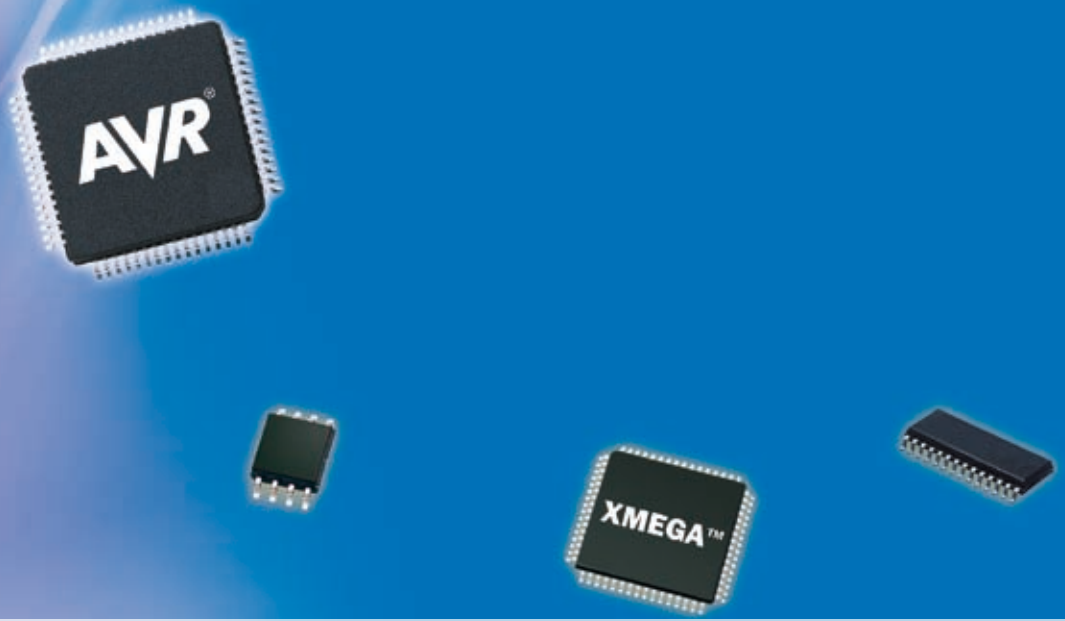
AVR® 8-bit Microcontrollers



Quick Reference Guide

March 2008

Everywhere You Are®

AVR Introduction

Atmel® offers both 8-bit and an 32-bit AVR®s. This guide covers 8-bit AVR microcontrollers.

AVR delivers unmatched flexibility. It 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. Not only do you get to market faster, but once there, you can easily and cost-effectively refine and improve your product offering.

The AVR architecture gives you 16-bit performance and leading low-power features at 8-bit price.

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

AVR Key Benefits

- Highest performance
- picoPower™ technology
- Highest Code Density
- Highest integration and scalability
- Complete tool offering
- Atmel's AVR and AVR32 cover the 8-bit to 32-bit market

AVR Keywords

AVR microcontrollers execute powerful instructions in a single clock cycle and operates anywhere from 1.8 to 5.5 volts. The effective core ensures scalability throughout the whole AVR family range.

With several low power modes available and additional picoPower features the power consumption in energy-critical applications can be minimized.

32 general purpose working registers and a RISC architecture designed for C-code development ensure fast operation and short time to market.

Flash memory also makes the AVR ideal for initial design, evaluation and volume production, resulting in reduced waste and significant cost savings.

AVR microcontrollers are easily programmed and debugged in-system via single wire debugWire interface or with 6- and 10-pins JTAG compatible interfaces.

The complete tools offering is easy to learn and covers the whole range of AVR microcontrollers.

AVR Environment Friendly Package Options

Atmel is offering versions of its products that eliminate lead or lead and halide materials.

For AVR microcontrollers, all the lead free package options are RoHS compliant, lead free, halide free and fully green.

All new parts will be offered in fully green packaging only.

AVR Product Range

Scalability

With an incredible variety of package and performance options, AVR gives you the versatility to meet any challenge and capture any opportunity. And both the instruction set and the architecture are the same for all AVR products. So when your code increases, you can easily and quickly port to a larger device.

Product Families

tinyAVR®

General purpose microcontroller with up to 8K Bytes Flash program memory, 512 Bytes SRAM and EEPROM.

megaAVR®

High performance microcontroller with Hardware Multiplier. Up to 256K Bytes Flash, 4K Bytes EEPROM and 8K Bytes SRAM.

picoPower™ AVR

Microcontrollers with leading edge power-saving characteristics.

XMEGA™

The new XMEGA 8/16-bit AVR microcontrollers have new and advanced peripherals with increased performance, DMA and Event system, and extends the AVR family in low power/high performance markets.

Application Oriented

AVR-based devices covering specified areas such as such as automotive, LCD drivers, CAN networking, USB connectivity, motor control, lighting applications, smart battery single-chip, 802.5.4/ZigBee™ and Remote Access Control.

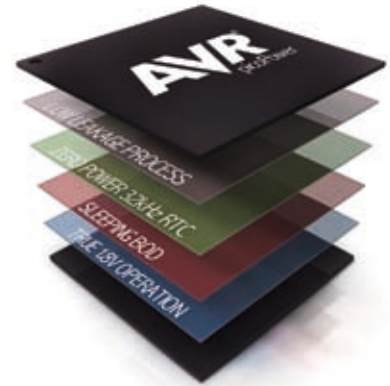
Low Power

To meet the tough requirements of modern microcontrollers Atmel has combined years of low power research and developed picoPower technology. picoPower enables AVR microcontrollers to achieve the industry's lowest power consumption with 500 nA @1.8V with a RTC running and 100 nA in Power-down sleep mode.

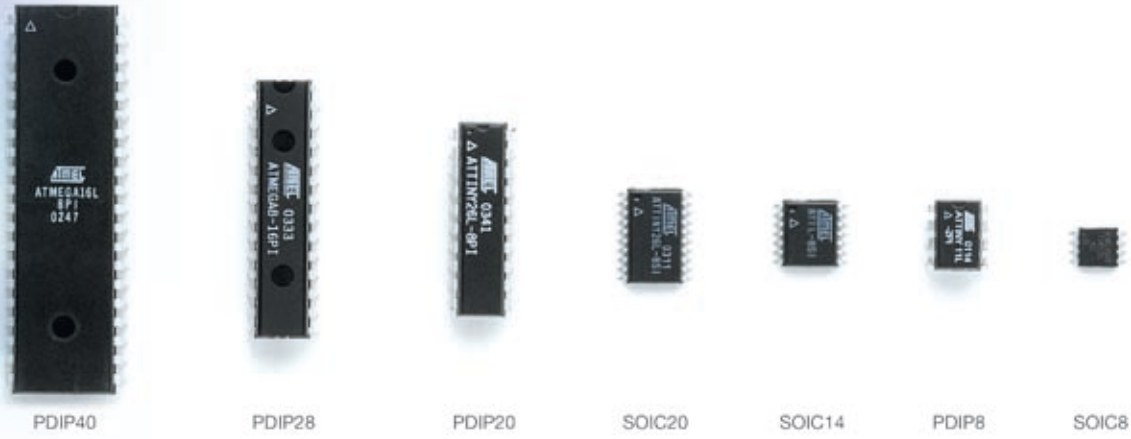
Active mode, and can double the battery life in low power applications.

- Full operation at 1.8V supply voltage
- Sleeping Brown-out detector
- Ultra low power 32 kHz crystal oscillator
- Power reduction register
- Flash sampling

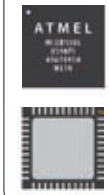
Web resources: www.atmel.com/products/avr/picopower/



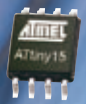
Packaging Range



QFN package example



Lead free packages are available



tinyAVR

Don’t let the name fool you... tinyAVR delivers huge capability. Optimized for a wide range of applications that require a small but powerful MCU solution, tinyAVR requires no external Glue Logic, and is available with integrated A/D convertor 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.

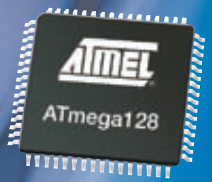
tinyAVR Key Benefits

- Optimized for simple applications requiring a small microcontroller.
- Great performance for cost effective devices.
- Fully featured with 10-bit ADCs and high speed PWMs onboard.
- Self-Programming Flash memory for maximum flexibility.
- debugWIRE On-Chip Debug and In-System Programming.

Product	Status (f)	Flash (KB)	EEPROM (Bytes)	RAM (Bytes)	I/O pins	UART/USART	SPI/TWI by USI	8-bit Timers	16-bit Timers	PWM (Channel)	10-bit A/D (Channel)	Analog Gain Stage	DebugWIRE/OCD	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green (a)	Temp. Range
ATtiny12	P	1	64	(b)	6			1						1.8 - 5.5	1.2	PDIP8, SOIC8	Y	-40°C to +85°C
	P	1	64	(b)	6			1						2.7 - 5.5	4	PDIP8, SOIC8	Y	-40°C to +85°C
	P	1	64	(b)	6			1						4.0 - 5.5	8	PDIP8, SOIC8	Y	-40°C to +85°C
ATtiny13	P	1	64	64	6			1		2	4		Y	1.8 - 5.5	10	PDIP8, SOIC8, QFN/MLF20	Y	-40°C to +85°C
	P	1	64	64	6			1		2	4		Y	2.7 - 5.5	20	PDIP8, SOIC8, QFN/MLF20	Y	-40°C to +85°C
ATtiny2313	P	2	128	128	18	1	1	1	1	4			Y	1.8 - 5.5	10	PDIP20, SOIC20, QFN/MLF20	Y	-40°C to +85°C
	P	2	128	128	18	1	1	1	1	4			Y	2.7 - 5.5	20	PDIP20, SOIC20, QFN/MLF20	Y	-40°C to +85°C
ATtiny24	P	2	128	128	12		1	1	1	4	8	Y	Y	1.8 - 5.5	10	SOIC14, PDIP14, QFN/MLF20	Y	-40°C to +85°C
	P	2	128	128	12		1	1	1	4	8	Y	Y	2.7 - 5.5	20	SOIC14, PDIP14, QFN/MLF20	Y	-40°C to +85°C
ATtiny25	P	2	128	128	6		1	2 (c)		4 (d)	4	Y	Y	1.8 - 5.5	10	PDIP8, SOIC8, QFN/MLF20	Y	-40°C to +85°C
	P	2	128	128	6		1	2 (c)		4 (d)	4	Y	Y	2.7 - 5.5	20	PDIP8, SOIC8, QFN/MLF20	Y	-40°C to +85°C
ATtiny26	P	2	128	128	16		1	2		2	11	Y		2.7 - 5.5	8	PDIP20, SOIC20, QFN/MLF32	Y	-40°C to +85°C
	P	2	128	128	16		1	2		2	11	Y		4.5 - 5.5	16	PDIP20, SOIC20, QFN/MLF32	Y	-40°C to +85°C
ATtiny261	P	2	128	128	16		1	1 (c)	1	5 (e)	11	Y	Y	1.8 - 5.5	10	PDIP20, SOIC20, QFN/MLF32	Y	-40°C to +85°C
	P	2	128	128	16		1	1 (c)	1	5 (e)	11	Y	Y	2.7 - 5.5	20	PDIP20, SOIC20, QFN/MLF32	Y	-40°C to +85°C
ATtiny28	P	2		(b)	11			1						1.8 - 5.5	1.2	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
	P	2		(b)	11			1						2.7 - 5.5	4	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
ATtiny44	P	4	256	256	12		1	1	1	4	8	Y	Y	1.8 - 5.5	10	SOIC14, PDIP14, QFN/MLF20	Y	-40°C to +85°C
	P	4	256	256	12		1	1	1	4	8	Y	Y	2.7 - 5.5	20	SOIC14, PDIP14, QFN/MLF20	Y	-40°C to +85°C
ATtiny45	P	4	256	256	6		1	2 (c)		4 (d)	4	Y	Y	1.8 - 5.5	10	PDIP8, SOIC8, QFN/MLF20	Y	-40°C to +85°C
	P	4	256	256	6		1	2 (c)		4 (d)	4	Y	Y	2.7 - 5.5	20	PDIP8, SOIC8, QFN/MLF20	Y	-40°C to +85°C
ATtiny461	P	4	256	256	16		1	1 (c)	1	5 (e)	11	Y	Y	1.8 - 5.5	10	PDIP20, SOIC20, QFN/MLF32	Y	-40°C to +85°C
	P	4	256	256	16		1	1 (c)	1	5 (e)	11	Y	Y	2.7 - 5.5	20	PDIP20, SOIC20, QFN/MLF32	Y	-40°C to +85°C

Product	Status (f)	Flash (KB)	EEPROM (Bytes)	RAM (Bytes)	I/O pins	UART/USART	SPI/TWI by USI	8-bit Timers	16-bit Timers	PWM (Channel)	10-bit A/D (Channel)	Analog Gain Stage	DebugWIRE/OCD	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green (a)	Temp. Range
ATtiny84	I	8	512	512	12		1	1	1	4	8	Y	Y	1.8 - 5.5	10	PDIP14, QFN/MLF20	Y	-40°C to +85°C
	I	8	512	512	12		1	1	1	4	8	Y	Y	2.7 - 5.5	20	PDIP14, QFN/MLF20	Y	-40°C to +85°C
ATtiny85	P	8	512	512	6		1	2 (c)		4 (d)	4	Y	Y	1.8 - 5.5	10	PDIP8, SOIC8, QFN/MLF20	Y	-40°C to +85°C
	P	8	512	512	6		1	2 (c)		4 (d)	4	Y	Y	2.7 - 5.5	20	PDIP8, SOIC8, QFN/MLF20	Y	-40°C to +85°C
ATtiny861	P	8	512	512	16		1	1 (c)	1	5 (e)	11	Y	Y	1.8 - 5.5	10	PDIP20, SOIC20, QFN/MLF32	Y	-40°C to +85°C
	P	8	512	512	16		1	1 (c)	1	5 (e)	11	Y	Y	2.7 - 5.5	20	PDIP20, SOIC20, QFN/MLF32	Y	-40°C to +85°C

a) Pb-free packaging alternative, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
b) The AVR core has 32 internal registers that can be used as RAM storage.
c) One high speed 8-bit timer/counter.
d) Two High Frequency, 250kHz, PWM Outputs.
e) Three High Frequency PWM Outputs for BLDC motor control.
f) P: Product in Full Production, I: Device under Introduction



megaAVR

When your designs call for a bit of extra muscle, you need megaAVR. Developed for applications that need to store a large amount of program code, megaAVR offers substantial program and data memories, and performance approaching 1 MIPS per MHz. Better yet, megaAVR delivers the power of self-programmability for fast, secure, cost-effective remote upgrades.

megaAVR Key Benefits

- Self-Programming Flash memory with boot block.
- High accuracy 10-bit A/D converters with up to x200 analog gain stage.
- USART, SPI and TWI(1) compliant serial interfaces.
- IEEE 1149.1 compliant JTAG interface on megaAVRs with 16KB Flash or more.
- On-Chip Debug through JTAG or debugWIRE interface.

(1): Two Wire Interface (TWI) is a I2C compliant interface.

Product	Status (b)	Flash (KB)	EEPROM (Bytes)	RAM (Bytes)	I/O pins	UART/USART	SPI/TWI by USI	SPI	TWI (I2C compliant)	8-bit Timers	16-bit Timers	PWM (Channel)	10-bit A/D (Channel)	Analog Gain Stage	DebugWIRE/OCD	JTAG/OCD	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green (a)	Temp. Range
ATmega48	P	4	256	512	23	1		1+USART	1	2	1	6	8 (c)		Y		1.8 - 5.5	10	TQFP32, PDIP28, QFN/MLF28/32	Y	-40°C to +85°C
	P	4	256	512	23	1		1+USART	1	2	1	6	8 (c)		Y		2.7 - 5.5	20	TQFP32, PDIP28, QFN/MLF28/32	Y	-40°C to +85°C
ATmega8	P	8	512	1K	23	1		1	1	2	1	3	8				2.7 - 5.5	8	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
	P	8	512	1K	23	1		1	1	2	1	3	8				4.5 - 5.5	16	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
ATmega88	P	8	512	1K	23	1		1+USART	1	2	1	6	8 (c)		Y		1.8 - 5.5	10	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
	P	8	512	1K	23	1		1+USART	1	2	1	6	8 (c)		Y		2.7 - 5.5	20	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
ATmega8515	P	8	512	512	35	1		1	1	1	1	3					2.7 - 5.5	8	TQFP44, PDIP40, QFN/MLF44, PLCC44	Y	-40°C to +85°C
	P	8	512	512	35	1		1	1	1	1	3					4.5 - 5.5	16	TQFP44, PDIP40, QFN/MLF44, PLCC44	Y	-40°C to +85°C
ATmega8535	P	8	512	512	32	1		1	1	2	1	4	8	Y			2.7 - 5.5	8	TQFP44, PDIP40, QFN/MLF44, PLCC44	Y	-40°C to +85°C
	P	8	512	512	32	1		1	1	2	1	4	8	Y			4.5 - 5.5	16	TQFP44, PDIP40, QFN/MLF44, PLCC44	Y	-40°C to +85°C
ATmega16	P	16	512	1K	32	1		1	1	2	1	4	8	Y		Y	2.7 - 5.5	8	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
	P	16	512	1K	32	1		1	1	2	1	4	8	Y		Y	4.5 - 5.5	16	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
ATmega162	P	16	512	1K	35	2		1	1	2	2	6				Y	1.8 - 5.5	8	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
	P	16	512	1K	35	2		1	1	2	2	6				Y	2.7 - 5.5	16	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
ATmega168	P	16	512	1K	23	1		1+USART	1	2	1	6	8 (c)		Y		1.8 - 5.5	10	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
	P	16	512	1K	23	1		1+USART	1	2	1	6	8 (c)		Y		2.7 - 5.5	20	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
ATmega32	P	32	1K	2K	32	1		1	1	2	1	4	8	Y		Y	2.7 - 5.5	8	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
	P	32	1K	2K	32	1		1	1	2	1	4	8	Y		Y	4.5 - 5.5	16	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
ATmega325	P	32	1K	2K	54	1	1	1+ USI	USI	2	1	4	8			Y	1.8 - 5.5	8	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	32	1K	2K	54	1	1	1+ USI	USI	2	1	4	8			Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega3250	I	32	1K	2K	69	1	1	1 + USI	USI	2	1	4	8			Y	1.8 - 5.5	8	TQFP100	Y	-40°C to +85°C
	I	32	1K	2K	69	1	1	1+ USI	USI	2	1	4	8			Y	2.7 - 5.5	16	TQFP100	Y	-40°C to +85°C
ATmega64	P	64	2K	4K	54	2		1	1	2	2	6+2	8	Y		Y	2.7 - 5.5	8	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	64	2K	4K	54	2		1	1	2	2	6+2	8	Y		Y	4.5 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega640	P	64	4K	8K	86	4		1+USART	1	2	4	12+4	16	Y		Y	1.8 - 5.5	8	TQFP100, CBGA100	Y	-40°C to +85°C
	P	64	4K	8K	86	4		1+USART	1	2	4	12+4	16	Y		Y	2.7 - 5.5	16	TQFP100, CBGA100	Y	-40°C to +85°C

Product	Status (b)	Flash (KB)	EEPROM (Bytes)	RAM (Bytes)	I/O pins	UART/USART	SPI/TWI by USI	SPI	TWI (I2C compliant)	8-bit Timers	16-bit Timers	PWM (Channel)	10-bit A/D (Channel)	Analog Gain Stage	DebugWIRE/OCD	JTAG/OCD	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green (a)	Temp. Range
ATmega644	P	64	2K	4K	32	1		1+USART	1	2	1	6	8	Y		Y	1.8 - 5.5	10	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
	P	64	2K	4K	32	1		1+USART	1	2	1	6	8	Y		Y	2.7 - 5.5	20	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
ATmega645	P	64	2K	4K	54	1	1	1+USI	USI	2	1	4	8			Y	1.8 - 5.5	8	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	64	2K	4K	54	1	1	1+USI	USI	2	1	4	8			Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega6450	I	64	2K	4K	69	1	1	1+USI	USI	2	1	4	8			Y	1.8 - 5.5	8	TQFP100	Y	-40°C to +85°C
	I	64	2K	4K	69	1	1	1+USI	USI	2	1	4	8			Y	2.7 - 5.5	16	TQFP100	Y	-40°C to +85°C
ATmega128	P	128	4K	4K	53	2		1	1	2	2	6+2	8	Y		Y	2.7 - 5.5	8	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	128	4K	4K	53	2		1	1	2	2	6+2	8	Y		Y	4.5 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega1280	P	128	4K	8K	86	4		1+USART	1	2	4	12+4	16	Y		Y	1.8 - 5.5	8	TQFP100, CBGA100	Y	-40°C to +85°C
	P	128	4K	8K	86	4		1+USART	1	2	4	12+4	16	Y		Y	2.7 - 5.5	16	TQFP100, CBGA100	Y	-40°C to +85°C
ATmega1281	P	128	4K	8K	54	2		1+USART	1	2	4	6+4	8	Y		Y	1.8 - 5.5	8	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	128	4K	8K	54	2		1+USART	1	2	4	6+4	8	Y		Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega2560	P	256	4K	8K	86	4		1+USART	1	2	4	12+4	16	Y		Y	1.8 - 5.5	8	TQFP100, CBGA100	Y	-40°C to +85°C
	P	256	4K	8K	86	4		1+USART	1	2	4	12+4	16	Y		Y	4.5 - 5.5	16	TQFP100, CBGA100	Y	-40°C to +85°C
ATmega2561	P	256	4K	8K	54	2		1+USART	1	2	4	6+4	8	Y		Y	1.8 - 5.5	8	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	256	4K	8K	54	2		1+USART	1	2	4	6+4	8	Y		Y	4.5 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C

a) Pb-free packaging alternative, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
b) P: Product in Full Production, I: Device under Introduction.
c) Only 6 ADC in PDIP packages.

picoPower

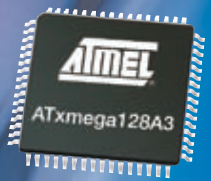
Most modern end-products have a power budget that points out the sleep power consumption as the most critical parameter.

With picoPower technology for the AVR microcontrollers Atmel combined years of low power research and development to meet the tough energy requirements for modern applications.

picoPower enables AVR to achieve the industry's lowest power consumption with a mere 500 nA @ 1.8V with a RTC running and 100 nA in Power-down sleep mode.

Product	Status (b)	Flash (KB)	EEPROM (Bytes)	RAM (Bytes)	I/O pins	LCD segments	UART/USART	SPI/TWI by USI	SPI	TWI (I2C compliant)	8-bit Timers	16-bit Timers	PWM (Channel)	10-bit A/D (Channel)	Analog Gain Stage	debugWIRE/OCD	JTAG/OCD	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green (a)	Temp. Range
ATmega48P	I	4	256	512	23		1		1+USART	1	2	1	6	8		Y		1.8 - 5.5	10	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
	I	4	256	512	23		1		1+USART	1	2	1	6	8		Y		2.7 - 5.5	20	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
ATmega88P	I	8	512	1K	23		1		1+USART	1	2	1	6	8		Y		1.8 - 5.5	10	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
	I	8	512	1K	23		1		1+USART	1	2	1	6	8		Y		2.7 - 5.5	20	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
ATmega164P	P	16	512	1K	32		2		1+USART	1	2	1	6	8	Y		Y	1.8 - 5.5	10	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
	P	16	512	1K	32		2		1+USART	1	2	1	6	8	Y		Y	2.7 - 5.5	20	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
ATmega165P	P	16	512	1K	54		1	1	1+USI	USI	2	1	4	8			Y	1.8 - 5.5	8	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	16	512	1K	54		1	1	1+USI	USI	2	1	4	8			Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega168P	P	16	512	1K	23		1		1+USART	1	2	1	6	8		Y		1.8 - 5.5	10	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
	P	16	512	1K	23		1		1+USART	1	2	1	6	8		Y		1.8 - 5.5	20	TQFP32, PDIP28, QFN/MLF32	Y	-40°C to +85°C
ATmega169P	P	16	512	1K	54	4x25	1	1	1+USI	USI	2	1	4	8			Y	1.8 - 5.5	8	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	16	512	1K	54	4x25	1	1	1+USI	USI	2	1	4	8			Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega324P	P	32	1K	2K	32		2		1+USART	1	2	1	6	8	Y		Y	1.8 - 5.5	10	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
	P	32	1K	2K	32		2		1+USART	1	2	1	6	8	Y		Y	2.7 - 5.5	20	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
ATmega325P	I	32	1K	2K	54		1	1	1+USI	USI	2	1	4	8			Y	1.8 - 5.5	10	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	I	32	1K	2K	54		1	1	1+USI	USI	2	1	4	8			Y	2.7 - 5.5	20	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega3250P	I	32	1K	2K	69		1	1	1+USI	USI	2	1	4	8			Y	1.8 - 5.5	10	TQFP100	Y	-40°C to +85°C
	I	32	1K	2K	69		1	1	1+USI	USI	2	1	4	8			Y	2.7 - 5.5	20	TQFP100	Y	-40°C to +85°C
ATmega328P	I	32	1K	2K	23		1		1+USART	1	2	1	6	8		Y		1.8 - 5.5	10	TQFP32, PDIP28, QFN/ML32	Y	-40°C to +85°C
	I	32	1K	2K	23		1		1+USART	1	2	1	6	8		Y		2.7 - 5.5	20	TQFP32, PDIP28, QFN/ML32	Y	-40°C to +85°C
ATmega329P	P	32	1K	2K	54	4x25	1	1	1+USI	USI	2	1	4	8			Y	1.8 - 5.5	10	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	32	1K	2K	54	4x25	1	1	1+USI	USI	2	1	4	8			Y	2.7 - 5.5	20	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega3290P	I	32	1K	2K	69	4x40	1	1	1+USI	USI	2	1	4	8			Y	1.8 - 5.5	10	TQFP100	Y	-40°C to +85°C
	I	32	1K	2K	69	4x40	1	1	1+USI	USI	2	1	4	8			Y	2.7 - 5.5	20	TQFP100	Y	-40°C to +85°C
ATmega644P	P	64	2K	4K	32		2		1+USART	1	2	1	6	8	Y		Y	1.8 - 5.5	10	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C
	P	64	2K	4K	32		2		1+USART	1	2	1	6	8	Y		Y	2.7 - 5.5	20	TQFP44, PDIP40, QFN/MLF44	Y	-40°C to +85°C

a) Pb-free packaging alternative, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
b) P: Product in Full Production, I: Device under Introduction.



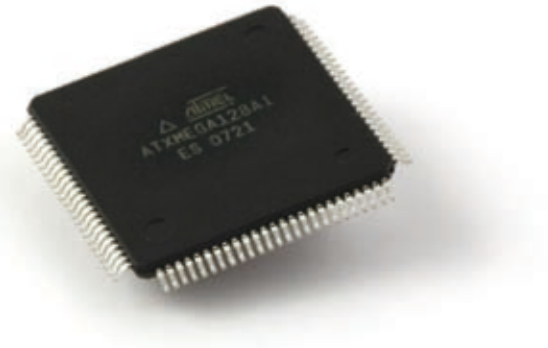
XMEGA

XMEGA extends the AVR product family to reach new markets and improve existing applications. DMA, Multi-level Interrupt Controller and an innovative Event System boost performance while the upgraded picoPower features further reduce power consumption.

The result is the MCU for the next generation of 8- and 16-bit applications!

XMEGA Key Benefits

- picoPower technology
- 4 channel Direct Memory Access (DMA) controller
- Innovative event system
- Multilevel interrupt controller
- 12-bit, 2 MSPS ADC
- 12-bit, 1 MSPS DAC
- Multiple Timers/Counters, SPIs, TWIs and USARTs



Product	Status (b)	Flash (KB)	Boot code (Bytes)	EEPROM (Bytes)	SRAM (Bytes)	DMA (Channels)	Event (Channels)	I/O	16-bit Timers	PWM (Channel)	RTC 16-bit	SPI	TWI (I2C)	USART	12bit A/D (Channel)	DAC 12bit (Ch.)	Ana. Comp.	BOD	WDT	Calibrated Int. RC	Interrupts	Interrupts Ext.	JTAG	PDI	Vcc (V) Range	Clock Speed (MHz)	Package	Pb-free, Green (a)	Temp. Range
ATxmega64A1	I	64	4	2K	4K	4	8	78	8	24	Y	4	4	8	2x8	2x2	4	Y	Y	32MHz, 2MHz, 32kHz	123	78	Y	Y	1.8 - 3.6	32	TQFP100, CBGA100	Y	-40°C to +85°C
ATxmega128A1	I	128	8	2K	8K	4	8	78	8	24	Y	4	4	8	2x8	2x2	4	Y	Y	32MHz, 2MHz, 32kHz	123	78	Y	Y	1.8 - 3.6	32	TQFP100, CBGA100	Y	-40°C to +85°C
ATxmega256A1	F	256	8	4K	16K	4	8	78	8	24	Y	4	4	8	2x8	2x2	4	Y	Y	32MHz, 2MHz, 32kHz	123	78	Y	Y	1.8 - 3.6	32	TQFP100, CBGA100	Y	-40°C to +85°C
ATxmega64A3	F	64	4	2K	4K	4	8	50	8	24	Y	4	2	8	2x8	1x2	4	Y	Y	32MHz, 2MHz, 32kHz	110	50	Y	Y	1.8 - 3.6	32	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATxmega128A3	F	128	8	2K	8K	4	8	50	8	24	Y	4	2	8	2x8	1x2	4	Y	Y	32MHz, 2MHz, 32kHz	110	50	Y	Y	1.8 - 3.6	32	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATxmega256A3	F	256	8	4K	16K	4	8	50	8	24	Y	4	2	5	2x8	1x2	4	Y	Y	32MHz, 2MHz, 32kHz	110	50	Y	Y	1.8 - 3.6	32	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATxmega16A4	F	16	4	1K	2K	4	8	36	5	16	Y	2	3	5	1x12	1x2	2	Y	Y	32MHz, 2MHz, 32kHz	82	36	N	Y	1.8 - 3.6	32	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATxmega32A4	F	32	4	2K	4K	4	8	36	5	16	Y	2	3	5	1x12	1x2	2	Y	Y	32MHz, 2MHz, 32kHz	82	36	N	Y	1.8 - 3.6	32	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATxmega64A4	F	64	4	2K	4K	4	8	36	5	16	Y	2	3	5	1x12	1x2	2	Y	Y	32MHz, 2MHz, 32kHz	82	36	N	Y	1.8 - 3.6	32	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATxmega128A4	F	128	4	2K	8K	4	8	36	5	16	Y	2	3	5	1x12	1x2	2	Y	Y	32MHz, 2MHz, 32kHz	82	36	N	Y	1.8 - 3.6	32	TQFP64, QFN/MLF64	Y	-40°C to +85°C

a) Pb-free packaging alternative, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
b) F: Future product, I: Device under Introduction.

Application Oriented

The range of standard AVRs is complemented by an increasing number of derivatives specified to deliver precise characteristics and capabilities. Available devices cover domains such as automotive, LCD drivers, CAN networking, USB connectivity, motor control, lighting applications, smart battery single-chip, 802.15.4/ ZigBee and Remote Access Control.

AVR for LCD Control

Designed for maximum flexibility and the highest possible integration, the LCD AVR family of high performance, low-power microcontrollers includes everything you need for human interface. The feature set includes keyboard interrupts, visual LCD driver with contrast control and interrupts for input switches.

Product	Status [b]	Flash (KB)	EEPROM (Bytes)	RAM (Bytes)	I/O pins	LCD Segments	UART/USART	SPI/TWI by USI	SPI	8-bit Timers	16-bit Timers	PWM (Channel)	10-bit A/D (Channel)	JTAG/OCD	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green [a]	Temp. Range
ATmega169P	P	16	512	1K	54	4x25	1	1	1+USI	2	1	4	8	Y	1.8 - 5.5	8	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	16	512	1K	54	4x25	1	1	1+USI	2	1	4	8	Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega329P	P	32	1K	2K	54	4x25	1	1	1+USI	2	1	4	8	Y	1.8 - 5.5	10	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	32	1K	2K	54	4x25	1	1	1+USI	2	1	4	8	Y	2.7 - 5.5	20	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega329	P	32	1K	2K	54	4x25	1	1	1+USI	2	1	4	8	Y	1.8 - 5.5	8	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	32	1K	2K	54	4x25	1	1	1+USI	2	1	4	8	Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega3290P	I	32	1K	2K	69	4x40	1	1	1+USI	2	1	4	8	Y	1.8 - 5.5	10	TQFP100	Y	-40°C to +85°C
	I	32	1K	2K	69	4x40	1	1	1+USI	2	1	4	8	Y	2.7 - 5.5	20	TQFP100	Y	-40°C to +85°C
ATmega3290	P	32	1K	2K	69	4x40	1	1	1+USI	2	1	4	8	Y	1.8 - 5.5	8	TQFP100	Y	-40°C to +85°C
	P	32	1K	2K	69	4x40	1	1	1+USI	2	1	4	8	Y	2.7 - 5.5	16	TQFP100	Y	-40°C to +85°C
ATmega649	P	64	2K	4K	54	4x25	1	1	1+USI	2	1	4	8	Y	1.8 - 5.5	8	TQFP64, QFN/MLF64	Y	-40°C to +85°C
	P	64	2K	4K	54	4x25	1	1	1+USI	2	1	4	8	Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
ATmega6490	I	64	2K	4K	69	4x40	1	1	1+USI	2	1	4	8	Y	1.8 - 5.5	8	TQFP100	Y	-40°C to +85°C
	I	64	2K	4K	69	4x40	1	1	1+USI	2	1	4	8	Y	2.7 - 5.5	16	TQFP100	Y	-40°C to +85°C

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AVR for USB Connectivity

The AT90USB microcontrollers are designed to address the varied requirements of embedded applications needing USB connectivity. Devices have either a USB interface for applications needing to communicate with USB host or comply with the USB On-The-Go (OTG) standard for use as Dual Role Devices (DRD) in applications operating as either host or function on the USB. Atmel offers a number of applications notes with implementation examples, and a set of development tools. An extensive software library is offered to support the most-relevant USB classes for the embedded market: Mass Storage Device (MSD), Human Interface Device (HID), Device Firmware Upgrade (DFU), Communication Device Class (CDC), Audio Class, etc.

Web resources: www.atmel.com/products/avr/usb/

Product	Status (b)	Flash (kB)	EEPROM (Bytes)	RAM (Bytes)	I/O pins	UART/USART	SPI	TWI (I2C compliant)	USB 2.0 Host/OTG	USB Full Speed	USB Low Speed	USB DPRAM (bytes)	USB endpoints	8-bit Timers	10-bit HS Timers	16-bit Timers	PWM (channel)	10-bit A/D (channel)	Analog Gain Stage	JTAG/OCD	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green (a)	Temp. Range
AT90USB82	P	8	512	512	22	1	1			Y		176	4	1		1	5				2.7 - 5.5	16	QFN/MLF32	Y	-40°C to +85°C
AT90USB162	P	16	512	512	22	1	1			Y		176	4	1		1	5				2.7 - 5.5	16	TQFP32, QFN/MLF32	Y	-40°C to +85°C
ATmega32U4	I	32	1K	2.5K	26	1	1	1		Y	Y	832	7	1	1	2	5+3+1	12	Y	Y	2.7 - 5.5	16	TQFP44, QFN/MLF44	Y	-40°C to +85°C
ATmega32U6	F	32	1K	2.5K	48	1	1	1		Y	Y	832	7	2		2	6+2	8	Y	Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
AT90USB646	P	64	2K	4K	48	1	1	1		Y	Y	832	7	2		2	6+2	8	Y	Y	2.7 - 5.5	16	QFN/MLF64	Y	-40°C to +85°C
AT90USB647	P	64	2K	4K	48	1	1	1	Y	Y	Y	832	7	2		2	6+2	8	Y	Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
AT90USB1286	P	128	4K	8K	48	1	1	1		Y	Y	832	7	2		2	6+2	8	Y	Y	2.7 - 5.5	16	QFN/MLF64	Y	-40°C to +85°C
AT90USB1287	P	128	4K	8K	48	1	1	1	Y	Y	Y	832	7	2		2	6+2	8	Y	Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C

a) Pb-free packaging alternative, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
b) F: Future product, I: Device under Introduction, P: Product in Full Production.

AVR for CAN Networking

AVRs with extended CAN (Controller Area Network) capabilities are perfectly suited for industrial applications. They feature a large amount of Flash memory to operate higher level protocol stack (CANopen, DeviceNet™ or J1939) and offer up to 16 MIPS throughput. Designers can take benefits of the highly flexible In-Application Programming capability via CAN, UART or SPI interface, as well as the V2.0A/V2.0B CAN controller with 15 independent message objects programmable on-the-fly.

Product	Status (b)	Flash (KB)	EEPROM (Bytes)	RAM (Bytes)	I/O pins	CAN Mess. Obj.	UART/USART	TWI (I2C compliant)	SPI	8-bit Timers	16-bit Timers	PWM (Channel)	10-bit A/D (Channel)	JTAG/OCD	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green (a)	Temp. Range
AT90CAN32	P	32	1K	2K	53	15	2	1	1	2	2	6+2	8	Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
AT90CAN64	I	64	2K	4K	53	15	2	1	1	2	2	6+2	8	Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C
AT90CAN128	P	128	4K	4K	53	15	2	1	1	2	2	6+2	8	Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	-40°C to +85°C

a) Pb-free packaging alternative, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
b) b) P: Product in Full Production, I: Device under Introduction.

AVR for Motor Control

Microcontrollers are more and more used for motor control instead of Application Specific Standard Products (ASSP). Incorporating the necessary functions, they provide more flexibility and offer a better cost solution in most of the cases. Ranging from 8- to 100-pin devices, AVR Flash microcontrollers are well suited for applications such as PC fans up to highly advanced motor control applications.

From ATtiny13 to AT90PWM3, designer can find a cost-effective solution for a variety of motor type and application complexity. Atmel is providing support to developers using AVR for motor control designs, with a number of applications notes with implementation examples, and a set of development tools.
This covers:

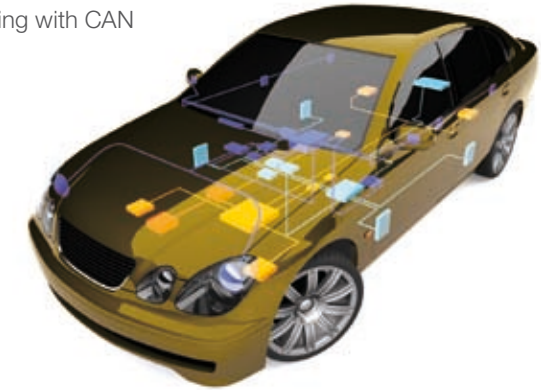
– Sensor-based or sensorless 2-phase BLDC Motors
– Sensor-based or sensorless 3-phase BLDC Motors
– AC motors

Web resources: www.atmel.com/products/avr/mc/

AVR for Automotive

AVR 8-bit architecture has reached a high level of acceptance in many market segments for its performance, high code density and efficient development tool set. It is perfectly suited for many automotive applications. The range of devices made available to automotive already covers a variety of needs and will expand rapidly in the future. AVR devices incorporate all the basic peripherals as well as powerful analog functions.

Typical applications cover sensors and actuators control and in-vehicle networking with CAN (Controller Area Network) and LIN (Local Interconnect Network).



In addition to usual manufacturing and development plant qualifications (ISO-TS-16949 and QS-9000) automotive products are being qualified according to the AEC Q100 (Automotive Electronic Council) requirements, and a PPAP (Production Part Approval Process) document is made available for each product.

Web resources: www.atmel.com/products/avr/auto/

Product	Status (b)	Flash (KB)	EEPROM (Bytes)	RAM (Bytes)	I/O pins	CAN Mess. Obj.	LIN (g)	UART/USART	USI	SPI	8-bit Timers	12-bit Timers	16-bit Timers	PWM (Channel)	10-bit A/D (channel)	Analog Gain Stage	DebugWIRE/OCD	JTAG/OCD	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green (a)	Temp. Range (c)
ATtiny24	I	2	128	128	12		S		1	1+USI	1		1	4	8	Y	Y		2.7 - 5.5	16	SOIC14, QFN/MLF20	Y	Z
ATtiny25	P	2	128	128	6		S		1	1+USI	2 (d)			4 (e)	4	Y	Y		2.7 - 5.5	16	SOIC8, QFN/MLF20	Y	T, T1, Z
ATtiny25V	P	2	128	128	6		S		1	1+USI	2 (d)			4 (e)	4	Y	Y		1.8 - 3.6	8	SOIC8, QFN/MLF20	Y	T
ATtiny44	I	4	256	256	12		S		1	1+USI	1		1	4	8	Y	Y		2.7 - 5.5	16	SOIC14, QFN/MLF20	Y	Z
ATtiny45	P	4	256	256	6		S		1	1+USI	2 (d)			4 (e)	4	Y	Y		2.7 - 5.5	16	SOIC8, QFN/MLF20	Y	T, T1, Z, T2
ATtiny45V	P	4	256	256	6		S		1	1+USI	2 (d)			4 (e)	4	Y	Y		1.8 - 3.6	8	SOIC8	Y	T
ATmega48	P	4	256	512	23		S	1		1+USART	2		1	6	8 (f)		Y		2.7 - 5.5	16	TQFP32, QFN/MLF32	Y	T, T1, Z
ATtiny84	I	8	512	512	12		S		1	1+USI	1		1	4	8	Y	Y		2.7 - 5.5	16	QFN/MLF20	Y	Z
ATtiny85	P	8	512	512	6		S		1	1+USI	2 (d)			4 (e)	4	Y	Y		2.7 - 5.5	16	SOIC8, QFN/MLF20	Y	T, T1, Z
ATtiny85V	I	8	512	512	6		S		1	1+USI	2 (d)			4 (e)	4	Y	Y		1.8 - 3.6	8	SOIC8	Y	T
ATmega88	P	8	512	1K	23		S	1		1+USART	2		1	6	8 (f)		Y		2.7 - 5.5	16	TQFP32, QFN/MLF32	Y	T, T1, Z, T2, D
ATmega88V	P	8	512	1K	23		S	1		1+USART	2		1	6	8 (f)		Y		1.8 - 3.6	8	TQFP32, QFN/MLF32	Y	T
ATmega168	P	16	512	1K	23		S	1		1+USART	2		1	6	8 (f)		Y		2.7 - 5.5	16	TQFP32, QFN/MLF32	Y	T, T1, Z, D
ATmega164P	P	16	512	1K	32		S	2		1+USART	2		1	6	8	Y		Y	2.7 - 5.5	16	TQFP44, QFN/MLF44	Y	T, T1, Z
ATmega324P	P	32	1K	2K	32		S	2		1+USART	2		1	6	8	Y		Y	2.7 - 5.5	16	TQFP44, QFN/MLF44	Y	T, T1, Z
ATmega32M1	I	32	2K	2K	32	6	H	1		1	1	1	1	6+4 (e)	11	Y	Y		2.7 - 5.5	16	TQFP32, QFN/MLF32	Y	Z, D
ATmega32C1	I	32	2K	2K	32	6	H	1		1	1		1	4	11	Y	Y		2.7 - 5.5	16	TQFP32, QFN/MLF32	Y	Z, D
AT90CAN32	P	32	1K	2K	53	15	S	2	1	1	2		2	6+2	8	Y		Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	T, T1, Z
ATmega644P	P	64	2K	4K	32		S	2		1+USART	2		1	6	8	Y		Y	2.7 - 5.5	16	TQFP44, QFN/MLF44	Y	T, T1, Z
AT90CAN64	P	64	2K	4K	53	15	S	2	1	1	2		2	6+2	8	Y		Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	T, T1, Z
AT90CAN128	P	128	4K	4K	53	15	S	2	1	1	2		2	6+2	8	Y		Y	2.7 - 5.5	16	TQFP64, QFN/MLF64	Y	T, T1, Z

a) Pb-free packaging alternative, complies to the European directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
b) P: Product in Full Production, I: Device under Introduction
c) T: -40°C; +85°C — T1: -40°C; +105°C — Z or D: -40°C; +125°C T2: -40°C; +150°C.
d) One high speed 8-bit timer/counter.
e) Two High Frequency, 250kHz, PWM Outputs.
f) Only 6 ADC in PDIP packages.
g) S: software, H: hardware.

AVR for Lighting

AT90PWM devices have been specially developed to handle ballasts for High Intensity Discharge (HID) and dimmable fluorescent lamps.

They feature enhanced 12-bit PWM to realize the Power Factor Correction and control the ballast. With an embedded EEPROM allowing to save configuration parameters and necessary analog functions, the microcontrollers help to reduce ballast component count and system cost. The Digital Addressable Lighting Interface (DALI) protocol is also supported, allowing highly flexible user control.

Product	Status (b)	Flash (KB)	EEPROM (Bytes)	RAM (Bytes)	I/O pins	UART/USART	DALI	SPI	8-bit Timers	12-bit Timers	16-bit Timers	PWM (Channel)	10-bit A/D (channel)	10-bit D/A	DebugWIRE/OCD	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green (a)	Temp. Range
AT90PWM1	P	8	512	512	19	1		1	1	2	1	7	8		Y	2.7 - 5.5	16	SO24	Y	-40°C to +105°C
AT90PWM2	P	8	512	512	19	1	Y	1	1	2	1	7	8		Y	2.7 - 5.5	16	SO24	Y	-40°C to +105°C
AT90PWM3	P	8	512	512	27	1	Y	1	1	3	1	10	11	Y	Y	2.7 - 5.5	16	SO32, QFN/MLF32	Y	-40°C to +105°C
AT90PWM216	P	16	512	1024	19	1	Y	1	1	2	1	7	8		Y	2.7 - 5.5	16	SO24	Y	-40°C to +105°C
AT90PWM316	P	16	512	1024	27	1	Y	1	1	3	1	10	11	Y	Y	2.7 - 5.5	16	QFN32, SO32	Y	-40°C to +105°C

a) Pb-free packaging alternative, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
b) P: Product in Full Production.

AVR for Smart Battery

The single-chip AVR smart battery products cover the 1 to 4 Li-ion cells market. They feature dedicated analog-to-digital converters tailored for battery fuel gauging and voltage monitoring. Other MCU features include independent battery protection circuitry, voltage regulators, integrated cell balancing FETs, and special high voltage I/O controlling charge and discharge.

Product	Status (b)	Flash (KB)	EEPROM (Bytes)	SRAM (Bytes)	I/O pins	8-bit Timers	16-bit Timers	PWM (Channel)	12-bit A/D (Channel)	Coulomb Counter	JTAG/OCD	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green (a)	Temp. Range
ATmega8HVA	F	8	256	512	6	1	1		5	Y		1.8 - 9.0	4	LGA36, TSOP28	Y	-20°C to +85°C
ATmega16HVA	I	16	256	512	6		1		5	Y		1.8 - 9.0	4	LGA36, TSOP28	Y	-20°C to +85°C
ATmega406	P	40	512	512	18	1	1	1	10	Y	Y	4.0 - 25	1	LQFP48	Y	-30°C to +85°C

a) Pb-free packaging alternative, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
b) F: Future product, I: Device under Introduction, P: Product in Full Production.

AVR Wireless solutions for 802.15.4/ZigBee Applications

Atmel's Z-Link® provides a complete single source for IEEE 802.15.4 and ZigBee wireless applications with its own Z-Link radios, AVR microcontrollers and Z-Link specific kits & tools. The RF230 radio requires only six external components and with -101 dBm receive sensitivity and 3 dBm transmit power it has the highest link budget on the market today.

A rich selection of FREE software for complete system solutions supporting the AVR Z-Link chipset is available:

– Transceiver Access Toolbox

– IEEE 802.15.4 Media Access Control (MAC)

– Wireless IPv6

– ZigBee stack

Web resources: www.atmel.com/products/avr/z-link/

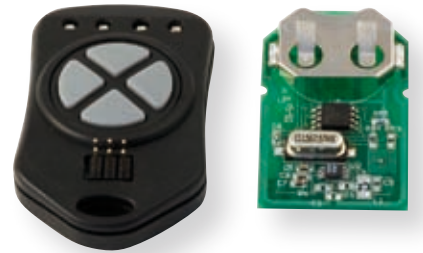
Product	Status (b)	MCU	RF Device	Flash (KB)	EEPROM (Bytes)	RAM (Bytes)	ISM Band	Bitrate (Kbps)	Sensitivity	Output Power	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green (a)	Temp. Range
ATmega64RZAV	I	ATmega644	AT86RF230	64	1K	4K	2.4 GHz	250	-101 dBm	+3 dBm	1.8 - 3.6	10	TQFP44, PDIP40, QFN/MLF44	Y	-40C to +85C
ATmega64RZAPV	I	ATmega644P	AT86RF230	64	1K	4K	2.4 GHz	250	-101 dBm	+3 dBm	1.8 - 3.6	10	TQFP44, PDIP40, QFN/MLF44	Y	-40C to +85C
ATmega128RZAV	I	A Tmega1281	AT86RF230	128	4K	8K	2.4 GHz	250	-101 dBm	+3 dBm	1.8 - 3.6	8	TQFP64, QFN/MLF64	Y	-40C to +85C
ATmega128RZB	I	ATmega1280	AT86RF230	128	4k	8K	2.4 GHz	250	-101 dBm	+3 dBm	1.8 - 3.6	8	TQFP100, CTBGA100	Y	-40C to +85C
ATmega256RZA	I	ATmega2561	AT86RF230	256	4K	8K	2.4 GHz	250	-101 dBm	+3 dBm	1.8 - 3.6	8	TQFP64, QFN/MLF64	Y	-40C to +85C
ATmega256RZBV	I	ATmega2560	AT86RF230	256	4K	8K	2.4 GHz	250	-101 dBm	+3 dBm	1.8 - 3.6	8	TQFP100, CTBGA100	Y	-40C to +85C

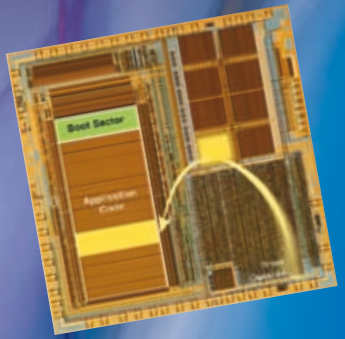
a) Pb-free packaging alternative, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
b) I: Device under Introduction

AVR for Remote Access Control

Remote Access Control (also referred to as Remote Keyless Entry and Remote Wireless Entry) is remote control of applications like doors, alarms, blinds etc. The communication is usually done via radio and the transmission uses IDs and encryption to provide authentication and prevent unauthorized users from accessing the system.
Atmel provides a complete secure solution using AVR microcontrollers, Smart RF radios, application notes and development tools.

Web resources: www.atmel.com/products/avr/rac/





AVR MCUs Are Designed to Program Themselves at Your Command

By eliminating the expensive and time-consuming steps inherent in Mask ROM-based microcontrollers, AVR slashes months from your development and production schedule. You get to market first. Then, you get back to thinking up your next great idea.

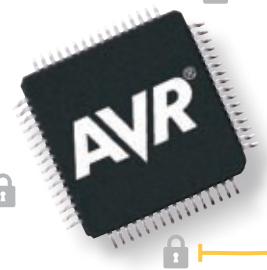
Flash Programming

Self-Programming Flash – Key Benefits

- Reprogram without External Components
- Small 128 Byte Sectored Flash
- Variable Boot Block Size
- Application Allowed to Run while Self-Programming
- Easy to Use
- Reduced Programming Time
- Hardware Controlled Programming

Flexible Programming Implementation

Self-Program using any physical link!
– Program through any interface (e.g. SPI, TWI)
– 100% secure encrypted remote updates

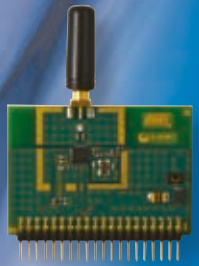


Parallel
– One of the fastest ways to download
– Compatible with major programmers

ISP
– Quick updates in the field
– Easy-to-use and efficient
– Native 3-wire interface

JTAG
– IEEE std. 1149.1 compliant interface
– Can program Flash, EEPROM, Fuses and Lock Bits
– On-Chip Debugging and test the PCB (Boundary-Scan)

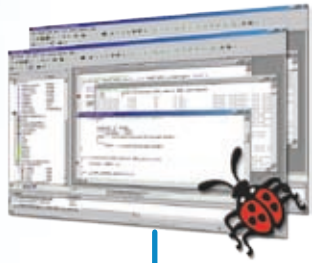
The programming channels can be disabled to avoid any further download !



Complete Tool Chain

There is only one tool chain to learn for the whole range of AVR Flash microcontrollers!
Atmel offers the completely free AVR Studio as the front-end assembler and simulator for the starter kits, programmers, debuggers, evaluation kits, and reference designs.
All created to deliver more functionality... for less.

Integrated Development Environment for AVR



AVR Studio

- Front end for all AVR tools
- C and assembly source level debugging
- Includes Atmel macro assembler
- Supports third party compilers
- Free GCC-AVR C-compiler included
- Freely available from http://www.atmel.com

Compilers	Starter kits	Programmers	Debuggers	Evaluation kits & Reference designs
IAR Systems® CodeVision ImageCraft® GCC-AVR Rowley	STK500 - expansion cards STK600 - expansion cards	AVRISP mkII JTAGICE mkII	JTAGICE mkII	A variety of Evaluation and Reference kits are available on www.atmel.com

Low Cost Development Tool

AVRDRAGON

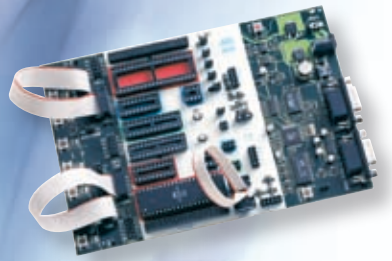
For less than $50, the AVR Dragon (ATAVRDRAGON) sets a new standard for low cost development tools.
AVR Dragon supports all programming modes for the AVR device family.
Programming Interfaces:
– In-System Programming
– High Voltage Serial Programming
– Parallel Programming
– JTAG Programming.

It also includes complete emulation support for devices with 32 KB or less Flash memory.
Emulation Interfaces
– JTAG
– debugWIRE

The AVR Dragon is USB powered and is capable of sourcing an external target.
A prototype area allows simple programming and debugging.

Starter Kits

Atmel offers a modular platform based on the STK500, providing designers an easy way to start with any AVR device and engage development activity.



STK500

STK500 handles most tinyAVR and megaAVR microcontrollers.

- In-system and parallel programming support
- Software programmable clock sources
- LEDs and switches
- Sockets for 8- to 40-pin AVRs
- Expansion connectors for custom boards or expansion modules
- Expansion modules available from Atmel for AVRs with more than 40 pins

STK501 (For 64-pin devices)

STK503 (For 100-pin devices)

STK505 (For 14-pin devices)

STK525 (For USB devices)

STK502 (For 64-pin devices with LCD display)

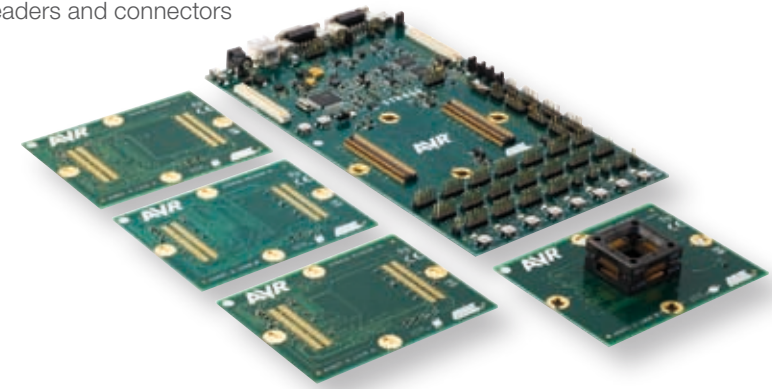
STK504 (For 100-pin devices with LCD display)

STK520 (For 24-pin and 32-pin AT90PWM devices with DALI interface)

STK600

The STK600 is a complete starter kit and development system for the 8-bit AVR and 32-bit AVR32 Flash microcontrollers.

– AVR Studio 4 and AVR32 Studio compatible
– Flexible routing and socket card system for all supported devices
– Parallel and Serial High-Voltage Programming of AVR devices
– JTAG and Serial In-System Programming (ISP) of AVR devices
– 8 general purpose LEDs and switches
– On-board 2 Mbit Data flash for non-volatile data storage
– USB, RS232, CAN, and LIN headers and connectors
– USB or external power



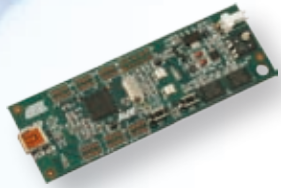
Evaluation and Development Kits

For more dedicated development needs, Atmel also offers specific tools.

LCD Control

AVR Butterfly (ATAVRBFLY) is an evaluation tool demonstrating the capabilities of the ATmega169.
The tool is shipped with preloaded firmware supporting temperature sensing, light measurement, voltage readings, music playback and nametag display.

It can also be re-programmed and used as a hardware platform for code development.



USB Connectivity

The AT90USBKey is a low-cost demonstration board based on the AT90USB1287 microcontroller.
It allows the quick evaluation of AVR microcontrollers and the AT90USB family.

Motor Control

– The ATAVRMC100 kit includes an evaluation board, a 3-phase BLDC motor and a demonstration software. It allows users to quickly evaluate the capability of the AT90PWM3 to control high speed brushless DC motor applications.

– The ATAVRMC200 is an evaluation kit dedicated to asynchronous AC motor control, using various sensors for regulation. The kit includes an evaluation board and a demonstration firmware. Supporting 110-230V motors, the kit also allows evaluation of BLDC motors using the AT90PWM3 AVR microcontroller.

CAN Networking

The ATDVK90CAN1 development kit is dedicated to the AT90CAN AVR microcontrollers. This stand alone board has numerous serial interfaces (dual RS232, CAN, LIN, SPI & TWI) and resources (keyboard, LEDs, voltage reading, light and temperature sensors and speaker) and comes with demonstration software.

Wireless solutions for 802.5.4/ZigBee

– The ATAVRRZ502 RF accessory kit enables point to point links development, debugging and demonstration.
More advanced network topologies can be developed by adding additional RF accessory kits. The kit is top modules for the STK500 AVR starter kit and require a STK500 and STK501 for development purposes.

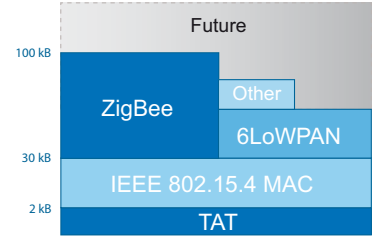
– The ATAVRRZ200 demonstration kit enables development, debugging and demonstration on 802.15.4/ZigBee networks. The kits contains five 802.15.4 compatible 2.4 GHz Radio-Controller Board (RCB) with AT86RF230 radio and ATmega1281V microcontroller.

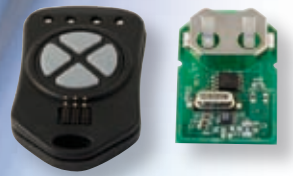
– The ATAVRRZ541 Packet Sniffer Kit is the ideal platform for analyzing 802.15.4 and ZigBee wireless networks. Included is the basic edition of the Sensor Network Analyzer software from Daintree Networks which enables visualization, measurement, and analysis of large networks.

– The ATAVRRZ201 kit contains five 2.4 GHz 802.15.4 compliant and ZigBee compatible Radio-Controller Boards equipped with ATmega1281V micro controller and AT86RF230 transceiver.
By offering additional RCB's, the RZ201 kit complements the RZ200 kit, enabling demonstration of larger wireless networks based on 802.15.4 and ZigBee.

RAVEN: AVR Wireless 2.4 GHz solution

The RZ Raven kit enables development, debugging and demonstration on 802.15.4/ZigBee networks. Raven is using Atmel's 2.4 GHz high performance radio and AVRR picoPower and USB microcontrollers. The software package enables network control, network debugging and over-the-air programming. The ATAVRRZRAVEN kit comes with two Ravens and one RZ USB Stick.





Remote Access Control

The ATAKSTK512 is an Remote Access Control kit for unidirectional communication.
The kit contains a functional standalone UHF radio system consisting of a transmitter (ATtiny45 + T575x) and receiver (ATA5743), and Interface Board.
The STK512 starter kit is available in 2 different versions covering 315 MHz or 434 MHz.

Smart Battery

The ATAVRSB100 smart battery development kit is an evaluation tool and development board for the ATmega406 single-chip smart battery device, accommodating designs incorporating from 2 to 4 Lithium-ion cells.

Lighting

The ATAVRFBKIT is a Dimmable Fluorescent Ballast kit which demonstrate the ability of the AT90PWM2 to control all the main functions of a DALI Fluorescent Ballast. C code is provided to speed-up development time.

In-System Programmers

- **AVRISP mkII**
  - – Supports In-System Programming on all AVRs
  - – Interfaces with AVR Studio
  - – Improved level converters
  - – Supports all AVR target voltages
  - – Target interface protection
  - – Fast programming
  - – USB 1.1 interface to PC
  - – Powers directly from USB, does not draw current from target

- **JTAGICE mkII**
  - – This powerful AVR debug tool can also be used for In-System Programming.
  - – Supports programming via JTAG and ISP.

Debugging Solutions

- **JTAGICE mkII**
  - – Real-Time emulation in actual silicon
    - • Debug the real device at the target level
    - • Communicates directly to the device through
      - 4-pin JTAG interface
      - One-wire debugWIRE interface
  - – Supports
    - Program breakpoints
    - Data breakpoints
    - Full I/O view and watches
    - Full execution control

Support & Contact

Atmel provides extensive support to AVR microcontrollers through its sales offices and network of representatives and distributors.

Atmel's dedicated technical staff as well as certified AVR consultants are available to help and support customer projects.

Atmel.com web site and other web resources from AVR community provide a huge amount of product literature, application notes, tools information and other technical advises. FAQs and community forums also offer a dynamic knowledge resource for AVR.

http://www.atmel.com/avr

Selection Guides, Data Sheets and Errata Sheets

Application Notes and Reference Library

Atmel and Third Party Tools

Software, User Guides

Consultants, Distributors and Atmel Representatives

http://support.atmel.no

Official Atmel MCU technical support center with FAQ and email notification service

http://www.avrtv.com

Official AVR podcasts

http://www.avrfreaks.net

AVR Experts Discussion Forum

Selection Guides for Tools and Products,

Third Party Tools Information, FAQs

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