flash Drive (Optional)
 - **Software for Real PC :**
 - Windows Subsystem for Linux (WSL) or VM VirtualBox
 - balenaEtcher (an SD card flasher app)
 - Tera Term (a serial communication program)
 - Visual Studio Code (a code editor)
 - Windows Terminal (Optional)
 - **Software for Virtual Machine :**
 - Ubuntu LTS
 - Visual Studio Code (a code editor)

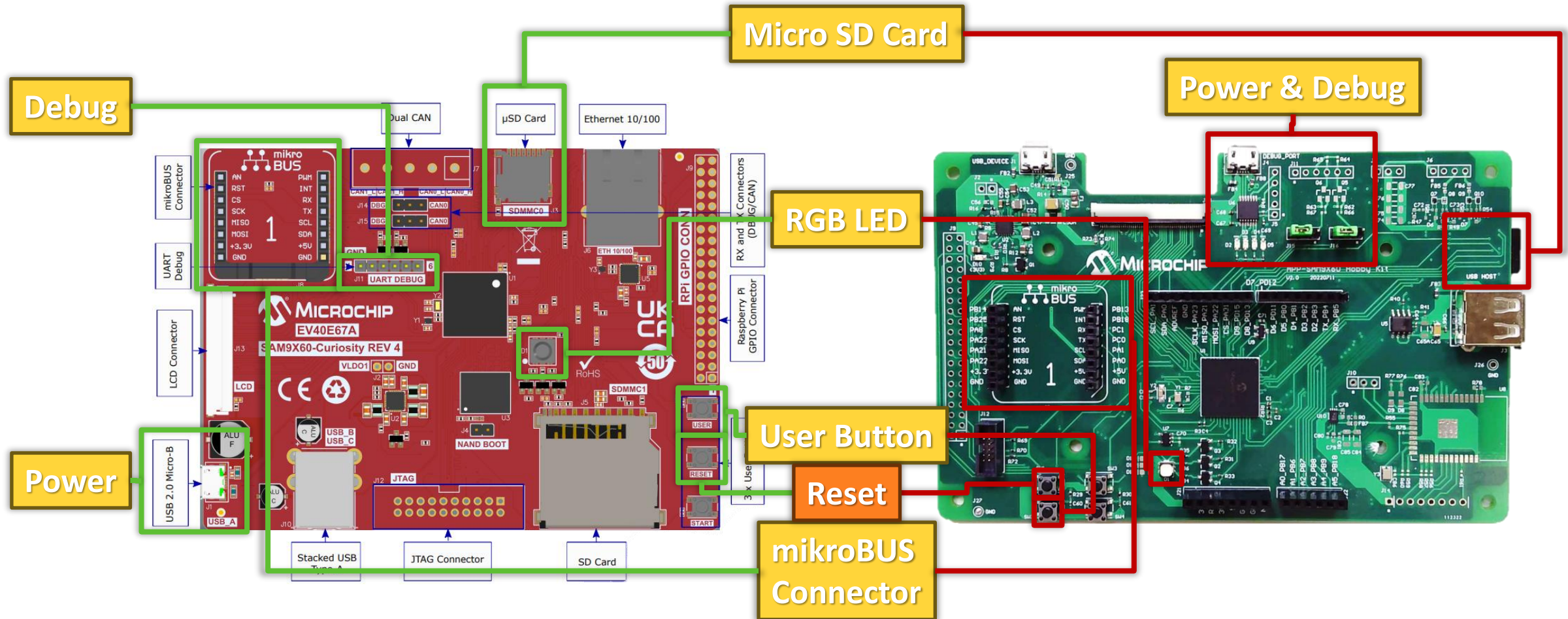


OR



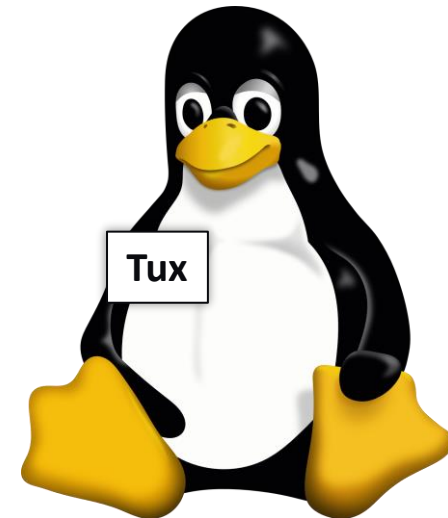
EVB Features Required for the Course

- There are some features that will be used frequently in the course.



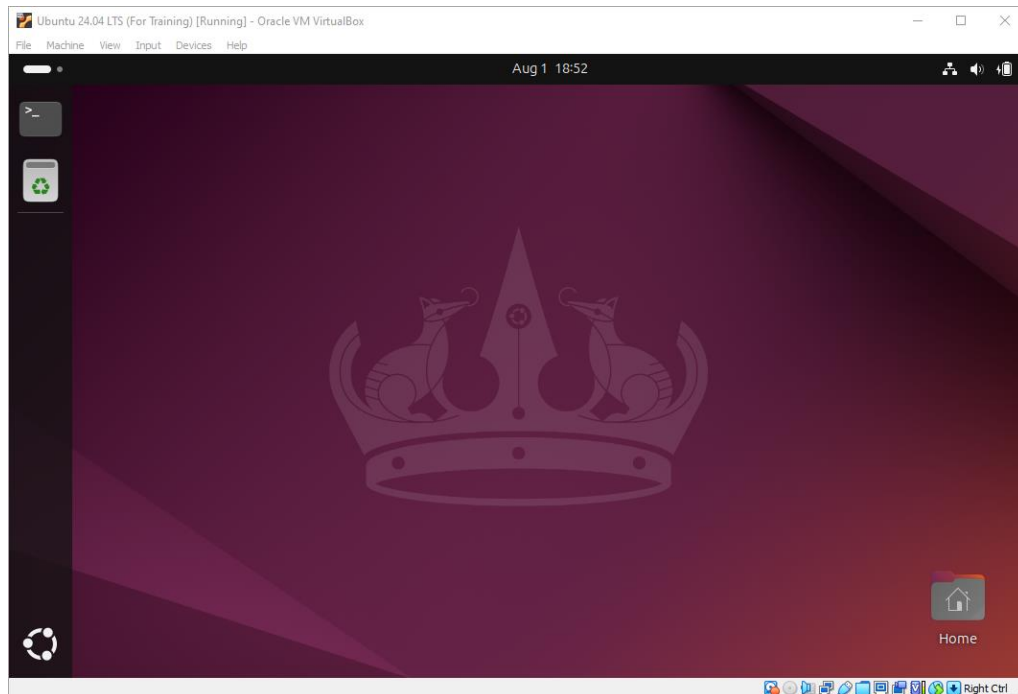
Embedded Linux

- Linux® is a clone of the operating system Unix, an operating system kernel first released in 1991, by Linus Torvalds. It is a **operating system** and a **large collection of software libraries, device drivers, networking stacks, software applications, and tools to choose from**.
- Linux® was originally developed for PC based and has since been ported to more platform, **is also runs on embedded systems**, includes routers, automation controls, smart home devices, and more.
- Embedded Linux® is a branch of Linux designed for embedded systems with **limited resources** and **optimized real-time performance**, which is a popular choice for microprocessor (MPU) development.



Virtual Machine and Ubuntu LTS

- A virtual machine (VM) can run its own operating system, configuration settings, and software in isolation with the host computer or other virtual machines.
- The course will **use VM VirtualBox to build a host Linux operating system** and install the software required to develop Embedded Linux of MPU.
- The course will use a long-term support version of a popular Linux operating system, Ubuntu LTS, which contains most of the commonly used tools and is easy to use.

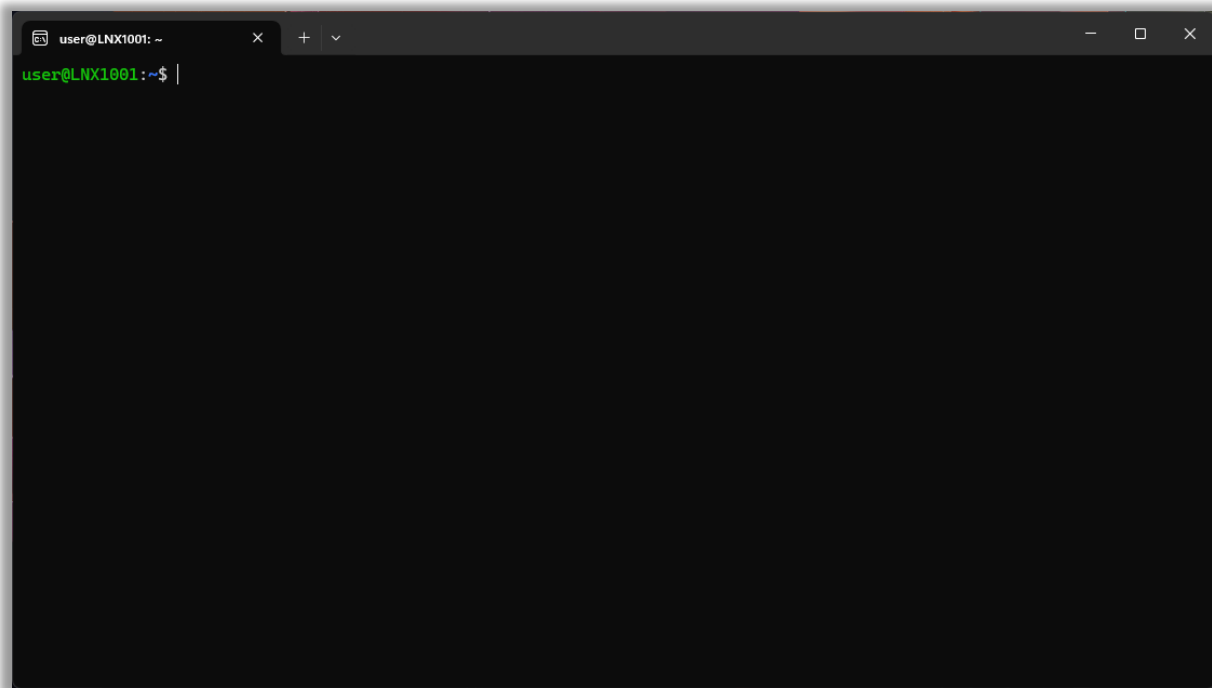


Benefits of using virtual machine

- **Great for testing**
- **Keeps the real computer safe from changes**
 - take snapshots
 - restore if something goes wrong
- **Restricted :**
 - relatively poor performance
 - restricted hardware access

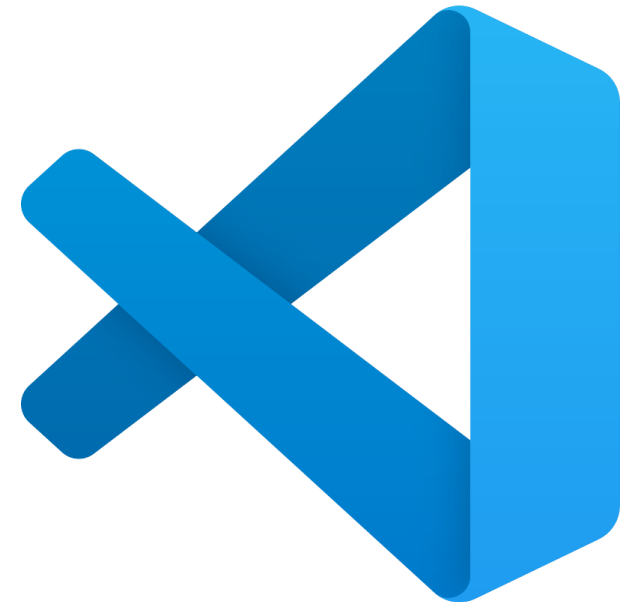
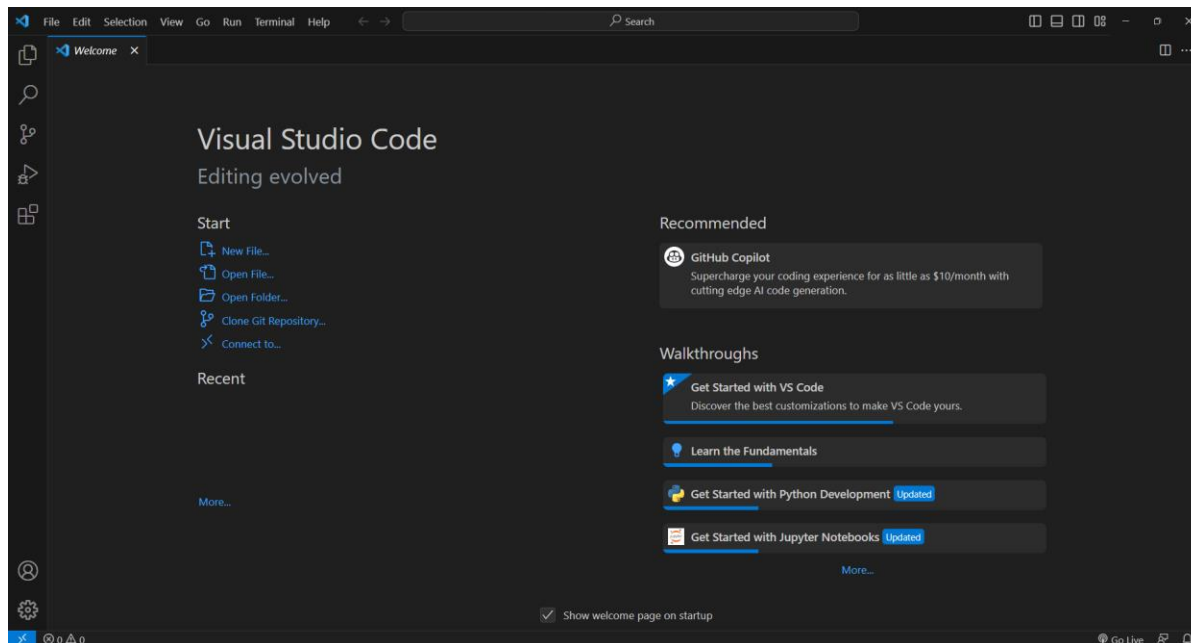
Windows Subsystem for Linux (WSL)

- **Windows Subsystem for Linux (WSL)** is a feature of Windows that allows you to run a Linux environment on your Windows machine, without the need for a separate virtual machine or dual booting.
- **WSL** is designed to provide a seamless and productive experience for developers who want to use both Windows and Linux at the same time.



VS Code

- Visual Studio Code (VS Code) is an integrated development environment developed by Microsoft for Windows, Linux, macOS and web browsers, can be used with a variety of programming languages, including C, C++, Python, etc.
- Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded version control with Git. Users can change the theme, keyboard shortcuts and preferences, as well as install extensions that add functionality.



Conventions

- Commands run on the **host computer** are entered as shown below:

```
user@VM:~$ command -a -b -cdefgh
```

- Commands run on the **target (Evaluation board)** are entered as shown below:

```
# command -a -b --cdefgh
```

- For modern style on the **target (Evaluation board)** are entered as shown below:

```
[root@sam9x60curiosity ~]$ command -a -b --cdefgh
```

- Optional steps in the Lab :

- Check something ...

- Required steps in the Lab :

- Execute something ...

* Please note that both the command is executed on the target (evaluation board).

Embedded Linux Resource Introduction

Microchip's Development Resources

- **Linux4SAM** (www.linux4sam.org)

The Linux4SAM site is the **main starting point for the Linux OS on Microchip microprocessors (MPUs)**. Its aim is to centralize information about Linux kernel and open-source projects on those products based on Arm cores (aka AT91).

- **Microchip Developer Help** (developerhelp.microchip.com)

The Microchip Developer Help site is **a comprehensive online resource for developers who use products and technologies**, covers a wide range of topics, from getting started guides to advanced programming techniques, and it provides detailed documentation, tutorials, videos, and code examples that help developers learn and apply Microchip's technology to their projects.

- **Microchip University (MU)** (mu.microchip.com)

Microchip has been delivering superior technical education to our clients. Now our **online platform** empowers you to master the art of designing robust embedded control systems whenever and wherever you want – **all for free!**

- **Microchip Taiwan** (www.microchip.com.tw)

This is the website of Microchip Taiwan, which provides event information, development resources and Q&A forums in Taiwan.

Microchip Trademarks

<https://www.microchip.com/en-us/about/legal-information/microchip-trademarks>

Trademarks	Description/Appropriate Nouns	Notes
Adaptec® "a" logo		Registered in other countries (not US)
Adaptec®	products, solutions, cables, software, drivers, adapters, controllers, series, family	
Adjacent Key Suppression™	technology	
AgileSwitch®	digital programmable gate driver, gate driver, drivers, family, device	US Only
AKS™	technology	
Analogue-for-the-Digital Age™	AIPD family tagline	
Any Capacitor™	stable	
AnyIn™	feature, structure, capability	
AnyOut™	feature, capability	
Augmented Switching™	technology	
AVR®	devices, microcontrollers, MCUs, CPU, architecture, family	
AVR Logo		
AVR Freaks®	forum	
BesTime®	technology	
BitCloud®	SDK	
BlueSky™	firewall, subscription service, technology	
BodyCom™	technology, system, development kit	
ClockStudio™	application, software, program, utility	
ClockWorks®	Configurator, products, series, family, devices	US Only
CodeGuard™	security	
CryptoAuthentication™	development library, library, devices, ICs, family	
CryptoAutomotive™	technology, security ICs, development kits	
CryptoCompanion™	chip	
CryptoController™	solution, Trusted Platform Module (TPM)	
CryptoMemory®	cryptographic security ICs, ICs	

NOTE: *Always check with the Legal Department for the most current trademarks.

Trademarks	Description/Appropriate Nouns	Notes
PIC ³² Logo		
PICDEM™	demonstration board	
PICDEM.net™	Internet/Ethernet demonstration board	
PICKit™	starter kit, programmer, debugger, in-circuit debugger, development tool, tool, on-board	
picoPower®	technology	
PICSTART®	development programmer	
PICtail™	daughter board, board	
PolarFire®	FPGA, family, kits, devices, SoC, System-on-Chip	
Power MOS IV™		
Power MOS 7™		
Powermite 3®	package	US Only
PowerSmart™	digital control library designer, development suite	
Precision Edge®	family, product family	US Only
ProASIC®	FPGA, architecture, board, kit, family	US Only
ProASIC Plus®	FPGA, devices, family, architecture, switch	US Only
ProASIC Plus Logo		US Only
Prochip Designer®	software suite	
PureSilicon™	oscillator, technology	
QMatrix™	sensor, devices	
QTouch®	sensor, devices, library, tools, development platform, project builder, Composer, Project Builder, board, solution, technology, Configurator	
Quiet-Wire®	enhanced EMI technology, family, technology	
Ripple Blocker™	technology, attenuators, product line, family of linear regulators	
REAL ICE™	In-circuit emulator	
RTAX™	FPGAs	
RTG4™	FPGAs	
SAM-BA®	software, application, monitor	

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Trademarks	Description/Appropriate Nouns	Notes
CryptoRF®	transponder, devices	
dsPIC®	Digital Signal Controllers (DSCs)	
dsPIC Logo		
dsPICDEM™	demonstration board, development board	
dsPICDEM.net™	board	
Dynamic Averaged Matching™ (DAM™)	architecture	
ECAN™	technology, solution	
Espresso T1S™	device	
EtherGREEN™	platform, technology, family	
EtherSynch®	platform, technology, family	US Only
EyeOpen™	cable compensation	
Flashtec™	controller, products, family	US Only
flexPVR®	technology	
Frequency on Demand®		Registered in other countries (not US)
GestIC®	technology, sensing, controllers	
GridTime™	device, time server, GNSS time server	
HELDO®	family, regulators	
Hyper Speed Control®	family, architecture	US Only
HyperLight Load®	mode	US Only
ICSP™ or In-Circuit Serial Programming™	programming capability	
IdealBridge™	rectifier, dual MOSFET-bridge rectifier	
IGAT™	board, demonstration board	
IGLOO®	FPGAs, family, devices, series	
INICNet™	technology, sniffer	
Intelligent Paralleling™	technology	
IntelliMOS™	family, power stage family	US Only
Inter-Chip Connectivity™	technology	
JitterBlocker™	family, attenuators	
JukeBlox®	technology, platform	

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Trademarks	Description/Appropriate Nouns	Notes
SAM-ICE™	emulator	
SenGenuity®	sensors, products	
Serial Quad I/O™ or SQI™	family, flash device, product	
Silicon Storage Technology®		Japan only
SimpleMAP™	protocol	
SimpliPHY™	family, products, devices	
SmartBuffer™	devices, ICs	
SmartFusion®	FPGA, evaluation kit, SoC, System-on-Chip,	US Only
SmartHLS™	IDE, compiler software, compiler, software	
SMART-I.S.™	technology	
SpyNIC®	device	
SST®		
SST Logo		
storClad™	encryption technology, technology	
SuperFlash®	technology, kit, macro, device, memory	
SuperSwitcher™	family, regulator, buck regulator	
SuperSwitcher II™	family	
Switchtec™	technology, family, switch(es), product line	
Symmmcom®		China only
Symmetricon®		
SynchroPHY™	family, products, devices	
SyncServer®	server, instrument, clock, oscillator, device	
SyncWorld®	timing, Ecosystem Program	US only
Tachyon®	products, family, controllers, platform, technology	
The Embedded Control Solutions Company®	MarCom Use Only	
TimeCesium®	products, primary frequency reference	US only
TimeHub®	platform, system	US only
TimePictra®	software suite, platform, Synchronization Management System	US only

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Trademarks	Description/Appropriate Nouns	Notes
JukeBlox with design	Registered word mark JukeBlox with a design	Image is not registered, this is a graphic treatment with the word mark
KEELOQ®	security ICs, protocol, technology	
Kleer®	technology	
Kleer with design	Registered word mark Kleer with a design	Image is not registered, this is a graphic treatment with the word mark
Knob-on-Display™/KoD™	technology, solution, HMI, user interface, touch controller, family, devices, Widget Configurator, Knob Designer, Position Wizard	
LANCheck®	online design review, online review, review	
Libero®	SoC Design Suite, tools, software, design files, IDE, designer	US registration
LinkMD®	cable diagnostics, technology, family, diagnostics engine	
MarginLink™	signal integrity testing	
maxCrypto™	controller-based encryption, encryption	
maXStylus™	solution	
maXTouch®	touchscreen controllers, technology, studio, family	
maxView™	storage manager, tools, drivers	
MediaLB®	bus, controller, device	
megaAVR®	devices, MCUs	
memBrain™	neuromorphic memory product, product, solution, technology	
Microchip Logo		
Microchip Name and Logo		
Microsemi Logo		
Microsem®		

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Trademarks	Description/Appropriate Nouns	Notes
TimeProvider®	series, server, clock, products, grandmaster, ePRTC, enhanced PRTC	US only
TimeSource®	Enhanced PRTC	
tinyAVR®	microcontroller, MCU	
Total Endurance™	software model	
Trusted Time™	technology	
TSHARC™	touch screen controller, controller	
Turing™	hardware security module, programmer	
UNIQ®	memory chips, bus, hardware port, communication protocol, firmware	
USBCheck™	design review	
VariSense™	technology	
VectorBlox™	accelerator, software development kit, SDK, intellectual property, IP, solution, platform, tools, tool chain, tool flow	
Vector®		
VeriPHY™	cable diagnostics algorithm, cable diagnostics software suite	
ViewSpan™	technology	
WiperLock™	technology	
XMEGA®	microcontroller, MCU, devices, Custom Logic (XCL), family, series	
XpressConnect™	retimer	
ZENA™	software, analyzer or wireless adapter	
ZL®		

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Microchip Technology Inc. Servicemarks*

Trademarks	Description/Appropriate Nouns	Notes
SQTP™	Serial Quick Turn Programming capability	

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Trademarks	Description/Appropriate Nouns	Notes
MindI™	analog simulator, analog simulator tool	
MIWI™	wireless networking protocol, protocol, network, stack, software, applications, mesh, coordinator	
MOST®	technology, NetServices, evaluation kit, board, system, device, product, network, specification, platform, cooperation, design	
MOST Logo		
motorBench®	Development Suite	US Only
MPASM™	assembler	
MPF™	products, devices	
MPLAB®	Integrated Development Environment, In-Circuit Debugger, In-Circuit Emulator, IDE, ICD, REAL ICE™ in-circuit emulator, starter kit, compiler, XC compiler, C compiler, Harmony, Integrated Programming Environment, IPE, Xpress, Code Configurator, development ecosystem, PICkit™, server, library, Snap, Connect Configurator, Network Creator, Analog Designer, Discover, MindI™, Analysis Tool Suite, Discover, Universal Device Programmer, Machine Learning Development Suite, PTG, Programmer-to-Go, Programmer-to-Go Mobil App, SiC Power Simulator	
MPLAB Certified Logo		
MPLIB™	object librarian or librarian	
MPLINK™	object linker or linker	
mSIC™	MOSFETs, diodes, products, gate drivers, modules, bare die, technology, solutions	
mTouch®	solution, sensing solution, evaluation kit, technology, development kit, library	US Only
MultiTRAK™	technology	
NetDetach™	technology	
Omniscient Code Generation™ (OCG)	compilation technology	
OptoLyzr®	tool, network analysis tool, Studio	
PIC®	microcontroller, MCU, device(s), assembler	

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