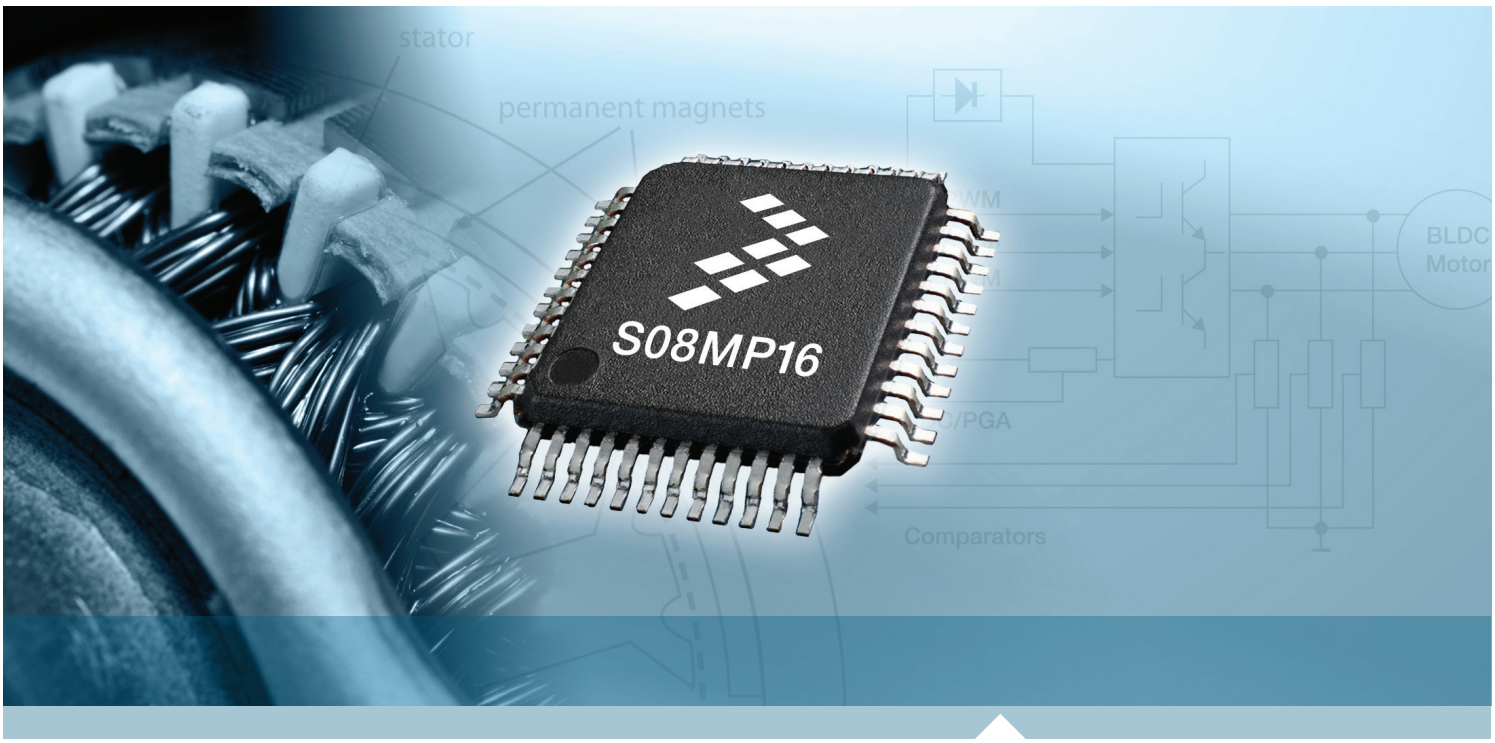

8-bit microcontrollers

S08MP16 Family

Applications

- Sensor and sensorless brushless DC motor control
  - Electric fuel pump
  - Window lift
  - Fan control
- High-brightness LEDs

Overview

MP16 is an 8-bit S08 microcontroller that enables precise control of brushless DC motors and high-brightness LED applications. It offers such features as 40 MHz CPU performance, three analog comparators, six PWMs, an LED driver and a programmable gain amplifier, all of which are well suited for these applications.

Designing the MP16 controller into new applications has been made easier because its non-intrusive, single wire background debug module (BDM) allows a user to read registers without stopping execution on the chip. Changes can be made in-application and in real time, which can significantly reduce development time and allow debug access in constrained locations. Integrated on-chip components eliminate the need for an external crystal, LVI circuit, voltage regulator, I/O mux, watchdog circuit, ADC and some development tools, which helps lower costs, save board space and improve overall quality.

S08MP16 Block Diagram

SPI	16 KB Flash		13-ch., 12-bit ADC with Temperature Sensor
SCI	1 KB RAM		(6+2)-ch., 16-bit FlexTimer with PWM functions
I^2C	BDM/ICE		Programmable Gain Amplifier
RTC	CRC Generator	ICS	Programmable Delay Blocks (x2)
8-bit MTIM	KBI	COP/Watchdog	High-Speed Analog Comparators (x3)
5-bit DAC (x3)	**40 MHz S08 CPU, 20 MHz Bus**		48-pin LQFP

■ Core

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Version	Bus Freq.	Flash	RAM	UART	SPI	I²C	Analog (ADC)	Timer	Clock	Additional Features	Operating Voltage	Temp.	Package
Automotive	20 MHz	16 KB	1 KB	1 x SCI	1	1	13-ch., 12-bit, 3 Comparators	6 ch. + 2 ch. 16-bit FlexTimer with PWM Functions and Automatic Fault Protection Inputs	ICS	Programmable Gain Amplifier, 2 x Programmable Delay Block (PDB), 8-bit Modulotimer Module (MTIM), COP, ICE, BDM, POR, KBI, Temp. Sensor	2.7V–5.5V	-40°C to +125°C	48-pin LQFP

System Challenges	MP16 Solution
Brushless DC Motor Control	
Smooth sensorless BLDC control across a wide speed range	• Motor control dedicated 6-channel PWM timers with dead-time insertion • Three analog comparators working in conjunction with on-board timers to capture back EMF zero-crossing events to provide accurate rotor position timing. Obtaining this information with analog comparators enables the motor to run smoothly across a wide speed range with no speed jittering. Jittering is a serious concern that hampers efficiency, generates noise and causes mechanical wear.
Save cost by eliminating off-chip components	• On-chip programmable gain amplifier (PGA) can replace the op amp by monitoring motor current, providing operating safety and direct torque control • Freescale provides MOSFET drivers that interface the MP16 to the power stage • On-board ICS with 1.5 percent accuracy eliminates the need for an external clock or resonator when receiving messages over a LIN bus through the SCI module
High-Brightness LEDs	
Precise sense and control of the LED's current to generate consistent brightness and color	• 6-channel PWM with 16-bit resolution and up to 40 MHz clock speed enables high-frequency and high-resolution PWM generation • 12-bit ADC with HW trigger from PWM module allows conversion at any point in the PWM cycle • One programmable gain amplifier (PGA) allows the use of a very small external sense resistor • Analog comparator works in conjunction with the PWM to enable quick LED current regulation
Protecting against over-temperature and over-voltage to extend the LED's lifecycle	• Internal temperature sensor • PWM module with emergency shutdown feature • Very quick analog comparators with PWM shutdown features provide over-voltage protection
Save cost by eliminating off-chip components	• On-chip PGA can replace op amp • High frequency PWMs reduce size and cost of external components (DC/DC inductor, for instance)

Temperature Options

Part Number	Temp Ranges (Ta)
S9S08MP16CLF	-40°C to +85°C
S9S08MP16VLF	-40°C to +105°C
S9S08MP16MLF	-40°C to +125°C

Development Tools

Demonstration board, DEMO9S08MP16

BDM multilink, USBMULTILINKBDME

- Real-time in-circuit debug through BDM interface
- Fast in-circuit flash programming
- USB-to-BDM interface

Cyclone Pro, M68CYCLONEPROE

- Provides all the capabilities of the BDM multilink, plus USB/Ethernet interfaces, the ability to function as a stand-alone programmer with push buttons and LEDs to control operation

CodeWarrior™ development software

- Visit **freescale.com/codewarrior** for complete details.

Emulation support (ICE)

- Built-in, on-chip support

Learn More: For more information about automotive microcontroller products, please visit **www.freescale.com/automotive**.

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