

➤ **Mixed-signal ICs**
for Body & Powertrain Electronics



Atmel's Automotive Commitment

Atmel®, a globally operating manufacturer of innovative integrated circuits, has more than 20 years of automotive electronics design expertise, and is a market leader in various automotive areas. With a broad scope of automotive-dedicated technologies such as BCDMOS and BCD-on-SOI, and with automotive-qualified fabs (ISO 9001: 2000, ISO/TS 16949: 2002, ISO 14001: 2004), Atmel

is able to provide high-end products that meet automotive's strict quality demands and that make vehicles more safe, economical, and convenient. Design-ins are supported by our application engineers, demonstration and evaluation kits, reference boards, software, and detailed documentation.



Body & Powertrain Electronics



Atmel has more than 20 years experience in body electronic designs and is a market leader in various areas (e.g., direction indicator ICs). Our leading body electronics IC program, based on long-time expertise in stand-alone basic car-function controllers, covers ICs for all standard car electronic functions. A family of intelligent BCDMOS load drivers for universal use completes Atmel's automotive product line.

The product portfolio includes:

- LIN Transceiver System Basis Chips (SBC)
- Smart Drivers and Bridges
- Microcontrollers
- ASICs



Applications

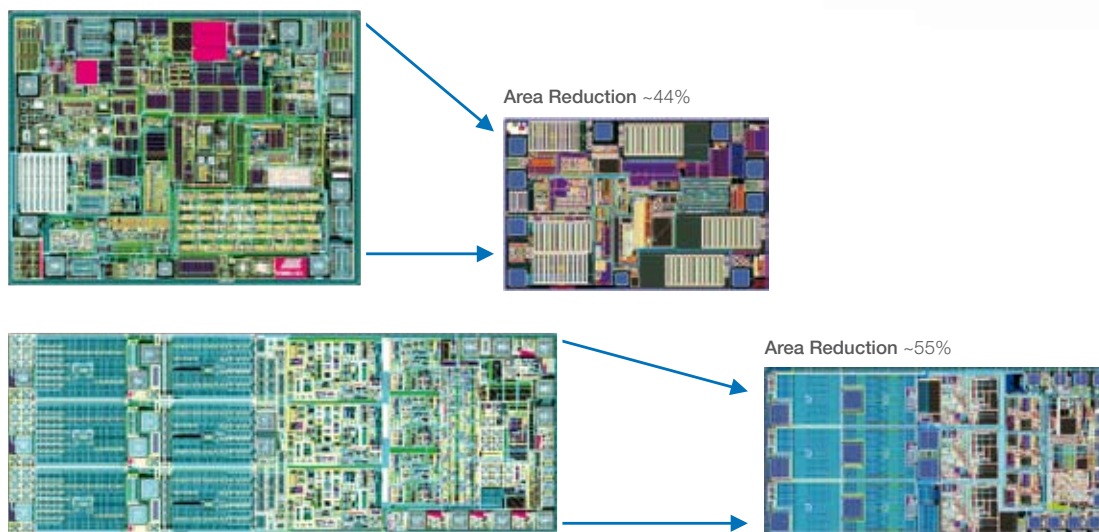
- In-vehicle Networking (LIN/CAN)
- Smart Drivers
- High-temperature Systems
- Failsafe Systems
- Watchdogs
- Direction Indication
- Airbag
- Flasher
- Wipe/Wash Systems
- Lamp-outage Monitoring
- Timers
- Dashboard Dimmers



BCD-on-SOI Technology

Atmel's innovative mixed-signal BCD-on-SOI technology (SMARTIS™), which is used for many body electronics and powertrain devices, enables maximum integration, extended EMC performance, and high-temperature capability.

Size Comparison of BCDMOS Bulk Technology and SOI



SOI: die-cost reduction



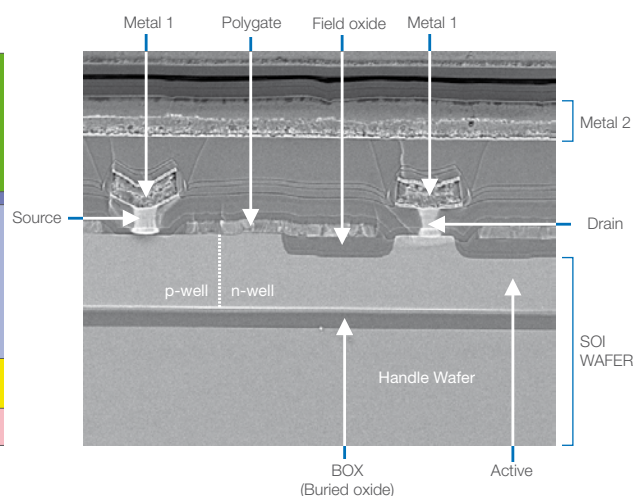
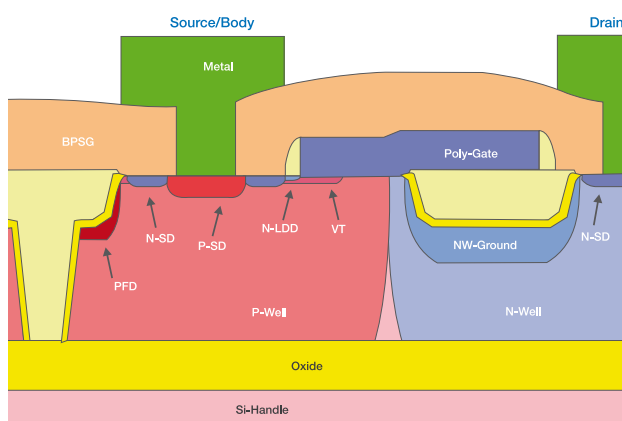
SMARTIS Features

- Fully Dielectric Isolated Twin Well, 3 Metal Layers, Operating Temperatures up to 200°C
- High-density 5V NMOS and PMOS Transistors
- DMOS High-voltage Capability up to 120V
- DMOS Family for 25V, 45V, 65V and 80V Available as Standard
- Additional 120V Option
- Bipolar PNP and NPN Transistors Available
- Patented DMOS Method for Optimized Trade-off between $V_{\text{breakdown}}$ and R_{dson}



SMARTIS Benefits

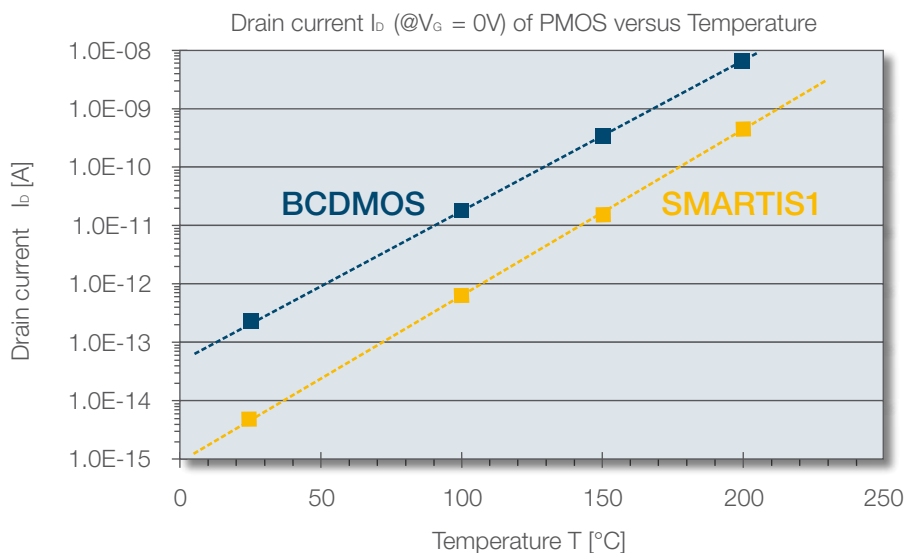
- High-temperature and High-voltage Capability
- Small Size (Gate Density Equivalent to 0.5 μm CMOS)
- Excellent Radiation Hardness
- Reduced R_{dson} Due to SOI
- Lower Parasitics for Simpler Design
- Higher Switching Frequencies for Power Devices
- Reduced Switching Losses
- Improved Latch-up Immunity
- Low Leakage Currents
- Reduced Electromagnetic Susceptibility
- Improved Efficiency, e.g., Power Converters
- New and Easy-to-realize Design Concepts
- Reuseability of IPs



Schematic (left) and SEM cross section (right) of high-voltage DMOS-on-SOI (SMARTIS)

The diagram shows the drain current of a typical PMOS transistor versus the ambient temperature for the two technologies: BCDMOS (bulk technology) and Atmel's dedicated BCD-on-SOI process, SMARTIS™. Due to the use of SOI substrates, the

SMARTIS technology provides extremely low leakage currents compared to conventional BCDMOS technologies. The leakage currents of MOSFETs realized in SMARTIS technology are up to 2 orders of magnitude lower.





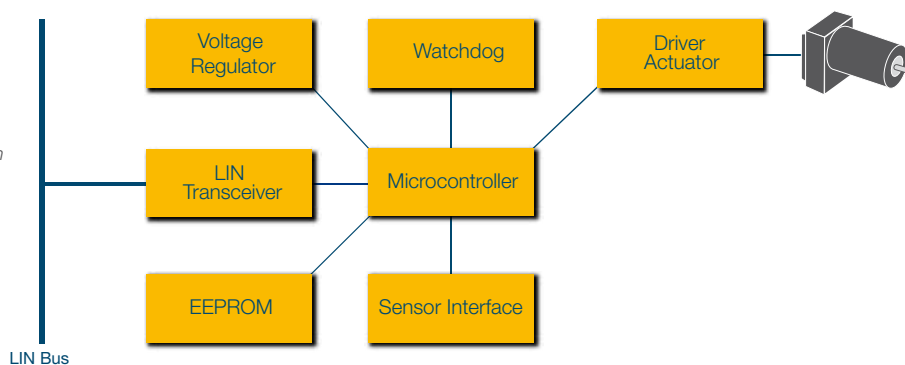
Applications

For body electronic applications, Atmel offers a broad range of standard ICs, including LIN transceiver ICs, watchdog ICs, multi half-bridges, H-bridges, stepper-motor driver ICs, EEPROMs, and a family of cost-effective AVR® microcontrollers. A new gate driver IC family allows maximum flexibility and enables intelligent functions such as LIN interface, watchdog, voltage regulator and sensor signal conditioning.

System-in-Package (SiP) solutions integrating a LIN transceiver and an 8-bit microcontroller in one small package allow the realization of a complete LIN node solution with one IC.

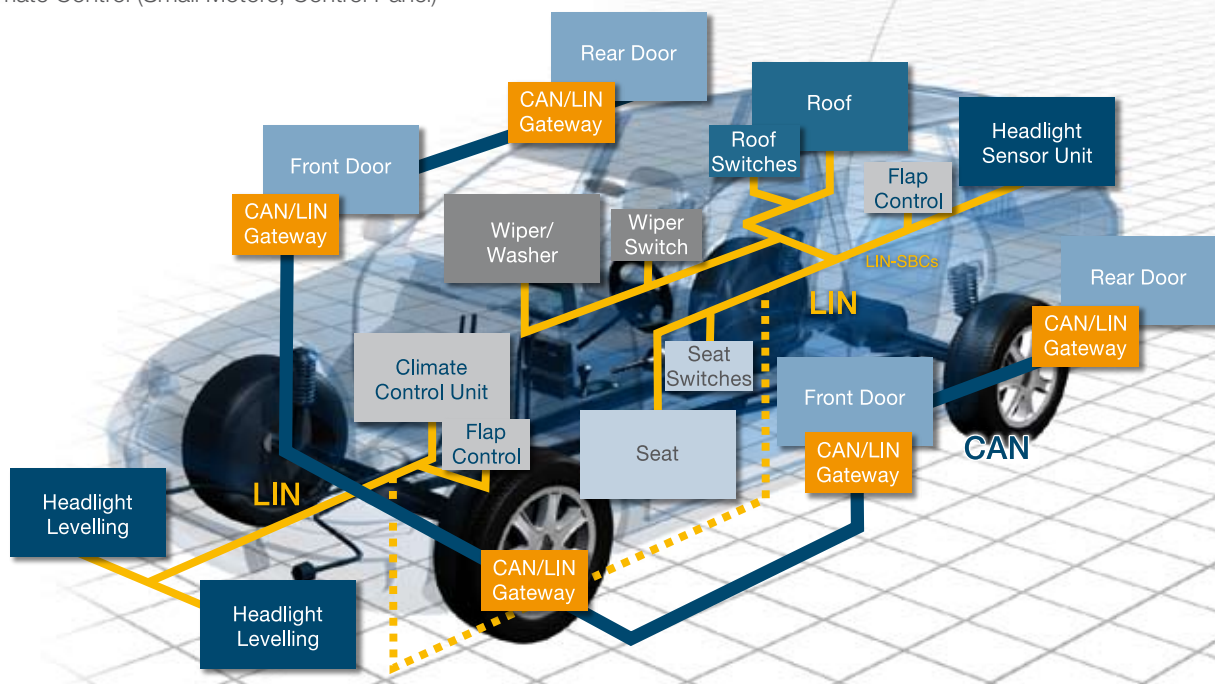
The following sections briefly outline these applications.

Intelligent partitioning: typical block schematic with LIN bus connection for a DC motor application



LIN Applications

- Roof (Rain Sensor, Light Sensor, Light Control, Sunroof, etc.)
- Door Modules (Mirror, Central ECU, Mirror Switch, Window Lift, Seat Control, Switch, Door Lock, etc.)
- Climate Control (Small Motors, Control Panel)
- Steering Wheel (Cruise Control, Wiper, Turn Signal, etc.)
- Seat (Seat Position Motors, Occupancy Sensor, Control Panel)
- Engine (Sensors, Small Motors)





LIN Transceiver System Basis Chips

Introduced in 1999, the emerging LIN protocol was established for simple, cost-effective applications, complementing the already existing CAN protocol.

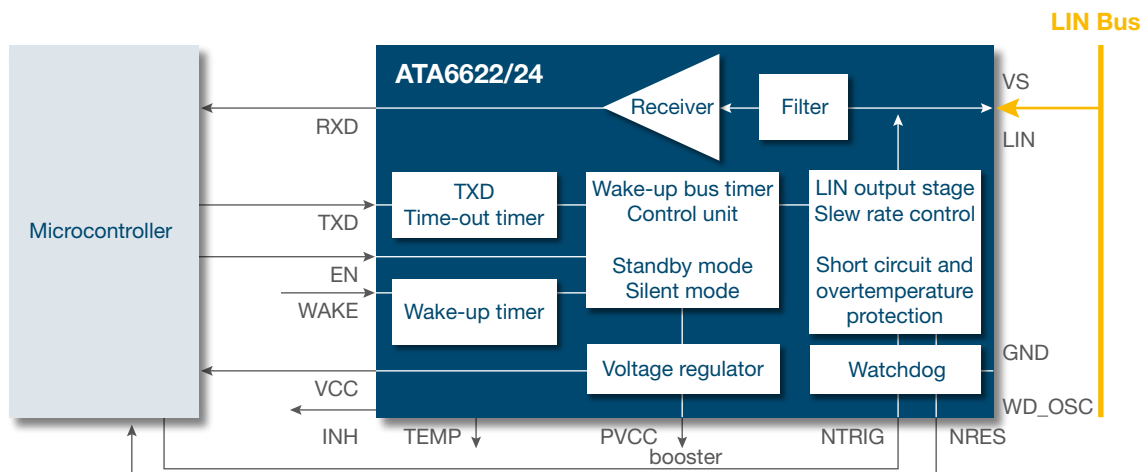
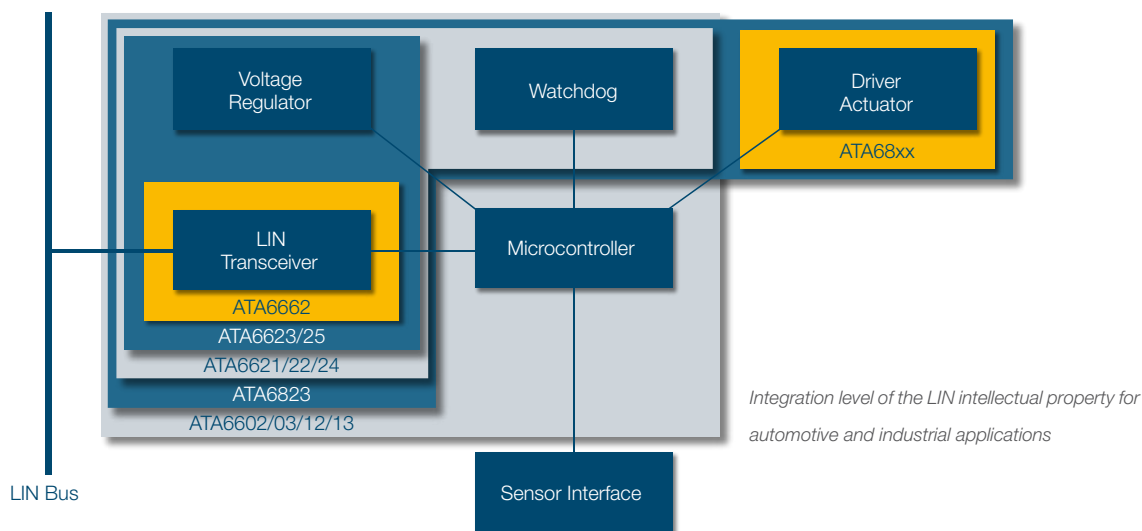
A typical LIN slave node consists of a LIN transceiver, 5V voltage regulator, microcontroller, watch-dog, EEPROM, and smart driver.



LIN Bus Transceiver ICs and SBCs

Atmel offers a new LIN transceiver generation, comprising the stand-alone LIN transceiver ATA6662 and the higher integrated LIN system basis chip (SBC) ATA6623/25, which includes a LIN2.0-compliant LIN transceiver and a 3.3V/5V voltage regulator. The extended version ATA6622/24 additionally integrates a window watchdog. These devices are designed in Atmel's high-voltage BCD-on-SOI (SMARTIS) process. Due to the advantages of this technology, Atmel's new LIN generation sets new benchmarks in EMI performance and ESD protection (8 kV). This helps to design robust electronic units in the auto-

motive harsh environment, including automotive comfort applications, intelligent sensors, or other body electronic applications, where low-speed data communication is sufficient and low cost is an important feature. All these functions are integrated in the gate driver IC ATA6823, which is extremely flexible and can be used for a variety of DC motor applications. Maximum integration is achieved by using a multi-chip module (MCM) where, for example, the system basis chip ATA6624 and a small 8-bit AVR microcontroller are implemented into one package.





LIN Microcontrollers

Atmel, a member of the LIN consortium since 2001, provides AVR- (RISC) based LIN microcontrollers, together with a set of powerful development tools, to allow designers to create fast and reliable automotive networking implementations.

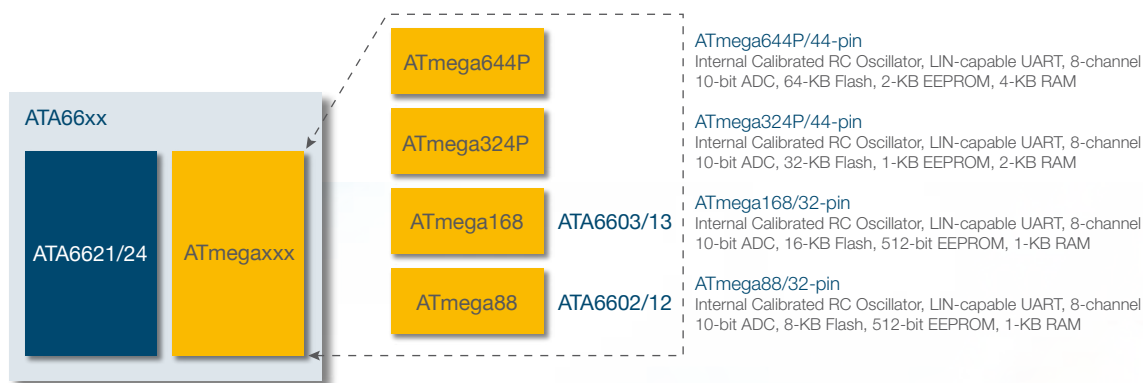


LIN & Microcontroller System-in-Package

An even higher integration level can be achieved by System-in-Package (SiP) solutions, where a die with analog functionality is assembled together with a microcontroller in one package. Atmel applies the SiP technology to its family of LIN & Microcontroller System-in-package devices, where the ATA6621/24 is combined with one of Atmel's well-known 8-bit microcontrollers in a single QFN package. First members of this family are the ATA6602/ATA6603, including both the ATA6621 and the AVR ATmega88 with 8 Kbyte Flash memory/AVR ATmega168 with 16 Kbytes Flash memory in a QFN48 package.

The second generation includes the new system basis chip ATA6624. This multi-chip device is available in various versions ranging from 8-Kbyte to 64-Kbyte Flash memory.

Using these devices, customers can create a complete LIN node solution, requiring minimum space, with one IC. Benefits include a reduced number of components needed, shorter time-to-market and lower cost of ownership. Atmel's standard AVR development tools can be used.



CAN Bus Transceiver ICs

For CAN systems, Atmel offers the high-speed BCDMOS CAN bus transceiver IC ATA6660, which is especially designed for high-speed differential-mode data transmission such as AC motor drivers in the large-scale equipment industry. The ATA6660 is fully compatible to ISO 11898 (CAN-C).

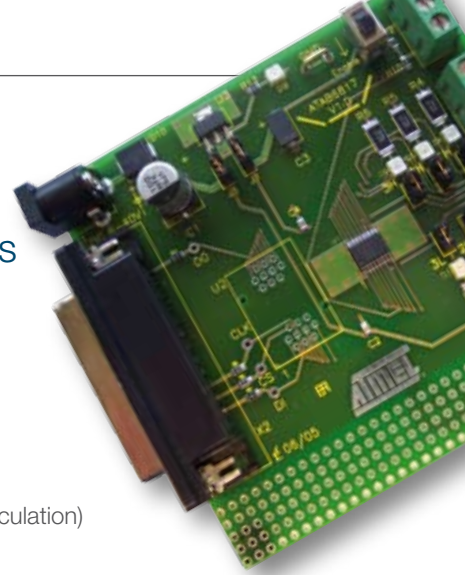




Smart Drivers and Bridges for DC-Brush Applications

- Beam Levelling
- Climate Control
- Mirror Control
- Power Seat
- Door Lock
- Power Window
- Wiper

- Sun Roof
- Engine Control
- Gear Box
- Fan Control
- Turbo Charger
- EGR (Exhaust Gas Recirculation)
- x-by-wire Applications



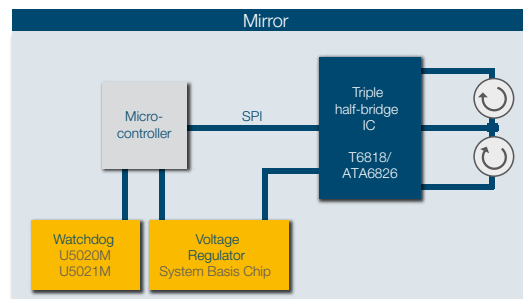
Multi-half-bridge Drivers



Door Module Solution

Today's smart-power technologies enable applications such as electric mirrors, power windows, electrical door locks, lights, LEDs, and control panels. The integration of electronic functions into the door will continue to increase in the future. The trend is towards plug-and-play modules for discrete door functions with communication via the LIN bus architecture. The master could be the central body ECU or the window lift module, additional functions can be added easily as slave connections. Flexibility of production using high-volume standard products, wiring harness reduction, and new power-

by a half-bridge driver IC. Atmel's T6818/ATA6826 have 3 high-side and 3 low-side drivers, each capable of driving up to 1.5A/1.0A. The ICs have integrated diagnostic features such as overtemperature warning and shutdown, undervoltage and open-load detection. Overload is regulated by current limitation. The communication with the microcontroller takes place via the 16-bit SPI interface.



saving concepts are all advantages offered by this model. Atmel's SMARTIS technology for powerful automotive smart drivers with integrated LIN interface is excellently suited to support this trend.

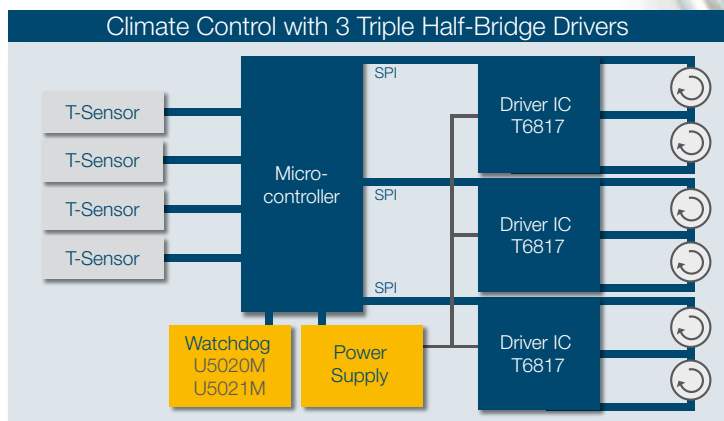
In the typical mirror application, two DC motors are required for positioning, one for the x-axis and the second for the y-axis. These motors can be driven

by a half-bridge driver IC. Atmel's half-bridge driver family offers additional features such as PWM functionality (T6819/ATA6831) or a small power package for higher power dissipation (ATA6828/29).

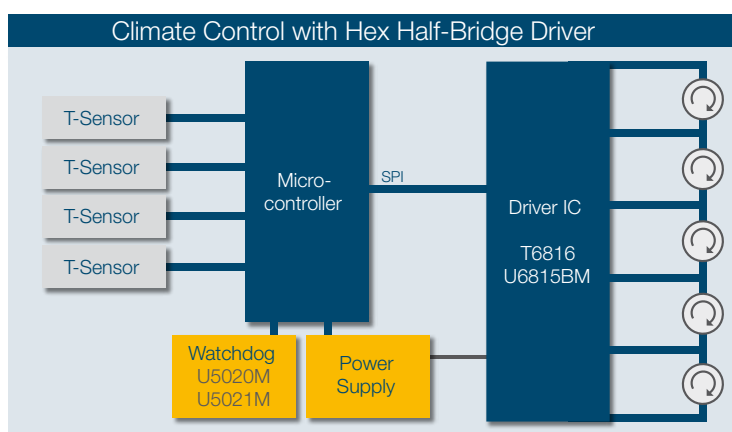
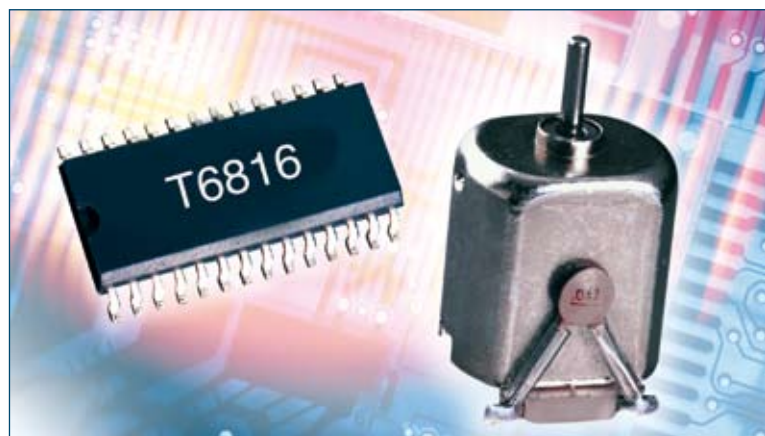




Body Control Unit



HVAC systems are becoming more and more complex, offering an increasing number of features as well as improved performance and reduced power consumption. With the T681x family, Atmel offers an extensive product portfolio for HVAC systems. These driver ICs are fully protected against overtemperature and undervoltage. Open-load and overload detection are also integrated.

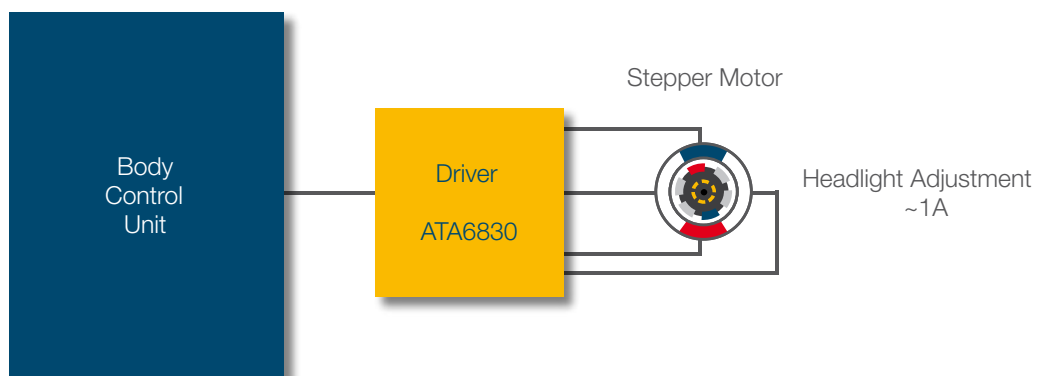




Stepper Motor Drivers



Lighting (e.g., Beam Levelling)



Today, there are different beam levelling systems available. Most cars have a static automatic beam adjustment, i.e., in the case of a heavy load in the trunk, the headlights have to be manually adjusted by turning a small wheel in the cockpit. Newer systems are based on an automatic or dynamic headlight adjustment which is used in HID (High-Intensity Discharge, XENON) lighting systems. This

system dynamically adjusts the light while the car is moving, for example, if acceleration or braking occurs. Atmel's stepper-motor control IC ATA6830 is specifically designed for such dynamic headlight adjustment applications. A special feature is that the integrated process control independently moves the stepper motor into the desired position. This enables automatic acceleration and slow-down.



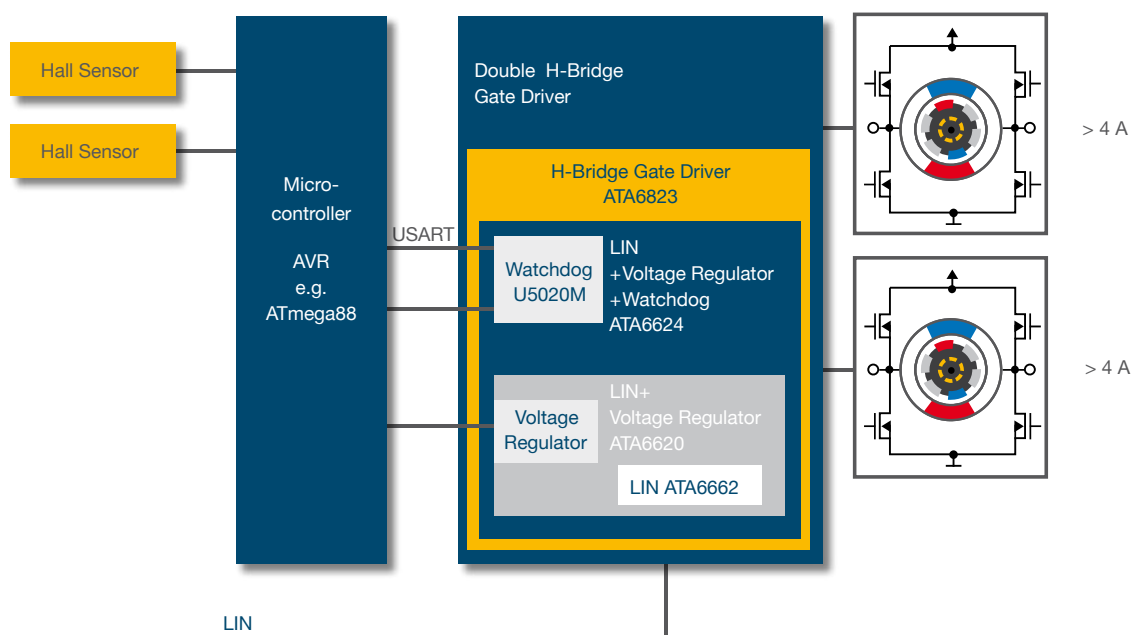


Gate Driver Family for DC-Brush Applications

Atmel's gate driver family in SOI (Silicon On Insulator) technology is designed for high-temperature applications (ambient temperatures up to 150°C) as required in mechatronic solutions for powertrain applications such as turbo chargers, throttle control, etc.



Seat Module Solution



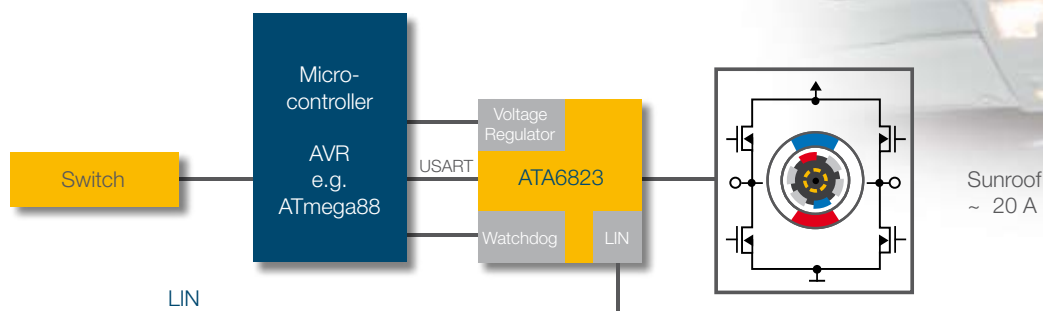
Comfort features are becoming more and more popular in modern automobiles. In the past, the seat control module covered mainly the seat positioning and heating, whereas today, additional features such as massage functionality and seat ventilation are integrated. This requires many power drivers to be integrated to manage the various brushed DC motors in the seat module. For these applications, Atmel offers both standard stand-alone products

(e.g., LIN transceiver ICs and AVR® microcontrollers), as well as highly integrated gate driver ICs such as the ATA6823 with integrated voltage regulator, watchdog functionality, and LIN transceiver.





Sunroof Module

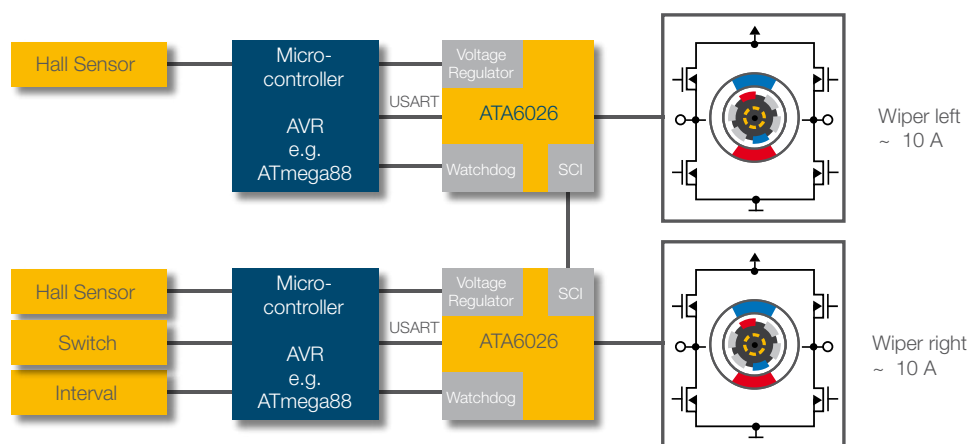


The sunroof module in the overhead console controls sunroof operations such as Open, Close and Vent. The fully electronic operation with one-touch safety/comfort control is a feature that allows open-

ing or closing the roof with a single touch of an illuminated switch. The roof is opened by a brushed DC motor which must be driven by a full-bridge driver IC such as the ATA6823.



Front Wiper



Today, a typical front wiper system consists of one DC motor which actuates the two front wipers. A mechanical link between the left and the right wiper ensures the synchronization which is necessary due to the different windshield films. The next generation of wiper systems will eliminate the noisy and heavy mechanical link.

In future systems, each wiper will be controlled and driven by its own brushed DC motor. To reduce wires, the microcontroller and the gate driver will be placed directly at the DC motor and only one wire between the gate drivers will be required to synchronize the system. Atmel's gate driver IC ATA6026 is specially designed for front wiper systems and includes a voltage regulator, watchdog, and SCI interface.



High-temperature Drivers

Atmel's driver ICs are also available for high-temperature applications. In mechatronic solutions, for example, turbo charger or exhaust gas recirculation systems, many flaps have to be controlled by DC motor driver ICs which are located very close to the hot engine. Due to the advantages of Atmel's own SOI technology SMARTIS™, these driver ICs can withstand ambient temperatures of up to 150°C/302°F.



ATA6824

If higher output currents are required, the MOSFET driver IC ATA6824 is recommended. This device includes in addition a 5V/3V voltage regulator for microcontroller supply, a window watchdog and a serial interface. The integrated motor control unit avoids peak currents within the H-bridge.



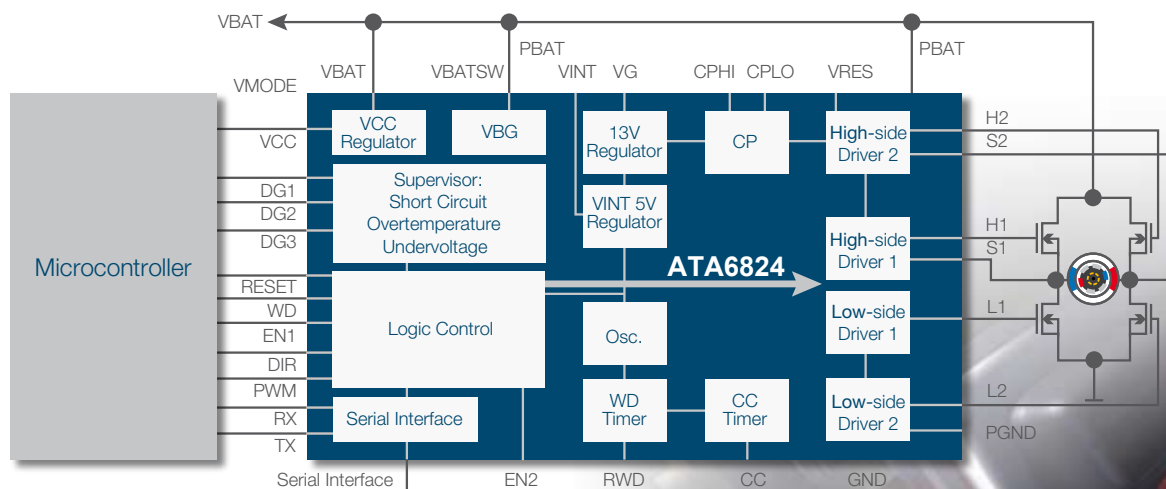
ATA6827

The ATA6827 is a fully protected triple half-bridge driver IC that controls up to 3 different loads by a microcontroller in automotive and industrial applications. Each of the 3 high-side and 3 low-side drivers is capable of driving currents up to 1.0A. The drivers are internally connected to form 3 half-bridges and can be controlled separately via a standard serial data interface. The ATA6827 is the high-temperature derivative of the ATA6826.



ATA6832

The power stages of the ATA6832 are also combined to 3 half-bridges. Due to the enhanced PWM signal of up to 25 kHz, the ATA6832 is able to generate a smooth control of a DC motor, for example, without any noise. The ATA6832 is the high-temperature derivative of the ATA6831.



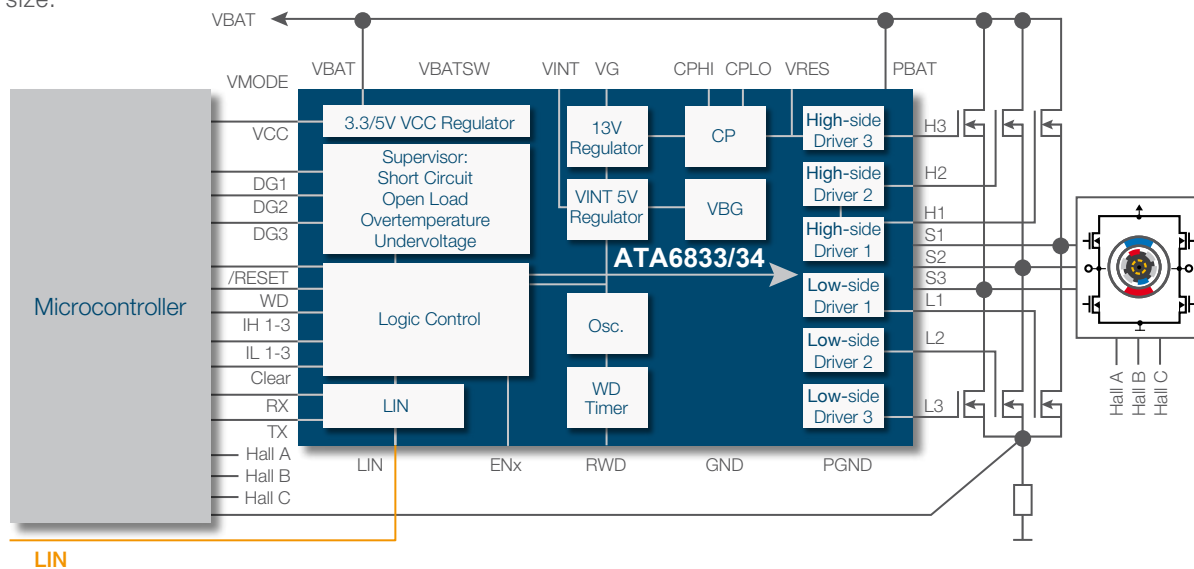


Driver ICs for Brushless DC Motors

Brushless DC (BLDC) motors are increasingly penetrating automotive applications.

BLDC motors provide several advantages over brushed type DC motors, including wearless and noiseless operation, high torque, and small size.

Atmel's driver ICs, implementing 3 half-bridges, support this trend. They are available as 650 mA and 1.0A types as well as gate driver ICs for universal use.



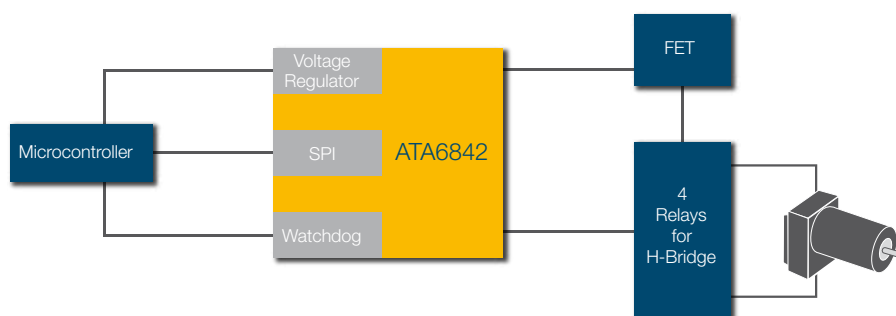
Fail-safe ICs

Fail-safe ICs are designed to support the fail-safe functions of ECUs, especially those related to safety-critical automotive applications such as anti-skid braking, electric stability programs, or electric power assisted steering systems.

Ideally, a fail-safe IC monitors all conditions and devices which could fail during a system's operation, starting from the microcontroller's frequency, voltages, load drivers, and pilot lamp drivers, via the detection of short-circuit conditions to battery voltage or ground potential, up to the detection of a broken ground wire, plus additionally double-checking the functionality of its own oscillator.

For fail-safe applications, Atmel offers a family of various fail-safe ICs, including a monolithically integrated fail-safe system IC, the ATA6842, manufactured using Atmel's state-of-the-art 0.8- μ m BCDMOS technology. With its built-in driver functions and complete monitor-

ing system, the ATA6842 is a unique solution beneficial for all safety-relevant automotive electronics, such as DC motor controls found in electric parking brake systems, power steering, chassis and powertrains. The ATA6842 combines various functions into one single IC, an improvement over competing solutions requiring the addition of several standard components such as stand-alone voltage regulators and watchdogs. This leads to significant board space reduction and smaller, more cost-efficient designs.





Multiplexing & Standard Microcontrollers

With a variety of microcontrollers manufactured with fully automotive qualified technologies, Atmel offers system designers powerful and flexible solutions.



AVR® 8-bit RISC Architecture – High Performance and Low Power

The 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 especially well suited for automotive applications.



Non-volatile Technologies

Our non-volatile technologies, embedded Flash and EEPROM memories allow the elimination of the expensive and time-consuming steps inherent in mask ROM-based microcontrollers. They also allow to build systems that can be easily reconfigured during development phases or during car maintenance.



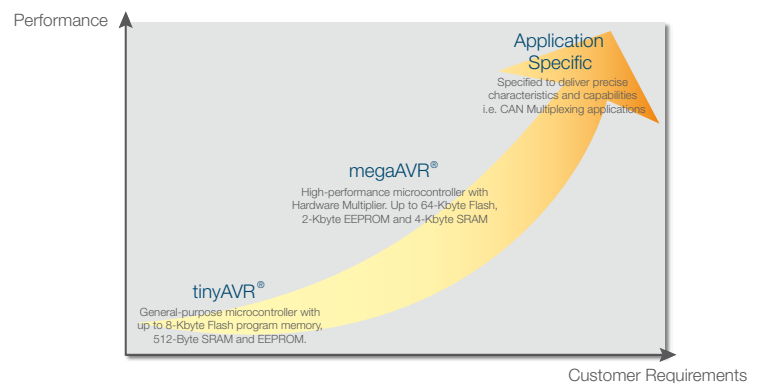
Broad Product Range

The range of devices made available to automotive already covers a variety of needs and will expand rapidly in the future. From 8- to 64-pin, from 2- to 128-Kbyte Flash, AVRs incorporate all the basic peripherals as well as powerful analog functions. Typically applications cover sensor and actuator control as well as in-vehicle networking with CAN (Controller Area Network) and LIN (Local Interconnect Network).

Four different temperature ranges are available to serve the various application constraints.

Special part numbering has been defined in order to differentiate automotive devices from standard industrial ones with special characters devoted to grade/temperature:

Grade 3 T:	-40°C; +85°C
Grade 2 T1:	-40°C; +105°C
Grade 1 Z:	-40°C; +125°C
Grade 0 T2:	-40°C; +150°C

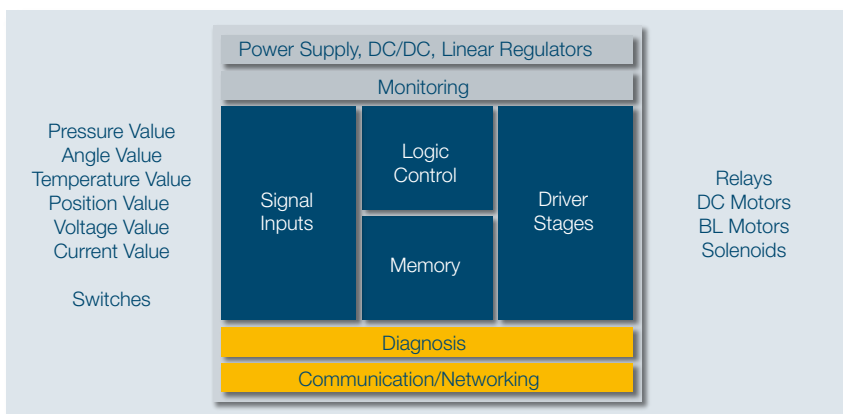




ASICs for Powertrain Solutions

Atmel can help customers as a development partner, providing the necessary IP to create a broad range of customer-specific ASICs supporting different requests.

Taking advantage of Atmel's BCDMOS or innovative BCD-on-SOI technologies, our ASICs are fully automotive qualified, and have high-temperature capability.



Benefits

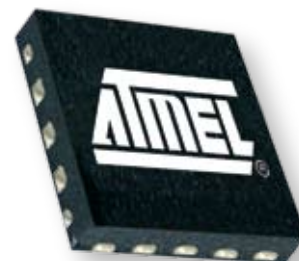
- Replace Standard Components to Achieve Cost Advantage
- Shrink Module Size to Fit into Smallest Space
- Reduce Component Count for Improved Quality
- Create Unique Solutions Which Cannot Easily Be Copied
- Introduce New Features
- Introduce New Functions
- Achieve Advantage Over Competition



Packages

During the last couple of years, the introduction of the QFN (Quad Flat No-Lead) package has taken the industry by storm due to its superb electrical and thermal performance characteristics. Atmel has chosen this package family as a standard for automotive mixed-signal ICs. The QFN package is plastic, encapsulated with a copper lead-frame substrate. Since the QFN has no leads, the electrical contact to the PCB is made by soldering the leads on the bottom surface of the package to the PCB, instead of the conventional formed-perimeter

leads. Therefore, a major advantage is the very small size which leads to a reduced PCB size. The electrical connection to the board is made by printing the solder paste on the board and reflow soldering after component placement. The exposed die-attach paddle on the bottom efficiently conducts heat to the PCB and provides a stable ground through down bonds and electrical connections through conductive die attach material. All Atmel QFN packages are green and Pb-free.



Foundry

For automotive customers, Atmel also provides its leading-edge BCDMOS and the innovative new BCD-on-SOI technology SMARTIS as a Foundry service. Atmel supports Foundry customers with multi-project wafers (MPWs), design kits, and starter kits.





Product Overview



Driver ICs

Part Number	Description	Package
T6801	Single-channel Driver; 25 mA Output with Thermal Monitoring, Thermal Shutdown, Short-circuit Protection	SO8
U6803B	Triple Driver; 3 x 25 mA Output with Thermal Monitoring, Common Thermal Shutdown, Short-circuit Protection	SO8
U6805B	Hex Driver; 6 x 25 mA Output with Thermal Monitoring, Common Thermal Shutdown, Short-circuit Protection	SO14
U6815BM	Dual Hex Driver with Serial Input Control, 6 High-side and 6 Low-side Drivers, 600 mA Current Limitation	SO28
T6816	40V Dual Hex Driver with Serial Input Control, 6 High-side and 6 Low-side Drivers, 600 mA Current Limitation	SO28
T6817	Dual Triple Driver with Serial Input Control, 3 High-side and 3 Low-side Drivers, 600 mA Current Limitation	SSO20
T6818	Triple Half-bridge Driver with Serial Input Control, 3 High-side and 3 Low-side Drivers, 1500 mA Current Limitation	SO14
T6819	Dual Triple Driver with Serial Input Control and PWM Input, 3 High-side and 3 Low-side Drivers, 1500 mA Current Limitation	SO16
U6820BM	Dual Quad Driver with Serial Input Control, 4 High-side Output Stages, 4 Low-side Output Stages, 50 mA Capability, Current Limitation	SO16
ATA6026	H-bridge Gate Driver with SCI Interface, Watchdog and 5V Voltage Regulator	QFN32
ATA6823	H-bridge Gate Driver with LIN 2.0 Transceiver, Watchdog and 3.3/5V Voltage Regulator	QFN32
ATA6824	H-bridge Gate Driver with Serial Interface, Watchdog and 3.3/5V Voltage Regulator	QFN32
ATA6826	Triple Half-bridge Driver with Serial Input Control, 3 High-side and 3 Low-side Drivers, 1000 mA Current Limitation	SO14
ATA6827	Same as ATA6826, for High-temperature Applications up to 150°C Ambient Temperature	QFN18
ATA6828	Triple Half-bridge Driver with Serial Input Control, 3 High-side and 3 Low-side Drivers, 1500 mA Current Limitation	SO14 Heat Slug
ATA6829	Dual Triple Driver with Serial Input Control and PWM Input, 3 High-side and 3 Low-side Drivers, 1500 mA Current Limitation	SO16 Heat Slug
ATA6830	Intelligent Stepper Motor Driver; Typical Application: Headlight Adjustment	QFN28
ATA6831	Triple Half-bridge Driver with Serial Input Control and 25-kHz PWM Input, 3 High-side and 3 Low-side Drivers, 1000 mA Current Limitation	QFN18
ATA6832	Same as ATA6831, for High-temperature Applications up to 150°C Ambient Temperature	QFN18
ATA6836	Hex Half-bridge Driver with Serial Input Control, 6 High-side and 6 Low-side Drivers, 650 mA Current Limitation	SO28 QFN24
ATA6837	Same as ATA6836, for High-temperature Applications up to 150°C Ambient Temperature	QFN24
ATA6838	Hex Half-bridge Driver with Serial Input Control, 6 High-side and 6 Low-side Drivers, 1.5 A Current Limitation	QFN24
ATA6839	Same as ATA6838, for High-temperature Applications up to 150°C Ambient Temperature	QFN24



Watchdog ICs

Part Number	Description	Package
U5020M	Watchdog Timer, Active and Sleep Mode, 6 Wake-up Inputs, Enable Output	SO16
U5021M	Watchdog Timer, Active and Sleep Mode, 1 Wake-up Input, Enable Output	SO8
ATA6020N	Watchdog IC, Programmable Via Metal Mask (Based on the ATAR080 Microcontroller)	SO20
ATA6025	Watchdog IC with Fail-safe Output, Voltage Monitors; Low-power Consumption in Standby Mode	SO8



In-vehicle Networking ICs

Part Number	Description	Package
B10011S	Low-speed CAN Transceiver for High Transmission Levels, Two-wire Bus Interface, Point-to-point Interface Between Trucks and Trailers, Interface Between Dashboard and Engine, etc.; High Reliability, 27V Operation, Hardware Fault Recognition	SO16
ATA6602	AVR LIN SiP Combining ATA6621 and AVR ATmega88 (8 Kbytes Flash) in One Package	QFN48
ATA6603	AVR LIN SiP Combining ATA6621 and AVR ATmega168 (16 Kbytes Flash) in One Package	QFN48
ATA6612	AVR LIN SiP Combining ATA6624 and AVR ATmega88 (8 Kbytes Flash) in One Package	QFN48
ATA6613	AVR LIN SiP Combining ATA6624 and AVR ATmega168 (16 Kbytes Flash) in One Package	QFN48
ATA6620	LIN System Basis Chip with LIN Transceiver and Integrated 5V/50 mA Voltage Regulator	SO8
ATA6621	Same as ATA6620, with Window Watchdog	QFN20
ATA6622	Same as ATA6623, with Window Watchdog	QFN20
ATA6623	LIN System Basis Chip with LIN Transceiver and Integrated 3.3V/50 mA Voltage Regulator	SO8
ATA6624	Same as ATA6621, with Outstanding EMC Performance	QFN20
ATA6625	Same as ATA6620, with Outstanding EMC Performance	SO8
ATA6626	Same as ATA6624, without Time-out Function	QFN20
ATA6660	High-speed CAN Transceiver, Fully Compatible with ISO 11898, High-voltage Bus Protection -40 to +40V	SO8
ATA6661	LIN Transceiver, Physical Layer Conforming to LIN Specification 2.0	SO8
ATA6662	LIN Transceiver with Outstanding EMC Performance, Physical Layer Conforming to LIN Specification 2.0 and SAE J2602-2	SO8
ATA6663	Same as ATA6662, Ability to Switch-off the Master Resistor	SO8
ATA6664	Same as ATA6663, no Time-out Function	SO8



Fail-safe ICs

Part Number	Description	Package
ATA6842	Fail-safe System IC with 4-channel Relay Driver, Power Supply, Watchdog	QFN48





Multiplexing & Standard Microcontrollers

tinyAVR®		
ATtiny24	AVR Microcontroller with 2-Kbyte Flash MCU, 128-byte RAM, 128-byte EEPROM, 10-bit ADC, up to 16 MIPS, LIN-capable USI, Internal Calibrated Oscillator, 2.7-5.5V	SOIC14, QFN20 (-40°C to +125°C Qualified)
ATtiny25	AVR Microcontroller with 2-Kbyte Flash MCU, 128-byte RAM, 128-byte EEPROM, 10-bit ADC, up to 16 MIPS, Internal Calibrated Oscillator, 2.7-5.5V	SO8, QFN20 (-40°C to +125°C Qualified)
ATtiny25V	AVR Microcontroller with 2-Kbyte Flash MCU, 128-byte RAM, 128-byte EEPROM, 10-bit ADC, Up to 16 MIPS, Internal Calibrated Oscillator, 1.8-5.5V	SO8, QFN20 (-40°C to +85°C Qualified)
ATtiny44	AVR Microcontroller with 4-Kbyte Flash MCU, 256-byte RAM, 256-byte EEPROM, 10-bit ADC, up to 16 MIPS, LIN-capable USI, Internal Calibrated Oscillator, 2.7-5.5V	SOIC14, QFN20 (-40°C to +125°C Qualified)
ATtiny45	AVR Microcontroller with 4-Kbyte Flash MCU, 256-byte RAM, 256-byte EEPROM, 10-bit ADC, up to 16 MIPS, LIN-capable USI, Internal Calibrated Oscillator, 2.7-5.5V	SO8 (-40°C to +125°C Qualified)
		QFN20 (-40°C to +150°C Qualified)
ATtiny45V	AVR Microcontroller with 4-Kbyte Flash MCU, 256-byte RAM, 256-byte EEPROM, 10-bit ADC, up to 16 MIPS, LIN-capable USI, Internal Calibrated Oscillator, 1.8-5.5V	SO8 (-40°C to +85°C Qualified)
ATtiny84	AVR Microcontroller with 8-Kbyte Flash MCU, 512-byte RAM, 512-byte EEPROM, 10-bit ADC, up to 16 MIPS, LIN-capable USI, Internal Calibrated Oscillator, 2.7-5.5V	QFN20 (-40°C to +125°C Qualified)
ATtiny85	AVR Microcontroller with 8-Kbyte Flash MCU, 512-byte RAM, 512-byte EEPROM, 10-bit ADC, up to 16 MIPS, LIN-capable USI, Internal Calibrated Oscillator, 2.7-5.5V	SO8 (-40°C to +125°C Qualified)
megaAVR®		
ATmega48	AVR Microcontroller with 4-Kbyte Flash MCU, 512-byte RAM, 256-byte EEPROM, 10-bit ADC, up to 16 MIPS, LIN-capable UART, Internal Calibrated Oscillator, 2.7-5.5V	QFN32, QFP32 (-40°C to +125°C Qualified)
ATmega88	AVR Microcontroller with 8-Kbyte Flash MCU, 1-Kbyte RAM, 512-byte EEPROM, 10-bit ADC, up to 16 MIPS, LIN-capable UART, Internal Calibrated Oscillator, 2.7-5.5V	QFP32 (-40°C to +125°C Qualified)
		QFN32 (-40°C to +150°C Qualified)
ATmega88V	AVR Microcontroller with 8-Kbyte Flash MCU, 1-Kbyte RAM, 512-byte EEPROM, 10-bit ADC, up to 16 MIPS, LIN-capable UART, Internal Calibrated Oscillator, 1.8-5.5V	QFN32, QFP32 (-40°C to +85°C Qualified)
ATmega164P	AVR picoPower Microcontroller with 16-Kbyte Flash MCU, 1-Kbyte RAM, 512 byte EEPROM, 10-bit ADC, up to 16 MIPS, LIN-capable USI, Internal Calibrated Oscillator, 2.7-5.5V	QFN44, TQFP44 (-40°C to +125°C Qualified)
ATmega168P	AVR Microcontroller with 16-Kbyte Flash MCU, 1-Kbyte RAM, 512-byte EEPROM, 10-bit ADC, Up to 16 MIPS, LIN-capable UART, Internal Calibrated Oscillator, 2.7-5.5V	QFN32, QFP32 (-40°C to +125°C Qualified)
ATmega324P	AVR picoPower Microcontroller with 32-Kbyte Flash MCU, 2-Kbyte RAM, 1-Kbyte EEPROM, 10-bit ADC, up to 16 MIPS, LIN-capable USI, Internal Calibrated Oscillator, 2.7-5.5V	QFN44, TQFP44 (-40°C to +125°C Qualified)
ATmega644P	AVR picoPower Microcontroller with 64-Kbyte Flash MCU, 4-Kbyte RAM, 2-Kbyte EEPROM, 10-bit ADC, up to 16 MIPS, LIN-capable USI, Internal Calibrated Oscillator, 2.7-5.5V	QFN44, TQFP44 (-40°C to +125°C Qualified)
Application-specific Microcontrollers		
AT90CAN32	AVR Microcontroller with 32-Kbyte Flash MCU, 15-message Objects CAN Controller, 2-Kbyte RAM, 1-Kbyte EEPROM, 10-bit ADC, TWI, up to 16 MIPS, LIN-capable UART, 2.7-5.5V	QFN64, QFP64 (-40°C to +125°C Qualified)
AT90CAN64	AVR Microcontroller with 64-Kbyte Flash MCU, 15-message Objects CAN Controller, 4-Kbyte RAM, 2-Kbyte EEPROM, 10-bit ADC, TWI, up to 16 MIPS, LIN-capable UART, 2.7-5.5V	QFN64, QFP64 (-40°C to +125°C Qualified)
AT90CAN128	AVR Microcontroller with 128-Kbyte Flash MCU, 15-message Objects CAN Controller, 4-Kbyte RAM, 4-Kbyte EEPROM, 10-bit ADC, TWI, up to 16 MIPS, LIN-capable UART, 2.7-5.5V	QFN64, QFP64 (-40°C to +125°C Qualified)