ANTI-LOCK BRAKING SYSTEMS

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KEY BENEFITS

- Retains directional control of the vehicle during emergency braking
- Improves stability of the vehicle during emergency braking
- Allows near optimal braking even by non-expert drivers
- Removes tire 'flat spot' wear caused by wheel lockup

OVERVIEW

Anti-lock braking systems (ABS) are designed to maintain driver control and stability of the car during emergency braking. Locked wheels slow a car but do not provide steering ability. ABS allows maximum braking to be applied while retaining the ability to "steer out of trouble." The operation of ABS can slightly reduce stopping distance in some cases such as wet road surfaces, but it can increase the stopping distance in others, such as in deep snow or gravel.

An ABS system monitors four-wheel speed sensors to evaluate wheel slippage. Slip can be determined by calculating the ratio of wheel speed to vehicle speed, which is continuously calculated from the four individual wheel speeds. During a braking event, the function of the control system is to maintain maximum possible wheel grip on the road—without the wheel locking—by adjusting the hydraulic fluid pressure to each brake through electronically controlled solenoid valves.

For passenger car applications, the majority of ABS components are often housed together in a single, under-hood mounted module.

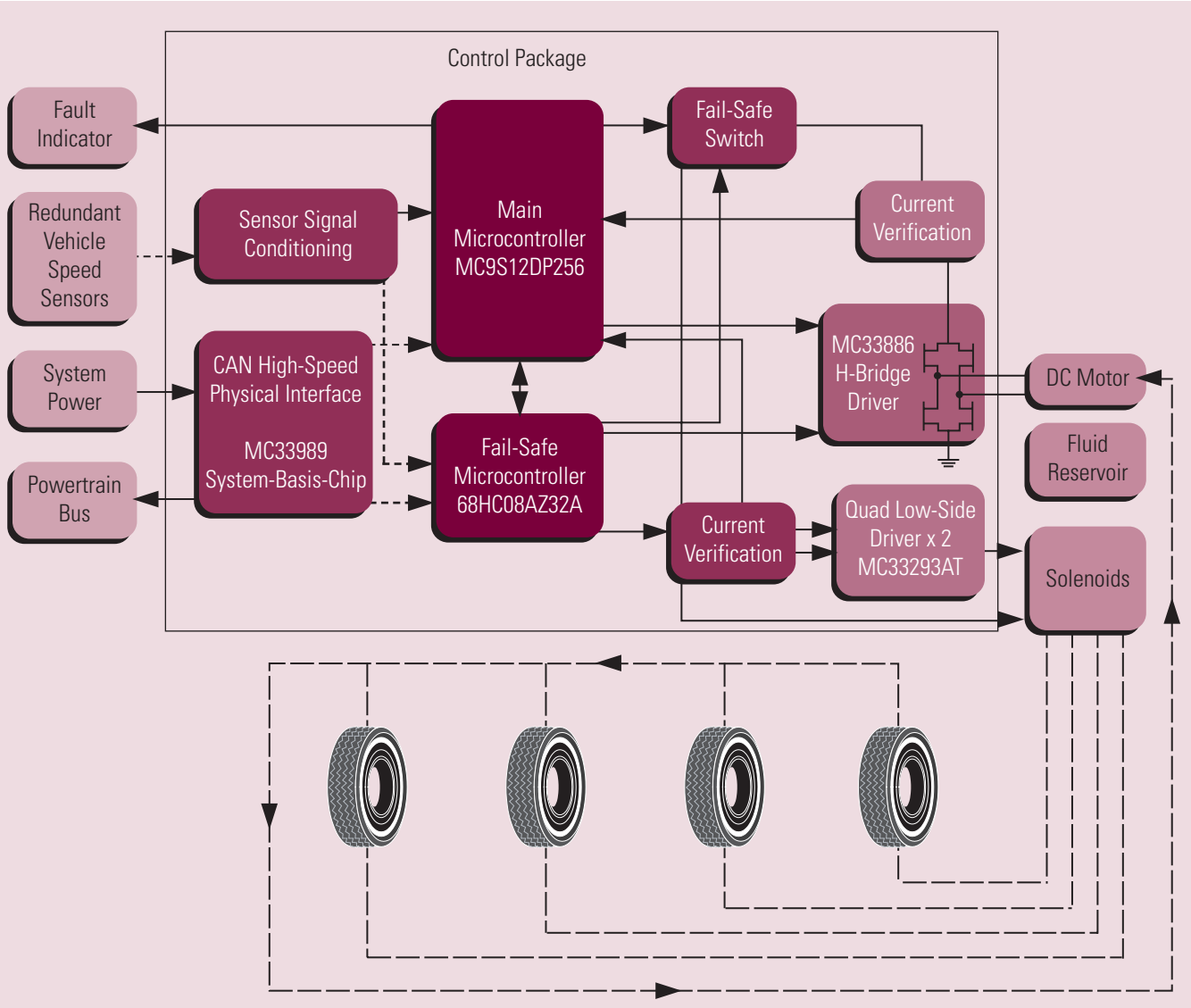

Figure 1. Anti-Lock Braking System Control Package

MOTOROLA ORDERING INFORMATION

Contact your Motorola sales representative for complete information on existing products and custom solutions.

Part Number	Product Highlights	Additional Information
68HC912D60	16-bit microcontroller unit	www.motorola.com/semiconductors[NOTE]
68HC08AZ32	8-bit microcontroller unit	
MC33293AT	Quad low-side driver x 2	
MC33886	H-bridge driver	
MC33989	CAN high-speed physical interface	

NOTE: Search on the listed part number.

DESIGN CHALLENGES

Because of the safety-related nature of the ABS application, special emphasis is placed on functions designed to detect system faults and ensure that a fail-safe state occurs during faults. These functions may be implemented with techniques such as dual processors and specialized self test and watchdog modules.

ABS systems typically include eight electric solenoid valves and other electrical loads, such as relays and pump motors, that require considerable drive currents. Electronic drive circuitry is often required to sense any failure of these components during operation.

MOTOROLA SOLUTION

ABS system components include the following:

- Wheel speed sensors on each vehicle wheel
- Electrically controlled hydraulic valves
- Electric motor powered hydraulic pump
- Electronic control unit (ECU)

The following example solution uses the 16-bit 68HC912D60 microcontroller for main application processing, with a 68HC08AZ32 processor functioning as an asymmetrical watchdog processor. Both controllers incorporate controller area network (CAN) communications modules to allow the ABS ECU to communicate with other vehicle systems. Standard devices such as the MC33293AT and MC33186 are designed to enable control of the higher power loads in the system. CAN physical layer devices and power supply regulation components are also available.

Motorola also has extensive experience in the development of specialized components for high-volume ABS applications. Motorola's SMARTMOS technology allows a large number of the analog and power electronics functions of the system to be integrated into a single device. Novel microcontroller architectures with comprehensive self-testing features have also been developed.

DEVELOPMENT TOOLS

Vendor	MPC555	MPC561	MPC562	MPC563	MPC564	MPC565	MPC566	TPU
Metrowerks								
CodeWarrior™ for PowerPC ISA Embedded Systems	●	●	●	●	●	●	●	
CodeWarrior for OSEK RTOS	●	●	●	●	●	●	●	
CodeWarrior Development Systems	●					●		
OSEKturbo (RTOS)	●	●		●		●		
TPU Low-Level Driver Library								●
Flash Programming — CodeWarrior for Embedded PowerPC ISA	●			●	●	●	●	
Flash Programming — CodeWarrior for OSEK RTOS	●			●	●	●	●	
Wind River Systems								
BDM Debugger — SingleStep	●	●		●		●		
BDM Debugger — SingleStep with Vision	●	●		●		●		
Flash Programming — SingleStep	●			●		●		
BDM Debugger — VisionCLICK	●	●		●		●		
Nexus Debugger — VisionCLICK		●		●		●		
Nexus Debugger — SingleStep with Vision		●		●		●		
Flash Programming — VisionCLICK	●			●		●		
Compiler — DiabData	●	●	●	●	●	●	●	
MATRIXX	●	●		●		●		
Simulator — SingleStep	●	●	●	●	●	●	●	

DEVELOPMENT TOOLS (continued)

Vendor	MPC555	MPC561	MPC562	MPC563	MPC564	MPC565	MPC566	TPU
Lauterbach								
BDM Debugger Trace32	●	●	●	●	●	●	●	●
Nexus Debugger Trace32		●	●	●	●	●	●	●
Code Trace (with Bus access)	●	●	●	●	●	●	●	
Code Trace (Nexus)	●	●	●	●	●	●	●	
Axiom Manufacturing								
Low-Cost Evaluation Board	●	●						
Mid-Range Evaluation Board	●	●						
Full-Feature Evaluation Board	●	●	●	●	●	●	●	
Ashling Microsystems								
BDM Debugger — Opella, Genia, and Vitra	●	●	●	●	●	●	●	
Nexus Debugger — Vitra (w/trace)		●		●		●		●
Nexus Debugger — Opella, Genia		●		●		●		
Green Hills Software								
IDE, Debugger — Multi	●	●		●		●		
Compiler — C/C++/EC++	●	●		●		●		
P&E Microcomputer Systems								
Low-Cost Debugger	●	●		●		●		
Flash Programming Tools	●			●		●		
GNU								
Compiler/Debugger	●	●		●		●		
ASH WARE								
TPU Simulator								●
ETAS								
ErCOSEK	●	●		●		●		
Calibration Tools (ETK)	●	●		●		●		
Calibration Tools (ETK) Nexus	●	●		●		●		
dSPACE								
TargetLink	●	●		●		●		
dli								
Logic Analyzer	●	●		●		●		
Agilent Technologies								
Logic Analyzer	●	●		●		●		
Inverse Assembler, Source Correlation	●	●		●		●		
Emulation Probe (BDV)	●	●		●		●		
Tektronix								
Logic Analyzer	●	●		●		●		
Abatron AG								
BDM Support	●	●		●		●		
Accelerated Technology								
Nucleus (RTOS)	●	●		●		●		

THIRD PARTY SUPPORT

Vendor	Contact Information
Metrowerks	800-377-5416 (www.metrowerks.com)
Axiom Manufacturing	972-926-9303 (www.axman.com)
Wind River Systems	800-872-4977 (www.windriver.com)
Green Hills Software	805-965-6044 (www.ghs.com)
Lauterbach	508-303-6812 (www.lauterbach.com)
Accelerated Technology	800-468-6853 (www.acceleratedtechnology.com)
Ashling Microsystems	408-732-6490 (www.ashling.com)
ASH WARE	503-533-0271 (www.ashware.com)
GNU	617-542-5942 (www.gnu.org)
ETAS	888-382-7462 (www.etasinc.com)
dSPACE	248-567-1300 (www.dspace.com)
P&E Microcomputer Systems	617-353-9206 (www.pemicro.com)

RELATED INFORMATION

For inquiries about Motorola products, contact the Technical Information Center at 800-521-6247, or visit us online at www.motorola.com/semiconductors.

Online Topics
M68HC12
MPC500
Analog and Mixed Signal
32-Bit Development Tools

Related Products

Product Number	Product Name	Contact Information
MC33253	Full bridge pre-driver with AOP for body electronic application	www.motorola.com/semiconductors[NOTE]
MC33186	Automotive H-bridge driver: 150 mΩ	

NOTE: Search on the product number listed.

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