



CAN BUS MICROCONTROLLERS

CAN BUS MICROCONTROLLER SOLUTIONS
INCLUDING INTEGRATED SINGLE VOLTAGE
FLASH MEMORY

FUJITSU

THE POSSIBILITIES ARE INFINITE

CAN BUS MICROCONTROLLERS

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CAN BUS MICROCONTROLLERS

INTRODUCTION TO CAN BUS CONTROLLERS & FLASH ROM MICROCONTROLLERS

CAN Bus Controllers

Fujitsu has F²MC-16LX and FR devices available that have full featured CAN Bus protocol controllers as on-chip peripherals for Automotive and Industrial applications.

Features

- CAN 2.0A and 2.0B protocol controller
- 16 message buffers (8 for MB90495 series), each individually programmable for:
 - Transmit or receive
 - 11 or 29 identifier bits
 - Full identifier bit compare / full mask / compare against 1 of 2 mask registers
- Ability to group buffers into flexible multi-level configuration
- Readable error counter

Additional Features

- G-CAN devices (G in part number) - these products allow a more flexible setting of CAN bit rates

FLASH ROM Microcontrollers

All of the CAN MCUs are supported by at least one version with FLASH ROM as the user programmable memory. This is the same technology as the standard Fujitsu Flash memories.

Features

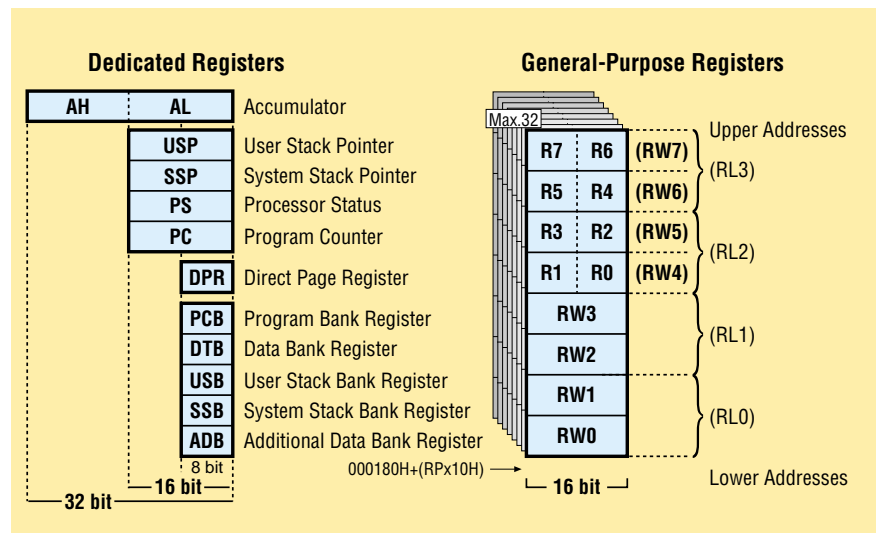
- Available block sizes 64kB, 128kB, 256kB, 384kB and 512kB
- Blocks divided into separately erasable and protectable sectors
- Supports programming by Embedded Algorithm™
- No second programming voltage required
- 10,000 minimum erase cycles guaranteed – 100,000 under specification
- 10 year data retention
- Programming can be by three methods:
 - On ordinary programmer with adapter as with traditional OTP devices
 - Using Fujitsu embedded serial programming mode via on-chip UART directly to the FLASH ROM
 - Copying or downloading to FLASH using customers' own bootstrap software
- Flash programming via CAN supported

F²MC-16LX CPU-CORE ARCHITECTURE

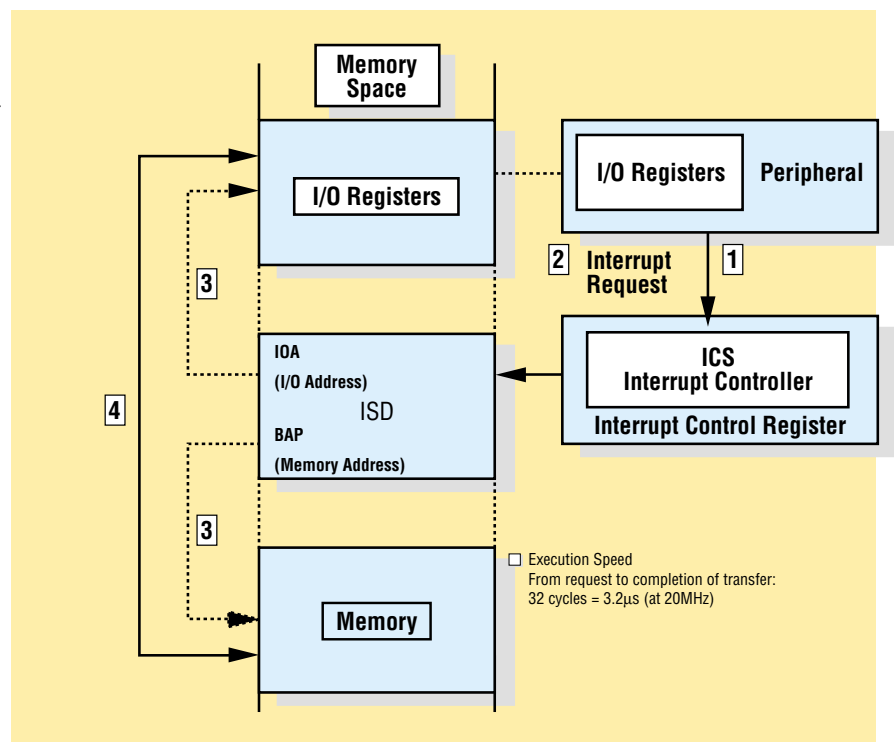
Fujitsu's 16 bit CPU core features easy programming with plenty of data types such as bit, nibble, byte, word and long word together with 23 addressing modes. The memory address range of 16MB is accessible using bank or linear addressing modes fully supported by the optimised instruction set.

On-chip registers such as USER- and SYSTEM stack pointers, together with its supporting instructions, provide additional advanced support to Real-Time Operating Systems.

An extremely high I/O throughput is achieved via the integrated DMA-like EI²OS (Extended Intelligent I/O Service). This, combined with the improved pipeline processing using a 4 Byte instruction queue, gives superior power to the system.



16 bit CPU Core Programming Model



Advanced I/O Architecture Speeds Up Data Handling

CAN BUS MICROCONTROLLERS

F²MC-16LX DEVICE FEATURES

- 0.5µm/0.35µm CMOS Technology
- Flash ROM or Mask ROM versions
- 16MHz (62.5ns)/20MHz (50ns) maximum internal clock speed from external 4MHz
- On-chip PLL can multiply x1, x2, x3 or x4 external clock speed
- Internal voltage regulator supports 3V MCU core offering low EMI and low power consumption figures
- Optimised instruction set for controller applications
 - bit, Byte, word, long word data types
 - 23 addressing modes
 - barrel shifter
 - variety of pointers
- 4 Byte instruction queue
- Signed multiply instruction – 16 bit x 16 bit
- Signed divide instruction – 32 bit / 16 bit
- EI²OS – Automatic transfer function independent of CPU with 16 channels of Intelligent I/O services
- 18 bit Time-base timer
- 15 bit Watch timer, (devices with 32kHz sub clock only)
- Watchdog timer
- Fast interrupt processing
- Powerful interrupt functions – 8 programmable priority levels, more than 30 possible hardware vectors and more than 200 software vectors
- Program patch function – facility to ‘patch over’ mask programmed code with update from external memory
- Power saving modes
 - 7 for single clock or 10 for dual clock
 - sleep, stop, CPU intermittent, hardware standby ...

F²MC-16LX Microcontrollers with CAN Bus

Series MB90xxx	Flash kB	Byte	MHz (kHz)	Counter	Conv	Bus Interface	Pulse Generator	Features	Saving Modes	Volts	Count				
425G/GA MB90427G/GA MB90F428G/GA	64 128	4096 6144	16 (PLL ext. 4MHz)	58	4 ch/ -	1 x 16 bit	1 ch	1 x 8 bit	8 x 10 bit	-	3 ch x 16 bit	1 ch CAN2.0B Interface 4 ch Stepper Motor Driver Sound generator LCD Controller 4 x 24	SLEEP, STOP,	4.5-5.5 4.5-5.5	100
495G MB90497G MB90F497G	64 64	2048 2048	16 (PLL ext. 4MHz) (32kHz)	49	4 ch/ -	2 x 16 bit	2 ch	-	8 x 10 bit	Yes	4 ch x 8 bit or 2 ch x 16 bit	1 ch CAN2.0B Interface	SLEEP, STOP, ...	4.5-5.5 4.5-5.5	64
440G MB90F443G* MB90443G**	128 128	6144 6144	16 (PLL ext. 4MHz) (32kHz)	81	8 ch/2 ch or 6 ch/4 ch	2 x 16 bit	2 ch	1 x 8 bit	8 x 10 bit	Yes	4 ch x 8 bit or 2 ch x 16 bit	3 ch CAN2.0B Interface	SLEEP, STOP, ...	4.5-5.5 4.5-5.5	64
540G MB90543G** MB90F543G	128 128	6144 6144	16 (PLL ext. 4MHz)	81	8 ch/2 ch or 6 ch/4 ch	2 x 16 bit	2 ch	1 x 8 bit	8 x 10 bit	Yes	4 ch x 8 or 16 bit	2 ch CAN2.0B Interface	SLEEP, STOP, ...	4.5-5.5 4.5-5.5	100
545G MB90F548G MB90548G* MB90549G* MB90F546G	128 128 256 256	4096 4096 6144 8192	16 (PLL ext. 4MHz) (32kHz)	81	8 ch/2 ch or 6 ch/4 ch	2 x 16 bit	2 ch	1 x 8 bit	8 x 10 bit	Yes	4 ch x 8 or 16 bit	1 ch CAN2.0B Interface	SLEEP, STOP, ...	4.5-5.5 4.5-5.5 4.5-5.5 4.5-5.5	100
590 MB90594G MB90F594G MB90591 MB90F591	256 256 384 384	6144 6144 8192 8192	16 (PLL ext. 4MHz)	78	6 ch/6 ch	2 x 16 bit	3 ch	1 x 8 bit	8 x 10 bit	-	6 ch x 8 or 16 bit	2 ch CAN2.0B Interface 4 ch Stepper Motor Driver Sound generator	SLEEP, STOP,	4.5-5.5 4.5-5.5 4.5-5.5 4.5-5.5	100
595 MB90598G MB90F598G	128 128	4096 4096	16 (PLL ext. 4MHz)	78	4 ch/4 ch	2 x 16 bit	2 ch	1 x 8 bit	8 x 10 bit	-	6 ch x 8 or 16 bit	1 ch CAN2.0B Interface 4 ch Stepper Motor Driver	SLEEP, STOP,	4.5-5.5 4.5-5.5	100

*under development **planned

16 BIT CAN MCU ROADMAP

	In Production	Samples available	Under development	Planned	
3 CAN		MB90F443G 128kB Flash, 6kB RAM		MB90F444G 256kB Flash, 8kB RAM MB90443G 128kB ROM, 6kB RAM	External Bus Interface
	2 CAN	MB90F543G 128kB Flash, 6kB RAM			MB90543G 128kB ROM, 6kB RAM
MB90F591A 384kB Flash, 8kB RAM			MB90F394G 384kB Flash, 10kB RAM	MB90F39x 512kB Flash, 16kB RAM	Stepper Motor Driver
MB90591 384kB ROM, 8kB RAM				MB90F39x 256kB Flash, 8kB RAM	
MB90F594G 256kB Flash, 6kB RAM					
MB90594G 256kB ROM, 6kB RAM				MB90593G 128kB ROM, 4kB RAM	Stepper Motor Driver
1 CAN	MB90F546G 256kB Flash, 8kB RAM	MB90549G 256kB ROM, 6kB RAM	MB90548G 128kB ROM, 4kB RAM		External Bus Interface
		MB90F548G 128kB Flash, 4kB RAM			
	MB90F497G 64kB Flash, 2kB RAM		MB90F385 64kB Flash, 2kB RAM <i>48 pin</i>	MB90F498G 128kB Flash, 2kB RAM	
	MB90F428G/A 128kB Flash, 6kB RAM		MB90427G/A 64kB ROM, 4kB RAM		LCD + Stepper Motor Driver
			MB90428G/A 128kB ROM, 6kB RAM		
	MB90F598G 128kB Flash, 4kB RAM			MB90598G 128kB ROM, 4kB RAM	Stepper Motor Driver

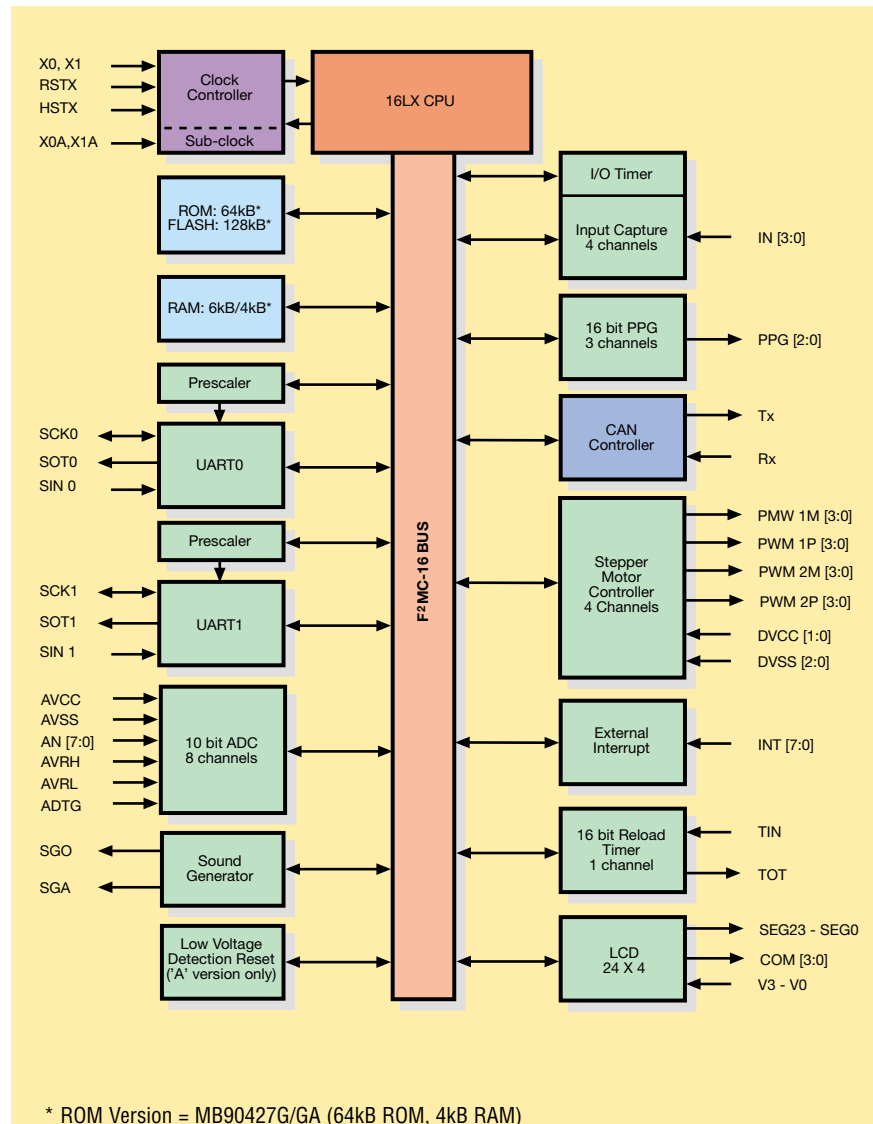
CAN BUS MICROCONTROLLERS

16 BIT SINGLE CAN BUS MICROCONTROLLERS

The **MB90425G/GA** series offers a highly integrated CAN solution to dashboard and other applications with a wealth of on-chip peripherals including four stepper motor controller-drivers, sound generator and a 24x4 segment LCD controller. A security feature is incorporated in this family, preventing the unauthorised reading of the contents of the Flash ROM.

Features

- Fujitsu F²MC-16LX microcontroller architecture
- 128kB Flash ROM (with single voltage and 10k erase cycles), or 64kB Mask ROM
- Flash security feature
- Full CAN 2.0A/2.0B interface with flexible buffering
- 6kB / 4kB RAM
- 32kHz sub clock
- LCD controller-driver 24 segments x 4 commons
- Stepper Motor Controller-Driver 4 channel
- Sound generator
- UART
- Synchronous serial I/O
- External interrupts 8 ch
- A/D converter 10 bit x 8 ch
- Input capture 16 bit x 4 ch
- Reload timer 16 bit x 1 ch
- Programmable pulse generator 16 bit x 3 ch
- Low voltage level detection (A version only)
- QFP 100 package
- -40 to +105°C temperature range



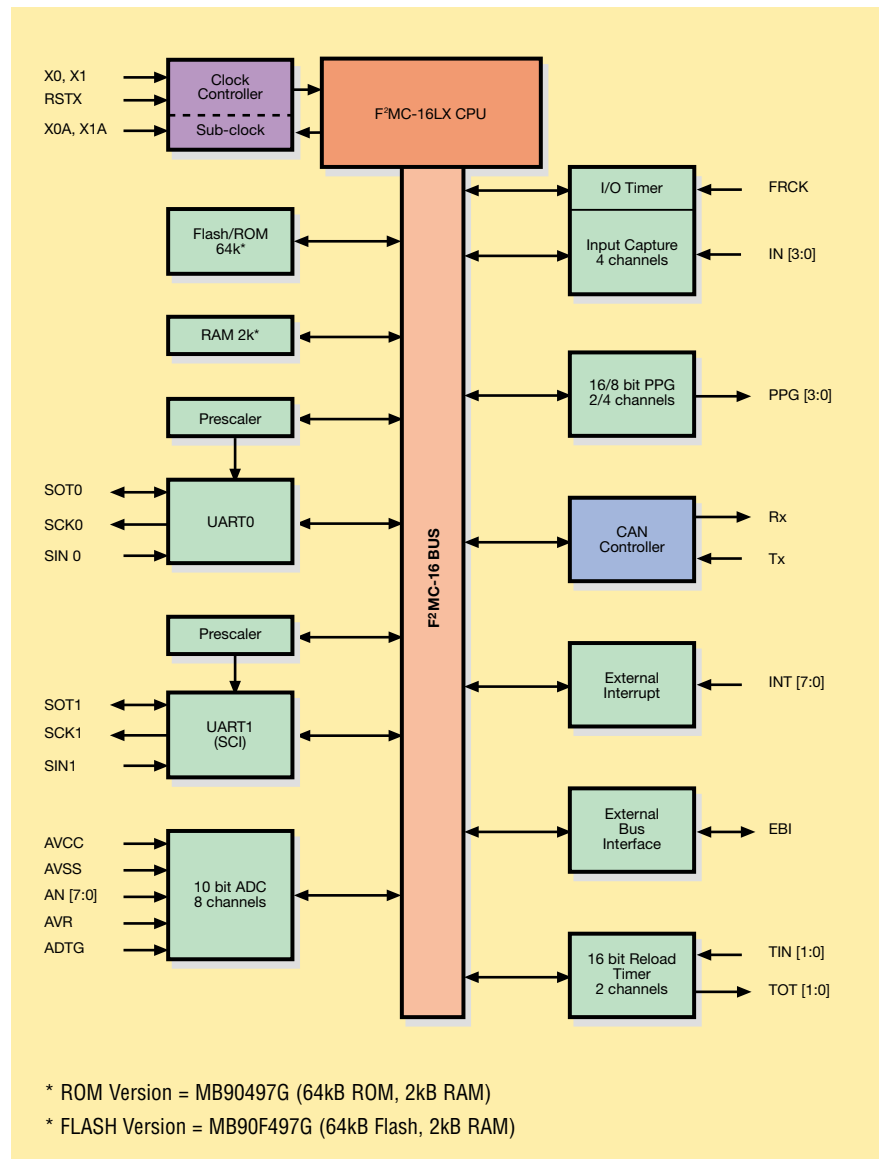
* ROM Version = MB90427G/GA (64kB ROM, 4kB RAM)
 * FLASH Version = MB90F428G/GA (128kB Flash, 6kB RAM)
 MB90425G/GA Series with Stepper Motor and LCD controllers Block Diagram

16 BIT SINGLE CAN BUS MICROCONTROLLERS

The **MB90495G** series brings 16 bit, full CAN performance to cost sensitive automotive and industrial applications which were previously obliged to use 8 bit basic CAN devices. It also provides an entry level to Fujitsu's range of F²MC-16LX microcontrollers with on-chip CAN with full compatibility except that the number of message buffers is reduced from 16 to 8.

Features

- Fujitsu F²MC-16LX microcontroller architecture
- 64kB Flash ROM (with single voltage and 10k erase cycles), or Mask ROM
- Full CAN 2.0A/2.0B interface with flexible buffering
- 2kB RAM
- 32kHz sub clock
- External bus interface
- 2 UARTs
- External interrupts 8 ch
- A/D converter 10 bit x 8 ch
- Input capture 16 bit x 4 ch
- Reload timers 16 bit x 2 ch
- Programmable pulse generator 16 bit x 2 ch or 8 bit x 4 ch
- QFP 64 package
- -40 to +105°C temperature range



MB90495G Series 16 bit CAN MCU Block Diagram

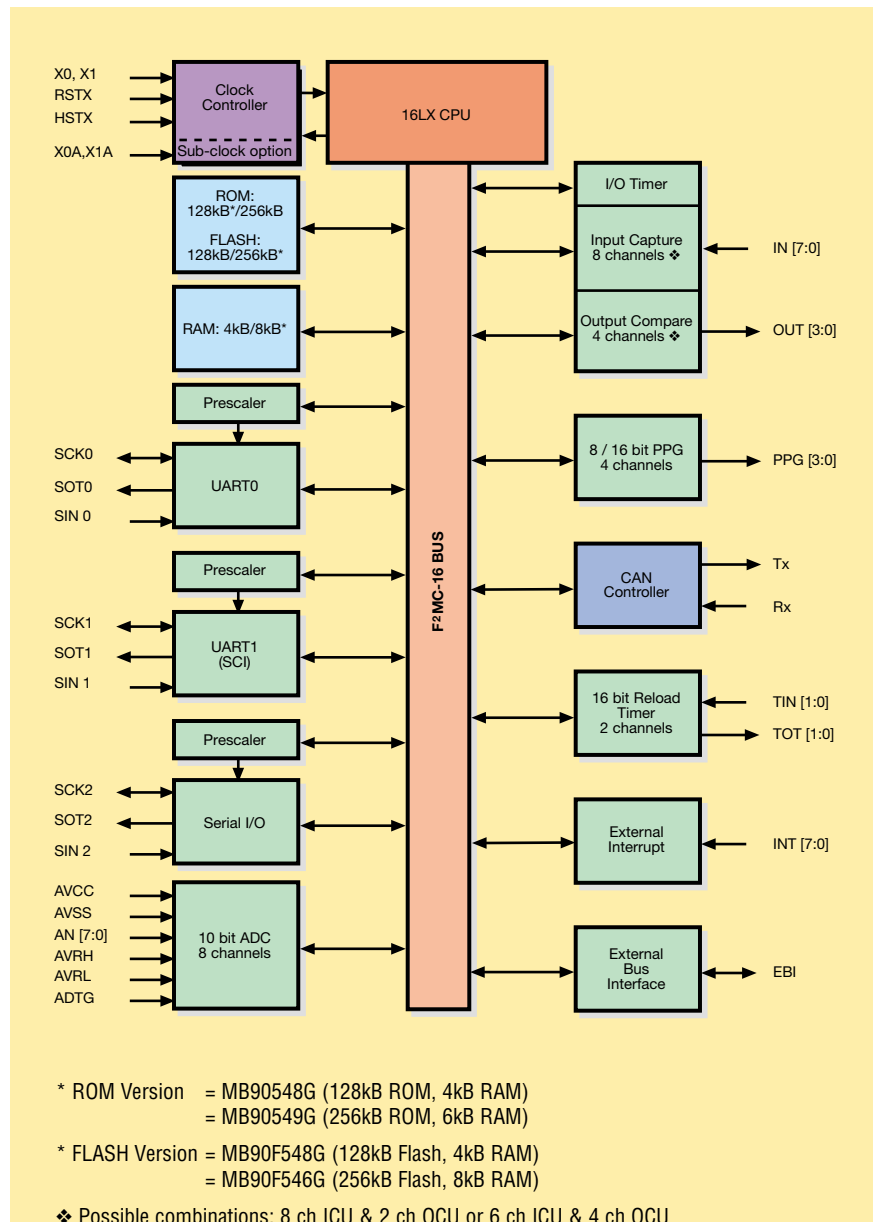
CAN BUS MICROCONTROLLERS

16 BIT SINGLE CAN BUS MICROCONTROLLERS

The **MB90545G** series is a product rich in peripheral features and designed with more general-purpose CAN applications. The functions that particularly distinguish it from other devices in Fujitsu's range are the inclusion of an external bus interface and a 32kHz sub clock. The MB90545G series is otherwise completely plug-compatible with its double and triple CAN counterparts. A security feature is incorporated in this family, preventing the unauthorised reading of the contents of the Flash ROM.

Features

- Fujitsu F²MC-16LX microcontroller architecture
- 128kB / 256kB Flash ROM (with single voltage and 10k erase cycles), or 128kB Mask ROM
- Flash security function
- Full CAN 2.0A/2.0B interface with flexible buffering
- 4kB / 8kB RAM
- 32kHz sub clock
- External bus interface
- 2 UARTs
- Synchronous serial I/O
- External interrupts 8 ch
- A/D converter 10 bit x 8 ch
- Input capture 16 bit x 8 ch
- Output compare 16 bit x 4 ch
- Reload timers 16 bit x 2 ch
- Programmable pulse generator 16 bit or 8 bit x 4 ch
- QFP 100 package
- -40 to +105°C temperature range



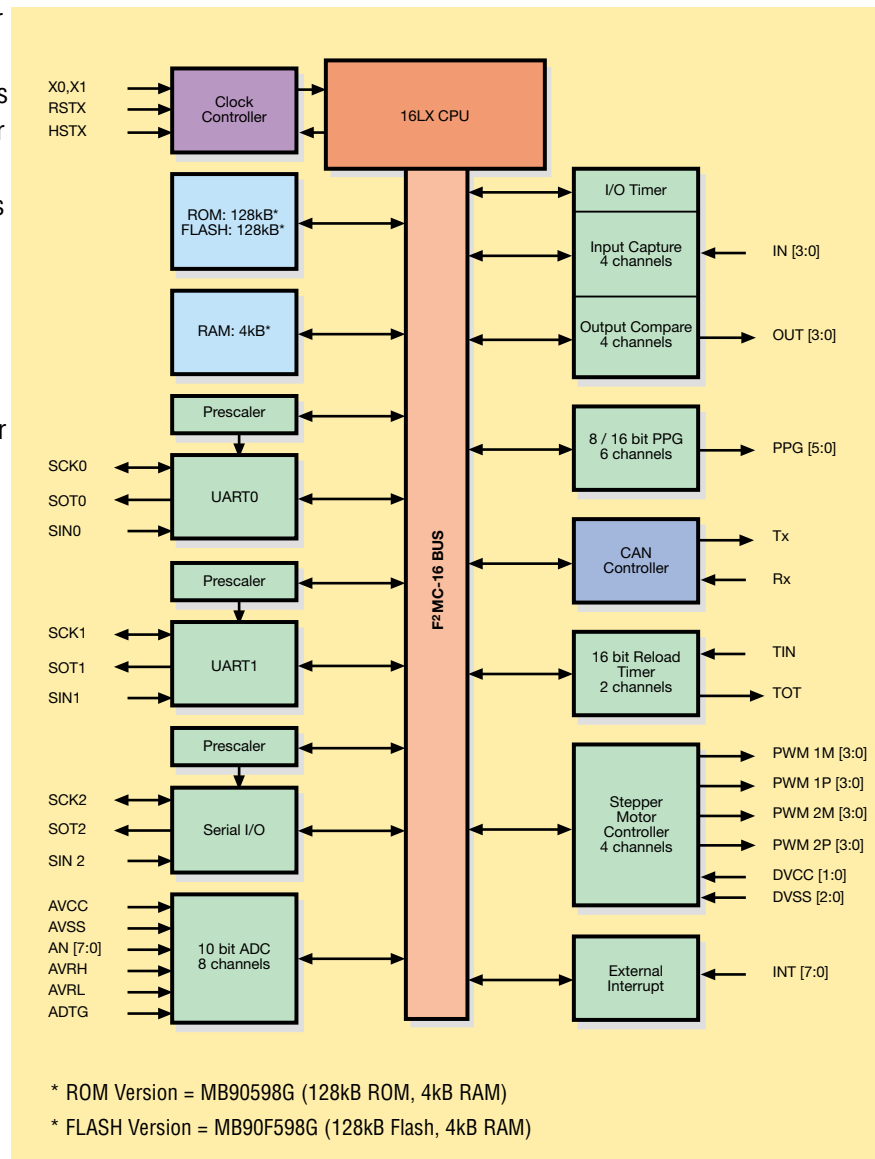
MB90545G Series General Purpose CAN Block Diagram

16 BIT SINGLE CAN BUS MICROCONTROLLERS

The **MB90595G** series is designed for mid- to high-end 16 bit automotive applications, especially dashboards as it features four on-chip stepper motor controller-drivers. It also contains a wealth of general-purpose peripherals such as UARTs, A/D converter and input capture / output compare.

Features

- Fujitsu F²MC-16LX microcontroller architecture
- 128kB Flash ROM (with single voltage and 10k erase cycles), or Mask ROM.
- Full CAN 2.0A/2.0B interface with flexible buffering
- 4kB RAM
- Stepper Motor Controller-Driver 4 channel
- 2 UARTs
- Synchronous serial I/O
- External interrupts 8 ch
- A/D converter 10 bit x 8 ch
- Input capture 16 bit x 4 ch
- Output compare 16 bit x 4 ch
- Reload timers 16 bit x 2 ch
- Programmable pulse generator 16 bit or 8 bit x 6 ch
- QFP 100 package
- -40 to +105°C temperature range



MB90595G Series General Purpose CAN Block Diagram

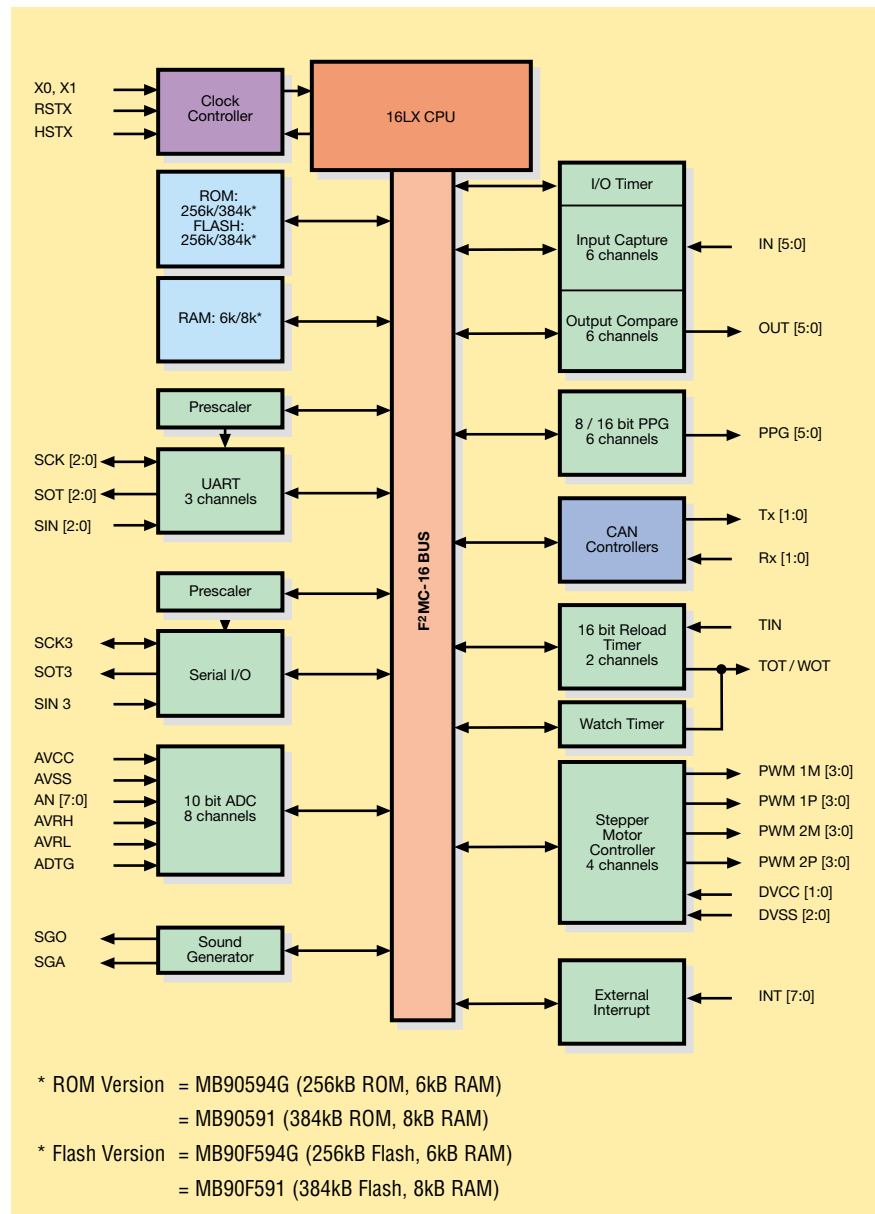
CAN BUS MICROCONTROLLERS

16 BIT DOUBLE CAN BUS MICROCONTROLLERS

The **MB90590** series is designed for high-end 16 bit automotive applications, especially dashboards as it features four on-chip stepper motor controller-drivers and sound generator. It also contains a high quantity of on-chip Flash or Mask ROM and RAM.

Features

- Fujitsu F²MC-16LX microcontroller architecture
- 256kB / 384kB Flash ROM (with single voltage and 10k erase cycles), or Mask ROM
- 2 Full CAN 2.0A/2.0B interfaces with flexible buffering
- 6kB / 8kB RAM
- Stepper Motor Controller-Driver 4 channel
- Sound generator
- 3 UARTs
- Synchronous serial I/O
- External interrupts 8 ch
- A/D converter 10 bit x 8 ch
- Input capture 16 bit x 6 ch
- Output compare 16 bit x 6 ch
- Reload timers 16 bit x 2 ch
- Programmable pulse generator 16 bit or 8 bit x 6 ch
- QFP 100 package
- -40 to +85°C temperature range



MB90590 Series with Stepper Motor Controllers Block Diagram

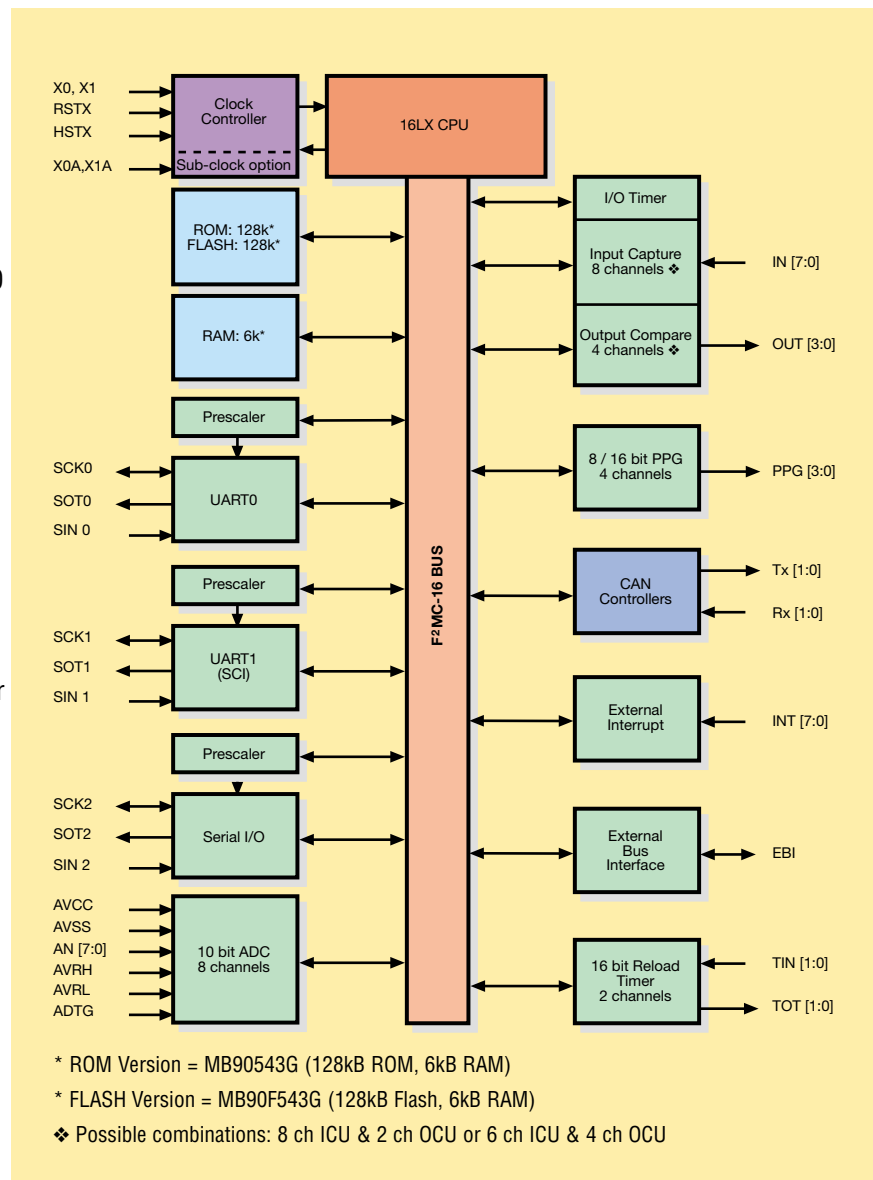
16 BIT DOUBLE CAN BUS MICROCONTROLLERS

The **MB90540G** series is a product rich in peripheral features and designed for general-purpose CAN applications. The functions that particularly distinguish it from other devices in Fujitsu's range are the inclusion of an external bus interface and a 32kHz sub clock. The MB90540 series is completely upwards compatible with its single and triple CAN counterparts.

A security feature is incorporated in this family, preventing the unauthorised reading of the contents of the Flash ROM.

Features

- Fujitsu F²MC-16LX microcontroller architecture
- 128kB Flash ROM (with single voltage and 10k erase cycles), or Mask ROM
- Flash security function
- 2 Full CAN 2.0A/2.0B interfaces with flexible buffering
- 6kB RAM
- 32kHz sub clock
- External bus interface
- 2 UARTs
- Synchronous serial I/O
- External interrupts 8 ch
- A/D converter 10 bit x 8 ch
- Input capture 16 bit x 8 ch
- Output compare 16 bit x 4 ch
- Reload timers 16 bit x 2 ch
- Programmable pulse generator 16 bit or 8 bit x 4 ch
- QFP 100 package
- -40 to +105°C temperature range



MB90540G Series General Purpose CAN Block Diagram

CAN BUS MICROCONTROLLERS

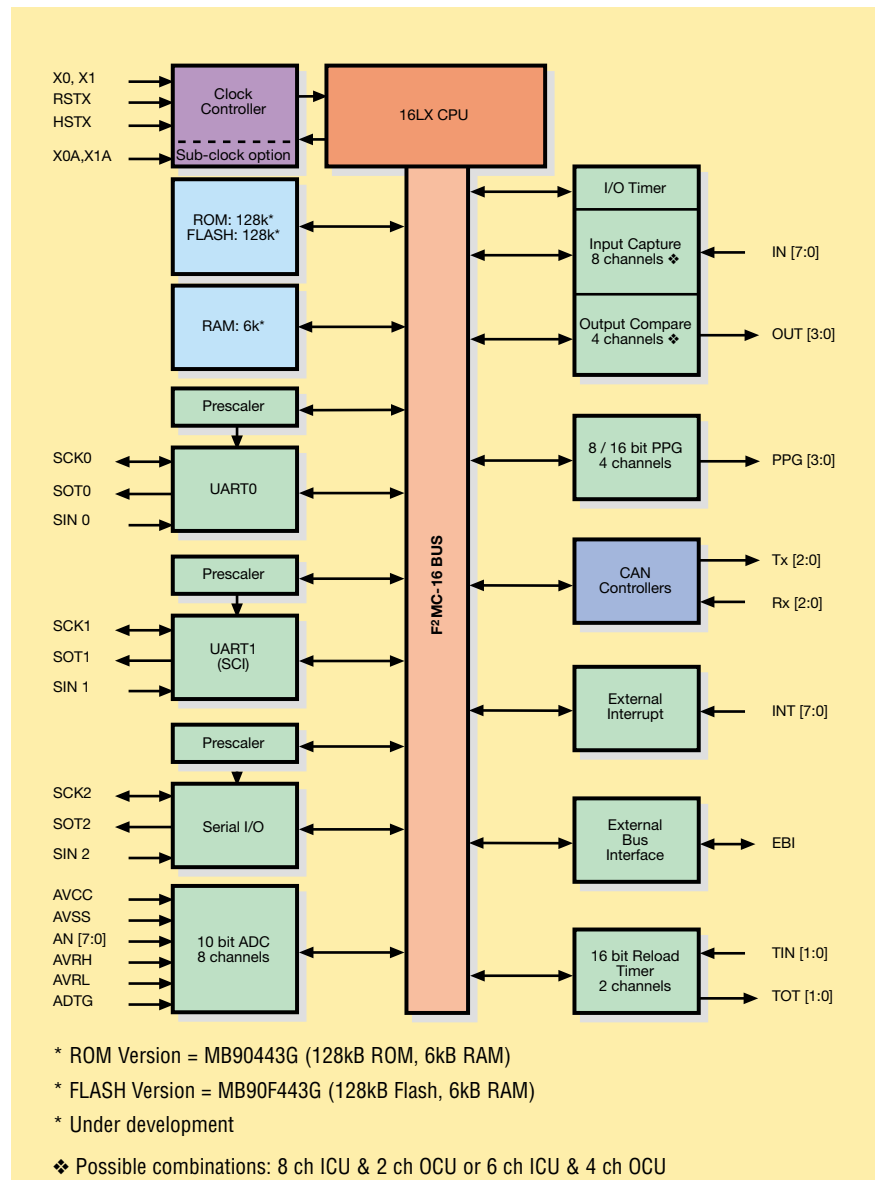
16 BIT TRIPLE CAN BUS MICROCONTROLLERS

The **MB90440G** series offers the same peripherals as MB90540 and MB90545 series but features a 3rd CAN Interface. Thus the migration between these three series is easy. Application areas of these products are demanding automotive body control applications. An external bus interface allows to connect off chip memory.

A security feature is incorporated in this family, preventing the unauthorised reading of the contents of the Flash ROM.

Features

- Fujitsu F²MC-16LX microcontroller architecture
- 128kB Flash ROM (with single voltage and 10k erase cycles), or Mask ROM
- Flash security function
- 3 Full CAN 2.0A/2.0B interfaces with flexible buffering
- 6kB RAM
- 32kHz sub clock
- External bus interface
- 2 UARTs
- Synchronous serial I/O
- External interrupts 8 ch
- A/D converter 10 bit x 8 ch
- Input capture 16 bit x 8 ch
- Output compare 16 bit x 4 ch
- Reload timers 16 bit x 2 ch
- Programmable pulse generator 16 bit or 8 bit x 4 ch
- QFP 100 package
- -40 to +105°C temperature range



MB90440G Series General Purpose CAN Block Diagram

FR SERIES – 32 BIT RISC ARCHITECTURE

The Fujitsu RISC (FR) architecture is a new generation 32 bit microprocessor core which is dedicated to resolving the twin demands of high performance coupled with low cost, which are needed by today's high-end Automotive, Consumer and Telecoms applications.

Designed from the outset to be optimised for embedded applications, the CPU has a 16 bit instruction Op Code, enabling maximum performance from low cost, half word external memory and instruction cache widths, or else allowing double instruction fetches for each bus cycle. The CPU employs the same five-stage pipeline and 32 x 32 Multiplier as the successful SPARClike family but adds a new barrel shifter and a bit search unit which finds the first 1, 0 or change in a data word in a single cycle. The concept of the instruction cache architecture with its flexible locking mechanism is also replicated.

The CPU has eight dedicated 32 bit registers: Program Counter, Processor Status, interrupt Table Base Register, Return Pointer, Supervisor and User Stack Pointers and two for multiply/divide result. There are sixteen 32 bit, general-purpose registers arranged as a single bank. The functions of R13 to R15 are reserved as Virtual Accumulator, Frame Pointer and Stack Pointer respectively. The instruction set contains many bit manipulation instructions and data moving instructions, which are very

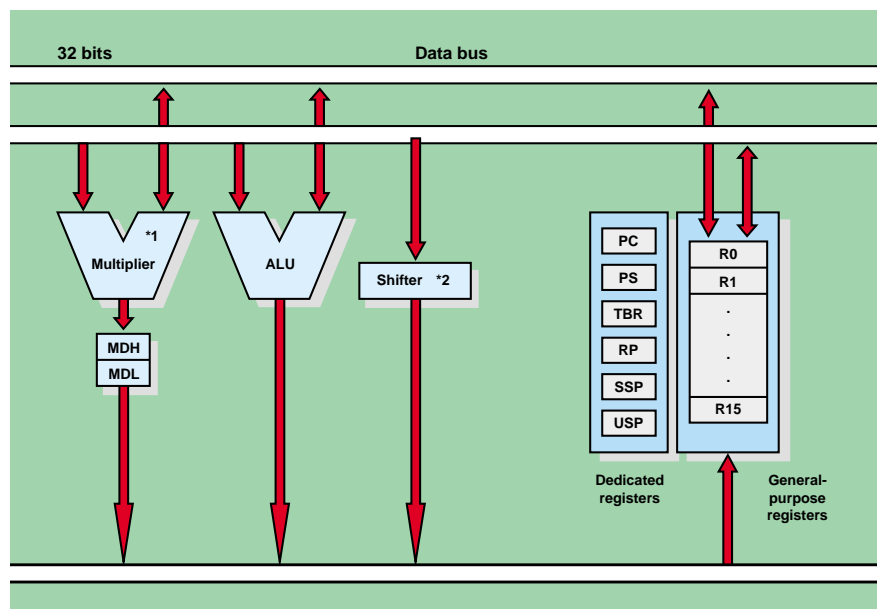
helpful in supporting the on-chip peripheral blocks.

Although the FR is a RISC, it contains a number of extended instructions, which help assembly level programming, often unavoidable in embedded applications. An example is the store of half of the register bank to memory.

Blocks that require fast access are connected to the FR-core within a 32 bit Harvard bus system. These units are the Instruction Cache, internal RAM, the DMA-Controller and the bit-Search unit. Resources that require simple control or status access, such as UARTs, Timers, etc., are hooked up on a 16 bit peripheral bus known as the R-Bus. The R-Bus gateway to the FR-core is a

bus-converter module like the one for the external bus interface. This general purpose bus, also called the 'User logic bus' is used for accessing the on-chip Flash ROM as well as the CAN-Interfaces, which typically require a faster and more extensive data flow to and from the FR-core than most of the other on-chip resources. The external bus also gives the user the possibility to access external memory or other memory-mapped devices on the target application, supporting seven fully configurable chip-select areas with external chip-select pins which can be controlled individually in terms of memory-area, bus-width, wait-states or alignment.

CPU Core Diagram



KEY *1: 32 bit x 32 bit: 5 clock cycles *2: 16 bit x 16 bit: 3 clock cycles **PC**: Program counter
PS: Program status **TBR**: Table base register **RP**: Return pointer **SSP**: System stack pointer
USP: User stack pointer **MDH/MDL**: Multiplication and division result register

CAN BUS MICROCONTROLLERS

FR+CAN BUS MICROCONTROLLERS

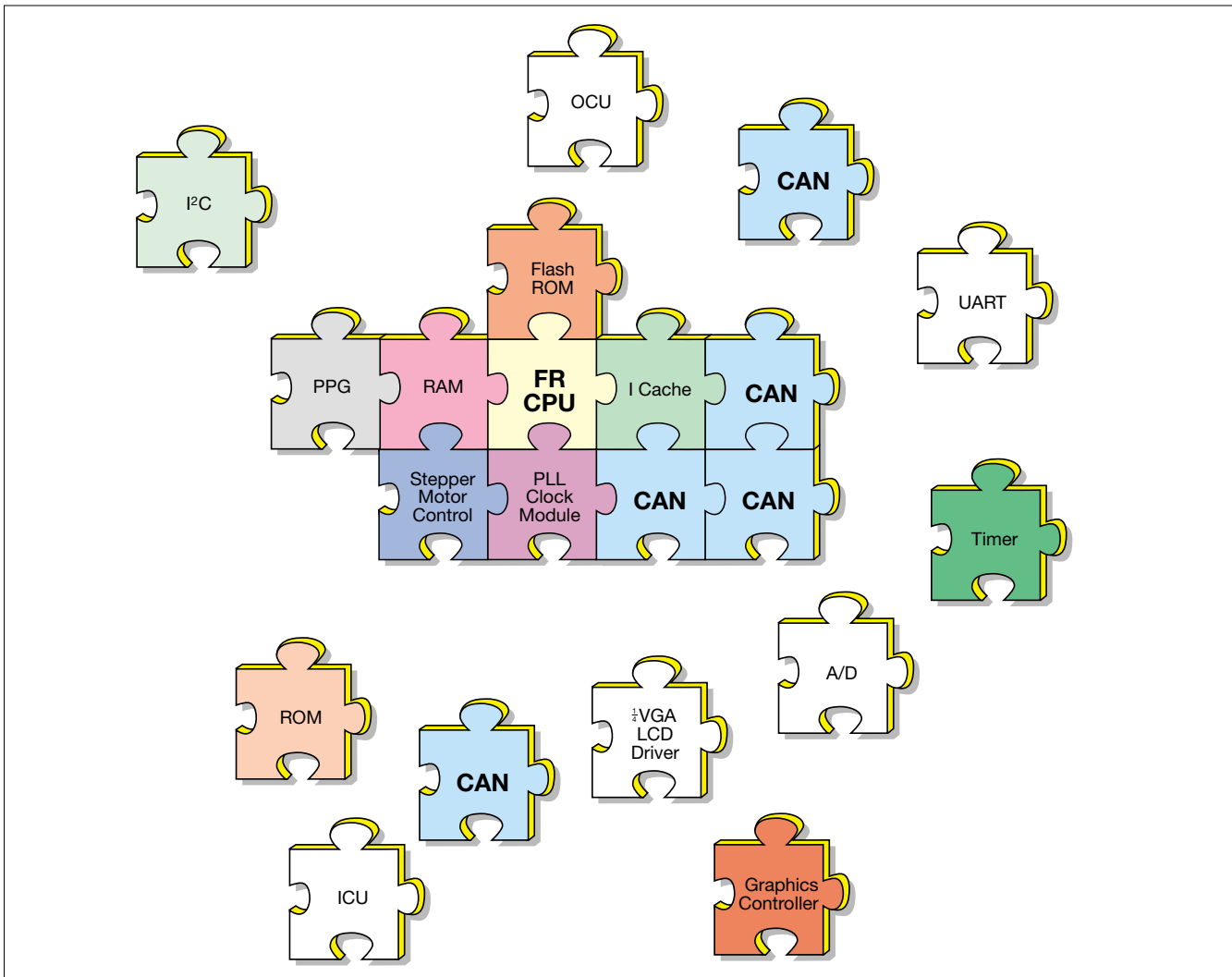
The MB91360 series represents not only a huge leap forward in the level of integration and performance of CAN bus microcontrollers but also should be viewed as a 'jumping off point' for customised and application specific solutions in Automotive electronic systems. This will be more than just a number of individual products; it is a whole new modular concept encompassing dashboards,

navigation systems and body electronics based on Fujitsu's FR 32 bit RISC CPU. At the heart of these applications lies Fujitsu's CAN bus macro which is in fact implemented four times on the MB91V360 evaluation device.

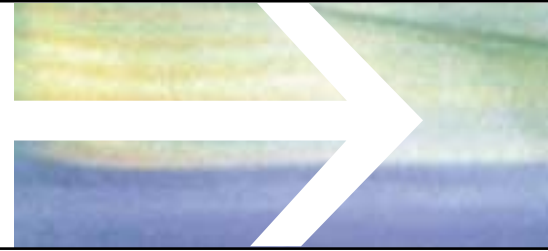
Derivatives of the FR+CAN both for the open market and specific customers are planned or in design. A special team within Fujitsu's

European Microcontroller Design Centre is dedicated to these projects. Variations will include stripped down parts for lower cost body and steering column applications, versions with many CAN bus controllers for linking between different CAN circuits and high-end types with graphics and LCD display driving capabilities for navigation systems.

Building Block Concept



MB91360 SERIES FR 32 BIT RISC MICROCONTROLLERS WITH THREE CAN INTERFACES



Created in Fujitsu's 0.35µm CMOS process, the triple CAN, MB91F361 Flash ROM version contains some 5 million transistors in 160 logical blocks. The FR CPU clocks at 64MHz internally and is supported by 1kB of Instruction cache and 16kB RAM. It is conceived as the part ideally suited to the needs of the next generation of dashboards, including on-chip features such as stepper motor controllers, real-time watch timer, sound generator, high current LED drivers and PPGs for light dimmers. It also contains a wealth of general-purpose peripheral blocks such as 16 channels of 10 bit A/D and 2 channels of 10 bit D/A converter, 4 channels each of input capture and output compare, six reload timers and 8 external interrupts. Additional serial communications are 3 UARTs, 2 synchronous serial ports and an I²C. Power down management features include reset if the voltage drops below a defined threshold and over / under voltage detection interrupt.

Features

- 32 bit core CPU; 64MHz / 15.6ns internal cycle time from 4MHz or 32kHz external clock
- 0.35µm CMOS Technology
- Internal voltage regulator supports 3V MCU core from 5V supply, offering low EMI and low power consumption figures
- 512kB FLASH ROM; supports automatic programming, 10,000 erase cycles, 10 year data retention time, no second programming voltage required
- 1kB Instruction Cache
- 16kB static RAM
- 5 channels DMA, 3 for external memory bus and 2 dedicated to internal peripherals with 16 sources
- Three FULL-CAN interfaces; conforming to version 2.0 Part A and Part B, flexible message buffering (mailbox and FIFO buffering can be mixed)
- Internal Boot ROM
- External Interrupts: 8 channel
- Power down reset if supply voltage falls below pre-set threshold
- Under / Over voltage detection, generating an interrupt if supply voltage goes above / below a pre-set threshold
- A/D Converter: 16 channel analogue inputs, resolution 10 bits
- D/A Converter: 2 channel analogue outputs, resolution 10 bits
- ICU (Input capture) 16 bit x 4 channel
- OCU (Output compare) 16 bit x 4 channel
- Programmable Pulse Generator 16 bits x 8 channel
- Stepper Motor Controller 4 channel
- UART, full duplex: 3 channel
- I²C Bus Controller: 1 channel
- Synchronous Serial I/O: 2 channel
- Reload Timer: 16 bit x 6 channel
- LED Driving Port: 8 channel
- Sound Generator
- Real-Time Watch Timer
- Package LQFP208

REALOS & OSEK/VDX

REALOS Real-Time OS for the F²MC-16L/LX Families

REALOS/907 is a Real-Time OS for the F²MC-16L/LX families of microcontrollers which conforms to Version 2.01 of the μ ITRON specification.

Features

- High speed system calls
- High speed interrupt processing
- Up to 255 tasks
- Up to 16 priorities
- 46 system calls
- Priority based and event driven scheduling system
- Kernel size from 0.8kB (resident) to 5.9kB (max)
- Multi-windows based Configurator which creates executable program with optimised environment of kernel and application programs
- Sample I/O driver
- Sample program
- Debugger macro enabling ordinary debugger to perform debugging of μ ITRON tasks
- Multi-windows based REALOS debugger, capable of working at the C level

REALOS Real-Time OS for the FR Series

REALOS/FR is a Real-Time OS for the FR Series of microcontrollers which conforms to Version 3.0 of the μ ITRON specification.

Features

- High speed system calls
- High speed interrupt processing
- Up to 32,767 tasks
- Up to 32 priorities
- 50 system calls
- Priority based and event driven scheduling system
- Kernel size from 2.7kB (min) to 7.2kB (max)
- Multi-windows based Configurator which creates executable program with optimised environment of kernel and application programs
- Sample I/O driver
- Sample program
- Debugger macro enabling ordinary debugger to perform debugging of μ ITRON tasks
- Multi-windows based REALOS debugger, capable of working at the C level

OSEK/VDX

OSEK/VDX is an operating system targeted for automotive applications. It consists of three parts, the OSEK kernel, the communications interface and the network management. Mainly automotive controller networks using CAN interfaces will employ the OSEK operating system. Both the F²MC-16LX and FR series microcontrollers are supported with optimised drivers for the Fujitsu CAN controller.

OSEK-OS defines the task types 'Basic' and 'Extended'. Basic tasks cannot have a waiting state and so are suitable for those which run completely after each activation. Extended tasks can react to events; they can have a waiting state. OSEK-OS also defines four conformance classes:

- BCC1 – basic tasks, single activation
- BCC2 – basic tasks, multiple activation
- ECC1 – basic and extended tasks, single activation
- ECC2 – basic and extended tasks, multiple activation

The FR series OSEK without CAN driver and network management requires 3.2kB ROM for class ECC1 (standard status)

CAN BUS MICROCONTROLLERS

EUROS

EUROS Enhanced Universal Real-Time Operating System

EUROS is an innovative real-time operating system characterised by short response times, robustness, scalability and flexibility. The primary aim of EUROS development was to create a uniform, hardware-independent operating system for real-time and embedded applications which takes into account the growing complexity and diversity of processor architectures, in order to make software engineering as economical as possible. It separates the user software from the hardware so that the application can easily be ported to state-of-the-art hardware.

Key Features

- supports Fujitsu F²MC-16LX and FR series
- unlimited number of system objects (tasks, mailboxes, signals, events, semaphores, drivers)
- up to 256 priorities
- synchronous and asynchronous system calls
- memory management supports fixed and variable size memory blocks
- waiting on multiple objects
- flexible open driver interface
- priority based scheduler with round robin support
- named system objects organised in clusters (hierarchical object trees)
- re-entrant ANSI compatible C runtime library
- generic graphic library
- TCP/IP network stack (BSD4.4 socket interface)
- Web server, FTP server, SMTP client, BOOTP client
- PPP, Ethernet
- CAN / CANopen
- MS-DOS™ compatible file system
- IDE hard disk drivers
- Floppy disk drivers
- Ramdisk, FTL for Flashdisks
- IrDA (IrLAP, IrLMP, IrComm)
- Profibus (slave)
- IEEE1394 (Firewire™)

EUROSvm Euros Virtual Machine

EUROSvm is an implementation of the Java Virtual Machine Specification V1.2. It has been designed for real-time and embedded systems and offers unparalleled support for this target domain. Among the extraordinary features of EUROSvm are:

- Hard real-time execution
- Minimal footprint
- ROMable code
- Native code support
- Dynamic linking
- Fast execution

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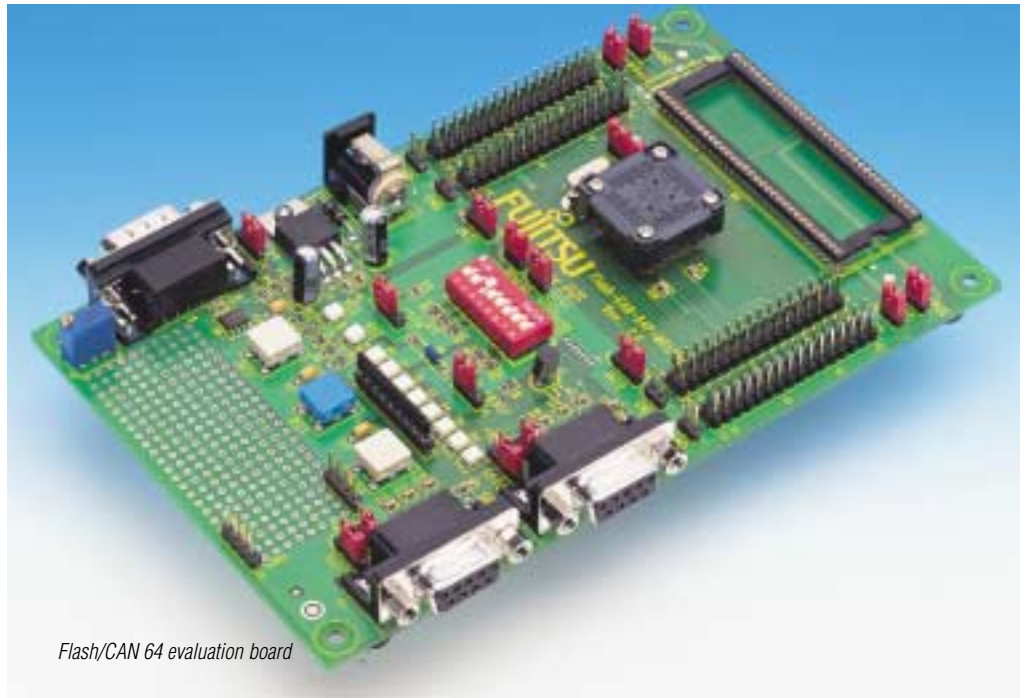


FLASH/CAN 64 EVALUATION BOARD

The Flash/CAN 64 is a low cost multifunctional evaluation board for the Fujitsu 16 bit Flash microcontroller series MB90560, MB90560L, MB90565 and Flash+CAN series MB90495G. It can be used stand-alone for software development and testing or as a simple target board to work with the emulator system. The board allows the designer to start immediately with the software development before his own final target system is available.

Features

- Supports 16 bit LX series MB90495G, MB90560, MB90560L and MB90565
- Fully supports 3V and 5V environment
- QFP-64 or DIP-64 sockets for device or emulator connection
- In-Circuit serial Flash programming
- High-speed CAN driver and connector
- All resources available for evaluation
- All pins routed to connectors
- 4MHz main crystal
- 32Hz sub clock crystal for MB90495G series
- Two UART interfaces (3V and 5V operating)
- 8 User LEDs
- Reset button
- Two buttons configurable for external interrupts
- Prototyping area
- Order code:
FLASH-CAN-64P-M01/M09



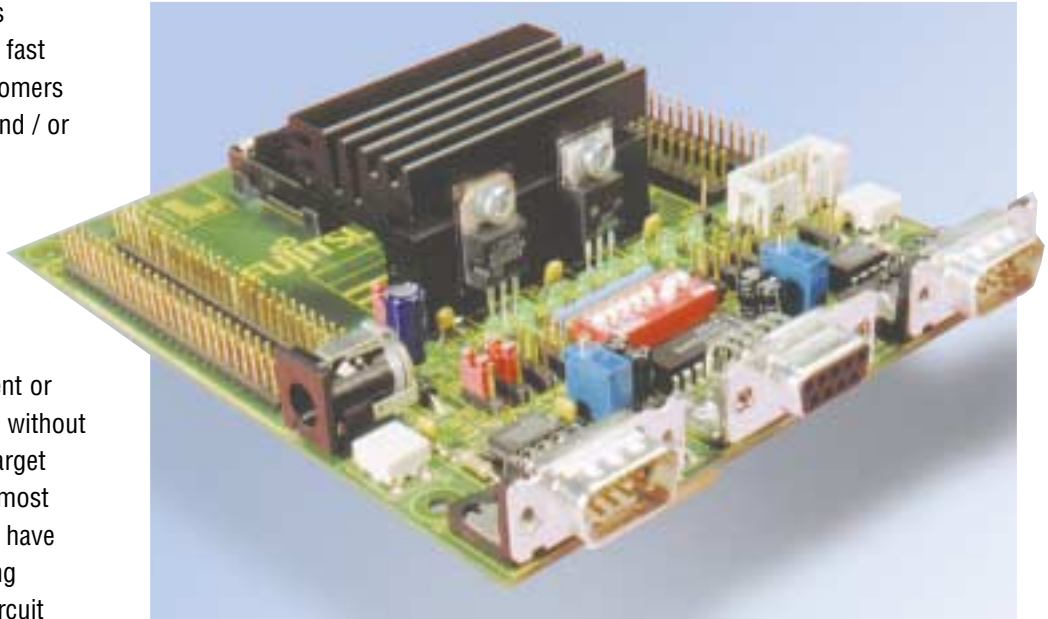
CAN BUS MICROCONTROLLERS

FLASH/CAN 100 EVALUATION BOARD

The Flash/CAN 100 board was developed, in order to allow a fast software design start for customers wishing to use Fujitsu Flash and / or CAN MCUs in the 100-pin QFP package. Since Fujitsu in-circuit emulators require a target system that provides Vcc and GND, as well as an oscillation circuit, it enables customers to start development or evaluation work straight away without having to wait for their own target hardware. Additionally, since most Fujitsu Flash microcontrollers have the burn-in Flash programming algorithm which enables in-circuit programming of blank devices, this is also supported via an RS232 connection.

The Flash/CAN100 Board Features

- 100-pin socket adaptor for device or emulator connection
- On-board regulator allows 7-14V unregulated external DC power supply
- 5V and 3.7V internal power supply available for emulator
- Two high-speed CAN drivers
- RS232 interface
- All MCU pins brought out twice to external connectors
- Optional sub-clock
- RST, HST push-button
- 8 test LEDs
- External reset via RS232



Flash/CAN 100 evaluation board

The Flash/CAN100 is supplied with the MB90F598 single-CAN, 128kByte Flash microcontroller but is able to support all of the following device types:

- MB90540G (MB90F543G, MB90543G)
- MB90545G (MB90F546G, MB90549G, MB90F548G, MB90548G)
- MB90550A (MB90F553A, MB90553A)
- MB90580 (MB90F583B, MB90583B)
- MB90590 (MB90F594G, MB90594G, MB90F591, MB90591)
- MB90595G (MB90F598G, MB90598G)

The order code for the kit is FLASH-CAN2-100P-M06 and it is delivered with:

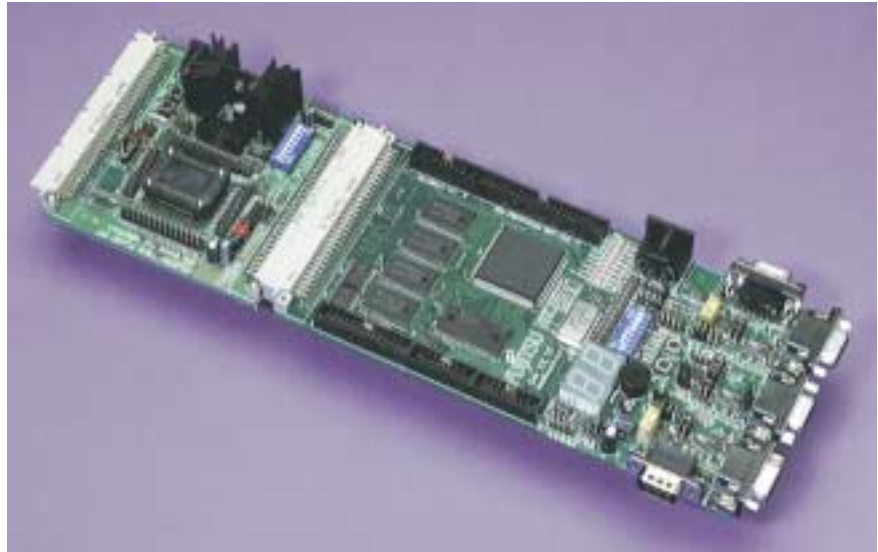
- The Flash/CAN100 board itself
- Two 50-pin socket connectors
- Power supply connector
- MB90F598 - 128kB Flash microcontroller
- 11 Jumpers
- 1 socket adapter cover
- English documentation

DEVKIT16

The DevKit16 is a multi-function, modular starterkit which provides plug and play evaluation of Fujitsu F²MC-16L/LX microcontrollers and software tools. The kit hardware consists of two parts, a main board which carries the emulation memory, ROM monitor debugger and communications functions and an interchangeable CPU board, which carries either a soldered MB90F543PF controller device or a socket. This socket enables it to accept other F²MC-16L/LX device types in 100-pin QFP, or act purely as an emulator target, with or without the main board. Flash serial programming and CAN Bus connectivity are also supported. Each kit comes with a Fujitsu CD ROM containing the complete documentation and Softune Workbench tool chain. Also provided is an evaluation licence copy of Processor Expert™ from Unis, which is an environment with resource oriented application design and CPU expert knowledge for rapid application development.

CPU Board Features

- Soldered MB90F543PF MCU (DevKit16-F543) or NQ-PACK100RB socket (DevKit16-MCU100)*
- Power supply regulators for 5V or 3.3V depending on device
- Main and sub clock crystals
- Flash serial programming interface
- Connectors for all MCU pins



The DevKit16, comprising main board and CPU board

- Device bus Euro connector for customer's own application board
- Interface bus connector to main board

DevKit16-Main - Board Features

- 512kB RAM, upgradable to 2MB
- 128kB Flash memory, upgradable to 2MB
- Additional external ports to replace those lost when device is in external bus mode
- 3 RS232 interfaces – 2 for MCU, one for board
- 2 high speed CAN Bus drivers and connectors
- 2 digit LED display with buffer, 8 test LEDs, diagnostic LED
- PC-AT keyboard interface with connector
- Amplifier and speaker for device PPG or sound generator
- User-programmable FPGA

Software Support Features

- Fujitsu Softune Workbench with tools – C compiler, assembler, linker...
- Fujitsu monitor debugger
- Processor Expert™ development environment
- Processor Expert™ debugger kernel
- Flash serial programming utility for MCU Flash or main board Flash
- Sample projects
- Main board diagnostic utility

**Under development*

CAN BUS MICROCONTROLLERS

STARTERKIT MB91360

The MB91360 Starterkit is a stand-alone application board that makes it easy to evaluate and demonstrate almost all features of the MB91360 microcontroller series. Along with the supplied Windows-based development tools, it can be used as a system for user program developments.

The board can be configured as a target for the MB91360 emulation-system or, by using the included MB91F361 device as a stand-alone evaluation board. All peripheral functions are available on external pin-headers in order to design and test user applications cost- and time-effectively. For some resource functions, additional hardware is already present on the board (e.g. CAN- and UART-transceivers, LEDs, Buttons, etc).



MB91360 Starterkit

Key Features

- Footprint QFP208 (0.5mm pitch) for MB91F361 (or emulation socket), surrounded by headers for test-pins, etc.
- 4MHz or 32kHz crystal selectable
- DC power-supply circuit (incl. testpins for Vcc, GND, power-LED and switch)
- 512kB external SRAM available for user code and data
- External 16550 UART (supports transfer-rates up to 115.2 kBaud)
- 3 Resets ('Monitor'=Flash monitor, 'User'=external RAM, 'Flash'=User Flash Area)
- 2 MAX232 + DB9 (female) connectors for monitor and internal UART
- CAN transceiver and DB9 (male) for internal CAN0
- External interrupt 0 and 1 connected to buttons for user interaction
- Various jumpers for individual configuration
- 2x16 char LCD (on Port G)
- 8 LEDs (on Port J)
- External bus and all resources logically grouped on pin-headers
- Area for extensions (2.54mm grid)
- Stand-alone configuration features built-in monitor debugger (in Flash)
- Software example projects for various applications

EUROPEAN MICROCONTROLLER DESIGN CENTRE



The European Microcontroller Design Centre (EMDC) was established in July 1997 at Fujitsu FME's European headquarters near Frankfurt.

The Centre represents a major investment in a market area of great strategic significance, and handles design projects and development support involving both standard microcontrollers and customised products.

Fujitsu can provide the basis for solutions to numerous applications from its wide portfolio of 8, 16 and 32 bit microcontroller devices. The Centre is focusing on some of the largest sectors for microcontrollers – automotive, industrial, and audio/video.

In the automotive marketplace, critical areas on which the Centre concentrates, include instrumentation, navigation, and in-car communications. The CAN protocol controller forms the focus for the Centre.



EMDC is housed in Fujitsu's European headquarters near Frankfurt



CAN devices designed at the Fujitsu EMDC



Fujitsu's European Microcontroller Design Centre provides a multitude of design solutions

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