

## ➤ **32-bit AVR UC3 Microcontrollers** Optimized for System Performance

- True 1.6V operation
- More MHz per mW
- Unrivalled DSP performance
- Peripheral DMA controller

[www.atmel.com/UC3](http://www.atmel.com/UC3)



## AVR Solutions

### 8- and 32-bit Low-Power, High-Performance MCUs

AVR combines the most code-efficient architecture for C and assembly programming with the ability to tune system parameters throughout the entire life cycle of your key products. No other microcontrollers deliver more computing performance at a lower power consumption. Combined with industry leading development tools and design support, you get to market faster. And once there, you can easily and cost-effectively refine and improve your product offering.

It's simple: AVR works across the entire range of applications you're working on, or want to work on.

#### 32-bit AVR UC3

The 32-bit AVR UC3 product family is built on the high-performance 32-bit AVR architecture and optimized for highly integrated applications. The 32-bit AVR UC3 microcontrollers deliver high computational throughput, deterministic real-time control, low power consumption, low system cost, high reliability and ease of use. The 32-bit AVR CPU includes cutting-edge features such as integer and fixed point DSP arithmetic, single-cycle multiply and accumulate instructions, and single-cycle SRAM access. The peripheral DMA controller and multi-layer high-speed bus architecture make the UC3 core ideal for high throughput applications. UC3 devices are perfectly suited for portable and battery-powered applications due to their outstanding low power properties.



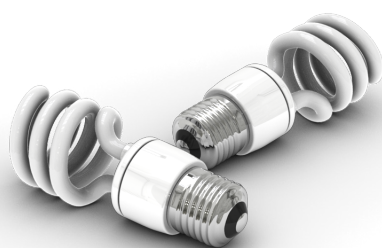
#### 8/16-bit AVR XMEGA

The AVR XMEGA delivers 16-bit performance and leading low-power features at an 8-bit price point. With a DMA controller, an innovative Event System, crypto engine, and high-speed ADC and DAC, AVR XMEGA pushes the boundaries for high-performance 8/16-bit MCUs.

All AVR XMEGA devices are compatible with tinyAVR and megaAVR devices. Within the XMEGA family, devices are 100% code compatible across all devices from the smallest to the largest. This makes it possible to develop with any XMEGA device, and switch to any other XMEGA device later without having to change any code. This allows multi-project development teams to keep and maintain only one code base and use and re-use this across multiple projects. The result is much faster development and prototyping cycles.

#### 8-bit megaAVR

The megaAVR family offers the broadest selection of devices and peripheral options, making them suitable for a wide range of applications. The family contains devices with LCD, USB, CAN, and LIN interfaces, in addition to the standard SPI, UART and I2C interface. Developed for applications that need large amount of program code, megaAVR offers substantial program and data memories. Better still, megaAVR features self-programming flash for fast, secure, cost-effective field upgrades.



#### 8-bit tinyAVR

tinyAVR devices are optimized for a wide range of applications that require a small but powerful microcontroller. They are perfect for size constrained applications and they are often found as glue logic in bigger systems. boards and is available with integrated A/D converter and EEPROM memory.

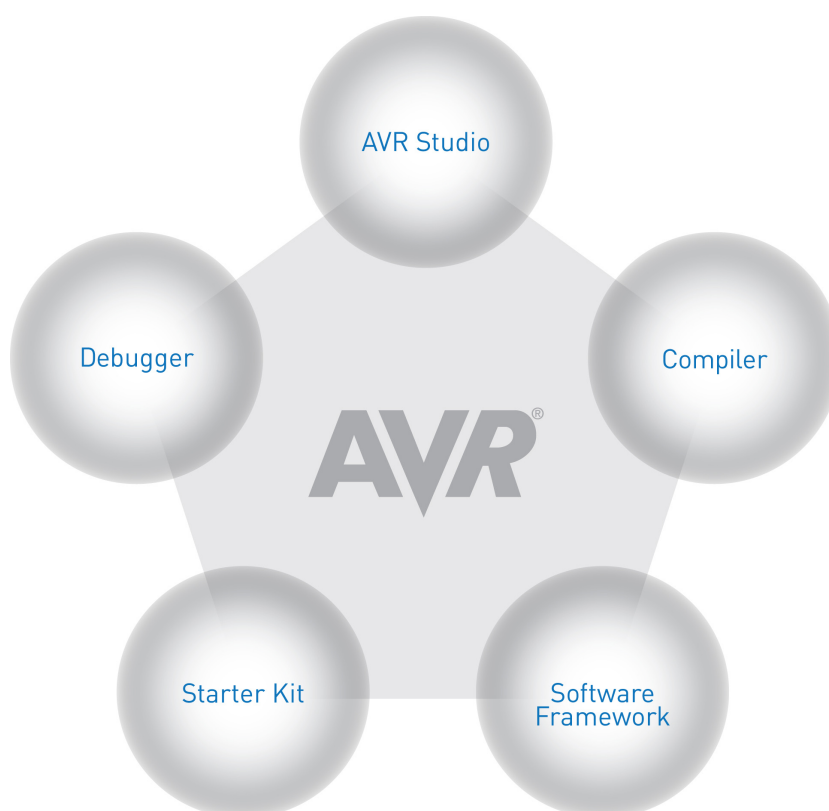
By delivering Flash flexibility at Mask ROM prices, tinyAVR significantly cuts your time to market, while boosting your bottom line. And there's nothing tiny about that.

## Ease of Use

Seamless integration between devices, tools, software framework and support

### AVR Tools – Quality and Low cost

32-bit AVR UC3 microcontrollers benefit from the well-established AVR tools and software chain renowned for its quality and ease of use. Selecting the UC3 microcontroller will bring your application higher performance and lower power consumption, as well as a seamless ecosystem of source code libraries, development tools, documentation, and a large user community. All this will allow you to focus on building better products and bringing them to market faster. As an embedded developer you will find it easy to succeed with the 32-bit AVR microcontrollers.



### Debugging and In-system Programming

32-bit AVR UC3 devices include a non-intrusive On-Chip Debug system that requires no device resources. This gives real-time access to all peripheral registers, data and program memories, and provides support for an unlimited number of break points. The UC3 provides fast serial programming interfaces, including USB, for production line or in system programming. By including the bootloader found in the AVR UC3 Software Framework in a project, the UC3 can also receive flash upgrades in the field through virtually any interface without reset or halt of critical program execution. The serial number in each device eases implementation of safe crypto bootloaders, networking applications, authentication and life cycle product tracking.

### Documentation, Software and Support

From the smallest device to the highest performance processors, reference datasheets describing features and implementations are available at [www.atmel.com/UC3](http://www.atmel.com/UC3). Application notes and our unique free AVR UC3 Software Framework library make it easy to start development.

## AVR UC3 Software Framework

### Software that Releases the Superior AVR Performance

#### Library of C Source Code

The AVR UC3 Software Framework is a collection of production-ready source code written and optimized by Atmel application experts and tested in hundreds of production designs. Using these peripheral drivers, communication stacks and application-specific libraries is the quick and effortless way to release the superior AVR performance. The AVR UC3 Software Framework supports all 32-bit AVR devices and development kits and is compatible with both AVR GNU Toolchain and IAR Embedded Workbench® compilers.

#### Drivers

##### Peripheral and CPU Drivers

A complete set of CPU and Peripheral drivers hide any device specific peripheral features below a standard set of Application Peripheral Interfaces (API) function calls to makes the migration between AVR devices quick and easy. Peripheral drivers include code used to initialize and service the clock system, I/O multiplexing, peripheral interrupts, DMA transfers and Peripheral Event System connections.

#### Components

##### External Peripherals

The AVR UC3 Software Framework contains drivers for popular off-chip components such as QTouch® capacitive touch keyboards, LCD displays, SRAM/SDRAM/NAND Flash memories, SD/MMC storage cards, and audio amplifiers/codecs.



#### AVR UC3 Software Framework Contents

- Peripheral and CPU drivers
- Communication library
- USB/ TCP/IP/ Bluetooth®/ IEEE 802.15.4™
- Storage library
- NAND/ SD/ MMC/ Memory stick
- DSP library
- Audio library
- Security and encryption library
- Graphics Toolkit and library
- FAT filesystem
- External components library
- LCD/ Sensors/ Keyboards

#### Boards

##### Hardware Abstraction Layer

To simplify the process of writing code for a specific hardware board, the AVR UC3 Software Framework uses a Boards layer to describe the external hardware and configure the board specific multiplexing of peripheral functions through the AVR I/O pins. Replacing pin numbers by more logical names when addressing external hardware makes the source code easier to read, and also simplifies the process of migrating a project from one board to another.

## Services

### Floating Point and DSP Arithmetic

The 32-bit AVR DSP Library is a complete set of math functions optimized in assembly by Atmel AVR experts.

#### DSP Library: 70 functions in 7 categories

- Basic filtering
- Operators
- Signal generation
- Transforms
- Vectors
- Windowing
- Advanced encoders and re-samplers

### Communication Stacks

The 32-bit AVR UC3 is built for very high speed communication, and the communications library contains complete communication stacks for USB, TCP/IP, and RF communication

- **USB stack:** Host or device configuration. Full support for popular classes including HID, Mass Storage, Audio, CDC serial port, and Device Firmware Upgrade
- **TCP/IP stack:** IP, TCP, UDP, ICMP, DHCP, PPP and ARP low level functions. FTP server, HTTP web server, SMTP client, and POP3 client
- **Bluetooth stack:** Will be added in 2010
- **IEEE 802.15.4 ZigBee PRO stack:** Will be added in 2010

### Encryption Library

The 32-bit AVR instruction set contains native support for encryption; a library of popular cryptographic functions for added security to any application. The source code is optimized in assembly by Atmel software experts for maximum speed and minimal size. The library contains AES, 3DES, ARC4, MD{2, 4, 5}, SHA-1, SHA-256, RSA1024, X.509, SSL version 3, and TLS version 1, and integrates seamlessly with other libraries such as the TCP/IP and USB communication stacks and memory card drivers.

### Audio Library

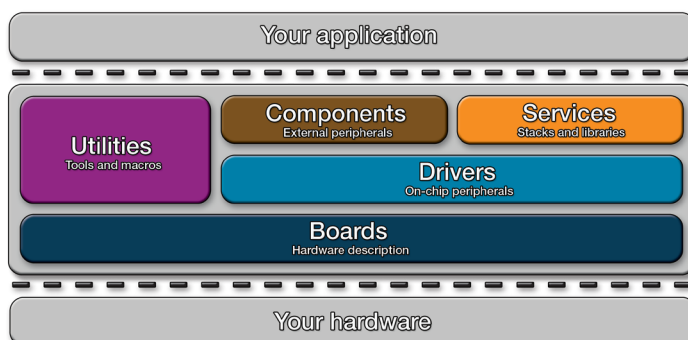
The Audio library contains software for decoding of popular audio formats, including MP3 and WMA. The audio library also includes support for docking audio players and the popular iPod®/ iPhone™ from Apple® via USB. The library will be expanded to support the OGG and AAC in 2010.

### Picture Library

This library is used for decoding and rescaling multiple picture formats including JPEG and BMP, and displaying them on an LCD screen.

### File System

The 32-bit AVR includes FAT12/16/32 file system support. It is also optimized for seamless integration with USB mass storage devices and SD memory cards. The library is complete with example code demonstrating how to implement a memory abstraction layer, a file-based data logger, and a shell example across an RS232 line.



## 32-bit AVR UC3 Flash Microcontrollers features

- True 1.6V operation
- More MHz per mW
- Unrivalled DSP performance
- Peripheral DMA controller

## HIGHER CPU PERFORMANCE

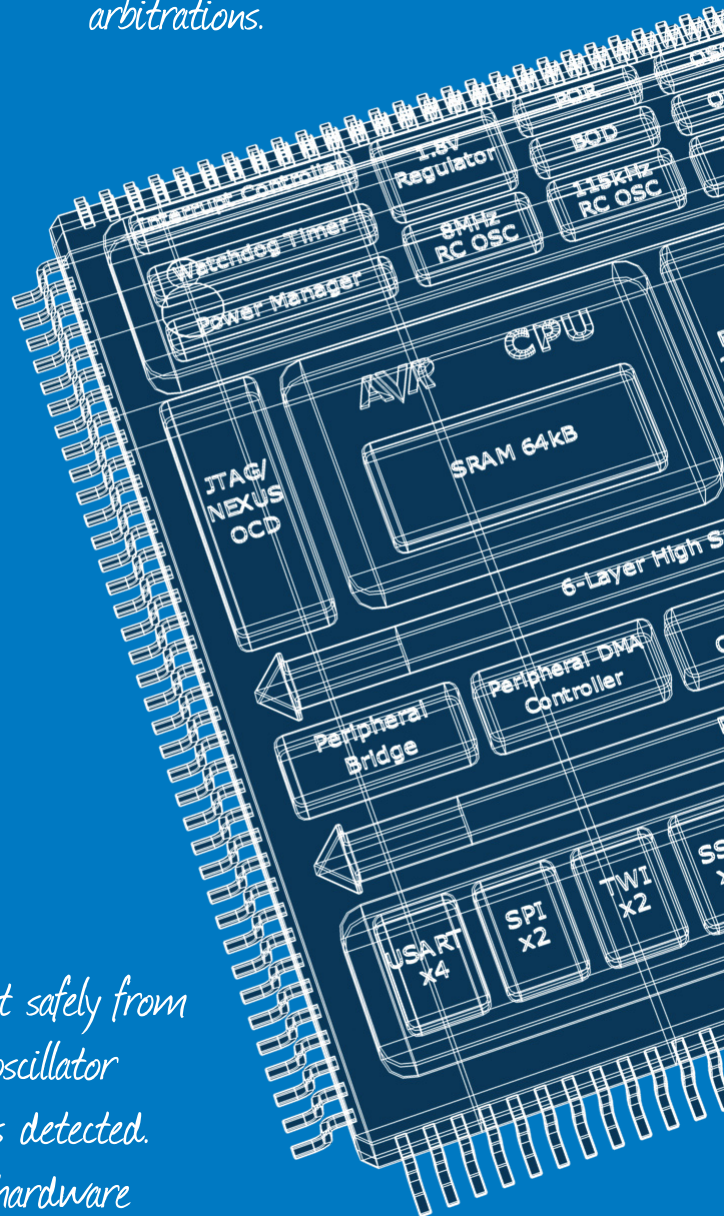
- The 32-bit AVR CPU and its tightly coupled dual port SRAM allow fast computation without latencies from pipeline stalls or system bus arbitrations.

## DETERMINISTIC REAL-TIME CONTROL

- Fast context switches, atomic peripheral read-modify-write access and a fully autonomous Peripheral Event System allow predictable external event handling.

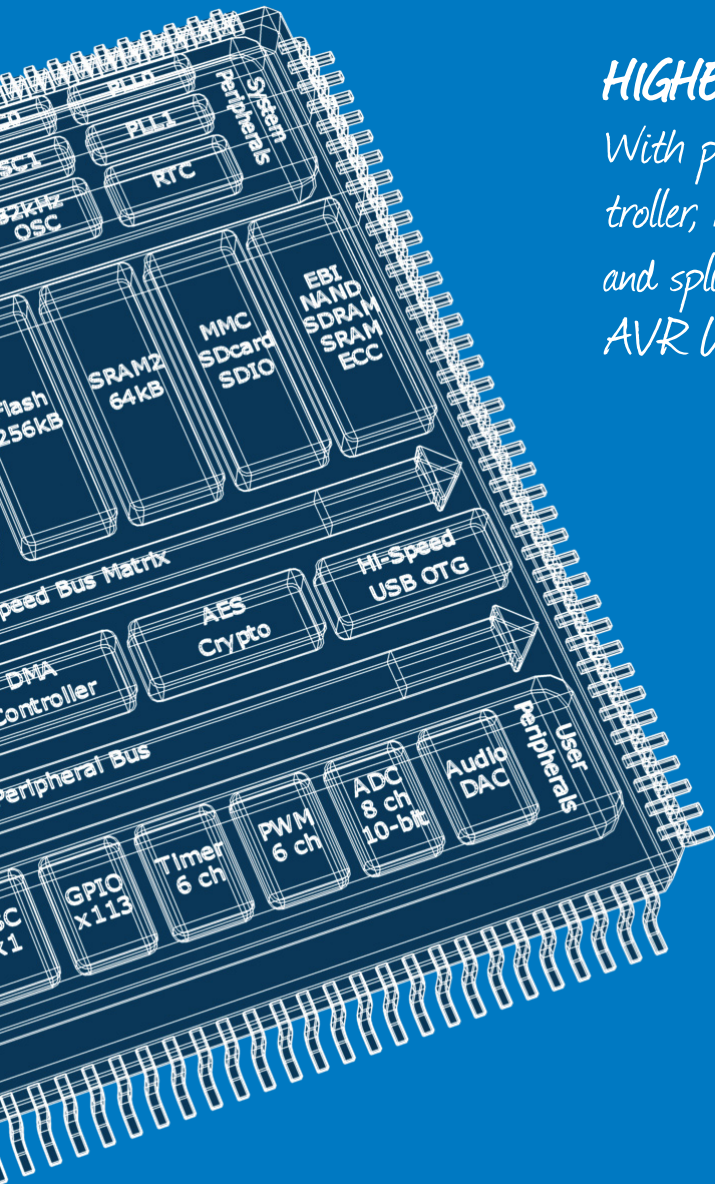
## HIGH RELIABILITY

- The 32-bit AVR UC3 microcontrollers boot safely from the on-board RC oscillator, and return to RC oscillator operation if external crystal oscillator failure is detected. The brown-out detector and the windowed hardware watchdog protect the system from environmental malfunctions. The non-maskable interrupt ensures critical event handling. The MPU and privileged operating modes keep the kernel safe from runaway application code.



## EASY TO USE

- The seamless integration between 32-bit AVR microcontrollers, development tools, source code libraries and reference designs enables the user to focus only on application development. Backed up by Atmel's excellent design support and a large and active developer community, the 32-bit AVR will cut development cycles and reduce time to market.



## HIGHER DATA THROUGHPUT

With parallel buses, peripheral DMA controller, memory to memory DMA controller and split memory architecture, the 32-bit AVR UC3 delivers superior bandwidth.

## LOW POWER CONSUMPTION

The 32-bit AVR UC3 includes a state of the art low power architecture. It consumes less than 0.8 mW/MHz in active mode. Designed to deliver more work per MHz than any competitor and with features such as dynamic frequency scaling and peripheral event controller, the 32-bit AVR UC3 is the worlds most efficient 32-bit low power alternative in the market today.

## SHORTEST TIME TO MARKET

The 32-bit AVR UC3 Software Framework offers a unique collection of application software, drivers and libraries. Combined with high-quality, low-cost development tools and a skilled world wide support staff we are proud to ensure the shortest time to market.

## System Performance

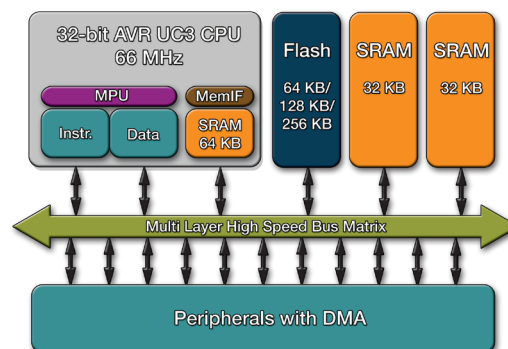
For embedded systems, system performance is much more than a good MIPS number. It is important to have powerful, fast peripherals and an energy-efficient memory system that allows the application to run effortlessly with minimal power consumption.

### Single Cycle SRAM

Fast SRAM access is critical to achieving the necessary computing performance. The UC3 CPU has a single-cycle access to the SRAM embedded in the CPU itself.

### Split Memory Architecture with DMA

High performance peripheral modules require a true memory DMA controller. In addition, the memory is partitioned such that one memory block resides inside the CPU to support single cycle memory access during program execution. To maximize the bandwidth, two more SRAMs are placed on two different layers on the multi-layered high-speed bus and can act as data buffers for high-speed peripherals like the USB. The SRAMs are coupled to the memory DMA controller such that data can be efficiently moved without loading the CPU.

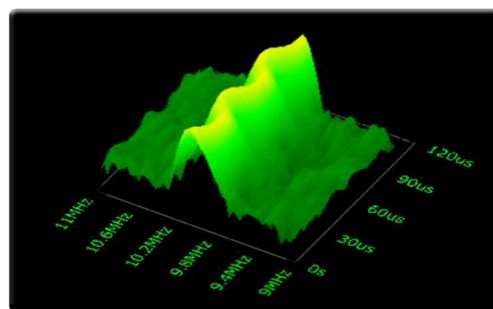


### Bus Matrix

To ensure sufficient data bandwidth, the 32-bit AVR architects have designed a set of parallel buses where each bus master has a dedicated bus for all the slaves. This gives the 32-bit AVR a tremendous data bandwidth and removes the bottleneck encountered in traditional 32-bit microcontrollers.

### Unrivalled DSP Performance

By including powerful instructions for single cycle multiply accumulate and fractional multiply for various number formats, the 32-bit AVR UC3 delivers unrivalled DSP performance compared to legacy architectures. In the AVR UC3 Software Framework more than 70 DSP functions have been assembly optimized utilizing these instructions. DSP has never been easier.



### Code Density and Efficiency

The 32-bit AVR architecture was designed in close cooperation with compiler experts. This ensures that the AVR architecture excels when compiling high-level programming languages like C and C++. Compact and extended instructions are chosen by the compiler without any performance penalty introduced by legacy architectures. A compact code is important, not only because it resolves in a smaller memory footprint, but also because a dense instruction can easily be optimized for both speed and size.



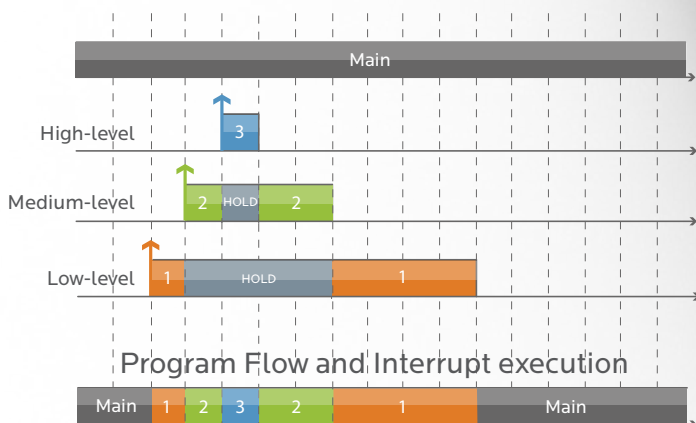
## Peripheral DMA Controller

The Atmel Peripheral DMA controller sets a new standard for data transfer efficiency. If the Peripheral DMA controller is not enabled, the maximum usable transfer rate on the SPI module would be approximately 1 MBit/s, occupying the CPU with more than 50% load just moving data around. With the Peripheral DMA controller this bottleneck is removed and the AVR32 UC3 microcontroller can achieve a transfer rate of 33 MBit/s on SPI and USART with only a 15% load on the CPU. The UC3 can even toggle the I/O pins at 33 MHz.

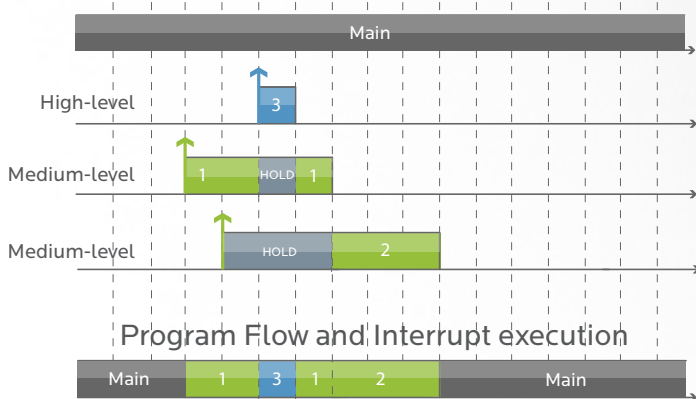
CPU load at various communication speeds		
Bit rate	Peripheral DMA Enabled	Peripheral DMA Disabled
0 Kbit/s	0 %	0 %
400 Kbit/s	0.4 %	17.7 %
1.2 Mbit/s	1.2 %	52.4 %
2 Mbit/s	2.2 %	89.9 %
4 Mbit/s	4.4 %	N/A
33 Mbit/s	14.4 %	N/A

## Interrupt Controller

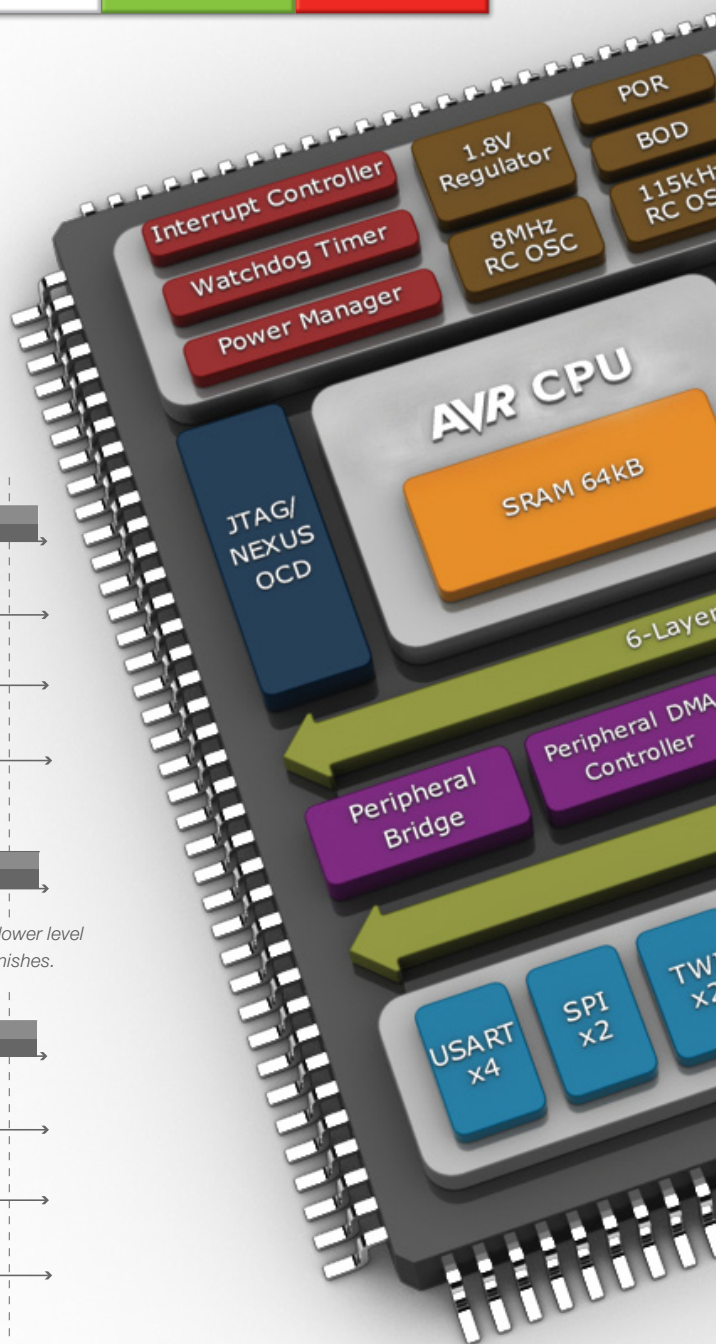
The 32-bit AVR UC3 CPU includes a multi-level interrupt controller. Four priority levels are supported where higher level interrupts are prioritized and executed before low level interrupts. All peripherals can be assigned any interrupt level and the interrupt vector addresses can be changed without stopping the CPU. Interrupt latencies are very fast, typically 11 clock cycles including saving the register file to the stack.



A higher level interrupt will halt execution of a lower level interrupt routine. The lower level interrupt routine will continue and finish after the higher level interrupt routine finishes.



A second interrupt at an interrupt level already being serviced, will pend until the first interrupt routine finishes.



### Security

The 32-bit AVR UC3L provides mechanisms to protect the system from hacker modification, flash software theft and runaway code.



#### Secure CPU State

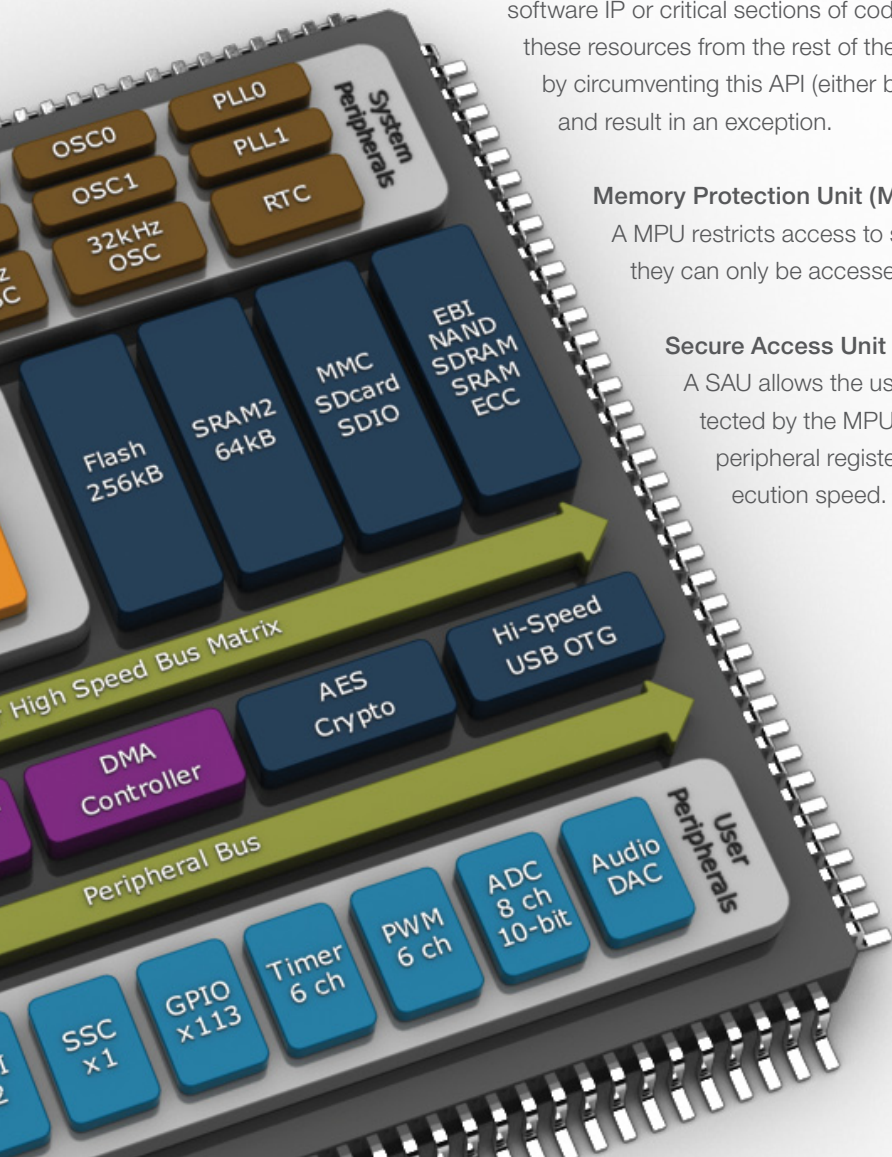
CPU resources and sections of code/data memory can be reserved for proprietary software IP or critical sections of code/data. A special API is used to access these resources from the rest of the code. Attempts to access these resources by circumventing this API (either by hacking or runaway code) will be aborted and result in an exception.

#### Memory Protection Unit (MPU)

A MPU restricts access to selected peripherals and memory regions so they can only be accessed in a controllable way.

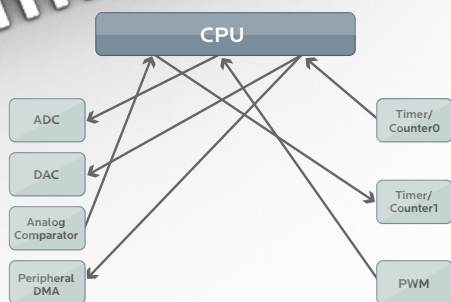
#### Secure Access Unit (SAU)

A SAU allows the user to set-up tunnels through regions protected by the MPU, allowing unrestricted access to specified peripheral registers, reducing code size, and increasing execution speed.

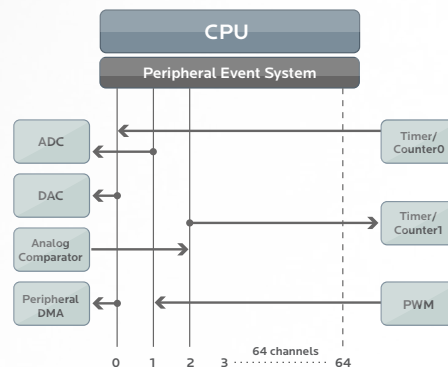


### Peripheral Event System

By removing interrupt-driven data transfer and replacing it with an event-triggered data transfer, the innovative Peripheral Event System in 32-bit AVR UC3 represents a paradigm shift. The Peripheral Event System allows the 32-bit AVR UC3 to send signals (events) directly to other peripherals without involving the CPU. This ensures short and predictable response time, and at the same time it offloads the CPU and reduces power consumption.



Without Peripheral Event System all Peripheral Requests need to be handled by the CPU.



With Peripheral Event System peripherals can send signals (events) to other peripherals.

## picoPower Technology

### Reducing Power Consumption while Maintaining Performance

#### True 1.6V Operation

The 32-bit AVR UC3L family offers true 1.6V operation. All functions — including ADC, DAC, onboard Flash and SRAM — are capable of operating down to 1.62V.

#### Minimized Leakage Current

The 32-bit AVR UC3L leakage current is only 100 nA retaining special purpose registers. The leakage current with a real-time clock running is less than 1.5  $\mu$ A. The real-time clock includes a calendar mode, ensuring that clock cycles are not wasted on calculating date and time.

#### Ultra Low Power 32 KHz Crystal Oscillator

The 32-bit AVR UC3L Real Time Clock consumes less than 1.5  $\mu$ A while running from a 32.768 kHz crystal oscillator.

#### Multiple Clock Domains

The main databus and two peripheral data buses can all be set to individual clock frequencies to ensure that no unnecessary power is consumed. The UC3 microcontrollers also feature two crystal oscillators and dual PLLs and DFFs to simplify the task of selecting a suitable crystal frequency for peripherals such as USB, UART and audio codec.

#### Dynamic Frequency Scaling

Dynamic Frequency Scaling (DFS) reduces power consumption when maximum speed is not required throughout the execution of an application. DFS makes it possible to adapt the clock frequency on-the-fly to an application without halting program execution.

#### Individual Peripheral Clock Control

It is used to turn the clocks on or off dynamically for peripheral units not in use.

#### High Speed I/O Interfaces

The 32-bit AVR UC3 comes with a variety of interfaces that combined with the DMA and Peripheral Event Control creates a fast and powerful communication platform.

##### USART

- Asynchronous and synchronous operation
- SPI Mode
- LIN Mode
- Supports IrDA
- Up to 33 Mbps communication
- Peripheral DMA

##### TWI

- I<sup>2</sup>C and SMBus™ compliant
- Full 100 kHz and 400 kHz support
- Master and Slave operation
- Peripheral DMA

##### Up to 36 PWM channels

- 8-bit resolution
- Up to 150 MHz base clock
- Peripheral Event System

##### Ethernet

- Up to 100 Mbps communication
- Peripheral DMA

##### USB On-the-Go

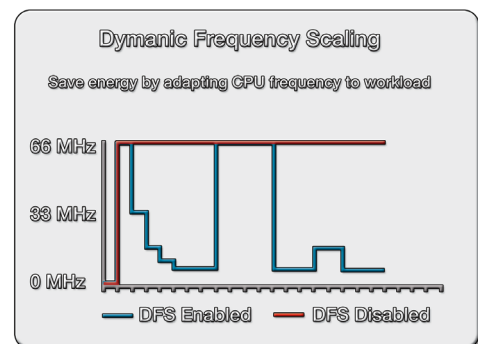
- Host mode
- Up to 480 Mbps communication in Hi-Speed mode
- Peripheral DMA

##### SPI

- Supports up to 15 external devices
- Up to 33 Mbps communication
- Peripheral DMA

##### Synchronous Serial Controller (SSC)

- Full duplex 24-bit I<sup>2</sup>S
- Up to 33 Mbps communication
- Peripheral DMA



## A0/A1 Series — for Ethernet and USB OTG Applications

Designed for high data throughput, low power consumption and outstanding computing performance, the A0 and A1 Series features high connectivity with USB On-The-Go, Ethernet MAC and SDRAM interfaces. These features, combined with a fast flash and large internal SRAM, make ideally suited for data-intensive applications.

The A0 and A1 Series are particularly well suited for applications requiring Ethernet or USB connectivity and high computing performance. These devices are used in a wide range of applications including audio, biometric, communication, industrial control and web servers.

### AT32UC3A0/A1 Key Features

- 128 - 512 KB Flash
- 32 - 64 KB SRAM
- SRAM / SDRAM controller
- Peripheral DMA controller
- Full Speed USB Device + OTG
- Ethernet MAC
- 4 USARTs
- 2 SPI
- 1 I<sup>2</sup>S 24-bit input
- 1 I<sup>2</sup>S 24-bit output
- Multiple timers and PWM
- 16-bit Stereo bit stream DAC
- 5V tolerant I/O
- 100- and 144-pin package options
- QFP and BGA packages
- Qualified for Automotive

## A3/A4 Series — for Hi-Speed USB Applications

### AT32UC3A3/A4 Key Features

- 64 - 256 KB Flash
- 128 KB SRAM (64 KB + 2x32 KB)
- SRAM/ SDRAM controller
- MLC NAND Flash controller
- AES crypto engine
- Peripheral DMA controller
- Memory to Memory DMA
- High Speed USB Device + OTG
- SD/ MMC/ SDIO card controller
- 4 USARTs
- 2 SPI
- 1 I<sup>2</sup>S 24-bit input
- 1 I<sup>2</sup>S 24-bit output
- 16-bit Stereo bit stream DAC
- 100- and 144-pin package options
- QFP and BGA packages

The AVR UC3 A3 and A4 Series are designed for exceptionally high data throughput with Hi-Speed USB On-The-Go, SD/SDIO card, Multi-Level-Cell (MLC) NAND flash with ECC and SDRAM interfaces. With their multi-layered AVR databus, 128 KB on-chip SRAM with triple high-speed interfaces, and multi-channel peripheral and memory-to-memory DMA controller, the A3 and A4 offers outstanding data throughput. They also feature a Hi-Fi stereo Audio DAC and a full duplex multi-channel I2S audio interface.

The A3 and A4 Series are available with an optional AES crypto module capable of 128 to 256-bit AES encryption at speeds of up to 22.8 MBytes/s. Note that export restrictions apply to this device variant.

The A3 and A4 Series are particularly well suited for applications requiring Hi-speed USB connectivity, high computing performance and fast memory interfaces. These devices are used in a wide range of applications including audio, biometric, communication, USB to SDcard bridges and USB dongles.

## B Series — for Battery/USB-Powered Applications

The AVR UC3 B Series is designed for high data throughput, low power consumption and outstanding computing performance. The series features high connectivity with USB On-The-Go. This feature, combined with a fast flash and large internal SRAM, make it ideally suited for data-intensive applications.

The B series is particularly well suited for applications requiring high computing performance and low power consumption in combination with USB connectivity. These devices are used in a range of applications, including USB Human Interface devices, USB stick gateway, biometric, bridging, industrial control, and low-power portable applications.

### AT32UC3B Key Features

- 64 - 512 KB Flash
- 16 - 96 KB SRAM
- Peripheral DMA controller
- Full Speed USB Device + OTG
- 3 USARTs
- 2 SPI
- 1 I<sup>2</sup>S 24-bit input
- 1 I<sup>2</sup>S 24-bit output
- Multiple timers and PWM
- 5V tolerant I/O
- 48- and 64-pin package options
- QFP and QFN packages

## C Series — for Industrial Control Applications

The AVR UC3 C Series is designed for industrial and automotive control applications, including high-speed communication and motor control. The devices feature single or dual CAN interfaces, a full speed USB with OTG, NAND flash and SDRAM interface, PWM with dead-time insertion, two 1.5 MSPS 12-bit ADC with 16 channels and dual sample-and-hold circuitry for synchronized sampling of 2 signals, two 1.5 12-bit analog DAC with dual outputs. Designed with the multi-layered AVR32 databus, 68 KB on-chip SRAM with triple high-speed interfaces, and multi-channel Peripheral and memory to memory DMA controller, the AT32UC3C offers outstanding data throughput.

The AT32UC3C Peripheral Event System provides a connection between on-chip peripherals to off-load the CPU, reduces power consumption and provides a deterministic response to external and internal events.

### AT32UC3C Key Features

- 64 – 512 KB Flash
- 68 KB SRAM (2 x 32 KB + 4 KB)
- SRAM / SDRAM controller
- NAND flash controller
- Peripheral DMA controller
- Memory to Memory DMA
- Peripheral Event System
- Single / Dual CAN interface
- Full speed USB device + OTG
- 16 ch 12-bit ADC, 1.5 MSPS dual
- 2 ch 12-bit DAC, 1.5 MSPS
- PWM with dead-time insertion
- 4 USART
- 2 SPI
- 1 I<sup>2</sup>S 24-bit input
- 1 I<sup>2</sup>S 24-bit output
- 144-, 100- and 64-pin packages
- QFP, QFN and BGA packages

## D Series — for Cost-Sensitive Applications

### AT32UC3D Key Features

- 64 - 256 KB Flash
- 8 - 16 KB SRAM
- Peripheral DMA controller
- Full Speed USB device
- 2 USARTs
- 1 SPI
- 1 Two-Wire Interface
- Multiple timers and PWM
- 48-pin package
- QFP and QFN packages

The AVR UC3 D Series is a cost reduced option, ideal for the most cost-sensitive embedded applications that require USB device connectivity. Designed to be 100% pin and functionally compatible with the UC3B series, the UC3D offers a reduced maximum speed, a USB device interface without OTG function, and I/O pads limited to 3.6V maximum voltage.

## L Series — for Battery-Powered Applications

The AVR UC3 L Series is Atmel's first picoPower 32-bit microcontroller. It delivers down to 0.48 mW/MHz in active operation and sleep mode consumption of 1.5uA with RTC running, or 100nA with all clocks stopped. The L series delivers a wide range of technological innovations to the 32-bit microcontroller market. It is the industry's first 32-bit microcontroller with a built-in Capacitive Touch Peripheral. The new FlashVault™ code protection allows the on-chip flash to be partially programmed and locked, creating secure on-chip storage for software intellectual property. Code stored in the FlashVault will execute as normal, but it cannot be read, copied or debugged. The FlashVault code protection can carry software such as a math library or an encryption algorithm to potentially untrustworthy environments where the rest of the source code can be developed and debugged.

### AT32UC3L Key Features

- 16 - 256 KB Flash
- 8 - 16 KB SRAM
- Peripheral DMA controller
- Peripheral Event System
- Full speed USB device
- 4 USARTs
- 1 SPI
- 2 Two-Wire Interfaces
- 6 channels 12-bit ADC
- 8 Analog Comparators
- 36 PWM channels
- 48-pin package
- QFP and QFN packages

Other innovations first introduced in the UC3L Series include SleepWalking™ intelligent peripherals, a Peripheral Event System, Clock Failure Protection, Spread Spectrum Clocks with fast startup times, a Frequency Meter, an RTC with Crystal Precision Tuner and calendar mode, and a PWM output on all 36 I/O pins.

The L series is targeted at portable consumer applications, board controller, game pads, remote controls, and human interface devices.

# Product Selector Guide

Products	Flash (KBytes)	SRAM (Bytes)	SD/MMC	Ethernet MAC	USB Hi-Speed	USB Full Speed	USB Host/OTG	CAN	USART	SPI with 4x Slave	SSC (FS audio)	TWI (I <sup>2</sup> C)	I/O	16-bit Timer/Counters	PWM (Channels)	RTC/ 32 KHz oscillator	Crystal oscillator	Memory Protection Unit	10-bit A/D (Channels)	12-bit A/D (Channels)	ABDAC (Audio Bitstream DAC)	DAC	Analog Comparator	Crypto (AES)	VCC (V)	Clock Speed (MHz)	Package (b)
AT32UC3A0128	128	32K		1		Y	Y		4	2	1	Y	109	3	13	Y	2	Y	8					3.0 - 3.6	66	LQFP144, TFBGA144	
AT32UC3A0256	256	64K		1		Y	Y		4	2	1	Y	109	3	13	Y	2	Y	8					3.0 - 3.6	66	LQFP144, TFBGA144	
AT32UC3A0512	512	64K		1		Y	Y		4	2	1	Y	109	3	13	Y	2	Y	8					3.0 - 3.6	66	LQFP144, TFBGA144	
AT32UC3A1128	128	32K		1		Y	Y		4	2	1	Y	69	3	13	Y	2	Y	8					3.0 - 3.6	66	TQFP100	
AT32UC3A1256	256	64K		1		Y	Y		4	2	1	Y	69	3	13	Y	2	Y	8					3.0 - 3.6	66	TQFP100	
AT32UC3A1512	512	64K		1		Y	Y		4	2	1	Y	69	3	13	Y	2	Y	8					3.0 - 3.6	66	TQFP100	
AT32UC3A364	64	128K	Y		Y	Y	Y		4	2	1	Y	110	6	13	Y	2	Y	8					3.0 - 3.6	66	LQFP144, TFBGA144	
AT32UC3A3128	128	128K	Y		Y	Y	Y		4	2	1	Y	110	6	13	Y	2	Y	8					3.0 - 3.6	66	LQFP144, TFBGA144	
AT32UC3A3256	256	128K	Y		Y	Y	Y		4	2	1	Y	110	6	13	Y	2	Y	8					3.0 - 3.6	66	LQFP144, TFBGA144	
AT32UC3A364S	64	128K	Y		Y	Y	Y		4	2	1	Y	110	6	13	Y	2	Y	8				Y	3.0 - 3.6	66	LQFP144, TFBGA144	
AT32UC3A3128S	128	128K	Y		Y	Y	Y		4	2	1	Y	110	6	13	Y	2	Y	8				Y	3.0 - 3.6	66	LQFP144, TFBGA144	
AT32UC3A3256S	256	128K	Y		Y	Y	Y		4	2	1	Y	110	6	13	Y	2	Y	8				Y	3.0 - 3.6	66	LQFP144, TFBGA144	
AT32UC3A464	64	128K	Y		Y	Y	Y		4	2	1	Y	83	6	13	Y	2	Y	8					3.0 - 3.6	66	VFBGA100	
AT32UC3A4128	128	128K	Y		Y	Y	Y		4	2	1	Y	83	6	13	Y	2	Y	8					3.0 - 3.6	66	VFBGA100	
AT32UC3A4256	256	128K	Y		Y	Y	Y		4	2	1	Y	83	6	13	Y	2	Y	8					3.0 - 3.6	66	VFBGA100	
AT32UC3A464S	64	128K	Y		Y	Y	Y		4	2	1	Y	83	6	13	Y	2	Y	8				Y	3.0 - 3.6	66	VFBGA100	
AT32UC3A4128S	128	128K	Y		Y	Y	Y		4	2	1	Y	83	6	13	Y	2	Y	8				Y	3.0 - 3.6	66	VFBGA100	
AT32UC3A4256S	256	128K	Y		Y	Y	Y		4	2	1	Y	83	6	13	Y	2	Y	8				Y	3.0 - 3.6	66	VFBGA100	
AT32UC3B064	64	16K			Y	Y			3	1	1	Y	44	3	13	Y	2	Y	8					3.0 - 3.6	60	TQFP64, QFN64	
AT32UC3B0128	128	32K			Y	Y			3	1	1	Y	44	3	13	Y	2	Y	8					3.0 - 3.6	60	TQFP64, QFN64	
AT32UC3B0256	256	32K			Y	Y			3	1	1	Y	44	3	13	Y	2	Y	8					3.0 - 3.6	60	TQFP64, QFN64	
AT32UC3B0512	512	96K			Y	Y			3	1	1	Y	44	3	13	Y	2	Y	8					3.0 - 3.6	60	TQFP64, QFN64	
AT32UC3B164	64	16K			Y				2	1		Y	28	3	13	Y	1	Y	6					3.0 - 3.6	60	TQFP48, QFN48	
AT32UC3B1128	128	32K			Y				2	1		Y	28	3	13	Y	1	Y	6					3.0 - 3.6	60	TQFP48, QFN48	
AT32UC3B1256	256	32K			Y				2	1		Y	28	3	13	Y	1	Y	6					3.0 - 3.6	60	TQFP48, QFN48	
AT32UC3B1512	512	96K			Y				2	1		Y	28	3	13	Y	1	Y	6					3.0 - 3.6	60	TQFP48, QFN48	
AT32UC3C064	64	16K		1		Y	Y	2	4	2	1	2	125	6	20	Y	2	Y	16			2	4	Y	3.0 - 5.5 <sup>(a)</sup>	66	LQFP144
AT32UC3C0128	128	32K		1		Y	Y	2	4	2	1	2	125	6	20	Y	2	Y	16			2	4	Y	3.0 - 5.5 <sup>(a)</sup>	66	LQFP144
AT32UC3C0256	256	64K		1		Y	Y	2	4	2	1	2	125	6	20	Y	2	Y	16			2	4	Y	3.0 - 5.5 <sup>(a)</sup>	66	LQFP144
AT32UC3C0512	512	64K		1		Y	Y	2	4	2	1	2	125	6	20	Y	2	Y	16			2	4	Y	3.0 - 5.5 <sup>(a)</sup>	66	LQFP144
AT32UC3C164	64	16K		1		Y	Y	2	4	2	1	2	83	6	20	Y	2	Y	16			2	4	Y	3.0 - 5.5 <sup>(a)</sup>	66	TQFP100
AT32UC3C1128	128	32K		1		Y	Y	2	4	2	1	2	83	6	20	Y	2	Y	16			2	4	Y	3.0 - 5.5 <sup>(a)</sup>	66	TQFP100
AT32UC3C1256	256	64K		1		Y	Y	2	4	2	1	2	83	6	20	Y	2	Y	16			2	4	Y	3.0 - 5.5 <sup>(a)</sup>	66	TQFP100
AT32UC3C1512	512	64K		1		Y	Y	2	4	2	1	2	83	6	20	Y	2	Y	16			2	4	Y	3.0 - 5.5 <sup>(a)</sup>	66	TQFP100
AT32UC3C264	64	16K		1		Y	Y	2	3	1	1	2	47	3	20	Y	2	Y	11			1	2	Y	3.0 - 5.5 <sup>(a)</sup>	66	TQFP64
AT32UC3C2128	128	32K		1		Y	Y	2	3	1	1	2	47	3	20	Y	2	Y	11			1	2	Y	3.0 - 5.5 <sup>(a)</sup>	66	TQFP64
AT32UC3C2256	256	64K		1		Y	Y	2	3	1	1	2	47	3	20	Y	2	Y	11			1	2	Y	3.0 - 5.5 <sup>(a)</sup>	66	TQFP64
AT32UC3C2512	512	64K		1		Y	Y	2	3	1	1	2	47	3	20	Y	2	Y	11			1	2	Y	3.0 - 5.5 <sup>(a)</sup>	66	TQFP64
AT32UC3D164	64	8K			Y				2	1		Y	28	3	13	Y	1		6						1.62 - 3.6	48	TQFP48, QFN48
AT32UC3D1128	128	16K			Y				2	1		Y	28	3	13	Y	1		6						1.62 - 3.6	48	TQFP48, QFN48
AT32UC3D1256	256	16K			Y				2	1		Y	28	3	13	Y	1		6						1.62 - 3.6	48	TQFP48, QFN48
AT32UC3L016	16	8K							4	1		2	36	6	36	Y	1	Y				9	Y	8	1.62 - 3.6	50	TQFP48, QFN48, LLGA48
AT32UC3L032	32	16K							4	1		2	36	6	36	Y	1	Y				9	Y	8	1.62 - 3.6	50	TQFP48, QFN48, LLGA48
AT32UC3L064	64	16K							4	1		2	36	6	36	Y	1	Y				9	Y	8	1.62 - 3.6	50	TQFP48, QFN48, LLGA48
AT32UC3L0128	128	32K							4	1		2	36	6	36	Y	1	Y				9	Y	8	1.62 - 3.6	50	TQFP48, QFN48, LLGA48
AT32UC3L0256	255	32K							4	1		2	36	6	36	Y	1	Y				9	Y	8	1.63 - 3.6	50	TQFP48, QFN48, LLGA48

a) P: Product in Full Production, I: Device under Introduction, F: Future device.  
 b) Pb-free packaging complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.  
 c) Voltage supply: 3.0 - 3.6V or 4.5 - 5.5V.

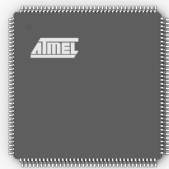
## Development Tools

32-bit AVR UC3 microcontrollers benefit from the well-known AVR tools and software chain, which is renowned for its quality and seamless integration of devices, hardware and software tools, and documentation. Embedded developers will find it easy to succeed with the AVR.

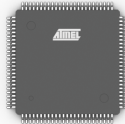
Kit P/N	Supported parts	Description	
<b>AVR ONE!</b> Debugger	All AVR MCUs	<ul style="list-style-type: none"> <li>• Nexus and JTAG Interface</li> <li>• Non-intrusive Real-Time Trace</li> <li>• Run-Time Control (Run, Stop, Single-step, Reset)</li> <li>• Program Flash and Fuses</li> </ul>	
<b>JTAGICE mkII</b> Debugger	All AVR MCUs	<ul style="list-style-type: none"> <li>• JTAG Interface</li> <li>• Run-Time Control (Run, Stop, Single-step, Reset)</li> <li>• Program Flash and Fuses</li> </ul>	
<b>AVR Dragon</b> Debugger	All AVR MCUs	<ul style="list-style-type: none"> <li>• JTAG and debugWire Interface</li> <li>• In-System Programming</li> <li>• High Voltage Serial Programming</li> <li>• Parallel Programming</li> </ul>	
<b>ATEVK1100</b> Evaluation kit	A0/A1 series	<ul style="list-style-type: none"> <li>• 10/100 Ethernet and USB OTG interface</li> <li>• SPI, TWI and USARTs</li> <li>• Temperature and light sensors</li> <li>• 20x4 character LCD</li> <li>• MMC/SD card &amp; expansion connector</li> </ul>	
<b>ATEVK1101</b> Evaluation kit	B series	<ul style="list-style-type: none"> <li>• USB OTG interface</li> <li>• SPI, TWI and USARTs</li> <li>• 3-axis accelerometer, temperature and light sensors</li> <li>• MMC/SD card &amp; expansion connector</li> </ul>	
<b>ATEVK1104</b> Evaluation kit	A3/A4 series	<ul style="list-style-type: none"> <li>• Hi-Speed USB OTG interface</li> <li>• 320 x 240 QVGA TFT LCD</li> <li>• Two MMC/ SD card connectors</li> <li>• SPI, TWI and USARTs</li> <li>• Capacitive Touch interface</li> </ul>	
<b>ATEVK1105</b> Evaluation kit	A0/A1 series	<ul style="list-style-type: none"> <li>• 10/100 Ethernet and USB OTG interface</li> <li>• SPI, TWI and USARTs</li> <li>• 320 x 240 QVGA TFT LCD</li> <li>• Capacitive Touch keyboard</li> <li>• Stereo Audio 3.5mm jack output</li> <li>• MMC/SD card expansion connector</li> </ul>	
<b>UC3C-EK</b> Evaluation kit	C series	<ul style="list-style-type: none"> <li>• Full Speed USB OTG interface</li> <li>• 320 x 240 QVGA TFT LCD</li> <li>• Dual CAN, LIN, SPI, TWI and USARTs</li> <li>• Capacitive Touch interface</li> <li>• Motor Control Interface</li> </ul>	Will arrive in 2010
<b>AT32UC3L-EK</b> Evaluation kit	L series	<ul style="list-style-type: none"> <li>• Capacitive Touch Keyboard</li> </ul>	Will arrive in 2010
<b>ATEXTWIFI</b> Evaluation kit	All UC3	<ul style="list-style-type: none"> <li>• 32-bit AVR Wi-Fi Extension Board</li> <li>• SD card form factor</li> <li>• For use with ATEVK1105, ATEVK1104, ATEVK1101 and ATEVK1100</li> <li>• AVR Wi-Fi Extension Board mounted with HDG104 WLAN 802.11b/g</li> <li>• <a href="http://www.hd-wireless.se">http://www.hd-wireless.se</a></li> </ul>	
<b>ATSTK600</b> Starter kit	All UC3	Complete programming and development system supporting all AVR32 UC3 series via socket adaptors	
<b>ATQT600</b> Evaluation kit	L series	<ul style="list-style-type: none"> <li>• 1x USB powered interface board</li> <li>• 3x MCU boards (ATtiny88, ATmega324PA, ATxmega128A1)</li> <li>• 3x Sensor boards supporting up to 64-channels</li> <li>• Cables</li> </ul>	
<b>Free AVR Development Software</b>	All UC3	<ul style="list-style-type: none"> <li>• AVR32 Studio (multi platform IDE)</li> <li>• GNU Toolchain (gcc, gdb, etc.)</li> <li>• AVR UC3 Software Framework</li> </ul>	
<b>Commercial Development Software<sup>(1)</sup></b>	All UC3	<ul style="list-style-type: none"> <li>• Embedded Workbench from IAR™ - <a href="http://www.iar.com">www.iar.com</a></li> <li>• ThreadX® from Express Logic - <a href="http://www.rtos.com">www.rtos.com</a></li> <li>• µC/OS-II from Micrium - <a href="http://www.micrium.com">www.micrium.com</a></li> <li>• EmbOS from Segger - <a href="http://www.segger.com">www.segger.com</a></li> </ul>	

<sup>(1)</sup> The AVR third party program is continuously expanding. Please visit [www.atmel.com/products/AVR/thirdparty.asp](http://www.atmel.com/products/AVR/thirdparty.asp) for the up-to-date information.

## Packaging Options



**LQFP-144**  
20 x 20 mm  
0.5 mm pitch



**TQFP-100**  
14 x 14 mm  
0.5 mm pitch



**TQFP-64**  
10 x 10 mm  
0.5 mm pitch



**TQFP-48**  
7 x 7 mm  
0.5 mm pitch



**QFN-64**  
9 x 9 mm  
0.5 mm pitch



**QFN-48**  
7 x 7 mm  
0.5 mm pitch



**FFBGA-144**  
11 x 11 mm  
0.8 mm pitch



**TLLGA-48**  
5.5 x 5.5 mm  
0.4 mm pitch

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www.atmel.com/literature

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## Award-Winning Products

32-bit AVR UC3 Microcontrollers  
HW Product of the year 2008  
Embedded World (Germany)



32-bit AVR UC3 Microcontrollers  
Hot Products 2007  
EDN (USA)



32-bit AVR  
Innovation of the Year 2007  
EDN (USA)



32-bit AVR Microcontrollers  
Product of the year 2006 & 2007  
Elektronik (Germany)



<http://www.atmel.com/avr>

Device selection Guides, Datasheets, Application notes, Tools, Software, Consultants

<http://www.avrfreaks.net>

AVR Experts Discussion Forum, Selection Guides, Third Party Tools Information

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