

# Inertial Sensor for Steering/Traction Control

## Overview

Combining the 56F8300 high-performance controllers with today's low-cost sensor technology makes traditionally high-cost intelligent sensor systems much more affordable. This reduction in cost and

increased performance has enabled inertial sensor systems to be applied to the automotive industry for vehicle steering/traction control applications.

## Key Benefits

- > Integrated peripheral set supports single-device solution
- > Combines MCU functionality and DSP processing power required for high-speed processing of sensor inputs
- > Highly reliable operation supports automotive environments (-40°C to +125°C)
- > Low cost device and system solution makes application available to wider market
- > Out-of-the-box software components designed to expedite time-to-market and reduce development costs

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### Freescale Ordering Information

Part Number	Product Highlights	Additional Information
56F8300 Family	60 MHz, 60 MIPS, up to 576KB Flash, 36KB RAM and Off-Chip Memory, SCI, SPI, ADC, PWM, Quadrature Decoder, Quad Timer, FlexCAN, GPIO, COP/Watchdog, PLL, MCU-style software stack support, JTAG/OnCE for debug, temperature sensor	<a href="http://www.freescale.com">www.freescale.com</a>
MMA2260D	Integral Signal Conditioning, Linear Output, 2nd Order Bessel Filter, Calibrated Self-test, EPROM Parity Check Status, Transducer Hermetically Sealed, High Shock Survivability, Sensing Direction is X-Axis.	Offered in a 16-pin SOIC

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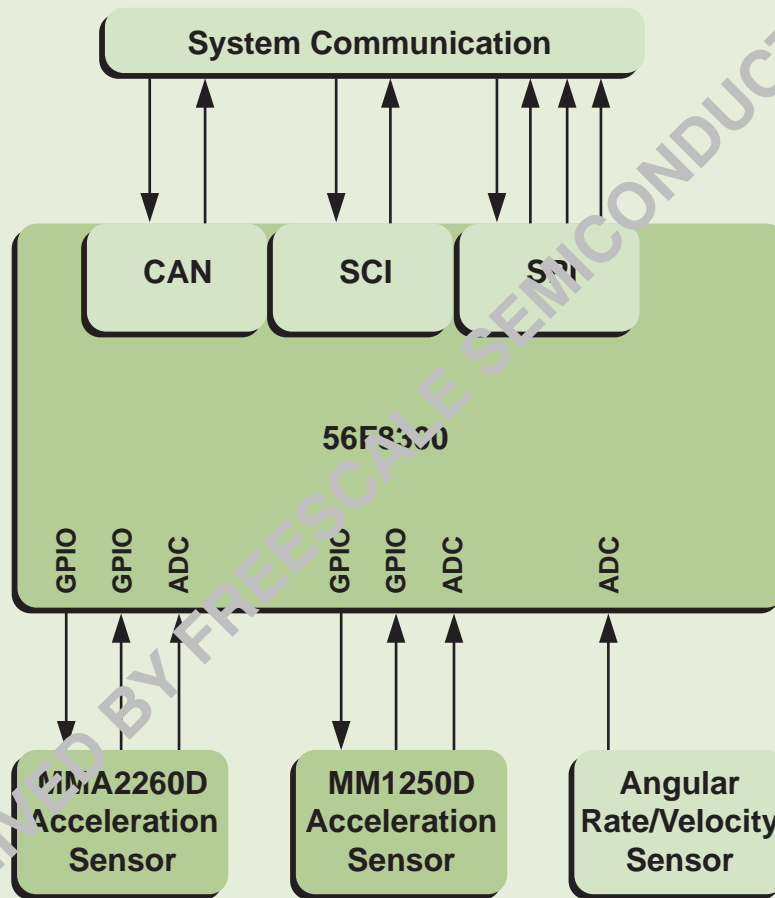
**Design Challenges**

Steering/traction control systems require a three variable inertial sensor system. In this example, the system must detect motion in the X- and Y-axis and rotation on the Z-axis (yaw). This system is able to detect the direction of actual vehicle movement in comparison to the desired movement and provide feedback to the overall system controller.

Traditionally, inertial sensors have been used for active stabilization and navigation applications. But in the past, intelligent inertial sensor systems were quite expensive because of the cost of mechanical accelerometers and gyros, and the cost of the high-performance processors required in the system. This made their use practical only for

expensive and complex systems, such as military submarines and commercial aircraft and was not cost effective for the automotive industry.

STEERING/TRACTION CONTROL SYSTEM



**Freescale Semiconductor Solution**

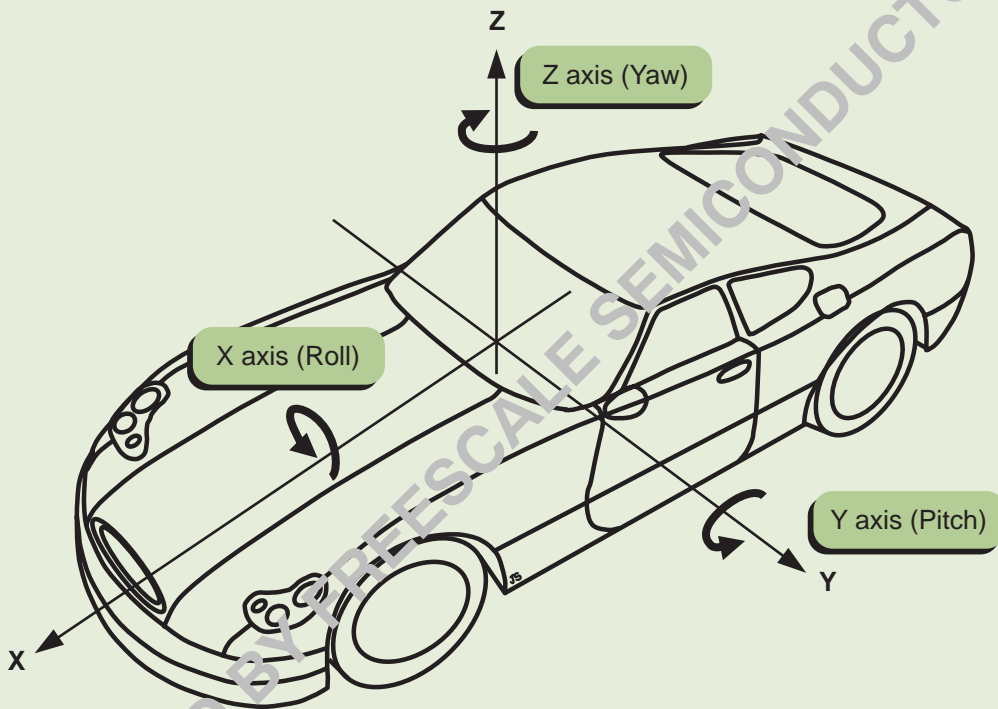
Now, with the introduction of the low-cost 56F8300 controllers and low-cost Micro Electro-Mechanical System (MEMS) technology, much more economical inertial sensors can now be targeted toward automotive steering/traction control.

The 56F8300 provides an integrated set of peripherals that easily supports the interfaces required to implement the

inertial sensor system shown in the Figure below. This series contains up to four four-input ADCs for sampling the directional and angular acceleration sensors. Its 60 MHz and/or 60 MIPs high-performance processing core provides the processing power required to not only gather this sensor data, but also to perform advanced calculations and control algorithms. The 56F8300 also provides several serial

communication peripheral options for inter-processor and system communication: SCI, SPI, and CAN. This solution even provides on-chip Flash program and data memory that truly enables a stand-alone operation. All of these features are tested and guaranteed across the automotive temperature range (-40°C to +125°C).

**INERTIAL SENSOR SYSTEM THREE-VARIABLE VEHICLE MOTION DETECTION**



### Development Tools

Tool Type	Product Name	Vendor	Description
Software	Processor Expert	Freescale Semiconductor	Software infrastructure that allows development of efficient, high-level software applications that are fully portable and reusable across all 56800/E family of processors.
Software	CW568X	Freescale Semiconductor	CodeWarrior™ Development Studio for Freescale Semiconductor DSP56800/E Controllers (Metrowerks)
Hardware	MC56F8367EVM	Freescale Semiconductor	Evaluation Module for the 56F834x, 56F835x, and 56F836x
Hardware	MC56F8323EVM	Freescale Semiconductor	Evaluation Module for the 56F8323 and 56F8322
Hardware	MMA2260D	Freescale Semiconductor	1.5g X-Axis Accelerometer for Consumer Applications

### Disclaimer

This document may not include all the details necessary to completely develop this design. It is provided as a reference only and is intended to demonstrate the variety of applications for the device.

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## Notes

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