Robust,
reliable analog
solutions

Automotive Airbag Systems

Automotive airbag systems continue to enhance passenger safety through the incorporation of increasingly sophisticated features.

OVERVIEW

Automotive suppliers face continuing pressure from the market to improve performance while reducing costs. Both of these trends are expected to continue as the focus on safety remains in the forefront.

NXP® is a leading semiconductor supplier for next-generation airbag applications, with custom and standard MCUs, analog and sensor products. We offer solutions for point-to-point and bus-based satellite interface architectures with the established distributed system interface (DSI) as well as the peripheral sensor interface (PSI5) architectures. Our airbag system portfolio offers an array of technology solutions that help you with even your most challenging airbag system designs, while providing quality solutions from entry-level to high-end applications.

Within our broad portfolio, NXP accelerometers in the low-, mid- and high-g range cover local and satellite sensor needs (XY-, X- and Z-axis). For system control, a range of 16- and 32-bit MCU solutions addresses low- to high-end system requirements, as well as 8- and 16-bit MCU solutions for the safing functions.
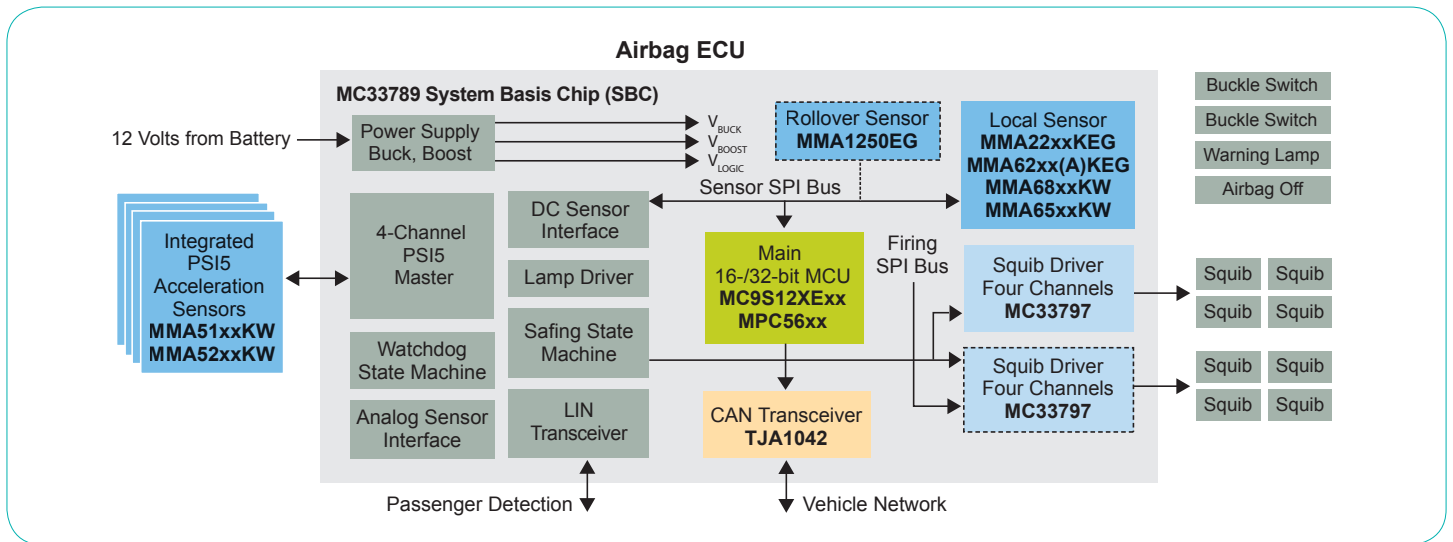
NXP also provides SMARTMOS®-based analog and mixed-signal standard product solutions for integrating power supply, satellite interfaces, buckle switch sensors, squib drivers and controller area network (CAN) and local interconnect network (LIN) physical layers.
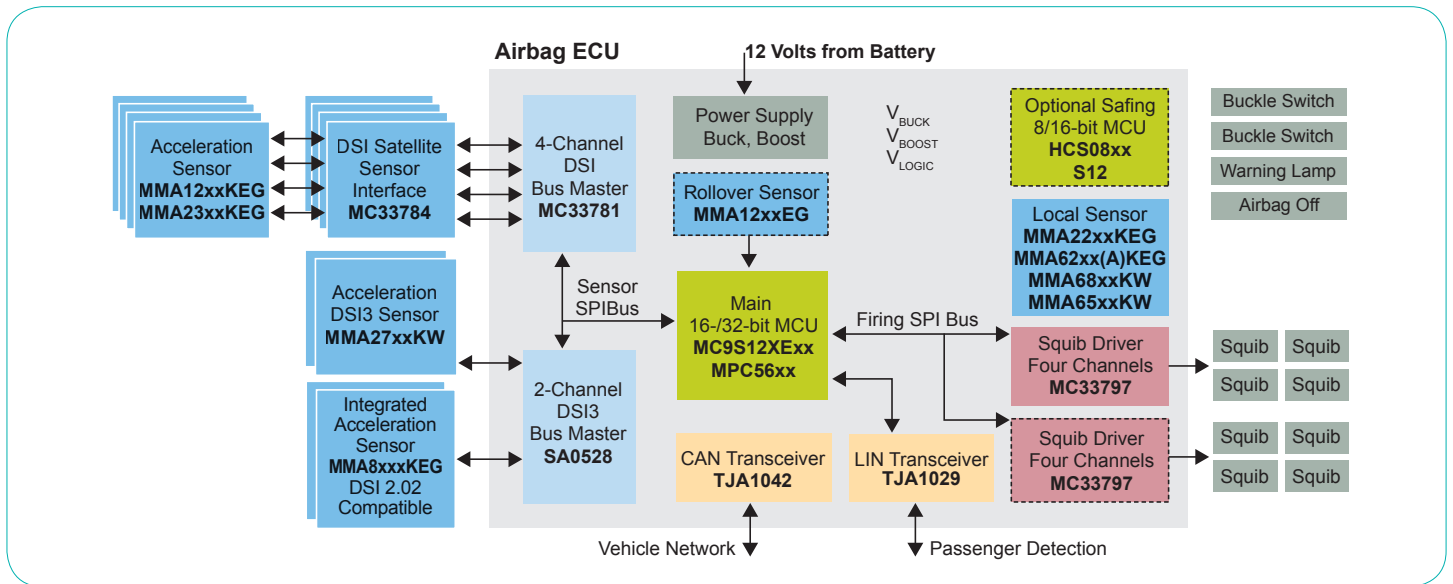
TYPICAL APPLICATIONS

▶ Crash detection

▶ Front crash detection

▶ Side crash detection

▶ Rollover sensing

AIRBAG SYSTEM-PSI5 PROTOCOL

Airbag ECU

MC33789 System Basis Chip (SBC)

12 Volts from Battery → Power Supply Buck, Boost → V_{BUCK}, V_{BOOST}, V_{LOGIC}

Rollover Sensor **MMA1250EG**	Local Sensor **MMA22xxKEG MMA62xx(A)KEG MMA68xxKW MMA65xxKW**

Buckle Switch
Buckle Switch
Warning Lamp
Airbag Off

Integrated PSI5 Acceleration Sensors **MMA51xxKW MMA52xxKW**

4-Channel PSI5 Master

DC Sensor Interface

Lamp Driver

Watchdog State Machine

Safing State Machine

Analog Sensor Interface

LIN Transceiver

Sensor SPI Bus

Main 16-/32-bit MCU **MC9S12XExx MPC56xx**

Firing SPI Bus

Squib Driver Four Channels **MC33797**

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Squib | Squib
Squib | Squib

Squib | Squib
Squib | Squib

CAN Transceiver **TJA1042**

Passenger Detection ↕   Vehicle Network ↕

AIRBAG SYSTEM-DSI PROTOCOL

Airbag ECU

12 Volts from Battery

Acceleration Sensor **MMA12xxKEG MMA23xxKEG**

DSI Satellite Sensor Interface **MC33784**

4-Channel DSI Bus Master **MC33781**

Power Supply Buck, Boost

V_{BUCK} V_{BOOST} V_{LOGIC}

Optional Safing 8/16-bit MCU **HCS08xx S12**

Buckle Switch
Buckle Switch
Warning Lamp
Airbag Off

Rollover Sensor **MMA12xxEG**

Local Sensor **MMA22xxKEG MMA62xx(A)KEG MMA68xxKW MMA65xxKW**

Acceleration DSI3 Sensor **MMA27xxKW**

Sensor SPIBus

Integrated Acceleration Sensor **MMA8xxxKEG DSI 2.02 Compatible**

2-Channel DSI3 Bus Master **SA0528**

Main 16-/32-bit MCU **MC9S12XExx MPC56xx**

Firing SPI Bus

Squib Driver Four Channels **MC33797**

Squib Driver Four Channels **MC33797**

Squib | Squib
Squib | Squib

Squib | Squib
Squib | Squib

CAN Transceiver **TJA1042**

LIN Transceiver **TJA1029**

Vehicle Network ↕   Passenger Detection ↕

FEATURES AND BENEFITS

▸ NXP portfolio: our airbag system solution strategy with MCUs, analog and sensor products expands the functionality customers can combine for cost effectiveness with a next-generation performance progression path.

▸ Quality commitment: our airbag system portfolio provides world-class quality solutions for entry-level to high-end applications through compliance with the ISO/TS 16949 quality standard as well as other critical automotive standards.

▸ Cost reduction: customers can reduce system costs while enhancing passenger safety. For example, customers can place multiple satellite sensors on a single bus.

▸ Integration: emerging safety systems will continue to be clustered into the airbag ECU and other areas, driving system complexity and increasing the need to optimize partitioning.

▸ Proven standards: NXP and its customers work with car makers to utilize proven standards such as DSI and PSI5 architectures.

SafeAssure PROGRAM: FUNCTIONAL SAFETY SIMPLIFIED.

The SafeAssure® functional safety program is designed to help you simplify the process of achieving system compliance with functional safety standards in the automotive and industrial markets.

For more information, visit **www.nxp.com/SafeAssure**.

ORDERING INFORMATION

Product	Description	Main Characteristics
MCUs		
MPC56xx	The 32-bit Power Architecture® technology-based MPC56xxx family supports an array of package options for systems performance and embedded flash requirements. MPC56xx MCUs are SafeAssure solutions.	Program flash range of 256 to 512 KB with separate data flash and error correction code (ECC) make the MPC56xx suitable for safety applications. Variable length encoding (VLE) offers 32-bit performance with 16-bit code efficiency.
MC9S12XE	The highly efficient 16-bit MC9S12XE family has high-end advanced features, including 32-bit calculation capability.	Program flash range of 128 KB to 1 MB with EEPROM with ECC and memory protection (MPU) make the MC9S12XE suitable for safety applications. XGATE coprocessor is capable of functioning separately as a watchdog processor.
MC9S08SG	The cost-efficient 8-bit MC9S08SG family runs up to 40 MHz to provide 16-bit performance at 8-bit cost.	Program flash range of 4 to 32 KB. No external crystal is required. Safety features include low-voltage interrupt (LVI), watchdog and temperature sensors.
Sensors		
MMA5xxxKW	PSI5-compatible X- or Z-axis satellite inertial sensors that contain the next-generation HARMEMS over-damped transducer. MMA5xxxKW sensors are SafeAssure solutions.	Available in +/-60g, +/-120g, +/-240g, +/-480g versions
MMA65xxKW	SPI-compatible serial interface main ECU 12-bit digital inertial sensors with independent programmable arming functions for each axis. MMA65xxKW sensors are SafeAssure solutions.	MMA655xKW X-axis devices at +/-105g or +/-120g full-scale range on each axis MMA65xxKW XY-axis devices at +/-80g, +/-105g or +/-120g full-scale range on each axis
MMA68xxKW	SPI-compatible serial interface main ECU 10-bit digital inertial sensors with independent programmable arming functions for each axis. MMA68xxKW sensors are SafeAssure solutions.	Available in ranges from +/-20g to +/-120g
MMA62xx(A)KEG	The MMA62xxEG series of XY-axis accelerometers features digital signal processing for filtering, trim and data formatting. These products contain the next-generation HARMEMS over-damped transducer.	Available in +/-20g, +/-50g, or +/-100g versions. The parts have 10-bit digital data output. These accelerometers are SPI compatible.
MMA22xxKEG	The MMA22xxEG series includes X-axis accelerometers	Available in +/-1.5g, +/-40g, +/-50g, or +/-100g versions
MMA32xxKEG	The MMA32xxEG series includes XY-axis accelerometers	Available in +/-40/40g, +/-100/30g, +/-100/50g versions
CAN and LIN Transceivers and Squib Driver Analog Components		
TJA1029	LIN enhanced physical interface	Local interconnect network (LIN) is a serial communication protocol designed to support automotive networks.
TJA1042	High-speed CAN physical interface	High-speed CAN transceiver with Standby mode
MC33797	Four-channel squib driver IC	Four-channel high-side and low-side 2.0 A FET switches, cross-coupled driver capability, externally adjustable FET current limit, SPI port for MCU interface, diagnostics for high-side safing sensor status
Peripheral Sensor Interface 5 (PSI5) and Distributed Systems Interface (DSI)		
MC33789	PSI5 Airbag SBC; MC33789 is a SafeAssure solution	Airbag control module monitors battery voltage, satellite sensor status and supplies various voltages to the airbag system using SPI for communication.
MC33781	Quad DSI 2.02 master with differential drive	Bus controller for four differential DSI channels. Dual SPI ports for MCU and safing interfaces. Variable CRC generation and detection, comprehensive fault detection, thermal protection, frequency spreading.
MC33784	DSI 2.02 sensor interface	DSI slave device optimized as a sensor interface. Differential bus capability and dual bus switches for improved EMC performance, 2-channel 10-bit ADC, 5 V regulated output, three configurable logic pins, CRC generation and checking.
SA0528	Dual DSI 3 master transceiver	Command and Response Mode for master to single slave bidirectional communication, Periodic Data Collection Mode for up to 444 kbps high-speed multiple slave data collection, and Discovery Mode for slaves auto-addressing and self-programming. A full-duplex, 10 MHz 32-bit dual SPI enables a fast communication with up to four slaves per DSI3 channel.

* This package is included in the Package Your Way program for Kinetis MCUs. For more details, please visit www.nxp.com/KPYW.

www.nxp.com/automotive