



Bosch Semiconductors for Automotive

MEMS Sensors
System ICs
Power Semiconductors
IP Modules



Invented for life

Smart and innovative components for new market requirements



300-mm-Waferfab Dresden

ABOUT THIS CATALOG

This catalog shows our current range of electronic components and IP modules for automotive applications. Bosch's portfolio addresses the mobility requirements of today and tomorrow: personalized – automated – connected – electrified. To meet these market requirements, Bosch develops and manufactures the following product groups:

POWER MODULES AND SWITCHES BASED ON SILICON CARBIDE (SiC) TECHNOLOGY:

SiC chips are a key component for electrified mobility. The global ramp-up of electromobility is creating an enormous demand. In e-cars, SiC chips enable greater ranges and more efficient charging processes, as they have up to 50 percent lower energy loss. In the power electronics of electric vehicles, they ensure that cars travel significantly further on one battery charge – on average, up to six percent more range is possible compared to chips based on silicon.

MEMS SENSORS:

MEMS sensors (micro-electromechanical systems): Bosch's (inertial) sensors for detecting changes in driving conditions are becoming smaller, more precise, and more reliable.

ASICs:

ASICs - application-specific integrated circuits, including application-specific system-on-chips (AsSoCs) Bosch's design expertise creates more flexibility for regulation, control, and communication in the vehicle. For example, innovative Advanced Driver Assistance Systems (ADAS) functions require new electronic hardware.

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.

SEMICONDUCTORS FROM BOSCH – SHAPING THE FUTURE

Bosch has a stable position among the Top 10 semiconductor manufacturers in the automotive sector. Bosch is one of the world's largest suppliers of MEMS sensors for vehicles and in the consumer electronics sector. Bosch holds some 1,500 patents and patent applications worldwide; 1,000 of these are in the field of MEMS sensors alone.

Bosch continuously invests in dedicated research and advance development that makes it possible to use the latest technologies and processes for future semiconductors. Bosch is a pioneer in MEMS sensor technology and invented the basic manufacturing processes itself, e.g. Deep Reactive Ion Etching (DRIE).

Through its active participation in research collaborations, Bosch is a key player in international research and development networks. Bosch is helping to shape the future in numerous semiconductor expert committees and publicly funded projects.

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Safety



Acceleration sensors for restraint systems

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 _{DD} typ. [V]	T _{min} [°C]	T _{max} [°C]	Package
Single axis (a _y)	SMA682	±120/240/480	PSI5, 10 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a _z)	SMA684	±120/240	PSI5, 10 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a _z)	SMA694	±480	PSI5, 10 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a _y)	SMA750	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a _z)	SMA751	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a _x)	SMA755	±240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a _x)	SMA758	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	SOIC8n
Single axis (a _x)	SMA780	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	LGA SiP
Single axis (a _z)	SMA781	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	LGA SiP
Single axis (a _x)	SMA790	±240/480	PSI5, 10 bit or 14 bit	7	4.5–11	–40	125	LGA SiP

Safety



Acceleration sensors for restraint systems

HIGH-G DUAL AXIS ACCELERATION SENSORS

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

Safety



Pressure sensors for restraint systems

Pressure sensors support an airbag system in the detection of accidents.

PRESSURE SENSORS FOR SIDE IMPACT SENSING AND PEDESTRIAN PROTECTION

Type	Product	Range [kPa]	Output	Sensitivity	Tolerance [kPa]	V _{DD} typ. [V]	T _{min} [°C]	T _{max} [°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

Safety



Inertial sensors for vehicle dynamics control (VDC)

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 _{DD} typ. [V]	T _{min} [°C]	T _{max} [°C]	Package
Dual angular rate sensor (Ω_{xz}) and tri-axis acceleration sensor (a_{xyz})	SMI860	± 300 °/s ± 6 g	SafeSPI, 16 bit	100LSB/°/s 5,000LSB/g	± 3 ± 3	3.3 or 5 or 6.7	-40	125	BGA64
Angular rate sensor (Ω_z) and dual axis acceleration sensor (a_{xy})	SMI810	± 300 °/s ± 6 g	SafeSPI, 16 bit	100LSB/°/s 5,000LSB/g	± 3 ± 3	3.3 or 5 or 6.7	-40	125	BGA64
Angular rate sensor (Ω_x) and dual axis acceleration sensor (a_{xy})	SMI800	± 300 °/s ± 6 g	SafeSPI, 16 bit	100LSB/°/s 5,000LSB/g	± 3 ± 3	3.3 or 5 or 6.7	-40	125	BGA64
Angular rate sensor (Ω_x) and single axis acceleration sensor (a_z)	SMI720	± 300 °/s ± 5 g	SPI, 16 bit	100LSB/°/s 5,000LSB/g	± 5 ± 6	3.3	-40	105	BGA64
Angular rate sensor (Ω_x) and dual axis acceleration sensor (a_{yz})	SMI710	± 300 °/s ± 5 g	SPI, PSI5, CAN, 16 bit	100LSB/°/s 5,000LSB/g	± 3 ± 3	3.3 or 5	-40	125	BGA64
Angular rate sensor (Ω_z) and dual axis acceleration sensor (a_{xy})	SMI700	± 300 °/s ± 5 g	SPI, PSI5, CAN, 16 bit	100LSB/°/s 5,000LSB/g	± 3 ± 3	3.3 or 5	-40	125	BGA64
Angular rate sensor (Ω_x)	SMG810	± 300 °/s	SafeSPI, 16 bit	± 100 LSB/°/s	± 3	3.3 or 5 or 6.7	-40	125	BGA64

ADAS



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 _{DD} typ. [V]	T _{min} [°C]	T _{max} [°C]	Package
High performance yaw rate sensor (Ω_z) and 3-axis accelerometer	SMU200	$\pm 300^\circ/\text{s}$ (Ω_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 (Ω_x) and 3-axis accelerometer	SMU210	$\pm 300^\circ/\text{s}$ (Ω_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 _{DD} typ. [V]	T _{min} [°C]	T _{max} [°C]	Package
Precise 3-axis gyroscope and 3-axis accelerometer	SMI240	$\pm 300^\circ/\text{s}$ (Ω_z) $\pm 16\text{ g}$ (a_{xyz})	SPI	$\pm 5^\circ/\text{s}$	3.3	-40	105	LGA12
Precise 3-axis gyroscope and 3-axis accelerometer	SMI270	± 300 or $\pm 500^\circ/\text{s}$ (Ω_z) ± 4 or $\pm 16\text{ g}$ ($axyz$)	SPI	$\pm 3^\circ/\text{s}$	3.3	-40	125	Open cavity LGA

ADAS



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 _{DD} typ. [V]	T _{min} [°C]	T _{max} [°C]	Package
Tri-axis acceleration sensor (a _{xyz})	SMA130	±2 ±4 ±8 ±16	SPI, I ² C 14 bit	4,096 2,048 1,024 512	±2.1	1.62–3.6	–40	105*	LGA12
Tri-axis acceleration sensor (a _{xyz})	SMA131	±2 ±4 ±8	SPI, I ² 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 _{DD} typ. [V]	T _{min} [°C]	T _{max} [°C]	Package
Tri-axis angular rate sensor (Ω _{xyz})	SMG130	±125 ±250 ±500 ±1,000 ±2,000	SPI, I ² 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

ADAS



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 _{DD} typ. [V]	T _{min} [°C]	T _{max} [°C]	Package
Tri-axis angular rate sensor (Ω_{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 ² C 16 bit (Ω) 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 (Ω_{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 ² C 16 bit (Ω) 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

ICE Powertrain



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 CO₂ and other pollutants.

PRESSURE SENSOR FOR DIESEL OR GASOLINE ENGINE MANAGEMENT

Type	Product	Range [kPa]	Output	Tolerance [over lifetime and temperature]	V _{DD} typ. [V]	T _{min} [°C]	T _{max} [°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

Comfort



Sensors for active suspension

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 _{DD} typ. [V]	T _{min} [°C]	T _{max} [°C]	Package
Low-g acceleration sensor (a _x)	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 _y)	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

Comfort



Low pressure sensors for seat comfort

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 _{DD} typ. [V]	T _{min} [°C]	T _{max} [°C]	Package
Low pressure sensor	SMP581	60–165	SPI 10bit	≤1.5 kPa (pressure) ≤5K (temperature)	3.3–5	–40	125	DFN8

Safety



System ICs for restraint systems

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 _{DD} typ. [V]	V _{VZP} typ. [V]	V _{VER} typ. [V]	Peripheral sensor interfaces	Analog interfaces	Interfaces	Firing loops	Features	T _{j min} [°C]	T _{j max} [°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"> ■ Enhanced sophisticated safety concept: safety controller; 3 watchdogs; ESP sensor data can be included in safety concept ■ Fully automatic diagnosis: <ul style="list-style-type: none"> – Monitoring of voltages (incl. VHx) and overtemperature, SVR diagnosis – Built-in sensor test, C_{ER} diagnosis, power stage and squib diagnosis, cross coupling diagnosis, connector capacitor diagnosis, STB and STG diagnosis ■ 2 independent 7 bit firing current counters per channel (max time: 3.2 ms) ■ PWM controlled GPIO 	-40	150	TQFP128-EPAD

Safety



System ICs for restraint systems

SYSTEM ICs FOR VARIOUS AIRBAG SYSTEM CONFIGURATIONS

Application	Product	V _{DD} typ. [V]	V _{VZP} typ. [V]	V _{VER} typ. [V]	Peripheral sensor interfaces	Analog interfaces	Interfaces	Firing loops	Features	T _{j min} [°C]	T _{j max} [°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, 32bit (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, 32bit (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, 32bit (3.3V), K-Line/LIN	4 (5 firing modes)	See CG904	-40	150	TQFP64-EPAD

Safety



System ICs for restraint systems

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"> ■ Max. 8 sensors ■ Bidirectional communication ■ Bosch AB, EM and Open SPI protocol ■ Integrated monitoring of voltages and overtemperature ■ Integrated diagnosis 	-40	150	LQFP32

ADAS



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

ADAS



Power Management ICs for Radar and Video SoCs

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

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

ICE Powertrain



System ICs

System power supply ICs for electrical and combustion engine powertrain management for virtually all current microcontrollers and peripheral sensors. Power stages to drive other peripheral functions. Malfunction monitoring ICs step in to control the power supply and protect the powertrain,

e.g., the gearbox. Dedicated current regulators efficiently drive magnetic hydraulic oil valves in transmission control or provide a stable board net in an alternator.

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

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

ICE Powertrain



System ICs

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

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

ICE Powertrain



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

ICE Powertrain



Drivers

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

ICE Powertrain



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

ICE Powertrain



Drivers

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 _{bat} typ. [V]	V _{DD} typ. [V]	Interfaces	Outputs	Features	T _{j min} [°C]	T _{j max} [°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"> ■ Power switch, shunt and free wheeling diode integrated current regulation range: 0...1,200 mA ■ Accuracy < 1 % ■ Dither function ■ Overcurrent protection ■ Overtemperature protection ■ SPI controlled regulation loop characteristics 	-40	150	TQFP44-EPAD

ICE Powertrain



B6 bridge

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

ICE Powertrain



Alternator

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

ALTERNATOR OUTPUT VOLTAGE CONTROL, PROGRAMMABLE FOR CUSTOMER SPECIFIC ALTERNATOR BEHAVIOUR

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

EV Powertrain



Gate drivers for traction inverters

For optimum performance, high voltage switches in traction inverters require precise gate charging and discharging as well as constant monitoring of their health status.

ISOLATED GATE DRIVERS

Application	Product	V _{bat} typ. [V]	Interfaces	Outputs	Features	T _{j min} [°C]	T _{j max} [°C]	Package
Isolated gate drivers for SiC or IGBT power switches	EG120	14	UART	4 synchronized outputs with +/-2.5A each	<ul style="list-style-type: none"> ■ Gate charge/discharge control based on programmable current profiles individually for each output ■ Gate current profile selection during runtime incl. phase current prediction ■ Fully integrated Active Miller Clamp (no external components) ■ Overcurrent- and DESAT-detection (warning + error) ■ OV/UV-Monitoring of all power supplies and gate outputs DC-link voltage ■ 2x external NTC ADC input measurement with internal 12-bit ADC ■ Active discharge mode to simplify the inverter 	-40	150	PSOP44

EV Powertrain



Pyro fuse drivers

Pyro fuse drivers are part of the battery management system and provide additional safety for electrical systems in (hybrid) electric vehicles. In case of an accident, pyro fuse drivers ignite the pyro fuses and physically separate the HV battery from the vehicles power lines.

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

Application	Product	μC supply [V]	V_{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"> ■ Sophisticated safety concept ■ Monitoring of voltages, power stage and firing loop diagnosis, STB and STG diagnosis, squib resistance measurement ■ 4-bit firing current counter per firing loop 	-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"> ■ Power supply capabilities: <ul style="list-style-type: none"> – 3.3V (microcontroller, onboard sensors) – 5V (CAN) – 6.7V (peripheral sensors) – 23.75/33V (energy reserve & pyro fuse firing) ■ Enhanced sophisticated safety concept (incl. sensor data monitoring) ■ Watchdog for microcontroller ■ 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 ■ 2 independent 7-bit firing current counters per channel (max. time: 3.2ms) ■ PWM controlled GPIO 	-40	150	TQFP64-EPAD

EV Powertrain

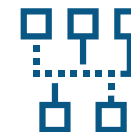


Pyro fuse drivers

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

Application	Product	μC supply [V]	V_{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"> ■ Power supply capabilities: <ul style="list-style-type: none"> – 3.3V, 1.3V (microcontroller, onboard sensors) – 5V (CAN) – 6.7V (peripheral sensors) – 23.75/33V (energy reserve & pyro fuse firing) ■ Enhanced sophisticated safety concept (incl. sensor data monitoring) ■ Watchdog for microcontroller ■ 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 ■ 2 independent 7-bit firing current counters per channel (max. time: 3.2ms) ■ PWM controlled GPIO 	-40	150	TQFP128-EPAD

Networking



In-vehicle communication

PHYSICAL CAN BUS INTERFACE

Application	Product	V_{bat} typ. [V]	Interfaces	Features	$T_{j\ min}$ [°C]	$T_{j\ max}$ [°C]	Package
CAN transceiver (ISO 11898)	CF160	5	5 V μ C interface	<ul style="list-style-type: none"> Supports up to 1MBaud Optimized slew rate 	-40	150	SOIC8

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"> Max. 8 sensors Bidirectional communication Bosch AB, EM and Open SPI protocol Integrated monitoring of voltages and overtemperature Integrated diagnosis 	-40	150	LQFP32

EV Powertrain



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 _{DS} [V]	I _{DS} [A]	R _{DSon} [mΩ]	T _{j min} [°C]	T _{j max} [°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	29	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	29	50	-40	175	TO263-7

EV Powertrain



Silicon carbide power switches

SILICON CARBIDE AUTOMOTIVE POWER MOSFETS 750 V, GEN. 2 (PLANNED)

Type	Product	V _{DS} [V]	I _{DS} [A]	R _{DSon} [mΩ]	T _{j min} [°C]	T _{j max} [°C]	Package
SiC power switch	BT2M0750013T3A	750	95	13	-40	175	TO247-3
SiC power switch	BT2M0750028T3A	750	48	28	-40	175	TO247-3
SiC power switch	BT2M0750013T4A	750	95	13	-40	175	TO247-4
SiC power switch	BT2M0750028T4A	750	48	28	-40	175	TO247-4
SiC power switch	BT2M0750013D7A	750	95	13	-40	175	TO247-7
SiC power switch	BT2M0750028D7A	750	48	28	-40	175	TO247-7

EV Powertrain



Silicon carbide power switches

SILICON CARBIDE AUTOMOTIVE POWER MOSFETS 1,200V

Type	Product	V _{DS} [V]	I _{DS} [A]	R _{DSon} [mΩ]	T _{j min} [°C]	T _{j max} [°C]	Package
SiC power switch	BT1M1200010BOA	1,200	175	10	-40	175	bare die
SiC power switch	BT1M1200013BOA	1,200	130	13	-40	175	bare die

Front side metallization: AlCu + + additional metallization for sintering and soldering

SILICON CARBIDE AUTOMOTIVE POWER MOSFETS 750V

Type	Product	V _{DS} [V]	I _{DS} [A]	R _{DSon} [mΩ]	T _{j min} [°C]	T _{j max} [°C]	Package
SiC power switch	BT2M0750005BOA	750	230	5	-40	175	bare die
SiC power switch	BT2M0750006BOA	750	200	6	-40	175	bare die

Front side metallization: AlCu + additional metallization for sintering and soldering

EV Powertrain



Silicon carbide power modules

The CSL (Compact Silicon Carbide Line) power module family covers all major requirements of the EV mass market. Robust Bosch SiC MOSFETs reduce conduction and switching losses and allow for higher switching frequencies.

1,200 V SiC POWER MODULES

Type	Product	Range [kPa]	Cooler type	DC link / phase terminals	Stray inductance [nH]	T _{min} [°C]	T _{max} [°C]	Formfactor [mm ²]
SiC power module	B6 bridge on cooler	1,200 V / 300 A DC	PinFin	screwable	<10	-40	175	158 x 106
SiC power module	B6 bridge on cooler	1,200 V / 300 A DC	PinFin	weldable	<6	-40	175	158 x 84
SiC power module	B6 bridge on cooler	1,200 V / 300 A DC	closed	screwable	<10	-40	175	172 x 106
SiC power module	B6 bridge on cooler	1,200 V / 300 A DC	closed	weldable	<6	-40	175	172 x 84
SiC power module	B6 bridge on cooler	1,200 V / 360 A DC	PinFin	screwable	<10	-40	175	158 x 106
SiC power module	B6 bridge on cooler	1,200 V / 360 A DC	PinFin	weldable	<6	-40	175	158 x 84
SiC power module	B6 bridge on cooler	1,200 V / 360 A DC	closed	screwable	<10	-40	175	172 x 106
SiC power module	B6 bridge on cooler	1,200 V / 360 A DC	closed	weldable	<6	-40	175	172 x 84

750 V SiC POWER MODULES

Type	Product	Range [kPa]	Cooler type	DC link / phase terminals	Stray inductance [nH]	T _{min} [°C]	T _{max} [°C]	Formfactor [mm ²]
SiC power module	B6 bridge on cooler	750 V / 420 A DC	PinFin	weldable	<6	-40	175	158 x 84
SiC power module	B6 bridge on cooler	750 V / 420 A DC	closed	weldable	<6	-40	175	172 x 84
SiC power module	B6 bridge on cooler	750 V / 515 A DC	PinFin	weldable	<6	-40	175	158 x 84
SiC power module	B6 bridge on cooler	750 V / 515 A DC	closed	weldable	<6	-40	175	172 x 84

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 μ 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

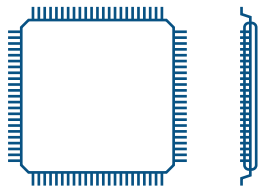
As used in data tables

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

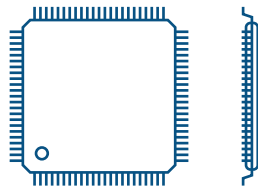
Packages

Body dimensions

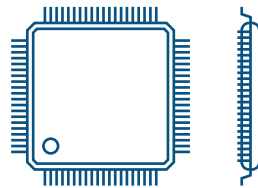
TQFP128-EPAD
(14 mm × 14 mm)



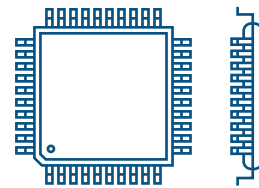
TQFP100-EPAD
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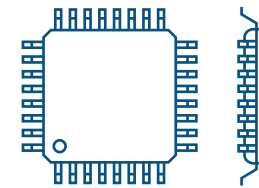
TQFP64-EPAD
(10 mm × 10 mm)



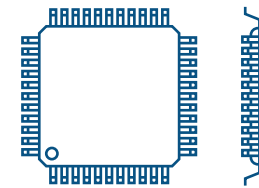
TQFP44-EPAD
(10 mm × 10 mm)



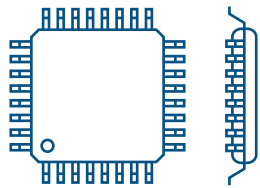
TQFP32-EPAD
(7 mm × 7 mm)



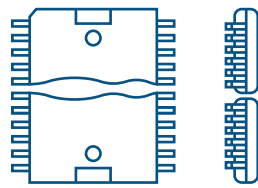
LQFP44
(10 mm × 10 mm)



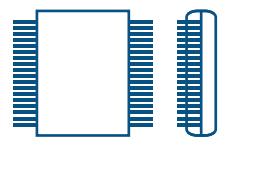
LQFP32
(7 mm × 7 mm)



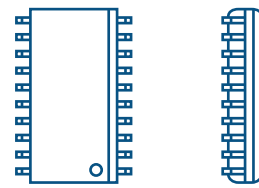
PSO36
(11.1 mm × 16 mm)



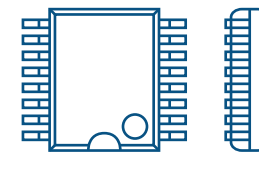
PSSO36
(10.3 mm × 7.6 mm)



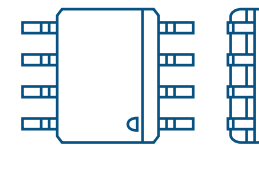
SOIC24w
(7.5 mm × 15.4 mm)



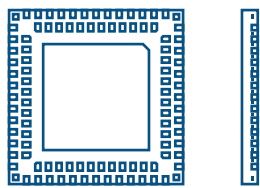
SOIC16w
(7.5 mm × 10.3 mm)



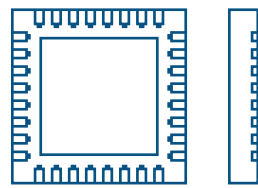
SOIC8n
(3.9 mm × 4.9 mm)



QFN-MR
(10 mm × 10 mm)



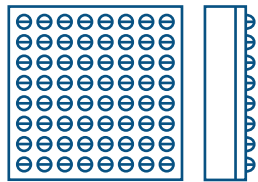
QFN36
(6 mm × 6 mm)



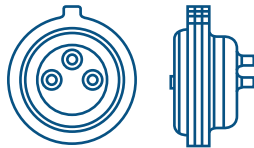
Packages

Body dimensions

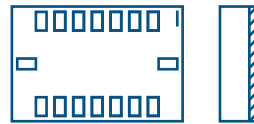
BGA64
(7 mm × 7 mm)



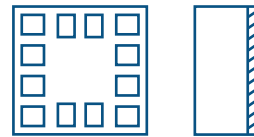
Metal package
(Ø 17.5 mm)



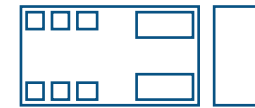
LGA16
(3 mm × 4.5 mm)



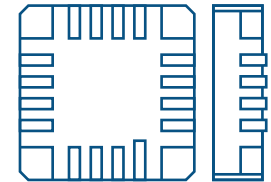
LGA12
(2 mm × 2 mm)



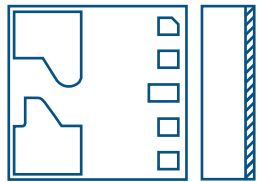
LGA8
(8.2 mm × 4.4 mm)



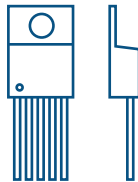
CLCC16
(8 mm × 8 mm)



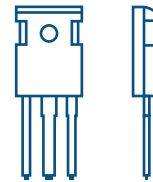
LGA SiP
(4 mm × 5 mm)



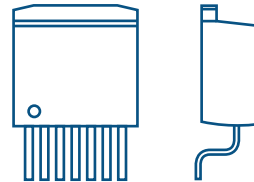
TO220-5



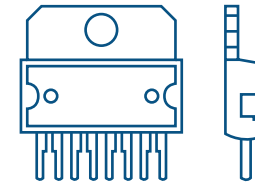
TO247-3



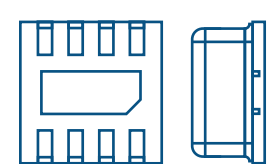
TO263-7



Multiwatt8 (in-line)



DFN8



Contact

EUROPE

Robert Bosch GmbH

Component Sales
Postfach 1342
72703 Reutlingen
Germany

bosch.semiconductors@de.bosch.com
www.bosch-semiconductors.com
www.bosch-sensors.com

KOREA

Robert Bosch Korea

Component Sales
298 Bojeong-dong, Giheung-gu
Yongin-si, Gyeonggi-do
Korea, 446-850

bosch.semiconductors@kr.bosch.com

USA

Robert Bosch LLC

Component Sales
15000 Haggerty Road
Plymouth, MI 48170
U.S.A.

bosch.semiconductors@us.bosch.com

USA

Robert Bosch LLC

Component Sales
384 Santa Trinita Ave
Sunnyvale, CA 94085
U.S.A.

bosch.semiconductors@us.bosch.com

JAPAN

Bosch Corporation

Component Sales
3-6-7, Shibuya, Shibuya-ku
Tokyo 150-8360
Japan

bosch.semiconductors@de.bosch.com

INDIA

Bosch Automotive Electronics India Pvt Ltd.

Component Sales
Building 703, Naganathapura
Electronic City P.O., Bangalore-560100
India

bosch.semiconductors@de.bosch.com

CHINA

Bosch (China) Investment Ltd.

Component Sales
333 Fuquan (N.) Road
Shanghai 200335
P.R. China

bosch.semiconductors@cn.bosch.com
www.bosch-semiconductors.cn

TAIWAN

Robert Bosch Taiwan Co. Ltd.

Component Sales
6F, No.90, Jian Guo N. Road, Sec.1
Taipei 10491
Taiwan

bosch.semiconductors@de.bosch.com