Bosch Semiconductors for Automotive

Bosch Mobility Solutions

MEMS Sensors
System ICs
Power Semiconductors
IP Modules

BOSCH
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.

MEMS SENSORS

SYSTEM ICS

POWER SEMICONDUCTORS

IP MODULES

APPENDIX

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_{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

Restraint systems

Acceleration sensors

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, 10 bit	7	4.5 – 11	–40	125	SOIC8n
Dual axis (a_{xz})	SMA686	±120/240	PSI5, 10 bit	7	4.5 – 11	–40	125	SOIC8n
Dual axis (a_{xz})	SMA696	±480	PSI5, 10 bit	7	4.5 – 11	–40	125	SOIC8n
Dual axis (a_{xy})	SMA752	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5 – 11	–40	125	SOIC8n
Dual axis (a_{xz})	SMA753	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5 – 11	–40	125	SOIC8n
Dual axis (a_{xy})	SMA757	±240/480	PSI5, 10 bit or 14 bit	7	4.5 – 11	–40	125	SOIC8n
Dual axis (a_{xy})	SMA773	±30/60	PSI5, 10 bit or 14 bit	7	4.5 – 11	–40	125	SOIC8n
Dual axis (a_{xz})	SMA774	±30/60	PSI5, 10 bit or 14 bit	7	4.5 – 11	–40	125	SOIC8n
Dual axis (a_{xy})	SMA777	±30/60	PSI5, 10 bit or 14 bit	7	4.5 – 11	–40	125	LGA SiP
Dual axis (a_{xz})	SMA778	±30/60	PSI5, 10 bit or 14 bit	7	4.5 – 11	–40	125	LGA SiP
Dual axis (a_{xy})	SMA782	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5 – 11	–40	125	LGA SiP
Dual axis (a_{xz})	SMA783	±120/240/480	PSI5, 10 bit or 14 bit	7	4.5 – 11	–40	125	LGA SiP
Dual axis (a_{xy})	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_{DD} typ. [V]	T_{min} [°C]	T_{max} [°C]	Package
Angular rate sensor (Ω_x)	SMG810	300	SafeSPI, 16 bit	±100 LSB/°/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_{DD} typ. [V]	T_{min} [°C]	T_{max} [°C]	Package
Angular rate sensor (Ω_x) and single axis acceleration sensor (a_z)	SMI720	±300 °/s ±5 g	SPI, 16 bit	100 LSB/°/s 5,000 LSB/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_{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

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_{DD} typ. [V]	T_{min} [°C]	T_{max} [°C]	Package
Tri-axis acceleration sensor (a_{xyz})	SMA130	±2 ±4 ±8 ±16	SPI, I²C 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, I²C 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, I²C 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_{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 ±2 g ±4 g ±8 g ±16 g	SPI, I²C 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 ±2 g ±4 g ±8 g ±16 g	SPI, I²C 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

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_2 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	SMP580	40 – 115	SPI 10 bit or 12 bit or 16 bit	≤1.0 kPa (pressure) ≤3 K (temperature)	3.3 – 5	–40	125	SOIC8

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_{DD} typ. [V]	T_{min} [°C]	T_{max} [°C]	Package
Low pressure sensor	SMP580	60 – 165	SPI 10 bit	≤1.5 kPa (pressure) ≤5 K (temperature)	3.3 – 5	–40	125	SOIC8

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 millisecond. This is crucial for fast and ultra-smooth shifting 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_{DD} typ. [V]	T_{min} [°C]	T_{max} [°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_{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	100 LSB/°/s 5,000 LSB/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 ±6g	SafeSPI, 16 bit	100 LSB/°/s 5,000 LSB/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 ±6g	SafeSPI, 16 bit	100 LSB/°/s 5,000 LSB/g	±3 ±3	3.3 or 5 or 6.7	–40	125	BGA64
Angular rate sensor (Ω_x) and dual axis acceleration sensor (a_{yz})	SMI710	±300 °/s ±5 g	SPI, PSI5, CAN, 16 bit	100 LSB/°/s 5,000 LSB/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	100 LSB/°/s 5,000 LSB/g	±3 ±3	3.3 or 5	–40	125	BGA64

Highly automated driving (HAD) systems

High performance inertial sensors

Highly automated driving (HAD) requires precise informations 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

Type	Product	Range	Output	Total offset error	V_{DD} typ. [V]	T_{min} [°C]	T_{max} [°C]	Package
High performance yaw rate sensor (Ω_z) and 3-axis accelerometer	SMU200	±300 °/s (Ω_z) ±6 g (a_{xyz})	SPI	±0.25 °/s	3.3 or 5	–40	125	CLCC16
High performance pitch / roll sensor (Ω_x) and 3-axis accelerometer	SMU210	±300 °/s (Ω_x) ±6 g (a_{xyz})	SPI	±0.25 °/s	3.3 or 5	–40	125	CLCC16

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_{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

Restraint systems

Single-chip airbag system ICs

Airbag system ICs combine all peripheral system functions of an airbag system in one single chip: digital crash sensor interfaces, firing loop drivers, extensive safety and diagnosis mechanisms and the power supply 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 inter-faces	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 (programma-ble)	6×PSI5 (V1.3)	10×AIN 2×AIO	SPI, 32 bit (3.3 V), K-Line/LIN	16 (5 firing modes)	▶ Enhanced sophisticated safety concept: safety controller; 3 watchdogs; ESP sensor data can be included in safety concept ▶ Fully automatic diagnosis: – Monitoring of voltages (incl. VHx) and overtem-perature, 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

Restraint systems

Single-chip airbag system ICs

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 inter-faces	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 (programma-ble)	4×PSI5 (V1.3)	10×AIN 2×AIO	SPI, 32 bit (3.3 V), 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 (programma-ble)	2×PSI5 (V1.3)	10×AIN 2×AIO	SPI, 32 bit (3.3 V), 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 (programma-ble)	2×PAS	4×AIN 2×AIO	SPI, 32 bit (3.3 V), 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} + 3.5 V) – 35 V V_{SYNC} typ.: (V_{AS} + 4.6 V) – 35 V	2 × PSI5 (V1.3)	SPI (3.3 V or 5 V)	▶ Max. 8 sensors ▶ Bidirectional communication ▶ Bosch AB, EM and Open SPI protocol ▶ Integrated monitoring of voltages and overtemperature ▶ Integrated diagnosis	–40	150	LQFP32, QFN36 (on request)

Advanced driver assistance systems

System basis ICs

Our system basis ICs for ADAS applications provide an innovative, configurable power management architecture to minimize total system costs.

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	▶ 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/100mA switch for partial network transceivers	▶ Reset ▶ Battery voltage monitoring switch ▶ Battery voltage drop detection	▶ 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

Advanced driver assistance systems

System basis ICs

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 (planned)	14/28	SPI 32 bit	▶ 2×0.7 V – 3.825 V (programmable) / 2 A (SMPS) ▶ 2×0.7 V – 3.825 V (programmable) / 1 A (SMPS) ▶ 2×0.7 V – 3.825 V (programmable) driver for ext. power stages ▶ 4×0.7 – 3.825 V / 300 mA/LDO)	▶ GPIO	▶ 10 programmable rails, possibility for multi phase configuration ▶ Programmable power-up and -down sequencing between all supply rails, incuding optional external sync ▶ Temperature monitoring and over-temperature shutdown ▶ Voltage monitoring (UV, OV) with configurable thresholds ▶ On-chip general purpose ADC (12 bit, 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

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_{DD} typ. [V]	Inter-faces	Supply voltages	Inputs	Outputs	Features	$T_{j\,min}$ [°C]	$T_{j\,max}$ [°C]	Package
System basis IC	CY327	14	SPI, 16 bit (3.3 V) 1 × CAN 1 × LIN	▶ System: 5 V/450 mA 3.3 V/300 mA, 5 or 3.3 V/250 mA ▶ Core supply 0.9 – 1.525 V/1.2 A switch-mode ▶ Sensors: 3 × 5 V	▶ Ignition ▶ 3 wake up pins ▶ Wake up on CAN	▶ Main relay control: 1 × LSPS	▶ Buck/boost pre-regulator switched mode supply for µC core voltage ▶ Advanced 3-level watchdog operating range 3 V – 40 V ▶ Stop counter functions ▶ Very low quiescent current	–40	150	TQFP64-EPAD or TQFP100-EPAD
System basis IC	CY320	14	1 × CAN 1 × ISO SPI, 16 bit (5 V)	▶ System: 5 V, 3.3 V, 2.6 V, 1.5 V ▶ Sensors: 3 × 3.3/5 V progammable	▶ Ignition ▶ Wake up	▶ Main relay control: 1 × LSPS	▶ 2 pre-regulator modes (switched, linear) ▶ Advanced 3-level watchdog ▶ µC-reset and system reset ▶ Stop counter functions	–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_{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	MSC	4×H bridge control	6×350 mΩ / 3.6 A / 55 V 2×720 mΩ / 2.2 A / 55 V 6×2.4 Ω / 0.6 A / 55 V 4×HSS 5 V / 20 mA (ignition driver) 4×HS/LS combined MOSFET driver 4×LS MOSFET driver	▶ 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		SPI, µs bus		4×3.0 A / 230 mΩ / 55 V 2×1.0 A / 700 mΩ / 55 V 2×1.0 A / 550 mΩ / 55 V	▶ 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	µs bus	TTL/CMOS logic, withstands 36 V permanently	4×0.6 A / 1,800 mΩ / 55 V 10×2.2 A / 500 mΩ / 55 V 2×3 A / 260 mΩ / 55 V 2×8 A / 150 mΩ / 55 V	▶ Diagnosis: OL, SCG, SCB and OT ▶ 5 V monitoring ▶ 2nd independent shut down path ▶ 2×lambda sensor heater	–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_{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	▶ Short-circuit protection ▶ Diagnosis ▶ Wiring diagnosis	–40	150	Bare die or 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_{bat} typ. [V]	V_{DD} typ. [V]	Inputs	Interfaces	Features	$T_{j\,min}$ [°C]	$T_{j\,max}$ [°C]	Package
Oxygen sensor control for Bosch, NTK & Denso oxygen sensors	CJ135F	14	3/5	Oxygen sensor signals	SPI	▶ Lambda measurement ▶ Probe temperature evaluation ▶ SPI programmable controls ▶ Active blackening control and protection ▶ Analog output current ▶ Diagnostic features ▶ Supports LSU5.2 / 4.9 / ADV (Bosch) ▶ Supports ZFAS-U2 / U3 (NTK) ▶ Supports Plus 5 / 6 (Denso)	–40	150	TQFP32-EPAD, QFN36 (on demand)
Bosch oxygen sensor (LSU)	CJ125	14	5	Oxygen sensor signals	SPI	▶ Lambda measurement ▶ Probe temperature measurement ▶ Programmable reference pump current ▶ Diagnostics ▶ Supports LSU5.2 / 4.9 / ADV / 4.2 (Bosch)	–40	150	SOIC24w, 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_{bat} typ. [V]	Interfaces	Features	$T_{j\,min}$ [°C]	$T_{j\,max}$ [°C]	Package
Monolithic B6 bridge for motors up to 60 W	CJ260	4.5 – 28	SPI, direct inputs	▶ $R_{DSon\,max}$: 540 mΩ (@3 A_{RMS}, 150 °C) ▶ $I_{out\,max}$: 3 A_{RMS} ▶ $f_{PWM\,max}$: 20 kHz ▶ Current limiter function ▶ Extensive protection features ▶ Diagnosis functions ▶ Suitable for systems up to ASIL-B	–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_{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 (3.3 V)	UBAT	▶ 3 × voltage monitoring channels ▶ 3 × speed sensor interface	▶ System reset ▶ Power control	▶ 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 (5 V)	3.3 V, 5 V, 9 V, UBAT	▶ 3 × speed sensor ▶ 4 × position sensor ▶ Wake up	▶ 3 × driver for HS switches ▶ Starter disable ▶ Startup, reset, shutdown for µC	▶ 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) 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_{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 (3.3 V or 5 V)	2 × regulated load current	▶ 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	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	µC supply [V]	V_{VZP} typ. [V]	HSS supply	Interfaces	Firing loops	Features	$T_{j\,min}$ [°C]	$T_{j\,max}$ [°C]	Package
4 channel pyro fuse driver	CG985	n.a.	14	25 or 33	SPI, 16-bit (3.3 V or 4.9 V)	4 (2 firing modes)	▶ 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 (3.3 V), K-Line/LIN	4 (5 firing modes)	▶ Power supply capabilities: – 3.3 V (microcontroller, onboard sensors) – 5 V (CAN) – 6.7 V (peripheral sensors) – 23.75 / 33 V (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: 3.2 ms) ▶ PWM controlled GPIO	–40	150	TQFP64-EPAD

Pyro fuse systems

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	$T_{j\,min}$ [°C]	$T_{j\,max}$ [°C]	Package
8 channel pyro fuse driver	CG902	3.3	14	23.75 or 33 (programmable)	SPI, 32 bit (3.3 V), K-Line/LIN	8 (5 firing modes)	▶ Power supply capabilities: – 3.3 V, 1.3 V (microcontroller, onboard sensors) – 5 V (CAN) – 6.7 V (peripheral sensors) – 23.75 / 33 V (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: 3.2 ms) ▶ PWM controlled GPIO	–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	$T_{j\,min}$ [°C]	$T_{j\,max}$ [°C]	Package
Regulator for 14 V alternators	CR719	n.a.	Excitation current	▶ Autonomous regulator concept ▶ Smart load management	–40	175	MultiWatt8
Regulator for 14 V alternators	CR724	n.a.	Excitation current	▶ Autonomous regulator concept ▶ Smart load management	–40	175	MultiWatt8
Regulator for 14 V alternators	CR665	LIN 1.3, 2.1	Excitation current	▶ LIN control functions acc. to VDA spec. ▶ Programmable ▶ Smart load management	–40	175	TO220-5
Regulator for 14 V alternators	CR636	PWM	Excitation current	▶ PWM controlled output ▶ Smart load management	–40	175	MultiWatt8
Regulator for 14 V alternators	CR760	C-Terminal	Excitation current	▶ C-Terminal controlled output ▶ Smart load management	–40	175	MultiWatt8
Regulator for 28 V alternators	CR298	n.a.	Excitation current	▶ Autonomous regulator concept ▶ Smart load management	–40	175	MultiWatt8
Regulator for 28 V alternators	CR291-294	n.a.	Excitation current	▶ Autonomous regulator concept ▶ Smart load management	–40	175	Bare die
Regulator for 28 V alternators	CR250	LIN 1.3	Excitation current	▶ LIN controlled output ▶ Programmable ▶ Smart load management	–40	175	MultiWatt8
Regulator for 28 V alternators	CR260	C-Terminal	Excitation current	▶ C-Terminal controlled output ▶ Smart load management	–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_{DS} [V]	I_{DS} [A]	R_{DSon} [mΩ]	$T_{j\,min}$ [°C]	$T_{j\,max}$ [°C]	Package
SiC power switch	BT1M1200025T3A	1,200	75	25	–40	175	TO247-3
SiC power switch	BT1M1200035T3A	1,200	55	35	–40	175	TO247-3
SiC power switch	BT1M1200060T3A	1,200	30	60	–40	175	TO247-3
SiC power switch	BT1M1200025D7A	1,200	75	25	–40	175	TO263-7
SiC power switch	BT1M1200035D7A	1,200	55	35	–40	175	TO263-7
SiC power switch	BT1M1200060D7A	1,200	30	60	–40	175	TO263-7

Bare-die versions on request

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	BT1M0750020T3A	750	90	20	–40	175	TO247-3
SiC power switch	BT1M0750025T3A	750	60	25	–40	175	TO247-3
SiC power switch	BT1M0750040T3A	750	30	40	–40	175	TO247-3
SiC power switch	BT1M0750020D7A	750	90	20	–40	175	TO263-7
SiC power switch	BT1M0750025D7A	750	60	25	–40	175	TO263-7
SiC power switch	BT1M0750040D7A	750	30	40	–40	175	TO263-7

Bare-die versions on request

IP modules

for networking applications

M_CAN AND M_TTCAN IP MODULE

The M_CAN is a CAN IP module that can be realized as a standalone device, as part of an ASIC or on an FPGA. It performs communication according to ISO11898-1:2015. It supports Classical CAN and CAN FD (CAN with Flexible Data-rate). Additional transceiver hardware is required for connection to the physical layer.

The message storage is intended to be a single or dual-ported Message RAM outside of the module. It is connected to the M_CAN via the Generic Master Interface. Depending on the chosen integration, multiple M_CAN controllers may share the same Message RAM. The Host CPU is connected via the 32-bit Generic Slave Interface.

C_CAN FD8 IP MODULE

The C_CAN FD8 is a CAN IP module that can be implemented as a standalone device, as part of an ASIC. It is software compatible to the well known C_CAN IP module. The C_CAN FD8 performs communication according to ISO11898-1:2015. It supports classical CAN and CAN FD (CAN with Flexible Data-rate) communication with up to 8 byte data fields. For connection to the physical layer additional transceiver hardware is required. For communication on a CAN network up to 32 Message Objects can be configured. The Message Objects and Identifier Masks for acceptance filtering of received messages are stored in the Message RAM.

The register set of the C_CAN FD8 can be accessed directly by an external CPU via the module interface. These registers are used to control/configure the CAN Core and the Message Handler and to access the Message RAM. The Module Interfaces delivered with the C_CAN FD8 module can easily be replaced by a customized module interface adapted to the needs of the user.

CAN FD

CAN FD (CAN with Flexible Data-rate) was introduced by Bosch in 2012 to overcome the Classical CAN's bit rate limitation to 1 Mbps 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 PROTOCOL

The CAN FD Protocol is developed by Robert Bosch GmbH and is patented. In addition to the CAN IP modules offered by Bosch, a CAN FD Protocol License is required. The CAN FD Protocol License is also required for self-developed CAN modules or for CAN modules purchased from other vendors.

VHDL REFERENCE CAN

The VHDL Reference CAN is intended for semiconductor designers/manufacturers who want to build their own implementation of a Classical CAN or CAN FD device using VHDL as hardware description language.

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.

IP modules

for timer applications

GENERIC TIMER MODULE (GTM)

The GTM IP module forms a generic timer platform for complex applications in the automotive industry like powertrain, power steering, chassis and transmission control. To serve these different application domains, the GTM provides a wide range of timer functions like:

- 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

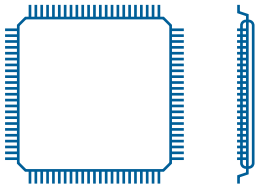
As used in data tables

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

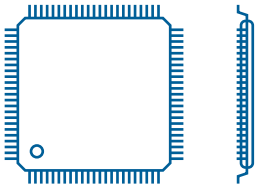
Packages

Body dimensions

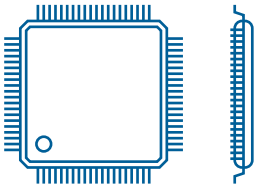
TQFP128-EPAD
(14 mm × 14 mm)



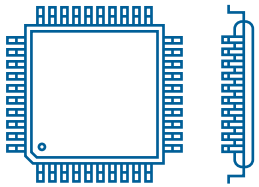
TQFP100-EPAD
(14 mm × 14 mm)



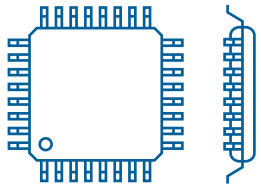
TQFP64-EPAD
(10 mm × 10 mm)



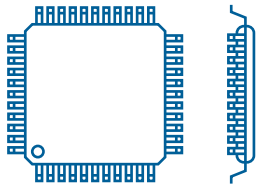
TQFP44-EPAD
(10 mm × 10 mm)



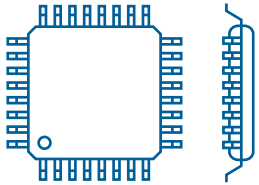
TQFP32-EPAD
(7 mm × 7 mm)



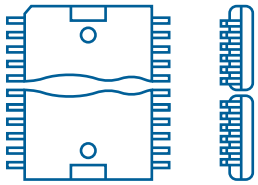
LQFP44
(10 mm × 10 mm)



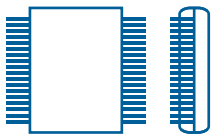
LQFP32
(7 mm × 7 mm)



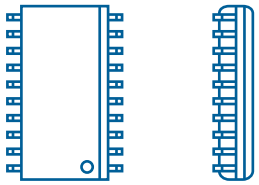
PSO36
(11.1 mm × 16 mm)



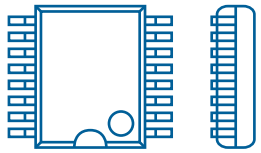
PSSO36
(10.3 mm × 7.6 mm)



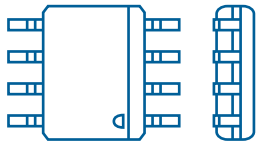
SOIC24w
(7.5 mm × 15.4 mm)



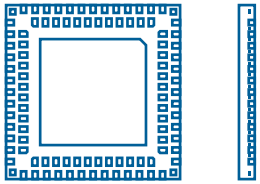
SOIC16w
(7.5 mm × 10.3 mm)



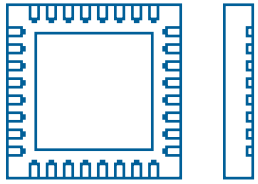
SOIC8n
(3.9 mm × 4.9 mm)



QFN-MR
(10 mm × 10 mm)



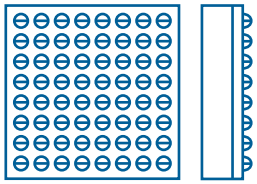
QFN36
(6 mm × 6 mm)



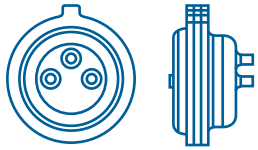
Packages

Body dimensions

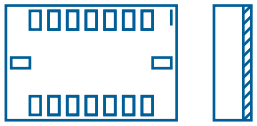
BGA64
(7 mm × 7 mm)



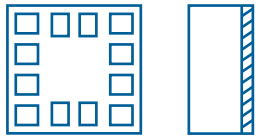
Metal package
(Ø 17.5 mm)



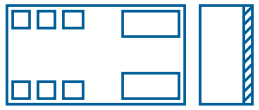
LGA16
(3 mm × 4.5 mm)



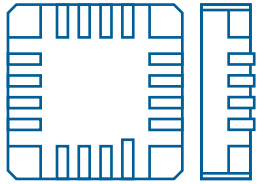
LGA12
(2 mm × 2 mm)



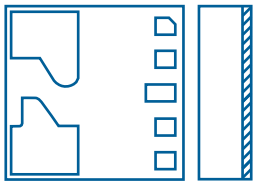
LGA8
(8.2 mm × 4.4 mm)



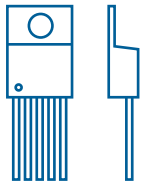
CLCC16
(8 mm × 8 mm)



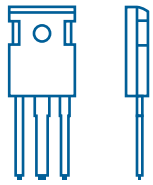
LGA SiP
(4 mm × 5 mm)



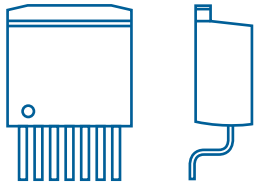
TO220-5



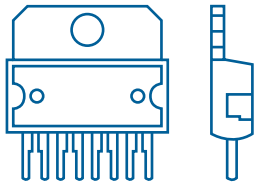
TO247-3



TO263-7



Multiwatt8 (in-line)



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