KEY BENEFITS

- Connects with emerging systems, such as adaptive cruise control

- Reduces system weight to provide improved vehicle performance and economy

- Assembles the system into the host vehicle simpler and faster

- Reduces pollutant sources by eliminating corrosive, toxic hydraulic fluids

- Removes the vacuum servo and hydraulic system for flexible placement of components

- Reduces maintenance requirements

- Supports features such as "hill hold"

- Removes mechanical components for freedom of design

OVERVIEW

Electromechanical braking systems (EMB), also referred to as brake by-wire, replace conventional hydraulic braking systems with a completely "dry" electrical component system. This occurs by replacing conventional actuators with electric motor driven units. This move to electronic control eliminates many of the manufacturing, maintenance, and environmental concerns associated with hydraulic systems.

Because there is no mechanical or hydraulic backup system, reliability is critical and the system must be fault tolerant. The implementation of EMB requires features such as a dependable power supply, fault-tolerant communication protocols (i.e., TTCAN and FlexRay™), and some level of hardware redundancy.

As in electrohydraulic braking (EHB), EMB is designed to improve connectivity with other vehicle systems, thus enabling simpler integration of higher-level functions, such as traction control and vehicle stability control. This integration may vary from embedding the function within the EMB system, as with ABS, to interfacing to these additional systems using communication links.

Another advantage of both EHB and EMB systems is the elimination of the large vacuum booster found in conventional systems. Along with reducing the dilemma of working with increasingly tighter space in the engine bay, this elimination helps simplify production of right- and left-hand drive vehicle variants. An increase in flexibility for the placement of components is also provided by EMB systems, compared to those of EHB, with the total elimination of the hydraulic system.
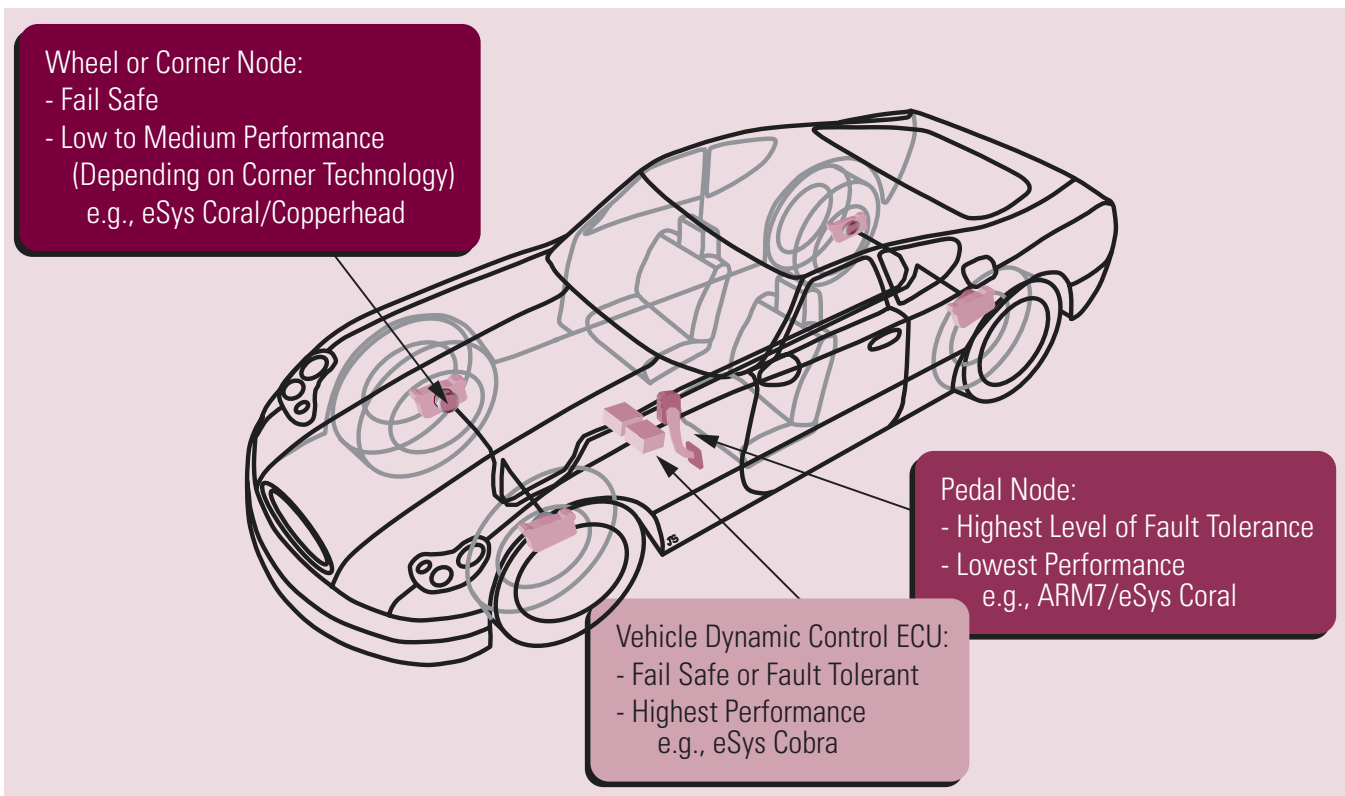
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digital dna ✳

Wheel or Corner Node:
- Fail Safe
- Low to Medium Performance
  (Depending on Corner Technology)
    e.g., eSys Coral/Copperhead

Pedal Node:
- Highest Level of Fault Tolerance
- Lowest Performance
    e.g., ARM7/eSys Coral

Vehicle Dynamic Control ECU:
- Fail Safe or Fault Tolerant
- Highest Performance
    e.g., eSys Cobra

Figure 1.   Control Package

MOTOROLA ORDERING INFORMATION

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

Part Number	Product Highlights	Additional Information
MPC500	32-bit microcontrollers	www.motorola.com/semiconductors[NOTE]
HC512	16-bit microcontrollers	
DSPxxxx	Digital signal processors	

NOTE: Search on the part number listed.

DESIGN CHALLENGES

EMB systems represent a complete change in requirements from previous hydraulic and electrohydraulic braking systems. The EMB processing components must be networked using high-reliability bus protocols that ensure comprehensive fault tolerance as a major aspect of system design.

The use of electric brake actuators means additional requirements that include motor control operation within a 42-volt power system and high temperature and high density to the electronic components.

In addition to supporting existing communications standards such as CAN and K-line, EMB systems require the implementation of deterministic, time-triggered communications, such as those available with FlexRay, to assist in providing the required system fault tolerance. The EMB nodes may not need to be individually fault tolerant, but they help to provide fail-safe operation and rely on a high level of fault detection by the electronic components.

These new system requirements must be met using high-end components at very competitive prices to replace established, cost-effective technology while maintaining strict adherence to the automotive qualification.

Delivering the large current requirements to stop a large SUV may cause limited adoption at first. The first implementation will be on small car platforms.

MOTOROLA SOLUTION

A multiple microcontroller unit (MCU) EMB system requires components such as high-performance MCUs from the MPC500 family for the vehicle control node, mid-range performance digital signal processors (DSP) or MPC500 microcontrollers for the wheel nodes, and HCS12 devices for brake pedal nodes.

Motorola has vast experience developing many of the specific aspects required for the implementation of EMB systems. Motorola has a strong background in fault-tolerant communications from previous development of fail-safe microcontrollers, braking specific modules such as the wheel speed timer, a dedicated motor control lab, and a software center that develops drivers, tools, and operating systems. Motorola is also a core team member in the FlexRay consortium and has been instrumental in the development of this protocol. With this strong foundation, Motorola has the knowledge to develop the right solutions in partnership with its customers.

DEVELOPMENT TOOLS

Vendor	MPC555	MPC561	MPC562	MPC563	MPC564	MPC565	MPC566	TPU
Metrowerks								
CodeWarrior for Embedded PowerPC ISA	●	●	●	●	●	●	●	
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	●	●	●	●	●	●	●	
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		●		●		●		

DEVELOPMENT TOOLS (continued)

Vendor	MPC555	MPC561	MPC562	MPC563	MPC564	MPC565	MPC566	TPU
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
Digital Signal Processors

Related Product

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

NOTE: Search on the product number listed.

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