FR60Lite Series 32-bit Microcontroller Mounted with the highest-speed A/D Converter in the Industry **MB91260 Series**

A microcontroller using a 32-bit RISC CPU from the FR60Lite Series.
With its high-speed product-sum macro, multi-function timer, and A/D converter at 12 inputs/3 units, this new product is optimal for devices requiring inverter control.

Overview

This new microcontroller is configured with a core 32-bit RISC CPU from FR60Lite Series, making it ideal for inverter control. Besides its high-speed product-sum macro and multi-function timers configured with input capture, output compare and a waveform generation circuit, the device is mounted with A/D converters at 12 inputs/3 units. The microcontroller function is suited for a wide range of appliances, including home appliances that require inverter control (such as air conditioners and washers), as well as devices requiring system control (such as printer engines, automobile audio products, pachinko products, and so on).

Fig.1 shows FUJITSU's line-up of microcontrollers with built-in multi-function timers.

Features

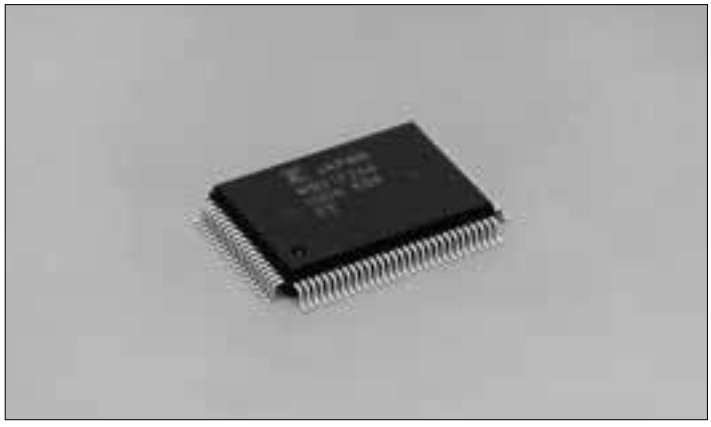
Repletion of Resources Suited to Inverter Control

12-Channel 10-bit High-Speed A/D Converter Mounted
(2 inputs×2 units +8 inputs×1 unit)

This product is configured with 12 channels (8 channels+2 channels+2 channels) and a series of built-in, high-speed A/D converters with conversion times of 1.2 μs at minimum (at machine clock operation of 33MHz, with sampling time included). The function to interlock with the multi-function timer is ideal for applications requiring inverter control.

The high-speed A/D converters are capable of interlock startup with the free run timer in the multi-function timer section (output compare function) and DMAC transfer.

Photo 1 External View



With these functions, inverter control can be efficiently executed by detecting the current running in the protection resistance section of the motor-driving element and controlling the rotation element position.

In interlock with the free run timer (output compare function), the device can execute delay startup from the same point, or startup at the compare clear match and zero-detection point. A/D startup point adjustment is also possible.

Multi-Function Timer Mounted

This product consists of the following.

- 16-bit free run timer×1
- 16-bit output compare×6
- 16-bit input capture×4
- 8/16-bit PPG timer×8
- Waveform generator×1
- A/D startup compare×2

The microcontroller can generate carrier frequency, basic signals, and non-overlap signals, and is designed to perform various signal controls (waveform generator section) required for inverter control.

The product can output 12 separate waveforms, and measure input pulse width/external clock cycle.

Timer Macro Repletion

Besides the multi-function timer, three different types of timers are built in.

- PWC timer×2
- Reload timer×3
- U timer×3

High-Speed Product-Sum Macro Mounted

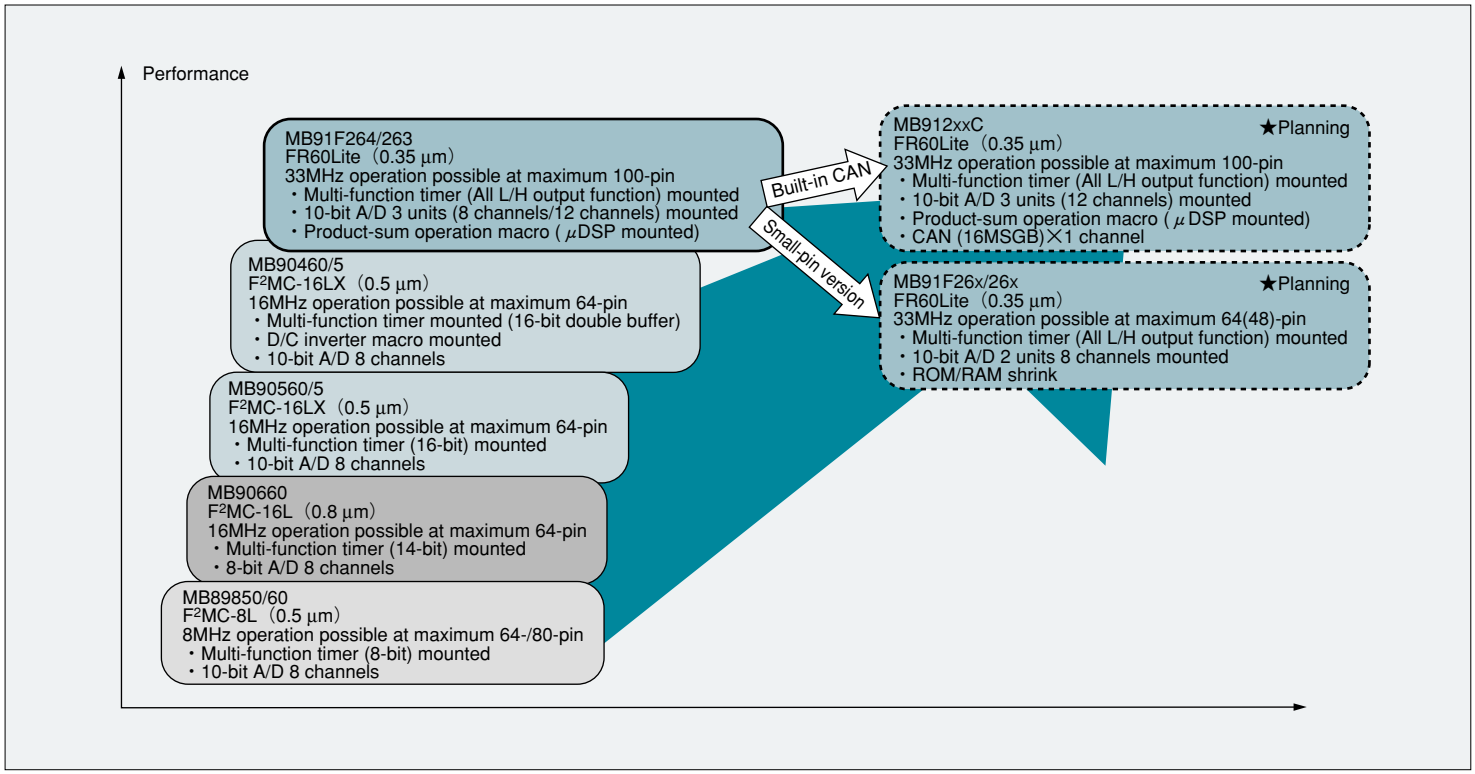
With its high-speed product-sum macro, MB91260 is optimal for purposes that require high-speed operation processes. It is possible to operate completely in parallel with the CPU.

The ability to execute 16 bits×16 bits+40 bits product-sum operation in a single cycle (33MHz at maximum) qualifies the product for application to sound processing, as well as image processing operations such as filter, FFT, and DCT. As an added feature, a 256-word command RAM, 64-word X-RAM, and 64-word Y-RAM are all built in.

FR60Lite Core Adopted

The product adopts an FR60Lite core which is compatible with our CPU core FR Series.

Figure 1 Line-up of FUJITSU's Microcontrollers with Built-In Multi-Function Timers



Other Built-in Peripheral Functions

Built-in RAM/ROM Density and ROM Type

The following types are now in the development pipeline.

- MB91263: RAM···8K bytes
  Mask ROM···128K bytes
- MB91F264: RAM···8K bytes
  Flash Memory···256K bytes

External interrupt input: 10 channels

DMAC (DMA Controller): 5 channels

Watchdog timer

Low power consumption mode: Sleep/stop function

Power supply: 4.0V to 5.5V

Package: FPT-100P-M06

Multi-Function Timer Macro

With the use of the multi-function timer macro, the product can generate the triangular modulation waveforms used in most general-purpose inverters.

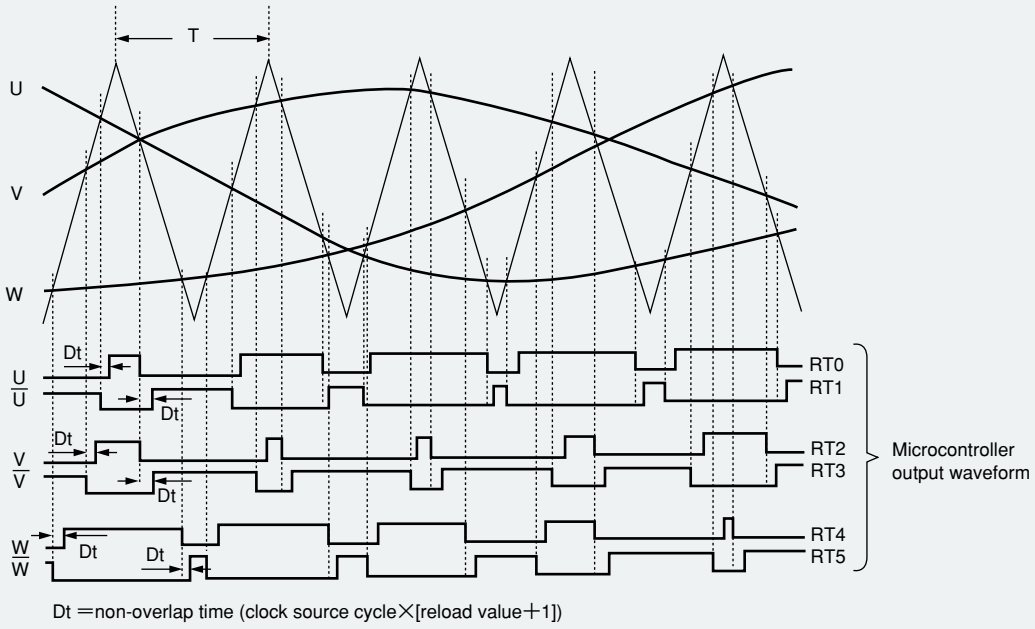
As an example, **Fig. 2** shows the waveform output required for generating triangular modulation (double-edge modulation) PWM using a triangular wave as a carrier. According to this figure, the basic signals of U/V/W phase are realized with one 16-bit free run timer and 3 compare registers. In addition, dead time can be generated by three 16-bit timers.

Fig. 3 shows the outline of the internal configuration of the multi-function timer, and **Figs. 4** and **5** show the block diagram and pin assignments.

Applicable Applications

This product offers excellent CPU capabilities of FR60Lite, a rich group of timers, a multi-channel, high-speed A/D converter, and 5V I/O. With these functions, this product can be used in wide range of purposes not only in inverter-related

Figure 2 Example of Waveform Generation for Triangular Wave Modulation PWM



products such as refrigerators, washers and air conditioners, but also in printer engines, automobile audio products, electronic products, pachinko products, coin mechs, and so on.

Development Environment

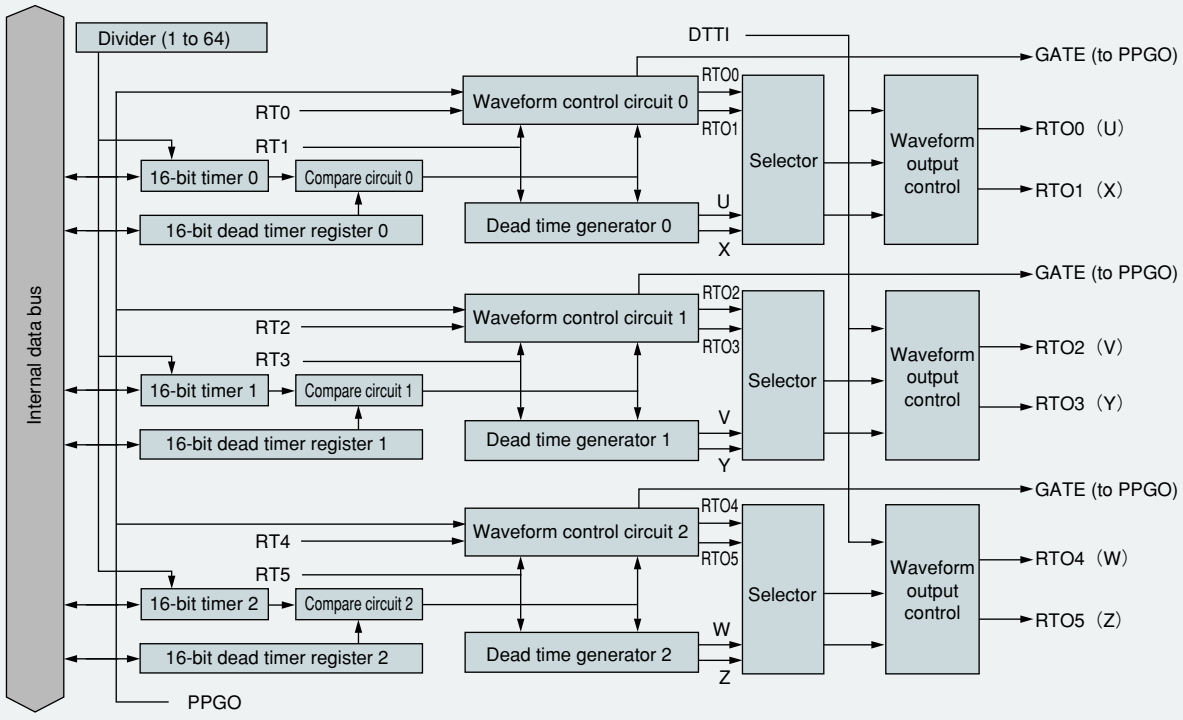
This product is supported by SOFTUNE™ V5/V6, a FUJITSU integrated software development environment. Likewise conventional FR Series, SOFTUNE V5/V6 application software is designed to simplify programming tasks to meet the diversified needs of program designers. A special evaluation board that permits real-time debugging is in the development pipeline.

Table 1 lists available development tools. *

NOTES

* SOFTUNE and REALOS are trademarks of FUJITSU LIMITED.

Figure 3 Outline of Multi-Function Timer's Internal Configuration



Example of basic signal (U, V, W) generation

PPG0: Corresponds to PPG ch.0, event input such as chopper waveform.
RT0 to 5: Corresponds to output compare output 0 to 5.

Figure 4 Block Diagram

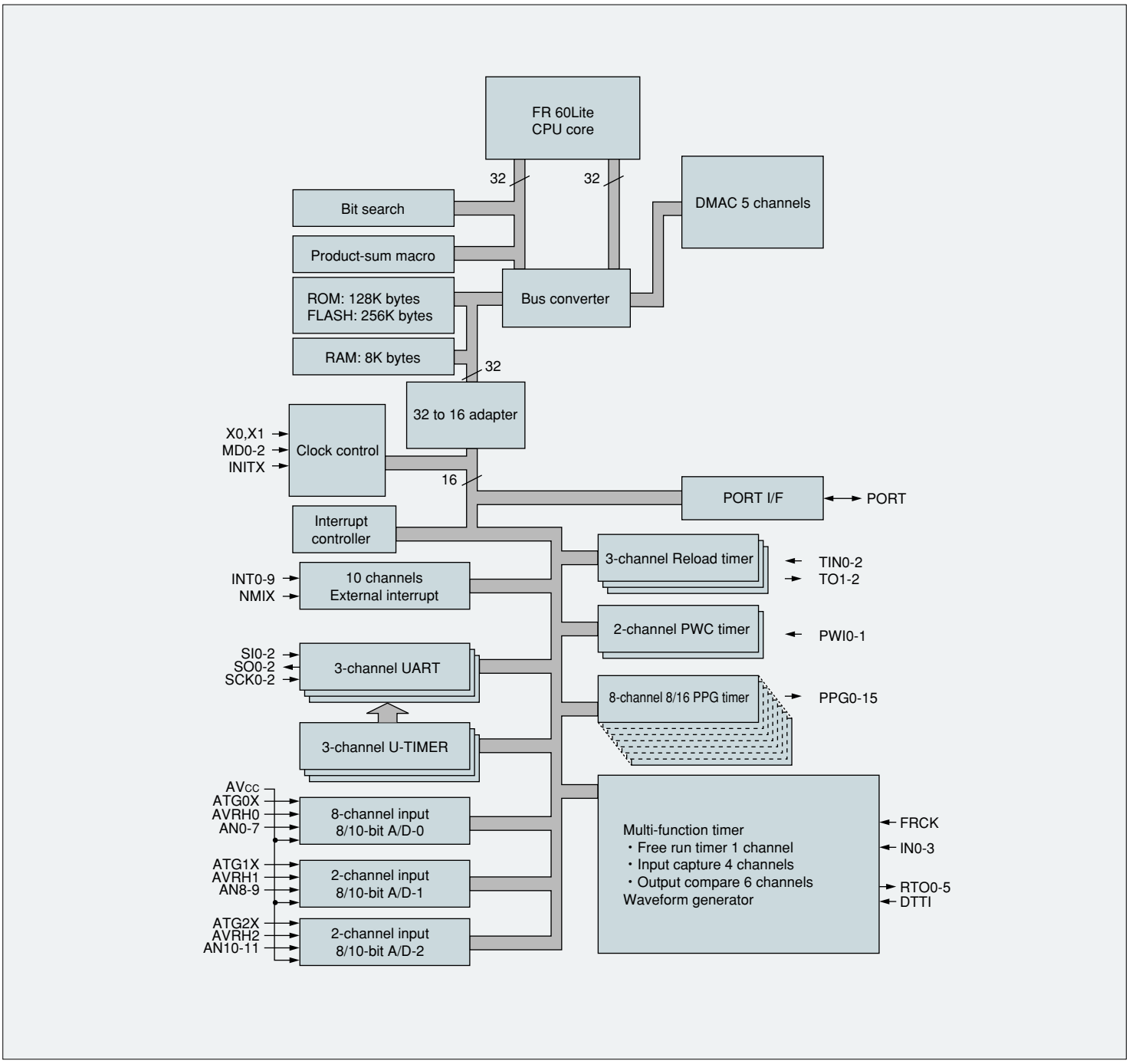


Figure 5 Pin Assignments

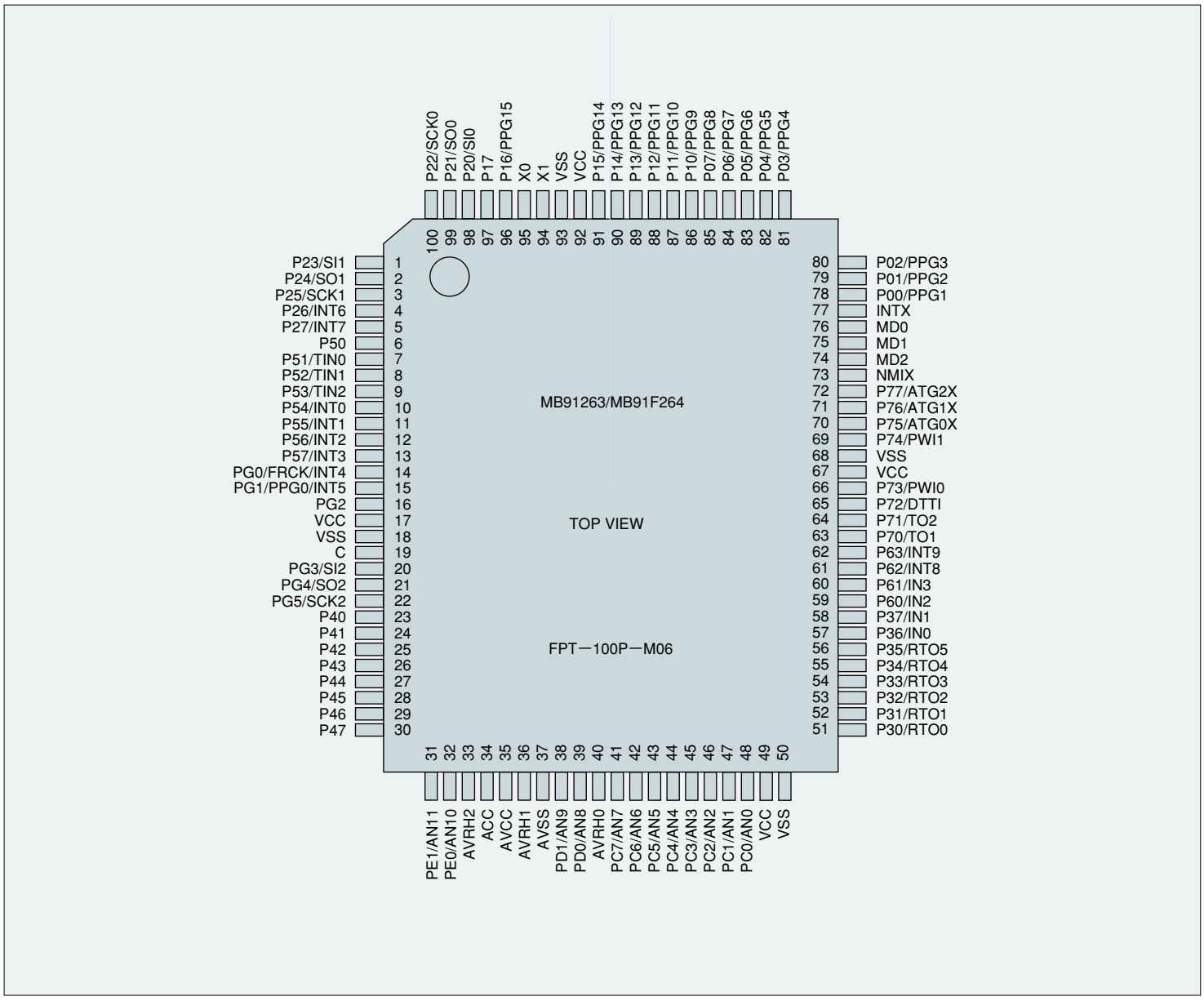


Table 1 Development Tools

Hardware	Emulator	MB2198-01
	Adapter board	MB2198-120
	Our evaluation board	In the works
Software	SOFTUNE V5/V6 Workbench	
	SOFTUNE V5/V6 C Compiler	
	SOFTUNE V5/V6 Assembler	
	SOFTUNE V5/V6 C Analyzer	
	SOFTUNE V5/V6 C Checker	
	SOFTUNE V5/V6 REALOS/FR	