# CAN-Mounted 32-bit Microcontrollers for Advanced Function Automotive Systems

# MB91F464AA/MB91F465KA/MB91F467RA

A 5V operation MB91F464AA/MB91F465KA microcontroller optimal for body systems and a 3.3V operation MB91F467RA microcontroller optimal for controlling automotive information systems have been added to MB91460 Series lineup.

## Overview

In recent years, automobile parts are increasingly being made electronic. Safety technology, environmentally conscious systems, and information telecommunication (primarily car navigation) are expected to advance in the near future. Since the importance of real-time control will increase in such systems, a microcontroller offering higher performance is required.

MB91460 Series is capable of providing control for all body, dashboard control, and information systems.

**Fig.1** shows the lineup of MB91460 Series.

FUJITSU has now released MB91F464AA/MB91F465KA with a 5V power supply for body system control and MB91F467RA with a 3V power supply for automotive information systems.

These products are microcontrollers capable of realizing high-performance, low power consumption systems with a 32-bit RISC CPU FR60 core. They have built-in resources suitable for body system control and automotive information systems, including various timers, A/D converters, and PPG in addition to CAN controllers and assorted LIN-UART and I²C interfaces. These products adopt 100-pin, 120-pin, and 176-pin packages.

**Table 1** presents the product lineup.

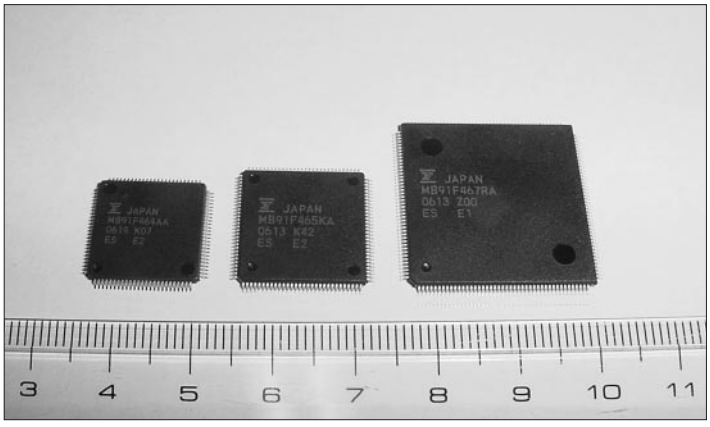
## Product Features

**Fig.2** presents a block diagram of MB91F467RA. The mounted resources offer the following features:

### FR60 core

These products adopt an FR60 core that has instruction compatibility with the FR Series. The FR60 core is a 32-bit RISC CPU core manufactured by FUJITSU. It enables high performance and low power consumption and is capable of

**Photo 1** External View



operation at a maximum operation frequency of 80MHz.

## Built-in Flash memory capacity

- MB91F464AA: 384Kbytes
- MB91F465KA: 512Kbytes
- MB91F467RA: 1Mbytes

Flash memory security supported

## Built-in RAM capacity

- MB91F464AA: 8Kbytes (data RAM), 8Kbytes (common RAM for instruction/data)
- MB91F465KA: Instruction cache 4Kbytes, 8Kbytes (data RAM), 8Kbyte (common RAM for instruction/data)
- MB91F467RA: Instruction cache 8Kbytes, 48Kbytes (data RAM), 16Kbytes (common RAM for instruction/data)

## CAN controller

Conforms to Parts A and B of CAN specification version 2.0. There are 32 or 64 built-in message buffers for data and ID with ranking. Supports communication speed up to 1Mbps.

- MB91F464AA/MB91F465KA: 1 channel, 32 message buffers
- MB91F467RA: 2 channels, 32/64 message buffers

## Various timers (MB91F464AA/MB91F465KA/MB91F467RA)

- 16-bit free-run timer: ×8 channels/8 channels/4 channels
- Input capture: ×8 channels/8 channels/4 channels
- Output compare: ×6 channels/8 channels/4 channels
- 8-/16-bit PPG: ×10 channels/12 channels/8 channels (at 8-bit selection)
- 16-bit reload timer: ×8 channels/8 channels/5 channels

## Various interfaces (MB91F464AA/MB91F465KA/MB91F467RA)

- LIN-supporting UART: ×5 channels/5 channels/7 channels
- $I^2C$ interface: ×1 channel/1 channel/3 channels
- External bus interface (Addr 24-bit, Data 16-bit): MB91F467RA
- SDRAM interface: MB91F467RA

## High-speed A/D converter

Sequential conversion A/D converter realizing conversion time of 1$\mu$s and 10-bit resolution

- MB91F464AA: 21 channels
- MB91F465KA: 26 channels
- MB91F467RA: 16 channels

**Figure 1** Lineup of MB91460 Series

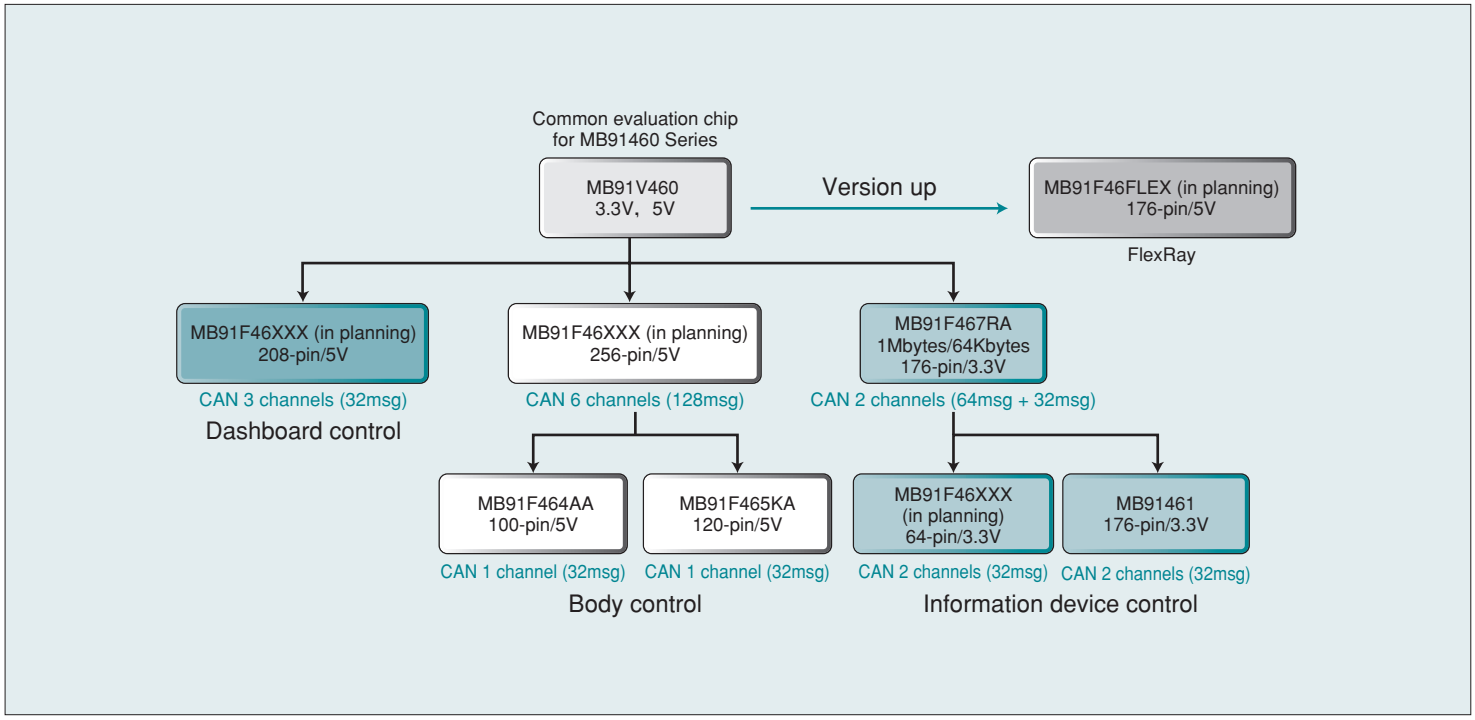


**Table 1** Product Lineup

| Product type | MB91F464AA | MB91F465KA | MB91F467RA |
|---|---|---|---|
| Flash memory | 384Kbytes | 512Kbytes | 1Mbytes |
| Instruction cache | — | 4Kbytes | 8Kbytes |
| Data RAM | 8Kbytes | | 48Kbytes |
| Instruction/data common RAM | 8Kbytes | | 16Kbytes |
| DMA | 5 channels | | |
| CAN | 1 channel (32msg) | | 2 channels (64msg+32msg) |
| LIN-UART | 5 channels | | 7 channels |
| $I^2C$ | 1 channel | | 3 channels |
| A/D converter | 21 channels | 26 channels | 16 channels |
| External interrupt | 10 channels | | 16 channels |
| 8-/16-bit PPG timer | 10 channels | 12 channels | 8 channels |
| 16-bit reload timer | 8 channels | | 5 channels |
| 16-bit free-run timer | 8 channels | | 4 channels |
| ICU | 8 channels | | 4 channels |
| OCU | 6 channels | 8 channels | 4 channels |
| Real-time clock | ○ | | |
| Watchdog timer | ○ | | |
| External bus/SDRAM interface | — | | ○ |
| Package | LQFP-100 | LQFP-120 | LQFP-176 |
| Power supply voltage | 3.0V to 5.5V | | 3.0V to 3.6V, 4.5V to 5.5V |

## Low power consumption mode (sleep/stop/shutdown mode functions)

The low power consumption modes are sleep mode (program stops) and stop mode (device stops). Shutdown mode (power supply is cut) is only incorporated in MB91F467RA. In shutdown mode, the power supply to all parts except RAM (64Kbytes) and the shutdown control circuit is cut off. In this way, standby current consumption can be reduced dramatically.

## 3V/5V pins (MB91F467RA)

Although the CPU power supply is 3V, the 3V/5V pins are divided into three blocks and a pin setting for 3V or 5V can be provided for each block.

(For details regarding setting, please refer to the hardware manual.)

## Other peripheral functions (MB91F464AA/MB91F465KA/MB91F467RA)

- External interrupt: ×10 channels/10 channels/16 channels
- DMAC: ×5 channels/5 channels/5 channels
- Real-time clock
- Watchdog timer

**Table 2** List of Development Tools

| | | |
|---|---|---|
| Hardware | Emulator main unit | MB2198-01 |
| | DSU cable | MB2198-10 |
| | Evaluation chip | MB91V460 |
| | Adapter board | * |
| | Header board | * |
| Software | SOFTUNE V6 Workbench | |
| | SOFTUNE V6 C Compiler | |
| | SOFTUNE V6 Assembler | |
| | SOFTUNE V6 C/C++ Analyzer | |
| | SOFTUNE V6 C Checker | |
| | SOFTUNE V6 REALOS/FR | |

* under developing

- Low voltage detection circuit: MB91F464AA, MB91F465KA
- Power-supply voltage:
  3.0V to 3.6V/4.5V to 5.5V (MB91F467RA)
  3.0V to 5.5V (MB91F464AA/MB91F465KA)
- Package: MB91F464AA: FPT-100P-M07 (LQFP 100 pins)
  MB91F465KA: FPT-120P-M07 (LQFP-120 pins)
  MB91F467RA: FPT-176P-M07 (LQFP-176 pins)

## Development Environment

Like the conventional FR Series, these products are supported by FUJITSU integrated development environment SOFTUNE™ V6. SOFTUNE V6 application software is designed to simplify programming tasks in order to meet the diversified needs of program designers.

**Table 2** lists the development tools and **Fig.3** the development environment configuration. *

**NOTES**

* SOFTUNE is a trademark of FUJITSU LIMITED.

**Figure 2** Block Diagram

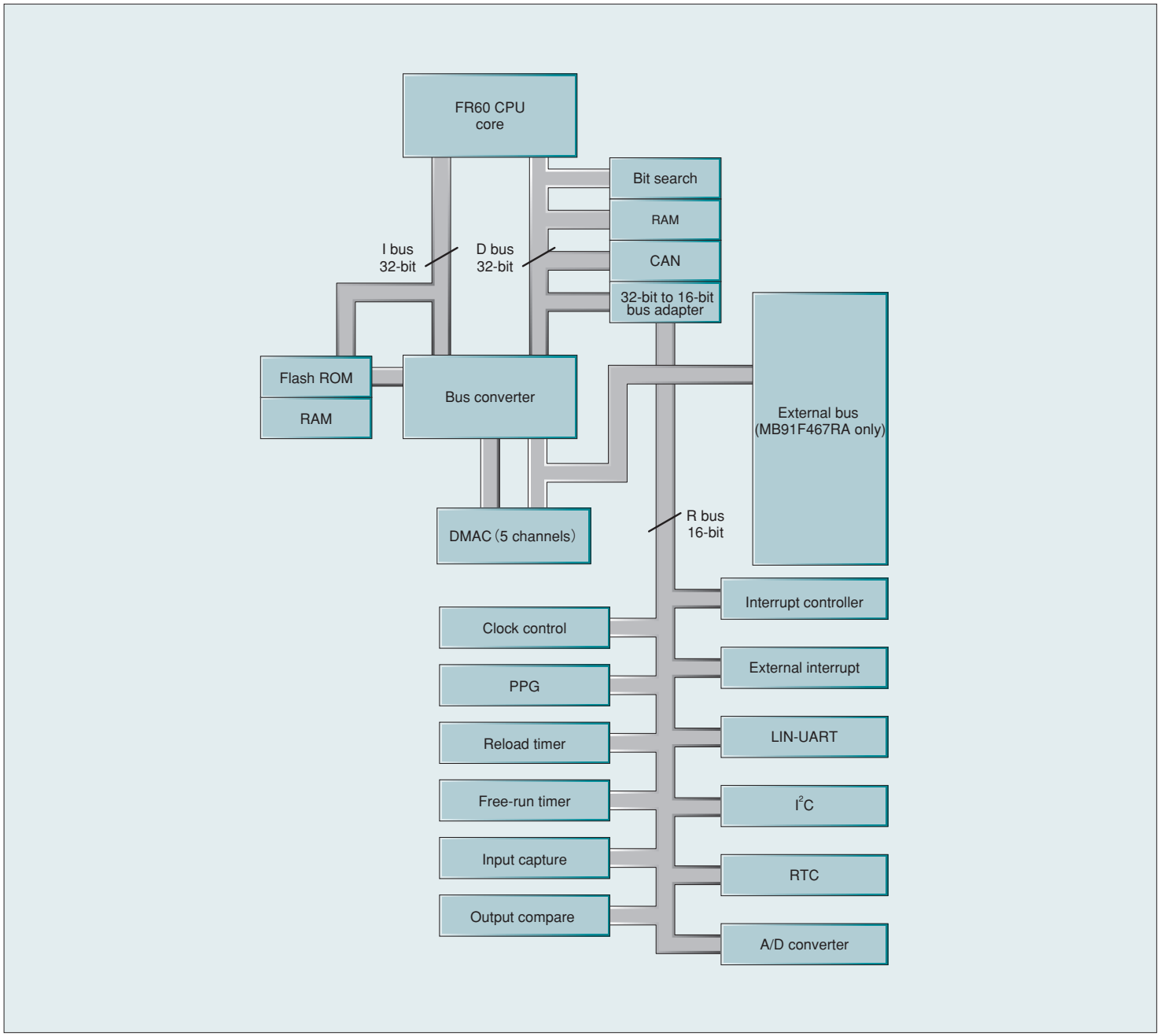


**Figure 3** Development Environment Configuration Diagram