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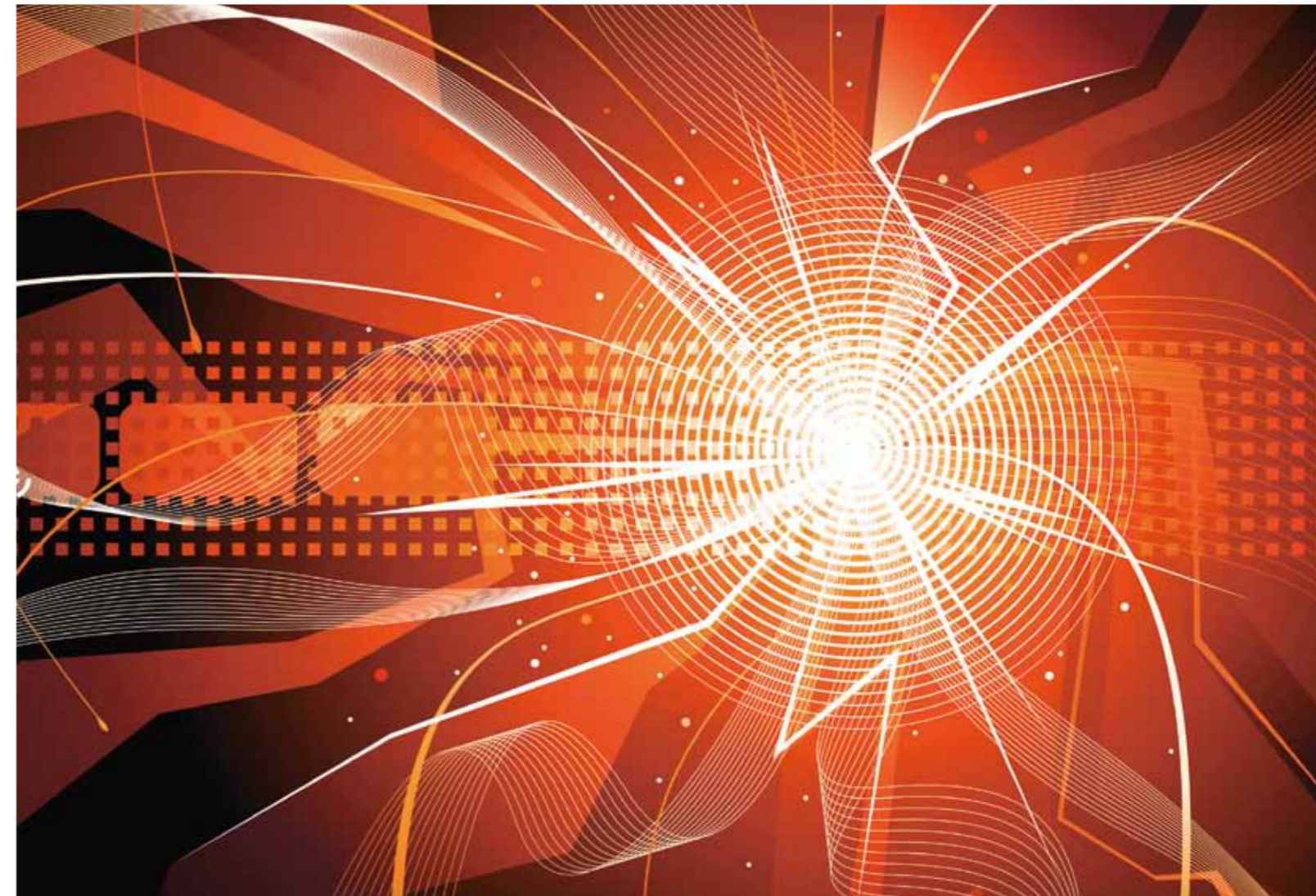
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MICROCONTROLLER



Bringing the voice of our customers into a new generation of microcontrollers

Highly reliable stable supply

Long-term stable supply based on a global manufacturing system and business continuity management (BCM). Manufactured at the same factory as the processors for the world's leading supercomputer "Kei."

High-performance analog IP

Fast, highly accurate 12-bit A/D converter, CR oscillator, etc.

Extensive lineup

Coverage of 32-bit, 16-bit, and 8-bit classes over a range from 144 MHz to 20 MHz with a wide range of power supply voltages from 1.65 V to 5.5 V.

Fast and highly reliable Flash technology

Maximum 100,000 rewrites, 20-year data retention, high-speed access, data protection function.

Cortex™-M3 global core

Global standard Cortex™-M3 core + Fujitsu's proprietary technology

Communication functions

CAN
USB
Ethernet

Multifunction peripherals

Multifunction serial (UART, SIO, I²C), multifunction timer, base timer, pin relocation function, etc.

One-stop development support

Supports a wide variety of third party tools. Fujitsu supports all stages from device to product development globally in a one-stop offering.

Safety circuits

Hardware watchdog
Low voltage detection
Clock supervisor

C o n t e n t s

02-03 | Features of Fujitsu Microcontrollers

Product overviews

04-05	32bit Core ARM Core
06-07	32bit Core Fujitsu Original Core
08-09	32bit Wide Lineup of Pin Counts and ROM Sizes
10-11	16bit Core Fujitsu Original Core
12-13	16bit Wide Lineup of Pin Counts and ROM Sizes
14-15	8bit Core Fujitsu Original Core
16-17	8bit Wide Lineup of Pin Counts and ROM Sizes

By application

18-19 | Product Selection by Application

Functionality

20-27	Built-in CAN microcontrollers
28	Built-in FlexRay microcontrollers
30-31	Built-in USB microcontrollers
32-33	Built-in LCD controller microcontrollers
34-35	Microcontrollers for inverter control

Development assistance tools

36-37	Software Tools
38-39	REALOS™ Series
40-41	SOFTUNE/REALOS series (Integrated Development Environment & Real-time OS)
42-43	SOFTUNE series (Integrated Development Environment)
44-48	Hardware Tools
50-51	Evaluation Board/Starter Kit
52-53	Education Kit
54-63	Development Environment/OS/Middleware/Tools
64-65	Writing Programs

Reference

66 | e-Learning Services

New generation microcontroller



The "FM3" new generation of microcontrollers holds the performance to advance all kinds of devices greenly and smartly. The architecture that is the focus of the Fujitsu microcontroller technology draws out the true value of the Cortex™-M3 global core and solves the challenges related to performance, low power consumption, and cost as demanded by the current age. The fully featured Fujitsu global support system also offers one-stop support for equipment development from devices to development tools.

FM3 family allowing freedom of choice

FMB [High Performance Group]

For high-performance applications such as motor control and inverter control in high-performance manufacturing equipment. Maximum 144 MHz high speed operation with a wide variety of built-in peripheral functions such as Ethernet.

FMB [Basic Group]

For a wide range of applications such as inverter control in household appliances and various motor control in information equipment. Best balance of performance, functionality, cost, and low power consumption.

FMB [Low Power Group]

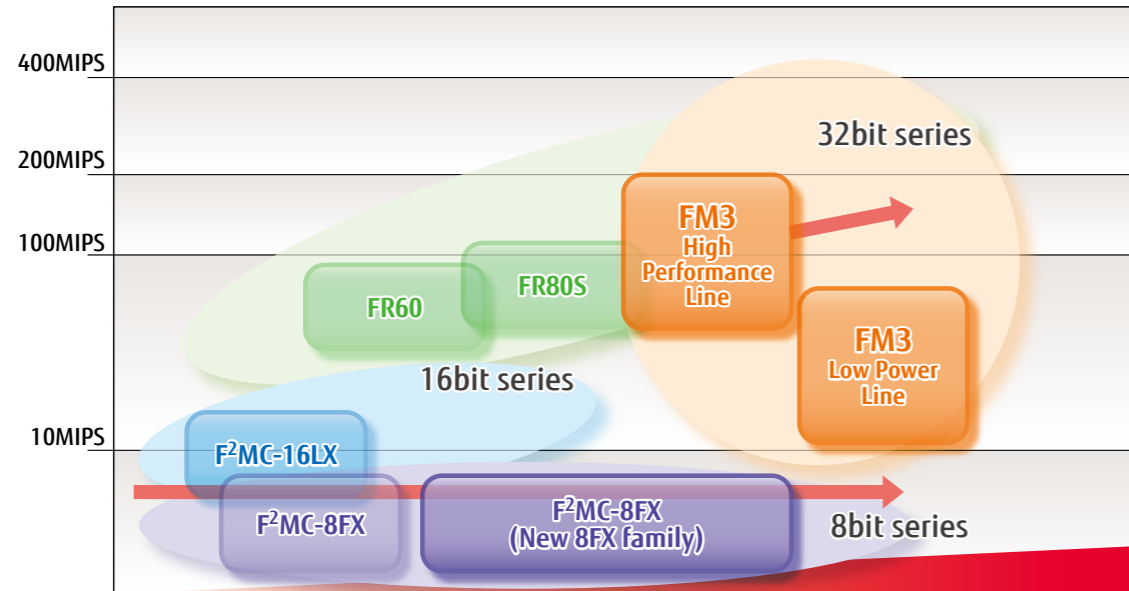
For handling power saving in AV equipment (TVs, digital cameras, music players). Low voltage operation at 1.65 V to 3.6 V with built-in LCD controller and USB.

FMB [Ultra Low Leak Group]

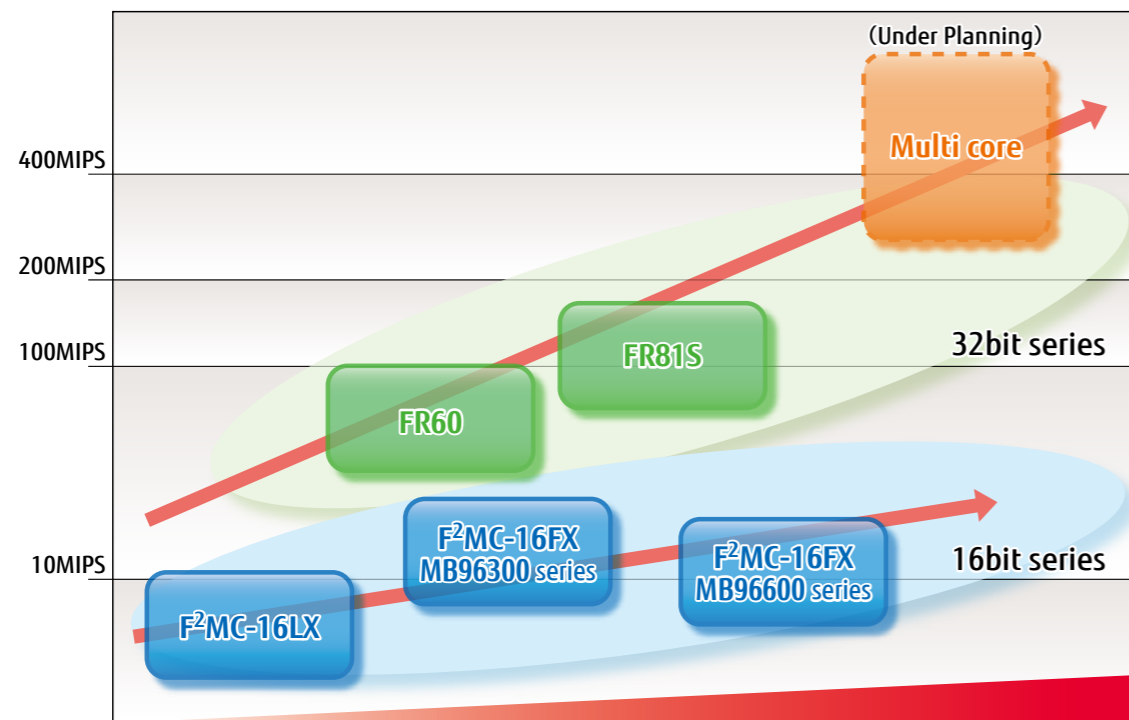
For battery-powered devices such as sensor networks and medical devices. Greatly reduces power consumption while in standby over a wide range of voltages from 1.8 to 5.5 V to deliver long-duration operation.

Features of Fujitsu Microcontrollers

Consumer/Industrial - CPU Core Roadmap



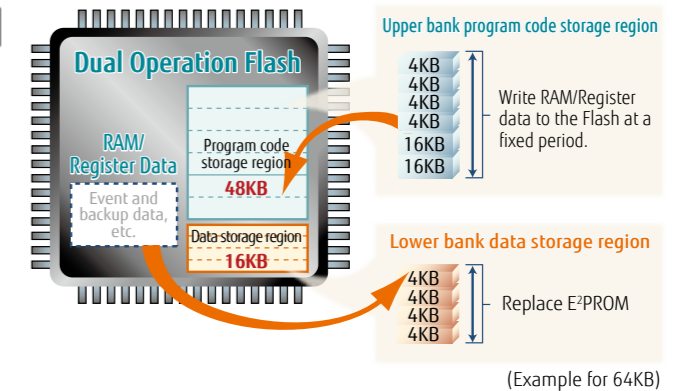
Automotive - CPU Core Roadmap



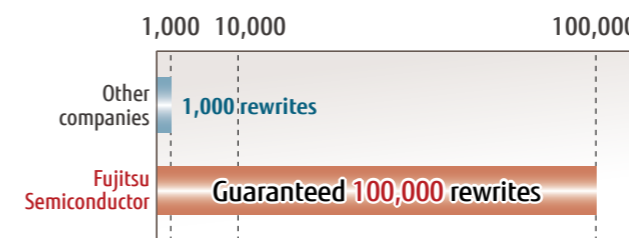
Flash Microcontroller

Flash Microcontroller Features

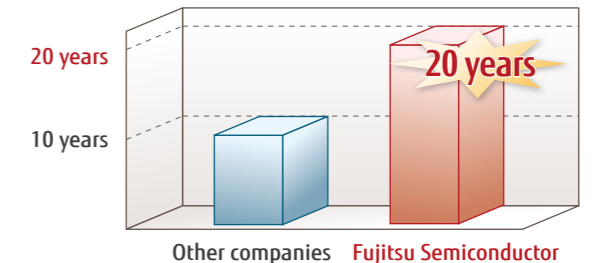
- **Dual Operation Flash**
 - Freely able to program other Flash banks while executing a program.
 - Can replace E²PROM
- **Flash Memory Reliability**
 - Guaranteed rewrites: Standard 10,000 times (separately guaranteed 100,000)
 - Data retention period: 20 years (Ta = +85°C)
 - Operating temperature range: Ta = -40°C to +105°C (TA=125°C can be supported separately)



Number of rewrites (compared to other companies)



Data retention period (compared to other companies)



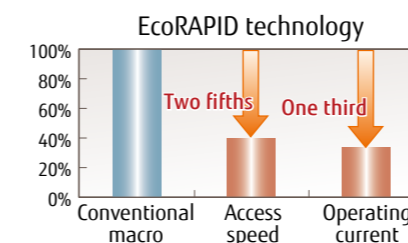
Flash microcontroller ecological technology

In addition to high reliability and high performance, demand has also grown for low power consumption in flash microcontrollers with a focus on ecology. Fujitsu has developed EcoRAPID high-speed low power consumption flash memory technology which is embedded into our Flash microcontroller products to deliver reduced load on the environment.

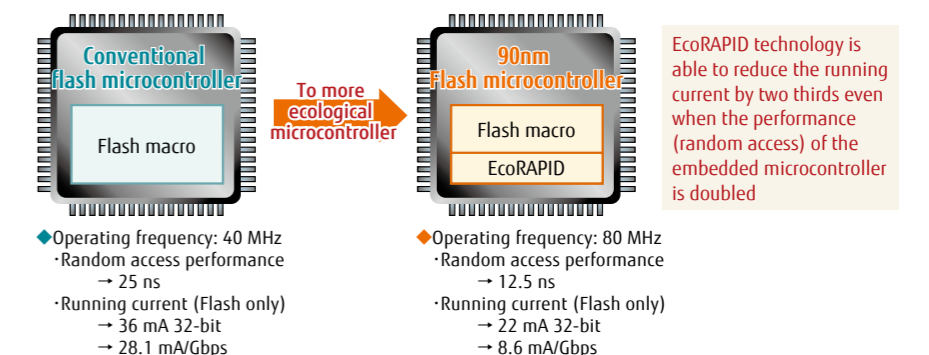
Features of EcoRAPID

- **Expanded application of FCRAM technology**
 - Fujitsu's proprietary FCRAM (Fast Cycle RAM) high-speed memory access technology is employed in NOR-type flash memory circuits
 - Load during operation is reduced by an optimized cell array and data read speed is increased by a mechanism in the power supply circuit technology
- **Increased speed and lower power consumption**
 - Delivers 10ns (2.5 times faster than normal) access speed together with 9μA operational power consumption per cell (one third of normal)
 - Using a microcontroller equipped with this technology makes it possible to improve the performance and extend the battery life of battery-powered portable devices.

Features of EcoRAPID technology



Example of an ecological microcontroller equipped with EcoRAPID





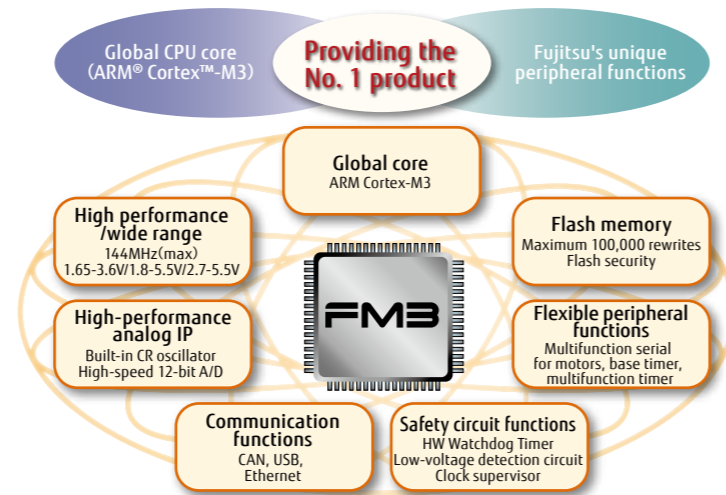
FM3 Family · 32-bit Microcontroller

NEW

The FM3 family products are 32-bit general-purpose microcontrollers that employ the ARM Cortex™-M3 CPU core. The combination of ARM technology applying global CPU core with Fujitsu Semiconductor's proprietary flash technology offers a complete product lineup suitable for industrial and consumer applications respectively.

FM3 Family Features

- **Employing ARM Cortex-M3**
 - 1) Best core for embedded controllers
 - 2) Rich software library
 - 3) Development support by partner vendors with proven track records
- **Fujitsu Semiconductor's unique flash technology**
 - 1) Program cycles: Maximum 100,000 cycles
 - 2) Data retention period: Maximum 20 years
 - 3) Data protection function
- **Easy to use peripheral functions**
 - 1) Flexible variety of peripheral functions (Multifunction serial, multifunction timer, upper compatible pin assignment, pin relocation function)
 - 2) Wide variety of communication peripherals (Ethernet, USB, CAN, various serial)
 - 3) Fast highly accurate analog peripherals (12-bit A/D, CR oscillator circuit)
 - 4) Safety circuits



Customer developments are supported with development tools which respective partner vendors have credible achievements.

- Customer development is supported by cooperation and working together on the best solutions and support with partner vendors.
- All kinds of inquiries related to development are supported by the Fujitsu technical support unit.

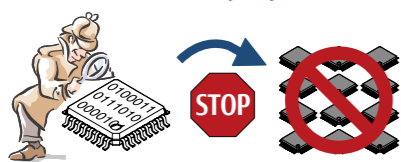


FM3 family product lineup

- **High Performance Group**
Maximum operating frequency 144 MHz, Operating voltage 2.7 to 5.5 V
Ether, CAN, and USB IP
Flagship model mainly for industrial applications
- **Basic Group**
Maximum operating frequency 40 MHz, Operating voltage 2.7 to 5.5 V
CAN and USB IP
Mass market model mainly for home appliances
- **Low Power Group**
Maximum operating frequency 40 MHz, Operating voltage 1.65 to 3.6 V
USB and LCDC IP
Energy-saving model for general home appliances
- **Ultra Low Leak Group**
Maximum operating frequency 20 MHz, Operating voltage 1.8 to 5.5 V
LCDC IP
Low leakage model suitable for battery-driven applications

Fujitsu Semiconductor's proprietary flash technology

- **High reliability/high quality**
 - Program cycles: **100,000 cycles**
 - Data retention: **20 years**
 - High reliability: **Employs the same technology as in vehicle-mounted microcontrollers**
- **Data protection function**
 - **External data read is absolutely impossible!**



- **High-speed flash memory**
High performance with zero-wait access (Table 1)
- **High CPU performance by Fujitsu's proprietary high-speed flash memory!** (Table 2)

Table 1 Comparison of MCU competitors

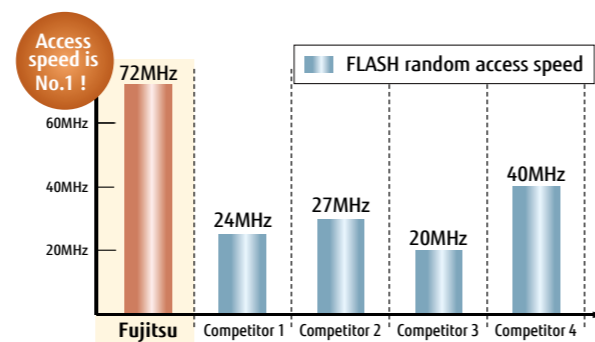
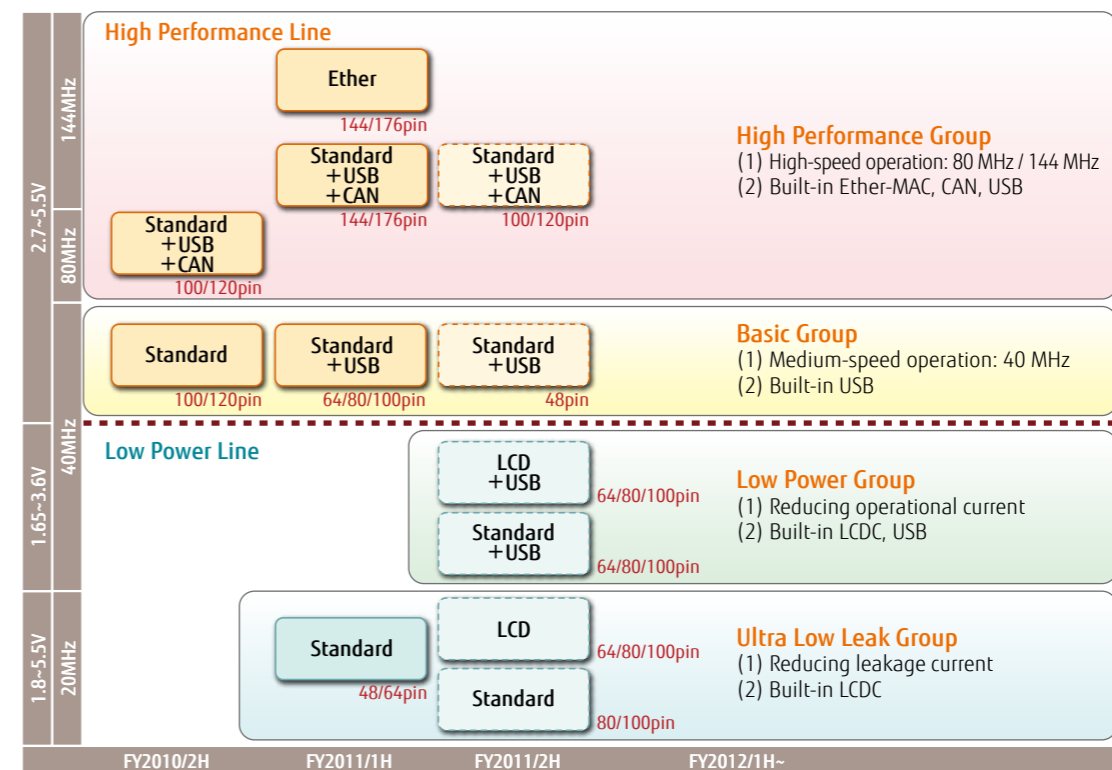
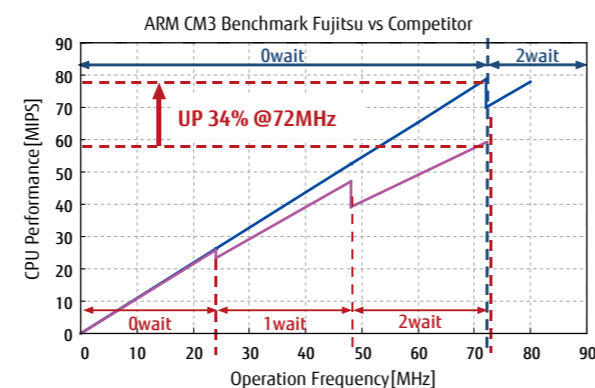


Table 2 Dhrystone2.1 benchmark result



- **Product lineup that is easy to choose from to suit market demand and application**
Expanding to approximately 200 models by the end of 2011.
Over 300 models are scheduled for the middle of 2012, to give a total lineup of over 500 models.

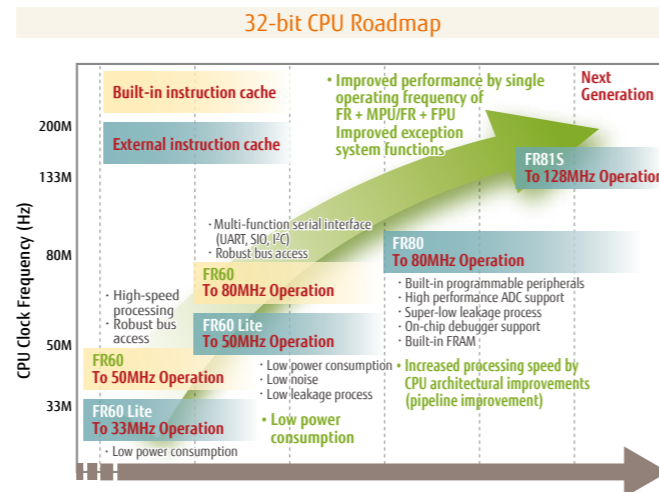
32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection
32 bit
16 bit
8 bit

FR Family · 32-bit Microcontroller

The FR family are 32-bit RISC controllers with Fujitsu original architecture whose functions are optimized for embedded device control. These microcontrollers are widely used in fields such as digital home electronics, PC peripherals, and vehicles, and are the optimal microcontrollers for applications that demand high speed computer processing functions.

FR CPU Features

- **High-performance 32-bit RISC microcontroller**
 - 1) High-speed operation using 5-stage pipeline processing
 - 2) Parallelization of processing by separation of the instruction, data, and resource buses
- **Low power consumption operation**
 - 1) Delivering low clock rates by high unit performance functions through increased MIPS value
 - 2) The operating frequencies of each of the CPU, built-in peripheral function, and external bus can be configured separately to suit the customer system
- **Instruction set optimized for embedded applications**
 - 1) Delivering compact object sizes with 16-bit instruction length
 - 2) A variety of bit processing instructions and addressing instructions
 - 3) Delayed-branch instructions (reduces branch processing overhead)



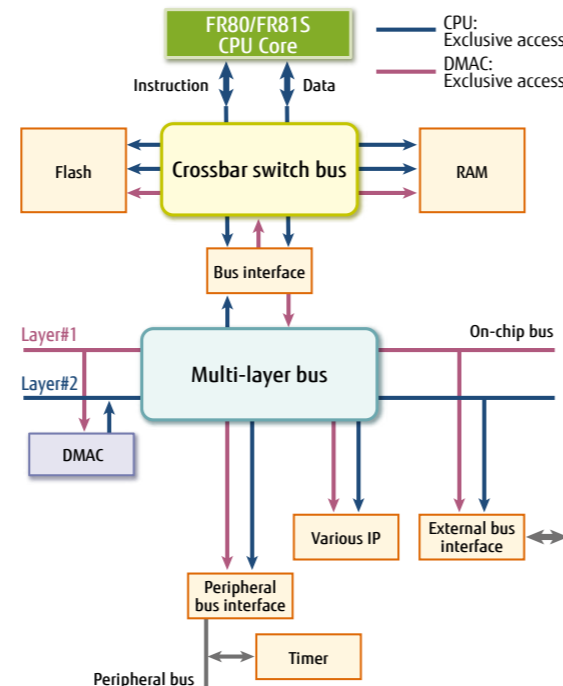
FR80/FR81S Features

FR80 Features

- **Built-in high-performance FR80 core**
CPU performance increased by **more than 30%** compare to the FR60 core
Inherits the instruction set from existing FR
- **Built-in 8 channel DMAC**
Capable of highly efficient data transfer to reduce CPU load
- **Crossbar switch bus**
 - Instructions in Flash memory and data in RAM can be accessed simultaneously
 - Even while the CPU is accessing instructions in Flash memory, the DMAC can access data in RAM
- **Multi-layer bus**
 - Data can be transferred by DMAC at the same time that CPU instructions are executed
 - Example) CPU ⇄ External bus
DMAC ⇄ Peripheral bus

FR81S Features

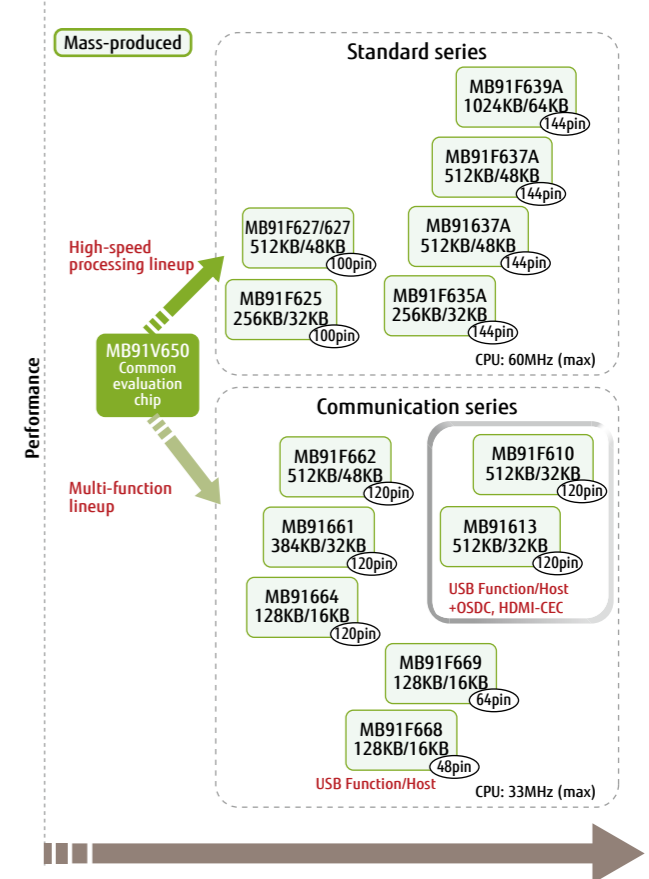
- **ECC (Error Correction Coding)**
Flash memory with an ECC function
- **FPU (Floating Point Unit)**
IEEE 754 compliant
Single-precision
- **MPU (Memory Protection Unit)**
Settable up to 8 areas (areas can be overlapped)
The areas can be set by the page address and page size (16 KB x 2 n)
- **On chip Debug Unit**
Enables debugging with a single wire



FR80 Product Lineup

- **Lineup includes a wide range of memory and pin counts**
Supports a wide range of models to suit customer applications
- **Built-in high-speed A/D converter (conversion time: approx. 1.2μs*)**
FR80 series (144/176 pin models) have **two 32-channel A/D converters** (Supports simultaneous conversion)
Supports continuous A/D conversion with built-in 16-stage FIFO
- **Built-in multichannel serial interface (maximum 12 channels)**
Able to support **a variety of serial interfaces** (SPI/UART/I²C mode)
4 channels equipped with 16-byte receive FIFO and 16-byte transmit FIFO
- **Maximum of 26 pins with 5V withstand voltage**
Can be connected to 5V peripheral I/O output ports without a level shifter
- **Lineup includes products supporting USB full-speed**
Product with built-in Function and Host

*Varies depending on the operating frequency and external circuit conditions.



FR Family Lineup

- **Built-in PLL clock circuit**
Can be set to a maximum of 20 times multiplication
(for products guaranteed for an 80 MHz operating frequency)
- **Built-in DMAC and multiply and accumulate circuit that can operate in parallel with CPU processing**
- **Built-in cache memory focusing on ROM less products**
- **Lineup of a wide variety of Flash memory microcontrollers**
Maximum 2 MB built-in Flash memory
- **Wide range of peripheral functions**
USB (Function, Mini-Host, Full-Host), FlexRay, MediaLB, CAN, LIN, SPI, 12bit-A/D, OSDC, GDC

	48pin	64pin	80pin	100pin	120pin	144pin	176pin	208pin	320pin
CAN		MB91580S MB91520 MB91460	MB91520	MB91580M MB91520 MB91460	MB91460 MB91520	MB91580L MB91520 MB91460 MB91570	MB91520 MB91460	MB91460 MB91590	MB91460
USB		MB91665			MB91610 MB91660				
Standard product				MB91625		MB91635A	MB91640A MB91645A		
ROM-less product							MB91605A		

ROM-less products: Product name Other products: Series name

32bit Wide Lineup of Pin Counts and

ROM Sizes



FR Family • 32-bit Microcontroller

[RAM(Byte)] Product name: Flash ROM product
 Product name: MASK ROM product/ROM-less products Dual Operation Flash Under developing Under planning

ROM[Byte]	48pin	64pin	80pin	100pin	112pin	120pin	144pin	176pin	192pin	208pin	216pin	320pin	ROM[Byte]
2112K												[96K]MB91F469G [96K]MB91F469Q	2112K
1152K		[128K]MB91F526B	[128K]MB91F526D	[128K]MB91F526F		[128K]MB91F526J	[128K]MB91F526K [72K]MB91F577 [96K]MB91F587L	[128K]MB91F526L		[72K]MB91F594 [72K]MB91F599			1152K
1088K							[40K]MB91F467B [64K]MB91F467C [64K]MB91F467T	[64K]MB91F467R [64K]MB91F467S		[64K]MB91F467D [128K]MB91F467E	[64K]MB91F467M		1088K
1024K							[64K]MB91F639A	[64K]MB91F644A					1024K
896K		[96K]MB91F525B	[96K]MB91F525D	[96K]MB91F525F		[96K]MB91F525J	[96K]MB91F525K [64K]MB91F586L	[96K]MB91F525L					896K
832K							[40K]MB91F466H						832K
640K		[64K]MB91F524B [48K]MB91F585S	[64K]MB91F524D	[64K]MB91F524F [48K]MB91F585M		[64K]MB91F524J	[64K]MB91F524K [48K]MB91F575 [48K]MB91F585L	[64K]MB91F524L				[48K]MB91F591 [48K]MB91F592 [48K]MB91F596 [48K]MB91F597	640K
544K				[32K]MB91F465X		[16K]MB91F465K	[40K]MB91F465B [32K]MB91F465C	[40K]MB91F465P				[48K]MB91F465D	544K
512K		[48K]MB91F523B [48K]MB91F584S	[48K]MB91F523D	[48K]MB91F523F [48K]MB91F584M [48K]MB91627		[48K]MB91F523J [32K]MB91613 [32K]MB91F610 [48K]MB91F627	[48K]MB91F523K [48K]MB91637A [48K]MB91F637A	[48K]MB91F523L [48K]MB91F647A					512K
416K					[16K]MB91F464A								416K
384K		[48K]MB91F522B [32K]MB91F583S	[48K]MB91F522D	[48K]MB91F522F [32K]MB91F583M		[48K]MB91F522J [32K]MB91661		[48K]MB91F522L					384K
288K		[10K]MB91F463N							[24K]MB91F463C				288K
256K				[32K]MB91F625					[32K]MB91F635A				256K
128K	[16K]MB91F668	[16K]MB91F669											128K
ROM-less						[16K]MB91664			[128K]MB91605A				ROM-less

FM3 Family • 32-bit Microcontroller

[RAM(Byte)] Product name: Flash ROM product
 Product name: MASK ROM product/ROM-less products Dual Operation Flash Under developing Under planning

ROM[Byte]	48pin	64pin	80pin	100pin	112pin	120pin	144pin	176pin	192pin	208pin	216pin	320pin	ROM[Byte]	
1M							[128K]MB9BF618S [128K]MB9BF518S [128K]MB9BF418S [128K]MB9BF318S [128K]MB9BF218S [128K]MB9BF118S	[128K]MB9BF618T [128K]MB9BF518T [128K]MB9BF418T [128K]MB9BF318T [128K]MB9BF218T [128K]MB9BF118T	[128K]MB9BF618T [128K]MB9BF518T [128K]MB9BF418T [128K]MB9BF318T [128K]MB9BF218T [128K]MB9BF118T				1M	
768K							[96K]MB9BF617S [96K]MB9BF517S [96K]MB9BF417S [96K]MB9BF317S [96K]MB9BF217S [96K]MB9BF117S	[96K]MB9BF617T [96K]MB9BF517T [96K]MB9BF417T [96K]MB9BF317T [96K]MB9BF217T [96K]MB9BF117T	[96K]MB9BF617T [96K]MB9BF517T [96K]MB9BF417T [96K]MB9BF317T [96K]MB9BF217T [96K]MB9BF117T				768K	
512K			[64K]MB9AF316M [64K]MB9AF116M	[64K]MB9BF506NA [64K]MB9BF406NA [64K]MB9BF306NA [64K]MB9BF106NA	[64K]MB9BF506N [64K]MB9BF406N [64K]MB9BF306N [64K]MB9BF106N	[64K]MB9BF506RA [64K]MB9BF406RA [64K]MB9BF306RA [64K]MB9BF106RA	[64K]MB9BF616S [64K]MB9BF516S [64K]MB9BF416S [64K]MB9BF316S [64K]MB9BF216S [64K]MB9BF116S	[64K]MB9BF616T [64K]MB9BF516T [64K]MB9BF416T [64K]MB9BF316T [64K]MB9BF216T [64K]MB9BF116T	[64K]MB9BF616T [64K]MB9BF516T [64K]MB9BF416T [64K]MB9BF316T [64K]MB9BF216T [64K]MB9BF116T				512K	
384K			[48K]MB9AF315M [48K]MB9AF115M	[48K]MB9BF505NA [48K]MB9BF405NA [48K]MB9BF305NA [48K]MB9BF105NA	[48K]MB9BF505N [48K]MB9BF405N [48K]MB9BF305N [48K]MB9BF105N	[48K]MB9BF505RA [48K]MB9BF405RA [48K]MB9BF305RA [48K]MB9BF105RA							384K	
256K		[32K]MB9AF314L [32K]MB9AF114L	[32K]MB9AF314M [32K]MB9AF114M	[32K]MB9BF504NA [32K]MB9BF404NA [32K]MB9BF304NA [32K]MB9BF104NA	[32K]MB9BF504N [32K]MB9BF404N [32K]MB9BF304N [32K]MB9BF104N	[32K]MB9BF504RA [32K]MB9BF404RA [32K]MB9BF304RA [32K]MB9BF104RA							256K	
128K	[8K]MB9AF132K	[8K]MB9AF132L [16K]MB9AF312L [16K]MB9AF112L	[16K]MB9AF312M [16K]MB9AF112M	[16K]MB9AF102NA [16K]MB9AF312N [16K]MB9AF112N	[16K]MB9AF102NA [16K]MB9AF312N [16K]MB9AF112N	[16K]MB9AF102RA							128K	
64K	[8K]MB9AF131K	[8K]MB9AF131L [16K]MB9AF311L [16K]MB9AF111L	[16K]MB9AF311M [16K]MB9AF111M	[16K]MB9AF311N [16K]MB9AF111N	[16K]MB9AF311N [16K]MB9AF111N								64K	
Lead pitch (mm)	Package name D×W×H(mm)			 TQFP-100P 12x12x1.5		 LQFP-120P 14x14x1.5	 LQFP-144P 16x16x1.5		 LQFP-176P 24x24x1.5	 FBGA-192P 12x12x1.25	 LQFP-208P 28x28x1.5	 HQFP-208P 28x28x3.75	 LQFP-216P 24x24x1.5	Lead pitch (mm)
0.4														0.4
0.5	 LQFP-48P 7x7x1.5	 LQFP-64P 10x10x1.5	 LQFP-80P 12x12x1.5	 LQFP-100P 14x14x1.5		 LQFP-120P 16x16x1.5	 LQFP-144P 20x20x1.5	 LQFP-176P 24x24x1.5	 FBGA-192P 12x12x1.25	 LQFP-208P 28x28x1.5	 HQFP-208P 28x28x3.75			0.5
0.65		 LQFP-64P 12x12x1.5		 QFP-100P 14x20x3.0										0.65
0.8					 FBGA-112P 10x10x1.25		 FBGA-144P 12x12x1.25					 FBGA-320P 18x18x1.25		0.8

32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection
32 bit
16 bit
8 bit



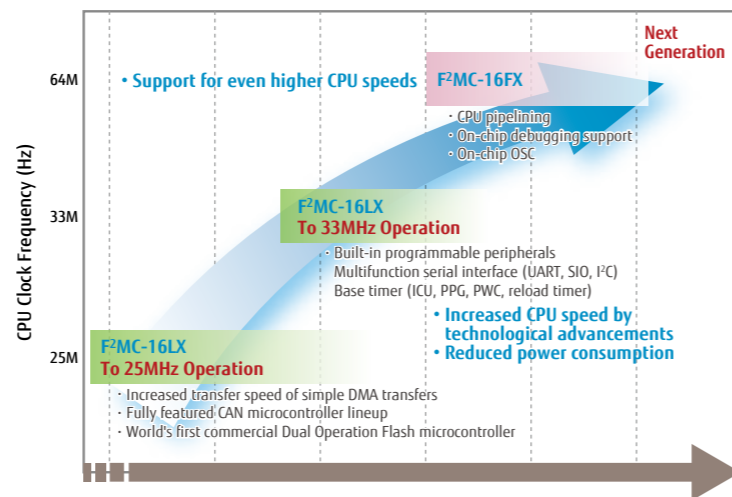
F²MC-16FX • 16-bit Microcontroller

The F²MC-16FX family are Fujitsu original microcontrollers. A wide variety of products are available, from automotive products that support CAN networks to systems controllers and subcontrollers for audio visual equipment, household appliance, office equipment, and industrial equipment. The F²MC-16FX family are the optimal microcontrollers for next-generation systems.

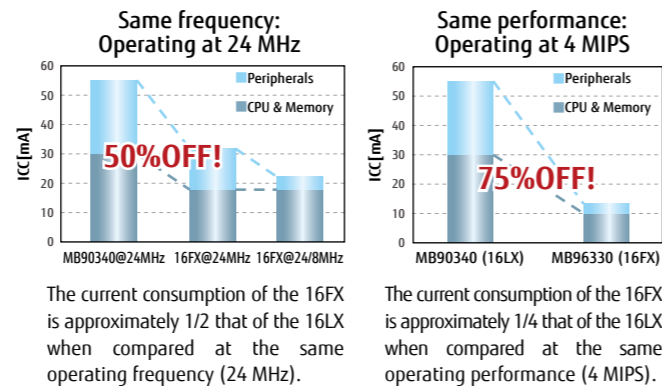
F²MC-16FX CPU Features

- **Basic instructions execute in one cycle**
Example) Multiplication (16-bit x 16-bit) - 4 cycles (16LX: 11 cycles)
Division (16-bit ÷ 8-bit) - 9 cycles (16LX: 15 cycles)
- **High-speed processing using a 5-stage pipeline and instruction queue (8 Bytes)**
- **High-speed interrupts**
Interrupt handling time (start time): 10 cycles (16LX: 24 cycles)
One interrupt source allocated to one vector
- **High-performance interrupts**
NMI pin function activation and input level are configurable
Vector table area can be located in ROM, RAM, or external memory
- **Built-in CR clock mode**
Selectable operating frequency from 100 kHz (low speed) and 2 MHz (high speed)

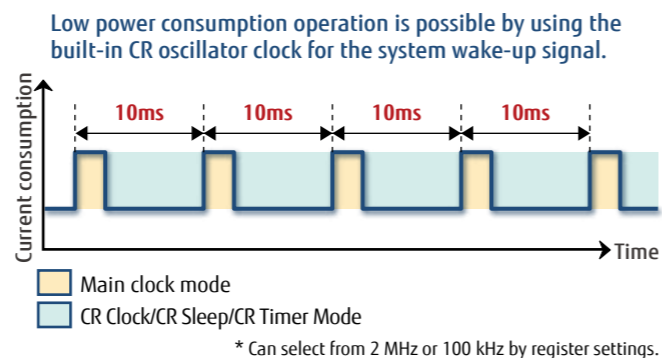
16-bit CPU Roadmap



F²MC-16FX Current Consumption



Low power consumption operation by CR oscillator clock



Product Lineup [MB96300 Series]

- **Wide lineup that are easy to choose to suit the application**
 - Built-in CAN products (Single CAN to Triple CAN)
Number of message buffers: 32
 - Built-in USB Full-Speed products (Support Function and Host)
- **Supports a wide range of system voltages from 3.0 V to 5.5 V**
- **CPU operating frequency: Up to 56 MHz**
Minimum instruction execution time: 17.8 ns

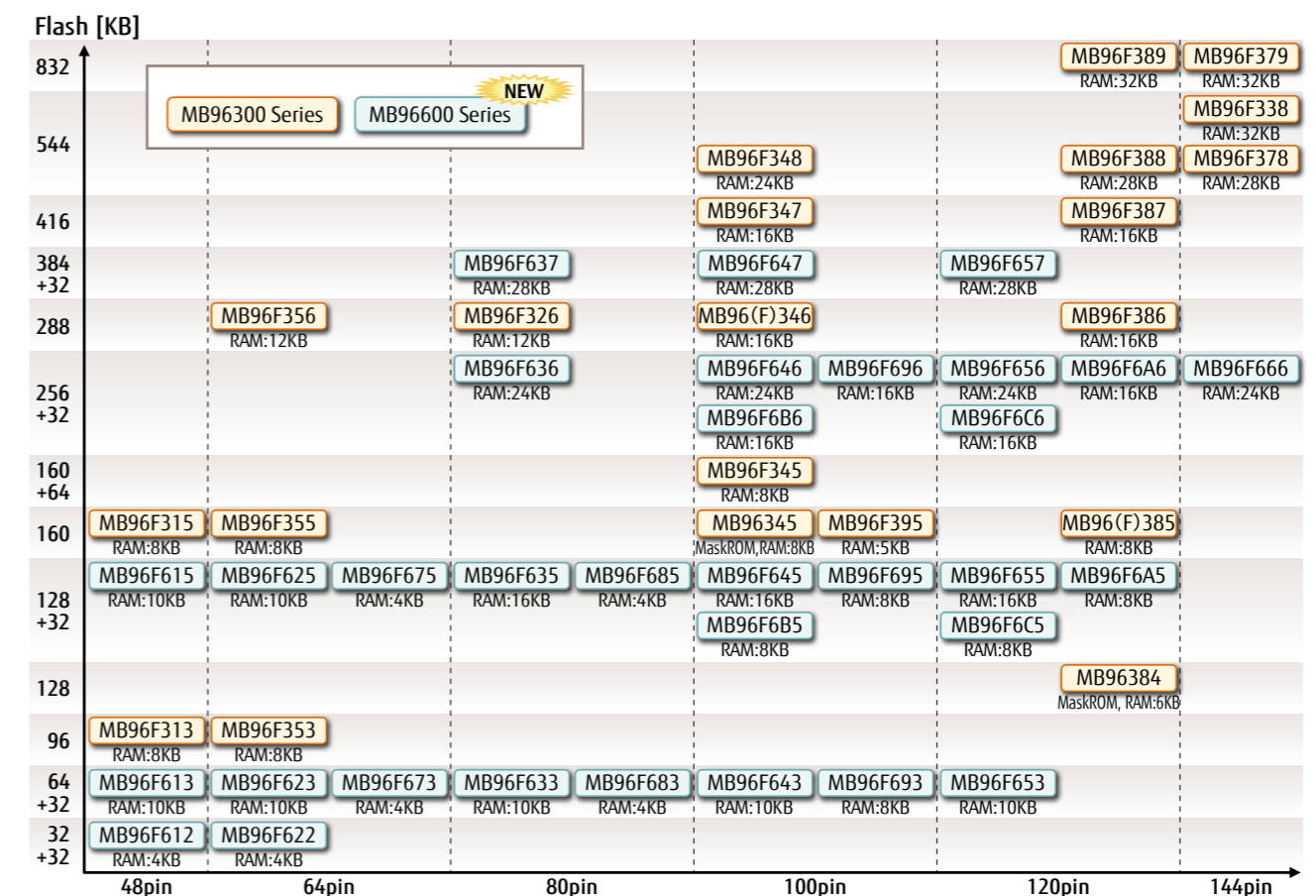
Product Lineup [MB96600 Series]

- **Vehicle-mounted communication interface built-in as standard**
 - CAN
Number of message buffers: 32
 - LIN-USART
Built-in LIN protocol assistance function
- **On Chip Debug Unit built-in as standard**
Able to perform debugging with only a single serial communication line using an actual device
- **Supports a wide range of system voltages from 2.7 V to 5.5 V**
- **Dual Operation Flash built-in as standard**
- **CPU operating frequency: Up to 32 MHz**
Minimum instruction execution time: 31.25 ns

	48pin	64pin	80pin	100pin	120pin	144pin
Triple CAN (32 message buffer)						MB96330
Double CAN (32 message buffer)		MB96350	MB96320	MB96340	MB96380	MB96370
Single CAN (32 message buffer)	MB96310 MB96610	MB96620 MB96670	MB96630 MB96680	MB96390 MB96640 MB96690 MB966B0	MB96650 MB966A0 MB966C0	MB96660*
USB						MB96330U
Standard product	MB96310A	MB96350A	MB96320A	MB96340A		

*: Under planning

F²MC-16FX MB96600/300 Series Product Lineup



32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Development assistance tools
Product selection
32 bit
16 bit
8 bit

















































16bit Wide Lineup of Pin Counts and

ROM Sizes



F²MC-16LX/FX • 16-bit Microcontroller

[RAM(Byte)] Product name: Flash ROM product
 Product name: MASK ROM product/ROM-less products  Dual Operation Flash  Under developing  Under planning

ROM[Byte]	48pin	64pin	80pin	100pin	120pin	144pin	ROM[Byte]
832K					[32K]MB96F389RS/F389RW	[32K]MB96F379RS/F379RW	832K
576K				[24K]MB96F348HS/F348HW	[28K]MB96F388HS/F388HW	[28K]MB96F378HS/F378HW	576K
544K				[24K]MB96F348RS/F348RW		[32K]MB96F338RS/F338RW	544K
512K				[20K]MB90F345CE/F345CES	[24K]MB90F924NC/F924NCS		512K
416K			[28K]MB96F637R 	[16K]MB96F347RS/F347RW	[16K]MB96F387RS/F387RW		416K
384K				[28K]MB96F647R 	[28K]MB96F657R 		384K
288K		[12K]MB96F356RS/F356RW	[12K]MB96F326RS/F326RW	[16K]MB96F346RS/F346RW	[16K]MB96F386RS/F386RW	[24K]MB96F666R 	288K
256K			[24K]MB96F636R 	[16K]MB96346RS/346RW	[24K]MB96F656R 		256K
224K				[24K]MB96F646R 	[16K]MB96F646R 		224K
160K	[8K]MB96F315RS/F315RW	[8K]MB96F355RS/F355RW	[16K]MB96F635R 	[16K]MB90342CE/342CES/342E	[16K]MB90349CE/349CES/349E	[16K]MB90922NCS	160K
128K	[8K]MB90F997JBS/F997MBS	[10K]MB96F625R 	[4K]MB96F685R 	[16K]MB90349CE/349CES/349E	[16K]MB90F342CE/F342CES	[10K]MB90922NCS	128K
96K	[10K]MB96F615RB 	[4K]MB96F675R 		[16K]MB90F342E/F342ES	[16K]MB90F349CE/F349CES		96K
64K	[8K]MB90F911AS	[4K]MB90352E/352ES/352TE/352TES		[16K]MB90F349E/F349ES	[16K]MB90F952JDS/F952MDS		64K
32K	[8K]MB90F912BS	[4K]MB90357E/357ES/357TE/358TES		[16K]MB90F349E/F349ES	[8K]MB96F345DS/F345DW		32K
24K		[4K]MB90F352E/F352ES 		[16K]MB90F349E/F349ES	[5K]MB96F395RS/F395RW		24K
160K		[4K]MB90F352TE/F352TES 		[16K]MB90F349E/F349ES	[8K]MB96345RS/345RW		160K
128K		[4K]MB90F357E/F357ES 		[16K]MB90F349E/F349ES	[8K]MB96645RS/345RW		128K
96K		[4K]MB90F357TE/F357TES 		[16K]MB90F349E/F349ES	[16K]MB96F645R 		96K
64K	[8K]MB96F313RS/F313RW	[8K]MB90F353RSB/F353RWB	[10K]MB96F633R 	[16K]MB90341CE/341CES	[8K]MB96F695R 		64K
32K	[10K]MB96F613R 	[10K]MB96F623R 	[4K]MB96F683R 	[16K]MB90341E/341ES	[8K]MB96F655R 		32K
24K		[4K]MB96F673R 		[6K]MB90347CE/347CES/347E	[8K]MB96F6A5R 		24K
160K	[4K]MB96F612R 	[4K]MB96F622R 		[16K]MB90348CE/348CES	[8K]MB96F6C5R 		160K
128K	[3K]MB90362E/362ES/362TE/362TES	[4K]MB90351E/351TE/351TES		[16K]MB90348E/ES	[8K]MB90931/931S		128K
96K	[3K]MB90367E/367ES/367TE/367TES	[4K]MB90356E/356ES/356TE/356TES		[6K]MB90F347CE/F347CES	[8K]MB90931/F931S		96K
64K	[3K]MB90F362E/F362ES/F362TE/F362TES	[4K]MB90F351E/F351ES		[6K]MB90F347E/F347ES	[6K]MB96384RS/384RW		64K
32K	[3K]MB90F367E/F367ES/F367TE/F367TES	[4K]MB90F351TE/F351TES		[6K]MB90867E/867ES			32K
24K	[2K]MB90F387/F387S	[4K]MB90F356E/F356ES		[6K]MB90F867E/F867ES			24K
160K	[2K]MB90F897/F897S 	[4K]MB90F356TE/F356TES		[10K]MB96F643R 	[10K]MB96F653R 		160K
128K	[2K]MB90457/457S			[8K]MB96F693R 			128K
96K	[2K]MB90F457/F457S						96K
64K	[4K]MB90911AS						64K
32K	[2K]MB90456/456S						32K
24K	[2K]MB90F456/F456S						24K
160K	[2K]MB90455/455S						160K
128K	[2K]MB90F455/F455S						128K
Lead pitch (mm)	Package name D×W×H(mm)						Lead pitch (mm)
0.4	     						
0.5	    						
0.65	  						
0.8/1.0							

32/16/8-bit core lineup
 ROM, RAM, Pins
 Applications
 Functionality
 Development assistance tools
 Product selection
 32 bit
 16 bit
 8 bit

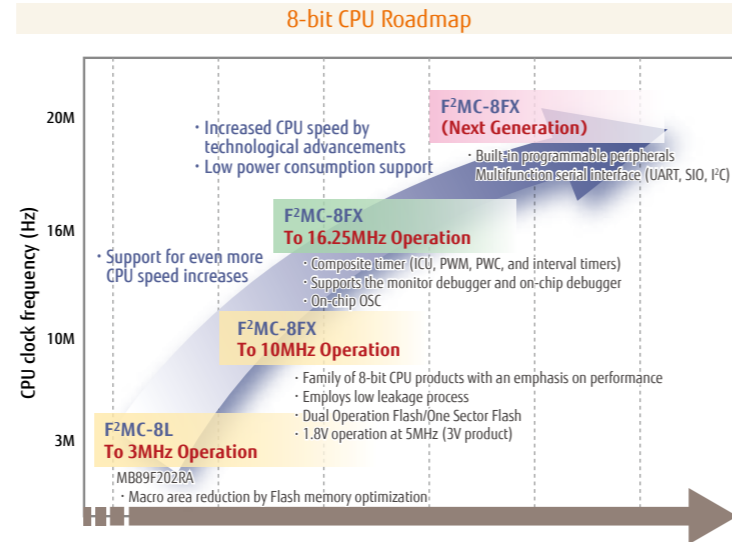


New 8FX · 8-bit Microcontroller

The New 8FX family are Fujitsu original microcontrollers. These microcontrollers can be used in a wide range of applications and products, including system control of small household appliances and subsystem control of digital home appliances, and factory automation equipment.

New 8FX CPU Features

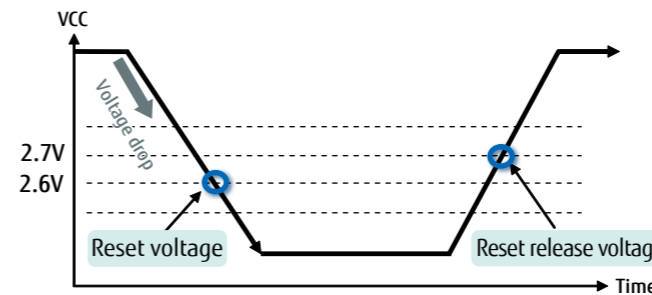
- CPU operating frequency: Up to 16.25MHz
Minimum instruction execution time: 61.5 ns
- Offers a high-speed instruction execution cycle
Example) Multiplication (8-bit x 8-bit) - 8 cycles
Division (16-bit ÷ 16-bit) - 17 cycles
- Interrupt levels: 4 levels
- Clock control unit offers a wide range of operating frequencies
Built-in PLL multiplier circuit
Built-in divider circuit



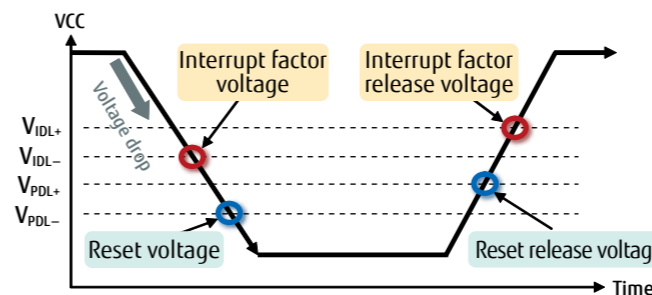
New 8FX Product Features

- Low voltage detection reset

Low voltage detection reset function in 5V products



Low voltage detection reset function in 3V products



When the operating voltage drops, a reset occurs automatically. The reset signal is also output.

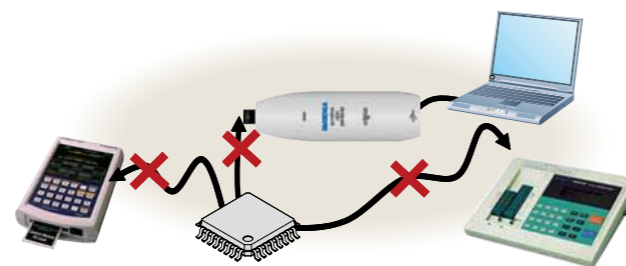
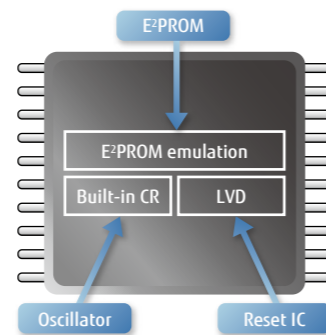
	Min	Typ.	Max.
LVD reset release voltage	2.52V	2.7V	2.88V
LVD reset voltage	2.42V	2.6V	2.78V

Because the interrupt voltage and reset voltage can be set separately, voltage errors can be processed in an interrupt routine before the reset.

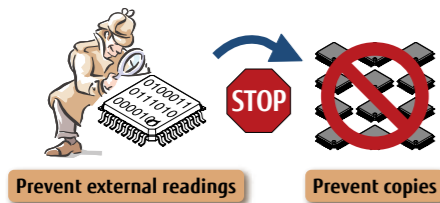
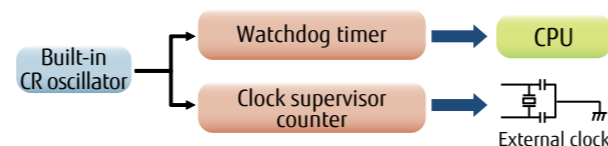
	Min	Typ.	Max.
LVD reset release voltage	V _{PDL+}	Selectable from 3 levels	
LVD reset voltage	V _{PDL-}	Selectable from 3 levels	
LVD interrupt factor release voltage	V _{IDL+}	Selectable from 5 levels	
LVD interrupt factor voltage	V _{IDL-}	Selectable from 5 levels	

New 8FX Product Features

- Cost reduction by using thirdparty parts
 - Oscillator
 - Main CR oscillator circuit
 - Sub built-in CR oscillator circuit
- Reset IC
 - Low-voltage detection circuit (LVD)
- E²PROM
 - Dual operation flash enabling E²PROM emulation
- Flash memory security
Customer software resources are protected by the flash security function.



When the flash security function is active, no data can be read even by a serial writer with BGM adapter nor by parallel writer.



- Watchdog timer and clock supervisor counter
The watchdog timer and clock supervisor counter constantly monitor the CPU and external clock by a built-in CR oscillator.

Product Lineup [New 8FX MB95300, MB95400, MB95500, MB95600 series]

- Handy low pin count series
8-pin to 80-pin product lineup
Suitable for small system control and as a sub-microcontroller
Can be used for power supply management to reduce power consumption
- Comprehensive development environment
Starter kit consists of an evaluation board, BGM adapter, and an evaluation version of SOFTUNE
Supports single wire on-chip debugging
- Abundant technical information on the web
- High quality flash memory
Standard 10,000 (individual guarantee 100,000) rewrites
Data retention period: 20 years

Application	8pin	16pin	20/24pin	32pin	48/52pin	64pin	80pin	
LCD	5V product					MB95470H	MB95410H	Evaluation environment common to all products
	3V product					MB95370L	MB95310L	
Inverter	5V product			MB95330H MB95630H	MB95390H			On-chip debugging support
	3V product			MB95350L				
Standard product	5V product	MB95570H	MB95580H	MB95560H	MB95280H			
	3V product							

32/16/8-bit core lineup
ROM, RAM, Pins
Applications
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Product selection
32 bit
16 bit
8 bit



New 8FX · 8-bit Microcontroller

[RAM(Byte)] Product name: Flash ROM product
 Product name: MASK ROM product/ROM-less products Dual Operation Flash Under developing Under planning

ROM[Byte]	8pin	16pin	20pin	24pin	32pin	48pin	64pin	80pin	ROM[Byte]	
60K						[2032]MB95F398H/F398K	[2032]MB95F378E/F378L	[2032]MB95F318E/F318L	60K	
							[2032]MB95F478H/F478K	[2032]MB95F418H/F418K		
36K					[1024]MB95F636H/F636K	[1008]MB95F396H/F396K	[1008]MB95F376E/F376L	[1008]MB95F316E/F316L	36K	
							[1008]MB95F476H/F476K	[1008]MB95F416H/F416K		
20K	[496]MB95F574H/F574K	[496]MB95F584H/F584K	[496]MB95F564H/F564K	[496]MB95F354E/F354L	[1008]MB95F334H/F334K	[496]MB95F394H/F394K	[496]MB95F374E/F374L	[496]MB95F314E/F314L	20K	
					[1024]MB95F634H/F634K		[496]MB95F474H/F474K	[496]MB95F414H/F414K		
12K	[496]MB95F573H/F573K	[496]MB95F583H/F583K	[496]MB95F563H/F563K	[496]MB95F353E/F353L	[496]MB95F333H/F333K				12K	
					[512]MB95F633H/F633K					
8K	[240]MB95F572H/F572K	[240]MB95F582H/F582K	[240]MB95F562H/F562K	[240]MB95F352E/F352L	[240]MB95F332H/F332K				8K	
					[256]MB95F632H/F632K					
Lead pitch (mm)	Package name D×W×H(mm)								Lead pitch (mm)	
0.5					 QFN-32P 5x5x0.75	 LQFP-48P 7x7x1.5	 QFN-48P 7x7x0.75	 LQFP-64P 10x10x1.5	 LQFP-80P 12x12x1.5	0.5
0.65		 TSSOP-16P 4.4x4.96x1.1	 TSSOP-20P 6.5x4.4x1.2	 TSSOP-24P 7.8x4.4x1.2			 LQFP-64P 12x12x1.5		0.65	
0.8/1.0					 LQFP-32P 7x7x1.5		 QFP-64P 14x20x3.0		0.8/1.0	
1.27	 SOP-8P 5.3x5.24x2.1	 SOP-16P 10.15x5.3x2.0	 SOP-20P 12.7x7.5x2.52	 SOP-24P 15.34x7.5x2.6					1.27	
1.778					 SH-DIP-32P 28x8.89x4.7				1.778	

32/16/8-bit core lineup

ROM, RAM, Pins

Applications

Functionality

Development assistance tools

Product selection

32 bit

16 bit

8 bit

Product Selection by Application

Expanding the possibility of applications

Fujitsu Semiconductor microcontrollers

Home appliances

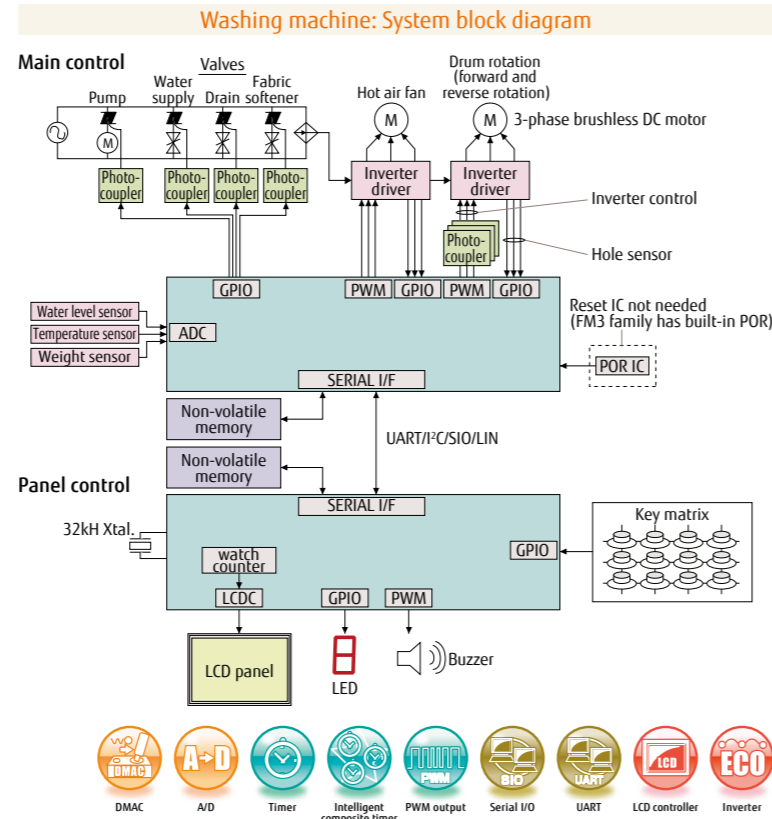
- Air conditioners
- Refrigerators
- Washing machines
- Microwave ovens, etc.



Main control
32bit
 · MB9A100A series
 · MB9A110 series
 · MB9A130L series
 · MB9A310 series
 · MB9B100A series
 · MB9B110T series
 · MB9B300A series

8bit
 · MB95560H series
 · MB95570H series
 · MB95580H series

Panel control
8bit
 · MB95310L series
 · MB95370L series



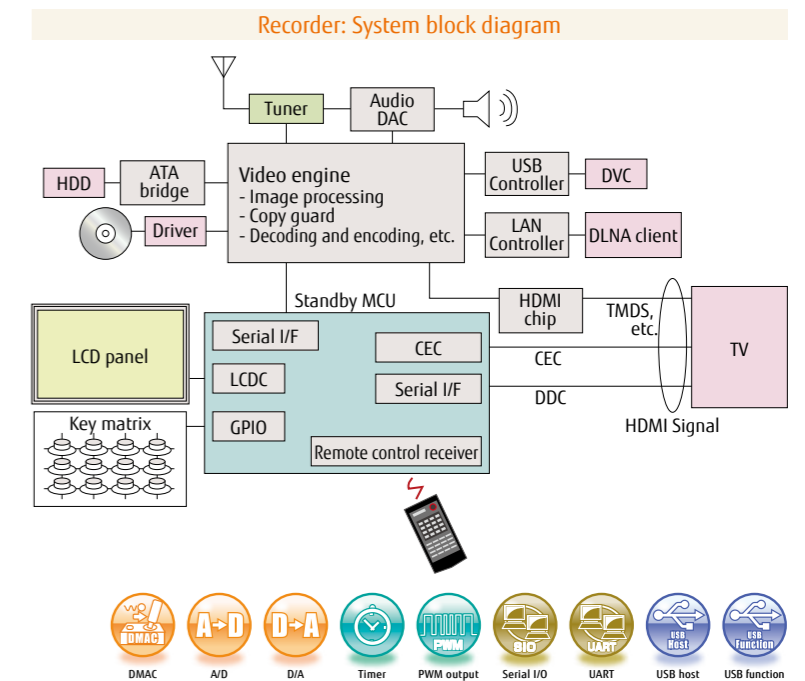
Digital audio-visual

- Players/recorders
- Home theaters
- Digital TV, etc.



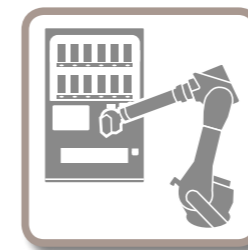
32bit
 · MB9A130L series
 · MB9B110T series
 · MB9B210T series
 · MB9B310T series
 · MB9B610T series

8bit
 · MB95310L series
 · MB95370L series



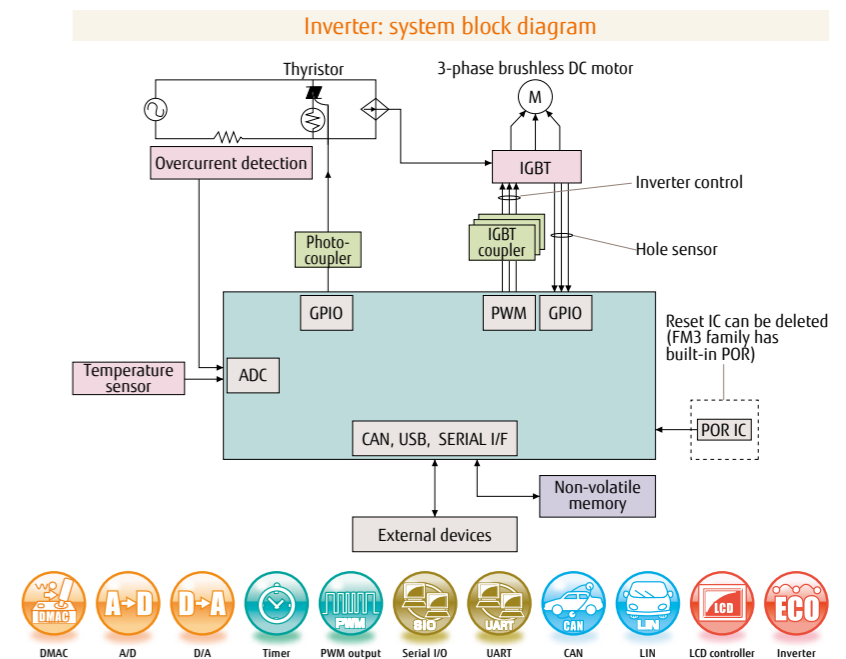
Industrial equipment

- Robots
- Inverter control
- Automatic vending machines
- Medical equipment, etc.



32bit
 · MB9A100A series
 · MB9A110 series
 · MB9A130L series
 · MB9A310 series
 · MB9B100A series
 · MB9B110T series
 · MB9B210T series
 · MB9B300A series
 · MB9B310T series
 · MB9B400A series
 · MB9B410T series
 · MB9B500A series
 · MB9B510T series
 · MB9B610T series

8bit
 · MB95330H series
 · MB95390H series



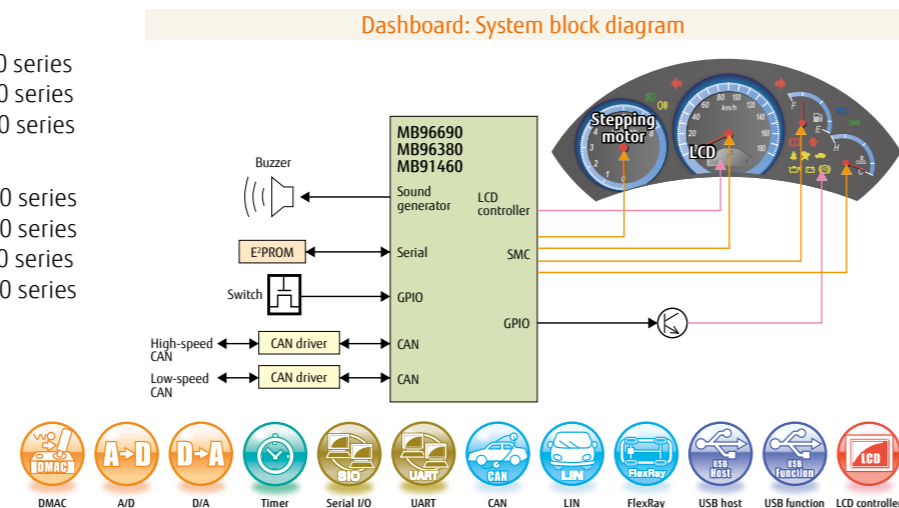
Automotive

- Dashboard
- Navigation systems
- Body control modules, etc.



32bit
 · MB91570 series
 · MB91590 series
 · MB91460 series

16bit
 · MB96340 series
 · MB96380 series
 · MB96610 series
 · MB96690 series



32/16/8-bit core lineup
 ROM, RAM, Pins
 Applications
 Functionality
 Development assistance tools
 Product selection

Built-in CAN microcontrollers

Built-in CAN microcontroller features

CAN is an abbreviation of Controller Area Network, and is a standardized network protocol proposed by Robert Bosch GmbH. CAN was originally developed as a LAN for automotive systems; however, it is being watched with keen interest from various areas due to its reliability and sophisticated error detection.

- (1) High-speed access (up to 1Mbps)
- (2) Error detection
- (3) Short message structure
- (4) Multi-master
- (5) Bus access priority order



EV/HV, EPS motor control microcontroller FR Family MB91580L/580M/580S series

NEW

Overview

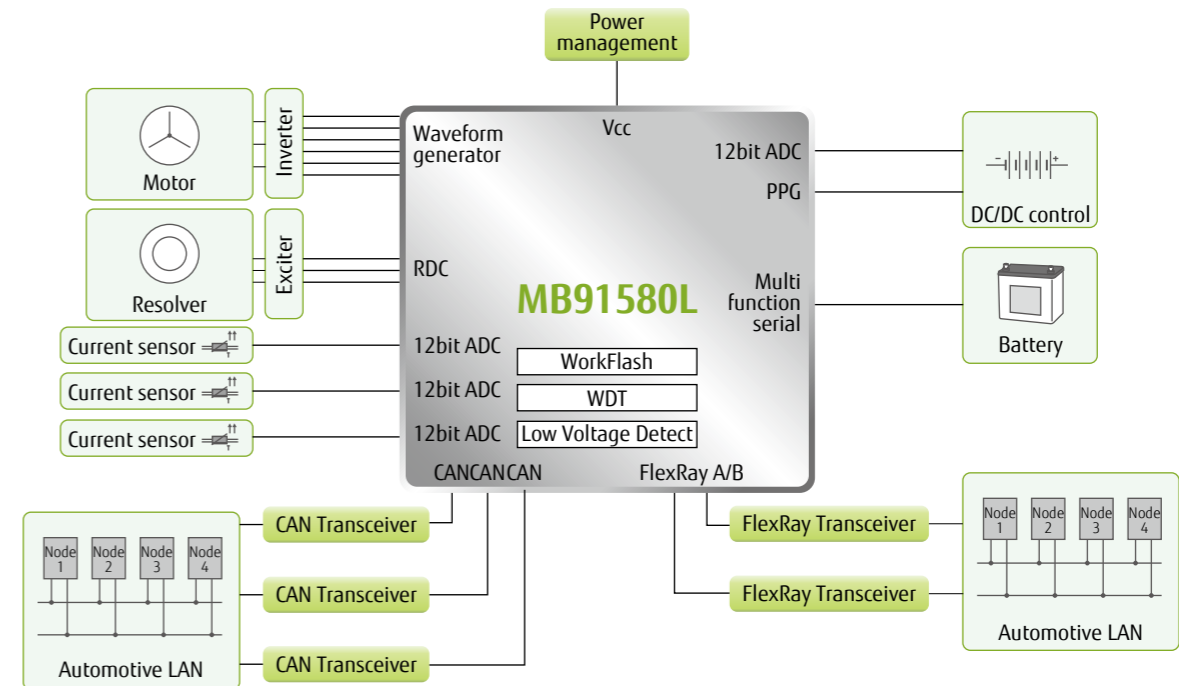
EH/HV motor control solutions

The MB91580L series employs the "FR815" CPU core. This product has built-in three-phase motor control circuit, dedicated resolver sensor interface circuit, fast highly accurate 12-bit A/D converter, and FlexRay and CAN communication control, and is the best product for motor control in the rapidly growing electric vehicle and hybrid vehicle (EV/HV) applications. Furthermore, the MB91580M/580S series are the best products for motor control such as in electric power steering (EPS).

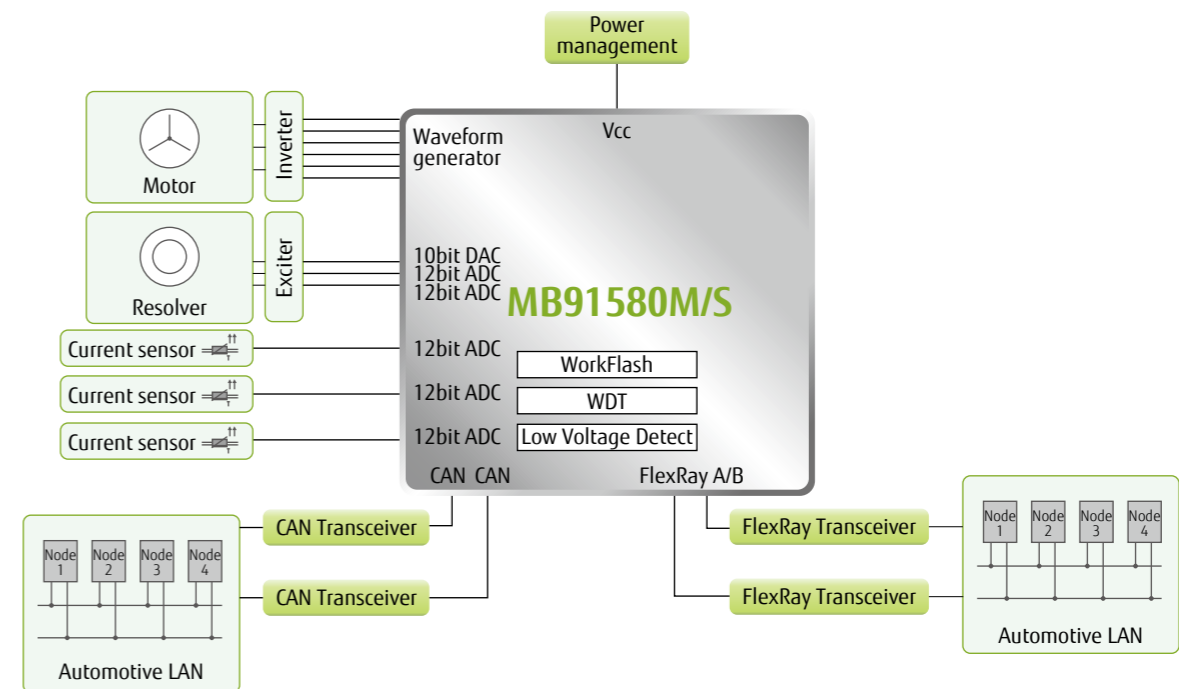
Features

- **High-performance "FR815" CPU core**
 - Core function
 - Cross-bar switch, multilayer bus, floating point operations (FPU), memory protection function (MPU), and ECC built into Flash memory/RAM
- **Built-in motor control function for vehicles**
 - Waveform generator
 - Equipped with 12 channels (2 units)
 - 12-bit A/D converter
 - Equipped with 24 channels (3 units), minimum conversion time 1μs
 - Resolver - digital converter (RDC)
 - Equipped with 1 channel (dedicated resolver sensor interface) (MB91580L only)
- **Built-in vehicle communication interface**
 - FlexRay : 1 unit, CAN : 3 channels,
 - Multifunction serial interface (able to select any combination of LIN-UART, UART, SPI (with CS), and I²C): Supports 5 channels
- **On Chip Debug Unit**
 - Single-wire On Chip Debug Unit built into the debug interface.
- **Key specifications**
 - Maximum operating frequency: CPU: 128 MHz (oscillation=4.0 MHz, 32 multiplication <PLL clock multiplication method>)
 - Package: MB91580L: 144-pin, MB91580M: 100-pin, MB91580S: 64-pin
 - Flash capacity: 320 KB to 1088 KB + WorkFlash 64 KB,
 - RAM capacity: 40 KB to 96 KB

EH/HV motor control & battery control system block diagram (MB91580L series)



Electric power steering control system block diagram (MB91580M/580S series)



Built-in CAN microcontrollers



Body control microcontrollers FR Family MB91520 series NEW

Overview

● Microcontroller solution for platforms for vehicle control

The MB91520 series employs the "FR81S" as the CPU core. This product offers a lineup with a wide variety of functions such as built-in CAN supports 128 message buffers, built-in 12-channel serial interface supporting LIN, and built-in 12-bit A/D converter with up to a maximum of 48 channels, making it the best product for platforms that vehicle control such as vehicle body and infotainment.

Features

● High-performance "FR81S" CPU core

- Core function
- Cross-bar switch, multilayer bus, floating point operations (FPU), memory protection function (MPU), and ECC built into Flash memory/RAM

● Vehicle communication interface built-in as standard

- CAN : 3 channels
- 128 message buffers
- Multifunction serial interface
- Able to select any combination of LIN-UART, UART, SPI (with CS), and I²C: Supports maximum 12 channels

● Built-in wide range of control functions for vehicles

- 12bit AD converter
- Equipped with maximum 48 channels (2 units)
- 16bit PPG timer
- Equipped with maximum 48 channels

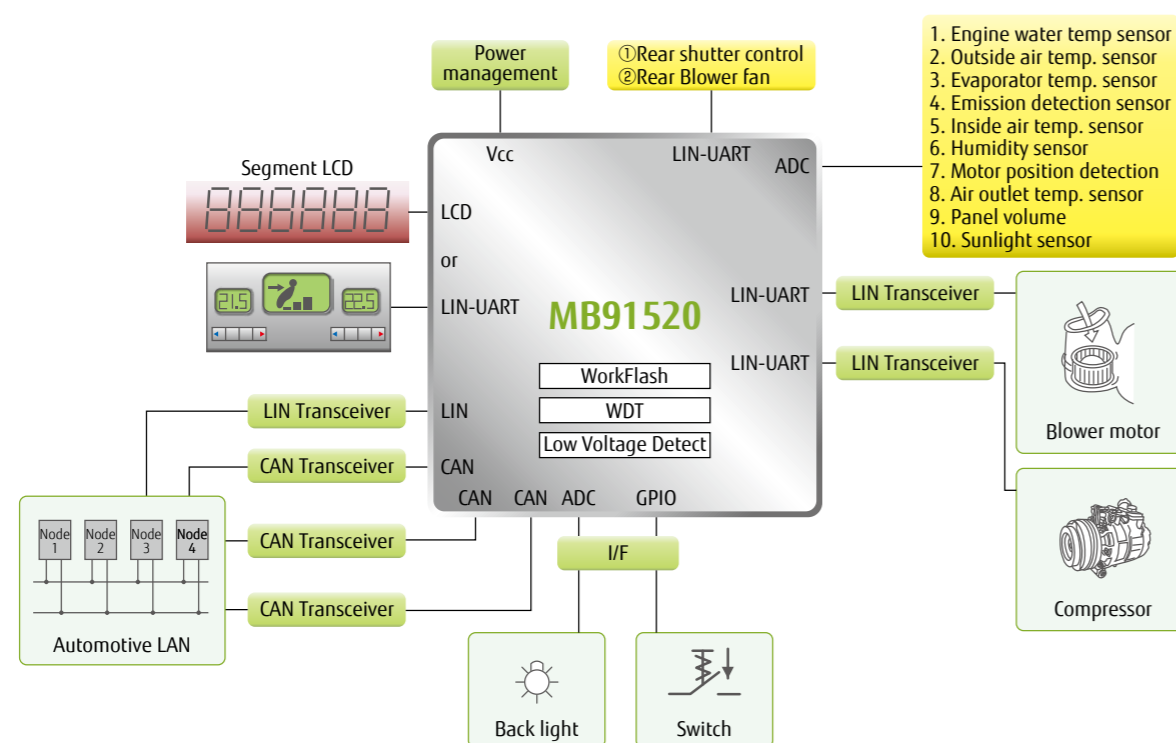
● On Chip Debug Unit

Single-wire On Chip Debug Unit built into the debug interface.

● Key specifications

Maximum operating frequency:
 CPU: 80 MHz (oscillation=4.0 MHz, 20 multiplication
 <PLL clock multiplication method>)
 Package: 64-pin to 176-pin
 Flash capacity: 320 KB to 1088 KB + WorkFlash 64 KB,
 RAM capacity: 48 KB to 128 KB

HVAC system block diagram (MB91520 series)



Dashboard control microcontrollers FR Family MB91590B series NEW

Overview

● Single chip solution for controlling dashboards that have a color LCD

The MB91590B series employs the "FR81S" as the CPU core and is also equipped with a graphic display controller. This is able to deliver communication control such as CAN, motor control, video input, and color display with a minimum of external components. The MB91590B series is a single chip solutions for dashboards that have a color LCD display.

Features

● High-performance "FR81S" CPU core

- Core function
- Cross-bar switch, multilayer bus, floating point operations (FPU), memory protection function (MPU), and ECC built into Flash memory/RAM

● Built-in graphics display controller

- Built-in sprite engine
- Capable of using 512 sprites of up to 512 x 512 dots
- A special sprite function which offers the three types of operations as blinking, auto movement, and image switching without any CPU intervention is also available
- Built-in frame buffer memory for graphics (VRAM) 260 KB to 800 KB
- Built-in decoder for video capture, able to directly input NTSC/PAL signals (also supports input with digital RGB/YUV)

● Built-in control functions for dashboards

- Stepper motor controller: 6 channels, 10bit ADC: 40 channels, 8bit DAC: 2 channels, CAN : 3 channels, LIN-USART : 6 channels, Multifunction serial interface (able to select any combination of LIN-UART, UART, SPI (with CS), and I²C): Supports 4 channels, Sound generator: 5 channels

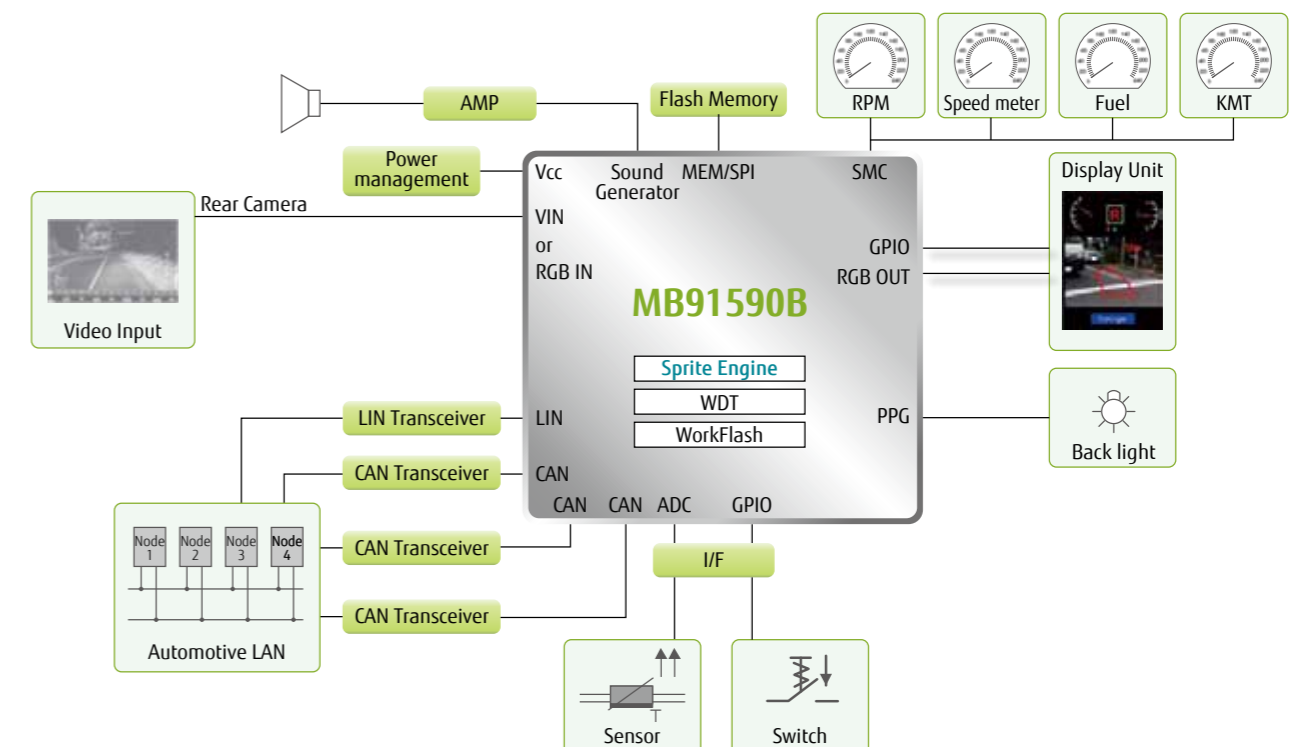
● On Chip Debug Unit

Single-wire On Chip Debug Unit built into the debug interface.

● Key specifications

Maximum operating frequency:
 CPU: 128 MHz (oscillation=4.0 MHz, 32 multiplication
 <PLL clock multiplication method>)
 Package: 208-pin
 Flash capacity: 576 KB to 1088 KB + WorkFlash 64 KB,
 RAM capacity: 40 KB to 64 KB

Dashboard system block diagram (MB91590 series)



Built-in CAN microcontrollers



Dashboard control microcontrollers FR Family MB91570 series **NEW**

Overview

● Single chip solution for segment dashboard control

The MB91570 series employs the "FR815" as the CPU core, and is equipped with the functionality to simultaneously perform motor control, LCD segment control, and communication control such as CAN. The MB91570 is a single chip solution for controlling dashboards that have a segment type LCD display.

Features

● High-performance "FR815" CPU core

- Core function
- Cross-bar switch, multilayer bus, floating point operations (FPU), memory protection function (MPU), and ECC built into Flash memory/RAM

● Dashboard control functions built-in as standard

- Stepper motor controller: 6 channels,
- Sound generator: 5 channels
- LCD controller: Built-in 4 com x 32 seg

● Vehicle communication interface built-in as standard

- CAN: 3 channels, LIN-USART: 6 channels
- Multifunction serial interface
- Able to select any combination of LIN-UART, UART, SPI (with CS), and I²C: Supports 4 channels

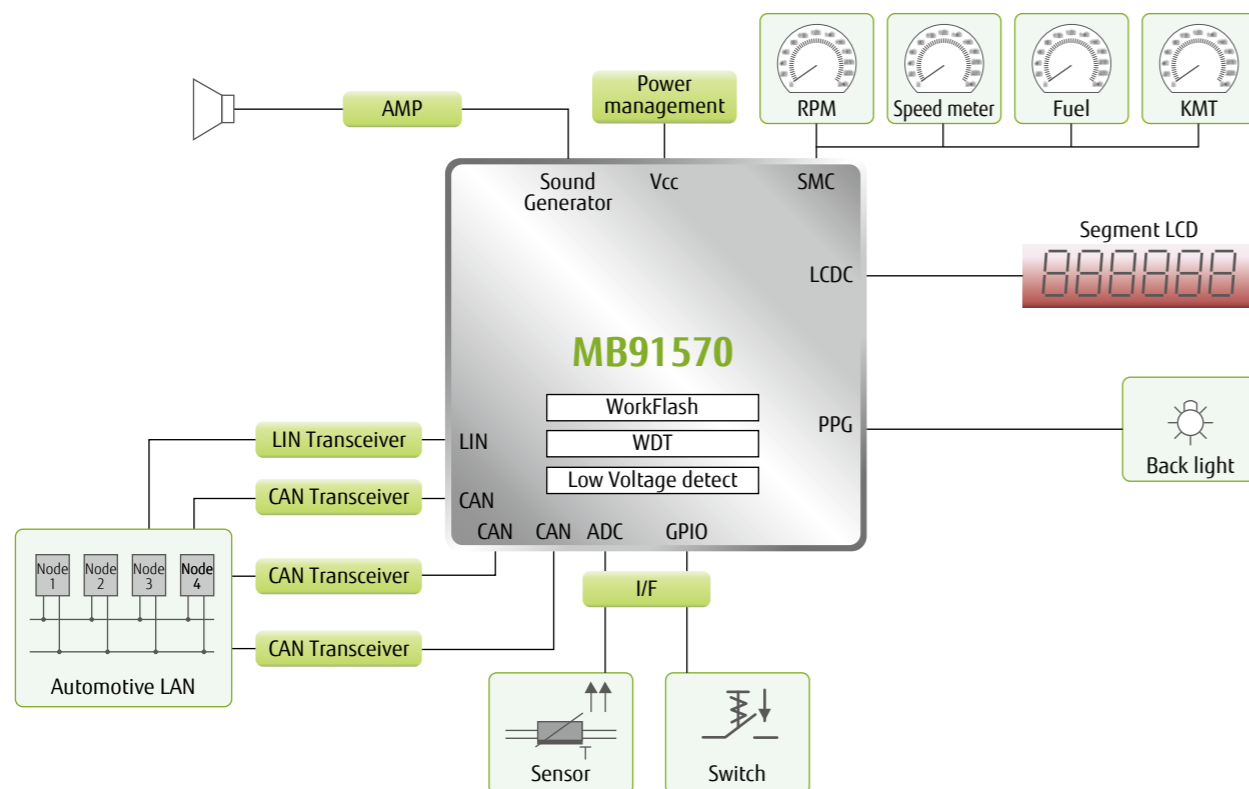
● On Chip Debug Unit

Single-wire On Chip Debug Unit built into the debug interface.

● Key specifications

Maximum operating frequency:
CPU: 80 MHz (oscillation=4.0 MHz, 20 multiplication
<PLL clock multiplication method>)
Package: 144-pin
Flash capacity: 576 KB to 1088 KB + WorkFlash 64 KB,
RAM capacity: 40 KB to 64 KB

Dashboard system block diagram (MB91570 series)



16-bit CAN microcontrollers for body control F²MC-16FX Family MB96610/620/630/640/650/6B0/6C0 series **NEW**

Overview

● Lineup of products from 48 pins to 120 pins as optimal for vehicle-mounted body system control systems

This product has a built-in CAN controller supporting 32 message buffers and is able to support the growing number of nodes in vehicle-mounted body system control systems. Furthermore, it is equipped with Dual Operation Flash that is equivalent to E²PROM functionality, and can contribute to reducing the cost of the overall system.

Features

● High-performance "F²MC-16FX" CPU core

- Basic instructions are executed in one cycle
- High-speed processing using a 5-stage pipeline and instruction queue (8 bytes)
- Fast interrupt processing
- Transition to interrupt time: 10 cycles,
- Return from interrupt time: 9 cycles

● Built-in vehicle communication interface

- CAN: 1 channel (32 message buffers)
- LIN-USART: 3 channels to 6 channels (Channels 1 and 2 among these have a hardware assistance function for LIN communication mode)

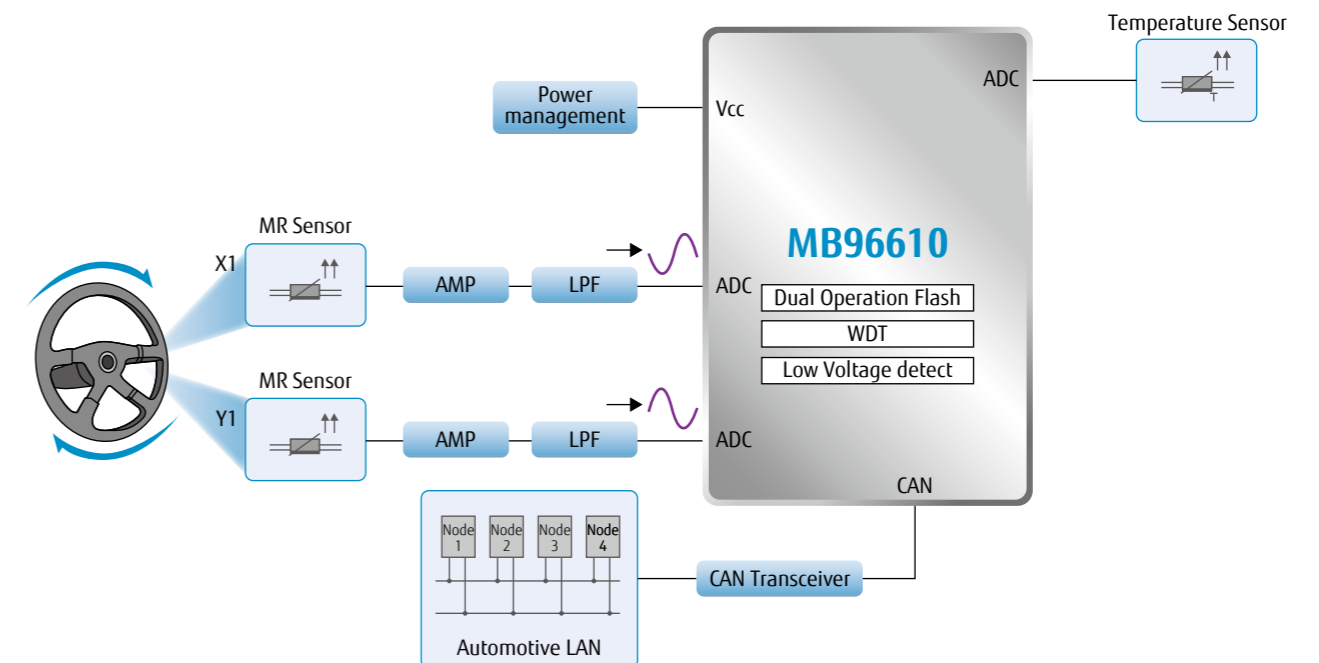
● On Chip Debug Unit

Single-wire On Chip Debug Unit built into the debug interface.

● Key specifications

Maximum operating frequency:
32 MHz (oscillation=4.0 MHz, 8 multiplication
<PLL clock multiplication method>)
Package: 48-pin, 64-pin, 80-pin, 100-pin, 120-pin
Dual Operation Flash capacity: 32 KB to 384 KB + 32 KB
RAM capacity : 4 KB to 28 KB

Steering wheel angle sensor control system block diagram (MB96610 series)



Built-in CAN microcontrollers

16-bit CAN microcontrollers for dashboard control F²MC-16FX Family MB96670/680/690/6A0 series

NEW

Overview

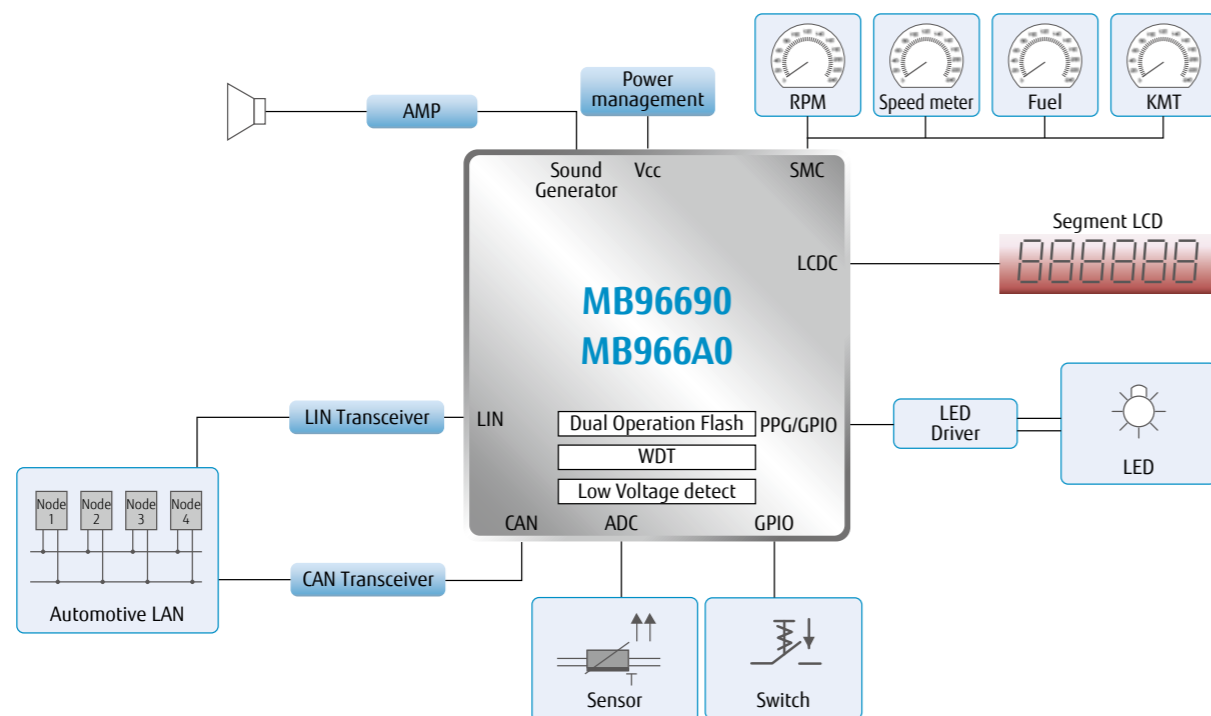
- Lineup of products from 64 pins to 120 pins as suitable for vehicle-mounted meter control systems

This product is equipped with functionality that can simultaneously perform stepper motor control, LCD segment control, and communication control such as CAN. Furthermore, it is equipped with Dual Operation Flash that is equivalent to E²PROM functionality, and can contribute to reducing the cost of the overall system.

Features

- High-performance "F²MC-16FX" CPU core**
 - Basic instructions are executed in one cycle
 - High-speed processing using a 5-stage pipeline and instruction queue (8 bytes)
 - Fast interrupt processing
 - Transition to interrupt time: 10 cycles,
 - Return from interrupt time: 9 cycles
- Built-in functionality optimized for meter control**
 - Stepper motor controller: 2 channels to 5 channels
 - LCD controller: 4 com x 24 seg to 44 seg
 - A/D converter: 10-bit x 12 channels to 32 channels
 - Sound generator: 1 channel to 2 channels
- Built-in vehicle communication interface**
 - CAN: 1 channel (32 message buffers)
 - LIN-USART: 2 channels to 5 channels (Channels 1 and 2 among these have a hardware assistance function for LIN communication mode)
- On Chip Debug Unit**
 - Single-wire On Chip Debug Unit built into the debug interface.
- Key specifications**
 - Maximum operating frequency: 32 MHz (oscillation=4.0 MHz, 8 multiplication <PLL clock multiplication method>)
 - Package: 64-pin, 80-pin, 100-pin, 120-pin
 - Dual Operation Flash capacity: 64 KB to 256 KB + 32 KB
 - RAM capacity: 4 KB to 16 KB

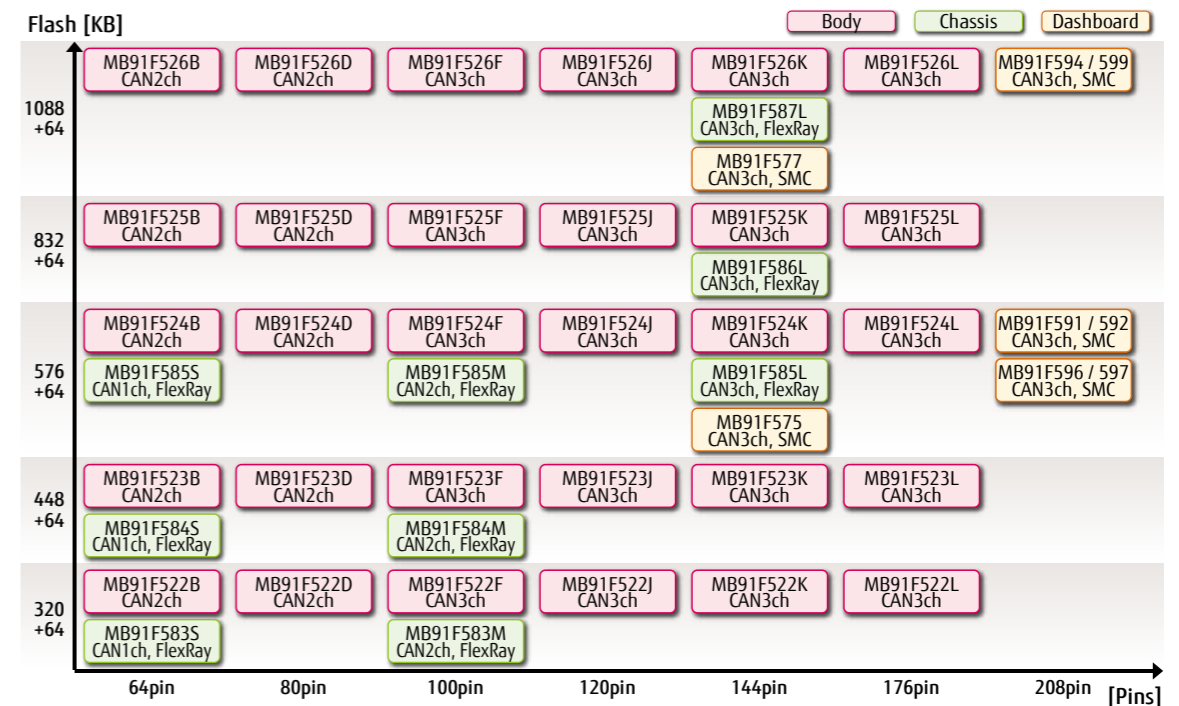
Meter control system block diagram (MB96690/6A0 series)



Series Lineup

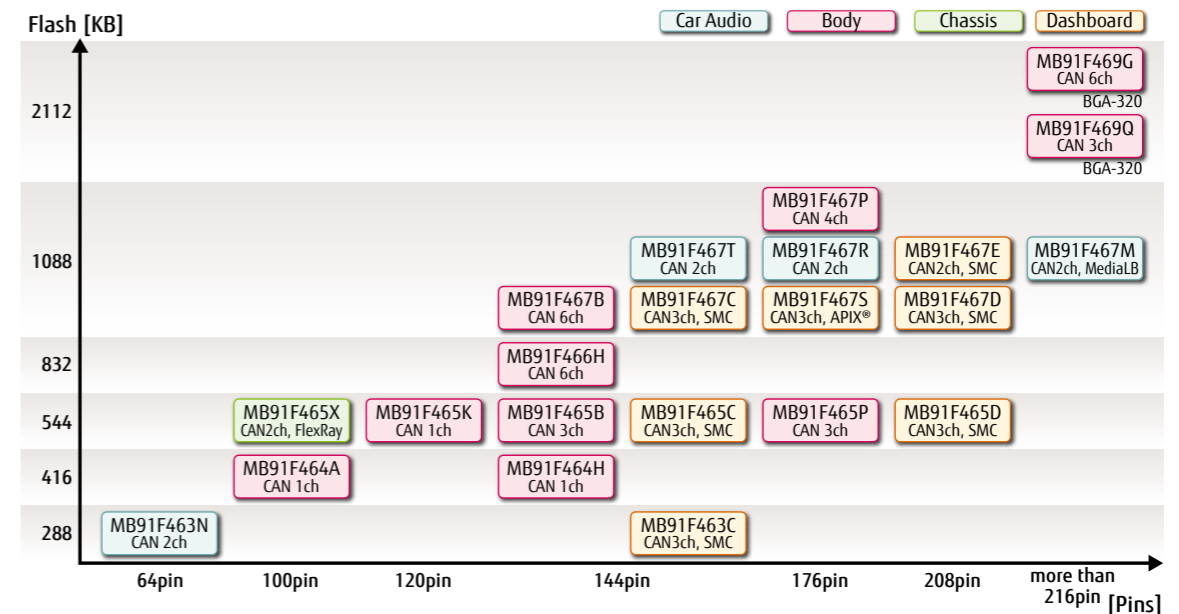
MB91500 Series Product Lineup

- High-performance FR81S core, Maximum operation frequency: 128 MHz
- Diverse lineup for vehicle system control such as motor control (EV/HV, EPS), dashboard, and body control
- AUTOSAR support
- AEC-Q100 compliance



MB91460 Series Product Lineup

- High-performance FR60 core, Maximum operation frequency: 100 MHz
- Diverse lineup for vehicle system control such as dashboard, car audio, body control, and chassis
- AUTOSAR support
- AEC-Q100 compliance



Built-in FlexRay microcontrollers



What is FlexRay

FlexRay is a next-generation vehicle-mounted network protocol.

FlexRay supports high reliability, high-performance control (maximum communication speeds of up to 10Mbps), and has drawn attention in a wide range of fields as a next-generation, high-performance automotive network protocol aimed at X-by-Wire replacement of mechanical control systems with electronic control systems.

The standardization of FlexRay as a next-generation vehicle-mounted communication protocol is being promoted by the FlexRay Consortium.

FlexRay features

- Vehicle-mounted LAN communication for X-by-Wire (limit of CAN)
 - Time Trigger Protocol
 - Max 10Mbps
- Communication protocol considering high reliability → Demanded by X-by-Wire applications
 - Supports completely duplicated networks (redundant communication)
 - Scheduling monitoring (bus guardian)
- Supports flexible topologies
 - Supports Bus, Star, and Hybrid topologies
 - Segment structure; static and dynamic segment



Built-in FlexRay microcontrollers

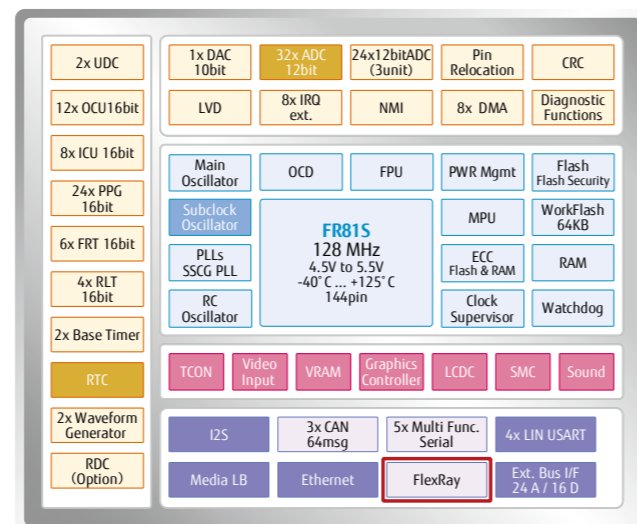
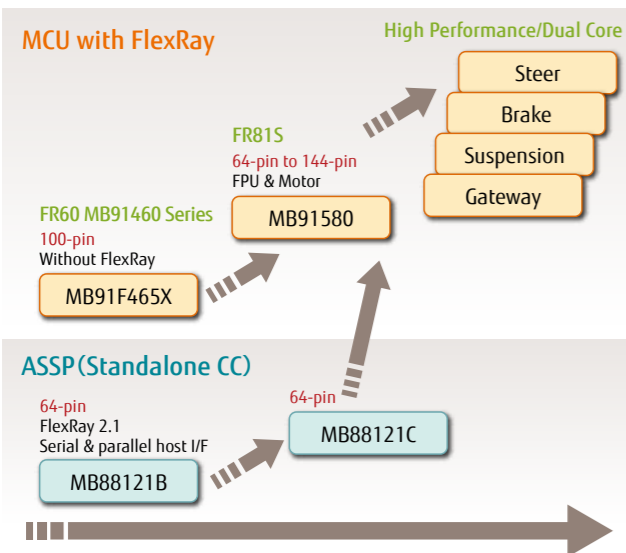
Features

- Built-in FlexRay controller macro from Robert Bosch GmbH supporting FlexRay Protocol Ver 2.1
- Supporting FlexRay communication speeds of 10Mbps, 5Mbps, and 2.5 Mbps
- Built-in PLL oscillator circuit exclusively used for FlexRay system clock

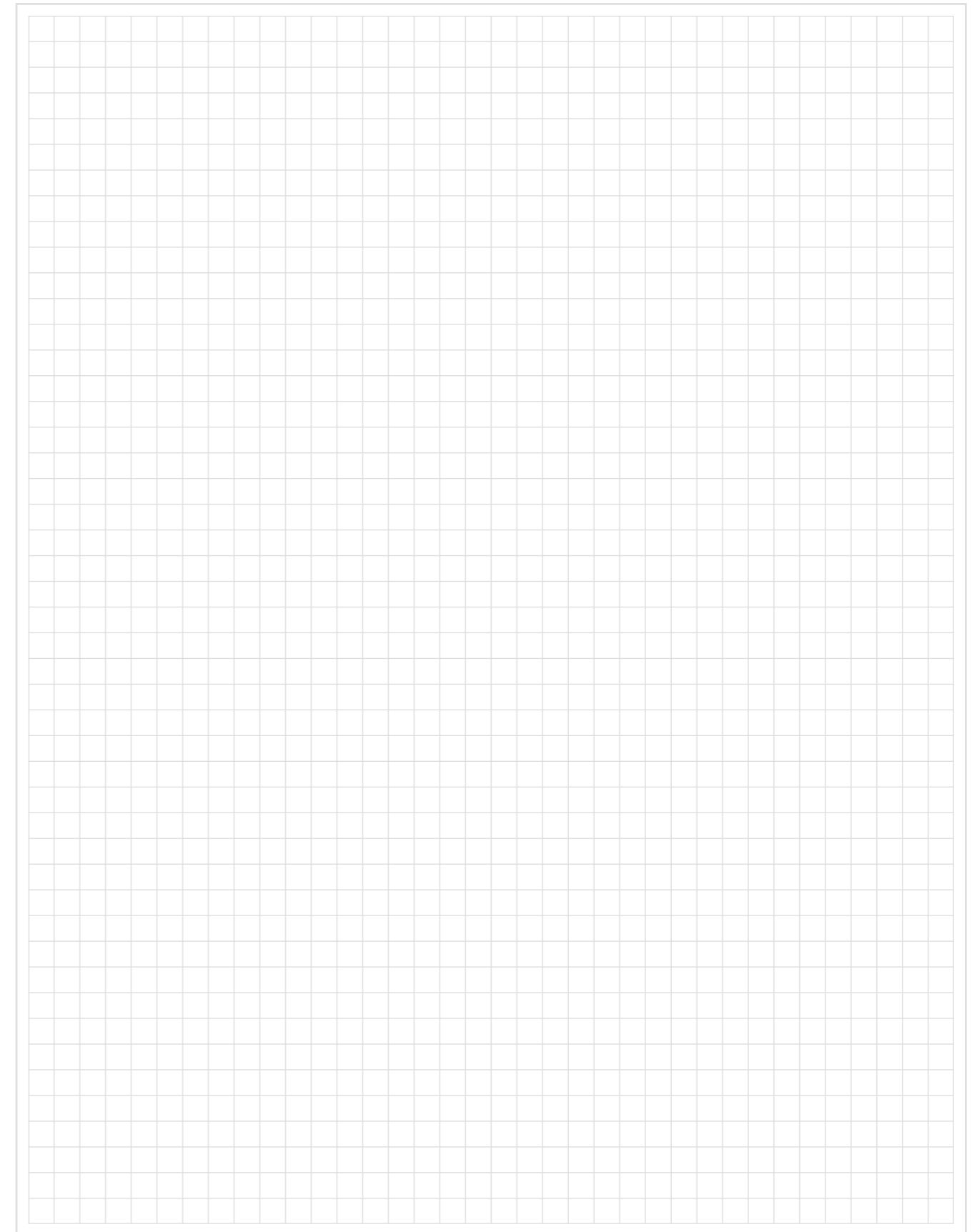
MB91F587L block diagram

- FR815 High Performance MCU Core
 - Single Voltage Vcc=4.5 V-5.5 V
 - 144-pin package
 - Motor Timer (Twin Motor)
 - RDC (Option)
 - 24 x 12bit A/D
 - 8x ADC0
 - 8x ADC1
 - 8x ADC2
- FlexRay
- 3x CAN
- FPU
- ECC
- MPU
- CRC

FlexRay MCU roadmap



memo



32/16/8-bit core lineup

ROM, RAM, Pins

Applications

Functionality

Development assistance tools

Product selection

Built-in USB microcontrollers



Built-in USB microcontroller features

USB is an abbreviation of Universal Serial Bus.

In recent years, support for USB interfaces has been spreading to various devices.

Fujitsu Semiconductor is expanding our lineup of microcontrollers with built-in USB Function (compliant with USB Full-Speed).

Products are also available with built-in simple Host functionality, making it possible to implement a system that can use a USB interface even without a PC.



FM3 Family MB9B310T series

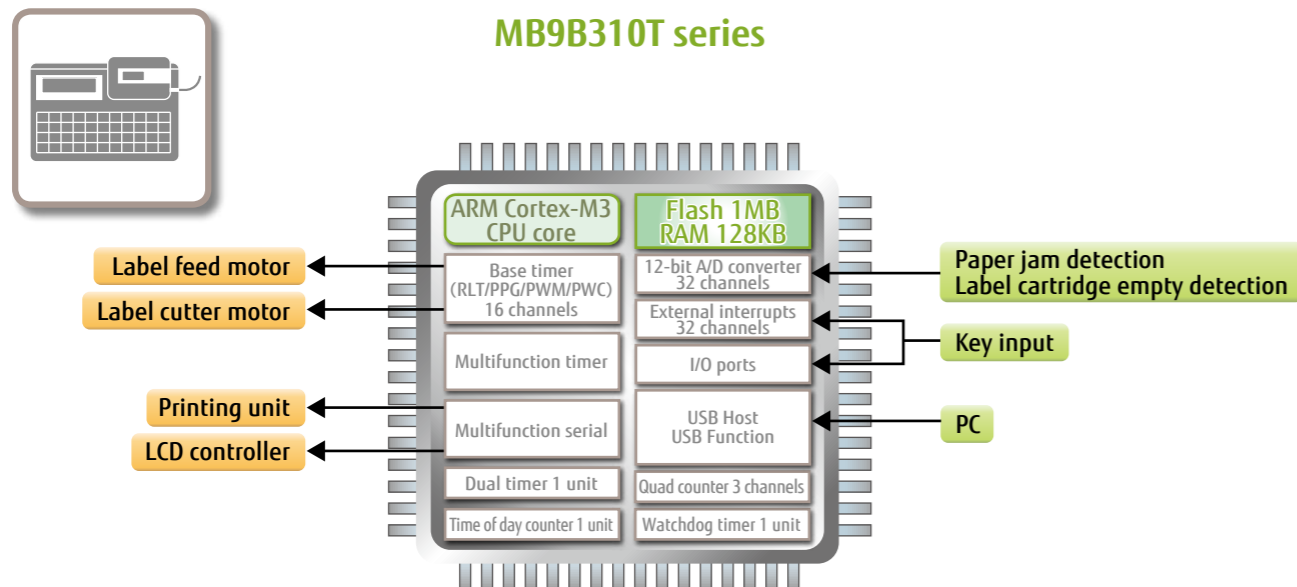
Overview

The "MB9B310T series" of high-performance 32-bit USB microcontrollers is equipped with an ARM Cortex-M3 core and is equipped with a maximum of 2 channels of USB Host/USB Function as peripheral functions. It also has a variety of other communication interfaces.

Features

- **ARM Cortex-M3 high-performance 32-bit RISC CPU core**
 - Maximum CPU operating frequency: 144 MHz
 - Memory protection unit (MPU): Increases the reliability of embedded systems
- **USB Function**
 - Supports USB 2.0 Full-Speed
 - The Flash memory built into the microcontroller can be rewritten via the USB interface
 - Supports up to a maximum of 6 endpoints
- **USB Host**
 - Supports USB 2.0 Full-Speed / Low-Speed
 - Offers connectivity with USB devices even without a PC
 - Bulk transfers, interrupt transfers, and isochronous transfers are supported
 - Automatic detection of USB device connectivity (connected/disconnected)

Sample label printer application: system block diagram



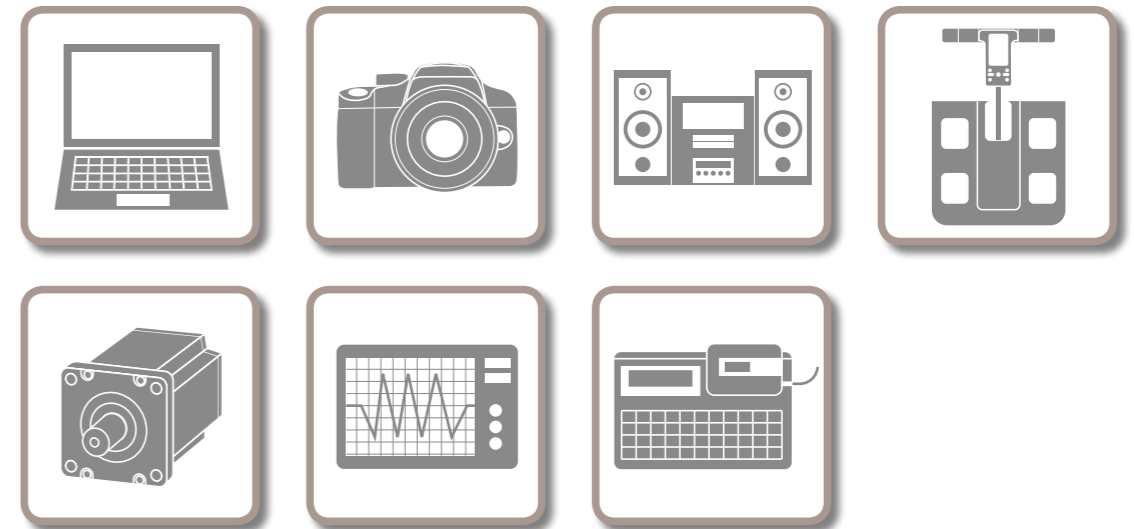
Series Lineup

FM3 Family/FR Family · 32-bit Microcontroller F²MC-16FX Family · 16-bit Microcontroller

Number of pins	48pin	64pin	80pin	100pin	120pin	144pin	176pin	192pin
ROM[Byte]								
1M							MB9B610T MB9B510T MB9B310T MB9B210T	
768K							MB9B610T MB9B510T MB9B310T MB9B210T	
544K						MB96330		
512K					MB91610		MB9B610T MB9B510T MB9B310T MB9B210T	
384K				MB9B500A MB9B300A				
256K			MB9A310		MB91660			
128K	MB91665							
64K								

Devices with USB connectivity

- Printers
- Scanners
- Notebook PCs
- SLR cameras
- Stereos
- Scales
- FA devices
- Measuring devices

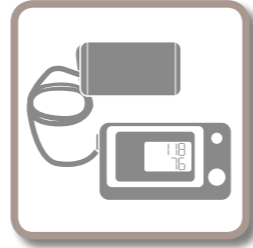


Built-in LCD controller microcontrollers



Built-in LCD controller microcontroller features

LCDs (Liquid Crystal Displays) are widely used as the display device in general home appliances and digital home applications. Fujitsu offers a lineup of microcontrollers with built-in LCD controller for embedded systems that require an LCD display.



- (1) Selectable frame cycle
- (2) Supports 4-common output/72 segment LCD (maximum)
- (3) Lit/not-lit is set by display RAM data

New 8FX MB95310L series

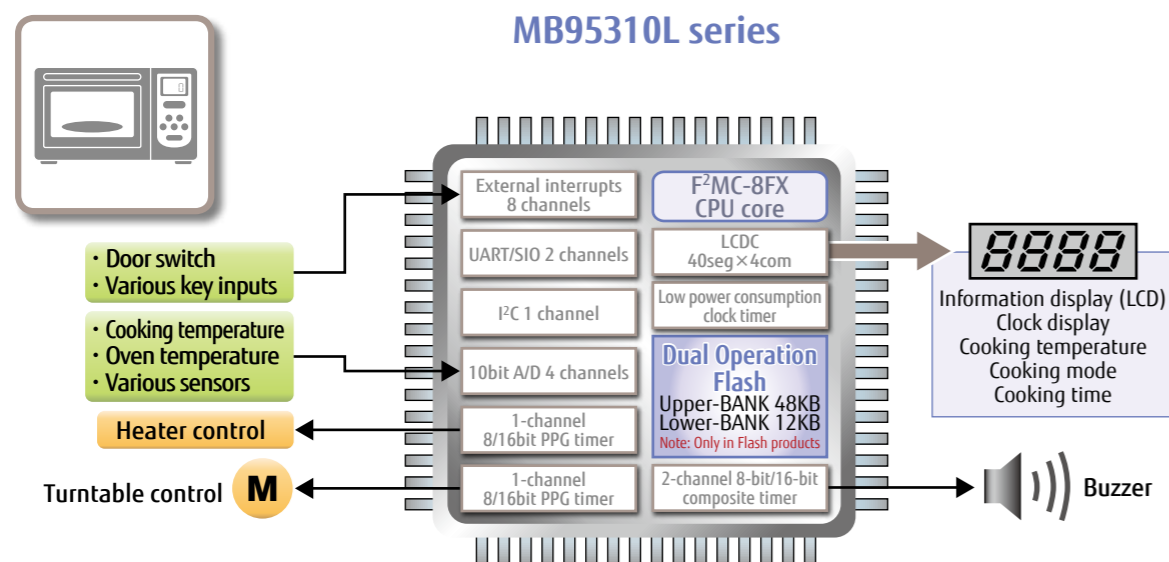
Overview

An 8-bit microcontroller with a built-in LCD controller. This product has a built-in LCD controller and operates at 3 V. This also supports human interface control applications such as LCD display units and key input in general home appliances such as refrigerators and microwave ovens.

Features

- The display clock source can be selected from the main and sub clocks. The frame rate can also be selected from 4 patterns
- 40 segment × 4 common output
Able to display a maximum of 160 characters
- Blinking control function
Offers hardware controlled blinking, reducing software load
- Selectable from:
 - 1/2 bias, 1/2 duty
 - 1/3 bias, 1/3 duty
 - 1/3 bias, 1/4 duty
- LCD display is enabled during microcontroller standby
LCD display is enabled during system low power operation
- LCD display pins / external power supply pins can be used as general-purpose ports when not used
- Built-in resistance divider
Contributes to reducing the number of parts

Sample application in microwave oven: system block diagram



Series Lineup

FR Family · 32-bit Microcontroller

ROM[Byte]	Number of pins	Product
1152K	144pin	MB91570 (32×4)
640K		

Values in parentheses are number of segments × number of common

F²MC-16FX Family · 16-bit Microcontroller

ROM[Byte]	64pin	80pin	100pin	120pin	144pin
832K				MB96380 (65×4)	MB96370 (72×4)
544K					
288K				MB966A0 MB966C0 (44×4)	
256K			MB966B0 (36×4)		
160K			MB96390 (49×4)		
128K	MB96670 (24×4)	MB96680 (32×4)			
64K			MB96690 (36×4)		

Values in parentheses are number of segments × number of common

New 8FX Family · 8-bit Microcontroller

ROM[Byte]	64pin	80pin
60K	MB95370L MB95470H (32×4)	MB95310L MB95410H (40×4)
36K		
20K		

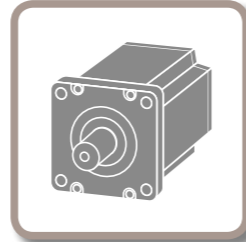
Values in parentheses are number of segments × number of common

Microcontrollers for inverter control



Features of microcontrollers for inverter control

This product is equipped with a variety of timers suitable for inverter control and a high-performance A/D converter suitable for feedback control in order to meet demands for energy efficiency in general home appliances such as air conditioners, washing machines and driers, refrigerators, induction cookers, etc.



- 1) Built-in multifunction timer capable of three-phase PWM control
- 2) The functionality that suits the application can be freely selected from a variety of timers (PPG, PWM, PWC, input capture) using the built-in base timer
- 3) Built-in multi-unit multi-channel high-performance A/D converter that can operate in conjunction with the multifunction timer and DMAC
- 4) Built-in dedicated high-speed multiply and accumulate calculation macro that can perform vector calculation processing in parallel with the CPU

FM3 Family MB9B500A series

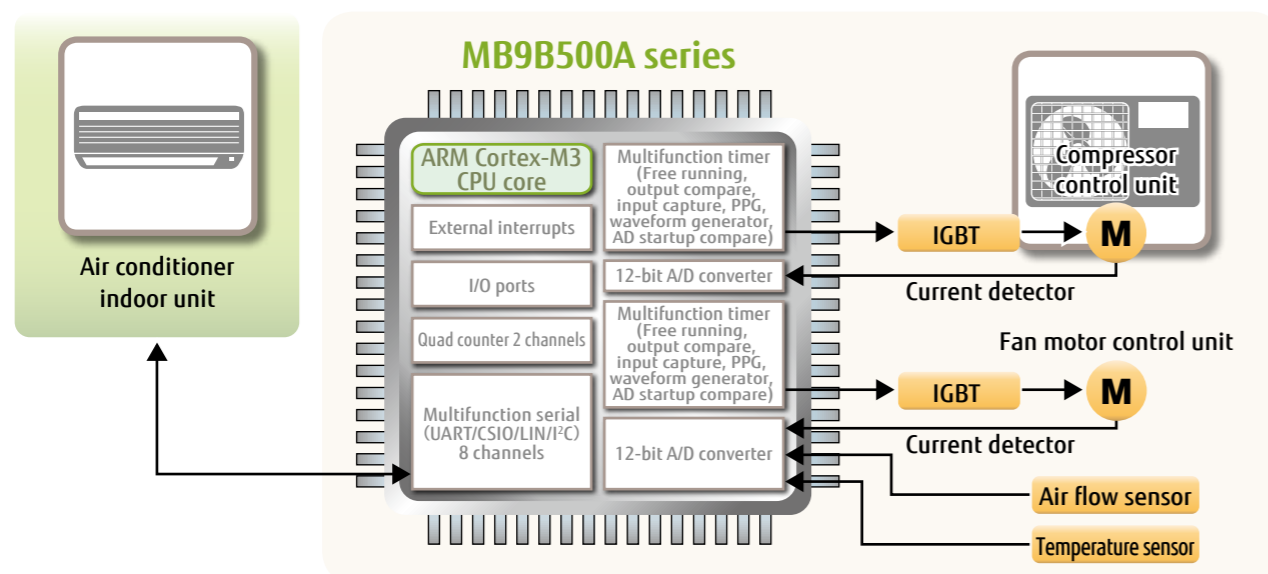
Overview

This series of microcontrollers is for inverter applications and employs the ARM Cortex-M3 RISC CPU as the core. Offers a built-in 32-bit CPU core with a maximum operation processing rate of 80 MHz, a multifunction timer capable of three-phase PWM control, a high-performance A/D converter, and a dedicated 32-bit high-speed multiply and accumulate macro in order to offer inverter control for home appliances such as air conditioners, washing machines and driers, refrigerators, and induction cookers.

Features

- CPU core: ARM Cortex-M3 RISC
 - Operating frequency: 80 MHz
 - Package: LQFP-100/LQFP-120
 - Flash capacity: 512 KBytes
 - RAM capacity: 64 KBytes
 - Operating voltage: 2.7 V to 5.5V
- Main functions
 - Analog function 12-bit A/D 16 channels (3 units)
 - Multifunction timer capable of motor control 2 units (PWM signal output function/DC chopper waveform output function/input capture function/A/D converter startup function/motor emergency stop (DTIF) interrupt function)
 - Base timer 8 channels (Each channel can be selected from 16-bit PWM timer, 16-bit PPG timer, 16-/32-bit reload timer, or 16-/32-bit PWC timer)

Example application to air conditioner outdoor unit: system block diagram



Series lineup

FM3 Family · 32-bit Microcontroller

Inverter control function built into all models in family

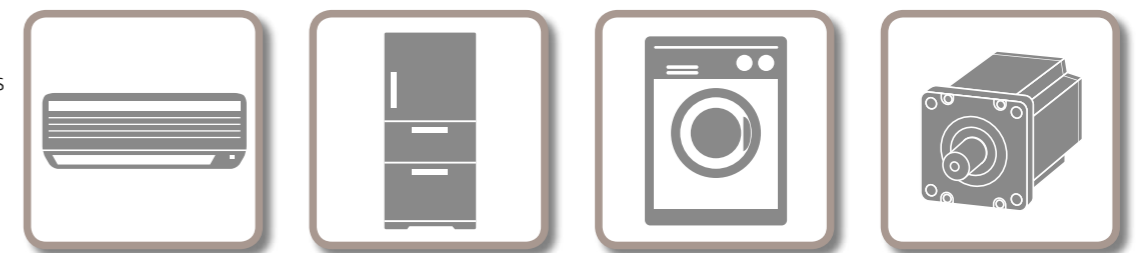
Number of pins ROM[Byte]	48pin	64pin	80pin	100pin	120pin	144pin	176pin	192pin
1M						MB9B610T MB9B510T		
768K						MB9B410T MB9B310T		
512K						MB9B210T MB9B110T		
384K								
256K			MB9A310 MB9A110		MB9B500A MB9B400A MB9B300A MB9B100A			
128K		MB9A130L			MB9A100A			
64K								

FR Family · 32-bit Microcontroller New 8FX Family · 8-bit Microcontroller

Number of pins ROM[Byte]	32pin	48pin	64pin	80pin	100pin	120pin	144pin	176pin
1088K			MB91520					
832K			MB91520					
576K			MB91520					
448K			MB91580		MB91580		MB91580	
320K			MB91520					
60K			MB91520					
36K	MB95630H	MB95390H						
20K	MB95330H							
12K								
8K								

Motor control equipment

- Air conditioners
- Refrigerators
- Washing machines
- Industrial motors



32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection

Development assistance tools

(software tools)



Development environment solution : Fujitsu AUTOSAR Solution

AUTOSAR

About AUTOSAR

AUTOSAR (Automotive Open System Architecture) is a standardization organization established in July 2003 mainly by Daimler-Chrysler, BMW AG, Robert Bosch GmbH in order to modularize and commonize automotive software.

The AUTOSAR software platform was prepared as a solution for the demands for in-vehicle system software and is being investigated by various OEM and ECU manufacturers for its application to in-vehicle software.

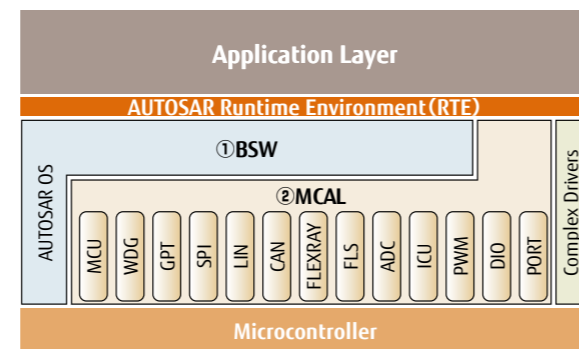
- Standardizing software frameworks
- Standardizing design processes
- Commonizing and modularizing application software by introducing a common runtime environment (RTE)
- Providing a microcontroller abstraction layer (MCAL) that absorbs the hardware differences and commonizes upper layer software

Scalable AUTOSAR compliant with HIS recommended specifications

The Herstellerinitiative Software (HIS) software initiative was established by five German automobile manufacturers Audi, BMW, Daimler, Porsche, and Volkswagen in order to assist with ECU related standardized software and modules, process maturity, software testing, software tools, and programming.

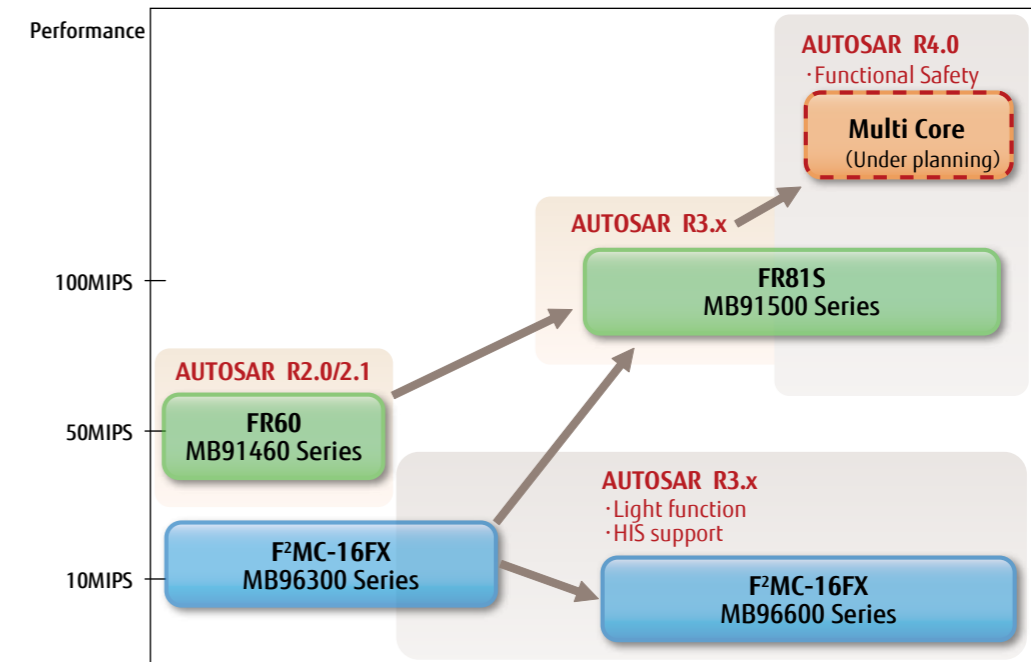
Scalable AUTOSAR compliant with HIS recommended specifications provides guidelines for implementing BSW functions optimized for small code size without violating the AUTOSAR specifications and contributes to cost reductions.

System configuration example



Note: The MCAL configuration changes depending on target microcontrollers.

AUTOSAR product roadmap



Product lineup

PARTS	Version	Provided by	Support MCU
① OS/BSW	R2.0/2.1 R3.0/3.1 R3.1 HIS recommended version	Elektrobit, Vector, KPIT, etc.	MB91460 series (32-bit), MB96300 series (16-bit), etc.
② MCAL	R2.0/2.1 R3.0/3.1/3.1 HIS recommended version	Elektrobit and Fujitsu Semiconductor Fujitsu Semiconductor	MB91460 series (32-bit) MB96300 series (16-bit)

memo



32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection
32 bit
16 bit
8 bit

Development assistance tools

(REALOS™ series)

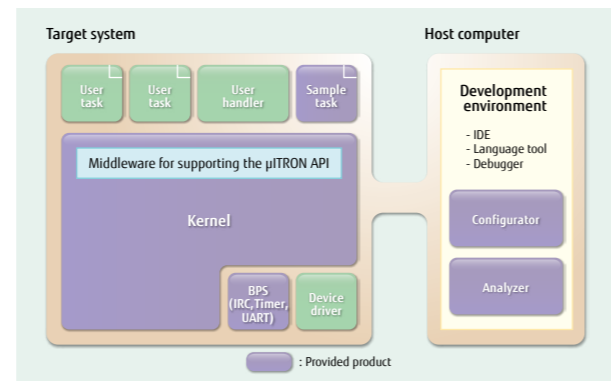
Fujitsu Semiconductor provides a real-time OS for developing software for Fujitsu microcontrollers (FM3 family, FR family and F²MC-16 family).

Features of the REALOS Series

- μT-Kernel specifications and μITRON specifications
- High-speed, lightweight kernel optimized for Fujitsu microcontrollers (kernel code size: from 0.8 KB, kernel data size (TCB): from 21 Bytes)
- Highly responsive interrupts
- Supports custom power-saving functions
- Includes kernel source code, royalty payments not required

System configuration

- Kernel conforms to μT-Kernel specifications and μITRON specifications
- REALOS configurator
- REALOS-aware debugging tool
- Sample programs
- ITRON specification API library



SOFTUNE REALOS/FR configuration diagram

Series Lineup

• μT-Kernel compliant OS

This OS conforms to the μT-Kernel specifications that are the successor to the μITRON specifications. μT-REALOS/FR has excellent migratability, many functions, and power-saving functionality. The kernel overhead is extremely small. This is the most advanced RTOS to conform to the μT-Kernel specifications.

• μITRON 4.0 compliant OS

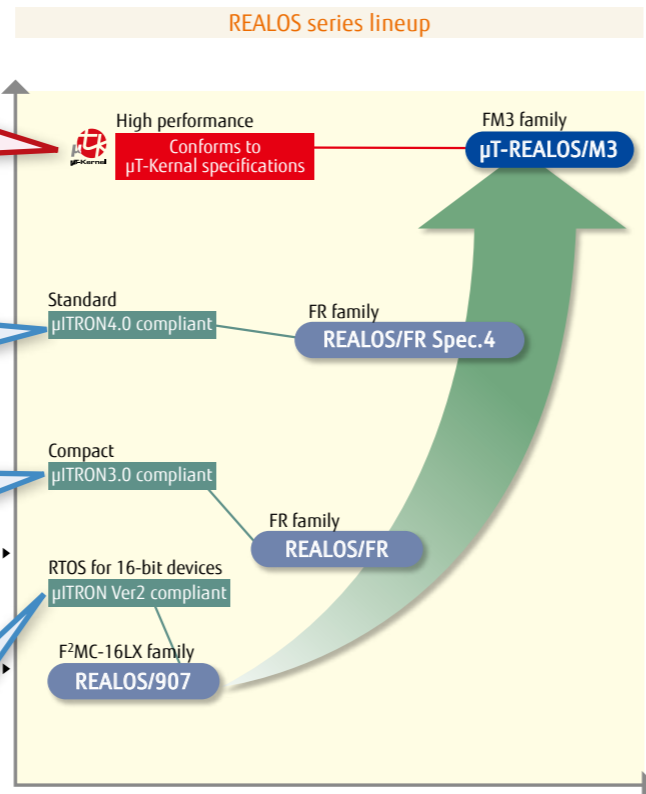
This OS conforms to the industry standard μITRON specifications. REALOS/FR Spec. 4 has many functions and simple powersaving functions. This RTOS can be used in large-scale systems that conform to μITRON 4.0.

• μITRON 3.0 compliant OS

This OS conforms to the industry standard μITRON specifications. REALOS/FR is a compact RTOS that can be used in devices with tight resource limitations. Use this to develop products that demand tight memory size limitations and large production volumes.

• μITRON 2.0 compliant OS

This OS conforms to the industry standard μITRON specifications. REALOS/907 is an extremely small RTOS that can be used in 16-bit devices. Use this to develop products that demand large production volumes.



μT-REALOS/M3 for EWARM / MDK / RVDS

Compact high-speed processing kernel that conforms to the latest real-time OS specifications

Supported microcontrollers

FM3 Family

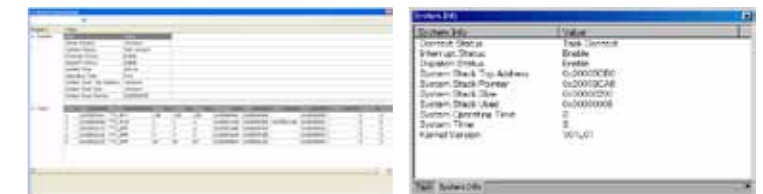


Features

- Ability to use the large amount of middleware in the market by conforming to the μT-Kernel specifications
- The base code size starts from 2.4 KB and is extremely compact
- High-performance interrupts
- Configurator allowing you to choose the required functions
- μT-REALOS Awareness kernel information display function tool (except RVDS)
- Supports task transition diagram display function (EJSCATT from Sophia Systems is required separately)
- Able to support a μITRON specification API making it possible to reuse existing software resources (optional)
- Supports a wide variety of development environments

Object display function (not supported by μT-REALOS/M3 for RVDS)

This tool is able to analyze the state of a μT-REALOS system. It enables you to display the state of tasks and objects (semaphores, event flags, etc.) managed by the kernel and to grasp the operation of the system so that you can rapidly identify problem areas.

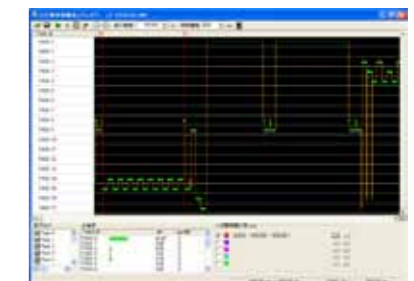


Middleware for supporting the μITRON API (optional)

This is middleware that makes it possible for existing software resources created under the μITRON specifications to run on μT-REALOS. Since this allows μITRON specification system calls to run as-is on μT-REALOS, it can greatly reduce the work hours of migration. It does not increase the amount of memory used, and the overhead is also no different from calling the μT-REALOS API.

Task transition diagram display function (works in conjunction with EJSCATT from Sophia Systems)

This function graphically displays task transition states. This works together with the debugger to allow you to grasp the operation of a system. This is used such as to detect tasks that are operating unexpectedly during debugging.



Power saving function

This function supports increased power saving in customer products. It has a simple energy saving function that jumps to an energy saving routine when there are no tasks that are running or ready to run.

32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection
32 bit
16 bit
8 bit

Development assistance tools

(SOFTUNE™ /REALOS series Integrated Development Environment & Real-time OS)

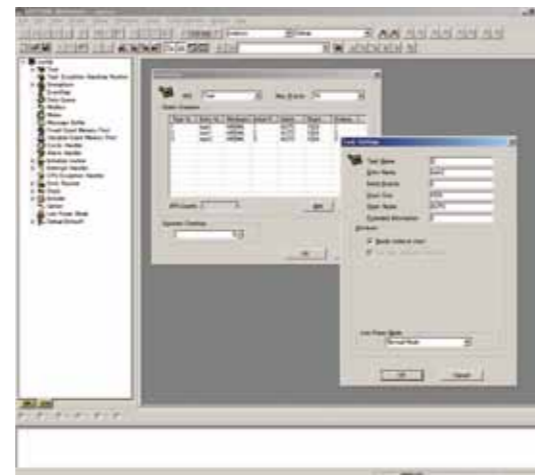


REALOS Development Support Functions

Support tools are available for increasing the efficiency of the "REALOS" kernel, a real-time OS which conforms to the μ T-Kernel specifications and μ ITRON specifications, and for increasing the efficiency of developing application programs that use the REALOS kernel.

REALOS configurator

The REALOS configurator provides a configurator that assists in configuring conditionals when creating the REALOS kernel. The kernel can be easily reconfigured by the necessary item settings according to the configurator screens.

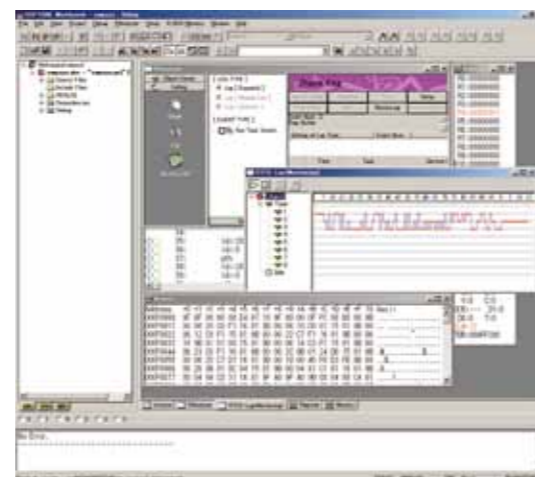


REALOS-aware debugging tools

● REALOS analyzer (for FR and F²MC-16)

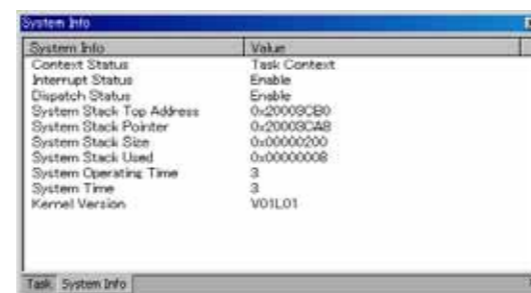
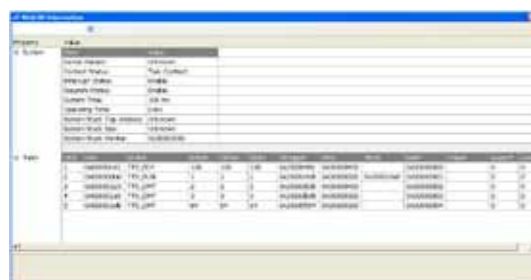
The REALOS analyzer graphically analyzes and displays the performance and task state transitions of systems that incorporate REALOS. This allows the operation of the system to be grasped visually.

- Object display
- OS breaks
(execution break, access break, dispatch break, service call/system call break)
- Service call/system call issued
- Task transition diagram
- Stack information
- Task context watch



● μ T-REALOS Awareness

This tool is able to analyze the state of a μ T-REALOS system. It enables you to display the state of tasks and objects (semaphores, event flags, etc.) managed by the kernel and to grasp the operation of the system so that you can rapidly identify problem areas.



List of products

Product name	Compliant specification	Family	Part number	Component products
μ T-REALOS/M3 for EWARM	μ T-Kernel	FM3	SP3680P1618RCC (development/integration license: Unlimited copies)	Kernel configurator Kernel source (integration license only)
			SP3680P1618RCC-01K (development/integration license: 1,000 copies)	
			SP3680P1618RCC-10K (development/integration license: 10,000 copies)	
			SP3680P1618EVC (evaluation license)	
μ T-REALOS/M3 for MDK	μ T-Kernel	FM3	SP3680P1718RCC (development/integration license: Unlimited copies)	Kernel configurator Kernel source (integration license only)
			SP3680P1718RCC-01K (development/integration license: 1,000 copies)	
			SP3680P1718RCC-10K (development/integration license: 10,000 copies)	
			SP3680P1718EVC (evaluation license)	
μ T-REALOS/M3 for RVDS	μ T-Kernel	FM3	SP3680P1228RCC (development/integration license: Unlimited copies)	Kernel configurator Kernel source (integration license only)
			SP3680P1228RCC-01K (development/integration license: 1,000 copies)	
			SP3680P1228RCC-10K (development/integration license: 10,000 copies)	
			SP3680P1228EVC (evaluation license)	
SOFTUNE REALOS/FR Spec.4	μ ITRON4.0	FR	SP365001518RCC (integration license)	Kernel configurator Kernel source (integration license only)
			SP365001518EVC (evaluation license)	
SOFTUNE REALOS/FR	μ ITRON3.0	FR	SP365000218RCC (integration license)	Kernel configurator Kernel source (integration license only)
			SP365000218EVC (evaluation license)	
SOFTUNE REALOS/907	μ ITRON Ver.2.01	F ² MC-16	SP3607M008BA (integration license)	Kernel configurator Kernel source (integration license only)
			SP3607M008EV (evaluation license)	

System requirements

Item	Specification
OS	Windows 7, Windows Vista, Windows XP
Memory	256 MByte or more (512 MByte or more recommended)
Hard disk	300 MByte or more (1 GByte or more recommended)

32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection
32 bit
16 bit
8 bit

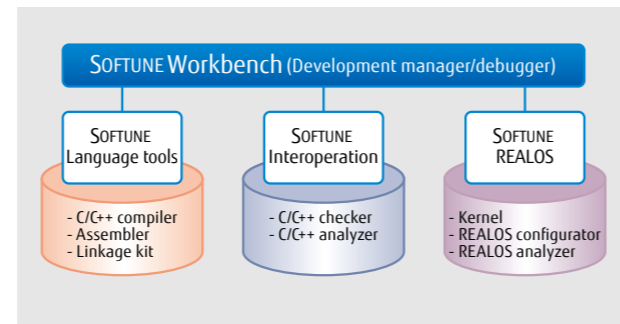
Development assistance tools

(SOFTUNE™ series Integrated Development Environment)

SOFTUNE is an integrated development environment that was designed to respond to the various demands of program developers and pursues ease of use.

Structure of SOFTUNE

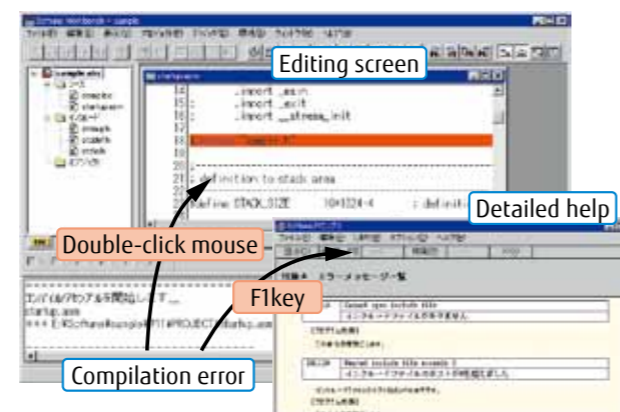
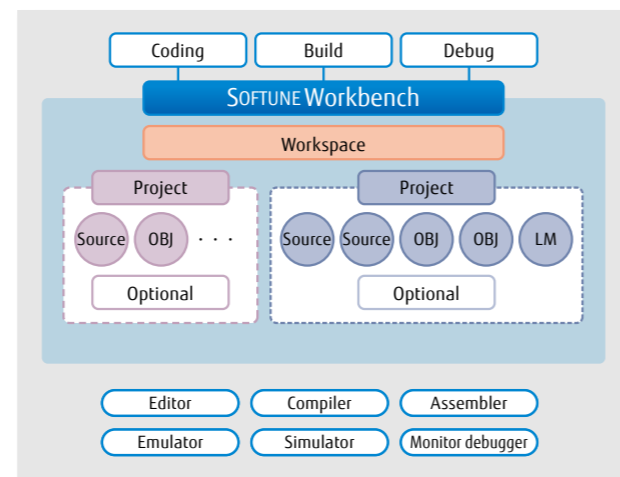
- Unification of manager section and debugger section.
Errors that are found can be fixed on the spot, and the result can be debugged immediately.
- Assists in development using the C/C++ languages.
- Equipped with tools for improving quality.
Projects integrated with "C/C++ Checker" for verifying coding and "C/C++ Analyzer" for structural analysis.
- Equipped with tools for simplifying the use of the μITRON compliant "REALOS". (Configurator and analyzer)



Manager functions

Work progresses based on a "project file" that contains all of the necessary information for developing a program.

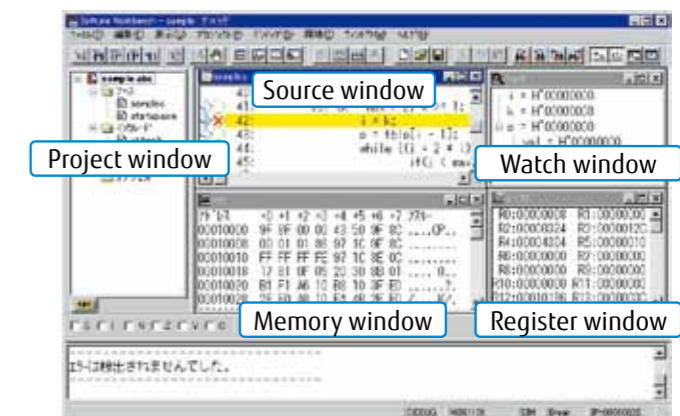
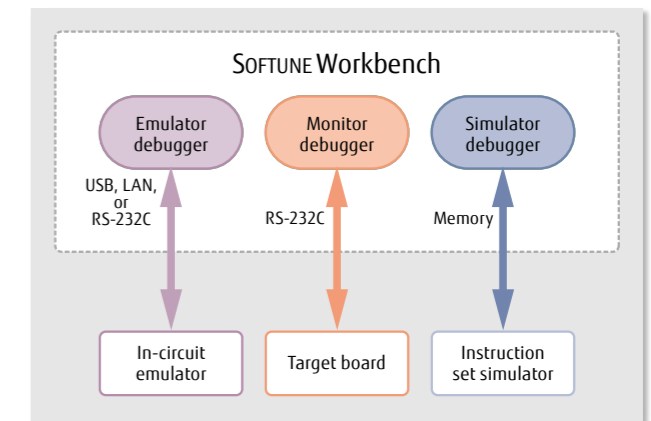
- Utilizing projects
The development environment can be easily constructed both for the case of a single person performing multiple jobs in parallel or for a group working on a single development by using project files.
- Delivering excellent usability
 - Editor provided as standard
An editor is built-in as standard, offering a plethora of functions such as keyword highlighting and auto-indenting.
 - Error jump and online help
Errors that occur during a build are displayed in the output window at the bottom of the screen. Jumping to the tag or displaying error details from the errors shown in this window are easily possible.
 - Able to interoperate with third-party editors
In response to the demand for using familiar editors, integration with third-party editors is also possible.
- Customizable usage environment
The development environment can be customized to suit every individual such as by interoperating with source control tools when sharing files or calling file conversion tools.



Debugger Functions

Three types of debugger functions are supported that need to be used at various different stages of the development cycle. Select the optimal debugging environment to match your circumstances.

- Easy to read screen information
The screen layout can be arranged freely by selecting and positioning the required windows. Furthermore, selecting the information to display or viewing only the necessary information are also possible.
- Simple environment settings
 - Debugging environment provides a setup wizard
The setup wizard supports settings such as selecting the emulator and board communication lines and the states of windows. The required settings can be made simply by following the on-screen directions.
 - MCU operating environment
A "CPU information file" that describes device-specific information for all models of supported MCUs is provided as standard. This allows all of the necessary information such as I/O port locations, ROM/RAM capacities, and starting addresses to be configured automatically.
 - Saving and restoring the debugging environment
The previous debugging environment settings can be saved and the same settings would be restored the next time. (Window layout, breakpoint settings, memory map information, etc.)
- On-chip debugging (F²MC-8FX family)
Debugging is supported by the on-chip in-circuit emulator (BGM adapter). Debugging can be performed using a single serial line.
 - Equipped with continuous execution, stepped execution, and forced break functions
 - Software breakpoints: 256 points
 - Host interface: Connectable via USB



List of products

Product name	Version	Family	Part number	Component products
SOFTUNE Professional Pack	V6	FR	SP365030118QAC (1 license)	Workbench C/C++ compiler Assembler pack C/C++ analyzer C/C++ checker
			SP365030118QBC (3 licenses)	
			SP365030118QCC (5 licenses)	
	V3	F ² MC-16	SP3607Z008-P01 (1 license)	Workbench C compiler Assembler pack C analyzer C checker
			SP3607Z008-P03 (3 licenses)	
			SP3607Z008-P05 (5 licenses)	
V3	F ² MC-8FX	SP3603Z008-P01 (1 license)	Workbench C compiler Assembler pack C analyzer C checker	
		SP3603Z008-P03 (3 licenses)		
		SP3603Z008-P05 (5 licenses)		

32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection
32 bit
16 bit
8 bit

Development assistance tools

(hardware tools)

Fujitsu Semiconductor provides development tools such as emulators and adapters for developing software for the FR family and F²MC family.

FR Family · 32-bit/F²MC-16FX Family MB96600 Series · 16-bit Microcontroller On-chip Debugger

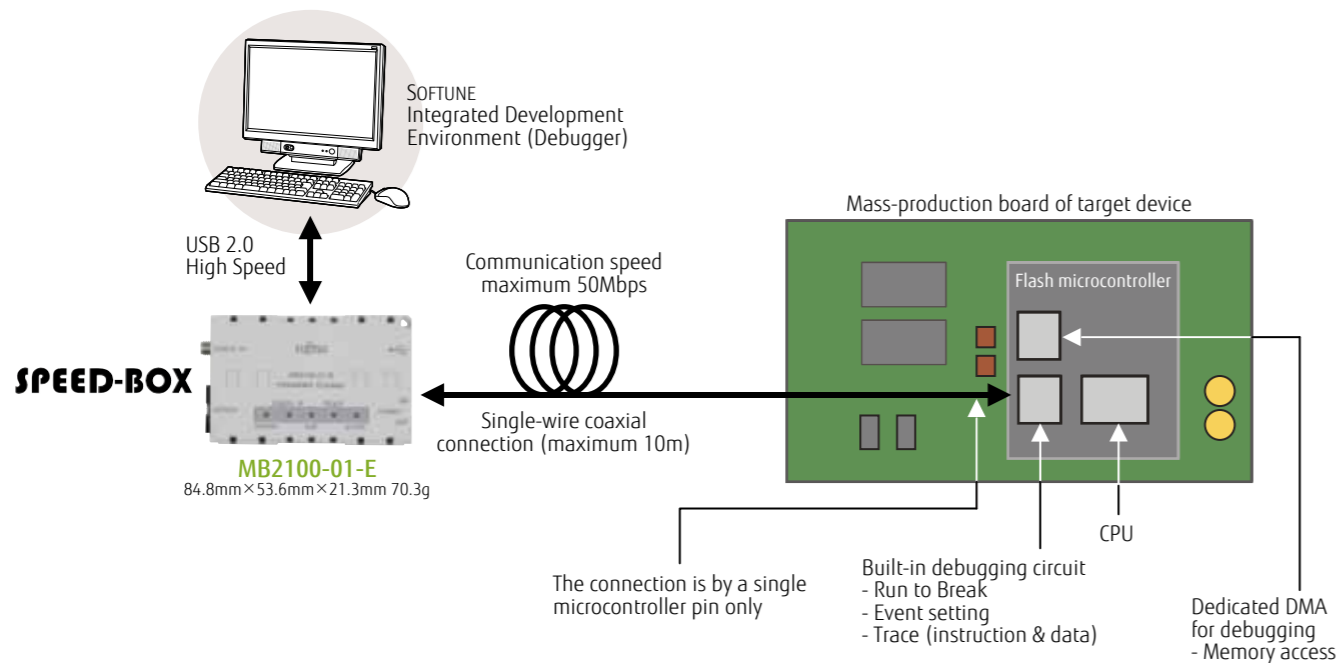
Features of the MB2100-01-E emulator **SPEED-BOX**

- Debug using a flash microcontroller on a mass-production board
- Connect to the flash microcontroller using a single wire coaxial cable
- Read from and write to memory without stopping the CPU
- Connect to a flash microcontroller at up to 10 m
- Configure traces and multiple events
- Security function with password
- Compact size and light weight 84.8 mm x 53.6 mm x 21.3 mm, 70.3 g
- Connect using USB 2.0 High Speed
- The power supply is USB bus-powered
- Power supply isolation
- Supports all flash microcontrollers that includes the single-wire coaxial cable debugging interface (MDI)
- The debug interface complies with JPwire, which is a single wire standard interface specification established by the JASPAR standards organization

External view of system



System Configuration



- JPwire® is a registered trademark of JASPAR.
- **SPEED-BOX**® is a registered trademark of FUJITSU SEMICONDUCTOR Limited.

New 8FX Family · 8-bit Microcontroller On-chip Debugger

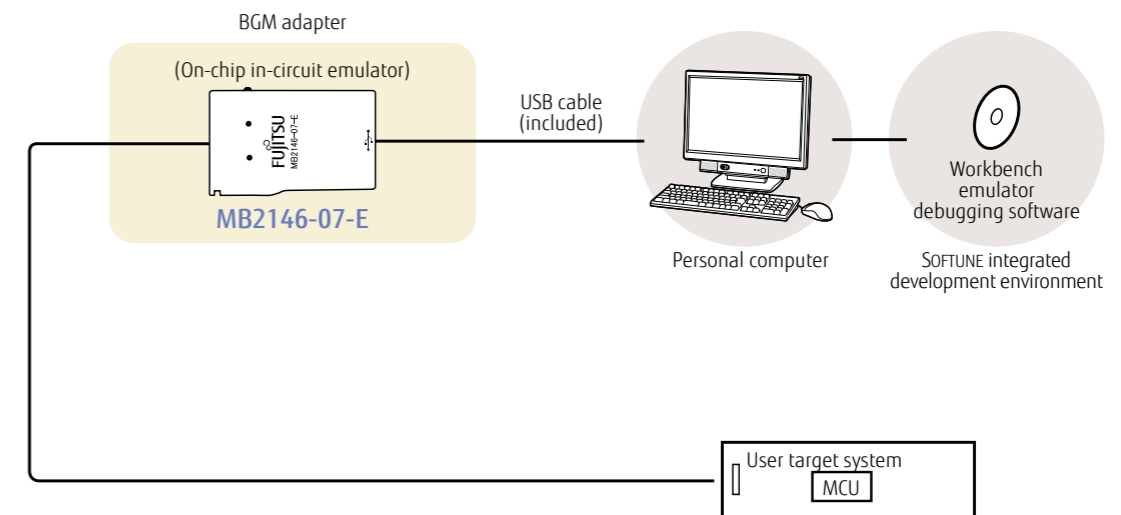
Features of the MB2146-07-E (BGM adapter)

- Supports microcontroller operating voltages of +1.8 to +5.5V
(The upper and lower limits on the microcontroller operating voltage and operating frequency vary between each of the devices. For the operating voltage and operating frequency of each MCU, see the documentation related to that device (data sheet, hardware manual, etc.))
- Compact development environment, with small lightweight BGM adapter
- Debugging possible over single-wire serial
- Because the monitor program executes in a dedicated memory space, it does not consume any of the user memory space
- Built-in continuous execution, step execution, and forced break functions
- Hardware breakpoints: 3 points
- Software breakpoints: 256 points
- Host interface: Able to connect using USB2.0 Full Speed 12 Mbps
- RAM realtime monitor
- Standalone programming
- Supplies power to the target microcontroller

External view of system



System Configuration



32/16/8-bit core lineup

ROM, RAM, Pins

Applications

Functionality

Development assistance tools

Product selection

32 bit

16 bit

8 bit

Development assistance tools

(hardware tools)



FR Family • 32-bit Microcontroller

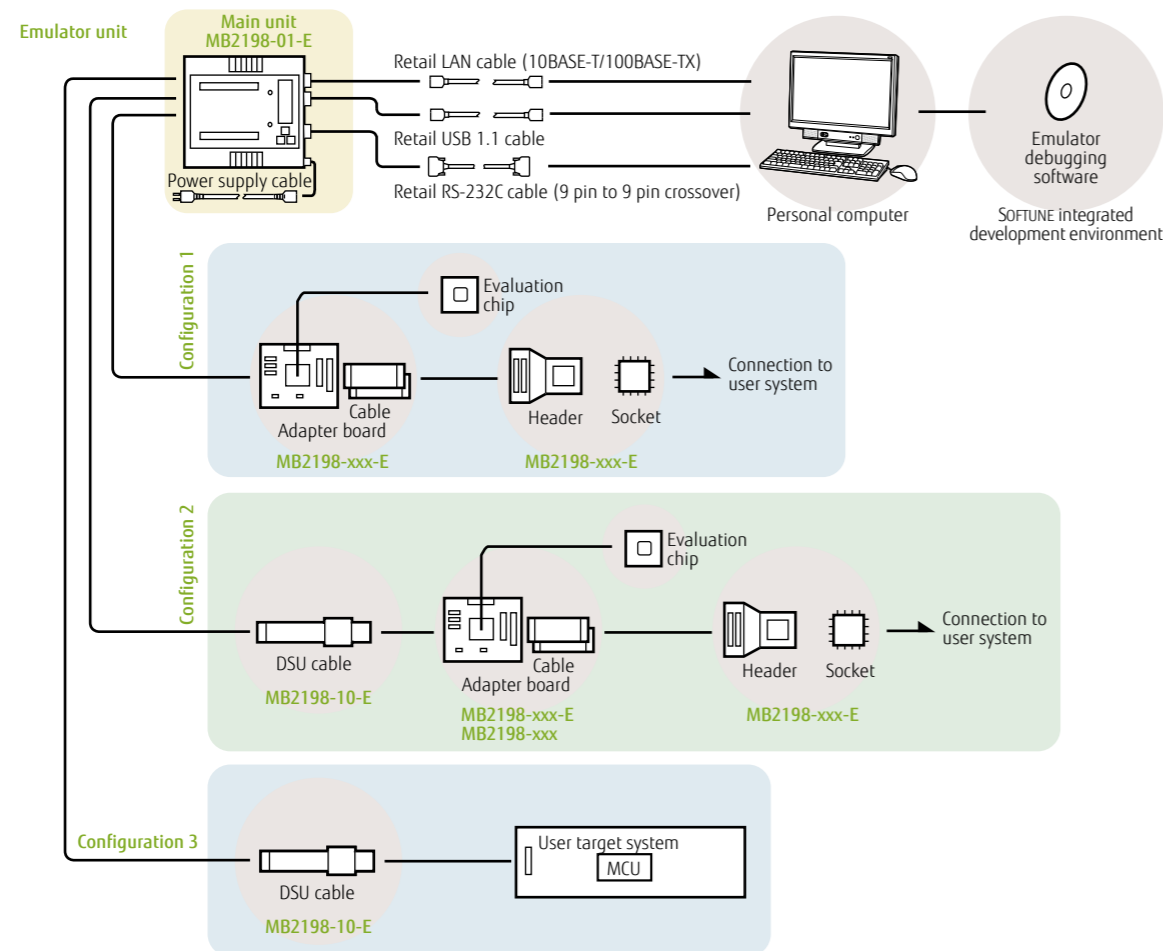
Features of the MB2198-01-E emulator

- Supported DSU: DSU3, DSU4
- Power supply voltage: Supports linear +2.7V to +5.5V
(The upper and lower limits on the microcontroller operating voltage and operating frequency vary between each of the devices. For the operating voltage and operating frequency of each MCU, see the documentation related to that device (data sheet, hardware manual, etc.))
- Capable of source-level debugging (assembler, C, mixed display)
- Simple GUI operation using pull-down menu buttons
- Real-time trace function
- Multiple window display, including source code, variables, registers, memory, trace, etc.
- Hardware break x 5, Software break x 4096, Code event x 2, Data event x 2
- Execution cycle measurement function
- Host interface: Equipped standard with RS-232C (max. 115kbps), LAN (10BASE-T, 100BASE-TX), and USB1.1

External view of system



System Configuration



F²MC-16FX Family MB96300 Series • 16-bit Microcontroller

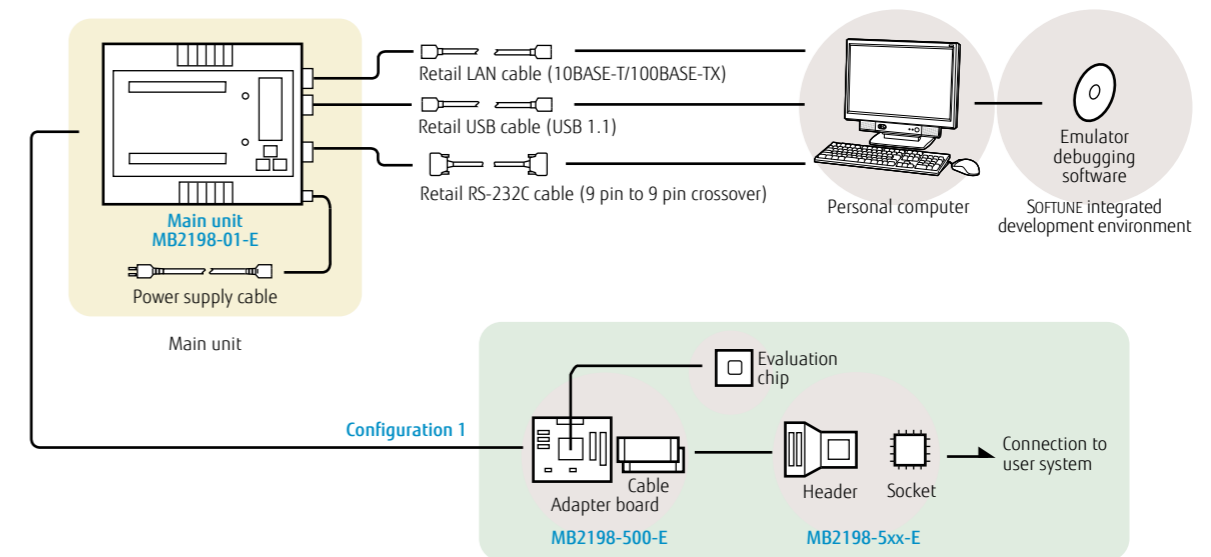
Features of the MB2198-01-E emulator

- Supported DSU: DSU4
- Power supply voltage: Supports linear +2.7V to +5.5V
(The upper and lower limits on the microcontroller operating voltage and operating frequency vary between each of the devices. For the operating voltage and operating frequency of each MCU, see the documentation related to that device (data sheet, hardware manual, etc.))
- Capable of source-level debugging (assembler, C, mixed display)
- Simple GUI operation using pull-down menu buttons
- Real-time trace function
- Multiple window display, including source code, variables, registers, memory, trace, etc.
- Hardware break x 4, Software break x 2048, Data break x 4
- Execution cycle measurement function
- Host interface: Equipped standard with RS-232C (max. 115kbps), LAN (10BASE-T, 100BASE-TX), and USB1.1

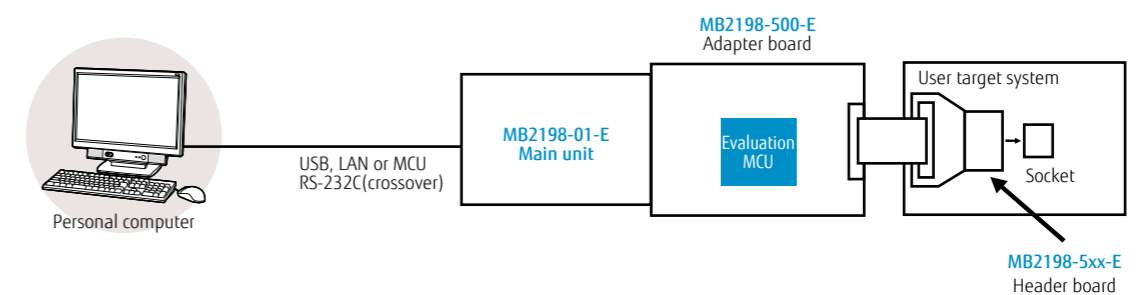
External view of system



System Configuration



Example System Configuration for the MB96300 Series



32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection
32 bit
16 bit
8 bit

Development assistance tools

(hardware tools)



F²MC-16LX Family • 16-bit Microcontroller

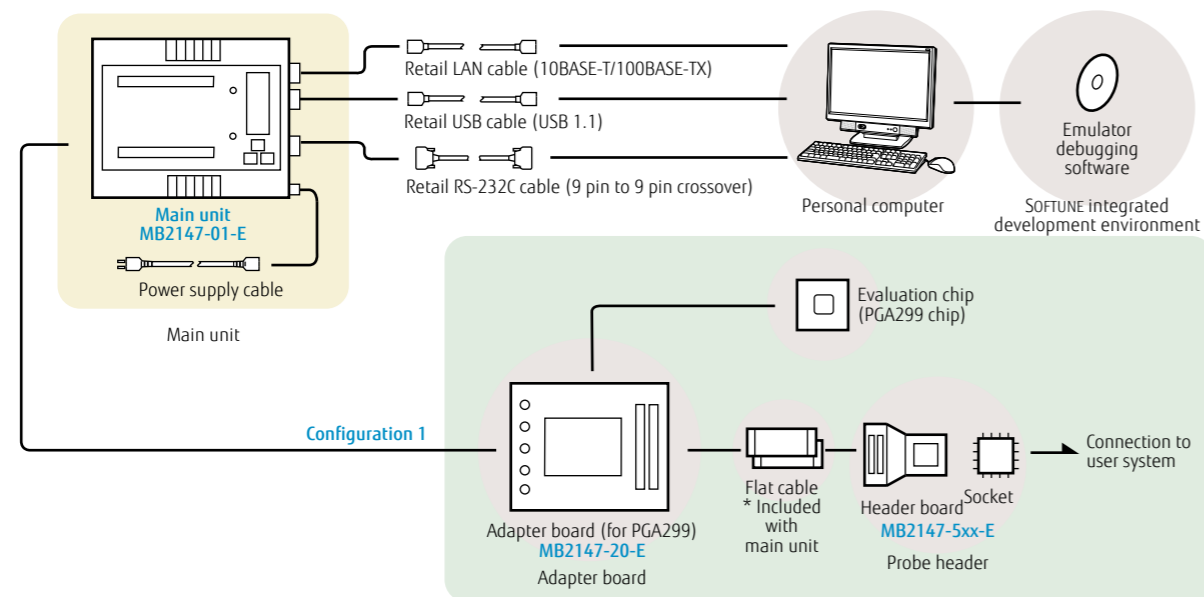
Features of the MB2147-01-E (version that supports high speeds)

- Supports a maximum microcontroller operating frequency of 33MHz
- Supports microcontroller operating voltages of +2.7V to +5.5V
(The upper and lower limits on the microcontroller operating voltage and operating frequency vary between each of the devices. For the operating voltage and operating frequency of each MCU, see the documentation related to that device (data sheet, hardware manual, etc.))
- Emulator memory (1M x 4 areas)
- Capable of source-level debugging (assembler, C, mixed display)
- Simple GUI operation using pull-down menu buttons
- On-the-fly function (execute commands during microcontroller execution)
- Powerful real-time trace function
- Multiple window display, including source code, variables, registers, memory, trace, etc.
- Event triggers that allow a wide variety of conditions to be specified
(code x 8, data x 8)
- Sequential control by sequencer (4 conditionals, 3 levels)
- Performance measurement function (function to measure the execution time between 2 points, measure elapsed cycles)
- CO coverage measurement function (measures program execution coverage)
- Host interface: Equipped standard with RS-232C (max. 115kbps), LAN (10BASE-T, 100BASE-TX), and USB1.1

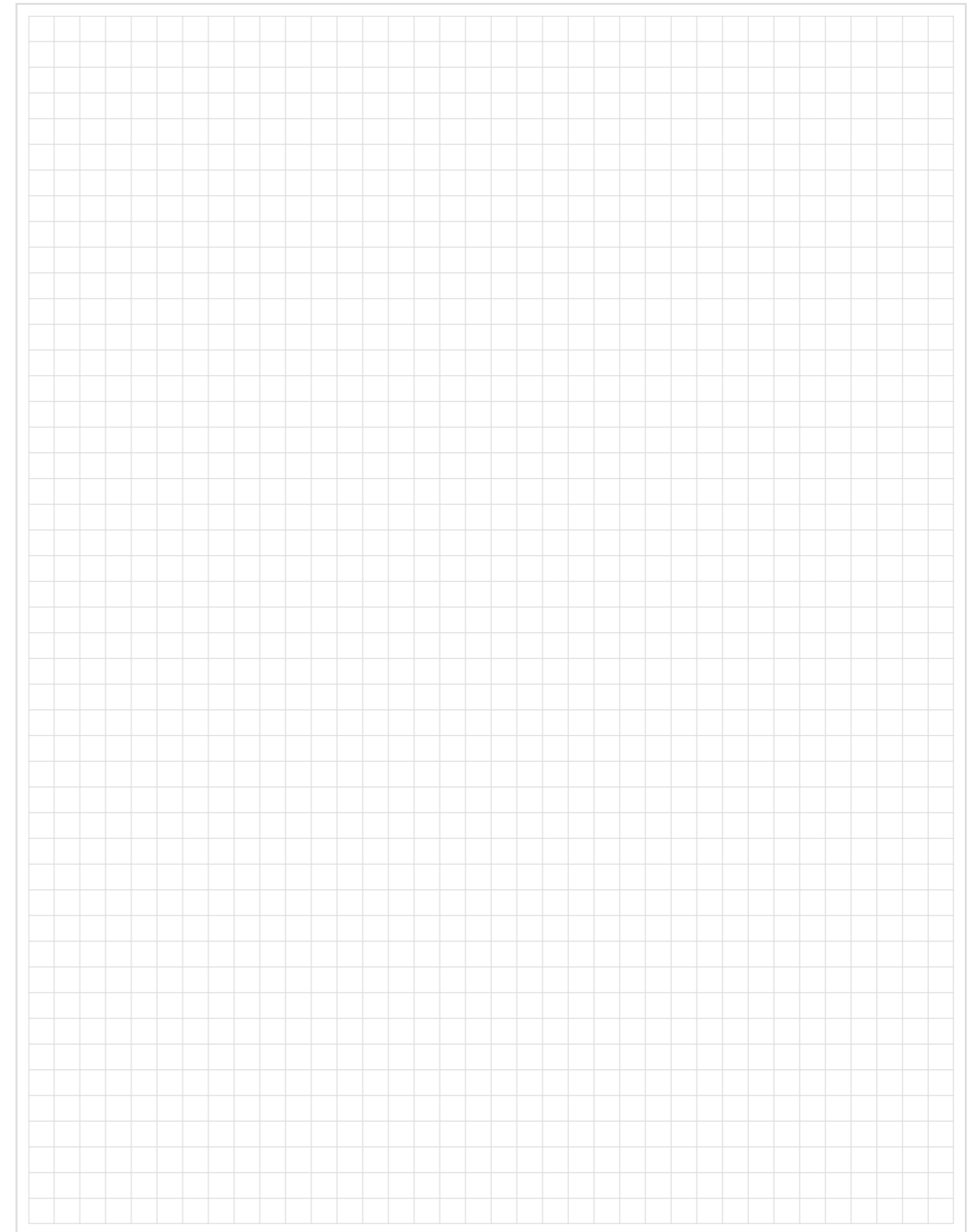
External view of system



System Configuration



memo



32/16/8-bit core lineup

ROM, RAM, Pins

Applications

Functionality

Development assistance tools

Product selection

32 bit

16 bit

8 bit

Development assistance tools

(evaluation board/starter kit)



Evaluation board

Fujitsu Semiconductor provides evaluation boards for developing embedded systems equipped with the FR family and F²MC family.

Evaluation Board for FR Family MB91590 (MB2198-751-E)

● Features

This is an evaluation board supporting the Fujitsu Semiconductor FR family MB91590 series.

Equipped with RF and D-sub video inputs, D-sub video output, CAN/LIN/UART I/O, LEDs, and switches (detachable).

This board contributes to improving the development efficiency because it can perform a simplified evaluation of operations before a mounting attempt in a customer's system.



Evaluation Board for FR Family MB91520 Series/F²MC-16FX Family MB96600 Series (MB2198-760-E)

● Features

This evaluation board supports the Fujitsu FR family MB91520 series and F²MC-16FX family MB96600 series.

The board has CAN, LIN, UART, USB, I/O, LED, switches, etc. mounted on it. (Can be disconnected using jumper switches.)

This makes it possible to perform simple operational evaluation before embedding into the customer system, and contributes to increased development efficiency. This board is structured as a main board and daughter board. The main board is common to all models, and the individual models are supported by changing the daughter board.



Evaluation Board for the FR Family and F²MC-16LX/FX (BBF2004)

● Features

This is an evaluation board manufactured by Sunhayato that supports the F²MC-16LX/FX and FR family. This makes it possible to perform simple operational testing of the MCU before embedding it into your system, contributing to increased development efficiency. This board is made up of a main board and a daughter board. By changing the daughter board, this evaluation board can be used to perform debugging using tools that incorporate an emulator debugger (ICE), to evaluate microcontrollers with built-in flash memory, and as a serial writer. The main board is common to all models, and can support different models by changing the daughter board.

Sunhayato Corporation Sales department
TEL: +81-3-3984-7791 FAX: +81-3-3971-0535



Microcontroller Starter Kit (Jouet Bleu)

The Jouet Bleu (Blue Toy) is a microcontroller starter kit for people learning about microcontrollers and embedded systems. It can be used as an effective tool for educating students and new recruits about developing embedded software.

● Features

- Microcontroller board equipped with a high-performance 16-bit microcontroller
- Software development environment
- Enables learning about microcontrollers from the basics to applications
- Notebook PCs can be used for software development

Sunhayato Corporation Sales department
TEL: +81-3-3984-7791 FAX: +81-3-3971-0535



IAR Systems FM3 Starter Kit [KSK-MB9BF506R]

● Microcontroller: 32bit-FM3 MB9BF506R

- Built-in MB9BF506R
- On-board JTAG emulator
- Includes a trial version compiler
- Built-in LCD panel
- Built-in accelerometer
- Built-in motor driver

Inquiries: Micrium, Inc.



KEIL FM3 Starter Kit [MCB9BF500]

● Microcontroller: 32bit-FM3 MB9BF500

- Built-in MB9BF500
- Includes JTAG emulator
- Includes a trial version compiler
- Built-in potentiometer

Inquiries: ARM Limited



FR80 MB91665 Series USB Evaluation Kit (MB91972EVB-1/MB91972EVB-2)

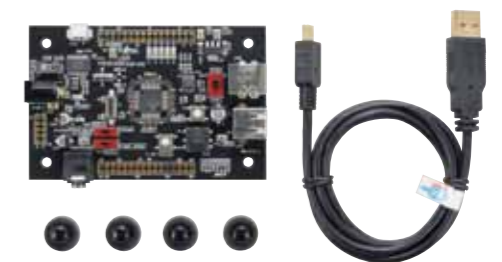
● Features

This is a USB evaluation kit supporting Fujitsu Semiconductor 32-bit FR80 family MB91665 series microcontrollers.

This kit can run USB host and USB function application software using Fujitsu Semiconductor original USB microcontroller middleware.

The evaluation kit includes the following:

- USB middleware (sample)
- Application software (sample)
- Evaluation board
- Integrated development environment



New 8FX Family Starter Kit (MB2146-510-01-E)

● Features

This is the starter kit for the New 8FX family of 8-bit Fujitsu microcontrollers with small pin counts. The New 8FX family starter kit is composed of a BGM adapter and evaluation board, and is optimal for evaluating performance and functionality and checking operation before embedding into the customer system. The SOFTUNE V3 integrated development environment (trial version), various sample software, application notes, etc. are provided through the Fujitsu website and can be downloaded free of charge.

The starter kit includes the following:

- Evaluation board with built-in MB95F564K
- BGM adapter
- Cable



32/16/8-bit core lineup

ROM, RAM, Pins

Applications

Functionality

Development assistance tools

Product selection

32 bit

16 bit

8 bit

Development assistance tools (education kit)

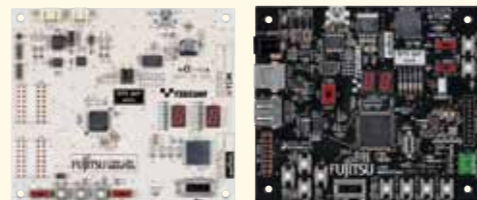


Bits pot* is a series of microcontroller boards that allows you to easily get to know, evaluate, and study microcontrollers. There is a series of five-color boards equipped with the microcontroller providing how to learn in-vehicle network technology, CAN, LIN, FlexRay and USB I/F using each of the 8-, 16-, and 32-bit New 8FX/16FX/FR microcontrollers.

A combination of the kits can easily construct in-vehicle networks, control USB devices in a standalone configuration, etc. Furthermore, the development environment, text books, and sample software required for developing software can all be downloaded from the website, creating a starter kit that allows you to study in-vehicle networks and USB from the basics to applications.

*: "bits pot" means putting a lot of things (functions) in a small jar (board).

Developer: TSUZUKI DENSAN Co., Ltd.
2-5-3, Nishi-shinbashi, Minato-ku, Tokyo, 105-8420, Japan
E-mail : pd-bitspot@tsuzuki-densan.co.jp
URL : <http://www.tsuzuki-densan.co.jp/bitspot/>



Kit for Learning CAN communication and brushless DC motor control (bits pot red)

CAN-MOTOR[CAN-100]

Microcontroller: 32bit-FR60Lite MB91F267N

- Brushless DC motor control using MOTOR driver circuit
- Motor control using temperature sensor
- Connecting with bits pot white, it controls the motor by the CAN communication.

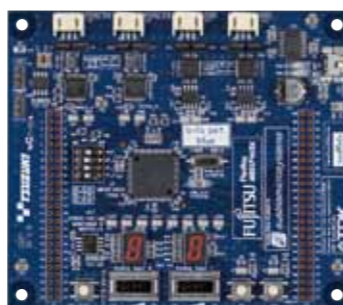


Kit for Learning FlexRay communication (bits pot blue)

FlexRay[FLR-100] Note: One set consists of two boards.

Microcontroller: 32bit-FR60 MB91F465X

- Basic function operation of FR60 MB91460 series
- Understand the FlexRay communication specifications by connecting two bits pot blue
- The bus evaluation is also possible with the FlexRay transceiver (austriamicrosystems company's AS8221C).
- Connecting with bits pot red or blue, it communicates by CAN.



Kit for Learning LIN communication (bits pot yellow)

LIN[LIN-100]

Microcontroller: 8bit-F²MC-8FX MB95F136J

- Buzzer output control using slide volume
- LED control using temperature sensor
- Connecting with bits pot white, it communicates by LIN using LIN slave sample software (supports LIN 2.0*1)

*1: Does not support config, diag, etc.



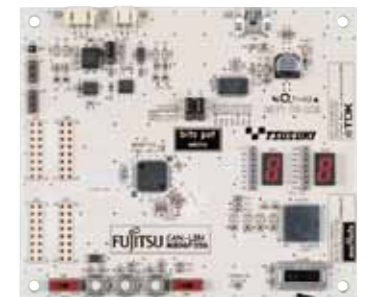
Kit for Learning CAN-LIN communication (bits pot white)

CAN-LIN[CAL-100]

Microcontroller: 16bit-F²MC-16FX MB96F356

- Basic function of board by SW operation (LED, 7seg, temperature sensor, and buzzer)
- Control motor and receive motor RPM and temperature sensor information using CAN communication with a bits pot red
- Connecting with bits pot yellow, it communicates by LIN using LIN master sample software (supports LIN2.0*2)

*2: Does not support config, diag, etc.



Kit for Learning USB (bits pot black)

USB[USB-100]

Microcontroller: 32bit-FR80 MB91F662

- Learn mouse function using HID class driver
- Fabricate a humidity gauge using a humidity sensor
- Learn about FRAM (ferroelectric memory)



Learning CAN/LIN communication with a particular aim is also possible by combining with a bits pot white (CAN-LIN), bits pot red (CAN-Motor), or bits pot yellow (LIN), and sample programs are also available depending on the combination.

The bits pot blue (FlexRay) has two board per set, allowing you to quickly learn FlexRay, which is the next generation in-vehicle network technology.



32/16/8-bit core lineup

ROM, RAM, Pins

Applications

Functionality

Development assistance tools

Product selection

32 bit

16 bit

8 bit

Development assistance tools

(development environment/OS/middleware/tools)



This section introduces the development supporting tools for developing embedded systems for the FM3 family, FR family, and F²MC family.

Tools supporting FM3 Family (ARM Cortex-M3 core)

Integrated Development Environments/Debugging environment

Vendor	Debugger	Overview	Compiler support	Emulator
IAR Systems	EWARM	Embedded WorkBench for ARM is a development environment with integrated C/C++ compiler, assembler, linker, editor, and C-SPY® debugger that allows a user to perform the full sequence of operations from creating a project to editing files, compiling, assembling, linking, and debugging applications.	IAR's ISO C/C++ and Extended Embedded C++	AnbyICE, ARM RealView ICE, J-Link, Macraigor Wiggler, and RDI-based JTAG interface
KEIL	µVISION4 (MDK-ARM)	This is an integrated software development environment for microcontrollers based on Cortex-M, Cortex-R, ARM 7, and ARM 9 that also supports the use of full-spec real-time OS and libraries for networking, file systems, and peripherals.	ARM, GNU & EABI-compliant	ULINK2, ULINKpro, Seggger Jlink
Yokogawa Digital Computer Corporation	microVIEW PLUS	<ul style="list-style-type: none"> High-performance JTAG tool High-speed JTAG communication Improved download speeds Advanced JTAG clock setting is available. Hot-plug support Capable of connecting to a target without dropping the target's power supply SWV/SWD support Multicore support Completely implements multicore debugging (ARM environments and SMP environments) *Supports up to 8 cores OS/platform support Original OS also supported Debugger: microVIEW-PLUS Original debugger that completely controls leading edge advice product functions. Sophisticated GUI improves the debugging efficiency. User-friendly interface and variety of functions significantly improve the complex debugging operations. - Simple operation - Effective monitoring - Customizable GUI Your preferred debug window can be defined over a TCL link library. 	RVDS, IAR, KEIL, GNU	adviceLUNA

Integrated Development Environments/Debugging environment

Vendor	Debugger	Overview	Compiler support	Emulator
Sophia Systems	WATCHPOINT	<ul style="list-style-type: none"> Supports Cortex®M0, M1, M3, and M4 products Supports ARM multi ICE interface (JTAG, SWD, SWV, ETM*) Supports ARM® Thumb® Thumb2® state debugging Hardware breakpoints Software breakpoints on RAM and Flash memory (no upper limit on the number of settings) Flash memory programming Optimized for on-site debugging USB bus-power support (AC power not required) Compact 86 x 101 x 23 mm Executes user macro scripts using JTAG pod button Connects to PC using USB 2.0 H/S Includes WATCHPOINT® for Windows® * The ETM interface is supported by "EjSCATT for ETM." 	IAR, KEIL, GNU	EjSCATT, EjSCATT for ETM
Mentor Graphics	Sourcery CodeBench	Sourcery CodeBench from Mentor Graphics is equipped with all of the tools for developing C/C++ embedded applications, including a compiler, runtime libraries, source and assembly code, debugger, and integrated development environment (IDE). Mentor Graphics Corporation http://www.mentor.com	GNU	J-Link
Atollic	TrueSTUDIO	Atollic TrueSTUDIO is a C++ development tool for embedded development. It is loaded with functionality from a leading edge editor, optimized C/C++ compiler, and multiprocessor debugger to team collaboration, graph modelling, design, code review, and review meeting functions. Atollic AB http://www.atollic.com	GNU	J-Link

Real-Time Operating System

Product name	Overview	Inquiries
embOS	SEGGER embOS is a realtime OS for embedded devices that delivers both reduced duration of disabled interrupts together with reduced memory.	SEGGER Microcontroller GmbH & Co.KG http://www.segger.com/cms
RTX	ARM RTX is a realtime OS for devices equipped with an ARM or Cortex-M core.	ARM Limited http://www.keil.com
µC/OS-III	Micrium µC/OS-III is the latest realtime OS from Micrium and is the successor to µC/OS-II. µC/OS-III limits as much as possible the duration of disabled interrupts.	Micrium, Inc. http://www.micrium.com

32/16/8-bit core lineup

ROM, RAM, Pins

Applications

Functionality

Development assistance tools

Product selection

32 bit

16 bit

8 bit

Development assistance tools

(development environment/OS/middleware/tools)



Middleware		
Product name	Overview	Inquiries
emUSB Device	SEGGER emb USB Device is a protocol stack for USB devices. It can be used together with a variety of RTOS in addition to embOS.	SEGGER Microcontroller GmbH & Co.KG http://www.segger.com/cms
emUSB Host	SEGGER emb USB Host is a protocol stack for USB hosts. It provides a variety of class drivers.	SEGGER Microcontroller GmbH & Co.KG http://www.segger.com/cms
embOS/IP	SEGGER embOS/IR is a TCP/IP protocol stack.	SEGGER Microcontroller GmbH & Co.KG http://www.segger.com/cms
USB Device Interface	ARM USB Device Interface is a USB device protocol stack that supports ADC, CDC, HID, and MSC.	ARM Limited http://www.keil.com
USB Host Interface	ARM USB Host Interface is a USB host protocol stack that supports HID and MSC.	ARM Limited http://www.keil.com
TCP/IP Networking Suite	ARM TCP/IP Networking Suite is a TCP/IP protocol stack that is optimized for the Cortex-M.	ARM Limited http://www.keil.com
μC/USB Device	Micrium μC/USB Device is a USB device protocol stack that supports MSC, CDC, and HID.	Micrium, Inc. http://www.micrium.com
μC/USB Host	Micrium μC/USB Host is a USB host protocol stack that supports MSC, HID, and CDC ACM.	Micrium, Inc. http://www.micrium.com
μC/TCP-IP	Micrium μC/TCP-IP is a TCP/IP protocol stack that is optimized for embedded systems.	Micrium, Inc. http://www.micrium.com
Multi Device File System Library	FAT file system software	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
RSA Library	Public key cryptography (RSA) software RSA encryption/decryption/signature generation/signature verification with a maximum key length of 2048 bits	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/

Middleware		
Product name	Overview	Inquiries
RSA Key Generation Library	Public key cryptography (RSA) software Generates RSA keys up to a maximum key length of 2048 bits	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
DH Library	Key exchange (Diffie-Hellman) software	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
DSA Library	Digital signature (DSA) software	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
ECCP Library	Elliptic curve cryptography (ECC) software	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
AES Library	Shared key cryptography (AES) software Encryption/decryption with key lengths of 128 bits, 192 bits, and 256 bits Supports AES ECB mode and CBC mode	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
AES CTR Library	Shared key cryptography (AES) software Encryption/decryption with key lengths of 128 bits, 192 bits, and 256 bits Supports AES CTR mode	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
AES OMAC-1 Library	Software for generating OMAC message authentication codes using AES	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
PKCS1 RSA PSS/OAEP Library	PKCS#1 RSASSA PSS signature generation and verification software PKCS#1 RSAES OAEP encryption and decryption software	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
Modular Exponentiation Library	Software for quickly finding exponentials	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/

32/16/8-bit core lineup

ROM, RAM, Pins

Applications

Functionality

Development assistance tools

Product selection

32 bit

16 bit

8 bit

Development assistance tools

(development environment/OS/middleware/tools)



Tool supporting FR Family and F²MC Family (Fujitsu original core)

Integrated Development Environments

Product name	Overview	Inquiries
SOFTUNE	An integrated development environment that is user friendly and highly-efficient. <ul style="list-style-type: none"> Integrates language tools and debugger tools that increase the efficiency of the work cycle of coding, compiling, and debugging. Frees users from the hassles of configuring settings when developing a program. Interoperates with a variety of tools, supporting seamless development with SOFTUNE. 	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
MULTI5.0	MULTI 5.0 is an integrated development environment that supports each of the phases in the process of system development. It consists of a compiler, builder, editor, debugger, etc. and is GUI-based, focusing on ease of use. This provides a total solution that increases the reliability, safety, and performance of developed products and contributes to shortening development times and reducing development costs through various functions and new technologies such as the DoubleCheck static source code analysis tool and TimeMachine dynamic analysis tool.	Green Hills Software http://www.ghs.com/
MicroPecker	MicroPecker is a tool platform that is equipped with a single wire interface. It is used to connect the main unit to a host PC via USB 2.0. It offers a variety of functions depending on the provided optional software and optional cables. Features: <ul style="list-style-type: none"> Eclipse-based software development environment (under developing) Flash microcontroller program (under planning) Vehicle-mounted ECU compatible tool (under planning) Vehicle-mounted network analyzer (under planning) 	Sunny Giken Inc. TEL : +81-72-775-0339 http://sunnygiken.jp/

Real-Time Operating System

Product name	Overview	Inquiries
SOFTUNE REALOS	<ul style="list-style-type: none"> A μTRON compliant real-time OS for the Fujitsu F²MC-16LX/FR family microcontrollers. Can be used for a broad range of development, from products with tight resource limitations to large-scale systems. An analyzer is included as a debugging support tool. 	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
SOFTUNE μ T-REALOS	<ul style="list-style-type: none"> A μT-Kernel compliant real-time OS for the Fujitsu FR family of microcontrollers. The kernel overhead is extremely small, making it optimal for products that demand power-saving functionality and real-time performance. An analyzer is included as a debugging support tool. 	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
EB tresos	<p>EB, which is a full member of JASPAR that is working to standardize electronic control unit (ECU) software evaluation work and vehicle-mounted LAN interface ratings, provides the EB tresos ECU development tool for AUTOSAR compliant vehicle-mounted products.</p> <p>EB tresos AutoCore/AUTOSAR compliant middleware (BSW and RTE) Graphical user interface for EB tresos Studio and embedded software configuration Real-time OS for AUTOSAR compliant real-time OS.</p>	Elektrobit http://www.elektrobit.com/
osCAN	<p>osCAN is a pre-emptive, real-time, multitasking operating system that has the optimal functions for operating on a microcontroller.</p> <p>Features:</p> <ul style="list-style-type: none"> Seamless integration with CANbedded from Vector Wide range of supported processors Static OS that is compact and fast All OS objects can be specified using a graphical configuration tool before compilation Conforms to OSEK/VDX2.2, providing long-term usability and stability 	Vector Informatik GmbH http://consulting.vector.com/
MICROSAR product group (AUTOSAR embedded software product)	<p>Configuration:</p> <ul style="list-style-type: none"> MICROSAR RTE: AUTOSAR RTE MICROSAR BSW: AUTOSAR Basic Software MICROSAR Configuration Suite/MICROSAR EAD: AUTOSAR BSW configurator set <p>Features:</p> <ul style="list-style-type: none"> Strong experience and track record with previous CANbedded and osCAN products Full BSW supporting AUTOSAR specification release 3.0 Covers applications from development to ECU implementation in concert with the DaVinci Tool Suite (from prototypes and evaluation units to mass production products) Can be configured in combination with MCAL from other manufacturers or EAD Full featured technical service and training, assistance migrating to AUTOSAR, etc. 	Vector Informatik GmbH http://consulting.vector.com/
KPIT AUTOSAR BSW Package	This software package consists of BSW (basic software) for the hardware-independent layer optimized for "F ² MC-16FX family" and the ECU Spectrum integrated tool for generating ECU configuration and RTE (AUTOSAR Runtime Environment). Features of this software package include the code size optimization for 16-bit microcontrollers with small ROM sizes, and it allows AUTOSAR to be introduced even on ECU with small configurations regardless of ROM sizes.	KPIT Cummins http://www.kpitcummins.com/

32/16/8-bit core lineup

ROM, RAM, Pins

Applications

Functionality

Development assistance tools

Product selection

32 bit

16 bit

8 bit

Development assistance tools

(development environment/OS/middleware/tools)



Middleware

Product name	Overview	Inquiries
RELC	<ul style="list-style-type: none"> This is a data compression and decompression library. It can be incorporated into devices using microcontrollers. Useful for reducing data transfer time and packet communication time. Useful for efficient usage of flash memory and write time reduction. Employs a Fujitsu Laboratories' lossless data compression method that is secure in terms of compression patents. 	Fujitsu Electronics Inc. http://jp.fujitsu.com/fei/en/
Multi Device File Access Library (MDF) for FR V03	<ul style="list-style-type: none"> Used for handling PC-compatible data on a target embedded device. Because the embedded device and PC data are managed in the same files and directories, it is easy to pass data between PCs and embedded devices. Supports exFAT, which is employed in the "SDXC" the large capacity SD card standards. 	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
Cryptography and security library	Library for encryption (AES ECB/CBC, AES CTR, DES, 3DES, RSA, RSA-OAEP), hash functions (SHA-1, SHA-2, MD5), message authentication (HMAC SHA-1, HMAC MD5, AES OMAC1), digital signatures (DSA, ECDSA, RSA-PSS, PKCS#1v1.5), pseudo random number generation (FIPS186-2 Appendix 3.1), key exchange (DH, ECDH), and modular exponentiation arithmetic.	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
JPEG library	<ul style="list-style-type: none"> This is middleware that performs compression and decompression (non-reversible) of image data in compliance with the DCT method baseline and process from the JPEG standards. 	FUJITSU SEMICONDUCTOR Limited http://www.fujitsu.com/global/services/microelectronics/contact/
CANdriver	<ul style="list-style-type: none"> Provides a hardware independent interface to the upper level software layer, making it possible to use and reuse components without regard to the hardware platform Parameters for initializing the hardware can be configured in advance using a settings/generation tool 	Vector Informatik GmbH http://consulting.vector.com/
LINdriver	<ul style="list-style-type: none"> Satisfies all requirements of the current LIN specifications (supports LIN 1.2/1.3 and LIN 2.0) Enables simple implementation of a CAN-LIN gateway when combined with the Vector CANbedded component 	Vector Informatik GmbH http://consulting.vector.com/

Analysis Tools

Product name	Overview	Inquiries
PGRRelief	<p>This is a static analysis tool for identifying bugs in C/C++ source code.</p> <ul style="list-style-type: none"> Identifies bug locations from data structures and processing flows. Checks conformance with SEC coding standards and MISRA-C guidelines. Analysis is performed by integration with SOFTUNE make/build, allowing checking and correction of bugs by simple operations. 	Fujitsu Software Technologies Limited TEL : +81-45-475-5600 http://jp.fujitsu.com/fst/services/pg/
QAC/MCM	<p>QAC is a static analysis tool for C source code that is used to improve the quality of software.</p> <p>MCM is an optional product for QAC that can evaluate conformance with MISRA C coding standards.</p> <p>QAC/MCM integrate with SOFTUNE make/build to check violations of standards, etc.</p>	Toyo Corporation Software Solutions TEL : +81-3-3245-1248 http://www.toyo.co.jp/ss/

CASE Tools

Product name	Overview	Inquiries
IBM Rational Rose® Technical Developer	Supports the most powerful model-driven development, such as executing models and generating completely executable code. This allows developers of specialist systems and embedded systems to also realize a high level of productivity.	IBM Corporation http://www-01.ibm.com/software/awdtools/developer/technical/
IBM Rational Test RealTime™	This is a cross-platform solution for component testing and runtime analysis. In particular, this is for developers writing code for embedded, real-time, and other types of cross-platform software products.	IBM Corporation http://www-01.ibm.com/software/awdtools/test/realtime/index.html
IBM Rational Rhapsody	This is a UML/SysML compliant model driver embedded system software development environment that is a complete object-oriented visual programming environment. It allows you to perform modeling, to analyze, design and implement embedded software and systems, and to dynamically verify the behavior of the model. Furthermore, since Rhapsody ensures traceability between models, it allows total management from analysis to design, implementation, and testing. By delivering the ability to maintain consistency between the model and source code using an automatic source code generation function, this allows you attain great improvements in productivity compared to traditional document-driven approaches.	IBM Corporation http://www-01.ibm.com/software/awdtools/rhapsody/
IBM Rational StateMate	StateMate, which provides powerful assistance for developing vehicle-mounted electronic components, is a design automation tool that optimizes the entire development sequence of modeling using structural analysis methods, automatic code generation, formal verification of models, and automatic generation of test cases. It also supports setting product specifications, verifying specifications, and verifying the validity of those specifications. It also has a diverse range of writing capabilities (parallelization, hierarchical) and can perform simulations of specification models even while the specifications are not complete. After checking the operation, it generates C code that performs the same operation as the specifications to increase the efficiency of confirmation work.	IBM Corporation http://www-01.ibm.com/software/awdtools/statemate/
Telelogic StateMate	StateMate is a graphical modeling toolset for system engineers. This offers powerful support for the upper development processes by functions for graphically modeling request specifications, detailed specifications, and function specifications.	Itochu Techno-Solutions Corporation TEL : +81-3-6417-5434 http://www.ctc-g.co.jp/solutions/embedded/index.html
visual STATE	<ul style="list-style-type: none"> This is a tool for designing using state charts, generating code, testing, and creating documents for embedded applications. Enables simply design under the concept of drawing a sketch, and reduces design man-hours Errors detected in design upper phase using powerful formal verification tool Improved quality by automated tests and coverage analysis Price half that of equivalent products 	IAR Systems AB http://www.iar.com/
MATLAB®/ Simulink®	MATLAB provides functions and analysis environment for efficiently developing scientific calculation programs. Simulink is a simulation environment for efficiently designing and verifying real-time systems that runs in MATLAB. Algorithms designed based on models using Simulink can be automatically converted into C code for embedded systems using Real-Time Workshop Embedded Coder. MATLAB/Simulink can perform advance evaluation of C code for embedded systems using PIL simulation by interoperating with the SOFTUNE debugger.	MathWorks Japan TEL : +81-3-6367-6700 http://www.mathworks.co.jp/

* IBM, Rational, Rational Rose, Rhapsody, and Rational Test Realtime are trademarks of IBM Corporation USA in the USA and other countries.

Development assistance tools

(development environment/OS/middleware/tools)



CASE Tools

Product name	Overview	Inquiries
ZIPC	<ul style="list-style-type: none"> This is a CASE tool that uses extended hierarchical state transition chart design methods. C source is automatically generated from the state transition chart. Supports REALOS system calls. Offers debugging using state transition charts integrated with SOFTUNE. 	CATS Co. Ltd. TEL : +81-45-473-2816 http://www.zipc.com/
SystemDesk	<ul style="list-style-type: none"> Designs AUTOSAR compliant software components and graphically models hardware independent software architectures. Automatically generates the AUTOSAR definition file, and interoperates with the TargetLink automatic code generation tool to create RUNNABLE. Configuring the network between ECU and assigning functions to multiple ECU can be easily performed using this tool, and the AUTOSAR runtime environment is automatically generated for each ECU. Interoperates with BSW tools such as Tresos (EB) to create production SW packages. 	dSPACE GmbH http://www.dspace.com
TargetLink	<ul style="list-style-type: none"> Directly generates C code for mass production from MATLAB/Simulink/Stateflow Generates ANSI C code efficiently that is suitable for the code developed by an actual programmer Embedded simulation and test environment that uses an actual processor Further optimized for the processor Can generate AUTOSAR compliant code 	dSPACE GmbH http://www.dspace.com

Verification Tools

Product name	Overview	Inquiries
CANoe	CANoe is an all-round tool for developing, testing, and analyzing networks and ECU, and supports users throughout the entire development process. <ul style="list-style-type: none"> Capable of network-wide simulation and analysis using simulation nodes created using CAPL.NET or models created using MATLAB/Simulink Features: <ul style="list-style-type: none"> Able to simplify the operation by user control panel The test function covers from ECU testing to automatic report creation Supports CAN, LIN, MOST, and FlexRay 	Vector Informatik GmbH http://consulting.vector.com/
CANalyzer	CANalyzer is a general-purpose analysis tool for distributed network systems that make it possible to easily monitor, analyze, and send messages on a network. Features: <ul style="list-style-type: none"> Simplifies testing using the user display panel Capable of performing various tests of bus data, and displaying in a Window or recording in a log file Capable of evaluation by offline playback using log files Sending and evaluation of messages using the programming function using CAPL Supports CAN, LIN, MOST, and FlexRay 	Vector Informatik GmbH http://consulting.vector.com/

Verification Tools

Product name	Overview	Inquiries
CANape	CANape is software that provides a complete development environment for measurement, compliance, and diagnosis. Features: <ul style="list-style-type: none"> Capable not only of measurement, compliance, and diagnosis of the memory built into an ECU, but is also able to measure and output vehicle-mounted networks such as CAN, LIN, and FlexRay as well as measure analog, GPS, audio, and video, and therefore supports various hardware Capable of evaluating and printing measurement data after measurement, and managing compliance data after compliance 	Vector Informatik GmbH http://consulting.vector.com/
CoverageMaster winAMS	This is a unit testing automatic execution and analysis tool that applies to microcontroller implementation code. This is not limited to simply to unit testing at the C source logic level, but is also able to perform highly reliable unit testing that includes microcontroller-dependent issues specific to embedded programming. <ul style="list-style-type: none"> Uses the "implementation microcontroller code" generated by the cross-compiler for testing Automatically reports CO/C1 coverage Automatically generates test data for C1/MCDC coverage testing The de facto tool for unit testing in vehicle development related fields 	GAIO TECHNOLOGY Co., Ltd. TEL : +81-3-3662-3041 http://www.gaio.co.jp/
RAMScope	RAMScope is a unit for extracting in real-time the data from built-in RAM using debugging interfaces such as NBD, AUD, RTD, NEXUS that are incorporated in vehicle-mounted MCUs. Because the extracted RAM data is saved directly into PC memory, a large amount of data can be accumulated, making it easy to analyze the operation of a control application. Features: <ul style="list-style-type: none"> Capable of monitoring RAM without stopping operation right from the microcontroller start-up Communication program to monitor RAM not needed => Almost no effect on microcontroller operation Capable of monitoring RAM synchronized to the microcontroller control cycle (scanstart function) Capable of tuning (overwriting) RAM 10µs/1 channel high frequency monitor (differs between microcontrollers) => Maximum 128 channels/1ms sampling performance (can support 1024 channels by special order) => When used with CAN: 100 channels/1ms + CAN: 64Bytes/1ms Saves logs with CAN and RAM on the same time axis (GT110) The target and RAMScope main unit are electrically isolated Synchronization of RAM values and external data by additional A/D and D/A units 	Yokogawa Digital Computer Corporation TEL : +81-422-52-5698 (Instrument business vehicle instrument center) http://www.yokogawa-digital.com/

32/16/8-bit core lineup

ROM, RAM, Pins

Applications

Functionality

Development assistance tools

Product selection

32 bit

16 bit

8 bit

Development assistance tools

(writing programs)



Flash write support

Fujitsu Semiconductor provides a support environment for writing programs that is tailored to the needs of our customers from development through to mass production and shipping. The most efficient mass production method for you can be chosen based on delivery schedules and production volumes.

The case of delivery of products that have been programmed by Fujitsu Semiconductor or an authorized agent

Request for pre-programmed products



Advantage: Large lots

The case of products programmed by the customer

Request for programming prior to mounting



Advantage: Short delivery time

Request for on-board programming



Advantages: Short delivery times, high maintainability

Pre-programmed device support

- **Programmed externally:** Can be handled by a programming house
 - Can also handle small programming volumes
 - Provides pre-programmed products with short delivery times
- **Pre-programmed products:** Can be programmed when shipped from the factory
 - Same shipping format as mask ROM products
 - Can handle short delivery times similar to mask ROM products

Programming before mounting support

Parallel writers for microcontrollers with built-in Flash

○ : Supported, △ : Under developing, - : Not supported

Parallel writer		New 8FX (MB95200 ~)	F ² MC-16LX	F ² MC-16FX	FR	FM3
Flash Support Group, Inc.						
Single unit programmers	AF9709C	-	○	○	○	○
	AF9710	-	○	-	-	-
Gang programmers	AF9723B	○	○	○	○	○
Minato Electronics Inc.						
Single unit programmers	MODEL1881XP	-	○	-	○	-
	MODEL1995/2	-	○	-	○	-
Gang programmers	MODEL1893	-	○	-	○	-
	MODEL1931	-	○	-	○	-
	MODEL1930+SU3000LX	-	○	-	○	-
	MODEL1940	-	○	-	○	-
	MODEL1895	-	○	-	○	-
	MODEL1896	-	○	-	○	-
Data I/O Corporation (USA) (Represented in Japan by Toyo Corporation)						
Gang programmers	FlashPAK II	○	○	-	○	△
Hi-Lo Systems Co., Ltd.						
Single unit programmers	ALL-100	○	-	-	-	△
Gang programmers	FLASH-100	○	-	-	-	△
Wave Technology Inc.						
Gang programmers	Y3000	-	○	-	-	○

Onboard programming support

Serial on-board writers

○ : Supported, △ : Under planning, - : Not supported

Serial on-board writers		New 8FX (MB95200 ~)	F ² MC-16LX	F ² MC-16FX	FR	FM3
Fujitsu Semiconductor Limited						
Flash USB Programmer (BGM adapter: MB2146-08-E must be acquired separately)		○	-	-	-	-
Flash MCU Programmer		-	○	○	○	○
Flash USB Direct Programmer		-	-	-	○	○
Yokogawa Digital Computer Corporation						
AF420/AF320		○	○	○	○	○
AF620/AF520		○	○	○	○	○
Flash Support Group, Inc.						
AF9101/03		○	○	-	○	○
Kyoei						
I.S.P-310		-	○	-	-	○

32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection



You can learn microcontroller basics such as microcontroller operations, peripheral functions, and programming using peripherals.

Microcontroller introductory e-Learning homepage : <http://www.fujitsu.com/global/services/microelectronics/e-learning/>

You can learn the following about microcontroller development.

- Features of embedded software
- Development steps
- Operations of microcontrollers
- Peripherals of a microcontroller

You can run the sample program used in the peripheral study on a Sunhayato 16-bit microcontroller starter kit jouet bleu to see the operation.

The sample program is available for download from the e-Learning page.

Suitable for beginners and new developer training.

Sunhayato Corp. jouet bleu page : http://www.sunhayato.co.jp/products_html/f2mc/index_e.html

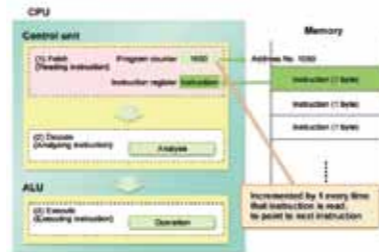
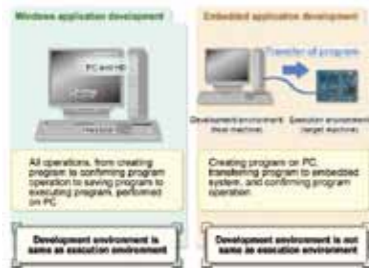
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Unit 1 Embedded Application Development

Unit 2 Microcontroller and External Peripheral Devices

1.2.5 Application development and execution environments

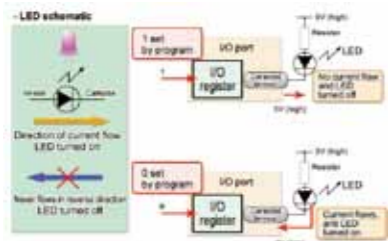
2.1.2 CPU operations



Unit 3 Programs Using Peripheral Functions

3.2.2 Mechanism : LED

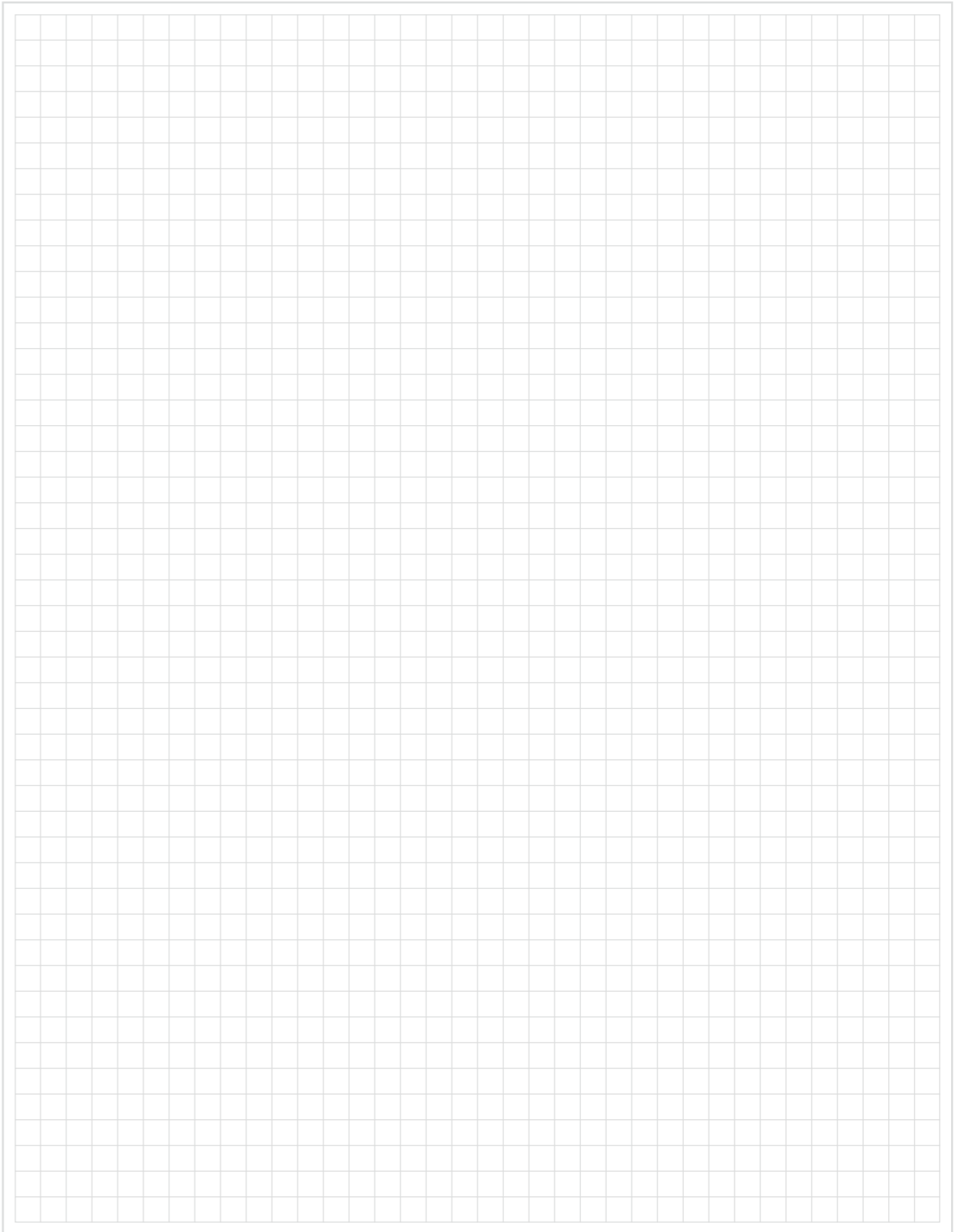
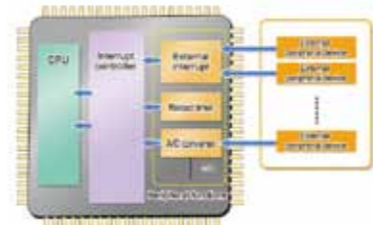
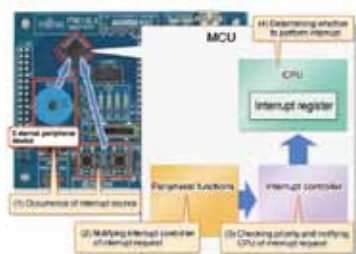
3.2.7 Sample program using an I/O ports



Unit 4 Programs Used with Interrupts

4.1.2 Interrupt processing

4.1.3 Types of hardware interrupt



32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection