

## Fujitsu's Technologies Drive Future of Car Electronics

Fujitsu Limited is helping to reshape the future of vehicles. That future is already here: the new network linking people and vehicles.

What will the next generation of vehicles be like? Although automobile manufacturers, engineers and designers might each give a different answer to that question, all their answers would be based on the same basic themes: that people and vehicles are linked, and that automotive functions, including those for driver assistance, communication and entertainment, must correspond to human intentions. The goal is to make vehicles safer, more convenient, and more comfortable.

Fujitsu's in-vehicle products will bring the network linking people and vehicles into a future that today is only a dream.

### The Dashboard as Information Hub

The dashboard incorporates a variety of important components, such as a graphical instrument panel that enables the driver to access the driving situation instantly, a heads-up display that provides information at a glance, and a navigation panel. Because the dashboard with its gauges and instruments is the information hub and because the volume of information it must convey keeps increasing, new dashboard designs will be needed. Such designs will include those based on network technology, for more precise processing of information, and on graphic technology, for more accurate display of information.

There are two faces of the dashboard: front and hidden. The dashboard will evolve into an easy-to-use graphical user interface that provides the driver and passenger display camera views of the surroundings, warnings to the driv-

er and other information. At the same time, another face of dashboard, the hidden face, will function through the in-vehicle network as the central vehicle information and data exchange point. In many cases, meter clusters will support this function, and those clusters will be backed up by highly reliable in-vehicle network technology (Fig. 1).

### Improves Display Visibility

Fujitsu's graphics display controller (GDC) has a proven track record in car systems and makes possible the best and latest products specific to the instrument panel. Besides helping optimize display size, content, picture quality and price/performance ratio, the GDC provides excellent component technologies, such as distortion correction, which improve the visibility of the head-up display.

### CAN-FlexRay Gateway Technology

Controller Area Network (CAN) is the de-facto standard for in-vehicle networks. Fujitsu, which started developing CAN microcontrollers in 1996, has consistently brought out highly popular optimized products for electric controller units, and is today one of the world's top suppliers. Fujitsu's CAN microcontrollers have been incorporated in dashboards in car air conditioners, in car body control modules, in door modules, in keyless entry systems and the like. Now FlexRay is attracting attention as a next-generation in-vehicle network, making a suitable gateway to the CAN network necessary. Fujitsu is responding to this challenge by developing CAN-FlexRay gateway technology. Fujitsu is using the advanced know-how the



company gained from constructing complicated **MB91F465XA FlexRay microcontroller**

and adaptable carrier-Internet protocol networks to create an environment in which CAN systems, which transfer data by "event-trigger" processing, and FlexRay systems, which control the data flow by "time-trigger" processing, can coexist (Fig. 2).

### Making Vehicles Safer

Safety needs are to be addressed in several ways: Preventive safety keeps accidents from happening; collision safety ensures safety even in the event of an accident; and driving safety increases driving stability. The technologies supporting these types of safety have evolved from simple construction technologies, such as car-body enhancement technologies, into electronic technologies involving many sensors and electronic control units. It is expected that FlexRay, which is faster and more reliable than CAN, will enable an in-vehicle network to make the entire vehicle safer.

### Taking The Lead: The FlexRay Way

Toward more advanced control, x-by-wire

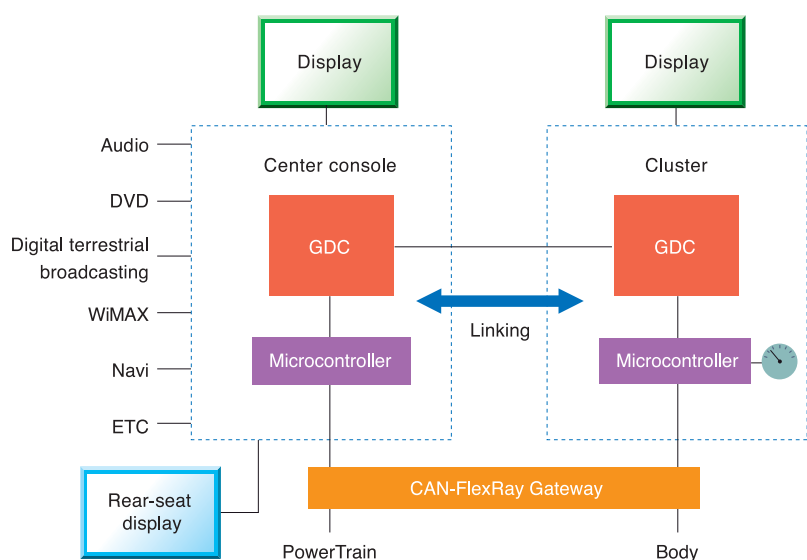


Fig. 1: Dashboard system

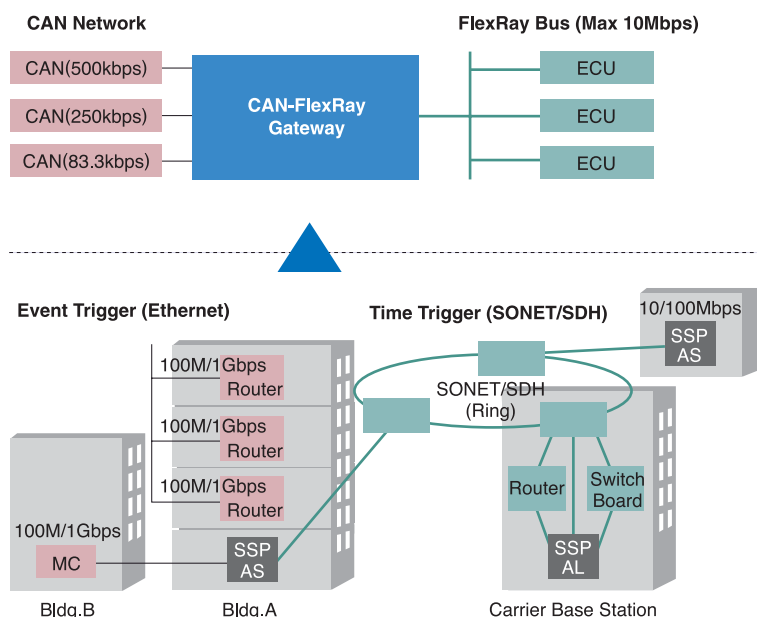


Fig. 2: CAN-FlexRay gateway technology

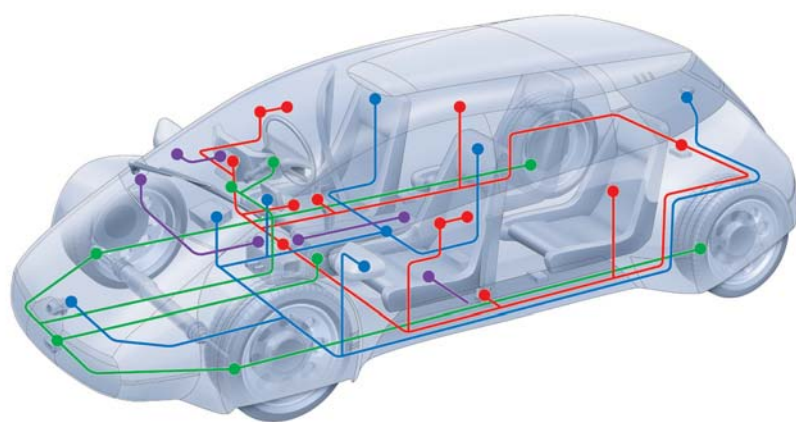
technology employs electronic control mechanisms instead of conventional mechanical controls. This technology is regarded as the next-generation technology for in-vehicle system design. However, the data volumes handled by in-vehicle control systems keep increasing and the in-vehicle control system themselves keep getting more complicated. Therefore, speedier and more reliable networks are essential for realizing x-by-wire technologies. FlexRay is expected to meet this need. The integration of the FlexRay networks and x-by-wire technology will enable advanced safety systems to be introduced smoothly and vehicle interior design and layout to be improved (Fig. 3).

Fujitsu was one of the first Japanese semiconductor manufacturers to participate in the FlexRay Consortium. Starting with the commercialization of its FlexRay starter kit. Fujitsu has continually developed and provided innovative products, such as the FlexRay ASSP MB88121 and the MB91F465XA, a one-chip microcontroller that conforms to the latest FlexRay specifications (Ver. 2.1).

Fujitsu will continue to enhance its lineup, which includes motor control applications and the CAN-FlexRay gateway. Fujitsu will offer optimized FlexRay products in cooperation with Austriamicrosystems AG, a company that provides high-quality FlexRay technology; Elektrobit Corp., which has a good track record in automotive software; and Decomsys GmbH, which provides FlexRay network analysis tools for customers worldwide (Fig. 4)

## Infotainment Solutions For Cars

With the introduction of such onboard digital appliances as TVs, DVD players and audio equipment, vehicles have already been turned into living spaces. Additionally, car navigation systems continue to evolve as information terminals that give directions and provide other useful information. The goal is to make vehicles more enjoyable, more comfortable and safer. Future vehicles will need to integrate the way the entertainment and information is delivered. They will need a multimedia network in which video and digital audio information can be han-



- Information system network: MOST, IDB-1394
- X-by-Wire system network: FlexRay
- Control system network: CAN
- Low-speed system network: LIN

Fig. 3: Automobile with four networking technologies

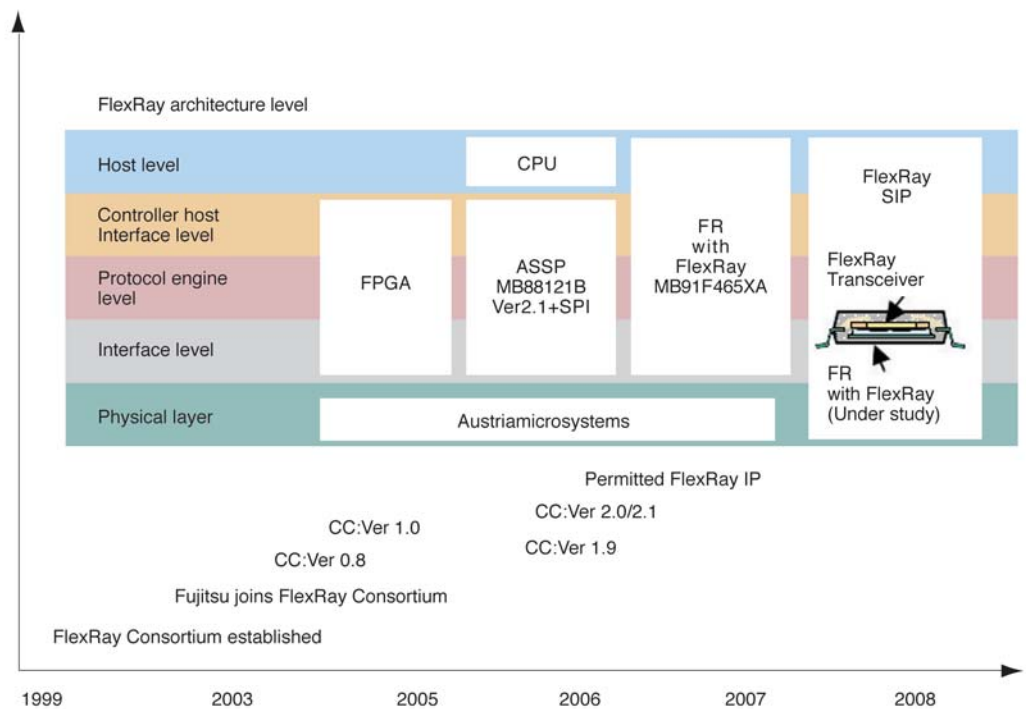


Fig. 4: Roadmap for the development of FlexRay technology

dled in a single system as well as advanced technology to provide a clear and speedy visual display.

### IDB-1394

The IDB-1394 controller links the TV, DVD, audio system, car navigation system, rear-seat display and other information systems, turning the vehicle interior into a comfortable entertainment space. This technology is attracting a great deal of attention because of its role in in-vehicle information-system networks, leveraging the technology based on its IEEE1394 controller for consumer products.

Fujitsu has integrated the physical layer, the logical layer and the Smart Codec, a proprietary compression technology, into a single chip to provide a low-latency, high-grade, high-speed network. Fujitsu is also enhancing an IDB-1394 controller for an in-vehicle camera, which will provide a safer and more secure system by linking multiple cameras inside and outside vehicles through a high-speed network (Fig. 5).

### MOST networking

Fujitsu is supporting Media Oriented System Transport (MOST) networks and providing a variety of products containing MediaLB, which is as an interface to the MOST network. A microcontroller with MediaLB built-in can, while controlling the audio system, seamlessly transfer an audio stream, packet data and control commands to a MOST network. Fujitsu offers a highly integrated product that not only controls the audio and media through

MediaLB, but also supports the control feature through an integrated CAN interface. This combination also enables the system to generate an audible alert should a problem occur in the CAN network.

## Fujitsu's Portfolio of In-Vehicle ICs

### Display controller

As the number of vehicles equipped with car-navigation systems grows, so grows the demand for graphic displays that can quickly provide more detailed images. To meet this need, Fujitsu continues to enhance its graphics display controller (GDC) line of products, which

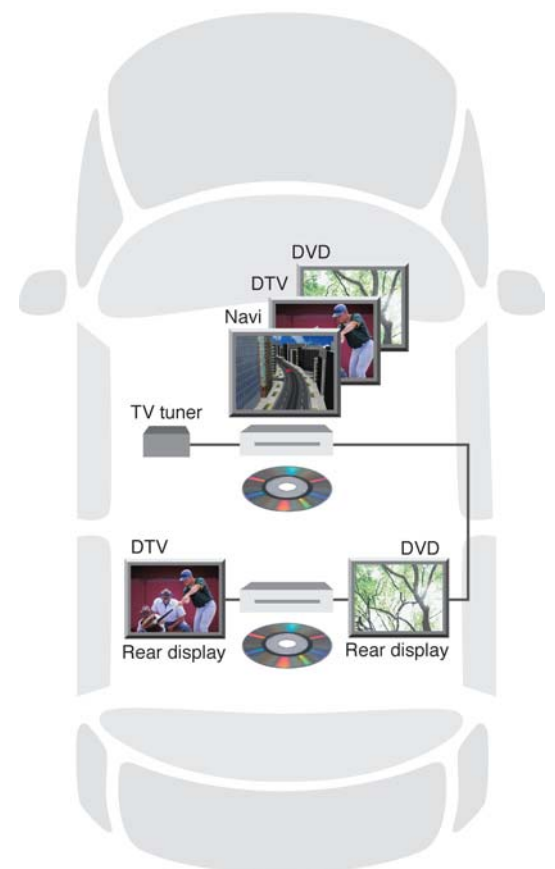


Fig. 5: Multimedia system

is now in its fourth generation. The latest GDC for navigation provides a high-speed, highly precise display with a drawing performance of 10 million polygons per second. The GDC also features a highly sophisticated technology that superimpose up to eight layers of extra information and video onto a map display, as well as technology that corrects distortions of images and video. This is the ultimate LSI for car-navigation systems that require advanced three-dimensional graphics (Fig. 6).

## Analog ICs

Fujitsu provides general-purpose sensor-conditioner ICs for displacement sensors measuring pressure, acceleration, angular speed and the like. These high-performance ICs amplify weak signals and correct the display of the measuring instruments. Fujitsu is working to shorten turnaround times, ensure stable mass production of these sensor-conditioner ICs, and develop application-specific products, creating more products for practical applications.

## ASICs

As a global supplier, Fujitsu creates a wide variety of ASIC products based on advanced technologies. In developing products based on leading-edge process technologies, Fujitsu takes full advantage of technologies for low-leakage current and high-speed operation. The company offers a full range of design methods and the technology needed to quickly develop ultra-high-speed, highly integrated ASICs. Also, Fujitsu has a large library of IPs for navigation systems and other automotive applications.

## FRAM

Fujitsu was one of the first companies to mass-produce ferroelectric RAM (FRAM), a highly promising advanced memory. Because FRAM is nonvolatile, it can retain data after power is off. It also can be rewritten at high speed and with high frequency. Moreover, because of its low power consumption, FRAM is suitable for car navigation system and in-vehicle information system terminals. In addition to 256Kb, 1Mb and 2Mb standalone memory,

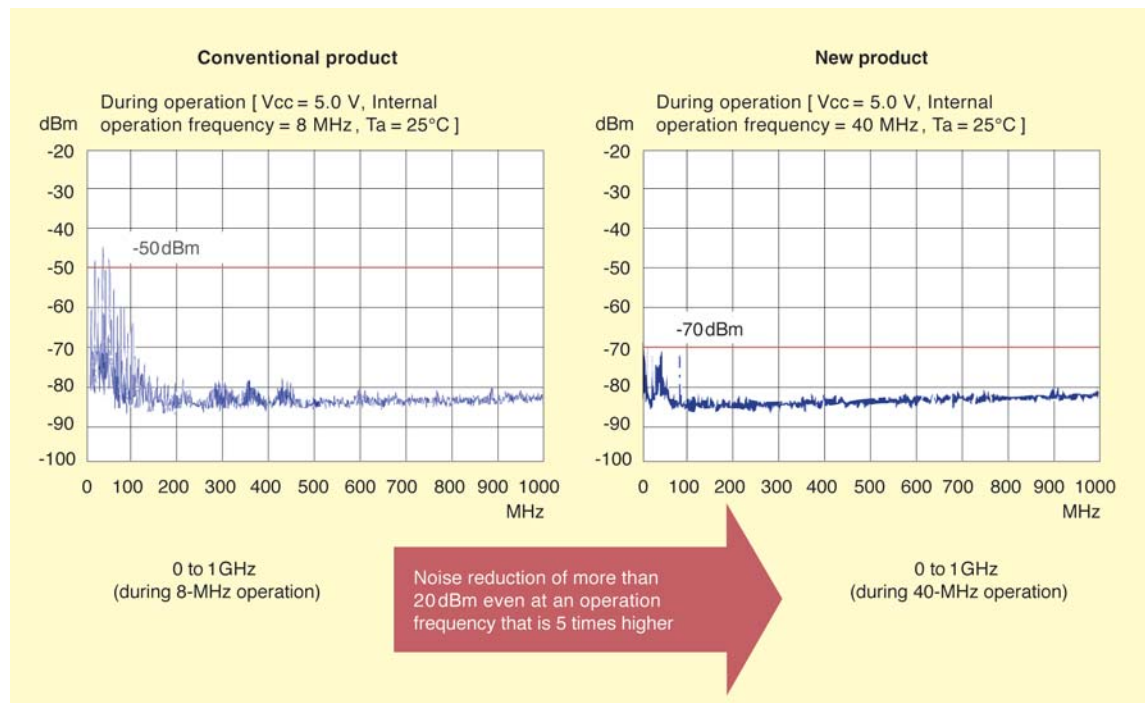


Fig. 7: Comparison of noise between conventional product and new product

Fujitsu can provide customized FRAM products.

## Leveraging on Leadership

Fujitsu has continually demonstrated leadership in advanced semiconductor manufacturing and has provided functional high-quality in-vehicle devices for years. Fujitsu will continue to provide high-level in-vehicle products by leveraging technologies Fujitsu originally developed for the company's information and communication systems.

## Flash memory

Spansion NOR flash memory has been adopted in all kinds of in-vehicle applications from infotainment, telematics and navigation systems to in-vehicle digital TVs, remote diagnosis systems and real-time traffic systems. The technology adds value, improves safety and enhances reliability. Fujitsu's product lineup ranges from low-capacity 4Mb devices to large-capacity 1Gb devices and Fujitsu provides both regular 3V devices and 1.8V products for low power consumption. Fujitsu's flash memory products

feature a variety of functions, such as simultaneous read and write, high-speed page mode and burst mode.

## Ultra-low-leakage technology

Because power consumption increases as the number of electronic controller units inside a vehicle increases, the challenge is to decrease current leakage, especially during standby mode. With the evolution of the wafer-production process, the current requirements during operation have decreased but the leakage current during standby mode has actually increased. It is important to reduce both the operation current and the leakage current. Fujitsu's dedicated low-leakage process technology enables customers to reduce leakage current up to the 0.35 $\mu$ m technology level without degrading the switching speed of 0.18 $\mu$ m technology.

## Flash microcontrollers

The Fujitsu flash microcontroller has been widely adopted in CAN microcontroller in-vehicle systems and in digital equipment. Fujitsu will continue to enhance the company's FF Value brand flash microcontrollers to respond to customers' needs. The goal for the company is to provide customers three types of value: superior process technology, superior performance and reliability, and guaranteed stable supply.

## Promoting low noise

With advances in digital technology, it is essential to reduce the electric noise in components mounted in a vehicle, because noise affects wireless applications, such as the radio. Fujitsu has carefully designed for the electric noise-level requirement of a vehicle. Moreover, to the extent possible, the company strives to offer products that can be used in a printed circuit board design without requiring special anti-noise measures (Fig. 7).

This article is from Fujitsu's booklet "What the Car of Tomorrow Will Be Like." **JEI**

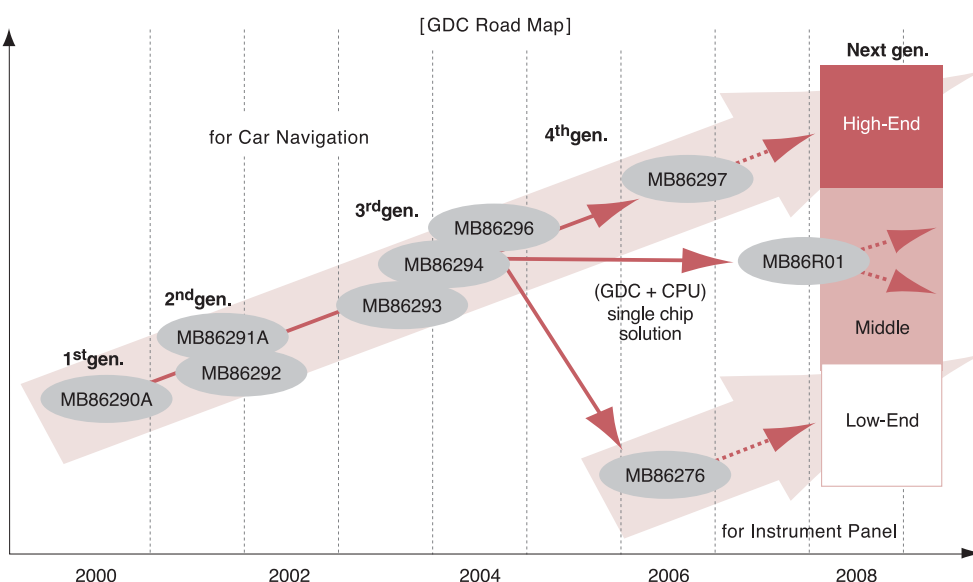


Fig. 6: Roadmap for the development of graphics display controllers