F²MC-16FX next generation microcontrollers

Fujitsu introduces the next generation of 16-bit microcontrollers, 16FX series.

Fast

16FX series is based on an improved CPU with significantly increased internal bus bandwidth. As a result, program execution is accelerated, as can be seen in the Dhrystone benchmark (Dhrystone 2.1 compared to MB90340 series). 16FX is about 3 times faster (depending on the memory model used) than 16LX at the same clock frequency. For example at 24MHz 16FX achieves more than 11 real MIPS (Dhrystone 2.1). The architecture improvement is particularly visible when handling large data structures (see memory model 'Large' in graph 1).

But that's not all. New technology and improved design allow for CPU frequencies up to 56MHz - thus achieving processing performance ranges of 32-bit processors.

Efficient

16FX combines the advantages of 16- and 32-bit architectures. The C-code efficiency benefits from the 16-bit instruction set. Instruction pipelining, a technique widely used in the 32-bit RISC world, allows 16FX to reach RISC-like performance. With instructions completed in less clock cycles, the same performance is achieved with less power consumption (compared to architectures without pipelining).

The 16-bit bus width again is an advantage for a low power consumption result compared to 32-bit architectures. A 32-bit bus will have a higher capacitance that increases current consumption particularly at high frequencies. The use of latest CMOS technology also translates into efficient use of silicon space (smaller chip) and lower power consumption.

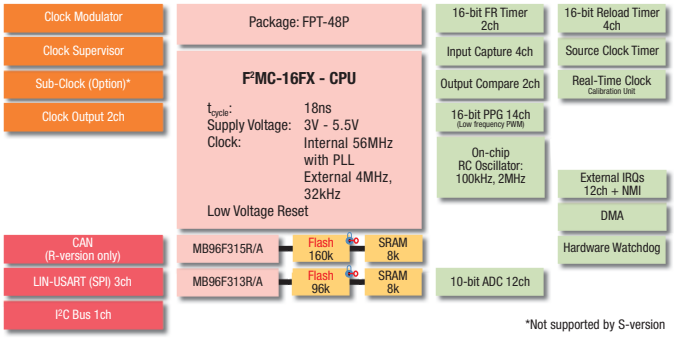
Next generation 16FX microcontroller delivers 5x the computing power, 78% less power consumption and is pin compatible with its proven predecessor - the 16LX.

16FX specific power reduction features include a reduced internal CPU supply voltage, peripheral clock speed selectable independently from CPU speed, and reduced number of clocks per instruction (CPI). The result is an 80% reduction in power consumption compared to 16LX at the same performance.

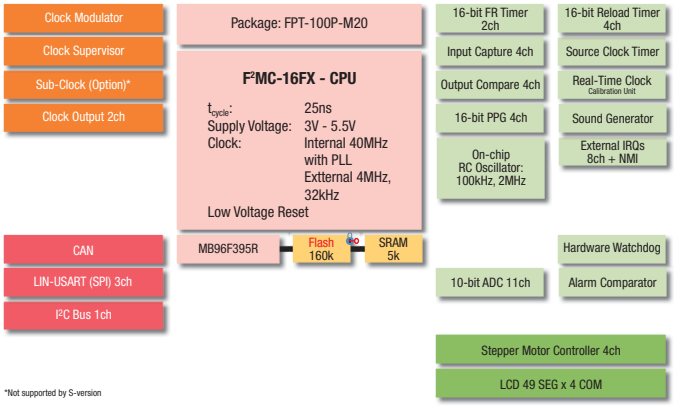
16LX compatible

The 16FX CPU uses all 16LX machine instructions. With the same instruction set, the Assembler and C-compiler are also unchanged when switching from LX to FX CPU. Quite a few of the 16LX peripherals can be found again on 16FX - making software conversion from LX to FX an easy task. On the hardware side it is even easier. The first 16FX product is fully pin-compatible to the successful MB90340 (16LX) series. So there is no need for a PCB change. You can even use the same Fujitsu Starter Kit (Flash-CAN-100P-340).

FACTSHEET
F²MC-16FX MICROCONTROLLERS



MB96310 FX series block diagram - maximum functionality in a small foot print package.



MB96390 FX series block diagram - 'Speedo-100' for low cost instrumentation.

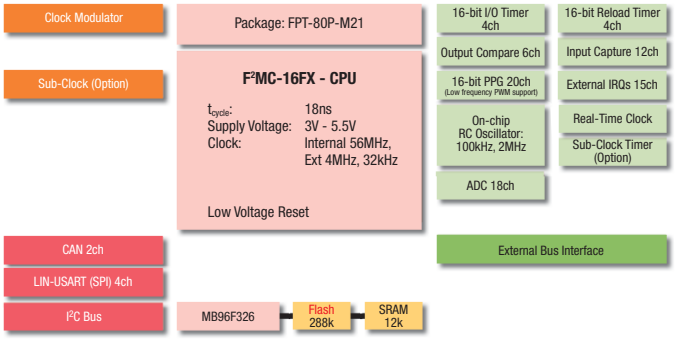
Features

- 20 Dhrystone MIPS computing performance (V.2.1)
- On-chip oscillators for short start-up, clock supervisor function, sub-clock or main clock operation
- Start-up time ‹1ms to RC run mode, ‹8ms to PLL run mode
- Operating voltage range 3.0-5.5V
- Internal CPU voltage reduced to 1.8V (less current consumption, less EM emissions)
- New energy-saving options: separate clock dividers for core and peripherals
- DMA: several channels that can be assigned to any peripheral resource - One Byte per clock cycle transfer speed
- Embedded Debugging: firmware support for debugging via USART (no need to link a monitor kernel to application software)
- Low voltage detection reset: available on all 16FX devices
- Interrupt: every resource has its own interrupt. A table base register allows relocation of the base address of the interrupt vector table
- Ports: up to 4 different input levels selectable by software 'port input enable' function allows pins to be left open (no termination by resistor required)

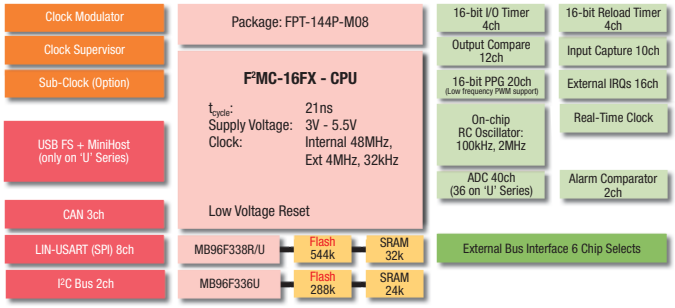
Package size	Pin compatible 16LX series	16FX products
144-pin	-	MB96F336 (288kB Flash) MB96F338 (544kB Flash)
144-pin	-	MB96F378 (544kB+32kB Flash) MB96F379 (832kB Flash)
120-pin	-	MB96384 (128kB ROM) MB96385 (160kB ROM) MB96F385 (160kB Flash) MB96F386 (288kB Flash) MB96F387 (416kB Flash) MB96F388 (544kB+32kB Flash) MB96F389 (832kB Flash)
100-pin	MB90340 128kB-512kB Flash 128kB-256kB ROM MB90860 128kB Flash / ROM	MB96345R (160kB ROM) MB96346R (288kB ROM) MB96F346R (288kB Flash) MB96F347R (416kB Flash) MB96F348R (544kB Flash) MB96F348H (544kB+32kB Flash)
100-pin	-	MB96F395 (160kB Flash)
80-pin	-	MB96F326 (288kB Flash)
64-pin	MB90350 64kB-128kB Flash / ROM	MB96F355 (160kB Flash) MB96F356 (288kB Flash)
48-pin	-	MB96F313 (96kB Flash) MB96F315 (160kB Flash)

16-bit flash microcontrollers compatibility overview.
Fujitsu reserves the right to change the specification of products under development without notice.

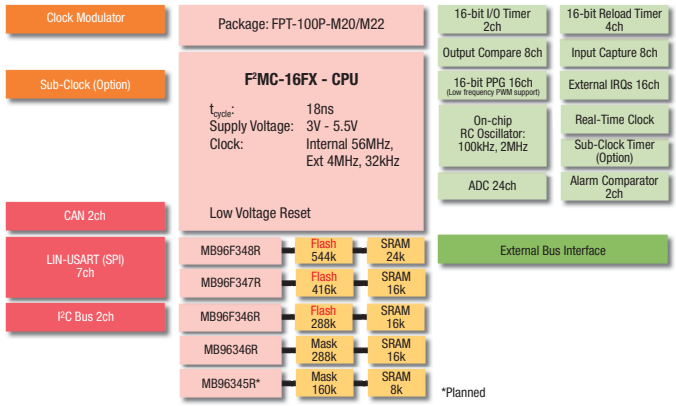
- CAN: each channel offers 32 message buffers. Bosch C-CAN
- PWM generation: improved programmable pulse generators offer more channels at full 16-bit resolution. Duty cycle and frequency are controlled in separate registers.



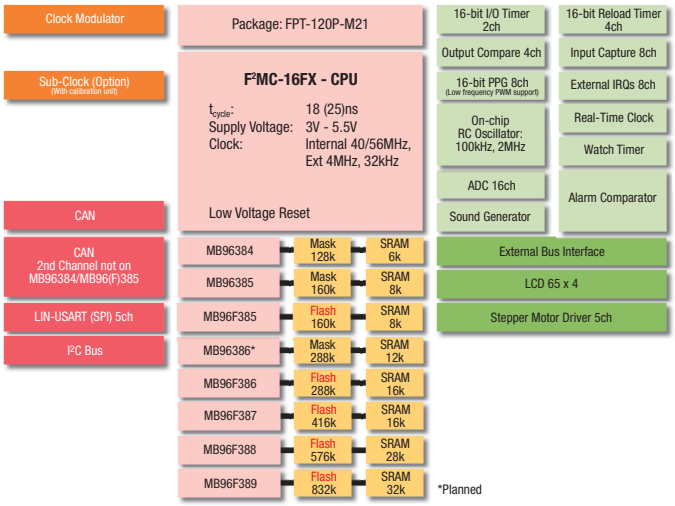
MB96320 FX series block diagram.



MB96330 FX series block diagram.



MB96340R FX series block diagram. Pin Compatible to MB90340.



MB96380 FX series block diagram 'Speedo-120'.

Embedded flash technology

All of the F²MC-16 series are supported by at least one device that has flash ROM as the user-programmable memory.

Features

- Blocks divided into separately erasable sectors
- Erase protection by sector capability
- Supports programming by on-chip firmware Embedded Algorithm™
- No second programming voltage required
- 10,000 erase cycles
- 20-year data retention
- Programming by 3 methods:
- On ordinary programmer with adaptor as with traditional OTP devices
  - Using Fujitsu embedded serial programming mode via on-chip UART/SIO directly to the flash ROM
  - Copying or downloading to flash using customer's own bootstrap software
- Programming via CAN possible
- 'Flash Security' read-out protection available on most flash devices

Microcontrollers with CAN bus controller

Fujitsu has a unique portfolio of 16-bit devices available offering a full featured CAN bus protocol controller as an on-chip peripheral for automotive and industrial applications.

The details of these parts are listed in the tables listing the device features in our Product Overview brochure and on our web site.

16FX support tools

16FX is supported by Fujitsu's proven emulator for 32-bit FR series.

The Software tools (Softune Workbench) are free-of-charge for customers in Europe.

One evaluation chip covers a host of future 16FX products. A complete system comprises the following items:

- Emulator: MB2198-01 (see web site for full details) http://emea.fujitsu.com/microcontrollers)
- MCU adaptor board (for Eva-chip connection) MB2198-500
- Eva-chip MB96V300
- IC package specific header board (for connection to target hardware)
- Target board

16FX On-chip debugging

The 16FX family supports on-chip debugging. The microcontroller can be connected directly to the Host-PC via a serial RS232 or USB interface (with a converter IC). Since an on-chip hardware module and the firmware (boot ROM) of the MCU completely implement the debug functionality, loading of kernels or linking of a library is not necessary.

EUROScope lite 16FX

Fujitsu and EUROS teamed-up to provide a special 'lite' version of EUROScope that contains all the standard functions of an 'everyday' debugger that a developer would normally require.

The sophisticated user interface helps keep track of every important piece of information: Windows can be docked to the edge of the main window without obscuring important data. The multi-threading makes the user interface highly responsive and extremely easy to work with.

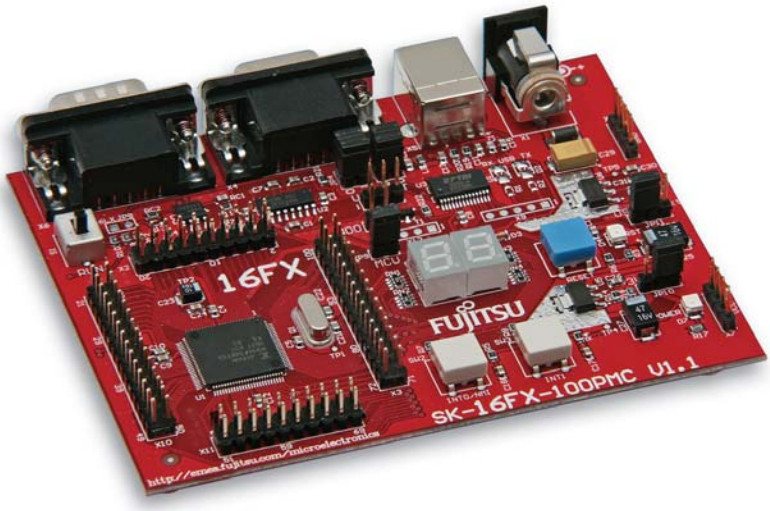
A full version of EUROScope, available from EUROS, offers further features such as OS support and visualisation of task- and other OS objects.

The inexpensive Quick Start Kit and an attractive licence scheme 'buy one, use on multiple PCs' makes EUROScope lite an interesting alternative to full-blown emulator systems (which are available for 16FX as well).

Features

- No kernel linkage/upload required
- Utilises on-chip debug interface of all 16FX MCUs
- Set/clear breakpoints
- Set/clear range breakpoint
- Run, stop, abort
- Single-step debugging (step, stepin, step-out)
- Memory window
- Watch window
- Mixed source code view
- CPU register window

MB2198-500 main unit and adaptor board of the 16FX high-speed emulator.



SK-16FX-EUROSCOPE: On-chip debugger with target board.

ASK FUJITSU MICROELECTRONICS EUROPE

Contact us on +49(0) 61 03 69 00 or visit
http://emea.fujitsu.com/microelectronics