The Communications System for Advanced Automotive Control Applications

The rapid growth in advanced automotive control systems requires a new, more powerful communications protocol to ensure a network that works together to accomplish critical tasks within the vehicle. The FlexRay™ Consortium—made up of a group of industry heavyweights, including Freescale—formed to enable the development of next-generation by-wire systems and to promote an open-source network communications protocol for the automotive industry.

FlexRay founders Motorola (Freescale Semiconductor), Philips, BMW and DaimlerChrysler have been working together since 2000 to help speed the adoption of the FlexRay protocol, a communications protocol designed to handle the growing number of digital elements that make up a 21st century automobile. Over the past two years, others, including Bosch, General Motors, Ford, Volkswagen and Siemens VDO, have joined these leaders in an effort to make FlexRay the de facto standard for advanced applications in the automotive industry. As of August 2004, more than 80 companies from the automotive, semiconductor and software industries are supporting the FlexRay standard. The goal is for the first FlexRay enabled vehicles to hit the street by model year 2006.

ADVANCED APPLICATIONS: VEHICLE DYNAMICS AND DRIVER ASSISTANCE SYSTEMS

| Passive safety | Airbag and restraint systems |
| Environment sensors | Pre-crash |
| Navigation | Radar, Close range, Video |
| Steering | Power steering, Hydr., Electr. |
| Brake | ABS, Brake pressure modulation |
| Chassis | Mechan., Pneumatic suspension |

Vehicle handling assistant
ACC = Antilock Braking System
ESP = Electronic Stability Program
TCS = Traction Control System
EMB = Electro-Mechanical Braking

Systems Working Together

The FlexRay protocol is expected to be a comprehensive communication system, providing speed, flexibility and scalability for complex networks. The protocol's key features include:

- Time- and event-triggered communication schemes
- Support of fault-tolerant systems
- High error detection and error diagnosis capability
- Support of different network topologies for cost-effective and safety-enhanced partitioning of the system
- Dedicated automotive electrical physical layer with sophisticated powerdown and wake up mechanisms
- Flexible extendability and full scalability to enable upgrades

Among the applications that the FlexRay protocol is expected to make possible are x-by-wire systems such as brake-by-wire and steer-by-wire. X-by-wire removes the need for hydraulic and mechanical systems, connecting the driver to these systems using sophisticated electronic systems that are less expensive to build and easier to maintain.

Other applications that the FlexRay protocol is expected to enable include active and passive safety systems, collision avoidance systems, powertrain management systems and driver assistance systems. With a gross data rate of 10 Mbits/sec, FlexRay delivers approximately 20 times higher net bandwidth than the CAN protocol currently used in advanced automotive control applications.
The first cars equipped with networking capabilities based on the FlexRay protocol are expected in 2006. Freescale also offers its FlexRay implementation to other semiconductor companies for license. This licensing ensures that multiple vendors offer interoperable solutions by making use of the same FlexRay protocol core that conforms to the FlexRay protocol specification.

Customer-specific product diversification can be made at the host interface level.

**FlexRay Advantages**

- Backed by the majority of the automotive industry, including the world’s three largest volume car manufacturers
- Working prototype cars for system evaluation in operation now
- Supported by a wide variety of tools available from many development partners
- FPGA and silicon prototypes from Freescale are available for key partners

Except for historical information, all of the expectations and assumptions contained in this document are forward-looking statements involving risk and uncertainties. Important factors that could cause actual results to differ materially from such forward-looking statements, include, but are not limited to, the competitive environment for our products, changes of rates of all related services, and legislation that may affect the industry. For additional information regarding these and other risks associated with the Company’s business, refer to the Company’s reports with the SEC.

Learn More: For more information about Freescale’s automotive products, please visit us at www.freescale.com.

To learn more about Freescale’s FlexRay products, please visit www.freescale.com/flexray.