

F²MC 8-bit Family

F²MC-8FX Family

- Low-cost, low-power high speed devices
- Low voltage operation min: 1.8V
- Low supply current: RTC mode standby 1uA
- Minimum instruction execution time: 100ns at 10MHz
- Embedded dual-operation Flash memory
- High-performance embedded peripherals
- Integrates EMI solution
- Compact low-cost debug environment

Fujitsu's low-power F²MC-8FX family of micro-controllers has a wide range of embedded peripheral functions including LCDC, ADC, LIN, UART, and I²C.

F²MC-8FX Application Coverage

White Goods: Washing machines, refrigerators

Consumer Products: Digital cameras, cordless phones, chargers

Industrial Home Automation:

Utility meters, heating/air-conditioning systems

Automotive: Smart door/window control, security, car audio

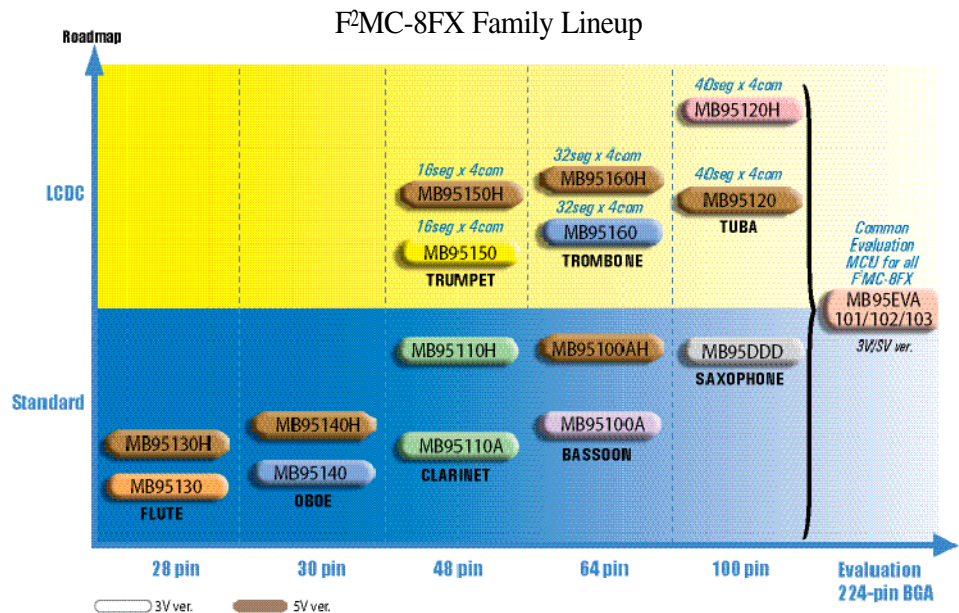
The broad spectrum of 8-bit Fujitsu flexible microcontrollers including the F²MC-8L and F²MC-8FX families, covers general-purpose and application-specific types with a rich feature set incorporating the latest technologies.

The new F²MC-8FX series features a minimum instruction speed three to four times faster than Fujitsu's F²MC-8L MCU series, along with a pipeline bus architecture that doubles the execution speed. These ultra-low-power microcontrollers were built using Fujitsu's 0.35-micron ultra-low-leakage embedded Flash process technology. Operating voltage is as low as 1.8V and low-power-consumption operations can be achieved using only 1.0 microamperes in the real-time clock mode.

The F²MC-8L family devices are single-chip microcontrollers that utilize Fujitsu's proprietary 8L core for low-voltage, high-speed performance. These devices offer a wide range of peripheral functions including I²C, UART serial interfaces, LCDC, ADC, and motor control.

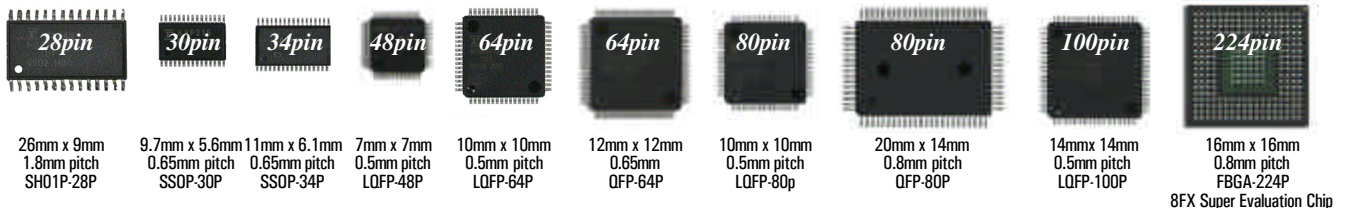
The new F²MC-8FX, with embedded dual-operation Flash memory, can perform write operations at the same time that program executes on the other memory bank. This makes it possible to reduce external memory requirements, reduce the PCB surface area, and lower the total cost.

Quality software and hardware development tools make Fujitsu the ideal one-stop shop for those developing products that benefit from the microcontroller revolution.



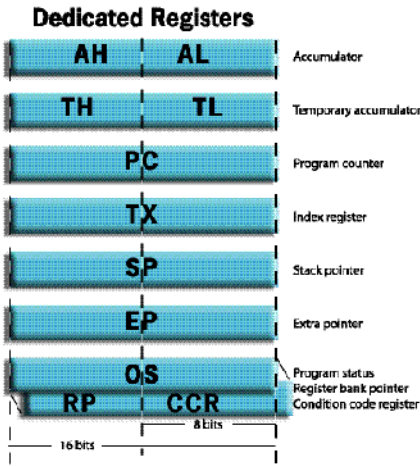
Wide Range of Package Lineup

Fujitsu pioneered packaging technology that provides flexible packages for F²MC-8FX and F²MC-8L from 28 pins to 100 pins.



F²MC 8-bit Family

CPU-CORE Architecture

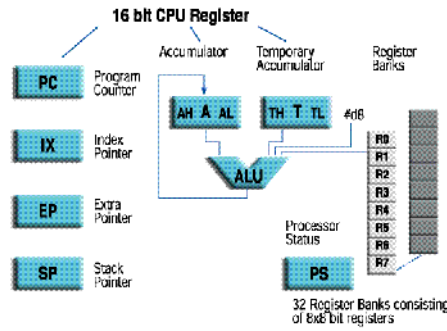


Fujitsu's advanced 8-bit CPU core consists of seven 16 bit registers and a maximum of 32 register banks, each consisting of eight 8-bit registers. The register banks can be used for a high-speed context switch after an interrupt.

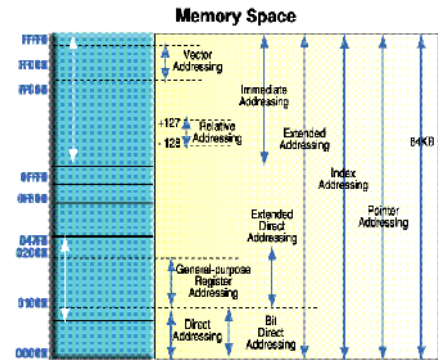
Dedicated Registers

General-purpose registers: 8 x 8-bit per bank. Max. 32 banks

- Enhanced interrupt function (prioritized multiple interrupts)
- Powerful operation and transfer functions using internal bus with pipeline



- Minimum execution time: 100 ns/10 MHz
- Operating voltage: +1.8V to +3.6V to +5.5V, external clock: 32.768 kHz to 20 MHz
- Software-switchable instruction cycle provides low-voltage, low-power consumption operation (clock gear function)
- Backup voltage in stop mode (voltage required to maintain RAM data: Min. +1.5V)
- Bitwise selectable pull-up resistors for each I/O port



- Memory mapped I/O
- Memory space: max. 64 Kbytes

Multiplication and division instructions:
 8-bit x 8-bit = 16-bit (0.8 s/10 MHz),
 16-bit ÷ 16-bit = 16-bit (1.7 s/10 MHz)

- Data transfer: Max. 16-bit
- Number of instructions: 136

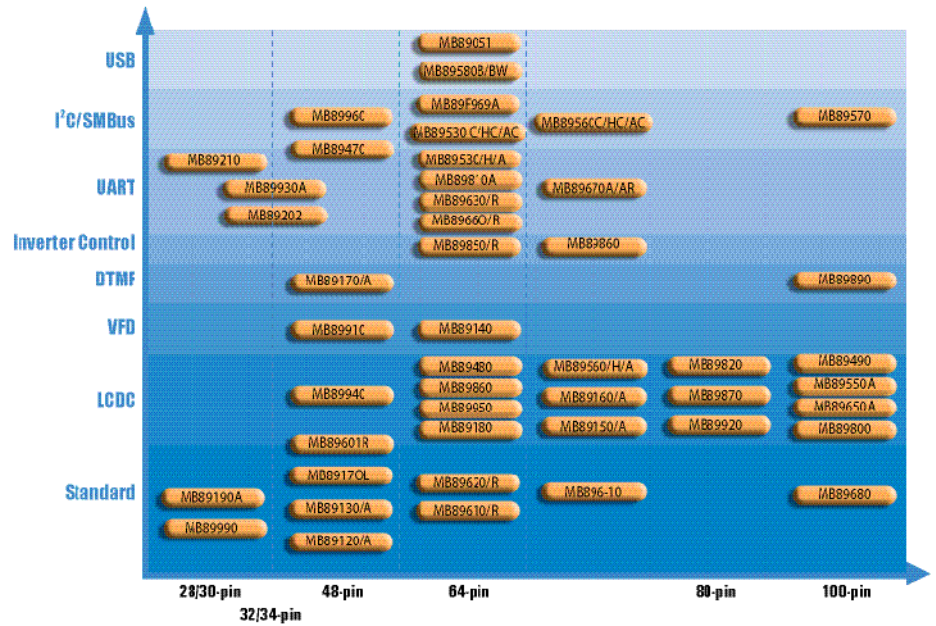
F²MC-8FX Peripheral Features

| | | |
|-----------------------------|---|--|
| <p>Super Low Power</p> | <ul style="list-style-type: none"> RTC-mode standby 1.0uA | 0.35u low-leak process technology offers ultra low power supporting Li-Ion or 2xAlkaline battery support |
| <p>Dual-operation Flash</p> | <ul style="list-style-type: none"> Supports EEPROM function | Embedded dual-operation Flash memory feature supports data programming and erasing during execution |
| <p>LIN-UART</p> | <ul style="list-style-type: none"> Supports bus function for Local Interconnect Network (LIN). | Possible to set flexible & accurate baud rates from 2Mbps to 10Mbps |
| <p>ADC</p> | <ul style="list-style-type: none"> Conversion time 1.7us at 10MHz | High-speed, high-resolution ADC has selectable sampling & conversion time, depending on the external impedance without using any external components |
| <p>LCDC</p> | <ul style="list-style-type: none"> Auto blinking | Supports auto-blink settings for each segment, reducing software overhead |




F²MC-8L Family

Fujitsu's F²MC-8L family devices are single-chip microcontrollers that utilize Fujitsu's proprietary 8L core for low voltage and high-speed performance with a variety of embedded peripheral resources including DTMF, VFD, LCDC, I²C, LIN-UART, and remote control receiver. The internal RC oscillator, embedded Flash, and PLL clock multiplier circuit, for main and sub clocks, give the designer power and flexibility.

F²MC-8L Family Lineup



F²MC-8L Peripheral Features

| | | |
|---|---|---|
|  | <ul style="list-style-type: none"> Up to 24 segments static | <p>This type of display gives a bright light with great contrast. Used in applications such as display panels for audio visual or other home appliances.</p> |
|  | <ul style="list-style-type: none"> Can drive large LCD up to 280 pixels Supports internal booster | <p>Can drive 1/2, 1/3, 1/4 multiplex modes. Capable to drive LCD panel in sleep mode.</p> |
|  | <ul style="list-style-type: none"> CCITT all-tone output capable | <p>The DTMF generator generates standard telephone digits as the sum of sinusoids corresponding to a frequency table for each digit. DTMF has a variety of uses in telephone systems.</p> |



F²MC 8-bit Family

F²MC-8FX Family

| Series | Pin Count | Vcc Volts | Clock MHz (kHz) | ROM KB | ROM Type | RAM (Bytes) | Max I/O | LCDC SegxCom | Ext Inter ch | Composite Timer/Capture ch | ADC bit x ch | Timer 16bit ch | PPG ch | I2C ch | UART ch | Special Features |
|------------|-----------|-----------|-----------------|----------|----------------------|-------------|---------|--------------|--------------|----------------------------|--------------|----------------|--------|--------|---------|--|
| MB95100A/H | 64 | 3 or 5 | 10 (32) | 48 to 60 | Mask, Dual Op. Flash | 2K | 55 | | 12 | 2 | 10 x 12 | 3 | 4 | 1 | 2 | LIN-UART, Dual Operation Flash, Low-voltage Detect, CLK supervisor |
| MB95110A/H | 48/52 | 3 or 5 | 10 (32) | 32 to 60 | Mask, Dual Op. Flash | 1K to 2K | 40 | | 8 | 2 | 10 x 8 | 2 | 3 | 1 | 2 | |
| MB95120H | 100 | 5 | 10 (32) | 60 | Mask, Dual Op. Flash | 4K to 4K | 87 | 40x4 | 12 | 2 | 10 x 12 | 3 | 2 | 1 | 2 | |
| MB95130/H | 28 | 3 or 5 | 10 (32) | 16 to 32 | Mask, Dual Op. Flash | 512 to 1K | 20 | | 8 | 2 | 10 x 8 | 2 | 1 | | 2 | |
| MB95140/H | 32 | 3 or 5 | 10 (32) | 32 | Mask, Dual Op. Flash | 1K | 24 | | 8 | 2 | 10 x 8 | 1 | 2 | | 2 | |
| MB95150/H | 48/52 | 3 or 5 | 10 (32) | 32 | Mask, Dual Op. Flash | 1K | 40 | 16x4 | 8 | 2 | 10 x 8 | 1 | 2 | | 2 | |
| MB95160/H | 64 | 3 or 5 | 10 (32) | 32 | Mask, Dual Op. Flash | 1K | 55 | 32x4 | 12 | 2 | 10 x 12 | 3 | 2 | 1 | 2 | |

F²MC-8L Family

| Series | Pin Count | Vcc | Clock MHz (kHz) | ROM KB | ROM Type | RAM (Bytes) | Max I/O | Ext Bus IF | Ext Inter ch | Input Capture ch | Output Compare ch | ADC bit x ch | DAC bit x ch | Timer 16bit ch | PPG bit x ch | PWM 8bit ch | PWC 8bit | I2C ch | SIO ch | UART ch | Special Features | | |
|--------------|-----------|--------|-----------------|----------|--------------------|-------------|---------|------------|--------------|------------------|-------------------|--------------|--------------|----------------|--------------|-------------|----------|--------|--------|---------|---|---|--------------------------------|
| MB89051 | 64 | 3 or 5 | 3 | 32 | Mask/Flash | 2 | 41 | | 7 | | | | | | | 2 | | 1 | 2 | 1 | USB function & hub endpoint 4 | | |
| MB89120/A | 48 | 3 or 5 | 1.05 (32) | 4 to 16 | Mask | 128 to 256 | 36 | | 3 to 11 | | | | | | | | | | 1 | | Remote controller carrier generator | | |
| MB89130/A | 48 | 3 or 5 | 1.05 (32) | 4 to 16 | Mask, OTP | 128 to 256 | 36 | | 3 to 11 | | | 8 x 4 | | | | | | | | | VFD driver | | |
| MB89140/A | 64 | 5 | 2 (32) | 8 to 32 | Mask, OTP | 512 to 1024 | 54 | | 2 | | | 10 x 12 | | | 12 x 1 | 3 | | | | 1 | LCDC, remote controller carrier generator | | |
| MB89150/A | 80 | 3 or 5 | 1.05 (32) | 4 to 16 | Mask, OTP | 128 to 256 | 43 | | 12 | | | | | | | | | | | | LCDC, remote controller carrier generator | | |
| MB89160/A | 80 | 3 or 5 | 1.05 (32) | 4 to 16 | Mask, OTP | 128 to 512 | 54 | | 12 | | | 8 x 8 | | | | 2 | | | | 1 | LCDC, remote controller carrier generator | | |
| MB89170/A | 48 | 3 or 5 | 0.89 (32) | 8 to 32 | Mask, OTP | 384 to 512 | 37 | | 12 | | | | | | 1 | | | | | | DTMF generator | | |
| MB89170L | 48 | 3 or 5 | 1.79 (32) | 8 to 32 | OTP | 384 to 512 | 37 | | 12 | | | | | | 1 | 2 | | | | | | | |
| MB89180 | 64 | 3 or 5 | 1.05 (32) | 4 to 16 | Mask, OTP | 128 to 256 | 43 | | 12 | | | | | | 1 | | | | | | Remote controller carrier generator | | |
| MB89190/A/AH | 28 | 3 or 5 | 1.05 | 4 to 16 | Mask, OTP | 128 to 256 | 22 | | 11 | | | 8 x 8 | | 1 | | | | | | 1 | Remote controller carrier generator | | |
| MB89201 | 32/34 | 3 or 5 | 3.125 | 16 | Mask | 512 | 21 | | 11 | 2 | | 10 x 8 | | | 12 x 1 | 1 | | | | 1 | 1 | Buzzer, compact, Flash device | |
| MB89210 | 30/48 | 5 | 3.125 | 16 to 32 | Mask, OTP, Flash | 512 to 1024 | 21 | | 3 | 2 | | 10 x 8 | | | 12 x 1 | 1 | | | | 1 | 1 | LIN-UART, internal RC, remote control generator, Flash device | |
| MB89470 | 48 | 3 or 5 | 3.125 (32) | 16 | Mask, OTP | 512 | 39 | | 9 | | | 10 x 8 | | 2 | | 1 | 2 | | | 1 | 2 | UART | |
| MB89480 | 64 | 3 or 5 | 3.125 (32) | 16 | Mask, OTP | 512 | 42 | | 12 | | | 10 x 4 | | 2 | 6 x 1 | 1 | 1 | | | 1 | 1 | LCDC | |
| MB89490 | 100 | 3 | 3.125 (32) | 48 to 60 | ROM, Flash | 2048 | 66 | | 16 | | | 10 x 8 | | 2 | 6 x 1 | 1 | 1 | 1 | 1 | 1 | 1 | LCDC, Flash | |
| MB89530/A/H | 64 | 3 or 5 | 3.125 (32) | 16 to 48 | Mask, OTP, Flash | 512 to 2048 | 53 | | 11 to 12 | | | 10 x 8 | | 1 | 12 x 2 | 2 | 1 | 1 | 1 | 1 | 2 | UART, I2C | |
| MB89550A | 100 | 3 or 5 | 3.125 (32) | 32 to 48 | Mask, OTP | 1024 | 50 | | 12 | | | 10 x 8 | 2 | 3 | 6 x 1 | 2 | 1 | | | | 2 | LCDC | |
| MB89560/A/H | 80 | 3 or 5 | 3.125 (32) | 32 to 48 | Mask, OTP | 1024 | 50 | | 12 | | | 10 x 8 | | 1 | 12 x 1 | 2 | 1 | 1 | 1 | 1 | 2 | LCDC | |
| MB89570 | 100 | 3 | 2.5 (32) | 32 to 60 | Mask, OTP | 3072 | 82 | | 4 | | | 10 x 12 | 2 | 1 | | | | | 1 | 1 | 1 | I2C | |
| MB89580B/BW | 64 | 3 or 5 | 3.125 | 8 to 16 | Mask | 512 to 18K | 53 | | 8 | | | | | | | 2 | | | | | 1 | USB function | |
| MB89620/R | 64 | 3 or 5 | 2.5 | 0 to 32 | Mask, OTP, ROMless | 256 to 4K | 53 | Yes | 4 | 1 | | 8 x 8 | | 1 | | 1 | 1 | | | 2 | | | |
| MB89630/R | 64 | 3 or 5 | 2.5 (32) | 0 to 32 | Mask, OTP, ROMless | 512 to 1K | 53 | Yes | 4 | | | 10 x 8 | | 1 | | 2 | 1 | | | 1 | 2 | UART | |
| MB89650AR | 100 | 3 or 5 | 2.5 (32) | 8 to 32 | Mask, OTP | 256 to 1K | 64 | | 12 | | | 8 x 8 | | | | 2 | | | | | 1 | LCDC | |
| MB89660/R | 64 | 3 or 5 | 2.5 | 8 to 16 | Mask, OTP | 256 to 512 | 52 | | 4 | 2 | 2 | 8 x 8 | | 2 | | 1 | | | | | 1 | 1 | UART |
| MB89800 | 100 | 3 or 5 | 2.5 | 8 to 48 | Mask, OTP | 256 to 2K | 32 | | 2 | | | | | | 1 | 1 | | | | | 1 | 1 | LCDC |
| MB89820 | 80 | 3 or 5 | 1.25 | 4 to 16 | Mask, OTP | 128 to 256 | 32 | | 2 | | | | | | 1 | 1 | | | | | 1 | 1 | LCDC |
| MB89860/50 | 64/80 | 3 or 5 | 2.5 | 0 to 32 | Mask, OTP, ROMless | 256 to 1K | 38 | Yes | 4 | | 1 | 10 x 8 | | | | 2 | | | | | | 1 | AC motor control |
| MB89870 | 80 | 3 or 5 | 2.5 (32) | 16 | Mask, OTP | 512 | 45 | | 8 | | | 10 x 8 | | 1 | | 1 | | | | 1 | 1 | 1 | 4ch OP-Amp, LCDC, I2C |
| MB89920 | 80 | 3 or 5 | 2 | 8 to 48 | Mask, OTP | 1K | 45 | | 4 | 2 | 2 | 10 x 8 | | | 12 x 1 | 1 | | | | | 1 | 1 | LCDC |
| MB89930B | 30 | 3 or 5 | 2.5 | 16 | Mask, OTP | 512 | 21 | | 11 | | | 10 x 8 | | 1 | 12 x 1 | 1 | | | | | 1 | 1 | UART |
| MB89940 | 48 | 5 | 2 | 8 to 16 | Mask, OTP | 512 | 37 | | 3 | | | 10 x 2 | | | | 2 | | | | | | | Stepper motor controller, LCDC |
| MB89950 | 64 | 3 or 5 | 1.25 | 4 to 16 | Mask, OTP | 128 to 512 | 33 | | 2 | | | | | | 1 | 1 | | | | | 1 | 1 | LCDC |
| MB89960 | 48/64 | 3 or 5 | 1.05 (32) | 8 to 16 | Mask, OTP | 256 to 512 | 37 | | 11 | | | 10 x 4 | | 1 | | | | | | 1 | 1 | | UART, I2C, Flash |
| MB89980 | 64 | 3 or 5 | 1.05 | 32 | Mask | 128 | 52 | | 12 | | | 8 x 4 | | 1 | | 2 | | | | | | | Remote control generator |
| MB89990 | 28 | 3 or 5 | 1.05 | 32 | Mask | 128 | 22 | | 11 | | | | | | | | | | | | | | Remote control generator |
| MB89860/50 | 64/80 | 3 or 5 | 2.5 | 0 to 32 | Mask, OTP, ROMless | 256 to 1K | 38 | Yes | 4 | | 1 | 10 x 8 | | | | 2 | | | | | | 1 | AC motor control |
| MB89940 | 48 | 5 | 2 | 8 to 16 | Mask, OTP | 512 | 37 | | 3 | | | 10 x 2 | | 1 | | 2 | | | | | | | Stepper motor controller, LCDC |

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