THE POSSIBILITIES ARE INFINITE

FUJITSU

FR Family

32-bit Original Architecture Embedded Controller

FR Family — New-Generation Microcomputers with Extensive Specifications

FR Family 32-bit Microcontrollers

- **Architecture designed exclusively for embedded applications**
- **Featuring both the ease of use of 16-bit microcontrollers and the high performance of 32-bit RISC**
- **Featuring both advanced functions and ease of use**

The FR Family was designed specially for embedded device control.
These 32-bit RISC controllers feature Fujitsu' original architecture, optimized for embedded applications.
The FR Family offers RISC's high-processing performance, a wealth of
resources that rivals that of 8-bit or 16-bit microcontroller, and better cost performance.
By optimizing the FR Family for embedded applications,
Fujitsu resolved the problems that customers commonly face when shifting from 8-bit and
16-bit units to RISC (such as insufficient resources, inadequate commands, and enlarged code size).
The FR Family features bus architecture that allows the integration of resources
available to the Fujitsu F^{2}MC-16 Family of 16-bit microcontrollers and uses
the 16-bit fixed-length commands required for such integration.
Furthermore, added commands address bit operation, peripheral control, direct memory-to-memory
transfer, and stack generation/release, to ensure optimum overall operation.
While as easy to use as any 8-bit or 16-bit microcontroller,
the FR Family also offers high code efficiency and the superb performance of RISC.

FR Family

Conventionally, products such as ink-jet printers, filing systems, audio-video equipment, and musical instruments functioned using 16-bit microcontrollers. However, manufacturers of these products are presently facing inadequate CPU performance and are now demanding better-performing microcontrollers.

For workstations and some personal computers, a new architecture referred to as "RISC" was adopted soon after it was introduced. RISC discarded certain complex commands that were infrequently used, as well as functions that could be executed by combining a number of simple commands, and commands that could not be executed per clock, incorporating into RISC architecture all remaining commands as hardware commands.
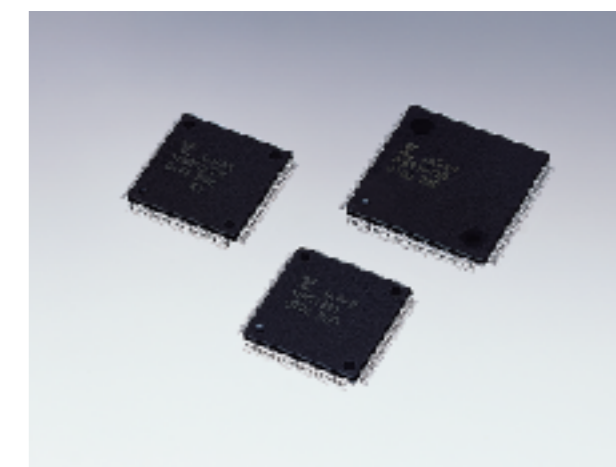
The use of RISC has dramatically boosted the performance of workstations, but it was first necessary to solve a number of problems in order to use RISC in embedded devices.

One of the problems with the use of RISC in embedded devices was its lack of sufficient commands for embedded applications. Many of the commands that were omitted in RISC due to infrequent use in workstations and personal computers are regularly used in embedded devices. These commands include those dealing with memory-to-memory transfer and bit management.
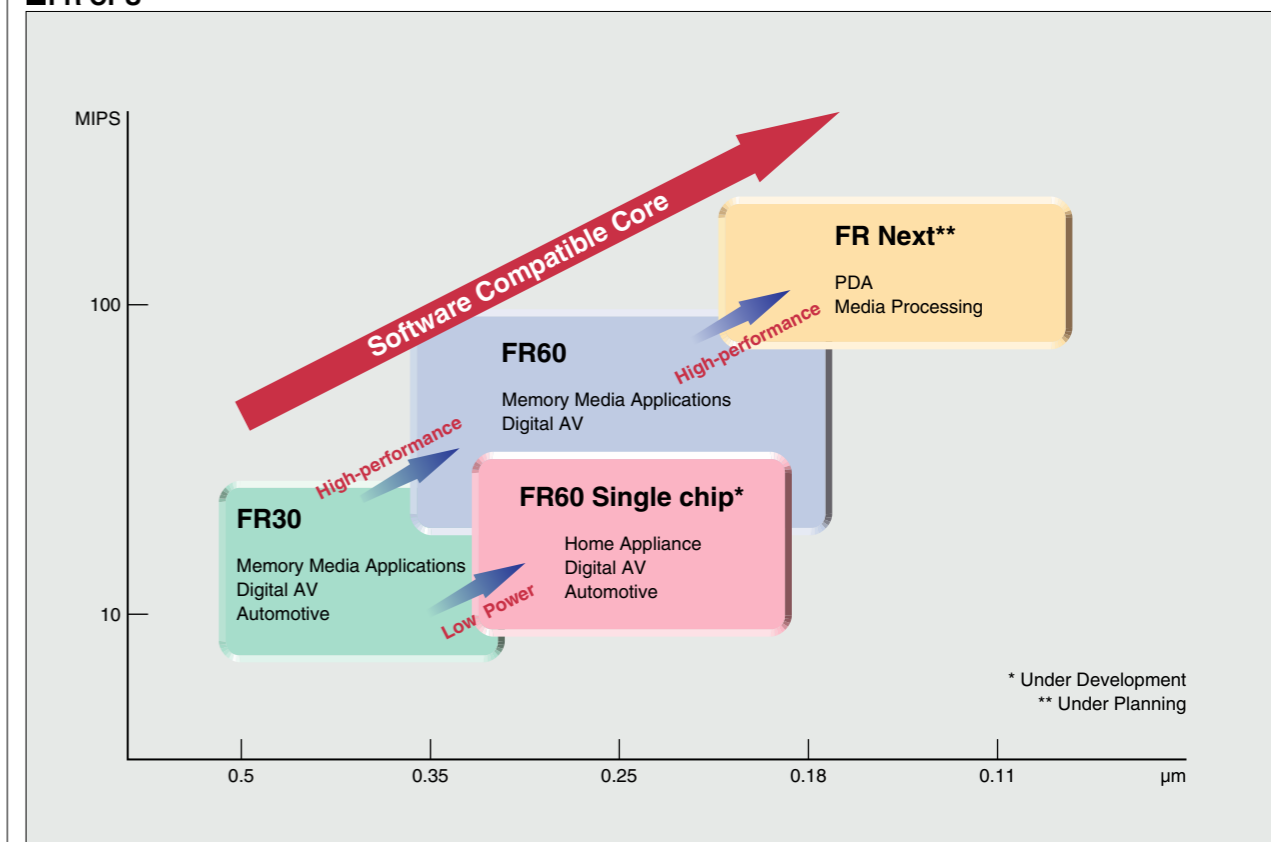
Object code efficiency posed another problem. Since workstation RAM sizes are on the order of several hundred megabytes and hard disks feature capacities of several gigabytes, high-speed operation and efficiency are top priorities. For embedded devices, however, there are cost pressures, and it thus becomes necessary to limit memory size. These challenges gave rise to efforts to develop a RISC architecture suitable for use in embedded devices.

To satisfy these market demands, Fujitsu has developed the "FR Family," which combines 8-bit and 16-bit technologies for personal equipment via the F^{2}MC Family. The FR Family features new RISC architecture designed exclusively for embedded devices, which has been incorporated into our high-performance embedded controllers ever since we introduced these controllers to the market.

The FR Family is widely used in electronic musical instruments, digital still cameras, and navigation system–sall of which previously used 16-bit controllers–as well as in multimedia systems and other new applications.

■FR CPU

MIPS

Software Compatible Core

FR Next**
PDA
Media Processing

FR60
Memory Media Applications
Digital AV

FR60 Single chip*
Home Appliance
Digital AV
Automotive

FR30
Memory Media Applications
Digital AV
Automotive

High-performance
Low Power

100

10

* Under Development
** Under Planning

| 0.5 | 0.35 | 0.25 | 0.18 | 0.11 | μm |

Microcontrollers Optimized for Embedded Devices

Offering Advanced Functions and Ease of Operation at a Low Price

Features

The FR Family of products consists of new-generation microcontrollers featuring the superb processing capacity of RISC and the embedding functions of 16-bit technology. To respond to future specification requirements, the architecture of the FR Family was designed specifically for embedded applications based on the following goals: (1) Advanced processing capacity; (2) Addition of commands necessary for embedded applications onto a RISC command base; (3) High object efficiency; and (4) Abundant peripheral functions.

(1) Advanced processing capacity

The CPU has a high processing capacity of 1.25 commands per clock (Dhrystone benchmark core functions). When operating at 50 MHz, core performance reaches 64 VAX MIPS. To efficiently drive the 5-stage pipeline, the internal buses incorporate the Harvard bus architecture, similar to such high-performance RISC processors as SPARC. These features, combined with such functions as a multiplier, a program counter adder, and barrel shifter, enable the FR Family of products to provide the same superior degree of performance as conventional RISC processors.

(2) Additional commands necessary for embedded applications

Based on what is called load/store architecture, standard RISC undertakes external access via load and store alone. Additionally, embedded microcontrollers require a number of frequently used commands to be combined. For the development of the FR Family, Fujitsu surveyed a wide range of memory-access methods and commands that were frequently used in embedded applications, then added such commands as memory-to-memory transfer, peripheral resource control, bit management, immediate data command, and barrel shift. Furthermore, in anticipation of the growing size of system applications, the need for shorter development periods, and increased use of the high-level C Language in development applications, Fujitsu provided commands to perform stack

frame generation/release and simultaneous loading and storing of multiple registers into the stack at function call entry and exit. Although one of the features of RISC is that some of these commands cannot be incorporated into its hardware-wiring commands, Fujitsu nevertheless considers them essential for embedded applications. As a result, the FR Family supports 160 such commands, rivaling the performance of an 8-bit microcontroller.

(3) High object efficiency

Through the use of compact 16-bit fixed-length commands and a group of 160 commands that are suitable for embedded applications, the FR Family has achieved the same level of object efficiency as a 16-bit microcontroller. High object efficiency means a reduced number of external-memory access operations and less cache usage, resulting in a lower external bus load, improved cache efficiency, and more efficient operation of the high-performance CPU core.

(4) Abundant peripheral resources

The FR Family incorporates buses that are electrically equivalent to those of Fujitsu's 16-bit F^2MC-16 Family of microcontrollers (R-BUS in the block diagram). When connected to these buses, the FR Family can use resources widely available to the F^2MC-16 Family (with the exception of resources that require direct FR bus connection and high-speed operation, such as DMA and DSP resources). Furthermore, incorporating FR Family into ASIC as a CPU core (as currently planned), can be achieved from the various macros according to their uses.

Macro examples: A/D, D/A, UART, serial, timer/counter, I^2C, CAN, PWM, and so on

■ Internal block diagram of FR
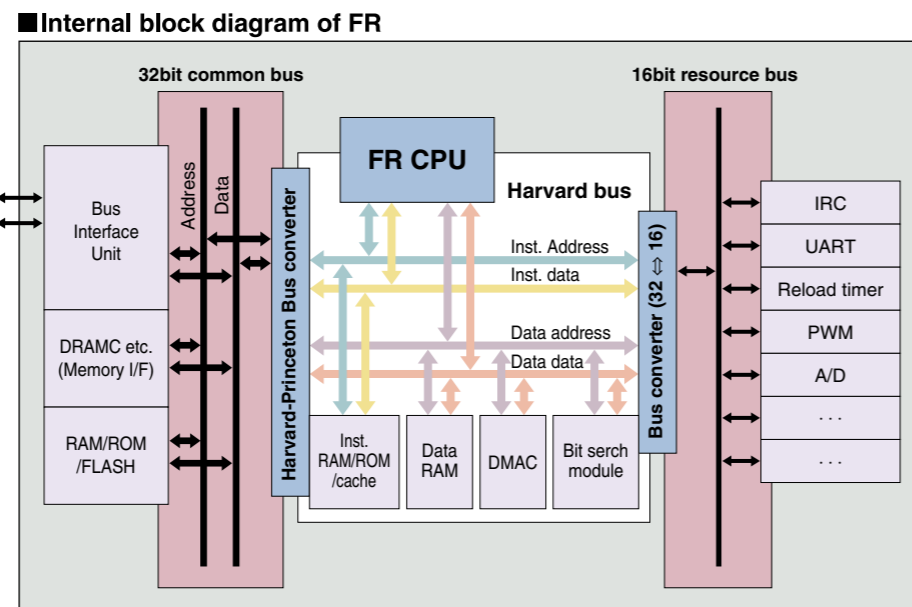
FR Family product lineup

The FR Family of controllers were developed exclusively for embedded applications. FR products combine the high performance of 32-bit RISC with the superb features of 16-bit microcontrollers, such as low price, low power consumption, and extensive resources. These controllers incorporate a PLL for internal multiplication of a low-frequency clock resonator input. For example, the MB91101 model is capable of multiplying an external signal of 12.5 MHz to 50 MHz internally. The FR Family is equipped with the STOP and SLEEP power management function, as well as a clock gear function, which can independently vary the frequencies of the CPU and peripheral system.

FR30 Series

MB91101A
• 64 VAX MIPS at 50 MHz core performance
• Built-in DRAM memory interface (such as for EDO-RAM)
• Internal regulator for use with 5-V or 3-V systems.

MB91106A
• MB91101A   127 KByte of built-in ROM

MB91107/108
• 64 VAX MIPS at 50 MHz core performance
• Built-in large-capacity RAM for high-speed data processing and program execution
  (MB91107: 128 KByte, MB91108: 160 KByte)
• Built-in DRAM memory interface (such as EDO-RAM)

MB91F109
• MB91106   254 KByte built-in FLASH

MB91121
• 64 VAX MIPS at 50 MHz core performance
• High-speed internal product-sum operation function
  (parallel processing with CPU possible: computation time/cycle[s])

MB91110
• 64 VAX MIPS at 50 MHz core performance
• 16-KByte built-in RAM capable of executing fetch instructions at cache speed
• 5-V interface compatibility, for use of conventional external interfaces without modification

MB91F127/F128
• Large-capacity built-in FLASH/RAM
  (FLASH: 256 KByte/510 KByte, RAM: 14 KByte)
• Built-in general-purpose I/O resources
  (UART, A/D, Timer, ICU, OCU, etc.)
• Compact 100-pin package (14 mm × 14 mm) for system miniaturization

MB91133/F133A
• Internal up/down counter for 3-phase PWM waveform generation macro and 2-phase encoder waveform input
• 5-V interface compatibility for use of conventional external interfaces without modification

MB91154/F154/F155A
• Large-capacity built-in ROM/RAM
  (FLASH/ROM: 512 KByte, RAM: 32 KByte)
• A wealth of built-in I/O resources (10 types, including UART, A/D, D/A, Timer, ICU, OCU, and I2C)
• Built-in RTC for calendar function

FR50 Series

MB91F362GA/F369GA
• Large-capacity built-in FLASH (FLASH: 512 KByte)
• Internal regulator for operation with single 5-V power supply
• Built-in CAN (in conformity with Ver. 2.0, parts A and B) for flexible setting of acceptance filter

FR60 Series

MB91301
• Various built-in memory interfaces
  (SDRAM, page ROM/FLASH, FCRAM)
• 4-KByte built-in instruction cache for improved performance
• Incorporation of selected general-purpose I/O resources
  (UART, A/D, Timer, etc.)

MB91307A
• Large-capacity built-in RAM for high-speed data processing and program execution (128 KByte)
• Incorporation of selected general-purpose I/O resources
  (UART, A/D, Timer, etc.)

MB91340
• Large-capacity built-in RAM for high-speed data processing and program execution (112 KByte)
• Stepping motor control possible by combining up/down counter, timer, D/A, and waveform data transfer function
• A wealth of built-in I/O resources
  (UART, A/D, D/A, Timer, ICU, OCU, etc.)

A Wide Range of Development Environments for Embedded Applications

Development environments

The FR Family features abundant development environments, including cross-development environments, in-circuit emulators, OS, and various libraries.

Cross-development environments

● Fujitsu

High object efficiency and superb performance can be achieved by taking advantage of the FR Family's unique high-level language and commands, designed specifically for embedded applications. The FR Family adapts to all types of environments, including the emulators made by Fujitsu and OS, as well as to various libraries. When the Fujitsu SOFTUNE integrated development environment is employed, it becomes possible to execute repeated tasks performed in application software development for microcontrollers, such as coding, compiling, and debugging simply by pressing a button, greatly enhancing the software development environment. Moreover, the SOFTUNE V5 offers a C++ compiler. A cross-development environment can also be linked with the state transition table CASE tool, such as ZIPC and RiMC, the upstream UML tool, such as Rose, and the state transition diagram tool, such as StatemateMAGNUM.
< Fujitsu Limited >

● Gaio Technology

Gaio Technology's cross tool features a general-purpose structure; therefore, without changing the development environment, it can support all MPUs through definition replacement. This general-purpose structure is used not only by compilers for source code processing but also by debuggers and simulators. The company also offers a system simulator which graphically displays system operation panels. < Gaio Technology Co., Ltd. >

● Green Hills Software

This tool permits generation of superior code through optimization from the C/C++ compiler. The use of the MULTI integrated development environment enables reduction of development times and improvements in the performance and quality of application programs.
< Advanced Data Controls Corporation >

Middleware libraries

● JPEG baseline processing library

The JPEG baseline processing library compresses and decompresses color images in conformity with the international color still image encoding standard.
< Fujitsu Limited / Arctechnology Inc. >

● MH/MR/MMR library

As a standard of G3 and G4 FAX, the MH/MR/MMR library compresses and decompresses binary images. The coding system complies with ITU Recommendations T.4 and T.6.

< Arctechnology Inc., Ltd. >

● 2D graphic library

2D graphic library is a library for drawing graphic forms in 2D. In addition to the basic drawing functions with points, lines, and polygons, Fujitsu's 2D graphic library offers character and image manipulation capability. < Fujitsu Limited >

Multitask OS

● REALOS/FR

This real-time OS, which conforms to the µITRON 3.0 specification, features a compact code size (kernel code size: 2.7 KByte to 8.4 KByte). Fujitsu's SOFTUNE and Yokogawa Digital Computer's micro VIEW-G are standard-equipped with a multitask debugging function. No loyalty fee is required.
< Fujitsu Limited >

● osCAN FR (Vector Japan)

osCAN FR is a real-time OS for automobile applications based on open software specifications, and complies with OSEK/VDX. It is comprised of three modules: the OSEK-OS (operating system), OSEK-COM (communication module), and OSEK-NM (network management module). By using the OIL Configurator (an OSEK function-building tool) for conformance class selection, an OS of appropriate scale may be easily constructed.
< Vector Japan Co., Ltd. >

● Tornado/VxWorks (Wind River)

This is an advanced-function real-time OS with an excellent track record and an easy-to-use development environment (Tornado). The Tornado development environment enables the easy establishment of a VxWorks-applied system that is best suited to a given application. < Wind River Systems, Inc. >

In-circuit emulators for the FR Family

● MB2198-01

The MB2198-01 emulator can be used for all FR Family models. Thanks to its simplified functions, this emulator is offered at a low price. < Fujitsu Limited >

● advice

The extensive line of "advice" full-spec emulators is highly regarded in the market. Micro VIEW-G debugging software is also available. < Yokogawa Digital Computer Corporation >

● UniSTAC

A wide range of highly acclaimed UniSTAC full-spec emulators is available, as well as the WATCH-POINT debugging software.
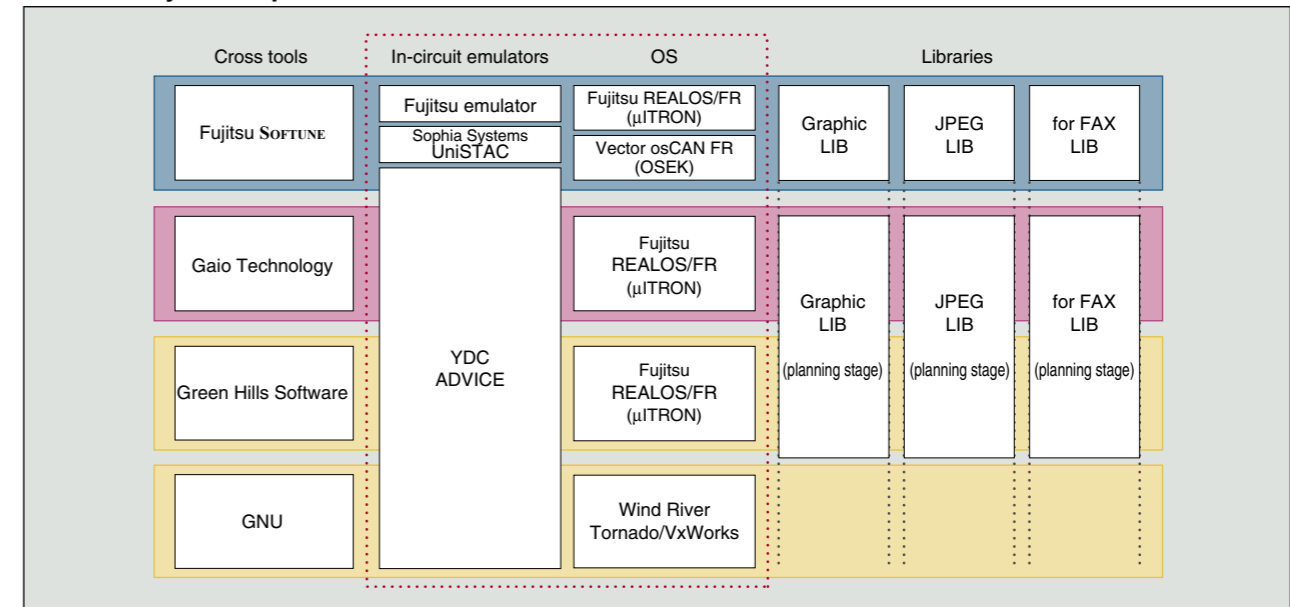< Sophia Systems Co., Ltd. >

Evaluation board for the FR Family

The evaluation board for the FR Family is equipped with an SRAM/DRAM. Featuring a dual-board structure with a mother board and a daughter board, it can be adapted to a variety of models simply via replacement of the daughter board.
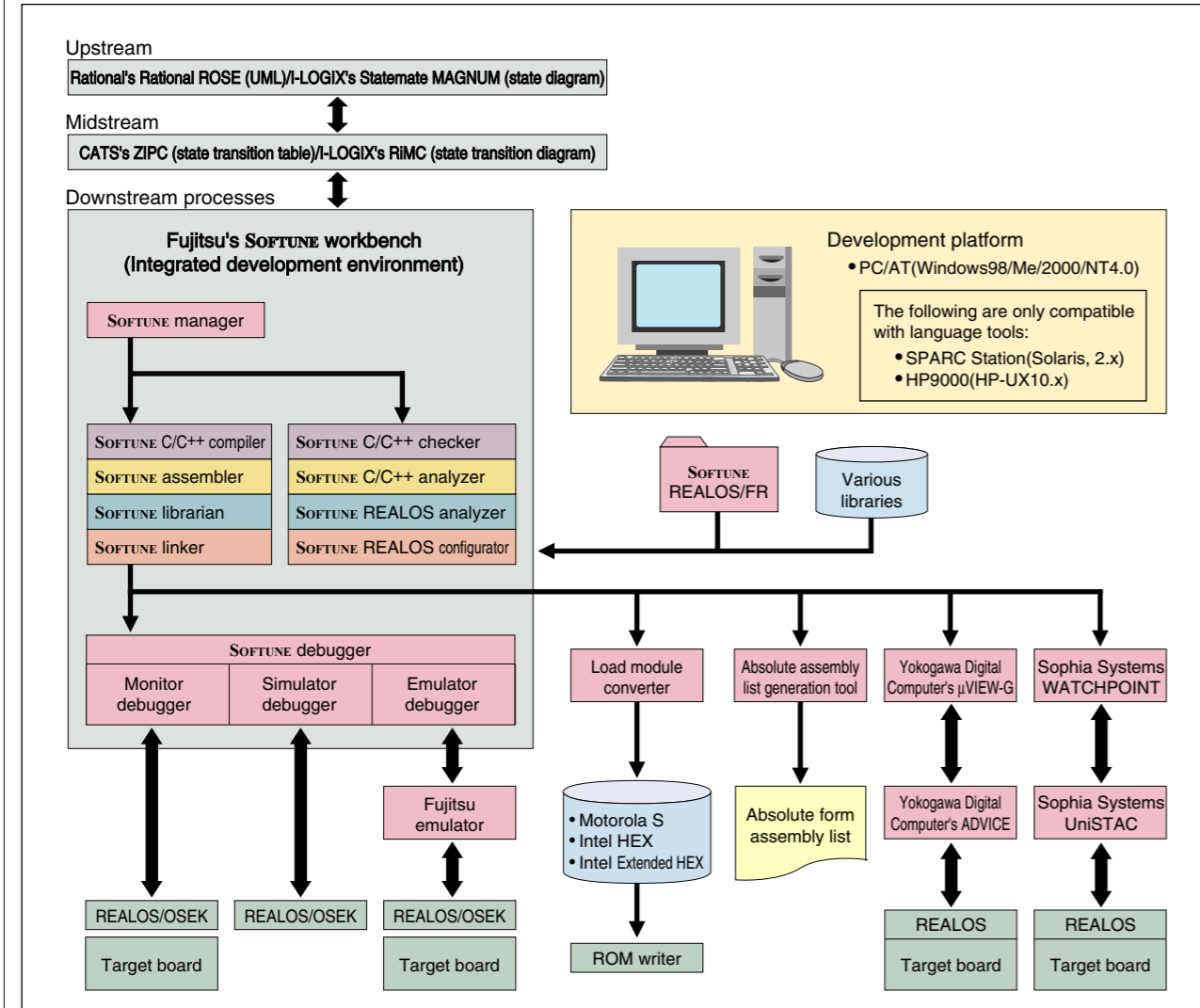< Fujitsu Limited >

■ FR Family development environments

Cross tools	In-circuit emulators	OS	Libraries		
Fujitsu SOFTUNE	Fujitsu emulator / Sophia Systems UniSTAC	Fujitsu REALOS/FR (µITRON) / Vector osCAN FR (OSEK)	Graphic LIB	JPEG LIB	for FAX LIB
Gaio Technology		Fujitsu REALOS/FR (µITRON)	Graphic LIB (planning stage)	JPEG LIB (planning stage)	for FAX LIB (planning stage)
Green Hills Software	YDC ADVICE	Fujitsu REALOS/FR (µITRON)			
GNU		Wind River Tornado/VxWorks			

Example of development environment based on Fujitsu's SOFTUNE®

■ Development environment based on Fujitsu's SOFTUNE®

Upstream
| Rational's Rational ROSE (UML)/I-LOGIX's Statemate MAGNUM (state diagram) |

Midstream
| CATS's ZIPC (state transition table)/I-LOGIX's RiMC (state transition diagram) |

Downstream processes

**Fujitsu's SOFTUNE workbench
(Integrated development environment)**

- SOFTUNE manager
- SOFTUNE C/C++ compiler
- SOFTUNE assembler
- SOFTUNE librarian
- SOFTUNE linker
- SOFTUNE C/C++ checker
- SOFTUNE C/C++ analyzer
- SOFTUNE REALOS analyzer
- SOFTUNE REALOS configurator

Development platform
- PC/AT(Windows98/Me/2000/NT4.0)

The following are only compatible with language tools:
- SPARC Station(Solaris, 2.x)
- HP9000(HP-UX10.x)

SOFTUNE REALOS/FR
Various libraries

SOFTUNE debugger
- Monitor debugger
- Simulator debugger
- Emulator debugger

- Load module converter
- Absolute assembly list generation tool
- Yokogawa Digital Computer's μVIEW-G
- Sophia Systems WATCHPOINT

Fujitsu emulator

- Motorola S
- Intel HEX
- Intel Extended HEX

- Absolute form assembly list
- Yokogawa Digital Computer's ADVICE
- Sophia Systems UniSTAC

| REALOS/OSEK | REALOS/OSEK | REALOS/OSEK | | REALOS | REALOS |
| Target board | | Target board | ROM writer | Target board | Target board |

■ Third-party vendors

Contact companies (developers)	Telephone No.	URL
Advanced Data Controls Corporation (Green Hills Software, Inc.)	03-3576-5351	http://www.adac.co.jp/ http://www.ghs.com/(GHS)
Gaio Technology Co., Ltd.	03-3662-3041	http://www.gaio.co.jp/
Vector Japan Co., Ltd.	03-5524-0902	http://www.vector-japan.co.jp/
Wind River Systems, Inc.	03-5778-6001	http://www.wrs.com/
Yokogawa Digital Computer Corporation	042-333-6222	http://www.ydc.co.jp/
Sophia Systems Co., Ltd.	044-989-7000	http://www.sophia-systems.co.jp/
Arctechnology Inc.	055-274-6171	http://www.arctech.co.jp
Communication And Technology Systems (CATS)	045-473-2816	http://www.zipc.com/
ITOCHU TECHNO-SCIENCE Corporation (I-LOGIX)	03-5728-7011	http://www.ctc-g.co.jp/
Nihon Rational Software Corporation	03-5642-9127	http://www.rational.co.jp/

Evaluation board for FR Family

Features

- The evaluation board may be used as a simple target board for the operation of an emulator. It is comprised of a main board and a daughter board. The main board can be used for all FR Family models.
- The evaluation board is packaged with SRAM, DRAM, and FLASH memory to enable the measurement of CPU performance. Additionally, by using the extension board connector on the main board, a hardware circuit can be configured.
- A ROM-substitute unit (MB2197-90) can be connected.
- Example of configuration using the MB2198-01 (emulator)
  MB2198-01 + MB2198-10 + MB91906EB (main board) + MB91901EB (daughter board)

Performance

- Operating conditions: 5-V power supply
- Memory access speed (with external bus clock at 25 MHz), SRAM (no-wait access, switchable 16-/32-bit data bus)
  DRAM (high-speed page mode, 16-bit data bus)
  FLASH memory (2-wait access, 16-bit data bus)
  Serial data transceiver (2-wait access, 16-bit data bus)

Configuration

- SRAM: 512 KByte
  128 K × 8.10 ns (MCM6726DWJ-10 equivalent) × 4 units
- DRAM: 8 MByte
  4 M × 16.60 ns EDO-type HM5165165TT-6 × 1 unit
- FLASH memory: 1 MByte
  512 K × 16.70 ns MBM29F800A-70 × 1 unit
- Interval timer (MB89254 equivalent × 1 unit)
- Serial data transceiver
  (MB89371A equivalent × 1 unit)

■ Main board

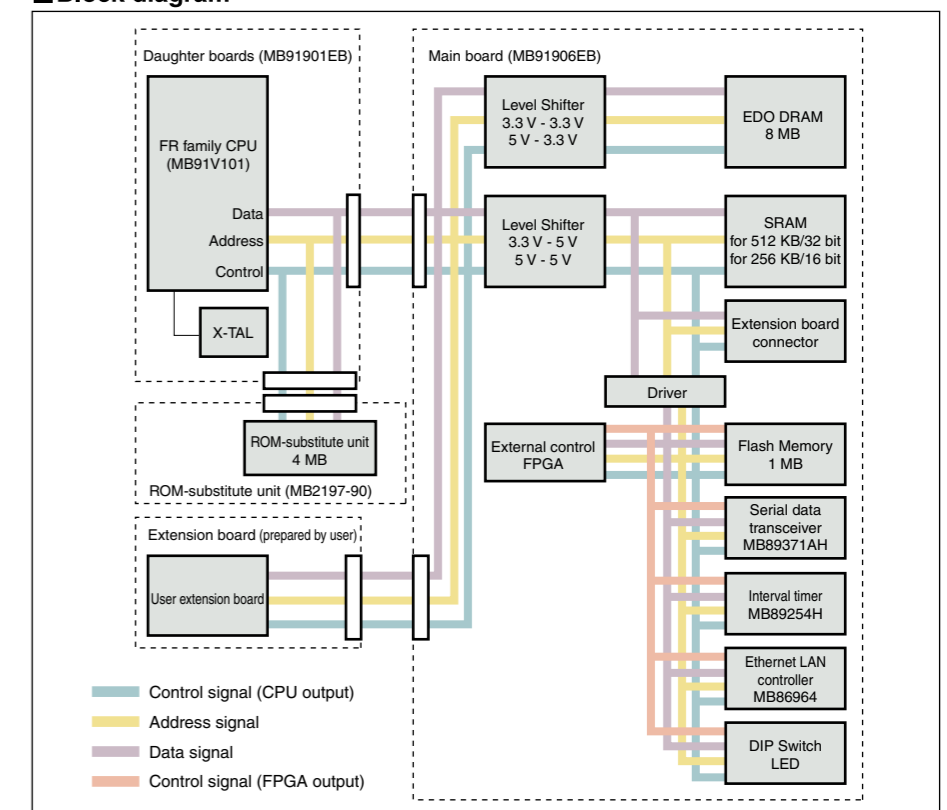| Name	Model	Remarks
Evaluation board for FR Family (main board)	MB91906EB	Must be used in combination with the mother board + daughter board (dual-board structure) Can be used for FR series (excluding the MB91130) that operate on a 5-V or 3-V power supply Replaces the MB91900EB (previous evaluation board for the FR Family) Provided with AC adapter (100 VAC)

■ Daughter boards

Name	Model	Remarks
Daughter board for MB91101A	MB91901EB	Can be connected to Fujitsu's ICE Can be used together with the main board (MB91906EB) Packaged with MB91V101A
	MB91902EB	Can be connected to Yokogawa Digital Computer's ICE for the MB91101A
Daughter board for MB91106/F109	MB91910EB	Must be used in combination with the main board (MB91906EB)
Daughter board for MB91107/108/121	MB91907EB	Can be connected to Fujitsu's ICE Must be used in combination with main board (MB91906EB). DRAM on main board can be used as a substitute ROM.
Daughter board for MB91110	MB91904EB	Must be used in combination with main board (MB91906EB)
Daughter board for MB91130	MB91908EB	Must be used in combination with main board (MB91906EB)
Daughter board for MB91150	MB91911EB	Must be used in combination with main board (MB91906EB)
Daughter board for MB91340	MB91912EB	Must be used in combination with main board (MB91906EB)
Daughter board for MB91362GA	MB91913EB	Must be used in combination with main board (MB91906EB)

■ Main board

Name	Model	Remarks
Simple target board for connection of ICE for MB91101A (FR30SRAM board)	MB91903EB	Must be used in combination with main board (MB91906EB) Packaged with MB91906EB. Can be connected to Fujitsu's ICE. RAM provided as standard equipment.

■ Block diagram

Daughter boards (MB91901EB)
Main board (MB91906EB)

- FR family CPU (MB91V101)
  - Data
  - Address
  - Control
  - X-TAL
- Level Shifter 3.3 V - 3.3 V 5 V - 3.3 V
- Level Shifter 3.3 V - 5 V 5 V - 5 V
- EDO DRAM 8 MB
- SRAM for 512 KB/32 bit for 256 KB/16 bit
- Extension board connector
- Driver
- ROM-substitute unit 4 MB
- ROM-substitute unit (MB2197-90)
- External control FPGA
- Flash Memory 1 MB
- Extension board (prepared by user)
- User extension board
- Serial data transceiver MB89371AH
- Interval timer MB89254H
- Ethernet LAN controller MB86964
- DIP Switch LED

- Control signal (CPU output)
- Address signal
- Data signal
- Control signal (FPGA output)

FR Family of products

FR30 Series

	Max. operating frequency	Clock multiplier	Power supply voltage	Internal ROM/RAM *	Built-in cache	External bus configuration	Memory I/F	DMAC	UART	A/D	Reload timer	PWM(PPG)	D/A	I²C	Up/down counter	Other functions	External interrupt	H/W Standby pin	PKG	EVA chip
MB91101A	50(In)/25(Ext)MHz	x 4	5V or 3.3V	D-RAM for DATA : 2KB	Instruction 1 KB												4ch + NMI	○	QFP-100, LQFP-100	MB91V101(DSU2)
MB91106A	50(In)/25(Ext)MHz	x 4	3.3V	D-RAM : 2KB I-ROM for Inst : 63KB C-ROM for : 64KB	–												4ch + NMI	–	QFP-100, LQFP-100	MB91V106(DSU3)
MB91107 MB91108	50(In)/25(Ext)MHz	x 4	3.3V	MB91107 : RAM 128KB MB91108 : RAM 160KB	Instruction 1 KB		SRAM, ROM/FLASH, DRAM	8ch(Ext 3ch)	3ch	10bit 4ch	16bit 3ch	4ch	–	–	–	–	8ch + NMI	–	LQFP-120	MB91V107(DSU2)
MB91F109	25MHz	x 2	3.3V	D-RAM : 4KB FLASH : 254KB	–	address : 25bit data : 8/16bit											4ch + NMI	–	QFP-100, LQFP-100	MB91V106(DSU3)
MB91121	50(In)/25(Ext)MHz	x 4	3.3V	D-RAM : 5KB	Instruction 1 KB											DSP(16 x 16 + 40)	4ch + NMI	○	LQFP-120	MB91V121(DSU2)
MB91110	50(In)/25(Ext)MHz	x 4	I/O 5V + CPU 3.3V	D-RAM : 5KB I-RAM : 16KB	Instruction 1 KB			8ch(Ext 3ch)	1ch	10bit 8ch	16bit 2ch	16bit 6ch				–	8ch +NMI	○	LQFP-144	MB91V110(DSU3)
MB91F128	27MHz	x 2	3.3V	D-RAM : 12KB(DBUS-RAM) RAM : 2KB(CBUS-RAM) MB91F128: FLASH 510KB MB91F127: FLASH 256KB	–			5ch	3ch	10bit 8ch	16bit 3ch	16bit 4ch	–	–	–	ICU 4ch, OCU 4ch	6ch + NMI	○	LQFP-100	MB91FV128(DSU3)
MB91133 MB91F133A	33(In)/ 16.5(Ext)MHz	x 4 (32KHz mode support)	I/O 5V + CPU 3.3V	D-RAM : 6KB RAM : 2KB MB91133: ROM 254KB MB91F133A: FLASH 254KB	–		SRAM, ROM/FLASH	8ch(Ext 3ch)	5ch	10bit 8ch	16bit 5ch	6ch	8bit 3ch	–	8bit x 2ch	ICU 4ch, OCU 8ch	24ch	–	LQFP-144, FBGA-144	MB91FV133(DSU3)
MB91154 MB91F154 MB91F155A	33(In)/ 25(Ext)MHz	x 2	3.3V	RAM : 2KB D-RAM : 32KB MB91154: ROM 384KB MB91F154: FLASH 384KB MB91F155A: FLASH 510KB	–	address : 24bit data : 8/16bit		8ch(Ext 3ch)	4ch	10bit 8ch	16bit 4ch	16bit 6ch	8bit x 3ch	1ch	8bit x 2ch	ICU 4ch, OCU 8ch, RTC	16ch	–	QFP-144	MB91FV150(DSU3)

*: I-ROM, I-RAM; Memory only for instruction/D-RAM; Memory only for data.

FR50 Series

	Max. operating frequency	Clock multiplier	Power supply voltage	Internal ROM/RAM	Built-in cache	External bus configuration	Memory I/F	DMAC	UART	A/D	Reload timer	PWM(PPG)	D/A	I²C	Up/down counter	Other functions	External interrupt	H/W Standby pin	PKG	EVA chip
MB91F362GA	64(In)MHz	x 16	5.0V	Data RAM : 12KB RAM : 4KB FLASH : 512 KB	–	address : 21bit data : 8/16/32bit	SRAM, ROM/FLASH	ext 1ch	3ch	10bit 16ch	16bit 6ch	8	10bit x 2ch	1ch	4ch	Free run timer 1ch CAN 3ch, ICU4ch, OCU4ch	8ch+NMI	○	QFP-208	MB91V360(DSU3)
MB91F369GA	64(In)MHz	x 16	5.0V	Data RAM : 16KB RAM : 4KB F-bus RAM : 16KB FLASH : 512 KB	–	address : 21bit data : 8/16/32bit	SRAM, ROM/FLASH	5ch(ext 1ch)	1ch	10bit 10ch	16bit 6ch	4	–	1ch	4ch	Free run timer 1ch CAN 2ch, SIO prescaler 2ch	8ch+NMI	○	–	MB91V360(DSU3)

FR60 Series

	Max. operating frequency	Clock multiplier	Power supply voltage	Internal ROM/RAM	Built-in cache	External bus configuration	Memory I/F	DMAC	UART	A/D	Reload timer	PWM(PPG)	D/A	I²C	Up/down counter	Other functions	External interrupt	H/W Standby pin	PKG	EVA chip
MB91301	68(In)/68(Ext)MHz	x 4	3.3V	Data RAM : 4KB	Instruction 4KB	address : 24bit data : 8/16/32bit	SRAM, ROM/FLASH, SDRAM, FCRAM	5ch	3ch	10bit 4ch	16bit 3ch	4	–	–	–	–	8ch+NMI	–	QFP-144	MB91V301(DSU4)
MB91307A	66(In)/33(Ext)MHz	x 4	3.3V	RAM : 128KB	Instruction 1KB	address : 25bit data : 8/16bit		8ch(Ext 3ch)	3ch	10bit 4ch	16bit 3ch	–	–	1ch	–	–	8ch+NMI	○	LQFP-120	MB91V307(DSU3)
MB91340	66(In)/33(Ext)MHz	x 4	I/O 3.3V + CPU 2.5V	Data RAM : 4KB RAM : 112KB ROM : 64KB	–	address : 24bit data : 8/16bit	SRAM, ROM/FLASH, Page mode, Burst mode support	8ch(Ext 3ch)	3ch	10bit 8ch	16bit 4ch (3ch)	–	3ch	1ch	4ch	Waveform generation macro 8bit Up counter, Free-run timer ICU 4ch, OCU 8ch	8ch+NMI	○	LQFP-176	MB91V340(DSU3)