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MICROCONTROLLER



Contributing to achieve the low carbon society through green and smart solutions

Fujitsu Semiconductor Ltd. Group is promoting activities such as reduction of greenhouse gas and industrial wastes, and at the same time, it is contributing to improvement of environmental performance in customers' products through green and smart solutions, which are low power consumption and space-saving. Also in microcontroller products, Fujitsu Semiconductor is promoting Green & Smart across the entire life cycle of products from design and development, manufacturing, logistics, to after-use.



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Product overviews

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16-17	8bit Core Fujitsu Original Core
18-19	8bit Wide Lineup of Pin Counts and ROM Sizes

By application

20-21	Product Selection by Application
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Functionality

22-29	Built-in CAN microcontrollers
30	Built-in FlexRay microcontrollers
31	Built-in touch sensor controller microcontroller
32-33	EtherMAC integrated microcontroller
34-35	Built-in LCD controller microcontrollers
36-37	Microcontrollers for inverter control

Development assistance tools

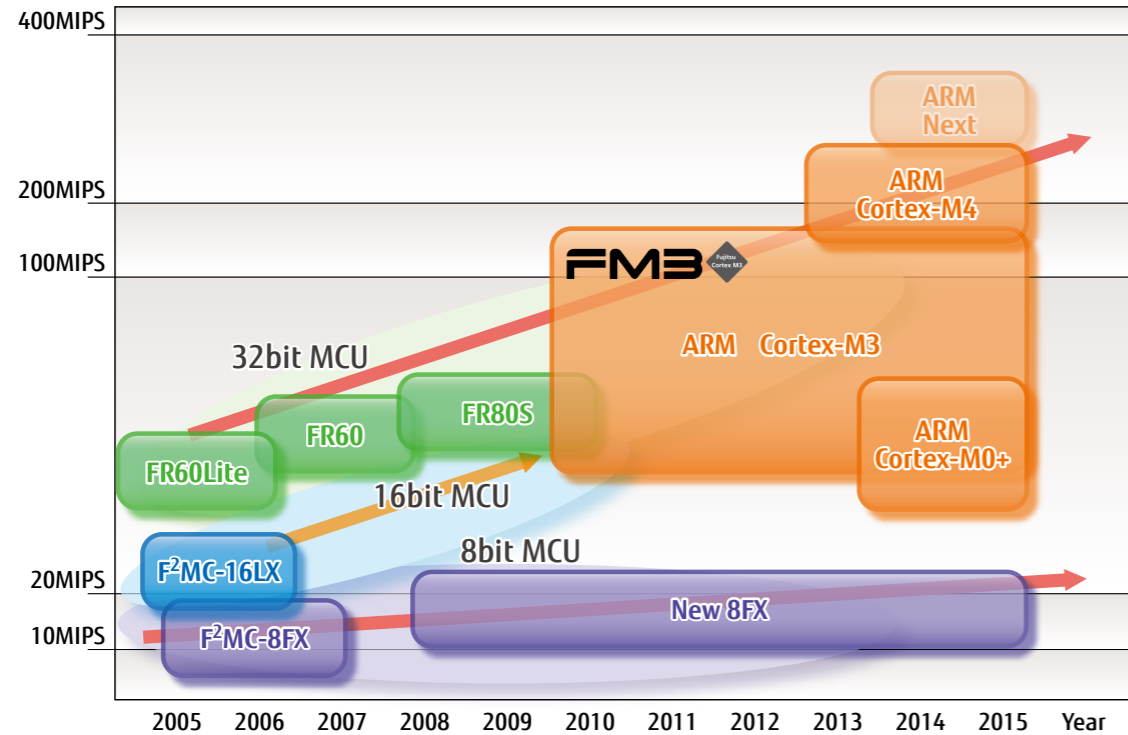
38-39	Software Tools
40-41	REALOS™ Series
42-43	SOFTUNE/REALOS series (Integrated Development Environment & Real-time OS)
44-45	SOFTUNE series (Integrated Development Environment)
46-50	Hardware Tools
52-53	Evaluation Board/Starter Kit
54-55	Education Kit
56-65	Development Environment/OS/Middleware/Tools
66-67	Writing Programs

Reference

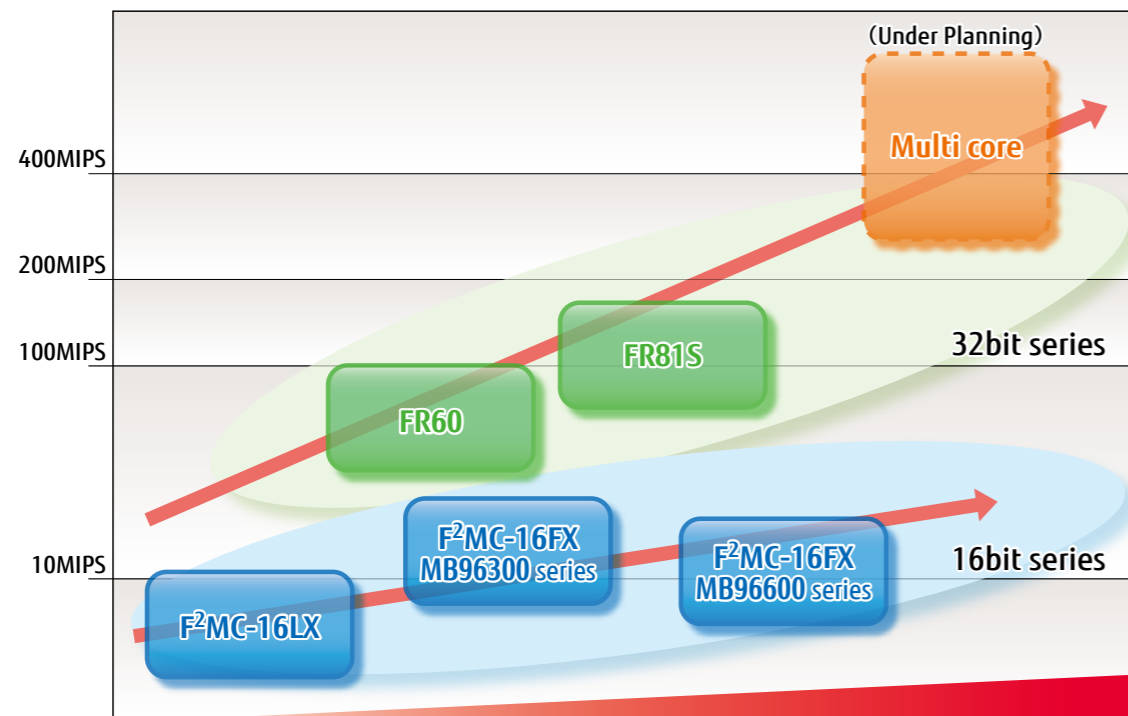
68	e-Learning Services
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Features of Fujitsu Microcontrollers

Consumer/Industrial - CPU Core Roadmap



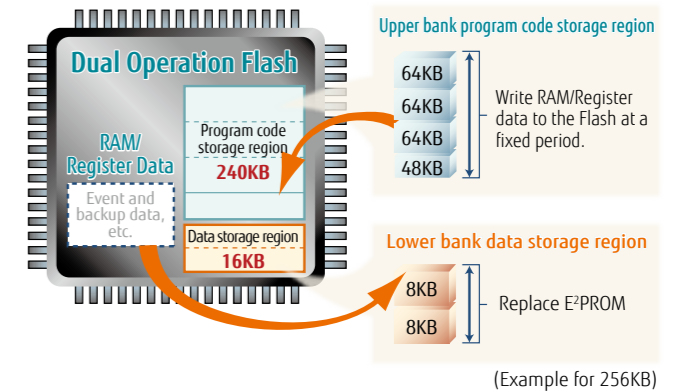
Automotive - CPU Core Roadmap



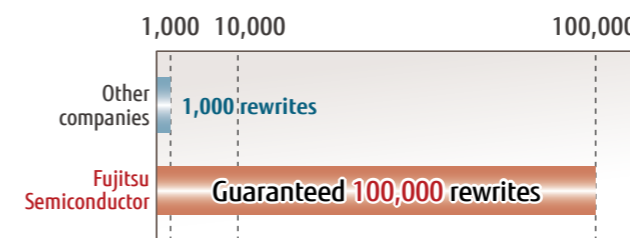
Flash Microcontroller

Flash Microcontroller Features

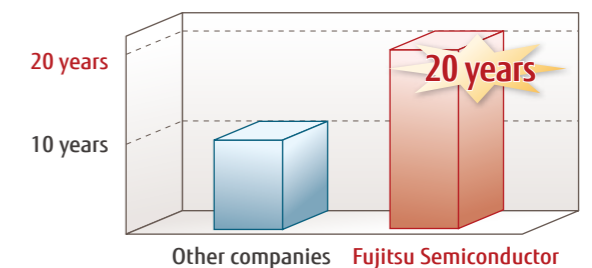
- **Dual Operation Flash**
 - Freely able to program other Flash banks while executing a program.
 - Can replace E²PROM
- **Flash Memory Reliability**
 - Guaranteed rewrites: Standard 10,000 times (separately guaranteed 100,000)
 - Data retention period: Up to 20 years (Ta = +85°C)
 - Operating temperature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



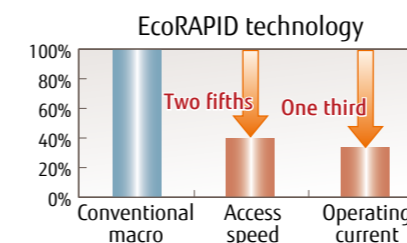
Flash microcontroller ecological technology

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.

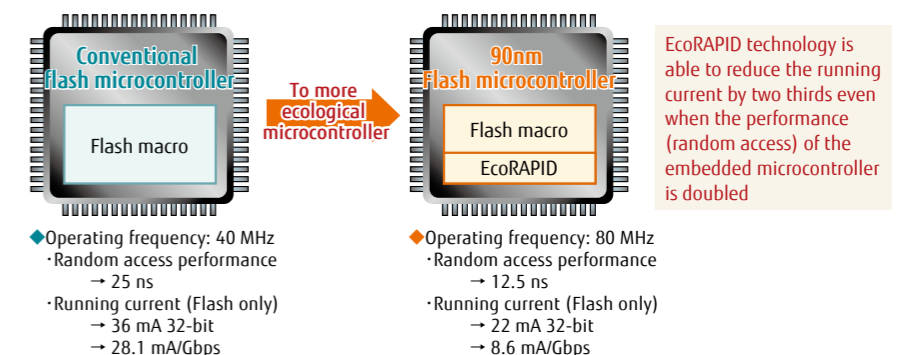
Features of EcoRAPID

- **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



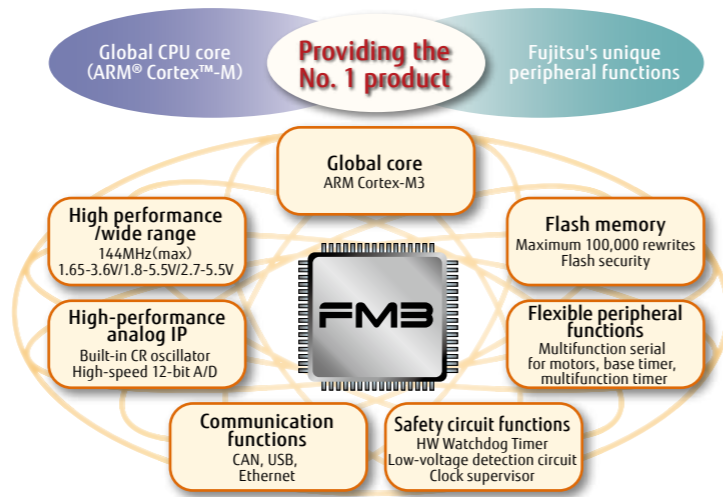
32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection
32 bit
16 bit
8 bit

FM3 Family • 32-bit Microcontroller

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.

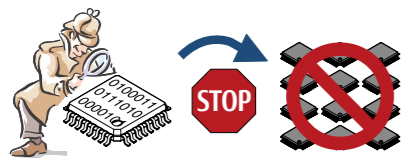
FM3 Family Features

- **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 functions (Ethernet, USB, CAN, Various serial communications)
 - 3) Fast highly accurate analog lines (12-bit A/D, CR oscillator circuit)
 - 4) Safety circuits



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

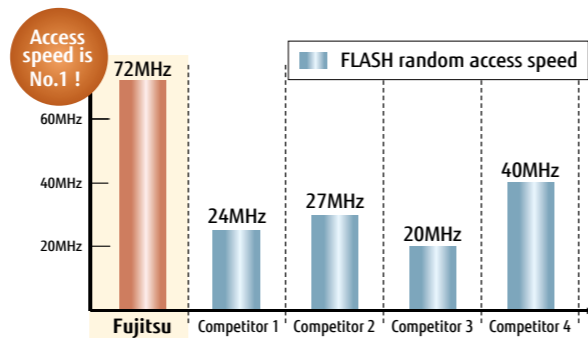
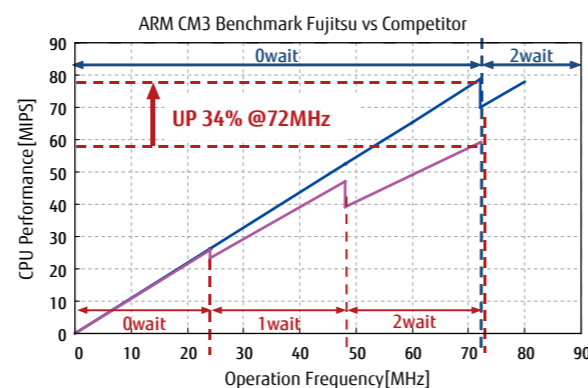


Table 2 Dhrystone2.1 benchmark result



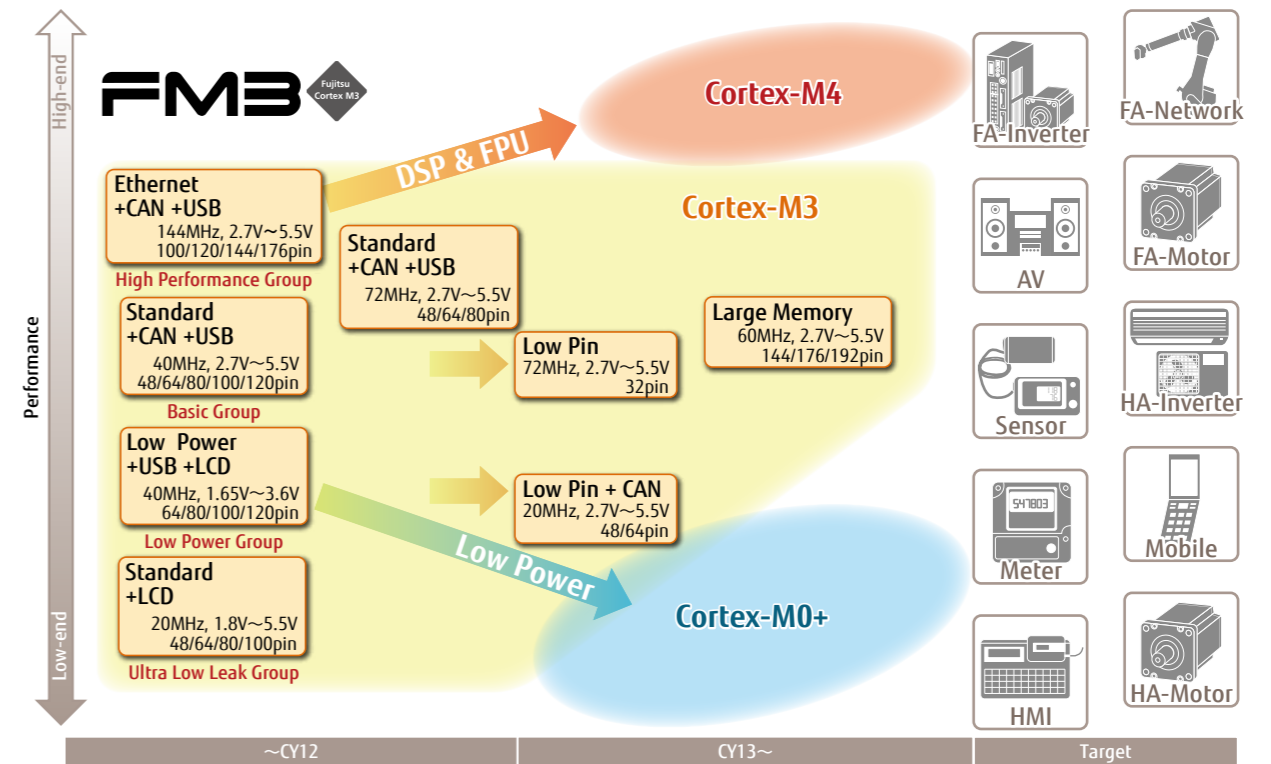
Customer developments are supported with development tools which respective partner vendors have creditable achievements.

- 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
Ethernet, CAN and USB IP
Flagship model mainly for industrial applications
- **Basic Group**
Maximum operating frequency 72 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, LCDC and HDMI-CEC 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 and HDMI-CEC IP
Low leakage model suitable for battery-driven applications



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
Development assistance tools
Product selection
32 bit
16 bit
8 bit

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	52pin	64pin	80pin	96pin	100pin	112pin	120pin	144pin	176pin	192pin	ROM[Byte]											
1M									[128K]MB9BFD18S [128K]MB9BF618S [128K]MB9BF518S [128K]MB9BF418S [128K]MB9BF318S [128K]MB9BF218S [128K]MB9BF118S	[128K]MB9BFD18T [128K]MB9BF618T [128K]MB9BF518T [128K]MB9BF418T [128K]MB9BF318T [128K]MB9BF218T [128K]MB9BF118T	[128K]MB9BFD18T [128K]MB9BF618T [128K]MB9BF518T [128K]MB9BF418T [128K]MB9BF318T [128K]MB9BF218T [128K]MB9BF118T	1M											
768K									[96K]MB9BFD17S [96K]MB9BF617S [96K]MB9BF517S [96K]MB9BF417S [96K]MB9BF317S [96K]MB9BF217S [96K]MB9BF117S	[96K]MB9BFD17T [96K]MB9BF617T [96K]MB9BF517T [96K]MB9BF417T [96K]MB9BF317T [96K]MB9BF217T [96K]MB9BF117T	[96K]MB9BFD17T [96K]MB9BF617T [96K]MB9BF517T [96K]MB9BF417T [96K]MB9BF317T [96K]MB9BF217T [96K]MB9BF117T	768K											
512K				[64K]MB9AF156M (DUAL) [32K]MB9AF316MA [32K]MB9AF116MA	[64K]MB9AF156M (DUAL)	[64K]MB9BF506NB [64K]MB9BF406NA [64K]MB9BF306NB [64K]MB9BF106NA [64K]MB9BF516N [64K]MB9BF416N [64K]MB9BF316N [64K]MB9BF116N [64K]MB9AF156N (DUAL) [32K]MB9AF316NA [32K]MB9AF116NA	[64K]MB9BF506NB [64K]MB9BF406NA [64K]MB9BF306NB [64K]MB9BF106NA [64K]MB9BF516N [64K]MB9BF416N [64K]MB9BF316N [64K]MB9BF116N [64K]MB9AF156N (DUAL) [32K]MB9AF316NA [32K]MB9AF116NA	[64K]MB9BF506RB [64K]MB9BF406RA [64K]MB9BF306RB [64K]MB9BF106RA [64K]MB9BF516R [64K]MB9BF416R [64K]MB9BF316R [64K]MB9BF116R [64K]MB9AF156R (DUAL)	[64K]MB9BFD16S [64K]MB9BF616S [64K]MB9BF516S [64K]MB9BF416S [64K]MB9BF316S [64K]MB9BF216S [64K]MB9BF116S	[64K]MB9BFD16T [64K]MB9BF616T [64K]MB9BF516T [64K]MB9BF416T [64K]MB9BF316T [64K]MB9BF216T [64K]MB9BF116T	[64K]MB9BFD16T [64K]MB9BF616T [64K]MB9BF516T [64K]MB9BF416T [64K]MB9BF316T [64K]MB9BF216T [64K]MB9BF116T	512K											
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Lead pitch (mm)	Package name D×W×H(mm)											Lead pitch (mm)											
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0.65			 LQFP-52P 10x10x1.5		 LQFP-64P 12x12x1.5		 LQFP-80P 14x14x1.5				 QFP-100P 14x20x3.0										0.65		
0.8													 FBGA-112P 10x10x1.25								0.8		

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

FR Family · 32-bit Microcontroller

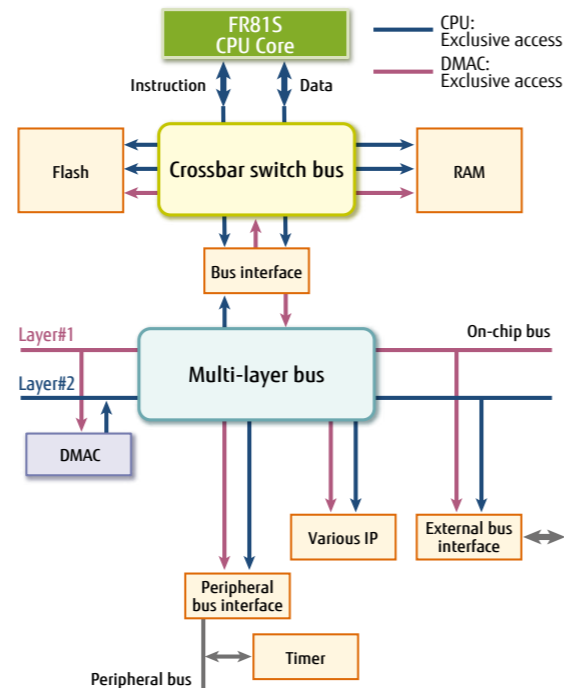
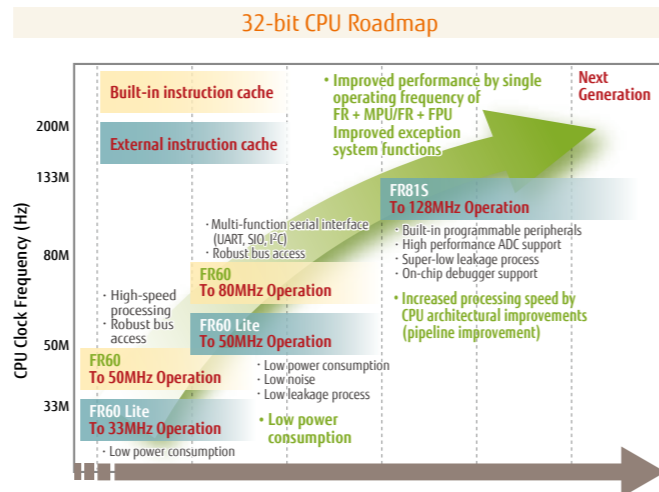
The FR family are 32-bit RISC controllers with Fujitsu original architecture whose functions are optimized for embedded device control. These microcontrollers are widely used in fields such as digital home electronics, PC peripherals, and vehicles, and are the optimal microcontrollers for applications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

FR81S Features

- FR81S Features**
- **Built-in high-performance FR81S 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
 - **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


















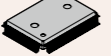


FR Family Lineup

- **Built-in PLL clock circuit**
 - Can be set to a maximum of 32 times multiplication (for products guaranteed for an 128 MHz operating frequency)
- **Built-in DMAC and multiply and accumulate circuit that can operate in parallel with CPU processing**
- **Lineup of a wide variety of Flash memory microcontrollers**
 - Maximum 2 MB built-in Flash memory
- **Wide range of peripheral functions**
 - FlexRay, MediaLB, CAN, LIN, SPI, 12bit-A/D, GDC

	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

FR Family · 32-bit Microcontroller

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

ROM[Byte]	64pin	80pin	100pin	120pin	144pin	176pin	208pin	216pin	320pin	ROM[Byte]
2112K									[96K]MB91F469G [96K]MB91F469Q	2112K
1152K	[136K]MB91F526BW/BL/BH/BJ [136K]MB91F526BS/BU/BY/BK	[136K]MB91F526DW/DL/DH/DJ [136K]MB91F526DS/DU/DY/DK	[136K]MB91F526FW/FL/FH/FJ [136K]MB91F526FS/FU/FY/FK	[136K]MB91F526JW/JL/JH/JJ [136K]MB91F526JS/JU/JY/JK		[136K]MB91F526KW/KL/KH/KJ [136K]MB91F526KS/KU/KY/KK [128K]MB91F587LA/LB/LC/LD	[136K]MB91F526LW/LL/LH/LJ [136K]MB91F526LS/LU/LY/LK	[72K]MB91F594B/BS/BH/BHS [72K]MB91F599B/BS/BH/BHS		1152K
						[72K]MB91F577 [64K]MB91F467C [64K]MB91F467T [40K]MB91F467B	[64K]MB91F467R [64K]MB91F467S	[128K]MB91F467E [64K]MB91F467D	[64K]MB91F467M	1088K
1088K										1088K
1024K										1024K
896K	[104K]MB91F525BW/BL/BH/BJ [104K]MB91F525BS/BU/BY/BK	[104K]MB91F525DW/DL/DH/DJ [104K]MB91F525DS/DU/DY/DK	[104K]MB91F525FW/FL/FH/FJ [104K]MB91F525FS/FU/FY/FK	[104K]MB91F525JW/JL/JH/JJ [104K]MB91F525JS/JU/JY/JK		[104K]MB91F525KW/KL/KH/KJ [104K]MB91F525KS/KU/KY/KK	[104K]MB91F525LW/LL/LH/LJ [104K]MB91F525LS/LU/LY/LK			896K
						[64K]MB91F586LA/LB/LC/LD				832K
832K										832K
640K	[72K]MB91F524BW/BL/BH/BJ [72K]MB91F524BS/BU/BY/BK [48K]MB91F585SG/SH/SJ/SK	[72K]MB91F524DW/DL/DH/DJ [72K]MB91F524DS/DU/DY/DK	[72K]MB91F524FW/FL/FH/FJ [72K]MB91F524FS/FU/FY/FK [48K]MB91F585MG/MH/MJ/MK	[72K]MB91F524JW/JL/JH/JJ [72K]MB91F524JS/JU/JY/JK		[72K]MB91F524KW/KL/KH/KJ [72K]MB91F524KS/KU/KY/KK [64K]MB91F585LA/LB/LC/LD	[72K]MB91F524LW/LL/LH/LJ [72K]MB91F524LS/LU/LY/LK	[48K]MB91F591B/BS/BH/BHS [48K]MB91F592B/BS/BH/BHS [48K]MB91F596B/BS/BH/BHS		640K
			[32K]MB91F465X	[16K]MB91F465K		[40K]MB91F465B [32K]MB91F465C	[40K]MB91F465P	[48K]MB91F465D		544K
512K	[56K]MB91F523BW/BL/BH/BJ [56K]MB91F523BS/BU/BY/BK [48K]MB91F584SG/SH/SJ/SK	[56K]MB91F523DW/DL/DH/DJ [56K]MB91F523DS/DU/DY/DK	[56K]MB91F523FW/FL/FH/FJ [56K]MB91F523FS/FU/FY/FK [48K]MB91F584MG/MH/MJ/MK	[56K]MB91F523JW/JL/JH/JJ [56K]MB91F523JS/JU/JY/JK [48K]MB91F662 [48K]MB91627 [48K]MB91F627	[32K]MB91613 [32K]MB91F610	[56K]MB91F523KW/KL/KH/KJ [56K]MB91F523KS/KU/KY/KK [48K]MB91637A [48K]MB91F637A	[56K]MB91F523LW/LL/LH/LJ [56K]MB91F523LS/LU/LY/LK			512K
				[16K]MB91F464A		[40K]MB91F464H				416K
384K	[56K]MB91F522BW/BL/BH/BJ [56K]MB91F522BS/BU/BY/BK [32K]MB91F583SG/SH/SJ/SK	[56K]MB91F522DW/DL/DH/DJ [56K]MB91F522DS/DU/DY/DK	[56K]MB91F522FW/FL/FH/FJ [56K]MB91F522FS/FU/FY/FK [32K]MB91F583MG/MH/MJ/MK	[56K]MB91F522JW/JL/JH/JJ [56K]MB91F522JS/JU/JY/JK [32K]MB91661		[56K]MB91F522KW/KL/KH/KJ [56K]MB91F522KS/KU/KY/KK	[56K]MB91F522LW/LL/LH/LJ [56K]MB91F522LS/LU/LY/LK			384K
						[24K]MB91F463C				288K
288K	[10K]MB91F463N									288K
256K			[32K]MB91F625			[32K]MB91F635A				256K
128K				[16K]MB91664						128K
ROM-less							[128K]MB91605A			ROM-less
Lead pitch (mm)	Package name D×W×H(mm)									Lead pitch (mm)
0.4			 TQFP-100P 12x12x1.5	 LQFP-120P 14x14x1.5	 LQFP-144P 16x16x1.5	 LQFP-216P 24x24x1.5				0.4
0.5	 LQFP-64P 10x10x1.5	 QFN-64P 9x9x0.9	 LQFP-80P 12x12x1.5	 LQFP-100P 14x14x1.5	 LQFP-120P 16x16x1.5	 LQFP-144P 20x20x1.5	 LQFP-176P 24x24x1.5	 LQFP-208P 28x28x1.5	 HQFP-208P 28x28x3.75	0.5
0.65	 LQFP-64P 12x12x1.5	 LQFP-80P 14x14x1.5	 QFP-100P 14x20x3.0							0.65
0.8						 FBGA-144P 12x12x1.25			 FBGA-320P 18x18x1.25	0.8

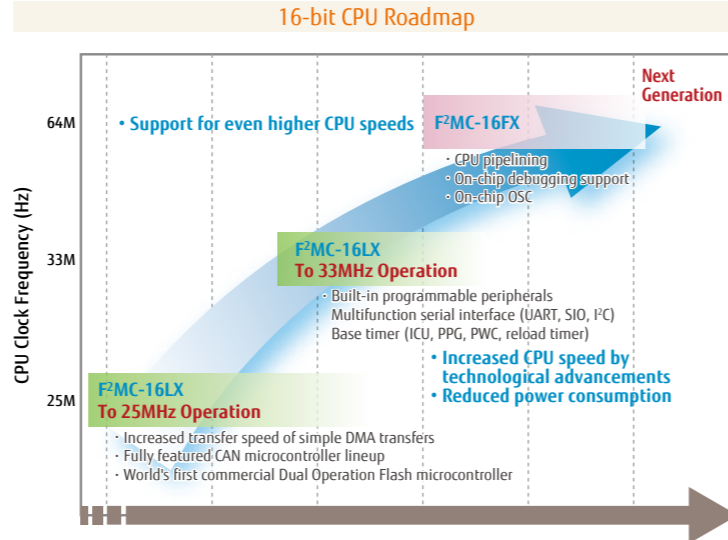
32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection
32 bit
16 bit
8 bit

F²MC-16FX • 16-bit Microcontroller

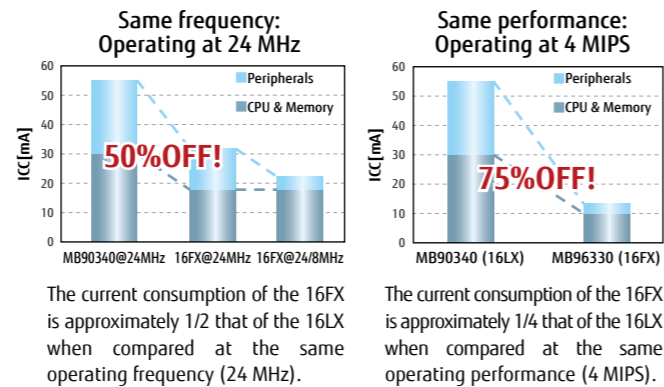
The F²MC-16FX family are Fujitsu original microcontrollers. A wide variety of products are available, from automotive products that support CAN networks to systems controllers and subcontrollers for audio visual equipment, household appliance, office equipment, and industrial equipment. The F²MC-16FX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

F²MC-16FX CPU Features

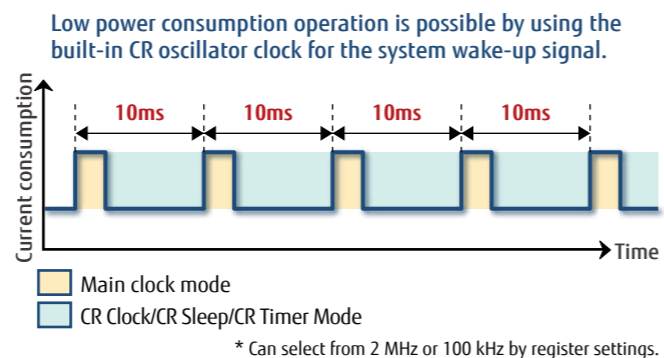
- **Basic instructions execute in one cycle**
Example) Multiplication (16-bit x 16-bit) - 4 cycles (16LX: 11 cycles)
Division (16-bit ÷ 8-bit) - 9 cycles (16LX: 15 cycles)
- **High-speed processing using a 5-stage pipeline and instruction queue (8 Bytes)**
- **High-speed interrupts**
Interrupt handling 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)



F²MC-16FX Current Consumption



Low power consumption operation by CR oscillator clock



Product Lineup [MB96300 Series]

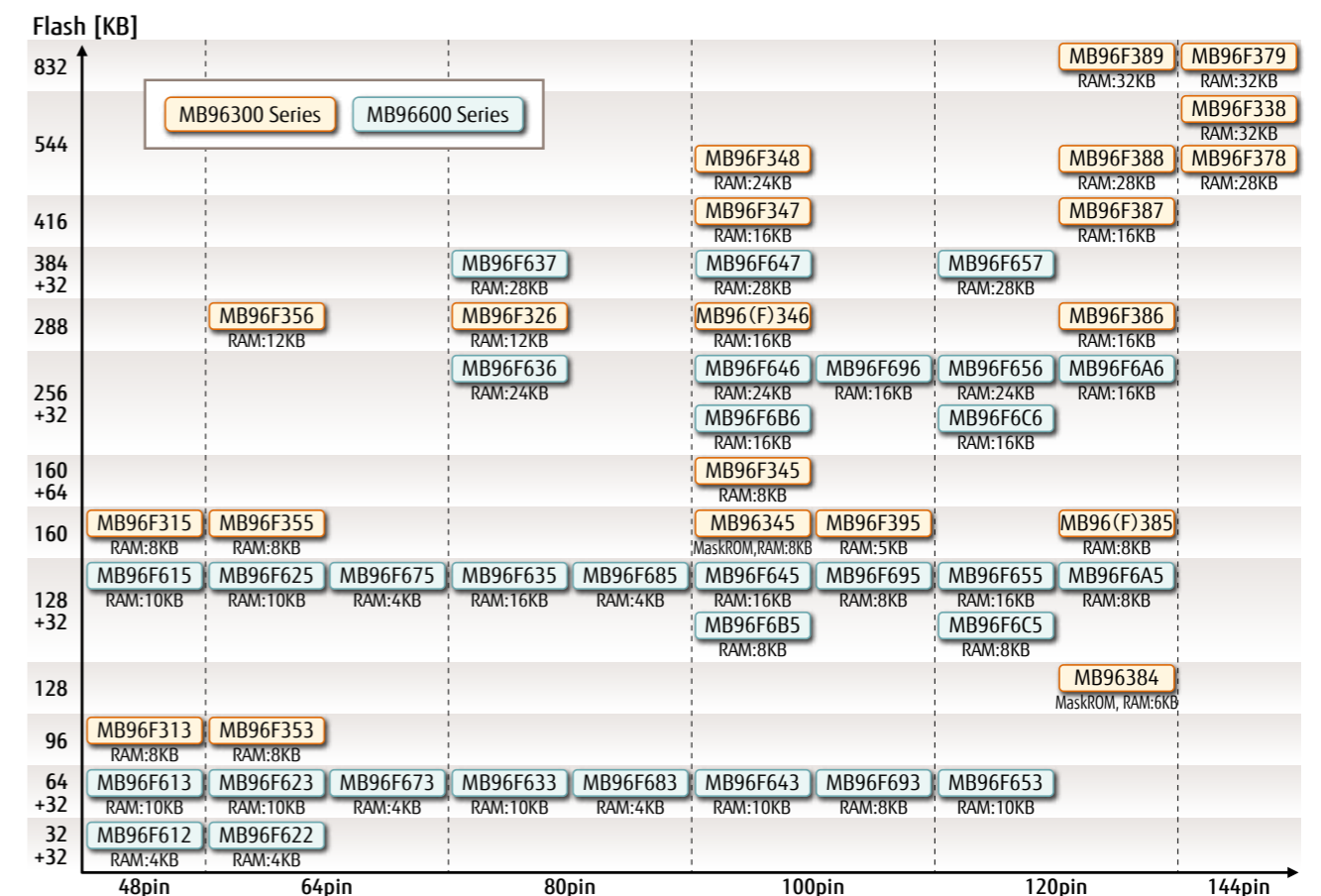
- **Wide lineup that are easy to choose to suit the application**
 - Built-in CAN products (Single CAN to Triple CAN)
Number of message buffers: 32
 - Built-in USB Full-Speed products (Support Function and Host)
- **Supports a wide range of system voltages from 3.0 V to 5.5 V**
- **CPU operating frequency: 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	
USB						MB96330U
Standard product	MB96310A MB96610A	MB96350A MB96620A	MB96320A MB96630A MB96680A	MB96340A MB96640A MB96690A MB966B0A	MB96650A MB966A0A MB966C0A	
















































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

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 [24K]MB96F348RS/F348RW	[28K]MB96F388HS/F388HW	[28K]MB96F378HS/F378HW	576K	
544K						[32K]MB96F338RS/F338RW [32K]MB96F338US/F338UW	544K	
512K				[20K]MB90F345CE/F345CES [20K]MB90F345E/F345ES	[30K]MB90F395A [24K]MB90F924NC/F924NCS		512K	
416K			[28K]MB96F637R 	[28K]MB96F647R  [16K]MB96F347RS/F347RW	[28K]MB96F657R  [16K]MB96F387RS/F387RW [16K]MB90F923NC/F923NCS		416K	
384K					[10K]MB90F394HA [10K]MB90394HA		384K	
288K		[12K]MB96F356RS/F356RW	[24K]MB96F636R  [12K]MB96F326RS/F326RW	[24K]MB96F646R  [16K]MB96F346RS/F346RW [16K]MB96346RS/346RW [16K]MB96F696R  [16K]MB96F6B6R 	[24K]MB96F656R  [16K]MB96F386RS/F386RW [16K]MB96F6A6R  [16K]MB96F6C6R 		288K	
256K				[16K]MB90342CE/342CES/342E [16K]MB90349CE/349CES/349E [16K]MB90F342CE/F342CES [16K]MB90F342E/F342ES [16K]MB90F349CE/F349CES [16K]MB90F349E/F349ES [16K]MB90F952JDS/F952MDS	[10K]MB90922NCS [10K]MB90F922NC/F922NCS		256K	
224K				[8K]MB96F345DS/F345DW			224K	
160K	[10K]MB96F615RB  [8K]MB96F315RS/F315RW [8K]MB90F997JBS/F997MBS	[10K]MB96F625R  [8K]MB96F355RS/F355RW [4K]MB96F675R 	[16K]MB96F635R  [4K]MB96F685R 	[16K]MB96F645R  [8K]MB96F395RS/F395RW [8K]MB96395RS/395RW [8K]MB96345RS/345RW [8K]MB96F695R  [8K]MB96F6B5R 	[16K]MB96F655R  [8K]MB96F385RS/F385RW [8K]MB96385RS/385RW [8K]MB96F6A5R  [8K]MB96F6C5R 	[12K]MB96375RS/375RW	160K	
128K	[8K]MB90F911AS [8K]MB90F912BS	[4K]MB90352E/352ES/352TE/352TES [4K]MB90357E/357ES/357TE/358TES [4K]MB90F352E/F352ES  [4K]MB90F352TE/F352TES  [4K]MB90F357E/F357ES  [4K]MB90F357TE/F357TES 		[16K]MB90341CE/341CES [16K]MB90341E/341ES [16K]MB90348CE/348CES [16K]MB90348E/348ES [6K]MB90347CE/347CES/347E [6K]MB90F347CE/F347CES [6K]MB90F347E/F347ES [6K]MB90867E/867ES [6K]MB90F867E/F867ES	[8K]MB90931/931S [8K]MB90F931/F931S [6K]MB96384RS/384RW		128K	
96K	[10K]MB96F613R  [8K]MB96F313RS/F313RW	[10K]MB96F623R  [8K]MB96F353RSB/F353RWB [4K]MB96F673R 	[10K]MB96F633R  [4K]MB96F683R 	[10K]MB96F643R  [8K]MB96F693R  [5K]MB96393RS/393RW [2K]MB90346CE/346CES [2K]MB90346E/346ES [2K]MB90F346CE/F346CES [2K]MB90F346E/F346ES	[10K]MB96F653R 		96K	
64K	[4K]MB96F612R  [4K]MB90911AS [3K]MB90362E/362ES/362TE/362TES [3K]MB90367E/367ES/367TE/367TES [3K]MB90F362E/F362ES/F362TE/F362TES [3K]MB90F367E/F367ES/F367TE/F367TES [2K]MB90F387/F387S [2K]MB90F897/F897S  [2K]MB90457/457S [2K]MB90F457/F457S [2K]MB90456/456S [2K]MB90F456/F456S [2K]MB90455/455S [2K]MB90F455/F455S	[4K]MB96F622R  [4K]MB90351E/351TE/351TES [4K]MB90356E/356ES/356TE/356TES [4K]MB90F351E/F351ES [4K]MB90F351TE/F351TES [4K]MB90F356E/F356ES [4K]MB90F356TE/F356TES						64K
32K							32K	
24K							24K	
Lead pitch (mm)	Package name D×W×H(mm)						Lead pitch (mm)	
0.4					 LQFP-120P 14x14x1.5	 LQFP-144P 16x16x1.5	0.4	
0.5	 LQFP-48P 7x7x1.5	 LQFP-64P 10x10x1.5	 LQFP-80P 12x12x1.5	 LQFP-100P 14x14x1.5	 LQFP-120P 16x16x1.5		0.5	
0.65		 LQFP-64P 12x12x1.5	 LQFP-80P 14x14x1.5	 QFP-100P 14x20x3.0			0.65	
0.8/1.0			 QFP-80P 14x20x3.05				0.8/1.0	

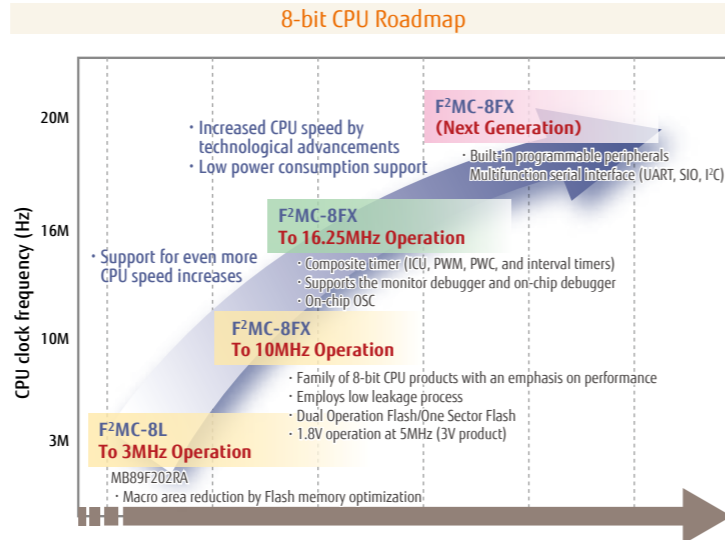
32/16/8-bit core lineup
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New 8FX · 8-bit Microcontroller

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.

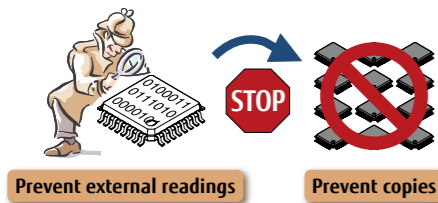
New 8FX CPU Features

- 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

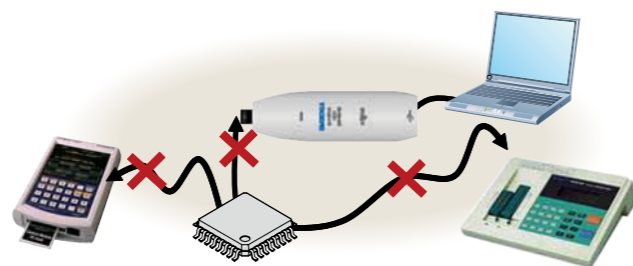


New 8FX Product Features

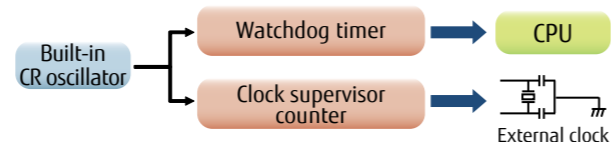
- Cost reduction by using thirdparty parts
 - Oscillator
Main CR oscillator circuit
Sub built-in CR oscillator circuit
 - Reset IC
Low-voltage detection circuit (LVD)
 - E²PROM
Dual operation flash enabling E²PROM emulation
- Flash memory security
Customer software resources are protected by the flash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



- 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.



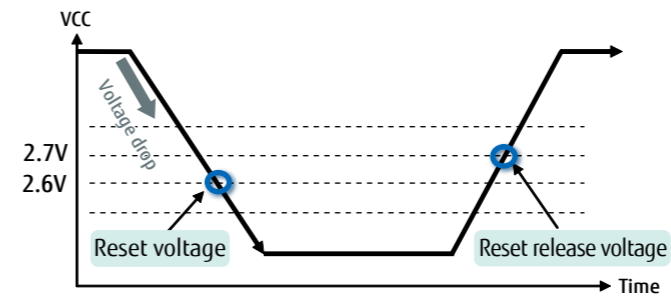
When the flash security function is active, no data can be read even by a serial writer with BGM adapter nor by parallel writer.



New 8FX Product Features

- Low voltage detection reset

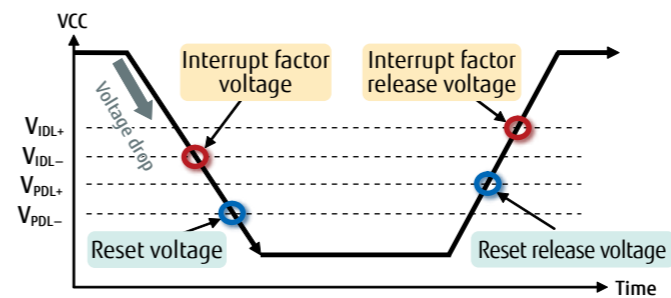
Low voltage detection reset function in 5V products



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

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

Low voltage detection reset function in 3V products



The interrupt factor voltage and reset voltage can be set separately; therefore, voltage errors can be handled by either one of the interrupt process or 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	














































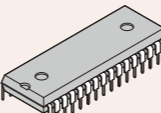
Product Lineup [New 8FX MB95400, MB95500, MB95600, MB95700, MB95800 series]

- Handy low pin count series
20-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	20pin	24pin	32pin	48/52pin	64pin	80pin	
LCD					MB95770L	MB95710L	All products On-chip debugging support
Inverter			MB95630H	MB95690K			
Touch sensor		MB95850K	MB95860K	MB95870K			
Standard product	MB9560H	MB95650L	MB9560H MB95650L		MB95810K		

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]	20pin	24pin	32pin	48pin	52pin	64pin	80pin	ROM[Byte]
60K				[2K]MB95F698K 	[2K]MB95F698K 	[2K]MB95F778E/F778L 	[2K]MB95F718E/F718L 	60K
						[2K]MB95F818K 		
36K		[1K]MB95F656E/F656L 	[1K]MB95F636H/F636K 	[1K]MB95F696K 	[1K]MB95F696K 	[1K]MB95F776E/F776L 	[1K]MB95F716E/F716L 	36K
		[1K]MB95F856K 	[1K]MB95F866K 	[1K]MB95F876K 	[1K]MB95F876K 	[1K]MB95F816K 	[1K]MB95F616K/F616H 	
20K	[496]MB95F564H/F564K 	[1K]MB95F654E/654L 	[1K]MB95F634H/F634K 	[512]MB95F694K 	[512]MB95F694K 	[512]MB95F774E/F774L 	[1K]MB95F614K/F614H 	20K
						[512]MB95F814K 	[512]MB95F714E/F714L 	
12K	[496]MB95F563H/F563K 	[512]MB95F653E/653L 	[512]MB95F633H/F633K 				[512]MB95F613K/F613H 	12K
8K	[240]MB95F562H/F562K 	[256]MB95F652E/652L 	[256]MB95F632H/F632K 					8K
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-20P 6.5x4.4x1.2	 TSSOP-24P 7.8x4.4x1.2				 LQFP-52P 10x10x1.5	 LQFP-64P 12x12x1.5	0.65
0.8/1.0			 LQFP-32P 7x7x1.5					0.8/1.0
1.27	 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

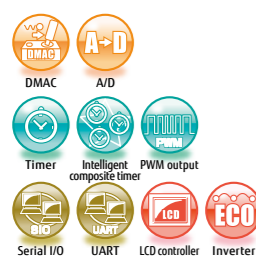
Product Selection by Application

Expanding the possibility of applications

Fujitsu Semiconductor microcontrollers

Home appliances

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



Main control

32bit

- MB9A100A series
- MB9A110K series
- MB9A130LA series
- MB9A310K series
- MB9B100A series
- MB9B110R series
- MB9B110T series
- MB9B300B series
- MB9B310R series
- MB9B410R series
- MB9B510R series

8bit

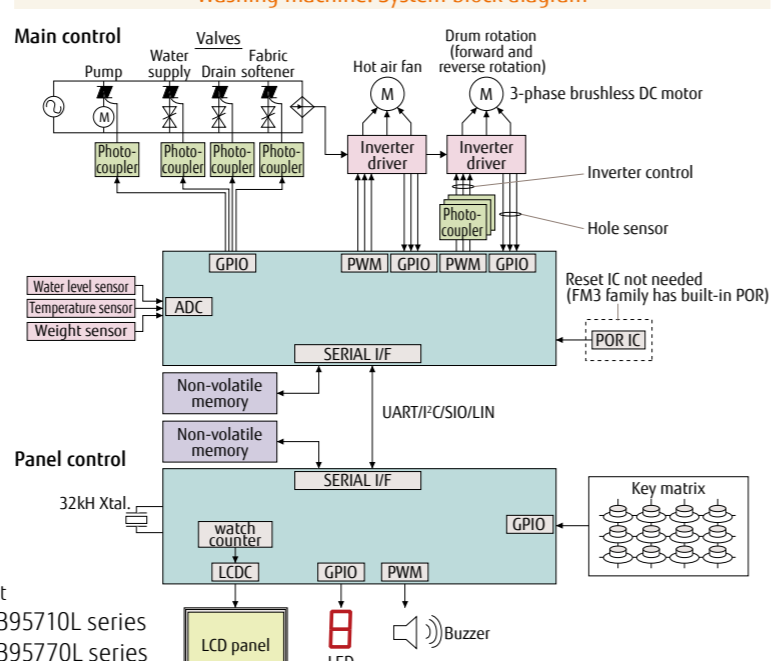
- MB95560H series
- MB95570H series
- MB95580H series

Panel control

32bit

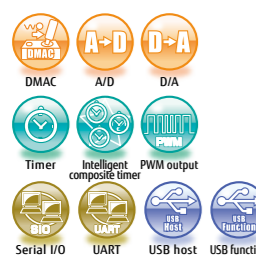
- MB9A130N series
- MB9AA30N series

Washing machine: System block diagram



Office equipment

- Printer
- Fax
- Scanner



Main body control

32bit

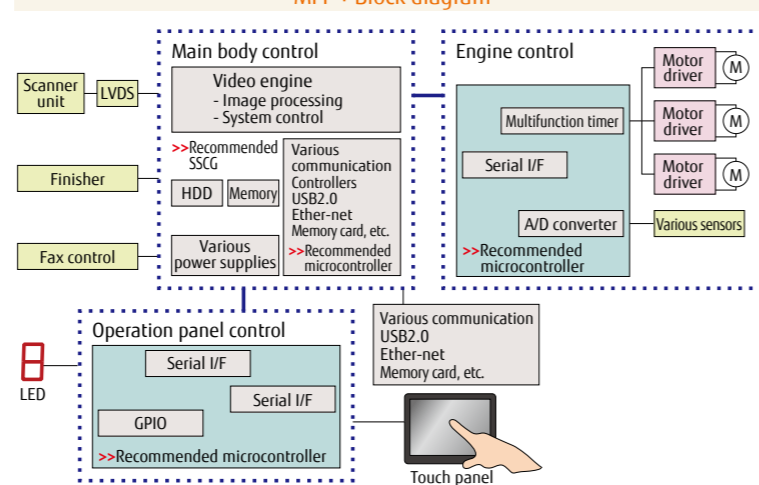
- MB9A310 series
- MB9A310K series
- MB9A340N series
- MB9B210T series
- MB9B300B series
- MB9B310R series
- MB9B310T series
- MB9B400A series
- MB9B410R series
- MB9B410T series
- MB9B500B series
- MB9B510R series
- MB9B510T series
- MB9B610T series

Engine control

32bit

- MB9B100A series
- MB9B110R series
- MB9B110T series

MFP : Block diagram



Operation panel control

32bit

- MB9A130LA series
- MB9A130N series

8bit

- MB95710L series
- MB95770L series

Digital audio-visual

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



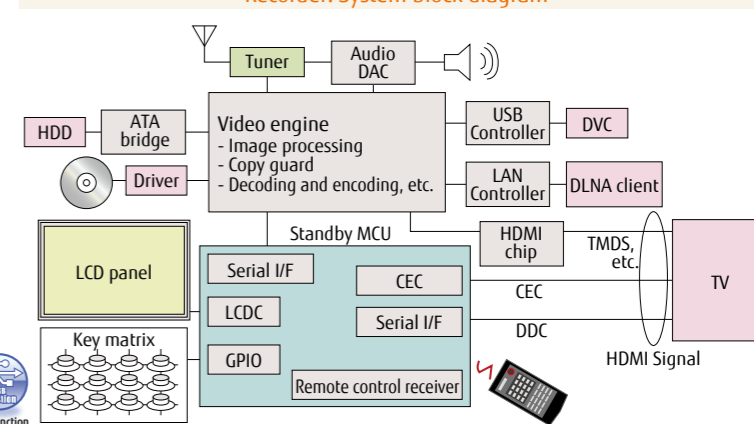
32bit

- MB9A130LA series
- MB9A130N series
- MB9AA30N series
- MB9B110T series
- MB9B210T series
- MB9B310T series
- MB9B610T series

8bit

- MB95710L series
- MB95770L series

Recorder: System block diagram



Automotive

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



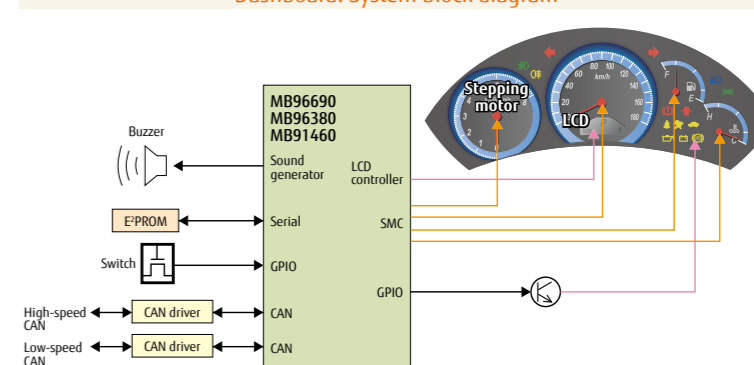
32bit

- MB91570 series
- MB91590 series
- MB91460 series

16bit

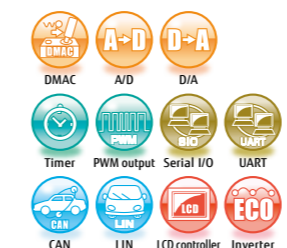
- MB96340 series
- MB96380 series
- MB96610 series
- MB96690 series

Dashboard: System block diagram



Industrial equipment

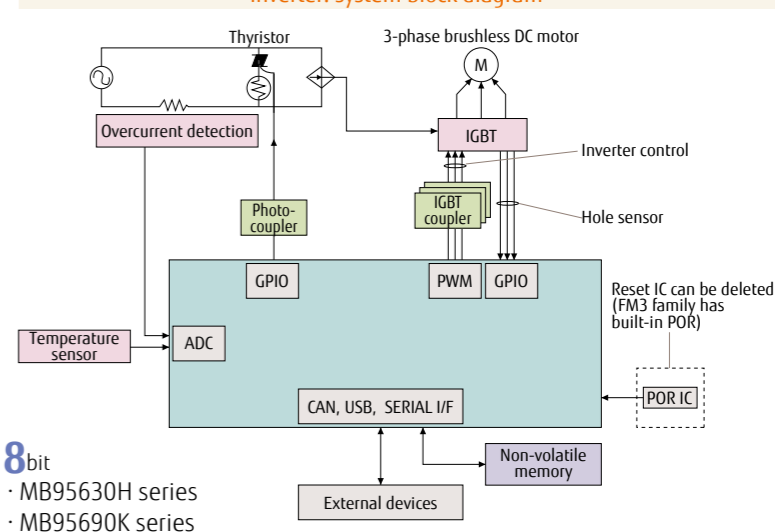
- Robots
- Inverter control
- Automatic vending machines
- Medical equipment, etc.



32bit

- MB9A100A series
- MB9A110K series
- MB9A130LA series
- MB9A310K series
- MB9B110R series
- MB9B110T series
- MB9B210T series
- MB9B300B series
- MB9B310R series
- MB9B400A series
- MB9B410R series
- MB9B410T series
- MB9B500B series
- MB9B510R series
- MB9B510T series
- MB9B610T series

Inverter: system block diagram



8bit

- MB95630H series
- MB95690K series

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

Overview

EH/HV motor control solutions

The MB91580L series employs the "FR81S" 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 "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 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

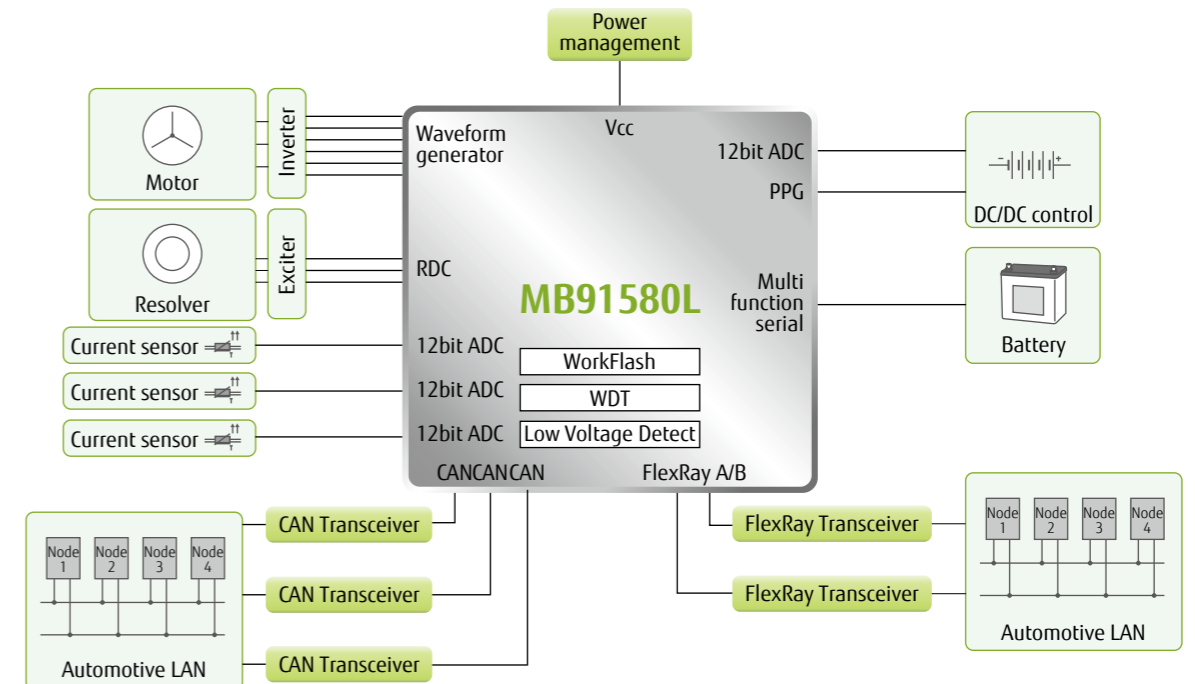
On Chip Debug Unit

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

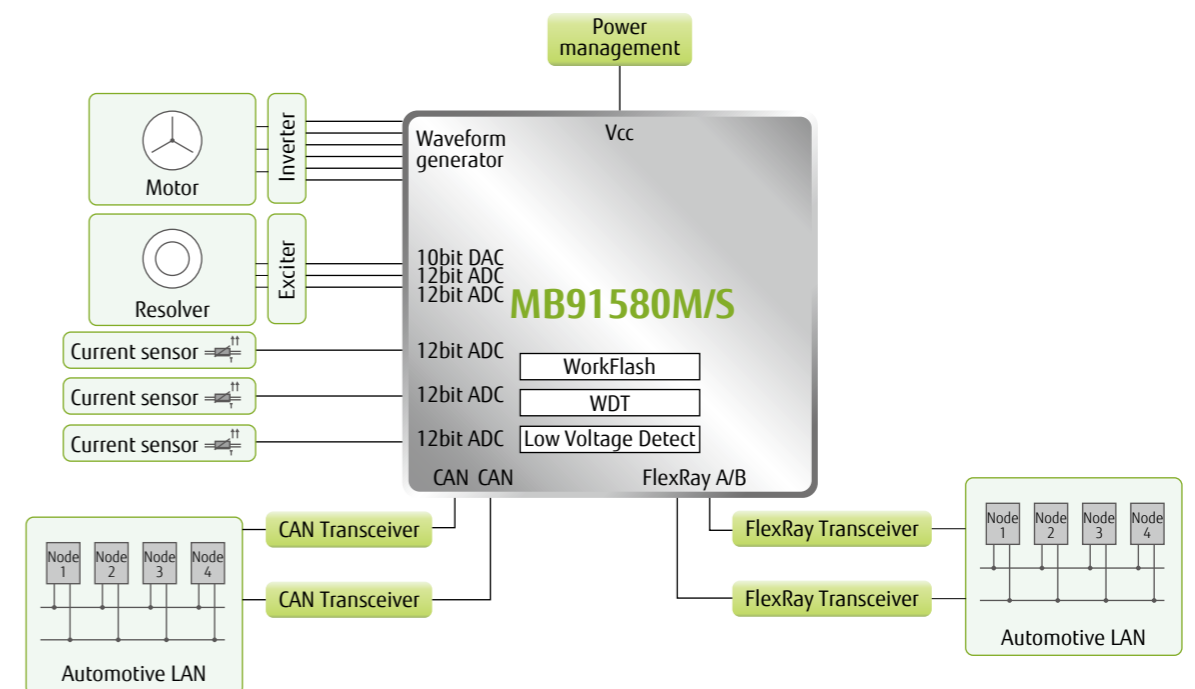
Key specifications

- 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

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

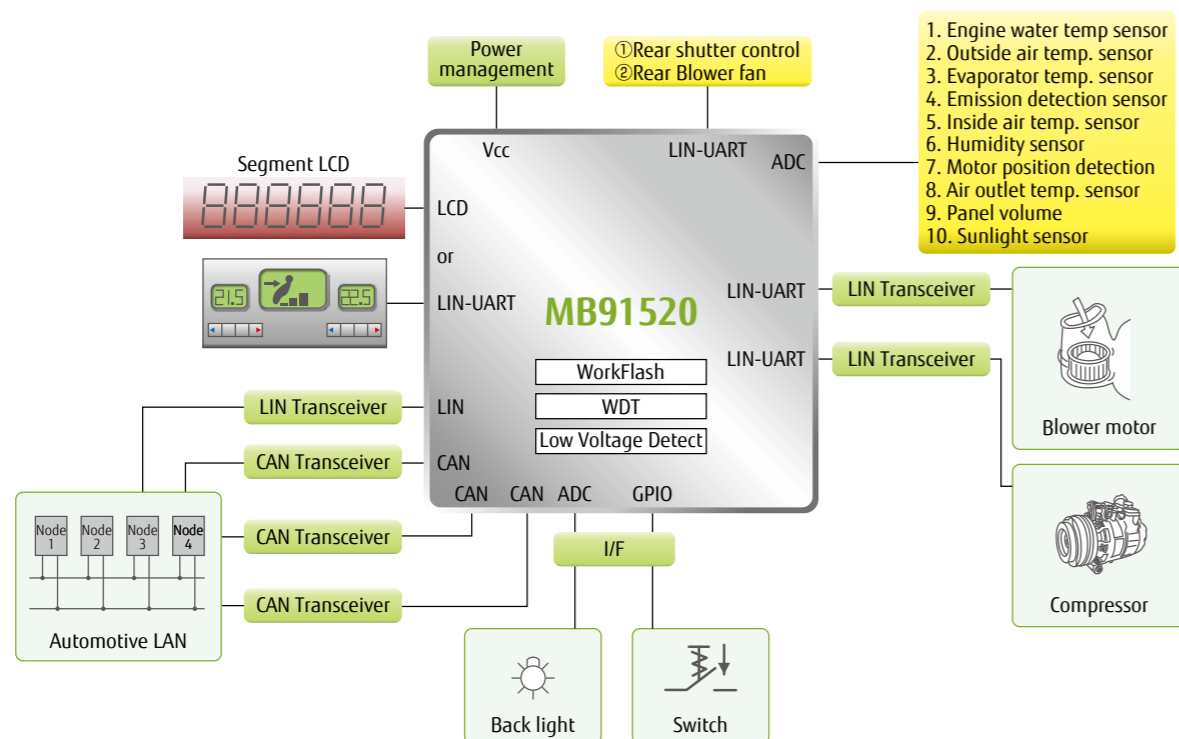
● On Chip Debug Unit

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

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

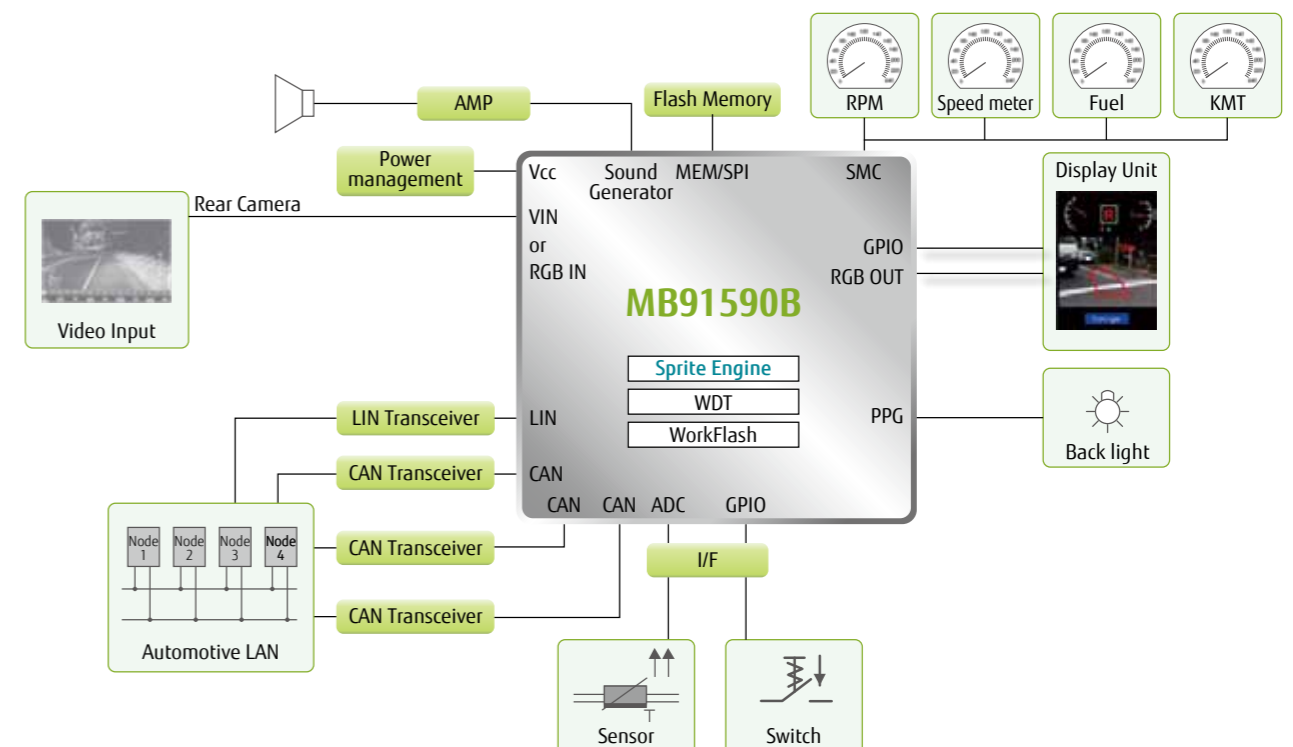
● On Chip Debug Unit

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

Overview

● Single chip solution for segment dashboard control

The MB91570 series employs the "FR81S" 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 "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

● 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

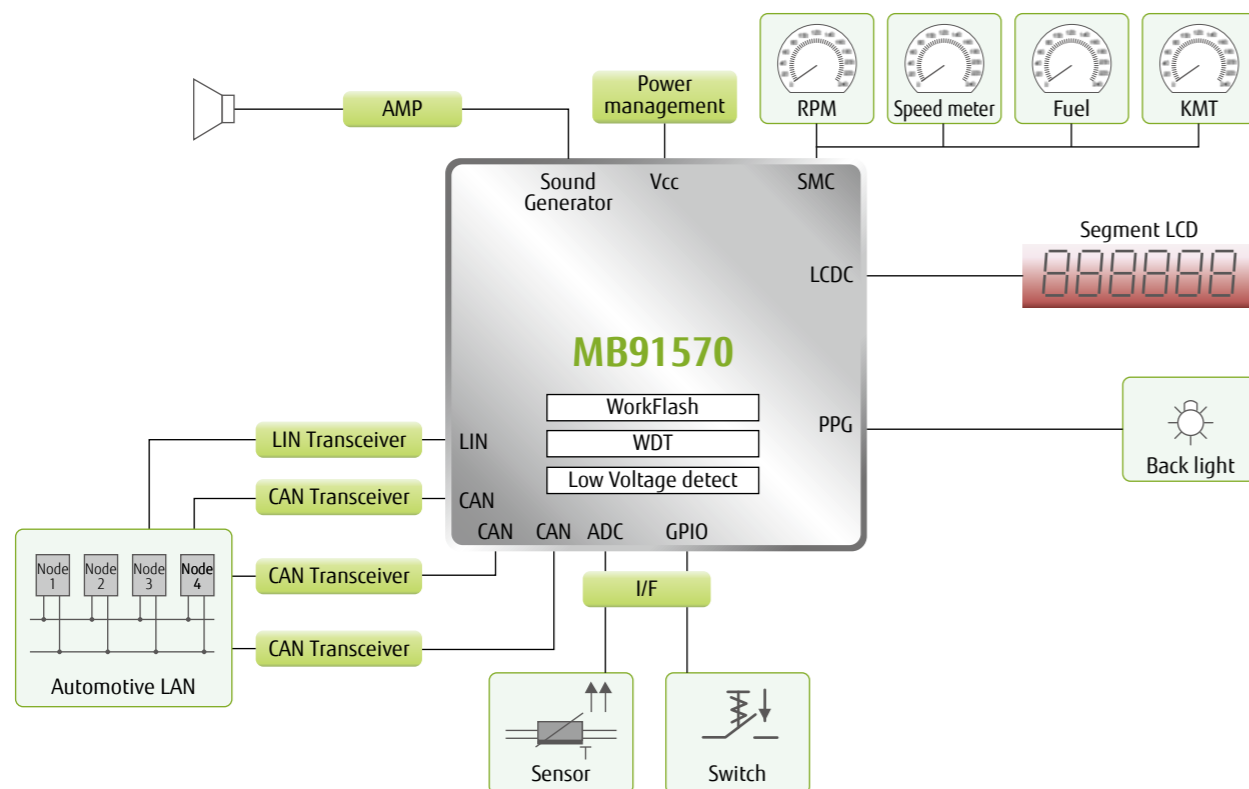
● On Chip Debug Unit

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

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)

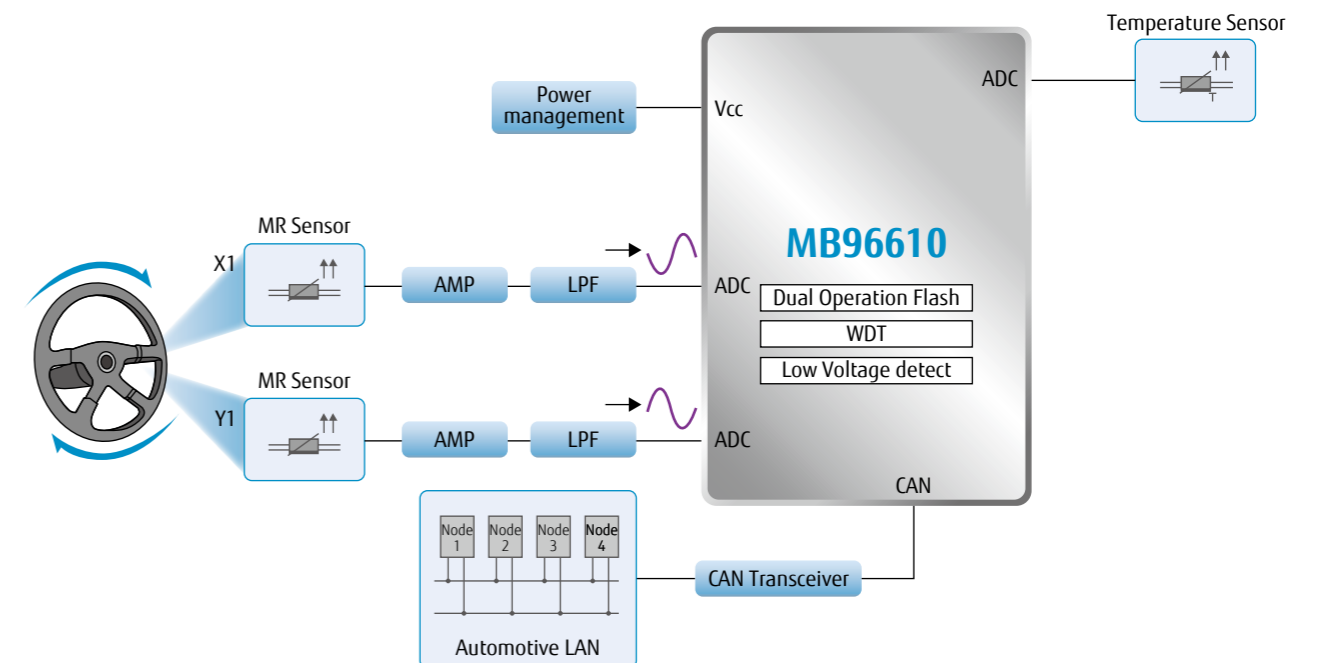
● On Chip Debug Unit

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

Overview

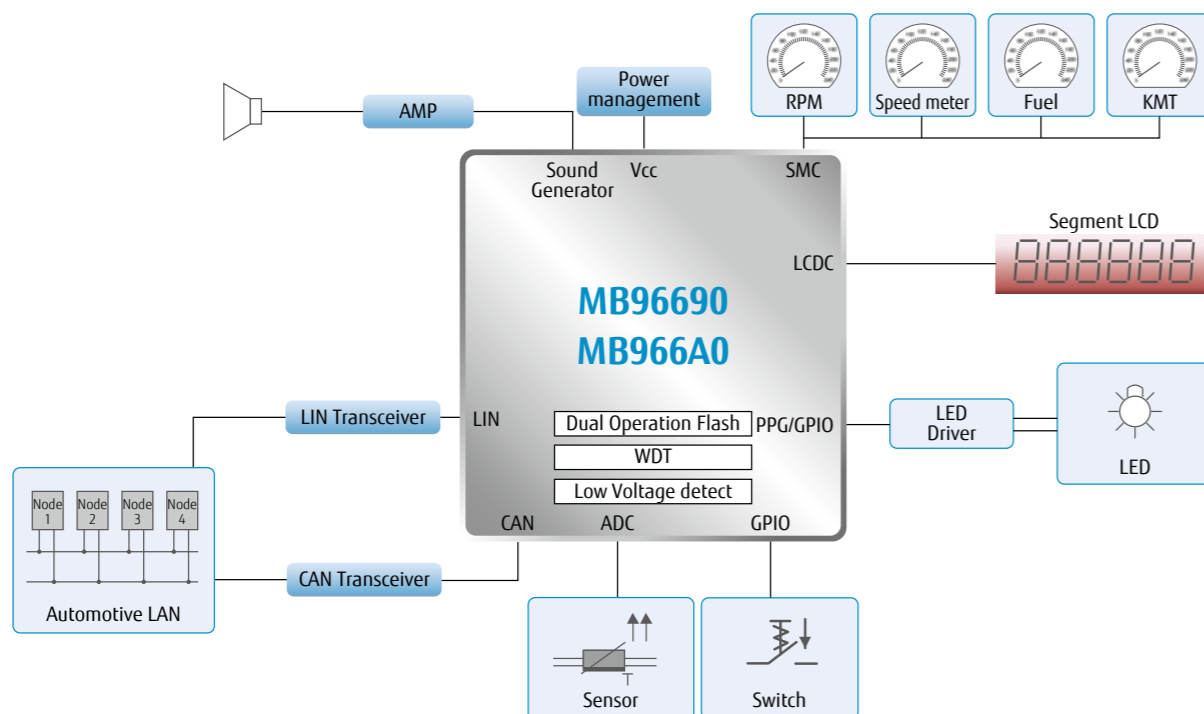
- Lineup of products from 64 pins to 120 pins as suitable for vehicle-mounted meter control systems

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

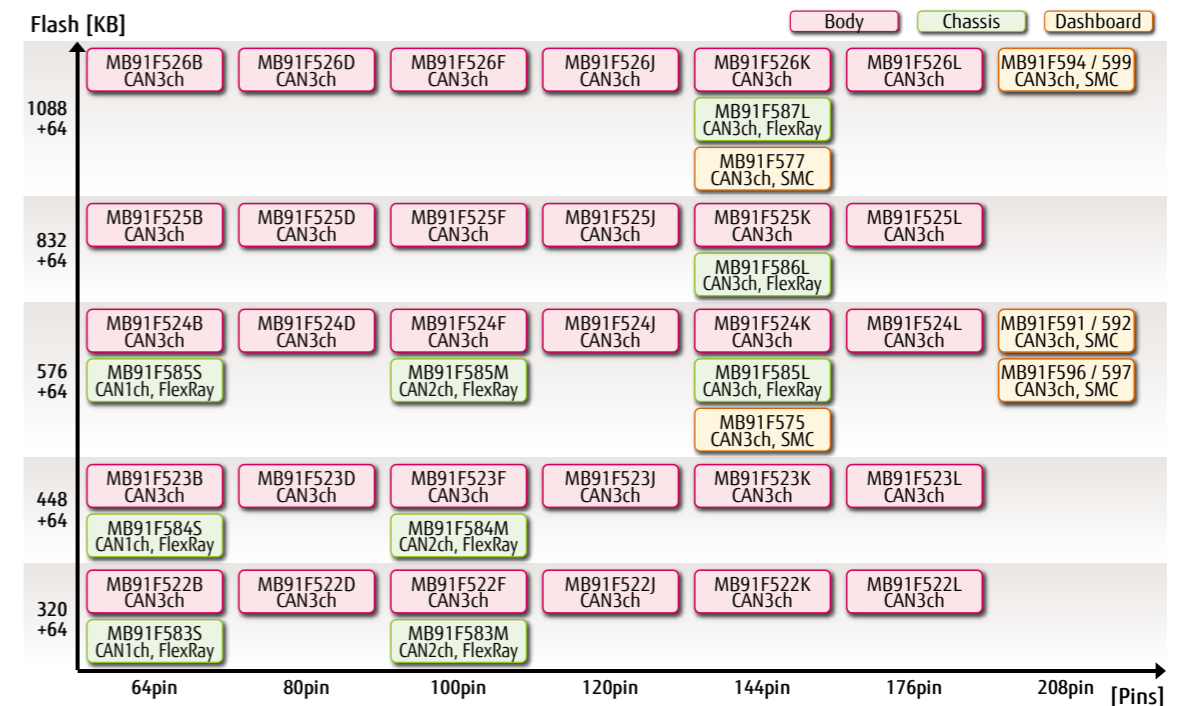
Meter control system block diagram (MB96690/6A0 series)



Series Lineup

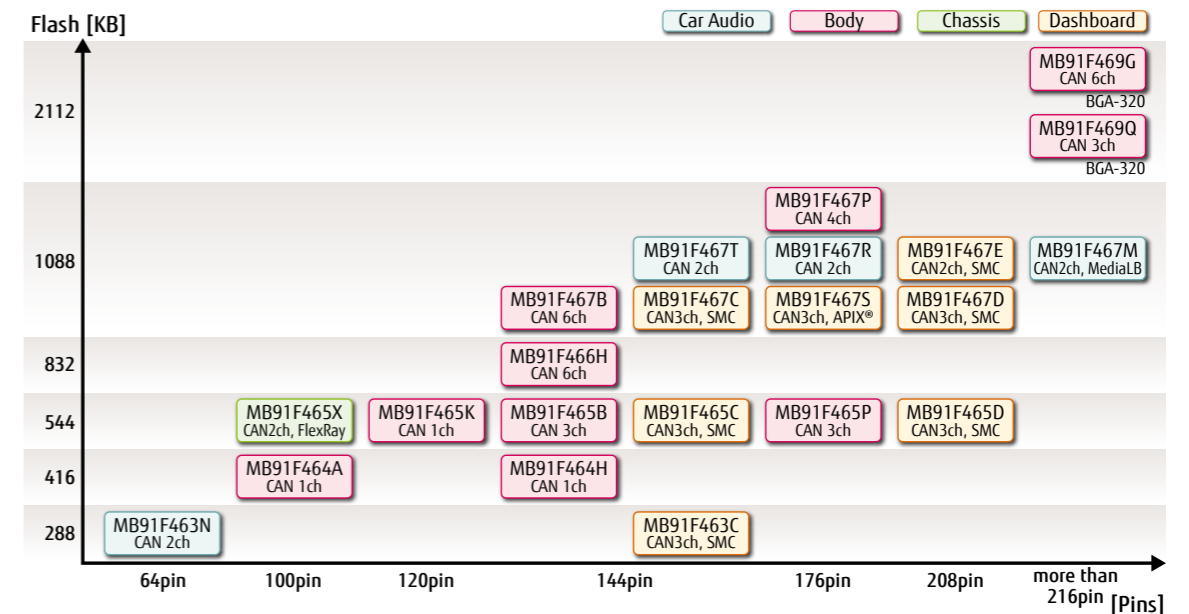
MB91500 Series Product Lineup

- 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



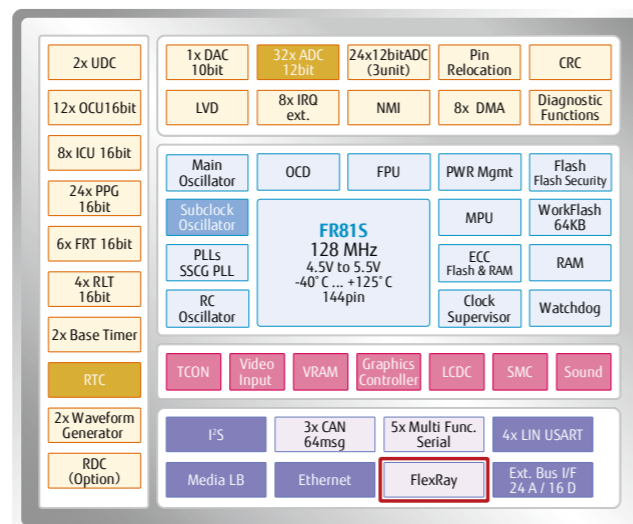
Built-in FlexRay microcontrollers

Features

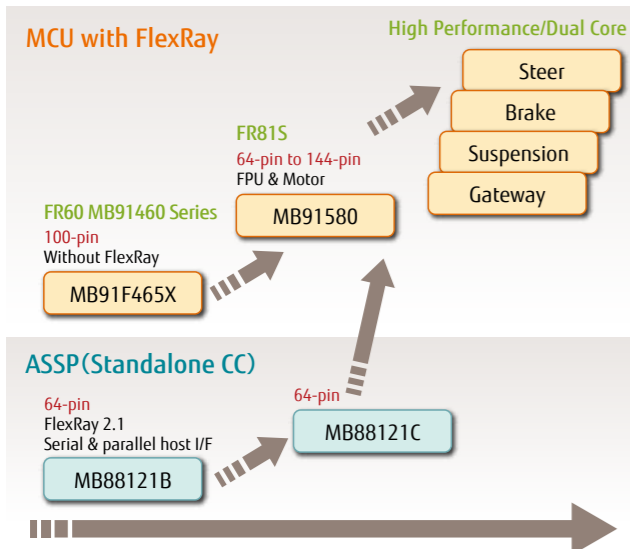
- Built-in FlexRay controller macro from Robert Bosch GmbH supporting FlexRay Protocol Ver 2.1
- Supporting FlexRay communication speeds of 10Mbps, 5Mbps, and 2.5 Mbps
- Built-in PLL oscillator circuit exclusively used for FlexRay system clock

MB91F587L block diagram

- FR81S 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



Built-in touch sensor controller microcontroller

Features of built-in touch sensor controller microcontroller

By replacing the general domestic-use mechanical switches with touch sensors, high design-ability by full flat switches can be achieved. Microcontrollers with the built-in touch sensor controller are lined up.

- (1) Corresponds to the capacitive sensing method with superior dust tightness, water resistance, and wear resistance
 - (2) By applying APIS™ function and AIC™ function and by achieving the detailed settings on the hardware, the software load is reduced, and operations under various environments become possible.
 - APIS™ (Adjacent Pattern Interference Suppression) function: Suppresses interfere from adjacent channels
 - AIC™ (Automatic Impedance Calibration) function: Automatically corrects impedance.
- APIS™ and AIC™ are trademarks of ATR Lab Inc. in Korea.

New 8FX MB95850K/860K/870K series

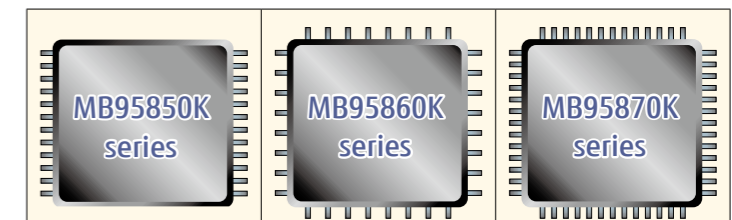


Overview

An 8-bit microcontroller with a built-in touch sensor controller. Can be used as low cost and low power consumption microcontrollers for the input touch keys and touch panels of various devices such as domestic electrical appliances, office equipment, and digital equipment.

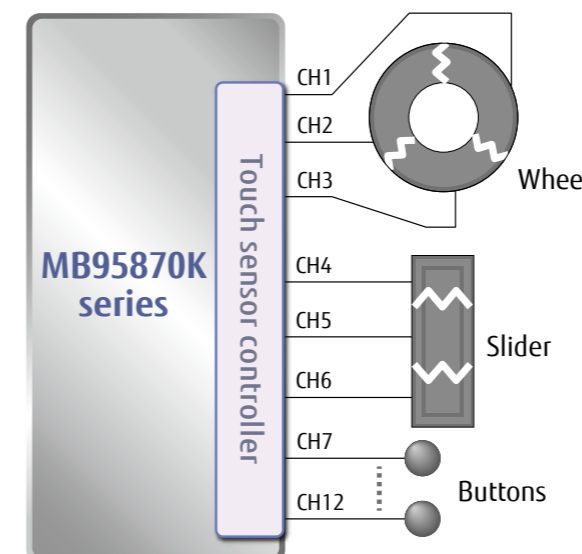
Features

- CPU core: F²MC-8FX
- Operating frequency: Max. 16 MHz
- Operating voltage: 2.4V to 5.5V
- Built-in analog comparator (with reference voltage)
- ROM capacity: 36 Kbytes (flash memory)



Package	MB95850K series	MB95860K series	MB95870K series
Touch sensor	SOP24, TSSOP24	LQFP32	LQFP48, LQFP52
	5 channels	8 channels	12 channels

Sample touch sensor application



- With the built-in touch sensor controller, touch detection without loads is possible.
- It can be used for wheel operations and slider operations by using multiple channels in addition to simple switches.
- By conducting the impedance measurement, the impact of the touch can be checked.

EtherMAC integrated microcontroller

EtherMAC integrated microcontroller features

Equipped with 2 channels of EtherMAC controller, 2 channels of USB2.0 Host/Function, and 2 channels of CAN, and widely used in various equipment using the network. In addition, it is equipped with IEEE1588 hardware and a function that enables temporal synchronization of each unit on the FA device or other devices.



FM3 Family MB9BD10T series

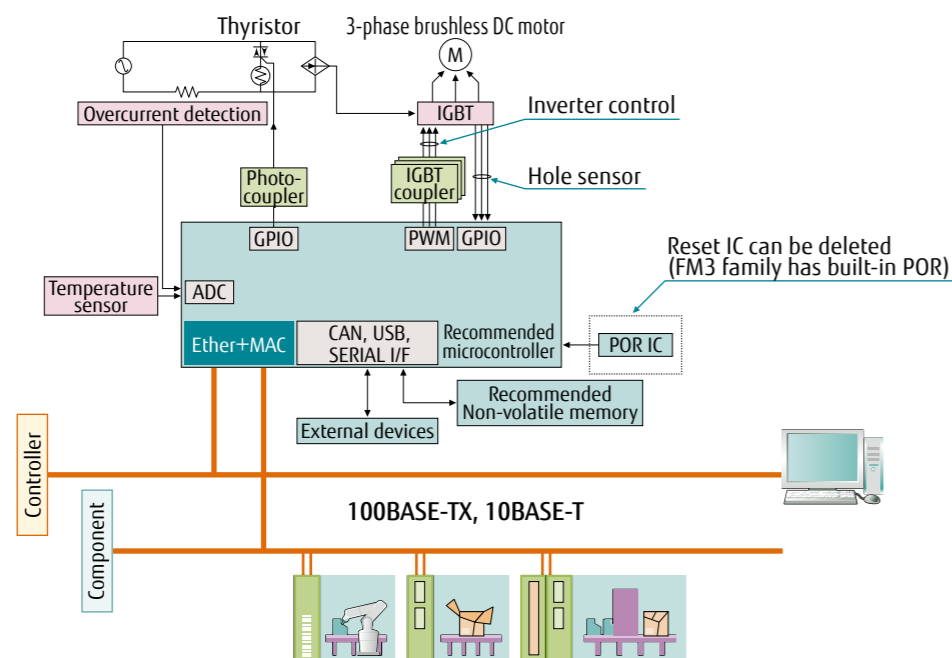
Overview

Equipped with ARM Cortex-M3 core, the high-speed CPU can operate the 1 MByte flash memories to 144 MHz with no wait. In addition, it contributes to power saving of the system by optimizing the peripheral functions for inverter control. EtherMAC controller functions are newly added to the conventional CAN and USB equipped microcontroller, and it corresponds to various FA network environments.

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
- **Ethernet-MAC**
Max. 2 channels, MII 1 channel, RMII 1 channel
- **CAN**
2 channels
- **USB 2.0 Host/Function**
- **Flash memory**
Max. 1 MByte, Flash security function

Sample programmable controller and inverter control applications



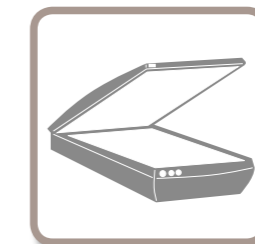
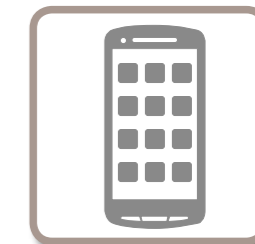
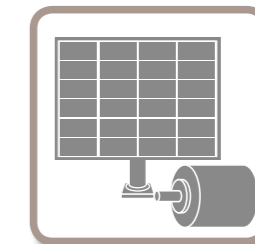
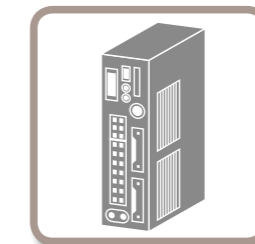
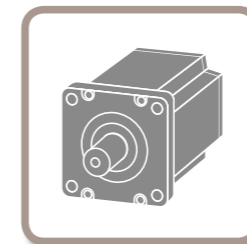
Series Lineup

FM3 Family · 32-bit Microcontroller

ROM(Byte)	Number of pins	144pin	176pin	192pin
1M			MB9BD10T MB9B610T MB9B510T MB9B310T MB9B210T	
768K				
512K			MB9B610T MB9B510T MB9B310T MB9B210T	

Devices with network connection

- FA devices
- Sequencer
- Solar inverter control
- Communication devices
- Printers
- Scanners

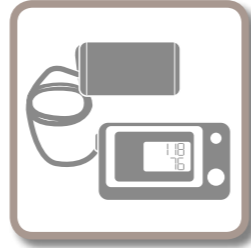


Built-in LCD controller microcontrollers

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 8-common output/40 segment LCD (maximum)
- (3) Lit/not-lit is set by display RAM data



FM3 Family MB9AA40N series/MB9AA30N series

NEW

Overview

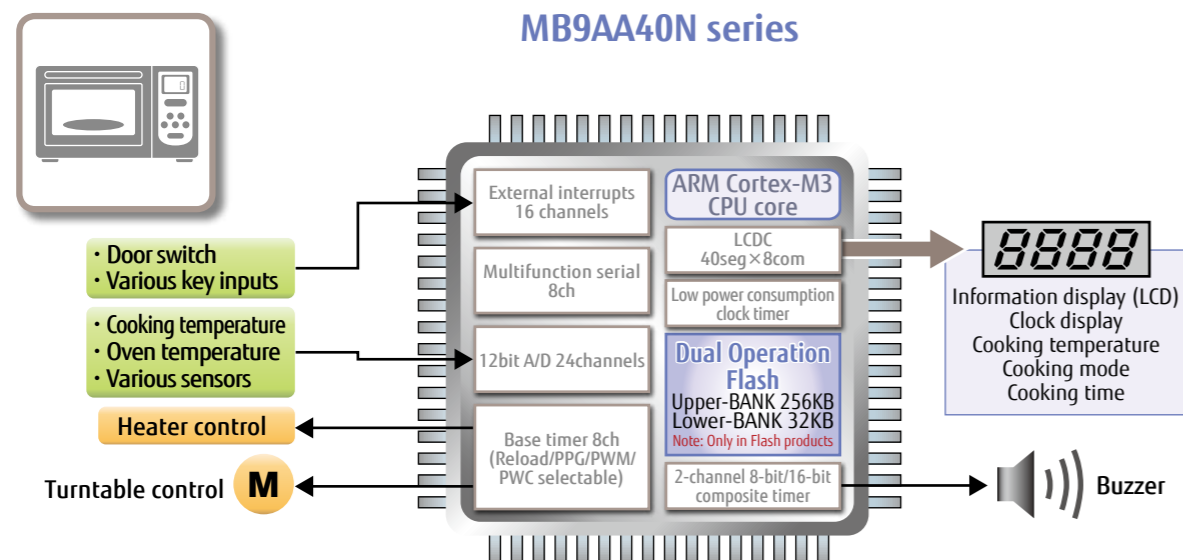
High performance 32-bit microcontroller with the built-in LCD controller.

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 washing machines, refrigerators, and microwave ovens.

Features

- High-performance 32-bit RISC CPU core ARM Cortex-M3
CPU maximum frequency: 40 MHz
- 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 × 8 common output
Able to display a maximum of 320 characters
- Blinking control function
Offers hardware controlled blinking, reducing software load
- Selectable from:
 - 1/3 bias, 1/8 duty
 - 1/4 bias, 1/8 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

FM3 Family/FR Family · 32-bit Microcontroller

Number of pins ROM(Byte)	64pin	80pin	100pin	144pin
1152K				MB91570 (32×4)
640K				
256K	MB9AB40N(Max. 40×8) MB9AA40N(Max. 40×8)			
128K	MB9AA30N(Max. 40×8)			
64K	MB9AA30N(Max. 40×8)			

Values in parentheses are number of segments × number of common

F²MC-16FX Family · 16-bit Microcontroller (Automotive applications)

Number of pins 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

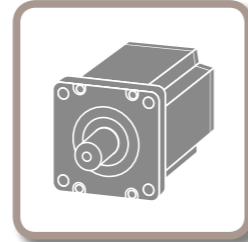
Number of pins ROM(Byte)	64pin	80pin
60K	MB95770L (32×4 or 28×8)	MB95710L (40×4 or 36×8)
36K		
20K		

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 MB9B110R, MB9A110A, MB9A130LA series NEW

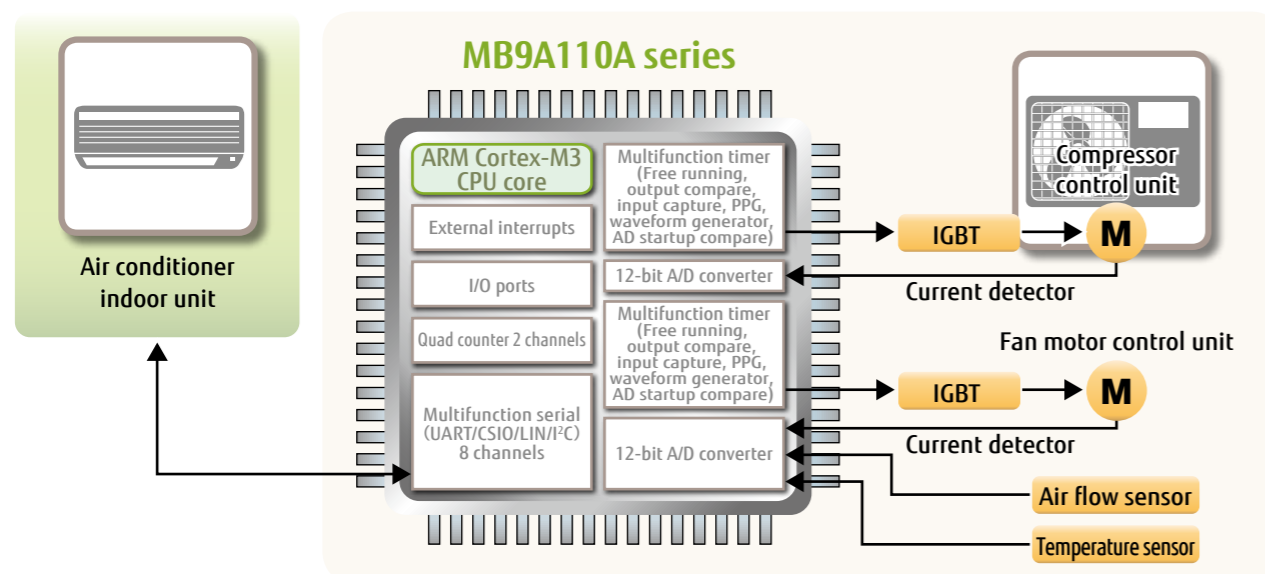
Overview

Microcontroller for inverter applications equipped with the ARM Cortex-M3 RISC CPU core. Covers all areas of the high end, middle range, and low end. Offers a built-in 32-bit CPU core with a maximum operation processing rate of 144 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: 20MHz to 144MHz
 - Package: 32pins to 172pins
 - Flash capacity: 64 KBytes to 1 MByte
 - RAM capacity: 8 KBytes to 128 KBytes
 - Operating voltage: 2.7 V to 5.5V
- Main functions
 - Analog function 12-bit A/D 6 channels to 32 channels (1 unit to 3 units)
 - Multifunction timer capable of motor control 1 unit to 3 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 to 16 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

Number of pins ROM(Byte)	48pin	64pin	80pin	100pin	120pin	144pin	176pin	192pin
1M						MB9BD10T MB9B610T MB9B510T MB9B410T MB9B310T MB9B210T MB9B110T		
768K				MB9A150R				
512K			MB9A310A MB9A110A		MB9B500B MB9B400A MB9B300B MB9B100A			
384K			MB9B520M MB9B320M MB9B120M		MB9B510R MB9B410R MB9B310R MB9B110R			
256K	MB9B520M MB9B320M MB9B120M			MB9A310R MB9A110R MB9A130N				
128K	MB9A310K MB9A110K	MB9A130LA						
64K								

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

Number of pins ROM(Byte)	32pin	48pin	52pin	64pin	80pin	100pin	120pin	144pin	176pin
1088K				MB91520					
832K				MB91520					
576K				MB91520					
448K				MB91580		MB91580		MB91580	
320K				MB91580					
60K				MB91580					
36K		MB95690K							
20K	MB95630H								
12K									
8K									

Motor control equipment

- Air conditioners
- Refrigerators
- Washing machines
- Industrial motors



Development assistance tools (software tools)

Development environment solution : Fujitsu AUTOSAR Solution



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.

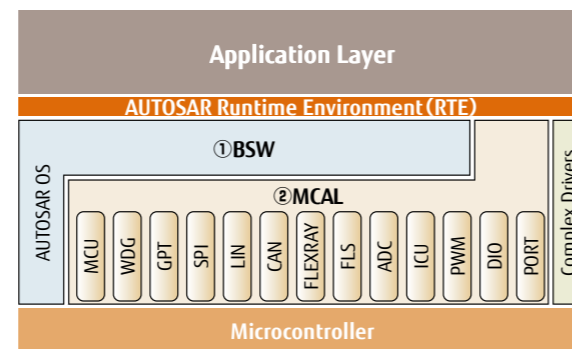
- Standardizing software frameworks
- Standardizing design processes
- Commonizing and modularizing application software by introducing a common runtime environment (RTE)
- Providing a microcontroller abstraction layer (MCAL) that absorbs the hardware differences and commonizes upper layer software

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

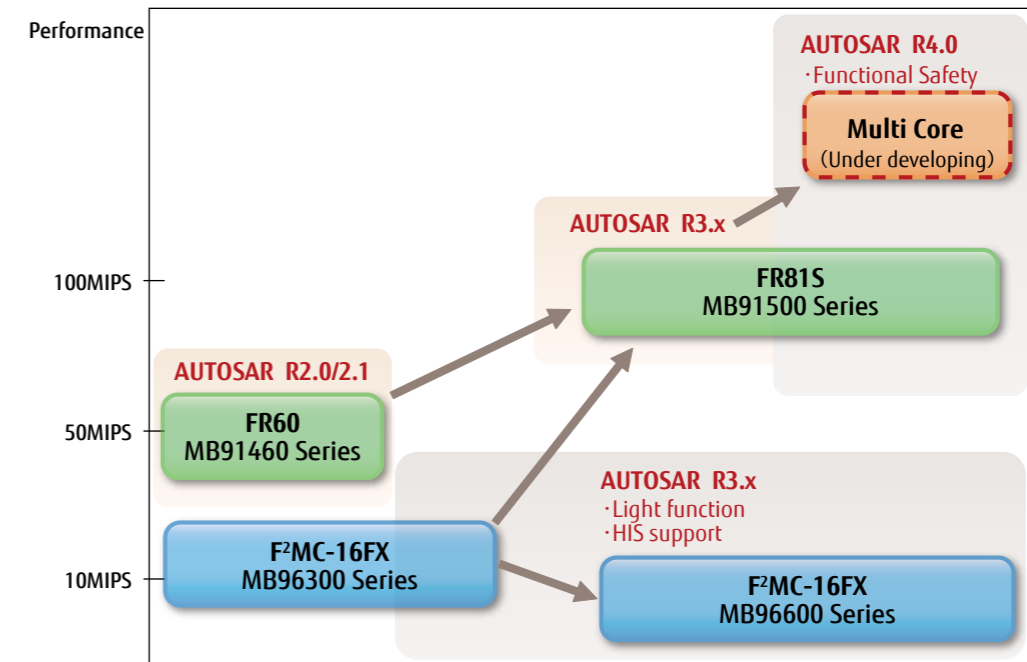


Note: The MCAL configuration changes depending on target microcontrollers.

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)

AUTOSAR product roadmap



memo



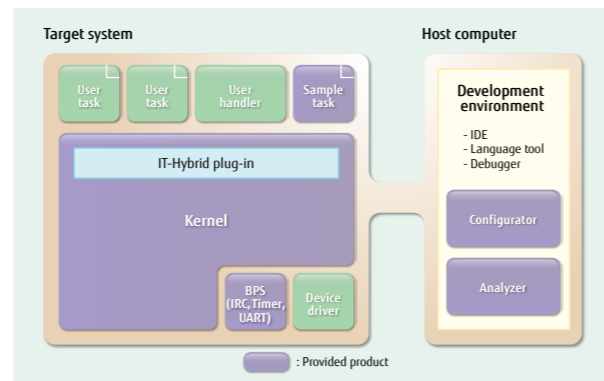
Fujitsu Semiconductor provides a real-time OS for developing software for Fujitsu microcontrollers (FM3 family, FR family and F²MC-16 family).

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
- IT-Hybrid plug-in (optional)



μT-REALOS/M3 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

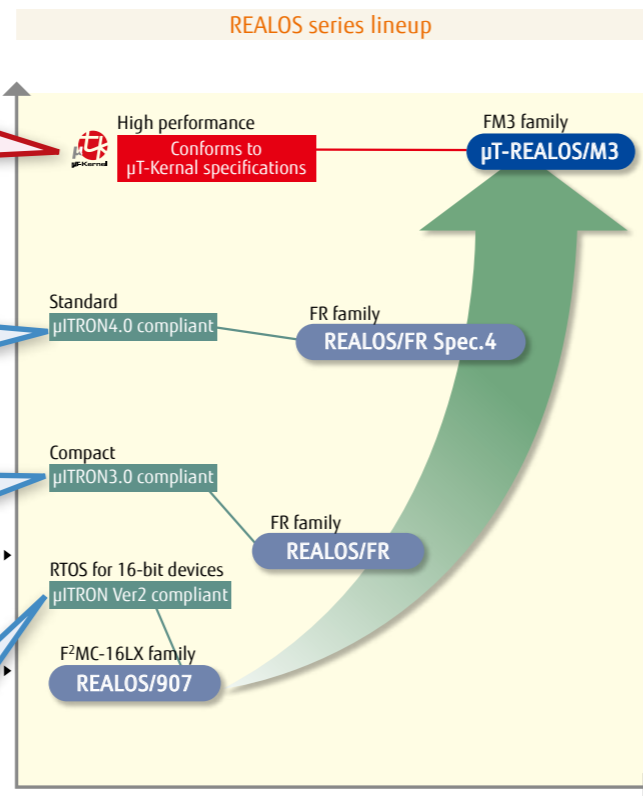
This OS conforms to the industry standard μITRON specifications. REALOS/FR Spec. 4 has many functions and simple powersaving functions. This RTOS can be used in large-scale systems that conform to μITRON 4.0.

• 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 2.6 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

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.

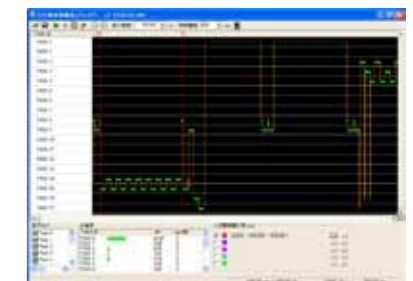


IT-Hybrid Plug-in for μT-REALOS/M3 (optional)

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.

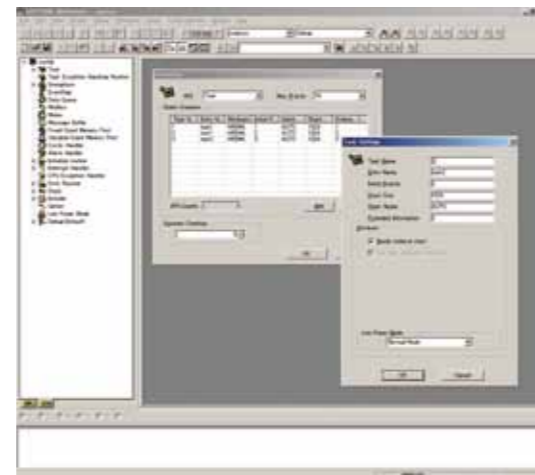
32/16/8-bit core lineup
ROM, RAM, Pins
Applications
Functionality
Development assistance tools
Product selection
32 bit
16 bit
8 bit

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.

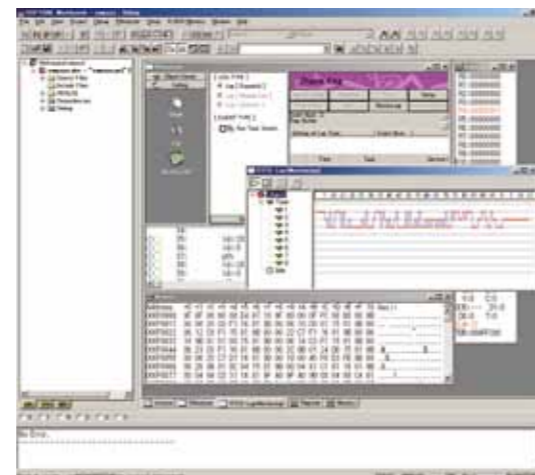


REALOS-aware debugging tools

● REALOS analyzer (for FR and F²MC-16)

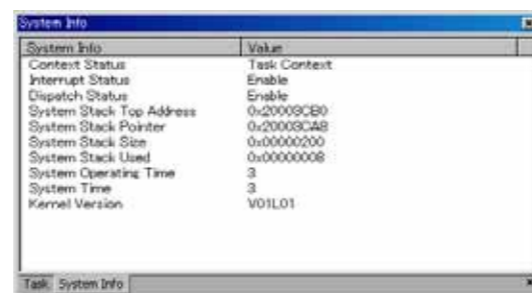
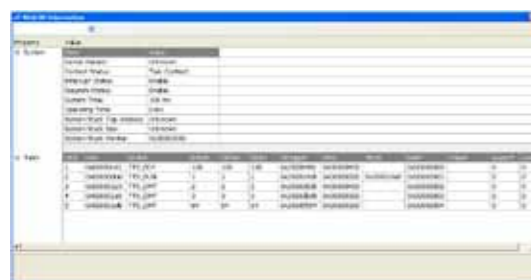
The REALOS analyzer graphically analyzes and displays the performance and task state transitions of systems that incorporate REALOS. This allows the operation of the system to be grasped visually.

- 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)	

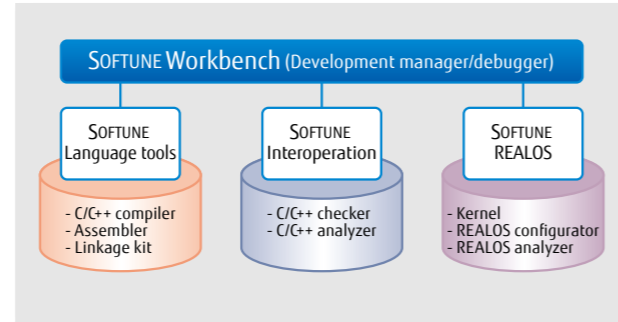
System requirements

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)

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

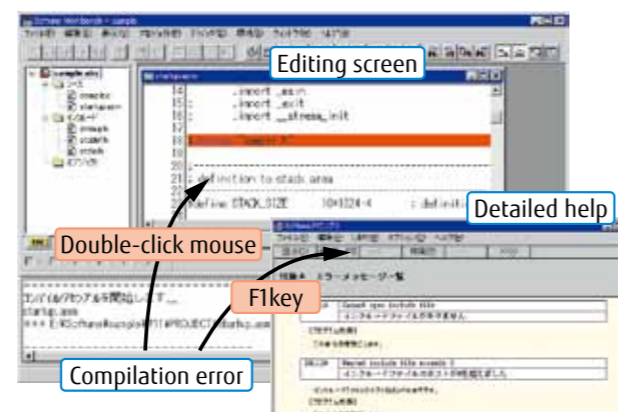
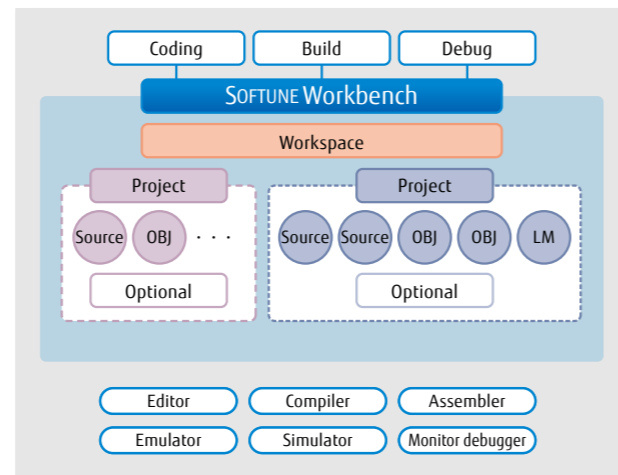
- Unification of manager section and debugger section.
Errors that are found can be fixed on the spot, and the result can be debugged immediately.
- Assists in development using the C/C++ languages.
- Equipped with tools for improving quality.
Projects integrated with "C/C++ Checker" for verifying coding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

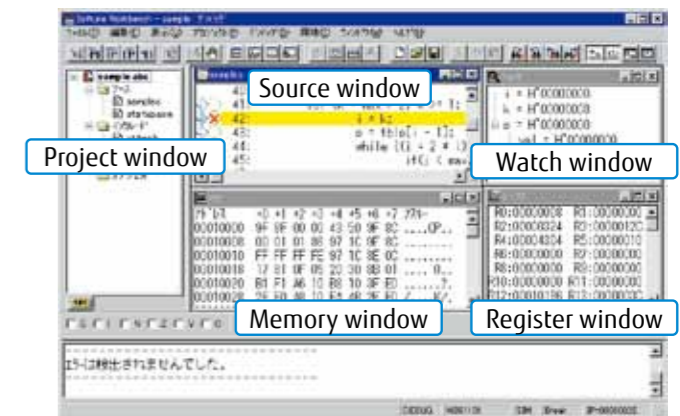
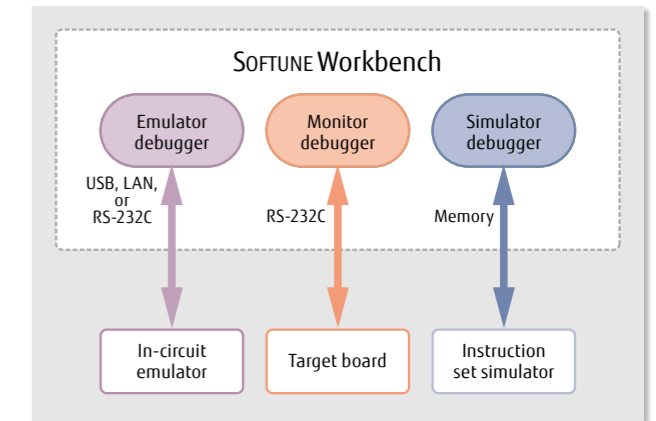
- Utilizing projects
The development environment can be easily constructed both for the case of a single person performing multiple jobs in parallel or for a group working on a single development by using project files.
- Delivering excellent usability
 - Editor provided as standard
An editor is built-in 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)	
			SP365030118QDC (10 licenses)	
	V3	F ² MC-16	SP3607Z008-P01 (1 license)	Workbench C compiler Assembler pack
			SP3607Z008-P03 (3 licenses) SP3607Z008-P05 (5 licenses) SP3607Z008-P10 (10 licenses)	
		F ² MC-8FX	SP3603Z008-P01 (1 license)	C analyzer C checker
			SP3603Z008-P03 (3 licenses)	
			SP3603Z008-P05 (5 licenses) SP3603Z008-P10 (10 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

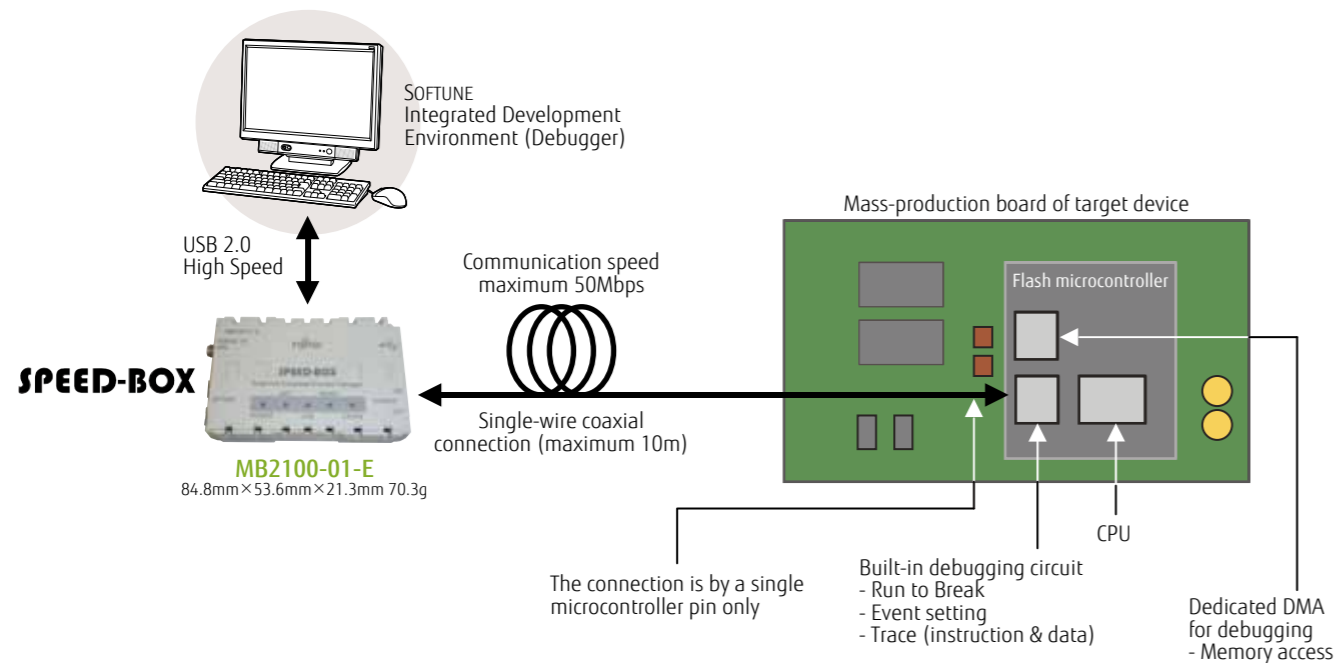
Features of the MB2100-01-E emulator **SPEED-BOX**

- 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 trademark of FUJITSU SEMICONDUCTOR Limited.

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

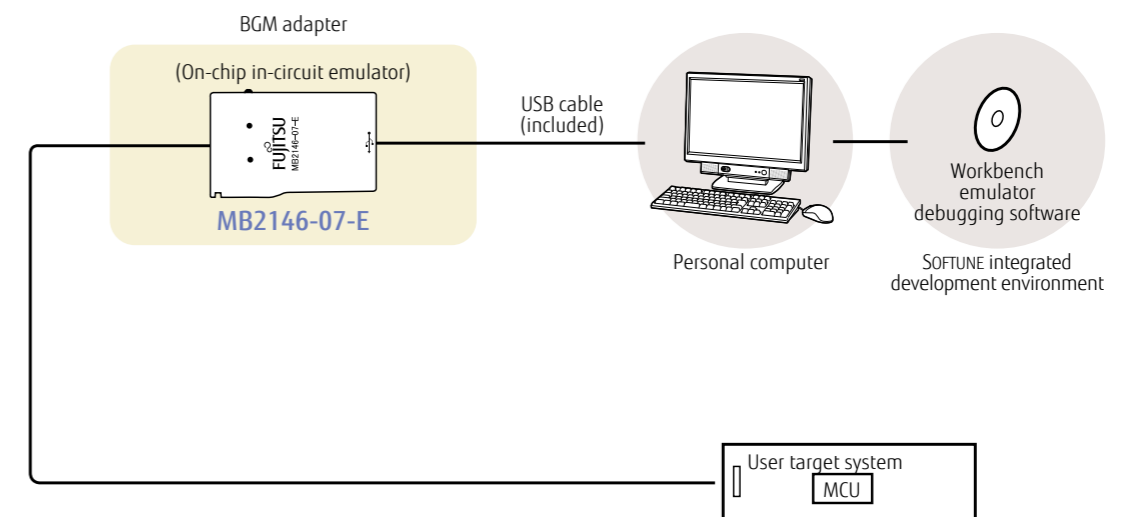
Features of the MB2146-07-E (BGM adapter)

- 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



Development assistance tools (hardware tools)

FR Family • 32-bit Microcontroller

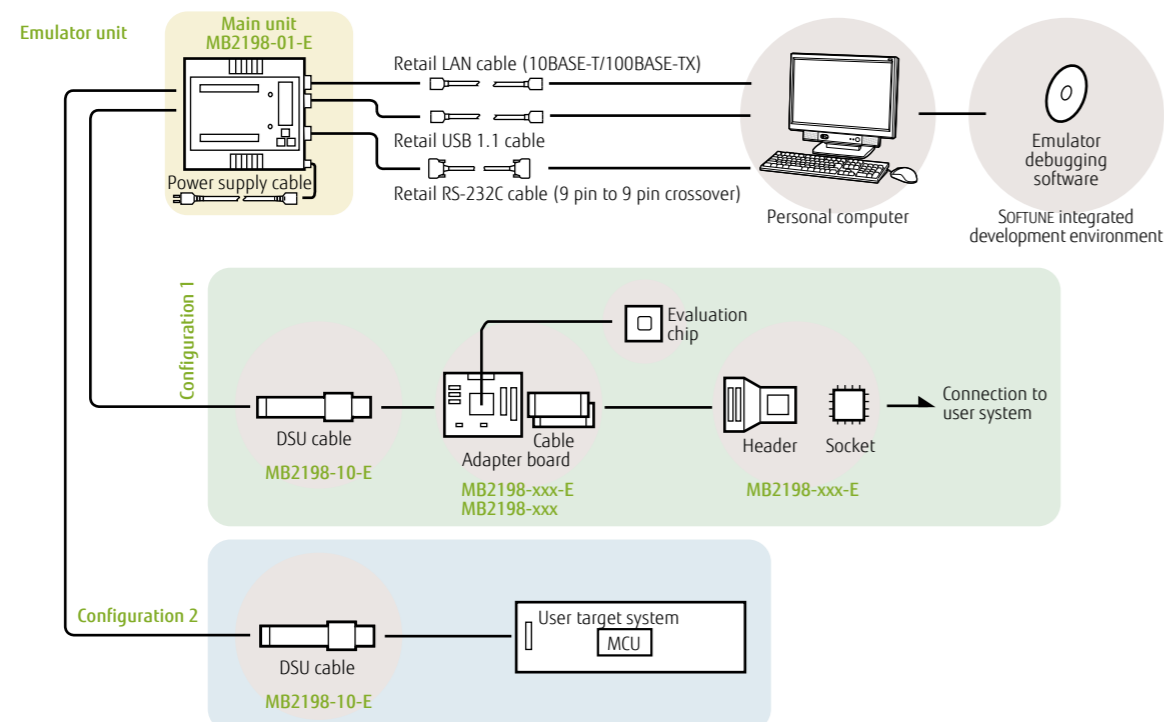
Features of the MB2198-01-E emulator

- 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

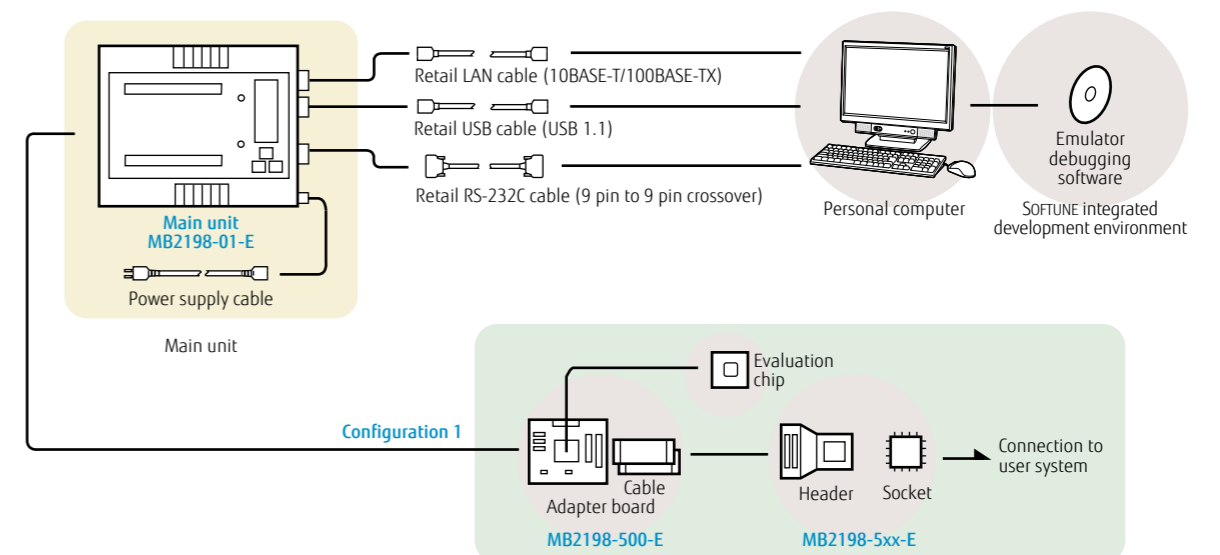
Features of the MB2198-01-E emulator

- 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

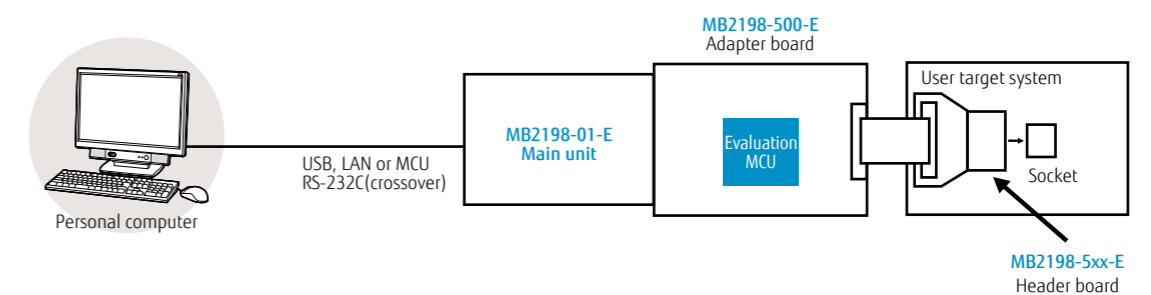
External view of system



System Configuration



Example System Configuration for the MB96300 Series



F²MC-16LX Family • 16-bit Microcontroller

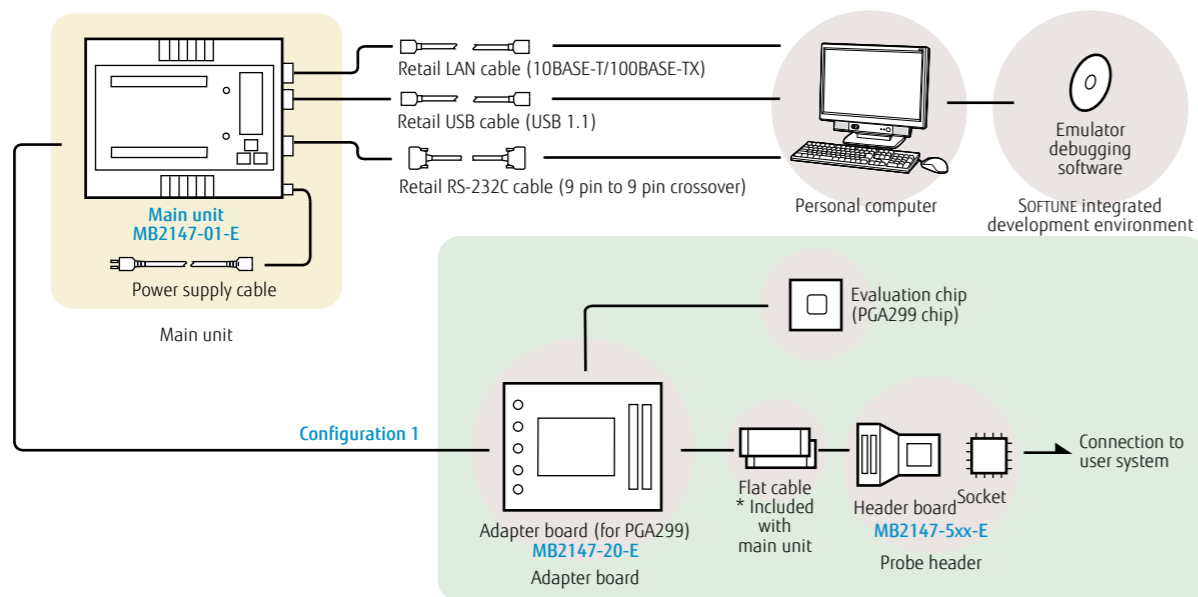
Features of the MB2147-01-E (version that supports high speeds)

- 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

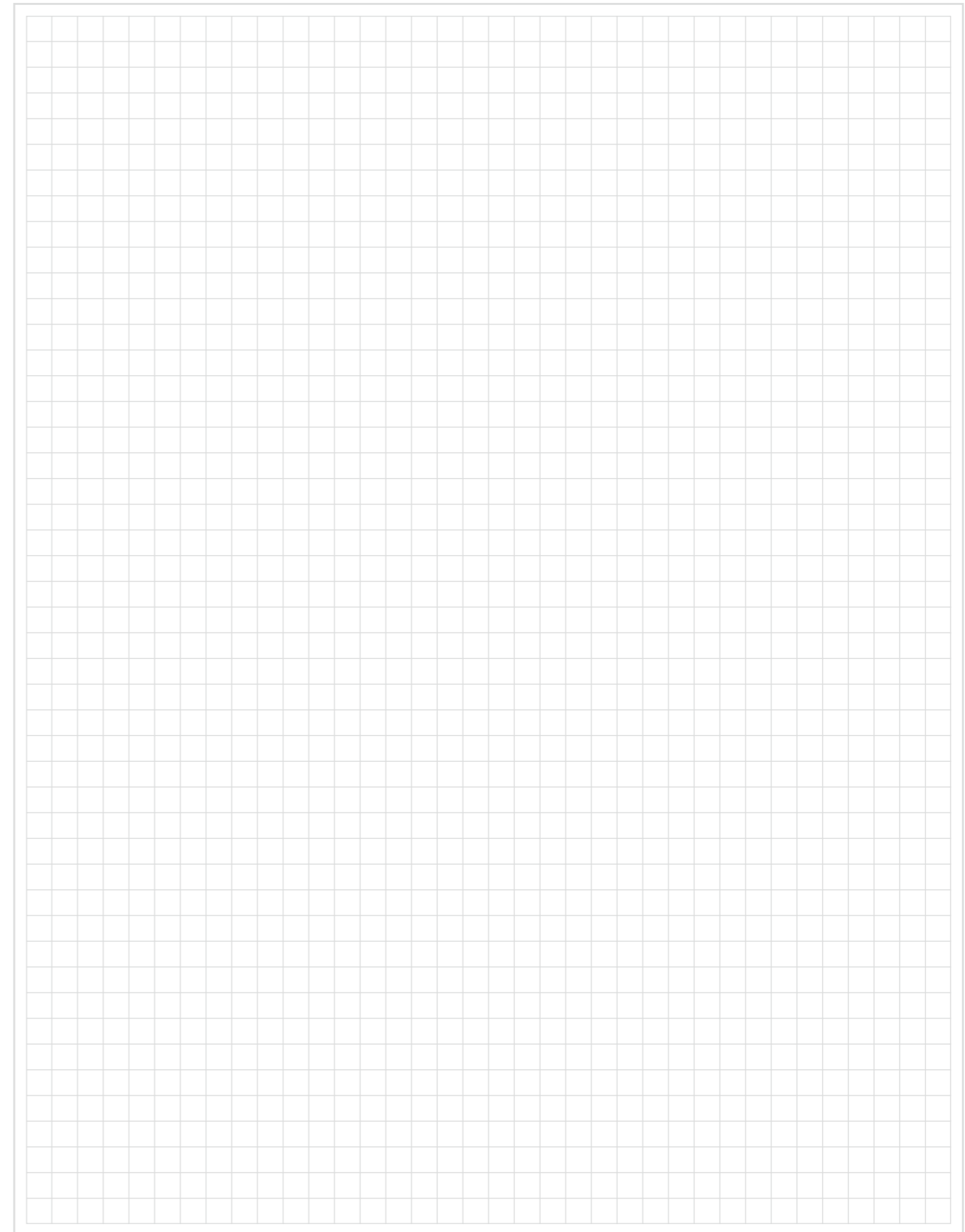
External view of system



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

Evaluation board

Introduces evaluation boards for developing embedded systems equipped with the FR family, F²MC family, and FM3 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 MB91520/580 Series/F²MC-16FX Family MB96600 Series (MB2198-760-E)

● Features

This evaluation board supports the Fujitsu FR family MB91520/580 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 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-MB9BF516R]

● Microcontroller: 32bit-FM3 MB9BF516R

- Built-in MB9BF516R
- On-board JTAG emulator
- Includes a trial version compiler
- LED
- Switch

Inquiries: Micrium, Inc.



IAR Systems FM3 Starter Kit [KSK-MB9BF618T]

● Microcontroller: 32bit FM3 MB9BF618T

- Built-in MB9BF618T
- On-board JTAG emulator
- Includes a trial version compiler
- Built-in Ethernet PHY LSI
- LED
- Switch

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



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



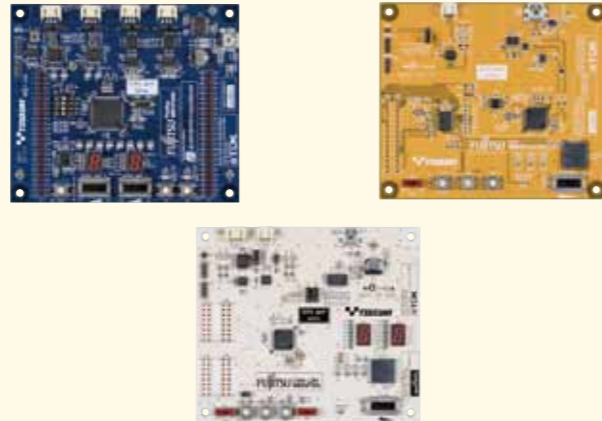
Development assistance tools (education kit)

Bits pot* is a series of microcontroller boards that allows you to easily get to know, evaluate, and study microcontrollers. This is a board equipped with a microcontroller providing how to learn in-vehicle network (CAN, LIN, FlexRay) 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. 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 from the basics to applications.

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

Developer: TSUZUKI DENKI CO.,LTD.
6-19-15 Shinbashi, Minato-ku, Tokyo 105-8665, Japan
URL : <http://tsuzuki.jp/bitspot/>



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 between bits pot blues for CAN communication



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.



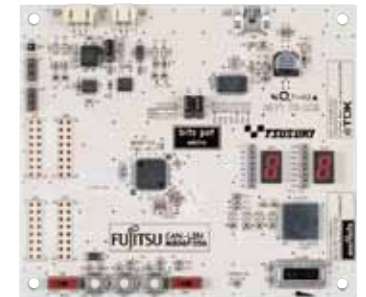
Kit for Learning CAN-LIN communication (bits pot white)

CAN-LIN [CAL-100]

Microcontroller: 16bit-F²MC-16FX MB96F356

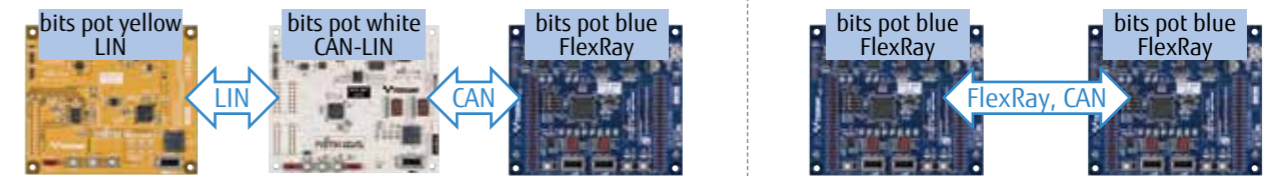
- Basic function of board by SW operation (LED, 7seg, temperature sensor, and buzzer)
- Connecting with bits pot yellow, it communicates by LIN using LIN master sample software (supports LIN2.0*2)

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

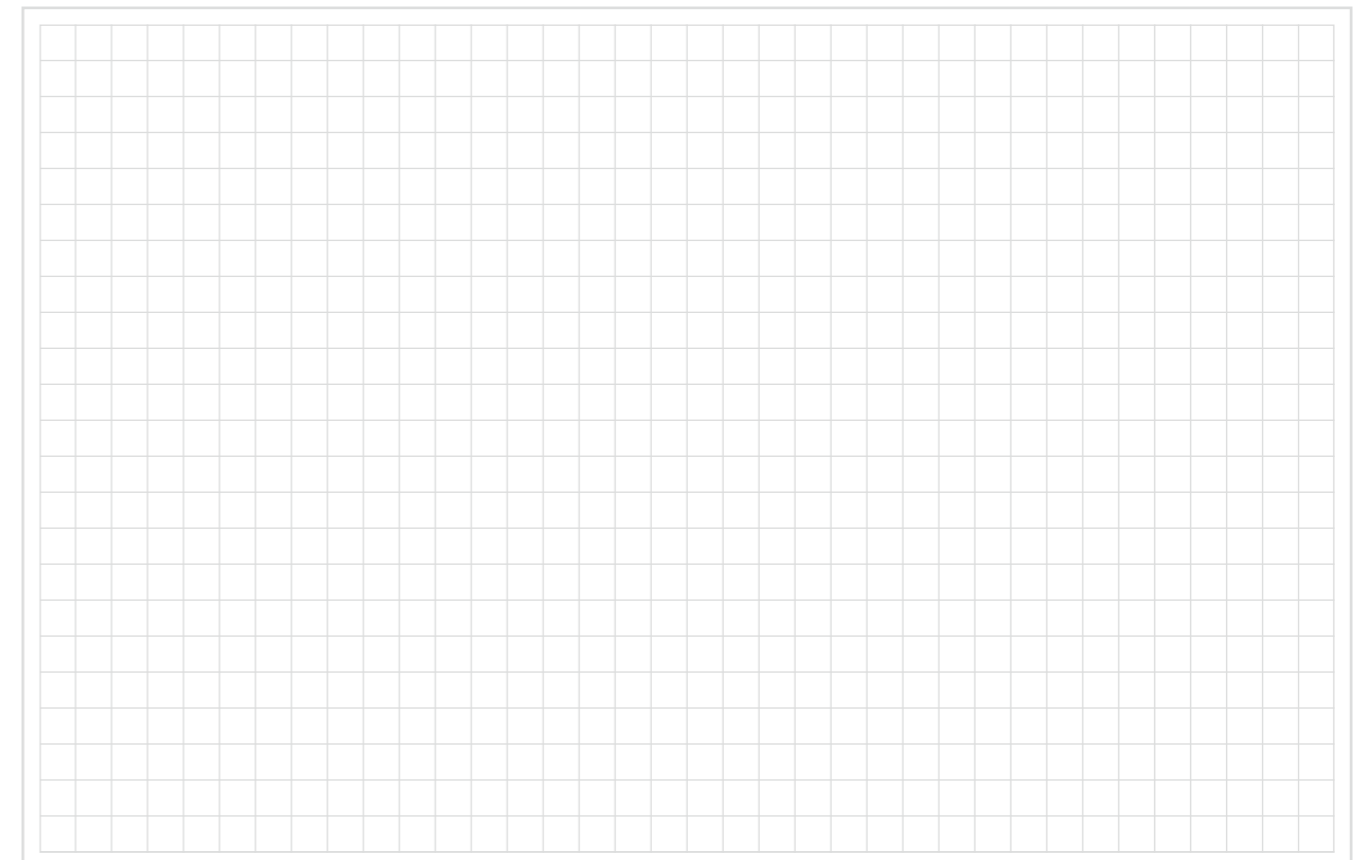


Learning CAN/LIN communication with a particular aim is also possible by combining with a bits pot white (CAN-LIN), bits pot blue (FlexRay), or bits pot yellow (LIN), and sample programs are also available depending on the combination.

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.



memo



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

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

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 μITRON 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 μT-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	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. 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.	Elektrobit http://www.elektrobit.com/
osCAN	osCAN is a pre-emptive, real-time, multitasking operating system that has the optimal functions for operating on a microcontroller. Features: <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)	Configuration: <ul style="list-style-type: none"> MICROSAR RTE: AUTOSAR RTE MICROSAR BSW: AUTOSAR Basic Software MICROSAR Configuration Suite/MICROSAR EAD: AUTOSAR BSW configurator set Features: <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/

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
PGRelief	<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/pgr/
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 driven 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/

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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 	GAI0 TECHNOLOGY Co., Ltd. TEL : +81-3-3662-3041 http://www.gai0.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/

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.						
Programmers for small production	MODEL1895/2	-	○	-	○	△
	MODEL1940	-	○	-	○	△
	MODEL1950	-	○	-	-	△
	MODEL1895	-	○	-	○	△
	MODEL1896	-	○	-	○	△
Gang programmers	MODEL 400 series	-	-	-	-	○
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 New 8FX (BGM adapter: MB2146-08-E or MB2146-07-E is separately required.)		○	-	-	-	-
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		-	○	-	-	○

