



Accelerometers

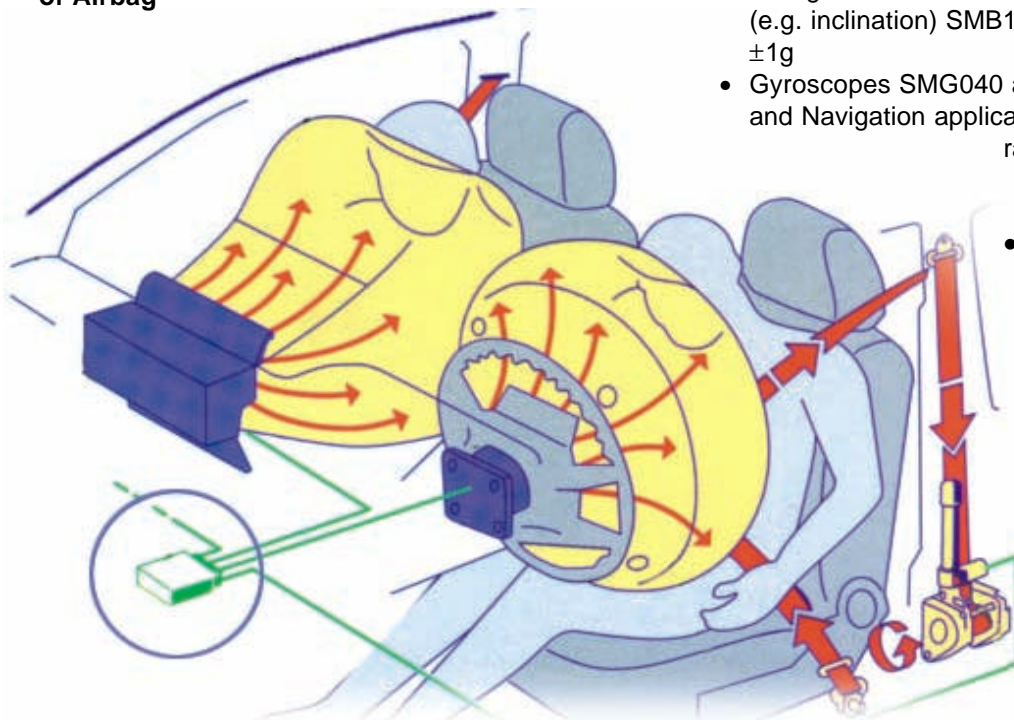
for Restraint and Safety Systems

Bosch produces accelerometers for deployment of airbags since 1978. The first systems have been using piezoelectric ceramics sensing elements. Starting in 1997 a new generation of sensors is in volume production providing a low-cost solution with increased functionality. The sensing elements are manufactured using a unique and robust surface micro-machining technology that has been developed at Bosch. This process features a 10µm thick polysilicon layer used for the movable sensor structure. The proofmass and the electrodes are sealed on wafer level with a bulk micro-machined capping wafer. To minimize production costs the sensors are packaged in a standard plastic housing (PLCC28).

The SMB05x/06x/ series features:

- Standard SMD PLCC28 Packaging
- Self Test
- Automotive Temperature Range
- Ratiometric Output
- On-Chip 2 Pole Filter
- On-Chip Offset Adjustment

Crash Test with Deployment of Airbag



The SMB05x/06x accelerometers cover various acceleration ranges and sensitivity axes:

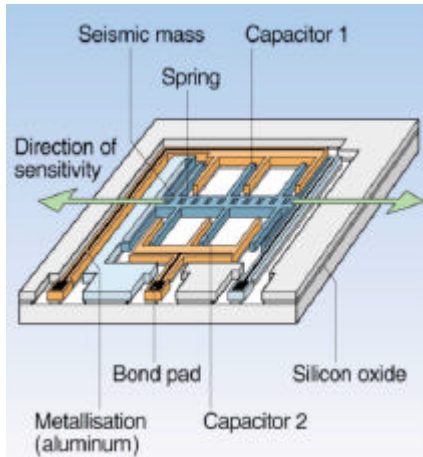
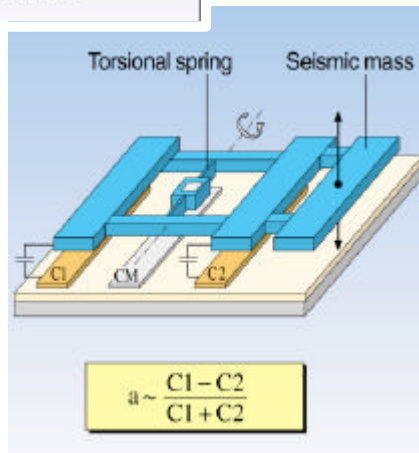
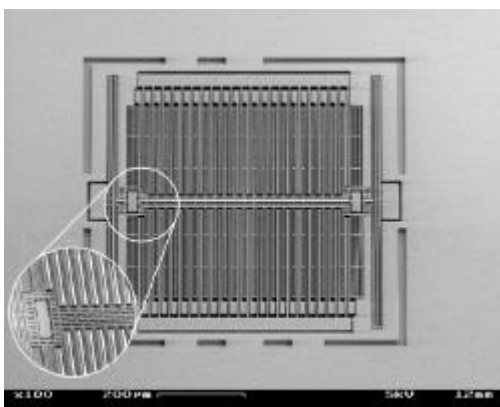
Type	Range	Sensitivity Axes
SMB050	±35 g	X (single axis)
SMB060		X, Y (dual axis)
SMB065		X, -X (dual axis)
SMB052	±50 g	X (single axis)
SMB062		X, Y (dual axis)
SMB067		X, -X (dual axis)

Product Portfolio

The SMB05x/06x series is part of a larger sensor portfolio based on a single manufacturing technology. The portfolio consists of the following sensors:

- Peripheral Airbag Sensors/Upfront Sensors SMB120/SMB170 with acceleration ranges of ±100 g and ±220 g
- Low-g sensor for various applications (e.g. inclination) SMB110 with acceleration range of ±1g
- Gyroscopes SMG040 and SMG045 for Rollover and Navigation applications with measurement range of ±250 °/s and ±75°/s

- 2nd generation of acceleration sensors is scheduled for B2003. Features:
 - improved performance and pricing
 - smaller packaging (SOIC28)

**Schematic drawing of x-sensor element****Schematic drawing of z-sensor element****Details of micromachined sensing element****Working Principle**

The common sensing principle of the accelerometers is capacitive. An acceleration in the lateral direction deflects the proof mass that is suspended by folded springs in the x-sensing element. One set of electrodes is attached to the proof mass and moves with acceleration. These movable electrodes form capacitors with two sets of fixed electrodes opposing them with a small air gap in between. The use of such a differential capacitive arrangement with two capacitors reduces the nonlinearity of the transfer function of the device. Over-range stops are implemented for shock protection that avoid the direct contact of the fingers at large accelerations. The mechanical sensitivity (in fF/g) can be adjusted by the thickness and/or the length of the springs.

The z-axis element uses a proof mass with an off-center point of gravity. Any acceleration in the vertical direction will result in a tilt of the proof mass and a change in the differential capacitor. The differential capacitance signal is evaluated by an ASIC which is electrically connected to the sensor by chip-to-chip wire bonds. A change of C_1 and C_2 is detected and transformed into a corresponding analog voltage by a capacitance/ voltage converter

Parameter	Min.	Nominal	Max.	Unit
Supply Voltage	4.75	5	5.25	V
Supply Current				
Single Channel		6	7	mA
Dual Channel		12	14	mA
Tolerance of Sensitivity		5	9	%
Nonlinearity of Sensitivity		0.8	2	%
Cross Axis Sensitivity			5	%
3db Corner Frequency	320	400	480	Hz

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