

Atmel®



# Atmel AVR Microcontrollers for Automotive

## Innovative Atmel AVR Microcontroller Solutions for Automotive

Increasing consumer demands for comfort, safety and reduced fuel consumption are driving rapid growth in the market for automotive electronics. All the new functions designed to meet these demands require local intelligence and control, which can be optimized by the use of small, powerful microcontrollers.

Atmel® leverages its unsurpassed experience in embedded Flash memory microcontrollers to bring innovative solutions for automotive applications. These include a wide range of Atmel AVR® 8- and 32-bit microcontrollers for everything from sensor or actuator control to more sophisticated networking applications. Atmel microcontrollers are fully engineered to fulfill the quality requirements of OEMs in their drive towards zero defects.

### Typical Applications

#### Powertrain

- Turbochargers
- Fuel pumps
  - Exhaust system
- Fan controls
- Battery monitoring
- Intelligent watchdog systems

#### Infotainment

- Car radio amplifiers
- Satellite radio receivers
- Front panels

#### Door, Seat, Sunroof Modules

- Electrical mirrors
- Window locks
- Power windows
- Capacitive touch sensing keypads
- Power seats
- Ambient light
- Roof panels

#### Battery Management

- Li-ion and standard lead-acid battery management for 12V powernet

#### Climate Control

- Blowers
- Flap controls
- Xbridge DC motor control

#### Security

- Car access
  - Remote keyless entry
  - Immobilizers
  - Passive entry/go

#### Dashboard

- Console indicators
- Radio panels
- Climate control panels
- Capacitive sensitive switch panels

#### Body Control Network

- CAN/LIN gateways
- CAN/MOST gateways

### +150°C Qualified

Several AVR microcontrollers are qualified for operation up to +150°C ambient temperature (AEC-Q100 Grade0). These devices enable designers to distribute intelligence and control functions directly into or near, transfer cases, engine sensors actuators, turbochargers and exhaust systems.

Automotive AVR microcontrollers available as Grade0 versions are the Atmel ATtiny45, ATtiny87/167, ATtiny261/461/861, ATmega88/168, ATmega16M1, ATmega32M1, ATmega32C1, ATmega64M1, and ATmega64C1.

Automotive AVR microcontrollers are available in two different temperature ranges to serve various applications:

AEC-Q100 Grade1 Z: -40°C to +125°C  
AEC-Q100 Grade0 D, T2: -40°C to +150°C

### Atmel AVR Architecture Benefits: 8-/32-bit RISC Core: High Performance, Low-power Consumption

The AVR 8-bit and 32-bit architectures have reached a high level of acceptance in many market segments for their:

- Highest system integration with a large number of analog and digital peripherals
- Highest CPU performance with executing instructions in a single clock cycle
- Highest code density with high-level C-language optimization
- Dedicated DSP and floating point instructions (32-bit)
- Self-programming memory
- Product compatibility for both code and features
- Complete and low-cost tool set
- Brown-out detection and Flash corruption security

# Atmel AVR Microcontrollers for Automotive

## Capacitive Touch Products

Capacitive touch solutions are entering the automotive market in integrated centerstacks, touch panels, navigation systems and radio HMI solutions. Atmel offers hardware and software library solutions for touch buttons, sliders and wheels as well as a sophisticated touchscreen controller portfolio addressing screens and pads of all common sizes up to 12 inches and more.

All touch controllers are based on Atmel's market-leading and patented charge transfer technology. They provide dedicated functionalities that meet the specific automotive requirements, such as high-temperature behavior, reliable operation in harsh environments and gloved operation.

The maXTouch® family comprises 4 touchscreen controllers with 143 to 768 nodes addressing different screen sizes, aspect ratios and sensor pitches. They deliver the X/Y coordinates of up to 16 touches via the I<sup>2</sup>C interface.

### mXT143E/ mXT224E Key Features

- Automotive grade 3: -40°C to +85°C
- 143 and 224 channels
- 12-bit resolution
- Support up to 7" screens
- Additional up to 32 channels touch keys
- Unintended touch suppression
- No additional parts needed
- Response time < 10ms from idle
- I<sup>2</sup>C host interface
- TQFP48 package

### mXT540E/ mXT768E Key Features

- Automotive grade 2: -40°C to +105°C
- 540 and 768 channels
- 12-bit resolution
- Support up to 12" screens
- Additional up to 64 channels touch keys
- Unintended touch suppression
- No additional parts needed
- Response time < 10ms from idle
- I<sup>2</sup>C host interface
- TQFP100 package

Part Number	Description	Package
QT1110	11-channel Touch Controller for Touch Buttons	TQFP32 (7x7mm)
mXT143E-A	143-channel Touchscreen Controller, Automotive Grade 3, I <sup>2</sup> C Interface	TQFP48 (7x7mm)
mXT224E-A	224-channel Touchscreen Controller, Automotive Grade 3, I <sup>2</sup> C Interface	TQFP48 (7x7mm)
mXT540E-A	540-channel Touchscreen Controller, Automotive Grade 2, I <sup>2</sup> C Interface	TQFP100 (14x14mm)
mXT768E-A	768-channel Touchscreen Controller, Automotive Grade 2, I <sup>2</sup> C Interface	TQFP100 (14x14mm)

## Meeting Customer Expectations

Features	Meeting Expectations
Capacitive touch technology supports proximity detection, touch buttons, slider, wheels and touchscreens	<ul style="list-style-type: none"> <li>• On-stop shop</li> <li>• Totally integrated HMI</li> </ul>
Unlimited, unambiguous touch identification, tracking and reporting	<ul style="list-style-type: none"> <li>• Multi-touch support</li> </ul>
Smart processing with integrated 32-bit MCU and DSP engine	<ul style="list-style-type: none"> <li>• Integrated gesture calculation</li> <li>• Suppressing unintended touches</li> </ul>
Embedded post-processing algorithms	<ul style="list-style-type: none"> <li>• Adjacent key suppression</li> <li>• Noise filtering</li> <li>• Improved EMI/ESD behavior</li> </ul>
Very fast response time <10ms	<ul style="list-style-type: none"> <li>• Supports character recognition</li> </ul>
High SNR (signal-to-noise ratio): 80:1	<ul style="list-style-type: none"> <li>• Fingertip, back of finger touches supported</li> <li>• Gloved finger operation</li> </ul>



## Automotive: A Completely Distributed Architecture

Comfort and safety features are continuously being added to modern vehicles, requiring more embedded computing power. As cost-effective microcontrollers become available, car makers now have the ability to design distributed architectures with scattered and reprogrammable 8-bit controllers. Alternatively, they can merge all functions in one powerful 32-bit microcontroller with multiple peripherals and networking connections. The Atmel AVR 8-bit microcontrollers are perfectly suited for distributed architectures. They feature on-chip analog interfaces for signal conditioning or programmable I/Os for actuator signaling, and CAN, LIN or PWM networking connections to the ECU.

Centralized architectures benefit from 32-bit AVR microcontrollers with rich peripheral set and multiple CAN and LIN connections.

### CAN Microcontrollers

Two families of automotive 8-bit AVR microcontrollers include an ISO 16845 certified CAN controller peripheral: Atmel AT90CAN128/64/32 series, Atmel ATmega64 M1/32M1/16M1 and Atmel ATmega64C1/32C1 series. They also feature a self-programming technology and a comprehensive set of analog and digital peripherals. With 16Kbytes to 128Kbytes of Flash, they cover a large range of applications. Vector Informatik drivers are available for the 8-bit AVR microcontrollers.

The first 32-bit AVR family UC3Cx512/256/128 incorporates an ISO 16845 certified dual CAN controller with 128 to 512Kbytes of Flash. The 32-bit AVR products are supported by a complete OSEK OSCAN driver and CAN boot loader.

### LIN Microcontrollers

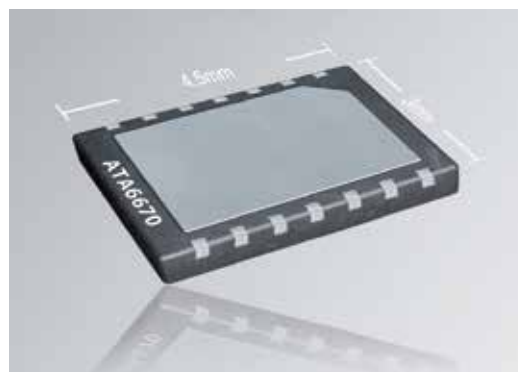
All automotive Atmel ATmega products feature a general-purpose USART to support LIN master and slave systems. A calibrated RC oscillator satisfies the LIN slave synchronization requirements. For LIN master applications, an oscillator with external crystal or resonator is also available.

The Atmel ATtiny167/87 family with a hardware LIN featuring self-synchronization serves cost-sensitive LIN slave applications. The same hardware LIN is also available in Atmel dedicated motor-control AVR products—the Atmel ATmega64M1/32M1/16M1 and Atmel ATmega64C1/32C1. A hardware LIN reduces the flash memory footprint and minimizes LIN real-time constraints.

LIN2.1 protocol stacks are available from Mentor Graphics, Vector Informatik and Dunasys for all AVR microcontrollers with general-purpose USART or hardware LIN.

### LIN Bus Transceivers

The modular Atmel LIN transceiver family includes simple transceiver ICs (Atmel ATA6662C/63/64/70) and complex system basis chips (Atmel ATA6622C/23C/24C/25C/26C/28/29/30/31). All Atmel LIN transceivers are compliant with the LIN specification 2.1 and the SAE J2602-2. A combination of voltage regulator and bus transceiver enables the development of simple, yet powerful slave nodes for LIN bus systems. The ATA6622C/24C/26C/28/30 transceivers also include a window watchdog. The Atmel ATA6626C/64 transceivers, which do not include a time-out feature at the LIN bus, are perfect for systems requiring very slow LIN communication. These devices are designed in the Atmel SMART-I.S.<sup>®</sup> high-voltage BCD-on-SOI process. Due to the advantages of silicon on insulator (SOI) technology, this generation sets new benchmarks for EMI performance. Its ESD protection (8kV) is best in class and enables the design of robust electronic units for harsh automotive environments. This includes automotive comfort applications, intelligent sensors, or other body electronic applications where low-speed data communication and low costs are a requirement.



# Atmel AVR Microcontrollers for Automotive

## LIN and Microcontroller System-in-Package

The highest integration level is achieved by Atmel ATA6612C/13C/14Q/16C/17C system-in-package (SiP) solutions. With these devices, the die of the the ATA6624C or ATA6630 LIN system basis chip (SBC)—including LIN transceiver, voltage regulator, and watchdog—is assembled together with an AVR microcontroller (Atmel ATmega88/168 and Atmel ATtiny87/167) in a single QFN package. Consequently, these SiP solutions enable customers to create complete LIN nodes using just one IC. As all pins of the AVR and SBC are bonded out, the full range of AVR tools are available for development.

## LIN ASSPs

### Battery Management

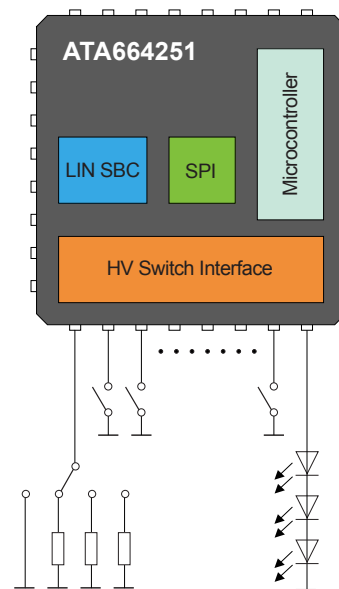
The AVR® ATmega32HVE2 and ATmega64HVE2 microcontroller-based devices with smart sensing technology are designed for intelligent battery sensor applications. The system-in-package solutions determine the state-of-charge and state-of-health of 12V standard lead-acid and lithium-ion batteries by measuring the battery voltage, current and temperature with up to 18-bit accuracy. This improves the performance and longevity of these batteries, and ensures a guaranteed engine start for cars with idle-stop-go function.

### Switch Scan and Ambient Lighting

Atmel's ATA664151 and ATA664251 for automotive switch scan applications and in-vehicle ambient lighting control include a broad range of on-chip functionalities.

The 8-channel high-voltage switch interface with current sources and analog voltage multiplexer enables to scan automotive switches with currents up to 20mA. An integrated state change detector facilitates switch scan applications with extremely low current consumption. The current sources are controlled by three independent PWM signals enabling the device to act as an ambient light circuit to control RGB LEDs.

The ATA664251 is a system-in-package solution with an ATA664151 chip and an Atmel AVR 8-bit ATtiny167 microcontroller.



## Motor Control Applications

Brushless DC motors (BLDC) are increasingly being employed in power train, chassis and body applications. Atmel has developed two families of 8-bit microcontrollers supporting Hall sensor and sensorless applications.

The first of these families is the Atmel ATmega64M1/32M1/16M1, which includes not only a powerful set of analog and digital peripherals optimized for up to six phases BLDC but also CAN and LIN communication to the ECU.

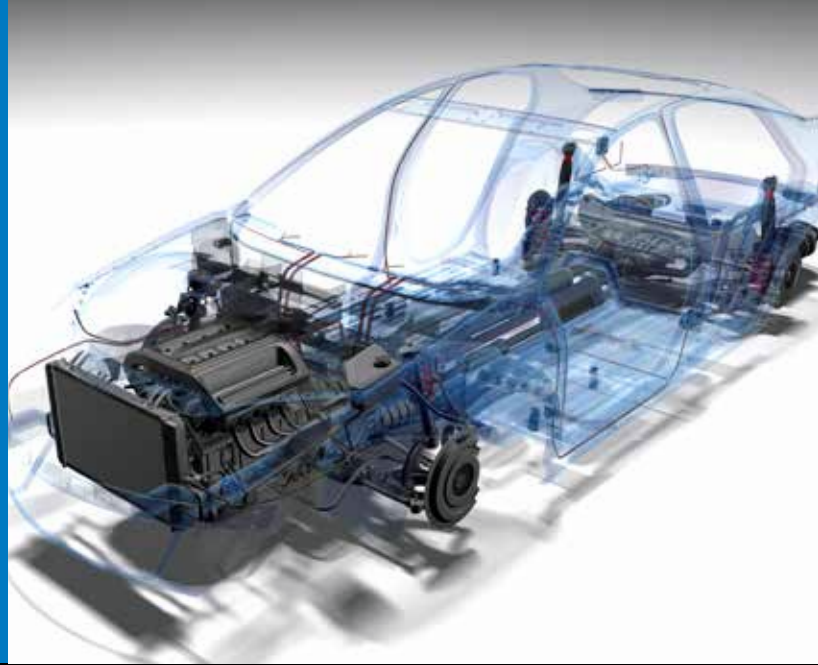
The second family is the Atmel ATtiny861/461/261, which includes a powerful set of analog and digital peripherals for BLDC. This family supports cost-sensitive applications where communication with the ECU is carried out via a simplified I/O system such as PWM command/response.

A family of high-voltage drivers complements Atmel motor-control solutions.

## Automotive Offering

Broad Product Range: Multiplexing and Standard Microcontrollers

The range of devices available to automotive customers currently covers a wide variety of needs and will expand rapidly in the future.



## LIN Bus Transceivers and System Basis Chips

Atmel Part Number	Description	Package
ATA6622C	Same as ATA6623C, with Window Watchdog	QFN20
ATA6623C	LIN System Basis Chip with LIN Transceiver and Integrated 3.3V/50mA Voltage Regulator	SO8
ATA6624C	Same as ATA6625C, with Window Watchdog	QFN20
ATA6625C	LIN System Basis Chip with LIN Transceiver and Integrated 5V/50mA Voltage Regulator	SO8
ATA6626C	Same as ATA6624C, with Time-out Function	QFN20
ATA6628	LIN System Basis Chip with LIN Transceiver, Integrated 3.3V/50mA Voltage Regulator and Window Watchdog	QFN20
ATA6629	LIN System Basis Chip with LIN Transceiver and Integrated 3.3V/50mA Voltage Regulator	SO8
ATA6630	LIN System Basis Chip with LIN Transceiver, Integrated 3.3V/50mA Voltage Regulator and Window Watchdog	QFN20
ATA6631	LIN System Basis Chip with LIN Transceiver and Integrated 3.3V/50mA Voltage Regulator	SO8
ATA6662C	LIN Transceiver with Outstanding EMC Performance, Physical Layer Conforming to LIN Specification 2.0 and SAE J2602-2	SO8
ATA6663	LIN Transceiver, Physical Layer According to LIN Specification 2.1 and SAE J2602-2	SO8, DFN8
ATA6664	LIN Transceiver, Physical Layer According to LIN Specification 2.1 and SAE J2602-2 without Time-out Feature	SO8
ATA6670	Fully Integrated Dual-LIN Transceiver Complying to LIN Specification 2.0, 2.1 and SAE J2602, with Advanced EMI/ESD Performance and TXD-dominant Time-out Feature	DFN14

# Atmel AVR Microcontrollers for Automotive



## LIN and Microcontroller System-in-Package (SiP)

A SiP device combines a LIN transceiver and a microcontroller in one package

Atmel Part Number	LIN SBC	Microcontroller	Package
ATA6612C	ATA6624C	ATmega88	QFN48
ATA6613C	ATA6624C	ATmega168	QFN48
ATA6614Q	ATA6624C	ATtiny87	QFN38
ATA6616C	ATA6624C	ATmega328P	QFN48
ATA6617C	ATA6624C	ATtiny167	QFN38

## LIN ASSPs

Atmel Part Number	Description	Package
<b>Switch Scan and Ambient Lighting</b>		
ATA664151	LIN System Basis Chip with LIN Transceiver, 5V Regulator, Watchdog, 8-channel High Voltage Switch/LED Interface with High Voltage Current Sources, 16-bit SPI	QFN32
ATA664251	16K Flash Microcontroller with LIN Transceiver, 5V Regulator, Watchdog, 8-channel High Voltage Switch / LED Interface with High Voltage Current Sources, 16-bit SPI	QFN48
<b>Battery Management</b>		
ATmega32HVE2	8-bit Microcontroller, 17/18-bit ADC, 32k Flash Memory, 32-bit Math Extension Module, PGA, Power Supply and LIN Transceiver	QFN48
ATmega64HVE2	8-bit Microcontroller, 17/18-bit ADC, 64k Flash Memory, 32-bit Math Extension Module, PGA, Power Supply and LIN Transceiver	QFN48



## Standard Automotive Atmel AVR 8-bit Microcontrollers

Atmel Part Number	Flash (kB)	EEPROM (Bytes)	SRAM (Bytes)	I/O Pins	Vcc (V)	10-bit A/D Channels	Analog Comparator	Motor Ctrl. Timer	16-bit Timer	8-bit Timer	Ext. Interrupts
<b>CAN</b>											
AT90CAN32	32	1024	2048	53	2.7-5.5	8	Yes		2	2	8
AT90CAN64	64	2048	4096	53	2.7-5.5	8	Yes		2	2	8
AT90CAN128	128	4096	4096	53	2.7-5.5	8	Yes		2	2	8
<b>megaAVR</b>											
ATmega48PA	4	256	512	23	2.7-5.5	8	Yes		1	2	26
ATmega88PA	8	512	1024	23	2.7-5.5	8	Yes		1	2	26
ATmega88V	8	512	1024	23	1.8-3.6	8	Yes		1	2	26
ATmega16M1	16	512	1024	27	2.7-5.5	11	4	1	1	1	27
ATmega164P	16	512	1024	32	2.7-5.5	8	Yes		1	2	32
ATmega168PA	16	512	1024	23	2.7-5.5	8	Yes		1	2	26
ATmega169P	16	512	1024	54	2.7-5.5	8	Yes		1	2	17
ATmega32C1	32	1024	2048	27	2.7-5.5	11	4		1	1	27
ATmega32M1	32	1024	2048	27	2.7-5.5	11	4	1	1	1	27
ATmega324P	32	1024	2048	32	2.7-5.5	8	Yes		1	2	32
ATmega328PA	32	1024	2048	23	2.7-5.5	8	Yes		1	2	26
ATmega644P	64	2048	4096	32	2.7-5.5	8	Yes		1	2	32
ATmega64C1	64	2048	4096	27	2.7-5.5	11	4		1	1	27
ATmega64M1	64	2048	4096	27	2.7-5.5	11	4	1	1	1	27
<b>tinyAVR</b>											
ATtiny1634	16	256	1024	18	2.7-5.5	12	Yes		1	1	18
ATtiny24	2	128	128	12	2.7-5.5	8	Yes		1	1	12
ATtiny25	2	128	128	6	2.7-5.5	4	Yes		--	2	7
ATtiny261	2	128	128	16	2.7-5.5	11	Yes		1	1 (10bit)	16
ATtiny44	4	256	256	12	2.7-5.5	8	Yes		1	1	12
ATtiny44V	4	256	256	12	1.8-3.6	8	Yes		--	1	12
ATtiny45	4	256	256	6	2.7-5.5	4	Yes		--	2	7
ATtiny45V	4	256	256	6	1.8-3.6	4	Yes		1	2	7
ATtiny461	4	256	256	16	2.7-5.5	11	Yes		1	1 (10bit)	16
ATtiny84	8	512	512	12	2.7-5.5	8	Yes		--	1	12
ATtiny85	8	512	512	6	2.7-5.5	4	Yes		--	2	7
ATtiny85V	8	512	512	6	1.8-3.6	4	Yes		1	2	7
ATtiny861	8	512	512	16	2.7-5.5	11	Yes		1	1 (10bit)	16
ATtiny87	8	512	512	16	2.7-5.5	11	Yes		1	1	16
ATtiny88	8	64	512	28	2.7-5.5	8	Yes		1	1	28
ATtiny167	16	512	512	16	2.7-5.5	11	Yes		1	1	16

All devices have a programmable brown-out controller, on-chip 8MHz RC oscillator and a watchdog. The maximum frequency is 16MHz.



# Atmel AVR Microcontrollers for Automotive

Hardware Multiplier	PWM Channels	RTC	Self Program Memory	CAN (Mess. Obj.)	SPI	TWI	UART (LIN HW)	Packages	Max. Temp (°C)
Yes	8	Yes	Yes	1 (15)	Yes	--	2	VQFN64, LQFP64	125
Yes	8	Yes	Yes	1 (15)	Yes	--	2	VQFN64, LQFP64	125
Yes	8	Yes	Yes	1 (15)	Yes	--	2	VQFN64, LQFP64	125
Yes	6	Yes	Yes		1+USART	Yes	1	TQFP32, VQFN32	125
Yes	6	Yes	Yes		1+USART	Yes	1	TQFP32, VQFN32	125
Yes	6	Yes	Yes		1+USART	Yes	1	TQFP32, VQFN32	85
Yes	10	--	Yes	1 (6)	Yes	--	1 (Y)	TQFP32, VQFN32	125
Yes	6	Yes	Yes		1+USART	Yes	2	VQFN44, TQFP44	125
Yes	6	Yes	Yes		1+USART	Yes	1	TQFP32, VQFN32	125
Yes	4	Yes	Yes		Yes	USI	1	VQFN64, TQFP64	85
Yes	4	--	Yes	1 (6)	Yes	--	1 (Y)	TQFP32, VQFN32	125
Yes	10	--	Yes	1 (6)	Yes	--	1 (Y)	TQFP32, VQFN32	125
Yes	6	Yes	Yes		1+USART	Yes	2	VQFN44, TQFP44	125
Yes	6	Yes	Yes		1+USART	Yes	1	TQFP32, VQFN32	125
Yes	6	Yes	Yes		1+USART	Yes	2	VQFN32, TQFP44	125
Yes	4	--	Yes	1 (6)	Yes	--	1 (Y)	TQFP32, VQFN32	125
Yes	10	--	Yes	1 (6)	Yes	--	1 (Y)	TQFP32, VQFN32	125
--	4	--	Yes		1+USI	2 (N)		VQFN20, TSSOP20	125
--	4	--	Yes		USI	USI	--	VQFN20, SOIC14	125
--	4	--	Yes		USI	USI	--	VQFN20, SOIC8	125
--	6	--	Yes		Yes	USI	--	VQFN32, VQFN20, SOIC20, TSSOP20	125
--	4	--	Yes		USI	USI	--	VQFN20, SOIC14	125
--	4	--	Yes		USI	USI	--	VQFN20, SOIC14	85
--	4	--	Yes		USI	USI	--	VQFN20, SOIC8	125
--	4	--	Yes		USI	USI	--	VQFN20, SOIC8	85
--	6	--	Yes		Yes	USI	--	VQFN32, VQFN20, SOIC20, TSSOP20	125
--	4	--	Yes		USI	USI	--	VQFN20	125
--	4	--	Yes		USI	USI	--	VQFN20, SOIC8	125
--	4	--	Yes		USI	USI	--	VQFN20, SOIC8	85
--	6	--	Yes		Yes	USI	--	VQFN32, VQFN20, SOIC20, TSSOP20	125
--	3	Yes	Yes		1+USI	No	1 (Y)	VQFN32, SOIC20, TSSOP20	125
--	4	--	Yes		Yes	Yes		TQFP32, VQFN32	125
--	3	Yes	Yes		1+USI	No	1 (Y)	VQFN32, SOIC20, TSSOP20	125



## Automotive Atmel AVR 8-bit Microcontrollers Grade 0 (150°C)

Atmel Part Number	Flash (kB)	EEPROM (Bytes)	SRAM (Bytes)	I/O Pins	V <sub>cc</sub> (V)	10-bit A/D Channels	Analog Comparator	Motor Ctrl. Timer	16-bit Timer	8-bit Timer	Ext. Interrupts
<b>megaAVR</b>											
ATmega88PA	8	512	1024	23	2.7-5.5	8	Yes		1	2	26
ATmega16M1	16	512	1024	27	2.7-5.5	11	4	1	1	1	27
ATmega168PA	16	512	1024	23	2.7-5.5	8	Yes		1	2	26
ATmega32C1	32	1024	2048	27	2.7-5.5	11	4		1	1	27
ATmega32M1	32	1024	2048	27	2.7-5.5	11	4	1	1	1	27
ATmega64C1	64	2048	4096	27	2.7-5.5	11	4		1	1	27
ATmega64M1	64	2048	4096	27	2.7-5.5	11	4	1	1	1	27
<b>tinyAVR</b>											
ATtiny261	2	128	128	16	2.7-5.5	11	Yes		1	1 (10bit)	16
ATtiny45	4	256	256	6	2.7-5.5	4	Yes		--	2	7
ATtiny461	4	256	256	16	2.7-5.5	11	Yes		1	1 (10bit)	16
ATtiny87	8	512	512	16	2.7-5.5	11	Yes		1	1	16
ATtiny861	8	512	512	16	2.7-5.5	11	Yes		1	1 (10bit)	16
ATtiny167	16	512	512	16	2.7-5.5	11	Yes		1	1	16

All devices have a programmable brown-out controller, on-chip 8MHz RC oscillator and a watchdog. The maximum frequency is 16MHz.

## Automotive Atmel AVR 32-bit Microcontrollers

Atmel Part Number	Core (DMIPS)	Flash (kB)	SRAM (kB)	DMA	I/O Pins	V <sub>cc</sub> (V)	ADC Channels	DAC Channels	Analog Comparator	16-bit Timer
UC3C0128	AVR32 (68)	128	32	16c & event system	123	3.0-3.6 / 4.5-5.5	12b 16c	12b 4c	4	6
UC3C1128	AVR32 (68)	128	32	16c & event system	81	3.0-3.6 / 4.5-5.5	12b 16c	12b 4c	4	6
UC3C2128	AVR32 (68)	128	32	16c & event system	45	3.0-3.6 / 4.5-5.5	12b 11c	12b 4c	2	3
UC3C0256	AVR32 (68)	256	64	16c & event system	123	3.0-3.6 / 4.5-5.5	12b 16c	12b 4c	4	6
UC3C1256	AVR32 (68)	256	64	16c & event system	81	3.0-3.6 / 4.5-5.5	12b 16c	12b 4c	4	6
UC3C2256	AVR32 (68)	256	64	16c & event system	45	3.0-3.6 / 4.5-5.5	12b 11c	12b 4c	2	3
UC3C0512	AVR32 (68)	512	64	16c & event system	123	3.0-3.6 / 4.5-5.5	12b 16c	12b 4c	4	6
UC3C1512	AVR32 (68)	512	64	16c & event system	81	3.0-3.6 / 4.5-5.5	12b 16c	12b 4c	4	6
UC3C2512	AVR32 (68)	512	64	16c & event system	45	3.0-3.6 / 4.5-5.5	12b 11c	12b 4c	2	3
UC3A0512	AVR32 with MPU (91)	512	64	15c	109	3.0-3.6 (5V tolerant)	10b 8c	Audio DAC	-	3

All devices have a programmable brown-out controller, on-chip 8MHz RC oscillator and a watchdog. The maximum frequency is 66MHz (UC3A0512) and 50MHz (all others).

# Atmel AVR Microcontrollers for Automotive

Hardware Multiplier	PWM Channels	RTC	Self Program Memory	CAN (Mess. Obj.)	SPI	TWI	UART (LIN HW)	Packages	Max. Temp. (°C)
Yes	6	Yes	Yes		1 + USART	Yes	1	TQFP32, VQFN32	150
Yes	10	--	Yes	1 (6)	Yes	--	1 (Y)	TQFP32, VQFN32	150
Yes	6	Yes	Yes		1 + USART	Yes	1	TQFP32, VQFN32	150
Yes	4	--	Yes	1 (6)	Yes	--	1 (Y)	TQFP32, VQFN32	150
Yes	10	--	Yes	1 (6)	Yes	--	1 (Y)	TQFP32, VQFN32	150
Yes	4	--	Yes	1 (6)	Yes	--	1 (Y)	TQFP32, VQFN32	150
Yes	10	--	Yes	1 (6)	Yes	--	1 (Y)	TQFP32, VQFN32	150
--	6	--	Yes		Yes	USI	--	VQFN32, VQFN20, SOIC20, TSSOP20	150
--	4	--	Yes		USI	USI	--	VQFN20, SOIC8	150
--	6	--	Yes		Yes	USI	--	VQFN32, VQFN20, SOIC20, TSSOP20	150
--	3	Yes	Yes		1 + USI	No	1 (Y)	VQFN32, SOIC20, TSSOP20	150
--	6	--	Yes		Yes	USI	--	VQFN32, VQFN20, SOIC20, TSSOP20	150
--	3	Yes	Yes		1 + USI	No	1 (Y)	VQFN32, SOIC20, TSSOP20	150

Extended Timers	Ext. Interrupts	DSP Instructions	RTC	CAN (Mailboxes)	Ethernet	USB	USART (LIN HW)	SPI	TWI	I <sup>2</sup> S	EBI	Package	Max. Temp. (°C)
20b 4c motor control	8	Y & FPU	Y	2 (16)	1	FS	5 (5)	2	3	1	Y	LQFP144	125
20b 4c motor control	8	Y & FPU	Y	2 (16)	1	FS	5 (5)	2	3	1	-	TQFP100	125
20b 4c motor control	8	Y & FPU	Y	2 (16)	1	FS	4 (4)	1	2	1	-	TQFP64/QFN64	125
20b 4c motor control	8	Y & FPU	Y	2 (16)	1	FS	5 (5)	2	3	1	Y	LQFP144	125
20b 4c motor control	8	Y & FPU	Y	2 (16)	1	FS	5 (5)	2	3	1	-	TQFP100	125
20b 4c motor control	8	Y & FPU	Y	2 (16)	1	FS	4 (4)	1	2	1	-	TQFP64/QFN64	125
20b 4c motor control	8	Y & FPU	Y	2 (16)	1	FS	5 (5)	2	3	1	Y	LQFP144	125
20b 4c motor control	8	Y & FPU	Y	2 (16)	1	FS	5 (5)	2	3	1	-	TQFP100	125
20b 4c motor control	8	Y & FPU	Y	2 (16)	1	FS	4 (4)	1	2	1	-	TQFP64/QFN64	125
20bit 7c PWM	8	Y	Y	-	1	FS-OTG	4 (0)	2	1	1	Y	LQFP144	85

## Atmel AVR 8-bit Tools: Easy and Complete Tool Chain Integrated Development Environment: Atmel Studio 6

- Front end for Atmel AVR Starter Kits, Programmers and Emulators
- Macro assembler
- C and assembly source level debugging
- C-compiler interface
- Plug-in for GCC compiler
- AVR simulator
- Freely available at <http://www.atmel.com>

Contents	Description
Compilers	CodeVision, GCC-AVR, IAR Systems®, ImageCraft®, Rowley
On-chip Debugger	JTAGICE mkII
In-system Programmers	AVRISP mkII, JTAGICE mkII, STK®501 + STK524
Starter Kits	STK600
CAN and LIN Driver Libraries	Atmel Drivers (See also Third-party Tools)

### Third-party LIN Stack

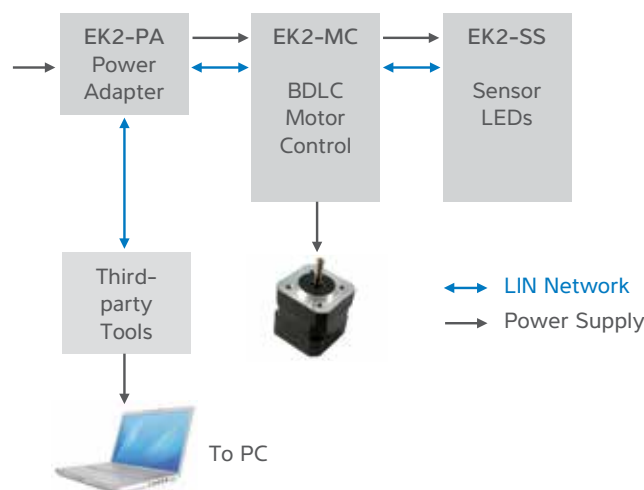
Vector, Mentor Graphics® and Dunasys provide LIN2.1 stacks that support all members of the Atmel microcontroller families with embedded USART (i.e., all Atmel ATmega devices), including all parts with an embedded hardware LIN macro (Atmel ATtinyx7 family). These stacks are available for master or slave LIN2.1 nodes.

All Atmel ATmega and ATtinyX7 devices are able to run Vector, Mentor or Dunasys LIN 2.1 stacks with the Atmel capacitive touch library, thereby allowing a one-chip solution for touch and LIN networking applications.

### Evaluation Kits

AVRAUTO-EK2 is an automotive kit for motor control and LIN. The individual boards are explained in the table below.

Atmel Part Number	Contents
AVRAUTO-EK2 (PA Board)	Power Adapter Board
AVRAUTO-EK2 (MC Board)	LIN2.1 Master Node for BLDC Motor Control
AVRAUTO-EK2 (SS Board)	LIN2.1 Slave Node with Sensors and LEDs



# Atmel AVR Microcontrollers for Automotive

## Development Kits

Contents	Description
MC320 Motor Control Kit for CAN and LIN Applications	
ATAVRMC300	Power Stage Board
ATAVRMC310	Device Board for ATmega32M1
Motor	BLDC Motor

## maXTouch Support Tools



For all automotive touchscreen controllers, evaluation kits including automotive-qualified PCBs, touch sensors, software and documentation are available.

Atmel Part Number	Ordering Code	Sensor
mXT540E	EVK-MXT540EAT-B	7" glass
mXT768E	EVK-MXT768EAT-B	8" glass

## Atmel QTouch Library

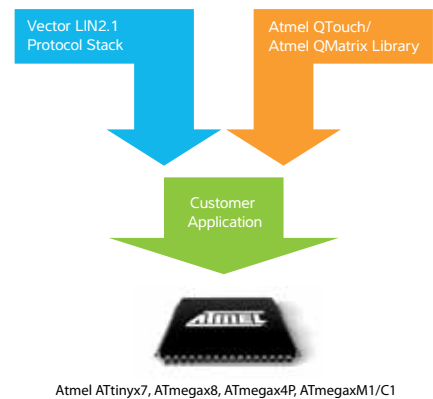
The Atmel QTouch® Library is a set of pre-compiled binaries for supported AVR microcontrollers. The library supports both QTouch and Atmel QMatrix® acquisition methods. Please refer to the QTouch Library User Guide for a full overview of which devices are supported in each technology.

### Supported Atmel ATtiny AVR products

- ATtiny44/84
- ATtiny45/85
- ATtiny461/861
- ATtiny88
- ATtiny87/167

### Supported Atmel ATmega AVR products

- ATmega48/88/168/328P
- ATmega164P/324P/644P
- ATmega169P
- ATmega16M1
- ATmega32M1/C1
- ATmega64M1/C1



## Atmel AVR 32-bit Tools

- Atmel Studio 6
- C/C++ Compiler
- Atmel Software Framework
- Starter Kits
- Debuggers

## Starter Kit

Atmel Part Number	Description
STK600	Generic Starter Kit

## Evaluation Kits

Atmel Part Number	Description
EVK1100	UC3A Evaluation Kit
AT32UC3C-EK	UC3C Evaluation Kit



## Quality: Atmel Fully Committed to Automotive

AVR microcontrollers meet the most stringent requirements for ensuring robust functionality in harsh environmental conditions. This is the result of more than 25 years experience in automotive design coupled with a continuous quest for excellence throughout the entire organization. The Atmel Quality Management System has complied from its inception with the highest-level standards, including ISO/TS 16949. As a result, car makers worldwide have for many years employed Atmel microcontrollers in a variety of vehicle applications—from infotainment to safety-critical functions, as well as multiplexing. This industrial expertise plus extended R&D efforts have allowed Atmel to successfully address the market of “Grade0” microcontrollers capable of withstanding the most severe environmental conditions.

## Dedicated Resources for Dedicated Methodologies

In the quality domain, as in many others, Atmel is a leader in its field. Beyond a full product qualification according to AEC-Q100, Atmel has embedded quality into the entire product lifecycle—from the early design stage until the end of life. This includes the application of particular techniques, tools and methodologies such as identification of Special Characteristics, Failure Modes and Effects Analysis (FMEA), design-for-test techniques, Part Average Testing (PAT) or Advanced Burn-In (AdBI), optimized capability, safe launch support teams and more. These approaches are developed and deployed by a dedicated automotive structure that includes world-class Marketing, Design, Applications, Product Engineering and Quality and Reliability in-situ facilities.

# Atmel AVR Microcontrollers for Automotive



## Key Atmel Quality Objectives for Automotive Success

- Zero defects is our goal, zero tolerance is our approach
- 100% on-time delivery
- Excellence in development and manufacturing to exceed customer expectations
- Immediate response to minimize the impact of any customer issue
- Total commitment by all employees throughout the entire organization

## Continuous Improvement

To meet the zero-defect challenge, Atmel launched a three year automotive quality plan in 2008 that resulted in harmonized targets, development, and supply chain and quality policy for the automotive portfolio. The implementation of a customer-focused quality structure has further enabled the company to closely adhere to customer-specific requirements. Atmel is also continuously examining its development and qualification approaches to achieve best-in-class reliability. All this explains why Atmel plays a key role in several major automotive European programs—such as Failure-driven Qualification (Medea+ A407 FdQ) and End of Life Investigation for Automotive Systems (Catrene 2T204 ELIAS)—which are paving the way to future international standards. These important R&D programs have resulted in techniques for Robustness Validation (SAE J1879) and contribute to support the new requirements of Road Vehicles Functional Safety (ISO 26262).



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