

Electromechanical Braking Utilizing FlexRay

Overview

Electromechanical braking systems (EMB), also known as brake by-wire, replace conventional actuators with electrical motor-driven units to connect the four braking “corners” to the pedal and to each other.

Switching from a conventional hydraulic braking system to an EMB eliminates environmental and maintenance concerns associated with hydraulic systems.

An EMB system also eliminates the use of large vacuum boosters as well as provides better control of pedal stiffness, traction control, vehicle stability, and brake force distribution than those found in conventional hydraulic systems.

While conventional hydraulic braking systems have a mechanical or hydraulic backup, an EMB braking system does not. Due to this, reliability in an EMB system is absolutely critical and the system must use a fault-tolerant communication protocol, such as FlexRay.

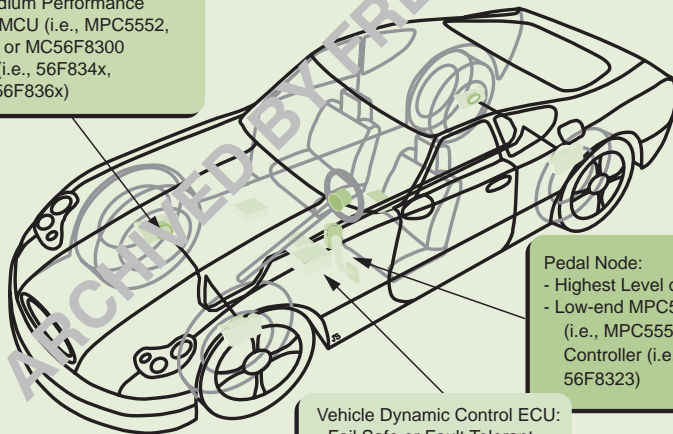
Key Benefits

- > Combines MCU functionality and DSP processing power using a single-device solution
- > Out-of-the-box software components designed to expedite time-to-market and reduce development costs
- > Removes large vacuum boosters from the system design to allow for flexible placement of components as well as reduced system weight
- > Assembles the system into the host vehicle simpler and faster
- > Eliminates environmental concerns associated with traditional hydraulic braking systems

BRAKE BY-WIRE SYSTEM USING FLEXRAY

Wheel or Corner Node:

- Fail Safe
- Low to Medium Performance
- MPC5500 MCU (i.e., MPC5552, MPC5554) or MC56F8300 Controller (i.e., 56F834x, 56F835x, 56F836x)



Pedal Node:

- Highest Level of Fault Tolerance
- Low-end MPC5500 MCU (i.e., MPC5552) or MC56F8300 Controller (i.e., 56F8322, 56F8323)

Vehicle Dynamic Control ECU:

- Fail Safe or Fault Tolerant
- Highest Performance (i.e., MPC5500)

Freescale Ordering Information

Part Number	Product Highlights	Additional Information
MC56F8300 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	www.freescale.com

Design Challenges

A major aspect of brake by-wire system design is that EMB system components must be networked together. This requires using a bus protocol with very high reliability that ensures comprehensive fault tolerance. The bus communication within an EMB system is also required to be time triggered and deterministic.

This represents a complete change in system requirements as compared to conventional hydraulic and electrohydraulic braking systems.

Freescale Semiconductor Solution

Freescale Semiconductor has vast experience developing many of the specific aspects required in the implementation of EMB systems. Freescale Semiconductor is a core team

member in the FlexRay consortium and has been instrumental in the development of the FlexRay protocol, software drivers, and hardware.

Now, with the introduction of the low-cost 56F8300 hybrid controllers coupled with Freescale Semiconductor's FlexRay expertise, Freescale Semiconductor has the products which allow its customers to develop the right EMB solution.

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 Hybrid Controllers (Metrowerks)
Hardware	MC56F8323EVM	Freescale Semiconductor	Evaluation Module for the 56F8322, 56F8323
Hardware	MC56F8367EVM	Freescale Semiconductor	Evaluation Module for the 56F834x, 56F835x, and 56F836x
Hardware	FRDC	Freescale Semiconductor	FlexRay Daughter Card; contact Factory for availability.

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.

Learn More: Contact the Technical Information Center at +1-800-521-6274 or +1-480-768-2130.

For more information about Freescale products, please visit www.freescale.com.