

# AVR32<sup>®</sup>

## AVR32 UC3 Flash MCU

### Product Line Introduction

Rev 1.2

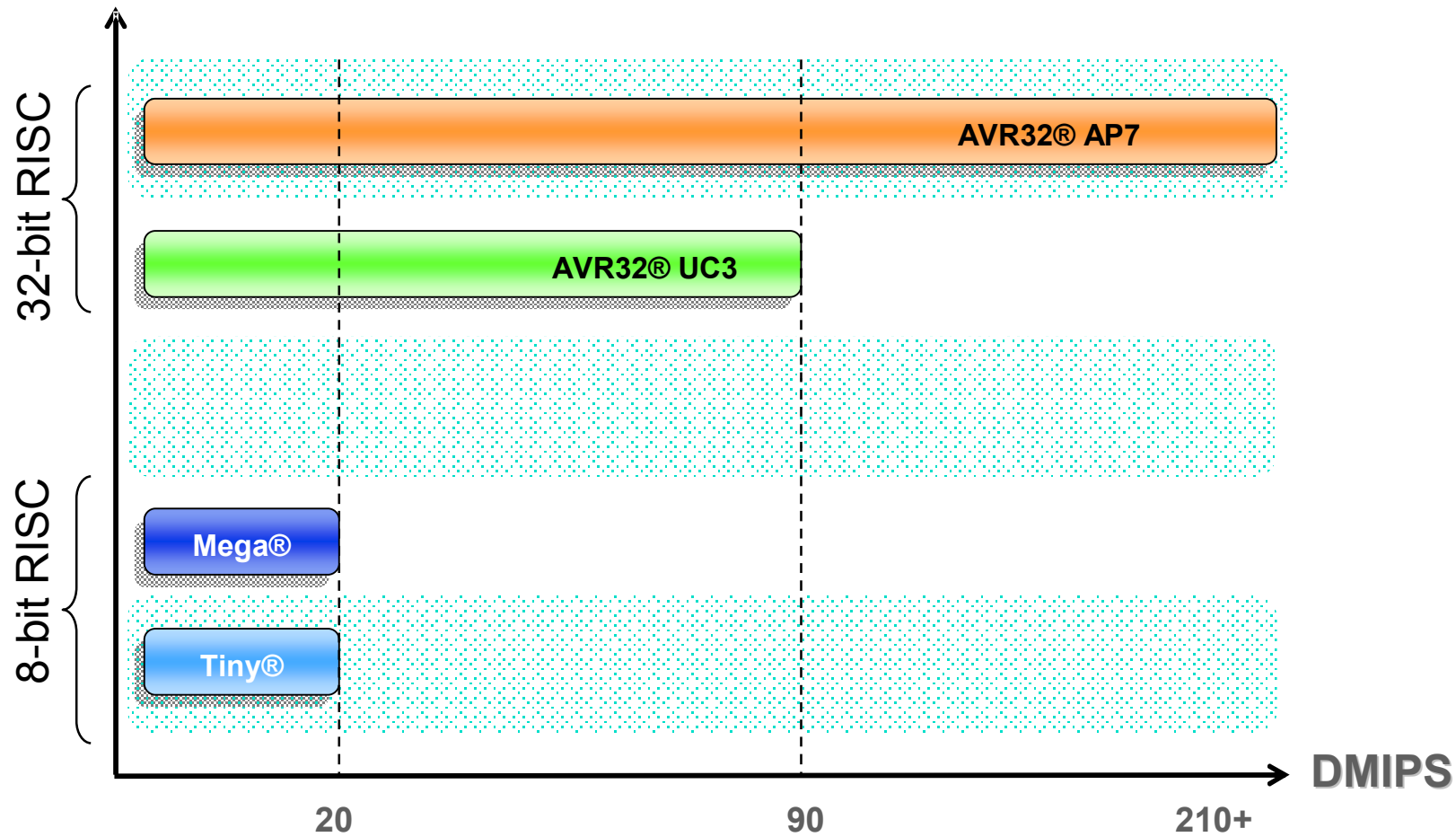


## Agenda

- n Introduction to AVR32**
- n AVR32 Products and Roadmap**
- n Development Tools**
- n Summary**

# AVR32 – One Architecture – Two Families

## AVR Families



## AVR32 Product Families

### *AVR32 AP7 Family Application Processors*

- 280 DMIPS @ 200MHz
- 7-stage CPU pipeline
- SIMD / DSP instructions
- Instruction & data caches
- Memory management unit
- Built for Linux

### *AVR32 UC3 Family Flash Microcontrollers*

- 90 DMIPS @ 66MHz
- 3-stage CPU pipeline
- DSP Instructions
- Instruction/data prefetch
- Memory protection unit
- Embedded Flash

## AVR32 UC3 Microcontrollers

### n High Performance

- § Innovative RISC & DSP instructions
- § Fast event handling
- § Multi-layer databus
- § Peripheral DMA

**1.36 DMIPS / MHz**  
**Up to 90 DMIPS at 66MHz**

*FIR filter: 4.5 cycles / tap*

### n Low Power Consumption

- § More performance per Watt
- § State of the art low power engineering
- § Do more work by clock cycle
- § Multiple sleep modes

**0.38mA / MHz**  
**23mA at 60MHz (3.3V)**

### n Low Cost

- § Smaller memory footprint
- § High chip integration
- § Easy software programming
- § Low-cost development tools

**AVR32 code is 30% to 50%  
smaller than ARM code**

## More Performance – Less Power

Device	CPU	Max. MHz	Max. DMIPS*	DMIPS* / mW	I <sub>dd</sub> @36MHz @3.3V
AVR32 UC3B	AVR32	60 MHz	82 DMIPS	<b>1.08</b>	13.8 mA
AVR32 UC3A	AVR32	66 MHz	<b>90 DMIPS</b>	<b>0.73</b>	20.3 mA
STM32F103	Cortex-M3	72 MHz	90 DMIPS	<b>0.62</b>	22 mA
LM3S6965	Cortex-M3	50 MHz	63 DMIPS	<b>0.39</b>	35 mA
LPC236x	ARM7	72 MHz	50 DMIPS	<b>0.13</b>	57 mA
SAM7X512	ARM7	55 MHz	39 DMIPS	<b>0.32</b>	24 mA

\*AVR32 : 1.36 DMips/MHz

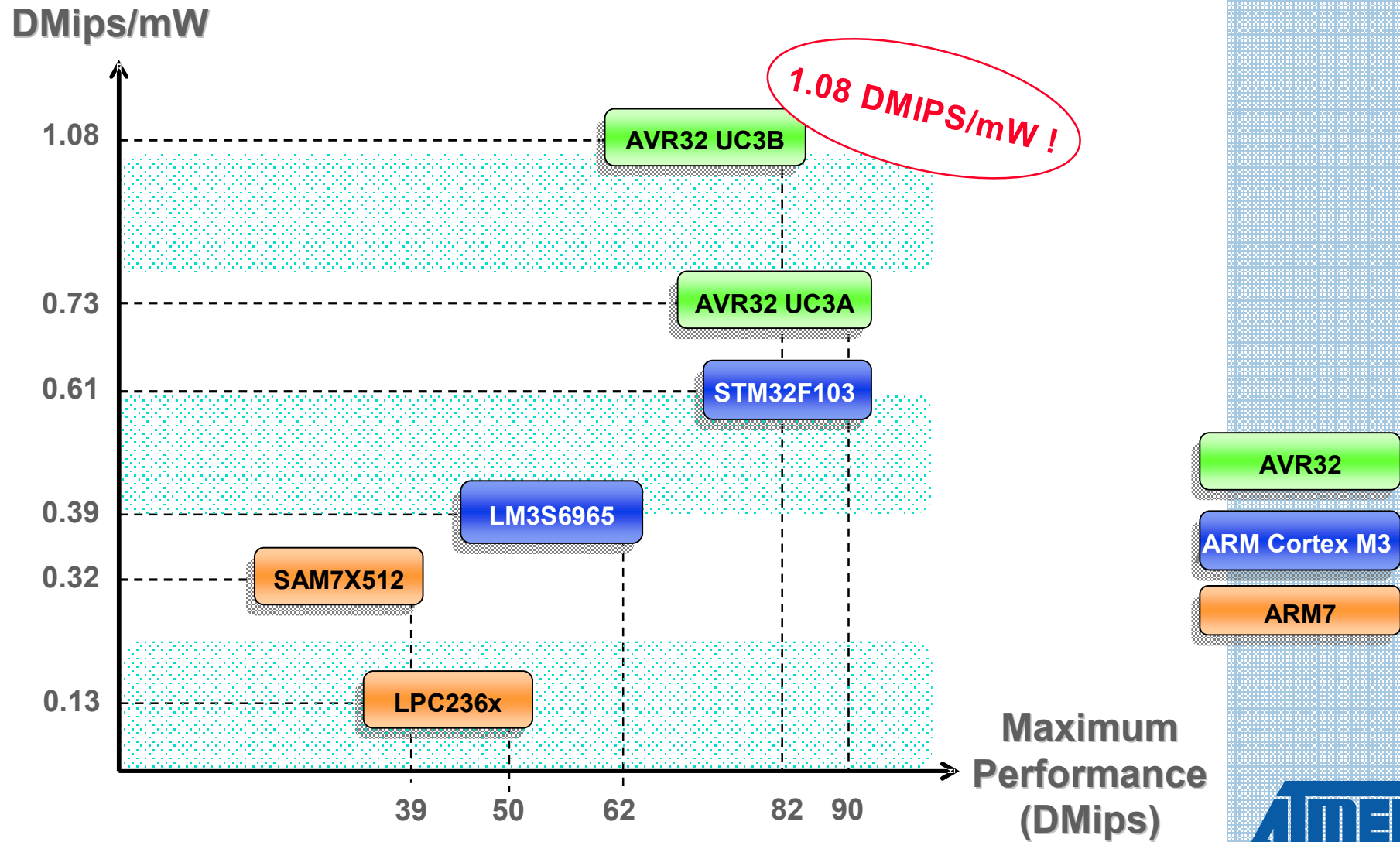
\*ARM Cortex-M3 : 1.25 DMips/MHz

\*ARM7 : 0.70 DMips/MHz

\*For simplicity, max. DMips and DMips/mW calculated with 0 waitstates memory access.



# More Performance – Less Power

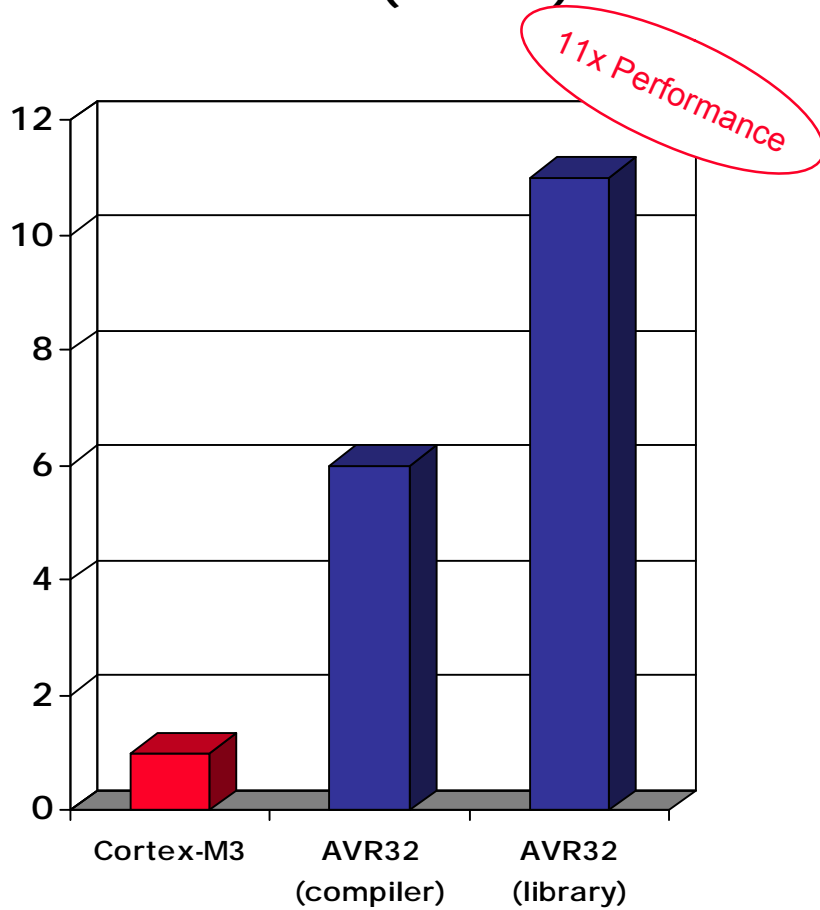


(Graph to scale)

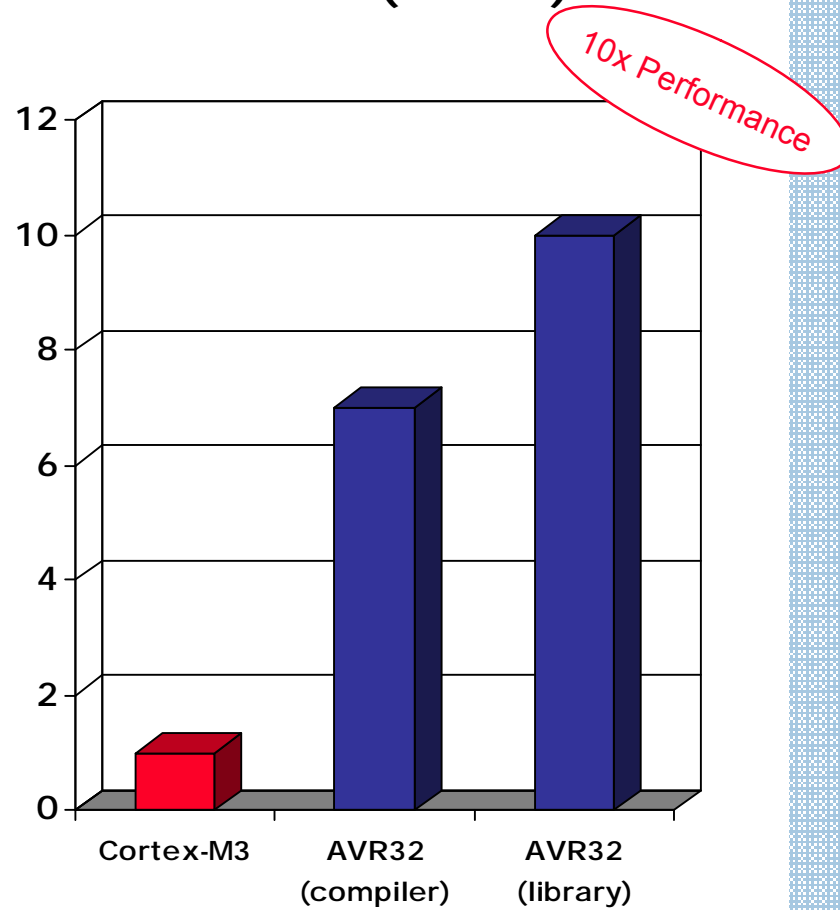


## Unrivaled DSP Performance

### FIR filter (32-bit)



### IIR filter (32-bit)



## Code Density is still important!

### **n Higher performance**

- § Fewer instructions to read from flash
- § Program executes faster

### **n Less power consumption**

- § Fewer flash reads minimize bus activity
- § Fewer instructions propagate through the pipeline

### **n Smaller memory footprints**

- § Reduced cost

## Chip Integration

**Unique integration eliminates external components**

### **n Key differentiators**

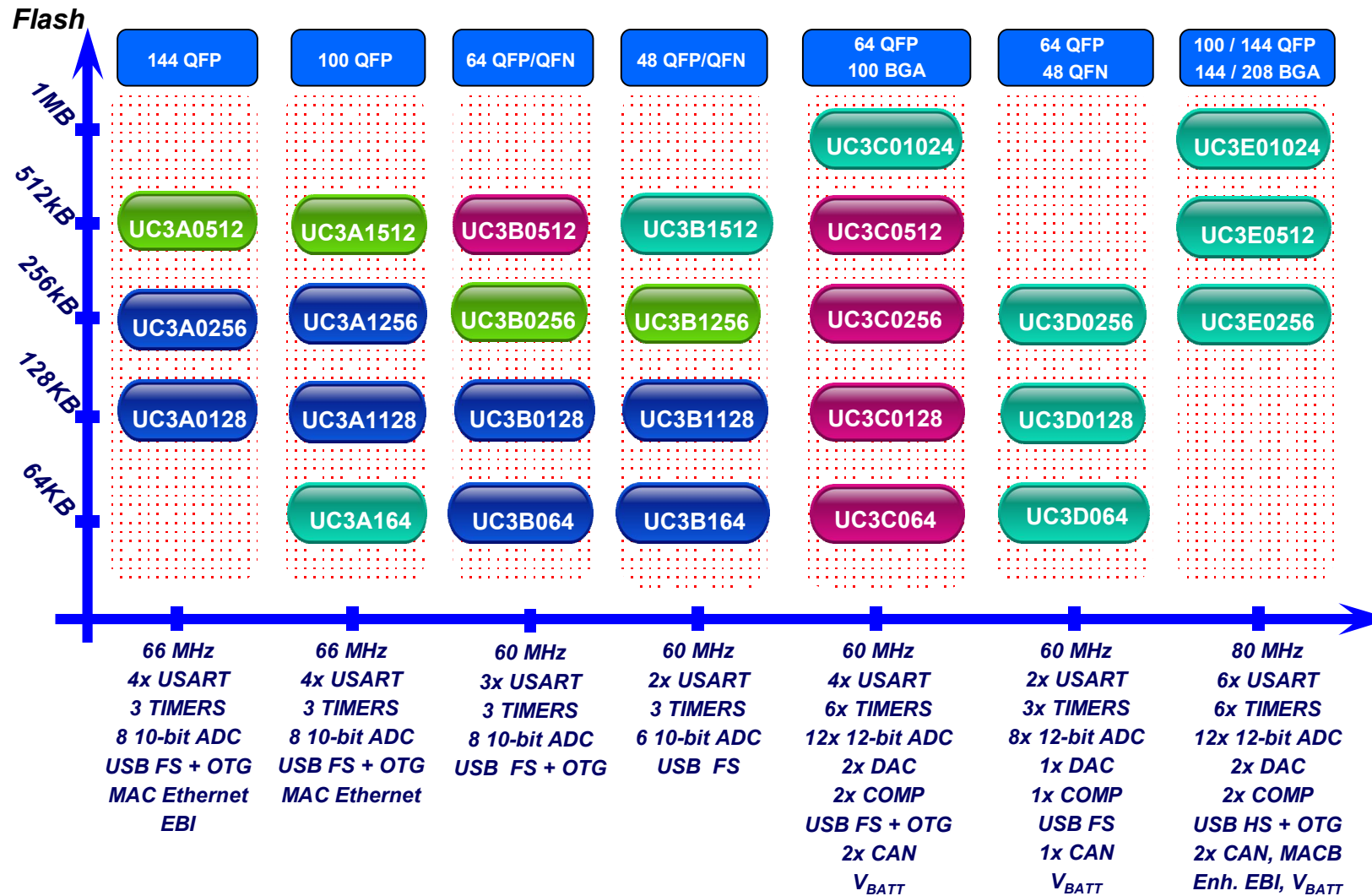
- § **High-speed PWM**
- § **Internal RC oscillator**
- § **Internal power management**
- § **Single voltage supply**
- § **Internal 1.8V regulator**
- § **Internal USB physical driver**
- § **Safety functions**
- § **Internal dual PLL**
- § **On-chip debug**



# AVR32 UC3 Product Overview



## AVR32 - UC3 Product Roadmap



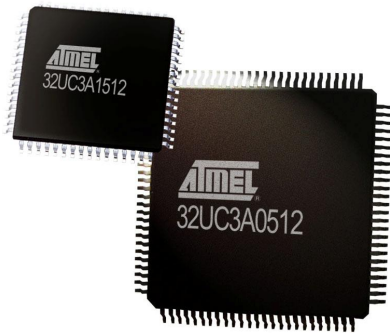
- Available
- In Fab
- In Development
- In Spec

**All Products**

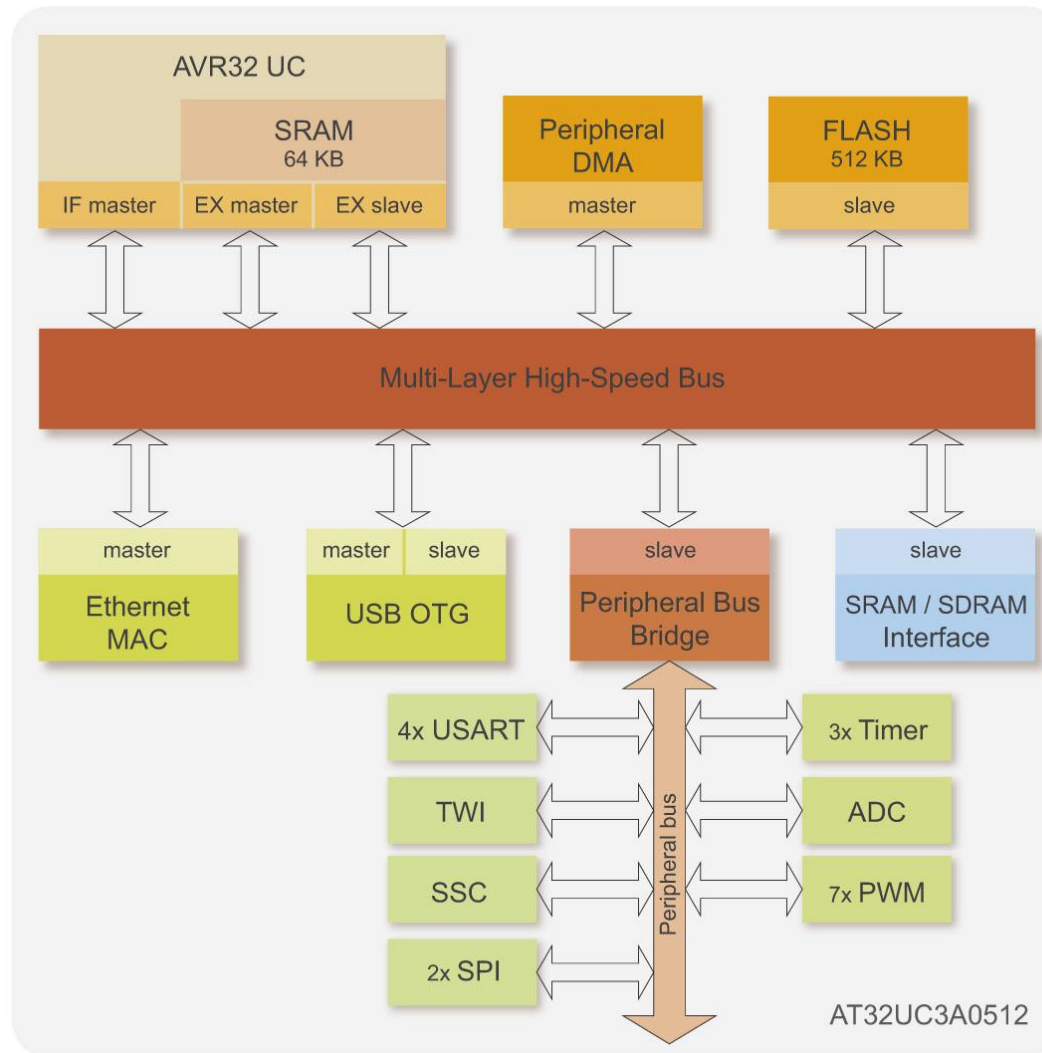
- PWM
- SPI
- SSC
- TWI
- RTC, HWDT



## AT32UC3A Block Diagram



*Communication High-Way*



## AT32UC3A Highlights



### n Communication

- § Ethernet MAC
- § USB Device with On-The-Go Host and internal PHY
- § Peripheral DMA with multi-layered databus
- § 4 USART, 2 SPI, 1 TWI, I2S

### n Large On-Chip Memory

- § 32 – 64 kB internal SRAM
- § 128 – 512 kB internal Flash
- § External SRAM / SDRAM interface

### n High Performance

- § Unique AVR32 CPU with DSP arithmetic

### n High Pin Count

- § 100-pin & 144-pin package
- § Up to 109 I/O pins

## UC3A Key Features

**n 90 Dhrystone MIPS @ 66MHz**

### n Peripherals

- § 4 USARTS with hardware flow control
- § 1 USART is full featured (modem, 7816, IRDA)
- § 13 timers (HWDT, RTT, OS Timer)

### n Power Consumption

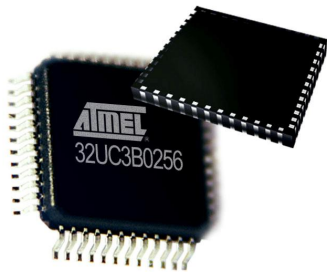
(25°C, typical)

- § 40mA @ 66MHz (3.3V)
- § 40µA deep-stop single power supply

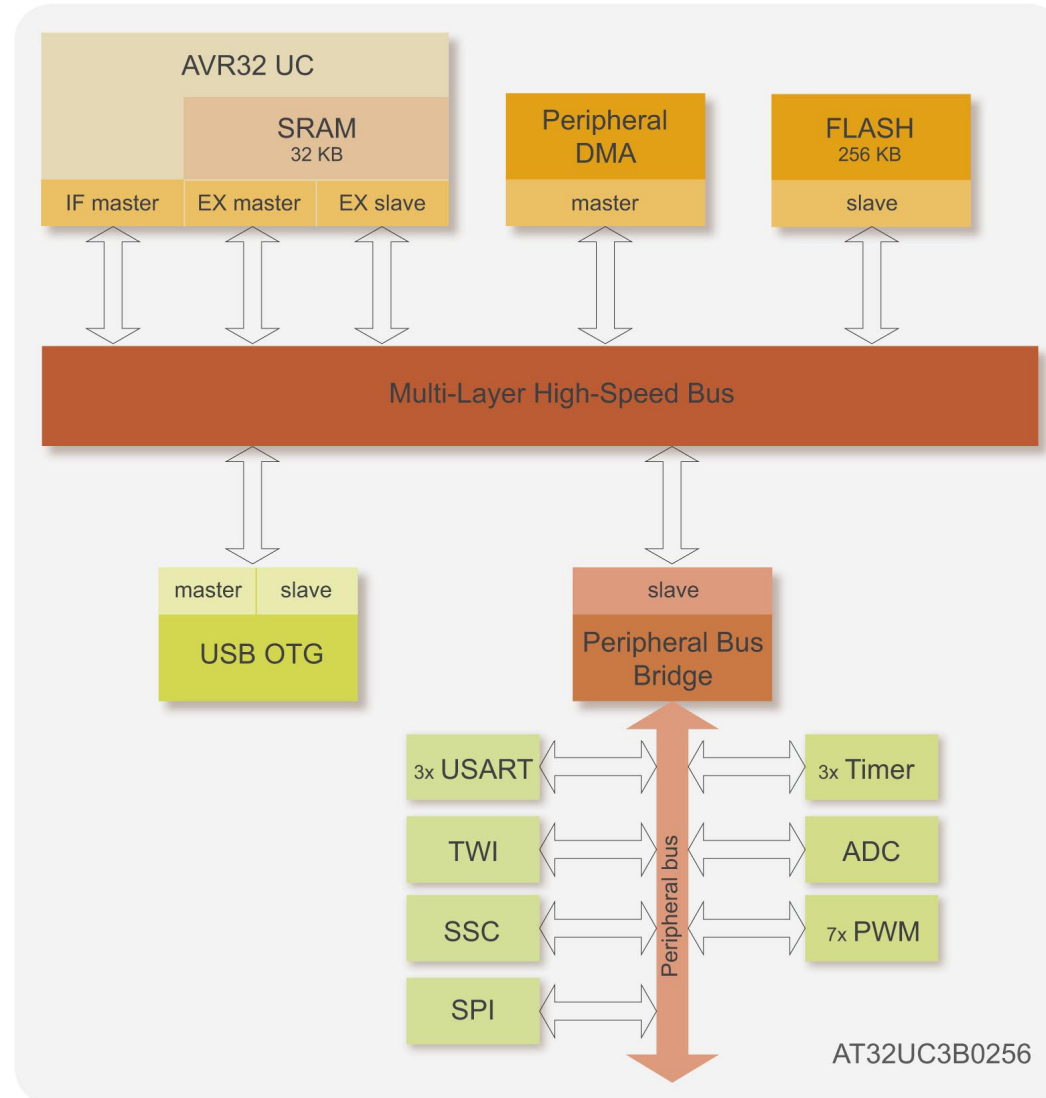
Series	AT32UC3A Series	
	A0 Series	A1 Series
Op. Frequency	66MHz	
Op. Voltage	3.3V	
Flash (KB)	512 / 256 / 128	
RAM (KB)	64 / 64 / 32	
HMATRIX / PDC	6 / 15	
SRAM/SDRAM Interface	Yes	No
Ethernet MAC	Yes	
FS USB 2.0	Device OTG	
Timers	3	
PWM	6 + 1	
UART	4	
SPI	2	
TWI	1	
SSC	1	
ADC	8 Ch. 10-bits	
Clocks	RC-OSC 2xOsc 2xPLL 32K-Osc	
Packages	LQFP144	TQFP100
Total GPIO's	109	69



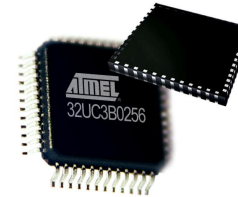
## AT32UC3B Block Diagram



**Low Power**



## AT32UC3B Highlights



### n Low Power Consumption

- § 0.38 mA / MHz
- § 1.08 DMips / mW
- § 15 $\mu$ A Standby Power (dual power supply)
- § USB Powered with wake up on USB connect detect

### n Communication

- § USB Device with On-The-Go Host
- § 3 USART, 2 SPI, 1 TWI, 1 I2S
- § Peripheral DMA with multi-layer data bus

### n High Performance

- § Unique AVR32 CPU with DSP arithmetic

### n Low-Pin Count

- § 64-pin & 48-pin package
- § Peripherals available on multiple pins

## UC3B Key Features

**n 82 DMIPS @ 60MHz**

**n USB Powered device**

- § Software controlled attach
- § Wake-up from sleep modes on attach

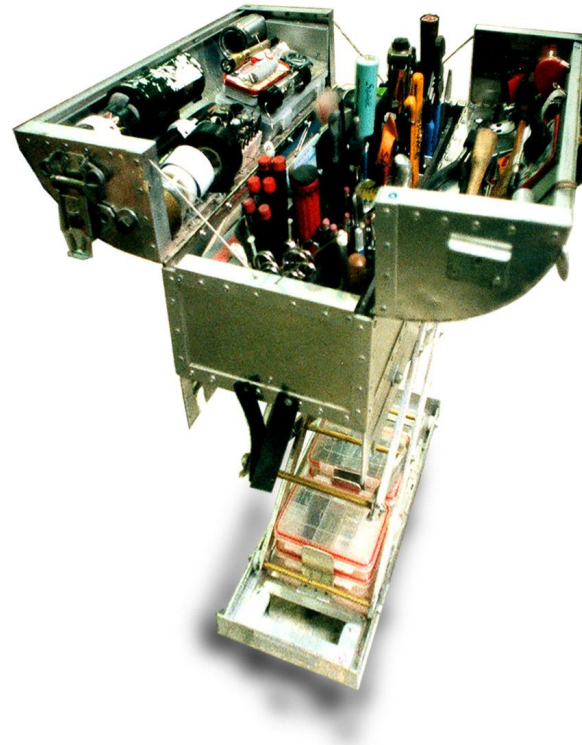
**n Power Consumption**

(25°C, typical)

- § 23mA @ 60MHz (3.3V)
- § 30µA deep-stop single power supply
- § 15µA deep-stop dual power supply

Series	AT32UC3B Series	
	B0 Series	B1 Series
Op. Frequency	60MHz	
Op. Voltage	3.3V	
Flash (KB)	256 / 128 / 64	
RAM (KB)	32 / 32 / 16	
HMATRIX / PDC	5 / 7	
Ext Bus Interface	No	
Ethernet MAC	No	
FS USB 2.0	Device OTG	Device
Timers	3	
PWM	6 + 1	
UART	3	2
SPI	1	
TWI	1	
SSC	1	No
ADC	8 Ch. 10-bits	6 Ch. 10-bits
Clocks	RC-OSC 2xPLL 32K-Osc	
	2xOsc	1xOsc
Packages	TQFP/QFN 64	TQFP/QFN 48
High Current GPIO's	4 x 16mA	
Total GPIO's	44	28

# AVR32 UC3 Development Tools



## AVR32 Studio

### n Integrated Development Environment

- § Edit
- § Compile, Assemble & Link
- § Program
- § Run
- § Debug
- § Analyze



### n Seamless integration

- § JTAGICE mkII debugger
- § AVR32 GCC Toolchain (GCC & GDB)

### n Available for Windows and Linux

## AVR32 UC3 Software Tools

### n Compilers

- § IAR Embedded Workbench
- § GNU GCC



### n RTOS

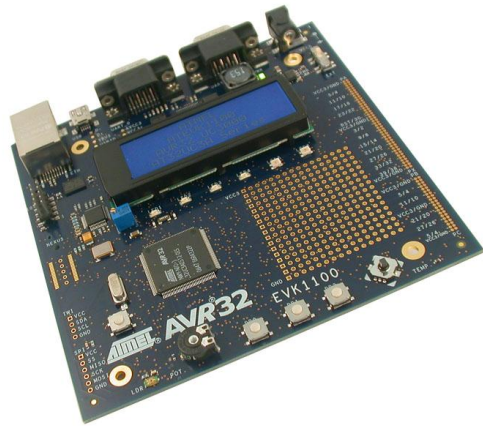
- § ExpressLogic
  - FileX, NetX, UsbX,...
- § Micrium
  - $\mu$ C/FS,  $\mu$ C/TCP-IP,  $\mu$ C/USB,...
- § freeRTOS
  - File system, TCP/IP, USB, ...



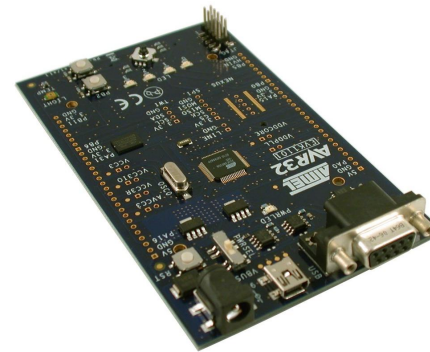
## AVR32 UC3 Atmel Hardware Tools

LOW COST!

n EVK1100 (AT32UC3A Series)



n EVK1101 (AT32UC3B Series)



n STK600 (all series)



n JTAGICE mkII Debug Adapter



## AVR32 Software Framework

**FREE!**

### n Code examples

- § Drivers
- § DMA configuration
- § Complete applications

### n Reference designs

- § EVK1100, EVK1101
- § Hardware

### n Training tutorials

- § Getting started guides

### n Optimized code library

- § Floating point arithmetics
- § Fixed point arithmetics
- § DSP functions
- § Comm. drivers
- § Audio codecs
- § Display drivers
- § Picture codecs
- § USB stack & drivers
- § TCP/IP stack
- § Web server
- § FAT32 file system
- § Real time OS

## AVR32 UC3 Summary

### **n Industry's Best**

- High integration level (memory, peripherals, power management)
- Performance, code density, power consumption
- Easy to use, great development tools, excellent support

### **n AT32UC3A: Industry's Best Connectivity**

- USB 2.0 Full Speed + OTG Host + Ethernet MAC + 4x Serial
- Large memory footprints (both Flash and SRAM)
- External Bus Interface

### **n AT32UC3B: Industry's Best 32-bit Low-Pin Count MCU**

- USB 2.0 Full Speed + OTG Host
- Small Package with flexible alternate function management
- Low Power (both active and stand-by)



# AVR32<sup>®</sup>

