

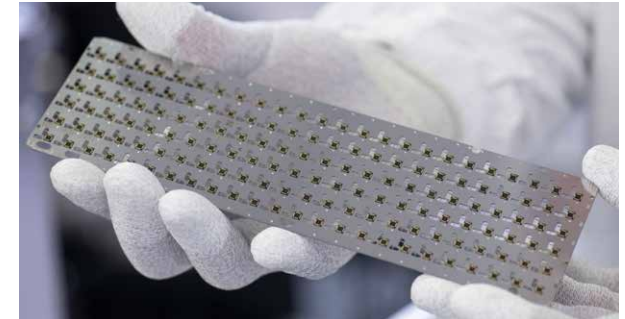


# Bosch Semiconductors for Automotive

MEMS Sensors  
System ICs  
Power Semiconductors  
IP Modules

Invented for life

# Smart and innovative components for new market requirements



## ABOUT THIS CATALOG

This catalog shows our current range of electronic components and IP modules for automotive applications. Bosch offers MEMS sensors, application-specific ICs and IP modules, based on almost half a century of experience.

We stand for future, innovative technologies – driven by customer-specific requirements. We are the largest manufacturer for micromechanical sensors, one of the biggest semiconductor makers for automotive and one of the driving forces in the IP module market.

Our world-wide customer base includes OEMs, well-known makers of electronic control units, and the Bosch automotive system divisions.

Whenever you design advanced safety and comfort systems or highly efficient powertrain electronics: Contact us to benefit from our smart and innovative portfolio.

## ABOUT OUR PRODUCTS

### MEMS SENSORS:

MEMS sensors (micro electro-mechanical systems) are a key technology for the mobile and connected world. Bosch has been at the forefront of MEMS technology for more than 25 years now. Bosch MEMS sensors deliver high performance, are small, sturdy, and extremely cost-effective due to high volume series production.

### SYSTEM ICs:

Modern types of vehicles include a number of electronic control units. Integrated circuits (ICs) are an essential component of such units. As one of the first suppliers, Bosch began with the development and production of such sophisticated integrated circuits as early as the late 1960s. Bosch ICs are customized for specific applications in the vehicle system (= application specific ICs).

### POWER SEMICONDUCTORS:

Efficient use of electric power is paramount for electric vehicles. Our new silicon carbide power switches are specifically designed for automotive use. They reduce power losses in drive electronics and power converters, resulting in an increase of range.

### IP MODULES:

Intellectual property (IP) modules allow chipmakers to quickly adopt complete ranges of functions in standard products such as microcontrollers, FPGAs and ASSPs, thus significantly reducing development times and costs. That is, they represent an assembly plan to implement these functions in hardware.

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# Restraint systems



## Acceleration sensors

Acceleration sensors in airbag systems measure strong acceleration values within milliseconds. Depending on the airbag system and the number of existing airbags, our customers can install the MEMS sensors in the ECU

or as a standalone component in the vehicle's front or side (satellite sensor).

### HIGH-G SINGLE AXIS ACCELERATION SENSORS

Type	Product	Range [g]	Output	Tolerance [%]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Single axis (a <sub>y</sub> )	SMA682	±120/240/480	PSI5, 10 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a <sub>z</sub> )	SMA684	±120/240	PSI5, 10 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a <sub>z</sub> )	SMA694	±480	PSI5, 10 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a <sub>y</sub> )	SMA750	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a <sub>z</sub> )	SMA751	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a <sub>x</sub> )	SMA755	±240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a <sub>x</sub> )	SMA758	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a <sub>x</sub> )	SMA780	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	LGA SiP
Single axis (a <sub>z</sub> )	SMA781	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	LGA SiP
Single axis (a <sub>x</sub> )	SMA790	±240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	LGA SiP

# Restraint systems



## Acceleration sensors

### HIGH-G DUAL AXIS ACCELERATION SENSORS

Type	Product	Range [g]	Output	Tolerance [%]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Dual axis (a <sub>xy</sub> )	SMA660	±120	SPI, 12 bit	5	3.3 or 5	-40	125	SOIC8n
Dual axis (a <sub>xz</sub> )	SMA665	±120	SPI, 12 bit	7	3.3 or 5	-40	125	SOIC8n
Dual axis (a <sub>xz</sub> )	SMA720	±128 (a <sub>x</sub> ) ±32 (a <sub>z</sub> )	SafeSPI, 14 bit	5 (a <sub>x</sub> ) 7 (a <sub>z</sub> )	3.3 or 6.7	-40	125	SOIC8n
Dual axis (a <sub>xy</sub> )	SMA760	±128	SafeSPI, 14 bit	5	3.3 or 6.7	-40	125	SOIC8n
Dual axis (a <sub>xy</sub> )	SMA685	±120/240/480	PSI5, 10 bit	7	4.5–11	-40	125	SOIC8n
Dual axis (a <sub>xz</sub> )	SMA686	±120/240	PSI5, 10 bit	7	4.5–11	-40	125	SOIC8n
Dual axis (a <sub>xz</sub> )	SMA696	±480	PSI5, 10 bit	7	4.5–11	-40	125	SOIC8n
Dual axis (a <sub>xy</sub> )	SMA752	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	-40	125	SOIC8n
Dual axis (a <sub>xz</sub> )	SMA753	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	-40	125	SOIC8n
Dual axis (a <sub>xy</sub> )	SMA757	±240/480	PSI5, 10 bit or 14 bit	7	4.5–11	-40	125	SOIC8n
Dual axis (a <sub>xy</sub> )	SMA773	±30/60	PSI5, 10 bit or 14 bit	7	4.5–11	-40	125	SOIC8n
Dual axis (a <sub>xz</sub> )	SMA774	±30/60	PSI5, 10 bit or 14 bit	7	4.5–11	-40	125	SOIC8n
Dual axis (a <sub>xy</sub> )	SMA777	±30/60	PSI5, 10 bit or 14 bit	7	4.5–11	-40	125	LGA SiP
Dual axis (a <sub>xz</sub> )	SMA778	±30/60	PSI5, 10 bit or 14 bit	7	4.5–11	-40	125	LGA SiP
Dual axis (a <sub>xy</sub> )	SMA782	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	-40	125	LGA SiP
Dual axis (a <sub>xz</sub> )	SMA783	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	-40	125	LGA SiP
Dual axis (a <sub>xy</sub> )	SMA792	±240/480	PSI5, 10 bit or 14 bit	7	4.5–11	-40	125	LGA SiP

# Restraint systems



## Angular rate and pressure sensors

Rollover and pressure sensors support an airbag system in the detection of accidents.

### ANGULAR RATE SENSOR FOR ROLLOVER SENSING

Type	Product	Range [°/s]	Output	Sensitivity	Sensitivity tolerance typ. [%]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Angular rate sensor ( $\Omega_x$ )	SMG810	300	SafeSPI, 16 bit	±100LSB/°/s	±3	3.3 or 5 or 6.7	-40	125	BGA64

Other configurations are possible on customer demand

### COMBINED INERTIAL SENSOR FOR ROLLOVER SENSING

Type	Product	Range	Output	Sensitivity	Sensitivity tolerance typ. [%]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Angular rate sensor ( $\Omega_x$ ) and single axis acceleration sensor ( $a_z$ )	SMI720	±300°/s ±5g	SPI, 16 bit	100LSB/°/s 5,000LSB/g	±5 ±6	3.3	-40	105	BGA64

### PRESSURE SENSORS FOR SIDE IMPACT SENSING AND PEDESTRIAN PROTECTION

Type	Product	Range [kPa]	Output	Sensitivity	Tolerance [kPa]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Barometric pressure sensor	SMP470	50–110 (enhanced: 140)	PSI5, 10 bit or 16 bit (V1.3/V2.1)	53.53 LSB/kPa	±3	4.55–11	-40	125	LGA8 (solderless contacting only)
Barometric pressure sensor	SMP475	50–110 (enhanced: 140)	PSI5, 10 bit or 16 bit (V1.3/V2.1)	53.53 LSB/kPa	±3	4.55–11	-40	125	SOIC8n

# Vehicle comfort systems



## Sensors for motion detection

Vehicle comfort features like navigation, tilt or inclination measurement, telematics, car key modules, car alarm or eCall systems are a rapidly growing field of application for MEMS sensors. Typically, these applications do not have ASIL-classified requirements of

safety applications, such as airbag or stability systems. Therefore, Bosch developed the concept for a new set of cost efficient MEMS sensors for motion detection in comfort applications.

### ACCELERATION SENSORS FOR NON-SAFETY APPLICATIONS

Type	Product	Range [g]	Output	Sensitivity	Sensitivity tolerance typ. [%]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Tri-axis acceleration sensor (a <sub>xyz</sub> )	SMA130	±2 ±4 ±8 ±16	SPI, I <sup>2</sup> C 14 bit	4,096 2,048 1,024 512	±2.1	1.62–3.6	–40	105*	LGA12
Tri-axis acceleration sensor (a <sub>xyz</sub> )	SMA131	±2 ±4 ±8	SPI, I <sup>2</sup> C 14 bit	4,096 2,048 1,024	±2.1	1.62–3.6	–40	105*	LGA12

\*85–105°C: Extended operating temperature range, typical values only

### ANGULAR RATE SENSOR FOR NON-SAFETY APPLICATIONS

Type	Product	Range [°/s]	Output	Sensitivity [°/s]	Sensitivity tolerance typ. [%]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Tri-axis angular rate sensor (Ω <sub>xyz</sub> )	SMG130	±125 ±250 ±500 ±1,000 ±2,000	SPI, I <sup>2</sup> C 16 bit	262.4 131.2 65.6 32.8 16.4	±1.5	2.4–3.6	–40	105*	LGA16

\*85–105°C: Extended operating temperature range, typical values only

# Vehicle comfort systems



## Sensors for motion detection

### COMBINED INERTIAL SENSORS FOR NON-SAFETY APPLICATIONS

Type	Product	Range (switchable)	Output	Sensitivity Gyroscope [LSB/°/s]	Sensitivity Accelerometer [LSB/g]	Sensitivity tolerance Gyroscope typ. [%]	Sensitivity tolerance Accelerometer typ. [%]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Tri-axis angular rate sensor ( $\Omega_{xyz}$ ) and tri-axis acceleration sensor ( $a_{xyz}$ )	SMI130	±125°/s, ±250°/s, ±500°/s, ±1,000°/s, ±2,000°/s ±2g ±4g ±8g ±16g	SPI, I <sup>2</sup> C 16 bit ( $\Omega$ ) 12 bit (a)	262.4 131.2 65.6 32.8 16.4	1,024 512 256 128	±1.5	±1.4	2.4–3.6	-40	105*	LGA16
Tri-axis angular rate sensor ( $\Omega_{xyz}$ ) and tri-axis acceleration sensor ( $a_{xyz}$ )	SMI230	±125°/s, ±250°/s, ±500°/s, ±1,000°/s, ±2,000°/s ±2g ±4g ±8g ±16g	SPI, I <sup>2</sup> C 16 bit ( $\Omega$ ) 16 bit (a)	262.4 131.2 65.6 32.8 16.4	16,384 8,192 4,096 2,048	±1.5	±1	2.4–3.6	-40	105	LGA16

\*85–105 °C: Extended operating temperature range, typical values only



# Engine management systems



## Barometric pressure sensors

Bosch barometric pressure sensors are a key component in engine management for diesel and gasoline engines. They are designed to measure the current ambient pressure accurately and with low drift. Atmospheric pressure is a function of height above

sea level as well as of weather conditions. The engine management system uses the sensor measurement data to ensure the optimum air-fuel mixture, irrespective of whether the vehicle is traveling along a coastal road or a road up in the mountains. The benefit of this

constant rebalancing of the mixture ratio is that it reduces fuel consumption as well as emissions of CO<sub>2</sub> and other pollutants.

### PRESSURE SENSOR FOR DIESEL OR GASOLINE ENGINE MANAGEMENT

Type	Product	Range [kPa]	Output	Tolerance [over lifetime and temperature]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Barometric pressure sensor	SMP581	40–115	SPI 10 bit or 12 bit	≤1.0 kPa (pressure) ≤3K (temperature)	3.3–5	–40	125	DFN8

# Seat comfort systems



## Low pressure sensors

Bosch low pressure sensors are a key component for pneumatic seat applications. The sensor regulates the correct inflation of the air chambers in multi-contoured seats and ensures that the seat adapts to the anatomy and the individual requirements of the driver and front-

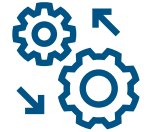
seat passenger. Thus, form-adjustable lumbar support as well as adjustable side bolsters on the backrest and seat area stabilize the vehicle occupants. A massage function can also be realized.

Particularly when driving on winding roads and on long trips, the low pressure sensors provide increased comfort and help reduce driver fatigue.

### PRESSURE SENSOR FOR PNEUMATIC SEAT APPLICATIONS

Type	Product	Range [kPa]	Output	Tolerance [over lifetime and temperature]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Low pressure sensor	SMP581	60 – 165	SPI 10 bit	≤1.5 kPa (pressure) ≤5 K (temperature)	3.3 – 5	-40	125	DFN8

# Transmission control systems



## Hydraulic pressure sensors

MEMS sensors for automatic transmission detect the oil pressure in the hydraulic actuators of the gearbox – with a very precise response time of less than a milli-second. This is crucial for fast and ultra-smooth shift-

ing of gears. The Bosch medium hydraulic pressure sensors are characterized by very high media resistance and durability due to their hermetically sealed metal package.

### PRESSURE SENSORS FOR TRANSMISSION CONTROL

Type	Product	Range [bar]	Output	Tolerance [% FS]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Hydraulic pressure sensor	SMP142	0.5–22	SENT/analog 12 bit	1.2–1.8	5	–40	150	Hermetically sealed metal package
Hydraulic pressure sensor	SMP144	0.5–40	SENT/analog 12 bit	1.2–1.8	5	–40	150	Hermetically sealed metal package
Hydraulic pressure sensor	SMP147	0.5–70	SENT/analog 12 bit	1.2–1.8	5	–40	150	Hermetically sealed metal package

Sensors with customer specific pressure ranges (10–70 bar) on request

# Vehicle dynamics control (VDC)



## Inertial sensors

In vehicle dynamics systems, MEMS inertial sensors measure angular rate and acceleration. This is essential to determine the dynamic state of the vehicle and to check the plausibility of the rotation rate signal.

### COMBINED INERTIAL SENSORS FOR VDC

Type	Product	Range	Output	Sensitivity	Sensitivity tolerance typ. [%]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Dual angular rate sensor ( $\Omega_{xz}$ ) and tri-axis acceleration sensor ( $a_{xyz}$ )	SMI860	$\pm 300^\circ/\text{s}$ $\pm 6\text{g}$	SafeSPI, 16 bit	100 LSB/ $^\circ/\text{s}$ 5,000 LSB/g	$\pm 3$ $\pm 3$	3.3 or 5 or 6.7	-40	125	BGA64
Angular rate sensor ( $\Omega_z$ ) and dual axis acceleration sensor ( $a_{xy}$ )	SMI810	$\pm 300^\circ/\text{s}$ $\pm 6\text{g}$	SafeSPI, 16 bit	100 LSB/ $^\circ/\text{s}$ 5,000 LSB/g	$\pm 3$ $\pm 3$	3.3 or 5 or 6.7	-40	125	BGA64
Angular rate sensor ( $\Omega_x$ ) and dual axis acceleration sensor ( $a_{xy}$ )	SMI800	$\pm 300^\circ/\text{s}$ $\pm 6\text{g}$	SafeSPI, 16 bit	100 LSB/ $^\circ/\text{s}$ 5,000 LSB/g	$\pm 3$ $\pm 3$	3.3 or 5 or 6.7	-40	125	BGA64
Angular rate sensor ( $\Omega_x$ ) and dual axis acceleration sensor ( $a_{yz}$ )	SMI710	$\pm 300^\circ/\text{s}$ $\pm 5\text{g}$	SPI, PSi5, CAN, 16 bit	100 LSB/ $^\circ/\text{s}$ 5,000 LSB/g	$\pm 3$ $\pm 3$	3.3 or 5	-40	125	BGA64
Angular rate sensor ( $\Omega_z$ ) and dual axis acceleration sensor ( $a_{xy}$ )	SMI700	$\pm 300^\circ/\text{s}$ $\pm 5\text{g}$	SPI, PSi5, CAN, 16 bit	100 LSB/ $^\circ/\text{s}$ 5,000 LSB/g	$\pm 3$ $\pm 3$	3.3 or 5	-40	125	BGA64

# Highly automated and hands-free driving systems



## High performance inertial sensors

Highly automated driving (HAD) and hands-free driving requires precise information about the vehicle's movements. The sensor data is used for lane keeping during a safe stop or to verify movement information derived from camera

image or steering angle sensor. The SMU2 family offers excellent offset stability over the entire temperature range.

### HIGH PERFORMANCE INERTIAL SENSORS WITH SUPERB OFFSET PERFORMANCE

Type	Product	Range	Output	Total offset error incl. lifetime and temperature	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
High performance yaw rate sensor ( $\Omega_z$ ) and 3-axis accelerometer	SMU200	$\pm 300^\circ/\text{s}$ ( $\Omega_z$ ) $\pm 6\text{ g}$ ( $a_{xyz}$ )	SPI	$\pm 0.25^\circ/\text{s}$	3.3 or 5	-40	125	CLCC16
High performance pitch/roll sensor ( $\Omega_x$ ) and 3-axis accelerometer	SMU210	$\pm 300^\circ/\text{s}$ ( $\Omega_x$ ) $\pm 6\text{ g}$ ( $a_{xyz}$ )	SPI	$\pm 0.25^\circ/\text{s}$	3.3 or 5	-40	125	CLCC16

### COMBINED INERTIAL SENSOR WITH ASIL B

Type	Product	Range	Output	Total offset error incl. lifetime and temperature	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Precise 3-axis gyroscope and 3-axis accelerometer	SMI240	$\pm 300^\circ/\text{s}$ ( $\Omega_z$ ) $\pm 16\text{ g}$ ( $a_{xyz}$ )	SPI	$\pm 5^\circ/\text{s}$	3.3	-40	105	LGA12

# Active suspension systems



## Acceleration sensors

Active suspension systems have an important impact on driving comfort and safety. They are based on low-g acceleration sensors that precisely record the dynamics of the chassis and body even under harsh conditions. Thus, the ECU regulates suspension damping and

reduces body movement to make driving safer and more comfortable. The braking distance is shortened and the danger of a rollover is reduced. Also, the vehicle's occupants experience higher driving comfort and less chassis movement.

### LOW-G ACCELERATION SENSORS FOR VIBRATION CONTROL

Type	Product	Range [g]	Output	Sensitivity [LSB/g]	Tolerance [%]	V <sub>DD</sub> typ. [V]	T <sub>min</sub> [°C]	T <sub>max</sub> [°C]	Package
Low-g acceleration sensor (a <sub>x</sub> )	SMA731/PSS2.31*	±16	PSI5 (V2.1), (V1.3 config.)	480	3.5	6.7	-40	125	SOIC8n (SMA731) Second level package, details upon request (PSS2.31)
Low-g acceleration sensor (a <sub>y</sub> )	SMA732/PSS2.32*	±16	PSI5 (V2.1), (V1.3 config.)	480	3.5	6.7	-40	125	SOIC8n (SMA732) Second level package, details upon request (PSS2.32)

\*PSS2.3x = satellite sensor variant

# Restraint systems



## Single-chip airbag system ICs

Restraint system ICs contain all peripheral system functions: Interfaces to connect digital crash sensors to the electronic control unit, firing loop drivers for deploying airbags, extensive safety and diagnosis

mechanisms to constantly monitor the system availability. They also provide power for the entire system.

### SYSTEM ICs FOR VARIOUS AIRBAG SYSTEM CONFIGURATIONS

Application	Product	V <sub>DD</sub> typ. [V]	V <sub>VZP</sub> typ. [V]	V <sub>VER</sub> typ. [V]	Peripheral sensor interfaces	Analog interfaces	Interfaces	Firing loops	Features	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
Single-chip integrated airbag system	CG904	3.3	14	23.75 or 33 (programmable)	6×PSI5 (V1.3)	10×AIN 2×AIO	SPI, 32 bit (3.3V), K-Line/LIN	16 (5 firing modes)	<ul style="list-style-type: none"> <li>■ Enhanced sophisticated safety concept: safety controller; 3 watchdogs; ESP sensor data can be included in safety concept</li> <li>■ Fully automatic diagnosis:               <ul style="list-style-type: none"> <li>– Monitoring of voltages (incl. VHx) and overtemperature, SVR diagnosis</li> <li>– Built-in sensor test, C<sub>ER</sub> diagnosis, power stage and squib diagnosis, cross coupling diagnosis, connector capacitor diagnosis, STB and STG diagnosis</li> </ul> </li> <li>■ 2 independent 7 bit firing current counters per channel (max time: 3.2ms)</li> <li>■ PWM controlled GPIO</li> </ul>	-40	150	TQFP128-EPAD

# Restraint systems



## Single-chip airbag system ICs

### SYSTEM ICs FOR VARIOUS AIRBAG SYSTEM CONFIGURATIONS

Application	Product	V <sub>DD</sub> typ. [V]	V <sub>VZP</sub> typ. [V]	V <sub>VER</sub> typ. [V]	Peripheral sensor interfaces	Analog interfaces	Interfaces	Firing loops	Features	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
Single-chip integrated airbag system	CG903	3.3	14	23.75 or 33 (programmable)	4×PSI5 (V1.3)	10×AIN 2×AIO	SPI, 32 bit (3.3V), K-Line/LIN	12 (5 firing modes)	See CG904	-40	150	TQFP128-EPAD
Single-chip integrated airbag system	CG902	3.3	14	23.75 or 33 (programmable)	2×PSI5 (V1.3)	10×AIN 2×AIO	SPI, 32 bit (3.3V), K-Line/LIN	8 (5 firing modes)	See CG904	-40	150	TQFP128-EPAD
Single-chip integrated airbag system	CG912	3.3	14	23.75 or 33 (programmable)	2×PAS	4×AIN 2×AIO	SPI, 32 bit (3.3V), K-Line/LIN	4 (5 firing modes)	See CG904	-40	150	TQFP64-EPAD



# Restraint systems



## Sensor interfaces

Digital interfaces connect peripheral sensors to the control unit. They provide supply power to the sensors and transfer the sensor readings to the microcontroller.

### SENSOR SUPPLY AND DATA TRANSMISSION FOR DIGITAL PERIPHERAL SENSORS WITH PSI5 INTERFACE (V1.3)

Application	Product	Inputs	Peripheral sensor interfaces	Interfaces	Features	$T_{j\ min}$ [°C]	$T_{j\ max}$ [°C]	Package
2 channel PSI5 receiver	CF190	$V_{ER}$ typ.: $(V_{AS} + 3.5V) - 35V$ $V_{SYNC}$ typ.: $(V_{AS} + 4.6V) - 35V$	2 × PSI5 (V1.3)	SPI (3.3V or 5V)	<ul style="list-style-type: none"> <li>■ Max. 8 sensors</li> <li>■ Bidirectional communication</li> <li>■ Bosch AB, EM and Open SPI protocol</li> <li>■ Integrated monitoring of voltages and overtemperature</li> <li>■ Integrated diagnosis</li> </ul>	-40	150	LQFP32, QFN36 (on request)

# Advanced driver assistance systems



## Power Management ICs for Radar and Video SoCs

Power Management ICs (PMICs) provide low noise and ultra stable high current for ASIL D advanced driver assistance systems. They serve as a compact supply not only for  $\mu$ Cs and peripherals, but also sensors, FPGA and memory.

### SUPER-LOW NOISE POWER SUPPLY FOR MONOLITHIC MICROWAVE INTEGRATED CIRCUIT (MMIC) RADAR TRANSCEIVERS

Application	Product	V <sub>DD</sub> typ. [V]	Interfaces	Supply voltages	Outputs	Features	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
System basis IC for radar ECUs	CS520	14/28	SPI, CAN FD	<ul style="list-style-type: none"> <li>■ 3.3V/1.8A SMPS for microcontroller and bus transceivers</li> <li>■ 3.3V/1.8A low noise LR for MMIC analog radar components</li> <li>■ 3.3V/0.9A LR for MMIC digital radar components</li> <li>■ 5V/100 mA switch for partial network transceivers</li> </ul>	<ul style="list-style-type: none"> <li>■ Reset</li> <li>■ Battery voltage monitoring switch</li> <li>■ Battery voltage drop detection</li> </ul>	<ul style="list-style-type: none"> <li>■ Designed for passenger car and commercial vehicle applications</li> <li>■ Suitable for systems up to ASIL C</li> <li>■ Voltage monitoring and overcurrent protection for all regulators</li> <li>■ SPI interface for control and diagnostics</li> <li>■ CAN FD driver (up to 5 Mbit/s)</li> </ul>	-40	150	TQFP64-EPAD

# Advanced driver assistance systems



## Power Management ICs for Radar and Video SoCs

### POWER SUPPLY FOR ADVANCED DRIVER ASSISTANCE SYSTEMS (ADAS), CAMERA OR LIDAR SYSTEMS

Application	Product	V <sub>DD</sub> typ. [V]	Interfaces	Supply voltages	Outputs	Features	T <sub>J</sub> min [°C]	T <sub>J</sub> max [°C]	Package
System basis IC for ADAS systems	CS600	14/28	SPI 32 bit	<ul style="list-style-type: none"> <li>■ 2×0.7V–3.825V (programmable) / 2A (SMPS)</li> <li>■ 2×0.7V–3.825V (programmable) / 1A (SMPS)</li> <li>■ 2×0.7V–3.825V (programmable) driver for ext. power stages</li> <li>■ 4×0.7–3.825V / 300mA/LDO)</li> </ul>	<ul style="list-style-type: none"> <li>■ GPIO</li> </ul>	<ul style="list-style-type: none"> <li>■ 10 programmable rails, possibility for multi phase configuration</li> <li>■ Programmable power-up and -down sequencing between all supply rails, including optional external sync</li> <li>■ Temperature monitoring and over-temperature shutdown</li> <li>■ Voltage monitoring (UV, OV) with configurable thresholds</li> <li>■ On-chip general purpose ADC (12 bit, maximum 1MSPS) for monitoring external voltages on 4 input pins with up to 7 channels</li> <li>■ OTP memory for device configuration of several functions</li> <li>■ Functional safety on-chip functions allowing to realize ISO26262 ASIL-C/D on ECU system level</li> <li>■ AEC-Q100 automotive qualified, grade 1</li> </ul>	-40	150	QFN-MR

# Engine management systems



## System basis ICs, power supply ICs

Bosch system ICs for engine management systems combine the power supply with additional peripheral functions. Virtually all current microcontrollers are supported.

### POWER SUPPLY WITH INTEGRATED CONTROL AND I/O FUNCTIONS, RPM SENSOR SUPPLIES AND INTERFACES

Application	Product	V <sub>DD</sub> typ. [V]	Interfaces	Supply voltages	Inputs	Outputs	Features	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
System basis IC	CY329	14	MSC bus 1×CAN-FD physical layer	<ul style="list-style-type: none"> <li>System: 5V/550mA, 5V/950mA</li> <li>Sensors: 3×5V/200mA</li> </ul>	<ul style="list-style-type: none"> <li>Ignition</li> <li>3 wake up pins</li> <li>Wake up on CAN</li> <li>External 5V monitor</li> </ul>	<ul style="list-style-type: none"> <li>Main relay control: 1×LSPS</li> <li>7×LS power stage: Ron_max = 2.4Ohm / UClamp = 55V</li> <li>1×HS power stage: Ron_max = 2.4Ohm, dedicated supply pin</li> </ul>	<ul style="list-style-type: none"> <li>Battery supply can be configured as permanent or non-permanent with or without CAN wake-up capability</li> <li>Minimal power dissipation</li> <li>Standby current down to 55µA</li> <li>Suitable for ASIL D systems</li> </ul>	-40	150	TQFP64-EPAD
System basis IC	CY327	14	SPI, 16bit (3.3V) 1×CAN 1×LIN	<ul style="list-style-type: none"> <li>System: 5V/450mA, 3.3V/300mA, 5 or 3.3V/250mA</li> <li>Core supply 0.9–1.525V/1.2A switch-mode</li> <li>Sensors: 3×5V</li> </ul>	<ul style="list-style-type: none"> <li>Ignition</li> <li>3 wake up pins</li> <li>Wake up on CAN</li> </ul>	<ul style="list-style-type: none"> <li>Main relay control: 1×LSPS</li> </ul>	<ul style="list-style-type: none"> <li>Buck/boost pre-regulator switched mode supply for µC core voltage</li> <li>Advanced 3-level watchdog operating range 3V–40V</li> <li>Stop counter functions</li> <li>Very low quiescent current</li> </ul>	-40	150	TQFP64-EPAD or TQFP100-EPAD
System basis IC	CY320	14	1×CAN 1×ISO SPI, 16bit (5V)	<ul style="list-style-type: none"> <li>System: 5V, 3.3V, 2.6V, 1.5V</li> <li>Sensors: 3×3.3/5V programmable</li> </ul>	<ul style="list-style-type: none"> <li>Ignition</li> <li>Wake up</li> </ul>	<ul style="list-style-type: none"> <li>Main relay control: 1×LSPS</li> </ul>	<ul style="list-style-type: none"> <li>2 pre-regulator modes (switched, linear)</li> <li>Advanced 3-level watchdog</li> <li>µC-reset and system reset</li> <li>Stop counter functions</li> </ul>	-40	150	PSO36

# Engine management systems



## Low-side power switches

Robust power stages for driving electric loads around the engine: injectors, igniters and other peripheral devices.

### POWER STAGE ARRAYS WITH INTEGRATED MONITORING FUNCTIONS

Application	Product	V <sub>bat</sub> typ. [V]	V <sub>DD</sub> typ. [V]	Interfaces	Inputs	Outputs	Features	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
14 channel low-side power switch and H bridge	CJ970	14	5	MSC	4×H bridge control	6×350 mΩ/3.6 A/55V 2×720 mΩ/2.2 A/55V 6×2.4 Ω / 0.6 A/55V 4×HSS 5V/20 mA (ignition driver) 4×HS/LS combined MOSFET driver 4×LS MOSFET driver	<ul style="list-style-type: none"> <li>Two voltage monitors for system supplies</li> <li>In H bridge configuration, bridge is controlled by dedicated pins directly</li> <li>Power stages protected against SCB</li> <li>Current limit or shutdown on overcurrent</li> <li>Diagnosis: OL, SCG, SCB and OTW for each powerstage</li> <li>Internal power stages can be connected in parallel</li> </ul>	-40	150	TQFP100-EPAD
8-fold low-side power switch	CJ960	14	5	SPI, MSC		4×3.0 A/230 mΩ/55V 2×1.0 A/700 mΩ/55V 2×1.0 A/550 mΩ/55V	<ul style="list-style-type: none"> <li>Diagnosis: OL, SCG, SCB and OT</li> <li>Flexible control by MSC or SPI</li> <li>Multiple safety features</li> <li>Separate shutdown path for OUT1-4</li> <li>Current limit or shutdown on overcurrent</li> </ul>	-40	140	TQFP64-EPAD
18-fold low-side power switch	CJ950	14	5	MSC	TTL/CMOS logic, withstands 36V permanently	4×0.6 A/1,800 mΩ/55V 10×2.2 A/500 mΩ/55V 2×3 A/260 mΩ/55V 2×8 A/150 mΩ/55V	<ul style="list-style-type: none"> <li>Diagnosis: OL, SCG, SCB and OT</li> <li>5V monitoring</li> <li>2<sup>nd</sup> independent shut down path</li> <li>2×lambda sensor heater</li> </ul>	-40	150	PSO36

# Engine management systems



## Ignition stage drivers

Efficient combustion requires a strong ignition spark at the spark plug. Ignition stage drivers convert the microcontroller's output signal in a driver current for the ignition coil.

### INVERTING DRIVER FOR EXTERNAL IGNITION STAGES IN 4 CYLINDER ENGINES

Application	Product	V <sub>DD</sub> typ. [V]	Channels	Interfaces	Features	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
4-channel inverting driver for external ignition stages	CK240	5	4	SPI	<ul style="list-style-type: none"> <li>■ Short-circuit protection</li> <li>■ Diagnosis</li> <li>■ Wiring diagnosis</li> </ul>	-40	150	SOIC16w

# Engine management systems



## Oxygen sensor interfaces

The oxygen sensor (or lambda sensor) interface IC permanently controls the probe for precise operation and provides the sensor's readings to the microcontroller within the engine control unit.

### OXYGEN SENSOR CONTROL AND READOUT WITH INTEGRATED MONITORING FUNCTIONS

Application	Product	V <sub>bat</sub> typ. [V]	V <sub>DD</sub> typ. [V]	Inputs	Interfaces	Features	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
Oxygen sensor control for Bosch, NTK & Denso oxygen sensors	CJ135	14	3/5	Oxygen sensor signals	SPI	<ul style="list-style-type: none"> <li>■ Lambda measurement</li> <li>■ Probe temperature evaluation</li> <li>■ SPI programmable controls</li> <li>■ Active blackening control and protection</li> <li>■ Analog output current</li> <li>■ Diagnostic features</li> <li>■ Supports LSU5.2 / 4.9 / ADV (Bosch)</li> <li>■ Supports ZFAS-U2 / U3 (NTK)</li> <li>■ Supports Plus 5 / 6 (Denso)</li> </ul>	-40	150	TQFP32-EPAD
Bosch oxygen sensor (LSU)	CJ125	14	5	Oxygen sensor signals	SPI	<ul style="list-style-type: none"> <li>■ Lambda measurement</li> <li>■ Probe temperature measurement</li> <li>■ Programmable reference pump current</li> <li>■ Diagnostics</li> <li>■ Supports LSU5.2 / 4.9 / ADV / 4.2 (Bosch)</li> </ul>	-40	150	LQFP32

# Engine management systems



## B6 bridges

Efficient one-chip solution for driving 3 phase BLDC motors.

### SMART BRIDGE FOR THROTTLE VALVE DRIVES, PUMPS AND OTHER MOTOR-DRIVEN ACTUATORS

Application	Product	V <sub>bat</sub> typ. [V]	Interfaces	Features	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
Monolithic B6 bridge for motors up to 60W	CJ260	4.5–28	SPI, direct inputs	<ul style="list-style-type: none"> <li>■ R<sub>DSon max</sub>: 540 mΩ (@3A<sub>RMS</sub>, 150 °C)</li> <li>■ I<sub>out max</sub>: 3A<sub>RMS</sub></li> <li>■ f<sub>PWM max</sub>: 20 kHz</li> <li>■ Current limiter function</li> <li>■ Extensive protection features</li> <li>■ Diagnosis functions</li> <li>■ Suitable for systems up to ASIL-B</li> </ul>	–40	150	PSSO36



# Transmission control systems



## System basis ICs

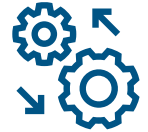
In transmission control systems, the system basis chipset provides the system power, disables the starter in case of gearbox malfunction and ensures proper system function by various monitoring routines.

Current regulators set the currents for magnetic oil valves rapidly and precisely to the desired value – crucial for fast and smooth gear shifting.

### 2-CHIP CONCEPT FOR HIGH SYSTEM SAFETY: POWER SUPPLY, STARTER RELAIS CONTROL AND VARIOUS I/O

Application	Product	V <sub>DD</sub> typ. [V]	Interfaces	Supply voltages	Inputs	Outputs	Features	T <sub>J</sub> min [°C]	T <sub>J</sub> max [°C]	Package
Safety IC for transmission control units	CG135	14	SPI (3.3V)	UBAT	<ul style="list-style-type: none"> <li>■ 3×voltage monitoring channels</li> <li>■ 3×speed sensor interface</li> </ul>	<ul style="list-style-type: none"> <li>■ System reset</li> <li>■ Power control</li> </ul>	<ul style="list-style-type: none"> <li>■ Complies with ISO26262:2011 for ASIL-D capability in combination with system basis ICs, solenoid drivers and high-side switches</li> <li>■ Flexible parameter configuration</li> <li>■ Diagnostic capability</li> </ul>	-40	150	TQFP32-EPAD QFN36 (on demand)
System basis IC combination	CG124 CG130	14	ISO/LIN SPI (5V)	3.3V, 5V, 9V, UBAT	<ul style="list-style-type: none"> <li>■ 3×speed sensor</li> <li>■ 4×position sensor</li> <li>■ Wake up</li> </ul>	<ul style="list-style-type: none"> <li>■ 3×driver for HS switches</li> <li>■ Starter disable</li> <li>■ Startup, reset, shutdown for μC</li> </ul>	<ul style="list-style-type: none"> <li>■ Ideally suited for Renesas SH7</li> <li>■ Reverse polarity protection for HS switches</li> <li>■ Reverse polarity protection for system supply</li> <li>■ HS switch for starter disable</li> <li>■ 2-fold voltage monitoring</li> <li>■ Question and answer watchdog</li> <li>■ Periphery clock monitoring</li> <li>■ 16 channel multiplexer for diagnosis: OL, SCG and SCB</li> </ul>	-40	150	TQFP64-EPAD (CG124) and LQFP32 (CG130) or bare die

# Transmission control systems



## Current regulators

High precision current regulators for driving hydraulic valves in automatic transmissions, allowing for fast gear changes.

### PRECISE CONTROL OF OIL PRESSURE VALVES IN HYDRAULIC SYSTEMS

Application	Product	V <sub>bat</sub> typ. [V]	V <sub>DD</sub> typ. [V]	Interfaces	Outputs	Features	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
Dual-channel fully integrated current regulator for inductive loads for low-side application	CG208	14	5	1 × SPI (3.3V or 5V)	2 × regulated load current	<ul style="list-style-type: none"> <li>■ Power switch, shunt and free wheeling diode integrated current regulation range: 0...1,200mA</li> <li>■ Accuracy &lt; 1%</li> <li>■ Dither function</li> <li>■ Overcurrent protection</li> <li>■ Overtemperature protection</li> <li>■ SPI controlled regulation loop characteristics</li> </ul>	-40	150	Bare die, TQFP44-EPAD

# Pyro fuse systems



## Pyro fuse drivers

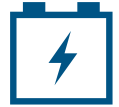
In case of an accident, pyro fuses physically separate the HV battery from the vehicle's power lines.

As part of the battery management system, pyro fuse drivers can trigger several pyro fuses independently of each other.

### PYRO FUSE DRIVERS WITH SPI CONTROL, NUMEROUS SAFETY AND DIAGNOSIS FEATURES

Application	Product	$\mu\text{C}$ supply [V]	$V_{\text{VZP}}$ typ. [V]	HSS supply	Interfaces	Firing loops	Features	$T_{\text{j, min}}$ [°C]	$T_{\text{j, max}}$ [°C]	Package
4 channel pyro fuse driver	CG985	n.a.	14	25 or 33	SPI, 16-bit (3.3V or 4.9V)	4 (2 firing modes)	<ul style="list-style-type: none"> <li>■ Sophisticated safety concept</li> <li>■ Monitoring of voltages, power stage and firing loop diagnosis, STB and STG diagnosis, squib resistance measurement</li> <li>■ 4-bit firing current counter per firing loop</li> </ul>	-40	150	LQFP44
4 channel pyro fuse driver	CG912	3.3	14	23.75 or 33 (programmable)	SPI, 32-bit (3.3V), K-Line/LIN	4 (5 firing modes)	<ul style="list-style-type: none"> <li>■ Power supply capabilities:               <ul style="list-style-type: none"> <li>– 3.3V (microcontroller, onboard sensors)</li> <li>– 5V (CAN)</li> <li>– 6.7V (peripheral sensors)</li> <li>– 23.75/33V (energy reserve &amp; pyro fuse firing)</li> </ul> </li> <li>■ Enhanced sophisticated safety concept (incl. sensor data monitoring)</li> <li>■ Watchdog for microcontroller</li> <li>■ Fully automated diagnosis: Monitoring of voltages (incl. VHx) and overtemperature, SVR diagnosis, CER diagnosis, power stage and squib diagnosis, cross-coupling diagnosis, connector capacitor diagnosis, STB and STG diagnosis</li> <li>■ 2 independent 7-bit firing current counters per channel (max. time: 3.2ms)</li> <li>■ PWM controlled GPIO</li> </ul>	-40	150	TQFP64-EPAD

# Pyro fuse systems



## Pyro fuse drivers

### PYRO FUSE DRIVERS WITH SPI CONTROL, NUMEROUS SAFETY AND DIAGNOSIS FEATURES

Application	Product	$\mu\text{C}$ supply [V]	$V_{\text{VZP}}$ typ. [V]	HSS supply	Interfaces	Firing loops	Features	$T_{\text{j min}}$ [°C]	$T_{\text{j max}}$ [°C]	Package
8 channel pyro fuse driver	CG902	3.3	14	23.75 or 33 (programmable)	SPI, 32 bit (3.3V), K-Line/LIN	8 (5 firing modes)	<ul style="list-style-type: none"> <li>■ Power supply capabilities:               <ul style="list-style-type: none"> <li>– 3.3V, 1.3V (microcontroller, onboard sensors)</li> <li>– 5V (CAN)</li> <li>– 6.7V (peripheral sensors)</li> <li>– 23.75/33V (energy reserve &amp; pyro fuse firing)</li> </ul> </li> <li>■ Enhanced sophisticated safety concept (incl. sensor data monitoring)</li> <li>■ Watchdog for microcontroller</li> <li>■ Fully automated diagnosis: Monitoring of voltages (incl. VHx) and overtemperature, SVR diagnosis, CER diagnosis, power stage and squib diagnosis, cross-coupling diagnosis, connector capacitor diagnosis, STB and STG diagnosis</li> <li>■ 2 independent 7-bit firing current counters per channel (max. time: 3.2ms)</li> <li>■ PWM controlled GPIO</li> </ul>	-40	150	TQFP128-EPAD

# Alternator electronics



## Alternator regulators

By adjusting the rotor current, Bosch alternator regulators set the output voltage to a constant level, regardless of the actual engine rotation speed. Regulators with interfaces allow for interaction with the engine

control, i.e. provide status information, set the output voltage to a desired level or switch off the alternator during acceleration.

### ALTERNATOR OUTPUT VOLTAGE CONTROL, PROGRAMMABLE FOR CUSTOMER SPECIFIC ALTERNATOR BEHAVIOUR

Application	Product	Interfaces	Outputs	Features	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
Regulator for 14V alternators	CR719	n.a.	Excitation current	<ul style="list-style-type: none"> <li>Autonomous regulator concept</li> <li>Smart load management</li> </ul>	-40	175	MultiWatt8
Regulator for 14V alternators	CR724	n.a.	Excitation current	<ul style="list-style-type: none"> <li>Autonomous regulator concept</li> <li>Smart load management</li> </ul>	-40	175	MultiWatt8
Regulator for 14V alternators	CR665	LIN 1.3, 2.1	Excitation current	<ul style="list-style-type: none"> <li>LIN control functions acc. to VDA spec.</li> <li>Programmable</li> <li>Smart load management</li> </ul>	-40	175	TO220-5
Regulator for 14V alternators	CR636	PWM	Excitation current	<ul style="list-style-type: none"> <li>PWM controlled output</li> <li>Smart load management</li> </ul>	-40	175	MultiWatt8
Regulator for 14V alternators	CR760	C-Terminal	Excitation current	<ul style="list-style-type: none"> <li>C-Terminal controlled output</li> <li>Smart load management</li> </ul>	-40	175	MultiWatt8
Regulator for 28V alternators	CR298	n.a.	Excitation current	<ul style="list-style-type: none"> <li>Autonomous regulator concept</li> <li>Smart load management</li> </ul>	-40	175	MultiWatt8
Regulator for 28V alternators	CR250	LIN 1.3	Excitation current	<ul style="list-style-type: none"> <li>LIN controlled output</li> <li>Programmable</li> <li>Smart load management</li> </ul>	-40	175	MultiWatt8

# Electric drive and power conversion systems



## Silicon carbide power switches

Bosch SiC MOSFETs reduce conduction and switching losses, allow for higher switching frequencies and are extremely robust. They are specifically designed for drive electronics or power conversion systems in (hybrid) electric vehicles.

### SILICON CARBIDE AUTOMOTIVE POWER MOSFETS 1,200V

Type	Product	V <sub>DS</sub> [V]	I <sub>DS</sub> [A]	R <sub>DSon</sub> [mΩ]	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
SiC power switch	BT1M1200023T3A	1,200	63	23	-40	175	TO247-3
SiC power switch	BT1M1200031T3A	1,200	44	31	-40	175	TO247-3
SiC power switch	BT1M1200050T3A	1,200	29	50	-40	175	TO247-3
SiC power switch	BT1M1200023T4A	1,200	63	23	-40	175	TO247-4
SiC power switch	BT1M1200031T4A	1,200	44	31	-40	175	TO247-4
SiC power switch	BT1M1200050T4A	1,200	30	50	-40	175	TO247-4
SiC power switch	BT1M1200023D7A	1,200	63	23	-40	175	TO263-7
SiC power switch	BT1M1200031D7A	1,200	44	31	-40	175	TO263-7
SiC power switch	BT1M1200050D7A	1,200	30	50	-40	175	TO263-7

# Electric drive and power conversion systems



## Silicon carbide power switches

### SILICON CARBIDE AUTOMOTIVE POWER MOSFETS 750V

Type	Product	V <sub>DS</sub> [V]	I <sub>DS</sub> [A]	R <sub>DSon</sub> [mΩ]	T <sub>jmin</sub> [°C]	T <sub>jmax</sub> [°C]	Package
SiC power switch	BT1M0750016T3A	750	82	16	-40	175	TO247-3
SiC power switch	BT1M0750022T3A	750	59	22	-40	175	TO247-3
SiC power switch	BT1M0750035T3A	750	39	36	-40	175	TO247-3
SiC power switch	BT1M0750016T4A	750	82	16	-40	175	TO247-4
SiC power switch	BT1M0750022T4A	750	59	22	-40	175	TO247-4
SiC power switch	BT1M0750035T4A	750	39	36	-40	175	TO247-4
SiC power switch	BT1M0750016D7A	750	82	16	-40	175	TO263-7
SiC power switch	BT1M0750022D7A	750	59	22	-40	175	TO263-7
SiC power switch	BT1M0750035D7A	750	39	36	-40	175	TO263-7

# Electric drive and power conversion systems



## Silicon carbide power switches

### SILICON CARBIDE AUTOMOTIVE POWER MOSFETS 1,200V

Type	Product	V <sub>DS</sub> [V]	I <sub>DS</sub> [A]	R <sub>DSon</sub> [mΩ]	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
SiC power switch	BT1M1200010BBA	1,200	175	10	-55	175	bare die
SiC power switch	BT1M1200010BOA	1,200	175	10	-55	175	bare die
SiC power switch	BT1M1200013BBA	1,200	130	13	-55	175	bare die
SiC power switch	BT1M1200013BOA	1,200	130	13	-55	175	bare die

Front side metallization options; BBA type: AlCu; BOA type: AlCu + additional metallization for sintering and soldering

### SILICON CARBIDE AUTOMOTIVE POWER MOSFETS 750V

Type	Product	V <sub>DS</sub> [V]	I <sub>DS</sub> [A]	R <sub>DSon</sub> [mΩ]	T <sub>j min</sub> [°C]	T <sub>j max</sub> [°C]	Package
SiC power switch	BT1M0750010BBA	750	225	7	-55	175	bare die
SiC power switch	BT1M0750010BOA	750	225	7	-55	175	bare die
SiC power switch	BT1M1200013BBA	750	165	10	-55	175	bare die
SiC power switch	BT1M1200013BOA	750	165	10	-55	175	bare die

Front side metallization options; BBA type: AlCu; BOA type: AlCu + additional metallization for sintering and soldering



# IP modules

## for networking applications



### X\_CAN IP MODULE

The X\_CAN is a CAN IP module that can be implemented in an SoC (System on Chip). It supports Classical CAN, CAN FD (CAN with Flexible Data-rate), and CAN XL (CAN with Extended Length) communication. CAN XL is being drafted by the CiA 610-1 specification (CAN in Automation) and will be standardized as part of ISO11898. For a connection to the CAN physical layer, additional transceiver hardware is required. The X\_CAN is being developed as Safety Element out of Context (SEooC) according to ISO 26262-11:2018 Clause 4. Safety Manual and FMEDA will be available on request.

### M\_CAN IP MODULE

The M\_CAN is a CAN IP module that can be realized as stand-alone device, as part of an ASIC, or on an FPGA. It supports Classical CAN and CAN FD (CAN with Flexible Data-rate) communication according to ISO11898-1:2015. For a connection to the CAN physical layer, additional transceiver hardware is required. The M\_CAN is also available as M\_TTCAN, to additionally support Time-Triggered CAN according to ISO11898-4. The M\_CAN has been developed as Safety Element out of Context (SEooC) according to ISO 26262-11:2018, Clause 4. Safety Manual and FMEDA are available on request.

### TSU IP MODULE – TIMESTAMPING UNIT FOR M\_CAN

The timestamping unit supplies IP module with hardware timestamps according to CiA 603 and AUTOSAR specification.

### DMU IP MODULE – DIRECT MEMORY ACCESS UNIT FOR M\_CAN

The DMU supports DMA transfers between M\_CAN message RAM and system memory.

### CAN XL PROTOCOL

CAN XL (Controller Area Network with Extended Length) provides a superior solution for data rates of up to 20Mbit/s by maintaining the advantages of the CAN protocol like collision-resolution by non-destructive arbitration. It expands the number of data bytes per CAN frame up to 2048. CAN XL is ready for SOA (Service Oriented Architecture) with new protocol features as it enables virtual CAN networks with the Virtual CAN network ID (VCID). The Service data type (SDT) defines higher protocol type and the 32bit Address Field (AF) is used for content or node based addressing. With respect to the bitrate, CAN XL fills the gap between CAN FD and 100BASE-T1 (Ethernet) with a bit rate of up to 20Mbit/s. CAN XL protocol controllers are also able to perform Classical CAN and CAN FD communication.

### CAN FD PROTOCOL

CAN FD (CAN with Flexible Data-rate) was introduced by Bosch in 2012 to overcome the Classical CAN's bit rate limitation to 1Mbps and to expand the number of data bytes per CAN frame from up to 8 to up to 64, thereby closing the gap between Classical CAN and other protocols. This is achieved by a modified CAN frame format where the bit rate can be switched to faster value inside the CAN frame and by a new data length coding.

CAN FD is standardized as ISO11898-1:2015. CAN FD protocol controllers are also able to perform Classical CAN communication.

### CAN FD LIGHT PROTOCOL

CAN FD Light is a lightweight version of CAN FD. It is intended for low cost application with one commander (master) controller and numerous responder (slave) controllers. CAN FD Light is currently intended for 1Mbps. For a CAN FD Light responder there is no need for an external crystal to have lower cost. CAN FD Light is currently being standardized by the CiA (CAN in Automation). Existing IP capable of CAN FD (X\_CAN and M\_CAN) can be used as CAN FD Light commander.

### MANDATORY LICENSE OF CAN PROTOCOLS

The CAN Protocols are patented products developed by Robert Bosch GmbH. A CAN Protocol License is required for all implementations of CAN FD, CAN FD Light, TTCAN and CAN XL module.

# IP modules

## for timer applications



### GENERIC TIMER MODULE (GTM)

The GTM IP is a scalable I/O co-processor and a generic timer for various automotive and industrial applications. It covers a wide range of applications: Power Factor Correction (PFC), electrical converter, motor control, traction control, EV (Electric Vehicle), powertrain, power steering, chassis and transmission control. The benefits of the GTM are:

- Offloading real-time critical I/O workloads from  $\mu$ C cores to a specialized I/O co-processor with massive parallel thread handling capabilities
  - Common architecture across multiple semiconductor controllers
  - Development of software/applications independent of selected MCU
  - Scalable design approach
  - Scales with the application demand – from low-end to high-end class applications
  - Large Eco-Environment
  - Short development cycle with a rich set of tools and compilers
  - Emulation of serial protocols (e.g. LIN, SENT)
  - Add serial protocol to your design with the GTM
- Counters (free running and resettable)
  - Multi-action capture/compare PWM input
  - Complex PWM output function
  - Duty-cycle measurement
  - Global time bases
  - Complex angle clock mechanism for powertrain applications
  - Input signal filtering
  - Internal RISC-like programmable cores for data processing and complex output sequence generation

The GTM IP is designed to offer flexible solutions for different application domains and for different application classes within one specific application domain. The IP is designed to run with minimal CPU interaction and to unload the CPU from handling interrupt service requests as much as possible.

Generic interfaces and the hierarchical system architecture make the GTM an ideal solution as IP core for various microcontroller architectures.

# Abbreviations

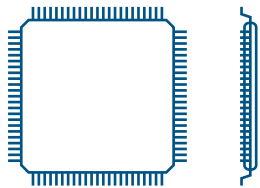
As used in data tables

$C_{ER}$	Energy reserve capacitor
HS	High side switch
HSPS	High side power switch
LS	Low side switch
LSPS	Low side power switch
PAS	Peripheral airbag sensor
PSI5	Peripheral sensor interface bus
SPI	Serial peripheral interface
$V_{BAT}$	Battery voltage
$V_{DD}$	System supply
$V_{PASOX}$	Sensor supply voltage
$V_{VER}$	Energy reserve voltage
$V_{VZP}$	Supply voltage

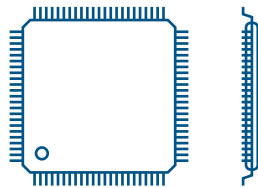
# Packages

## Body dimensions

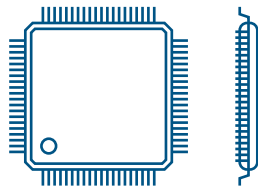
TQFP128-EPAD  
(14 mm × 14 mm)



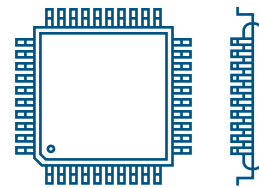
TQFP100-EPAD  
(14 mm × 14 mm)



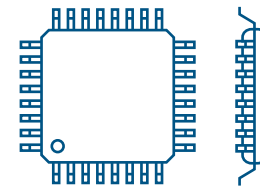
TQFP64-EPAD  
(10 mm × 10 mm)



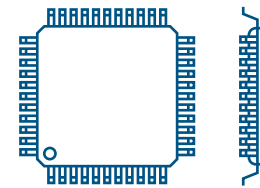
TQFP44-EPAD  
(10 mm × 10 mm)



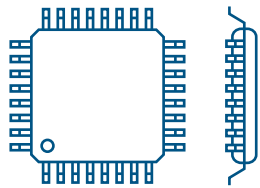
TQFP32-EPAD  
(7 mm × 7 mm)



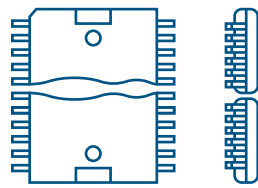
LQFP44  
(10 mm × 10 mm)



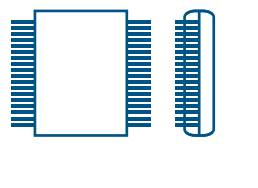
LQFP32  
(7 mm × 7 mm)



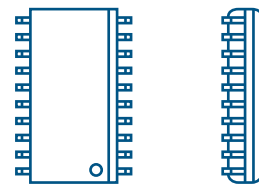
PSO36  
(11.1 mm × 16 mm)



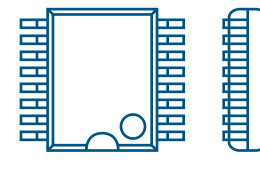
PSSO36  
(10.3 mm × 7.6 mm)



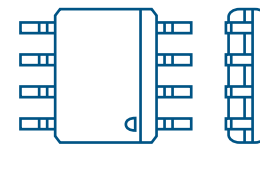
SOIC24w  
(7.5 mm × 15.4 mm)



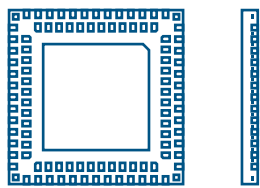
SOIC16w  
(7.5 mm × 10.3 mm)



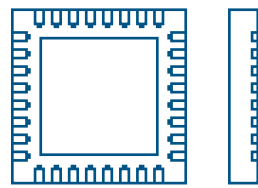
SOIC8n  
(3.9 mm × 4.9 mm)



QFN-MR  
(10 mm × 10 mm)



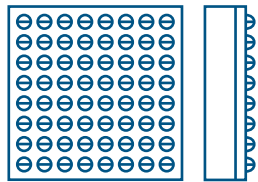
QFN36  
(6 mm × 6 mm)



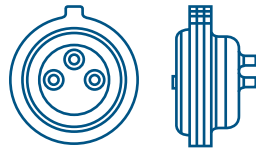
# Packages

## Body dimensions

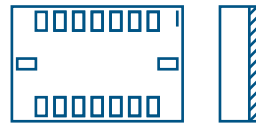
BGA64  
(7 mm × 7 mm)



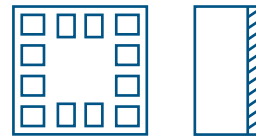
Metal package  
(Ø 17.5 mm)



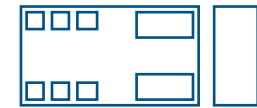
LGA16  
(3 mm × 4.5 mm)



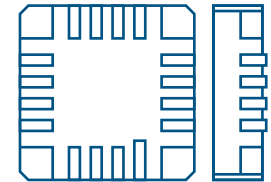
LGA12  
(2 mm × 2 mm)



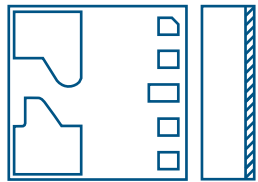
LGA8  
(8.2 mm × 4.4 mm)



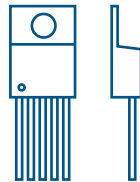
CLCC16  
(8 mm × 8 mm)



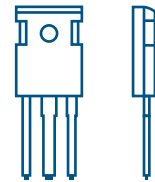
LGA SiP  
(4 mm × 5 mm)



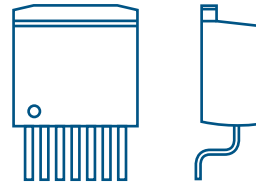
TO220-5



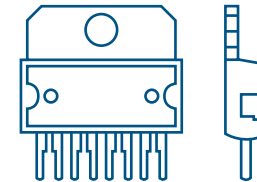
TO247-3



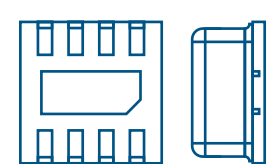
TO263-7



Multiwatt8 (in-line)



DFN8







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