F²MC-16LX Family 16-Bit Microcontroller for Automotive Applications: MB90420G/425G Series

A 16-bit microcontroller featuring the F²MC® core, a CAN controller, an LCD controller and stepper motor controller is ideal for automotive applications.

Features

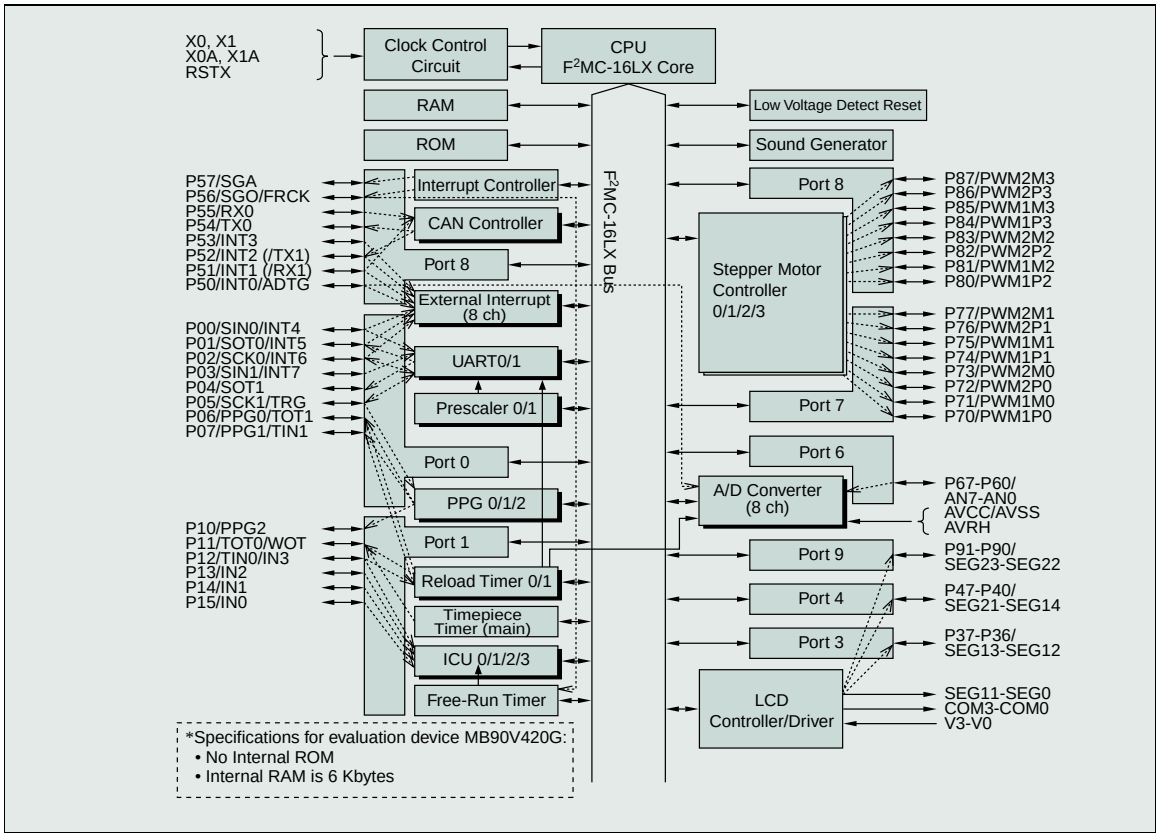
- ***Numerous timers with input capture and output compare***
- ***8-channel, 10-bit A/D converter***
- ***Low voltage detect circuitry***
- ***CPU operation detection circuitry***
- ***Built-in flash memory and RAM available***
- ***QFP-100 package***

Product Overview

The FUJITSU series of F²MC® system microcontrollers (FUJITSU Flexible Microcontrollers) now includes the MB90420G/425G Series of 16-bit microcontrollers. This new series of microcontrollers incorporates the FUJITSU original F²MC-16LX CPU and is designed for use in automotive applications.

The MB90420G/425G Series includes automotive LAN control functions (for full CAN), stepper motor control functions, timer functions for generating a variety of control signals, A/D converter, sound generator for alarms, UART functions, and LCD control functions. The built-in LCD controller is composed of a segment driver with 24 SEG pins capable of direct LCD panel drive. It also contains a common driver with four common pins, as well as a 16-byte display data RAM.

Figure 1. MB90420G/425G Series Block Diagram



The MB90420GA/425GA Series and the MB90420GB/425GB Series also provide built-in fail-safe functions, which prevent the device from becoming deadlocked. The fail-safe function uses a low-voltage detection circuit (LVR) to generate an internal reset signal whenever the voltage drops below a given level. It also uses a program looping detection circuit that is activated as soon as power is applied to the device. The program looping detection circuit produces periodic internal reset signals according to an internal counter to initialize the device. When the microcontroller is programmed, a sequence is regularly written to clear the internal counter so that the internal reset signals are not generated. Then, if for any reason the CPU does not operate according to the program, the internal counter is not cleared (as a signal that the CPU is not operating properly), and the device is automatically initialized.

". . . built-in fail-safe functions, which prevent the device from becoming deadlocked."

Customer system specifications determine whether to select the MB90420GA/425GA, the MB90420GB/425GB, or the MB90420GC/425GC Series.

The MB90F423G/F428G Series microcontroller is available with built-in 128-KB flash memory for additional flexibility in modifying embedded programs. Normally, microcontrollers with built-in flash memory require two power supply systems for write/erase and read applications. However, FUJITSU microcontrollers with built-in flash memory provide internal step-up circuits that allow the device to operate from a single power supply. This simplifies system power supply design and reduces the cost and size of the device.

". . . internal step-up circuits that allow the device to operate from a single power supply."

Table 1. MB90420G/425G[1] Series Built-In Peripheral Functions

Function	Description
16-Bit Input Capture (4 channels)	Detects Rising or Falling Edge or Both Edges 16-Bit Capture Register x 4 Detects Edge on Pin Input, Latches the 16-Bit Free-Run Timer and Generates an Interrupt Request
16-Bit Reload Timer (2 channels)	16-Bit Reload Timer Operation (select toggle output or one-shot output) Event Count Function Available
Timepiece Timer (main clock)	Operates Directly from the Oscillator Clock Signal Oscillator Variation Compensation Accepted Read-, Write-Enabled Second/Minute/Hour Register Signal Interrupt
16-Bit PPG (3 channels)	Output Pin x 3, External Trigger Input Pin x 1 Oscillator Clock Frequency: fcp, fcp/4, fcp/16, fcp/64
Delay Interrupt	Generates Interrupts for Task Switching Software Can Enable/Disable Interrupts to CPU
External Interrupts (8 channels)	8 Independent Channels Interrupt Sources: Selection of 'L' to 'H' Edge, 'H' to 'L' Edge, 'L' Level, or 'H' Level
A/D Converter	10-Bit or 8-Bit Resolution x 8 Channels (input multiplexing) Conversion Time: 6.13 µs or Less (at fcp = 16 MHz) External Trigger Available (P50/INT0/ADTG) Internal Timer Start Available (16-bit reload timer 1)
UART (8 channels)	Full Duplex Double Buffer Type Supports Asynchronous/Synchronous Transfer (with start/stop bit) Internal Timer Can Be Used as a Clock (16-bit reload timer 0) Asynchronous Speed: 4,808 bps, 5,208 bps, 9,615 bps, 10,417 bps, 19,230 bps, 38,460 bps, 62,500 bps, 500,000 bps Synchronous Speed: 500 Kbps, 1 Mbps, 2 Mbps (at fcp = 16 MHz)
CAN Interface[1]	Conforms to CAN Specification Version 2.0 Part A and B, Automatic Resend in case of Error Automatic Transfer with Remote Frame 16-Message Buffer with Sequencing for Data and ID Supports Multiple Messaging Receiving Filter Has Flexible Configuration: All Bit Compare/All Bit Mask/2-Area Partial Bit Mask Supports up to 1 Mbps CAN Wakeup Function (RX internally connected to INT0)
LCD Controller/Driver (1 channel)	A Segment Driver Capable of Directly Driving an LCD Display Panel and a Common Driver Common (COM) Outputs: 4, Segment (SEG) Outputs: 24 Display Data RAM: 16 x 8 Dots
Low Voltage/Program Looping Detect Reset[2]	Automatic Reset when Low Voltage Is Detected Program Looping Detection Available
Stepper Motor Controller (4 channels)	High Current Output on all 4 Channels Synchronized 8/10-Bit PWM x 2 on All Channels

Table 1. MB90420G/425G[1] Series Built-In Peripheral Functions, continued

Function	Description
Sound Generator	8-Bit PWM Signals Are Mixed with Tone Frequencies from the 8-Bit Reload Counter PWM Frequencies: 62.5 kHz, 31.2 kHz, 15.6 kHz, 7.8 kHz (at fcp –16 MHz) Tone Frequency = PWM Frequency / 2 / (reload value + 1)
Input/Output Ports	Push-Pull Output and Schmitt Trigger Output Programmable in Bit Units for Input/Output or Peripheral Signals
Flash Memory	Auto Programming, Embedded Algorithm,™ Supports Write/Erase/Erase Pause/Erase Resume Commands Flag Signals Completion of Algorithms Boot Block Configuration Erasable by Block Each Bank Protected by Voltage During Programming

[1]The MB90420G Series has two built-in channels, and the MB90425G Series has one built-in channel.
[2]Provided in the MB90420GA Series, not provided in the MB90420GC/425GC Series.

Product Features

Table 1 (see pp. 11-12) shows the built-in peripheral functions, and Table 2 (see pp. 14-15) lists the models in the series. Figure 1 (see p. 10) shows a block diagram and Figures 2 and 3 (see p. 13) show the pin assignments.

Development Environment

This series is supported by the FUJITSU integrated development environment Softune® V3 software, which was developed to meet a variety of requirements of programmers and designed with ease of use in mind. The hardware is compatible with the MB2140 emulator series for the F^{2}MC family, which supports real-time debugging.

Table 3 (see p. 15) lists the development tools. ◆

Endnotes

F^{2}MC and Softune are registered trademarks of FUJITSU, Ltd.

Embedded Algorithm is a trademark of Advanced Micro Devices, Inc.

Figure 2. LQFP-100 Pin Assignments

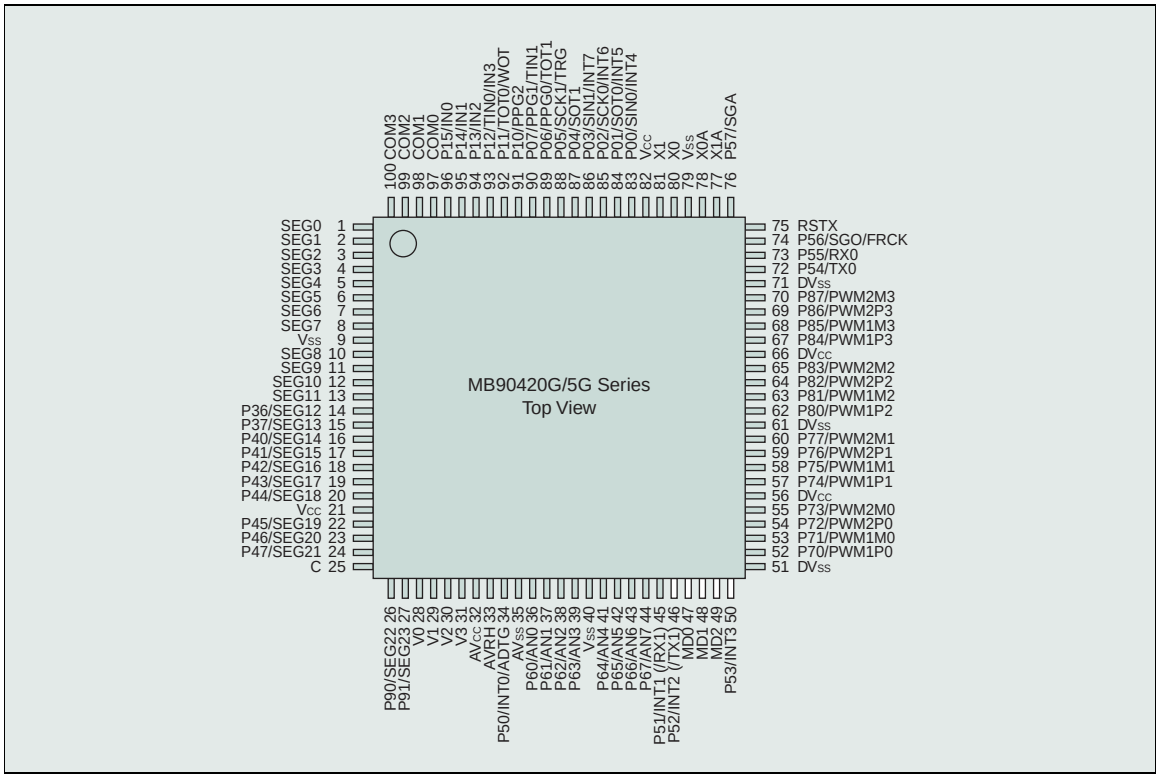


Figure 3. QFP-100 Pin Assignments

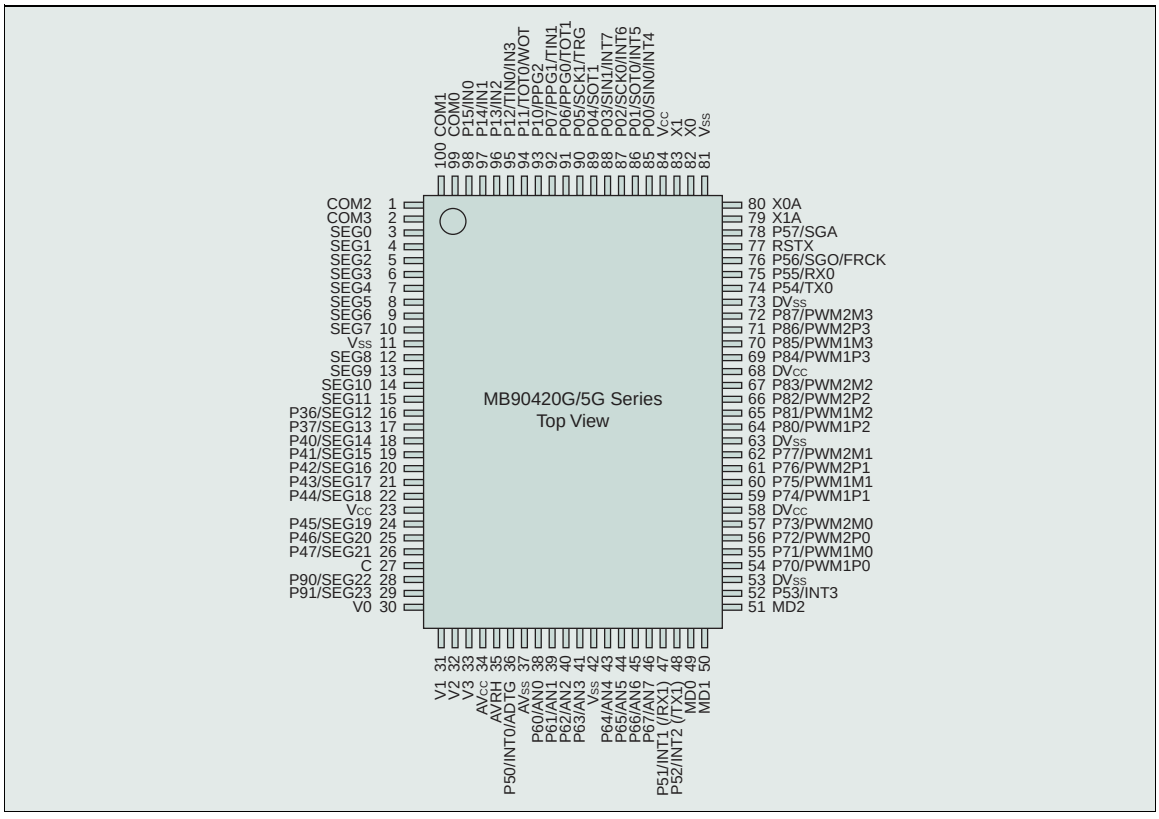


Table 2. Product Series Configuration

MB90420G Series Product Configuration

Feature	MB90V420G	MB90F423GA*	MB90F423GB**	MB90F423GC**	MB90423GA**	MB90423GB**	MB90423GB**
Product Composition	EVA Model	Flash Model			Mask ROM Model		
CPU	F^2MC-16X CPU						
Clock	2 Systems	1 System	2 Systems		1 System	2 Systems	
System Clock	On-Chip PLL Clock Multiplier Type (x1, x2, x3, x4, 1/2 when PLL is stopped) Minimum Instruction Execution Time: 62.5 ns (4 MHz base oscillator x4)						
ROM	External	Flash ROM 128 KB			Mask ROM 128 KB		
RAM	6 KB	6 KB			6 KB		
CAN Interface	2 Channels						
Low Voltage/Program Looping Detect Reset	No	Yes		No	Yes		No
Package	PGA-256	QFP100, LQFP100					
Emulator Dedicated Supply	No	—					

*Under Development
**Will Be Developed

Table 2. Product Series Configuration, continued

MB90425 Series Product Configuration

Feature	MB90F428 GA*	MB90F428 GB**	MB90F428 GC**	MB90427 GA**	MB90427 GB**	MB90428 GC**	MB90428 GA*	MB90428 GB**	MB90428 GC**
Product Composition	Flash Model			Mask ROM Model					
CPU	F^2MC-16X CPU								
Clock	1 System	2 Systems		1 System	2 Systems		1 System	2 Systems	
System Clock	On-Chip PLL Clock Multiplier Type (x1, x2, x3, x4, 1/2 when PLL is stopped) Minimum Instruction Execution Time: 62.5 ns (4 MHz base oscillator x4)								
ROM	Flash ROM 128 KB			Mask ROM 64 KB			Mask ROM 128 KB		
RAM	6 KB			4 KB			6 KB		
CAN Interface	1 Channel								
Low Voltage/ Program Looping Detect Reset	Yes		No	Yes		No	Yes		No
Package	QFP100, LQFP100								
Emulator Dedicated Supply	—								

*Under Development
*Will Be Developed

Table 3. Development Tools

Hardware	Main Unit MB2141A
	Emulation Pod MB2145-507
	Probe Cable MB2132-464
Software	Softune V3 Workbench
	Softune V3 C Compiler
	Softune V3 Assembler
	Softune V3 C Analyzer
	Softune V3 C Checker