



# Z8FMC16100 Series

## Product Brief

PB016607-0308



### Product Block Diagram

|  |                                  |                               |
|--|----------------------------------|-------------------------------|
| 12-Bit PWM Module for Motor Control      | 16-Bit Timer Capture/Compare/PWM | Operational Amplifier         |
| Up to 16 KB Flash                        | 20 MHz eZ8™ CPU                  | 8-Channel 10-Bit ADC          |
| 512 B SRAM                               |                                  | VBO/POR and Reset Control     |
| I <sup>2</sup> C, SPI, and UART with LIN |                                  |                               |
| Watchdog Timer                           | Single-Pin Debugger              | Internal Precision Oscillator |
| Comparator                               |                                  | Interrupt Controller          |
| 17 General Purpose I/O Pins              |                                  |                               |

### Overview

Zilog's Z8FMC16100 Series Flash microcontrollers, a part of the Z8 Encore! MC™ family of motor control devices, are based on Zilog's advanced eZ8™ 8-bit CPU core. Optimized for motor control applications, these devices support the control of Single and Multiphase variable-speed motors. Target applications are large appliances, small appliances, HVAC, automotive, power tools, and personal care devices.

Z8FMC16100 Series Flash MCUs feature a flexible pulse width modulator (PWM) module with three complementary pairs or six independent PWM outputs supporting dead-band operation and fault protection trip input. These features provide multiphase control capability for a variety of motor types and ensure safe operation of the motor by

providing Pulse-by-Pulse or latched fast shutdown of the PWM pins during fault condition.

Z8FMC16100 Series MCU features up to eight single-ended channels of 10-bit analog-to-digital conversion, with a sample and hold circuit. It also features one operational amplifier for current sampling and one comparator for over-current limiting or shutdown.

A high-speed analog-to-digital converter (ADC) enables voltage, current, and back-EMF sensing, while dual-edge interrupts and a 16-bit timer provide a Hall-effect sensor interface.

A full-duplex 9-bit UART provides serial, asynchronous communication and supports the local interconnect network (LIN) serial communications protocol. The LIN bus is a cost-efficient Single Master, Multiple Slave organization that supports speed up to 20 kbps.

Included in its rich-set of peripherals are other features such as: one additional 16-bit timer with Capture/Compare/PWM capability, SPI or I<sup>2</sup>C Master/Slave for serial communication, and an internal precision oscillator (IPO).

The single-pin debugger and programming interface simplifies code development and allows easy in-circuit programming.

### Z8FMC16100 Series MCU Features

The features of Z8FMC16100 Series MCU include:

- 20 MHz eZ8 CPU core
- Up to 16 KB Flash program memory
- 512 B register SRAM

- Fast 8-channel 10-bit ADC for current sampling and back-EMF detection
- 12-bit PWM module with three complementary pairs or six independent PWM outputs with dead-band generation and fault trip input
- One 16-bit timer with Capture/Compare/PWM capability
- One analog comparator for current limiting or over current shutdown
- One operational amplifier provides current level-shifting and amplification for ADC current sampling
- I<sup>2</sup>C in MASTER, SLAVE, and MULTIMASTER modes
- SPI controller
- UART with LIN interface
- Internal Precision Oscillator (IPO)
- Oscillator supports either internal IPO or external crystals and ceramic resonators
- 17 General-Purpose I/O pins (GPIO)
- Voltage Brownout/Power-On Reset (VBO/POR)
- Watchdog Timer (WDT) with internal RC oscillator
- Single-Pin On-Chip Debugger
- In-circuit serial programming
- Operating at 2.7 V to 3.6 V
- 32-pin QFN and LQFP packages
- Lead-free packaging option
- Standard and extended temperature ranges: 0 °C to 70 °C (standard) and -40 °C to +105 °C (extended)
- Up to 20 interrupts with configurable priority

## eZ8™ CPU Features

The features of eZ8 CPU include:

- New instructions for improved performance including BIT, BSWAP, BTJ, CPC, LDC, LDCI, LEA, MULT, and SRL
- Compatible with existing Z8® code
- Up to 10 MIPS operation
- C-Compiler friendly
- 2 to 9 clock cycles per instruction

## Architecture

Figure 1 displays the Z8FMC16100 Series MCU block diagram.

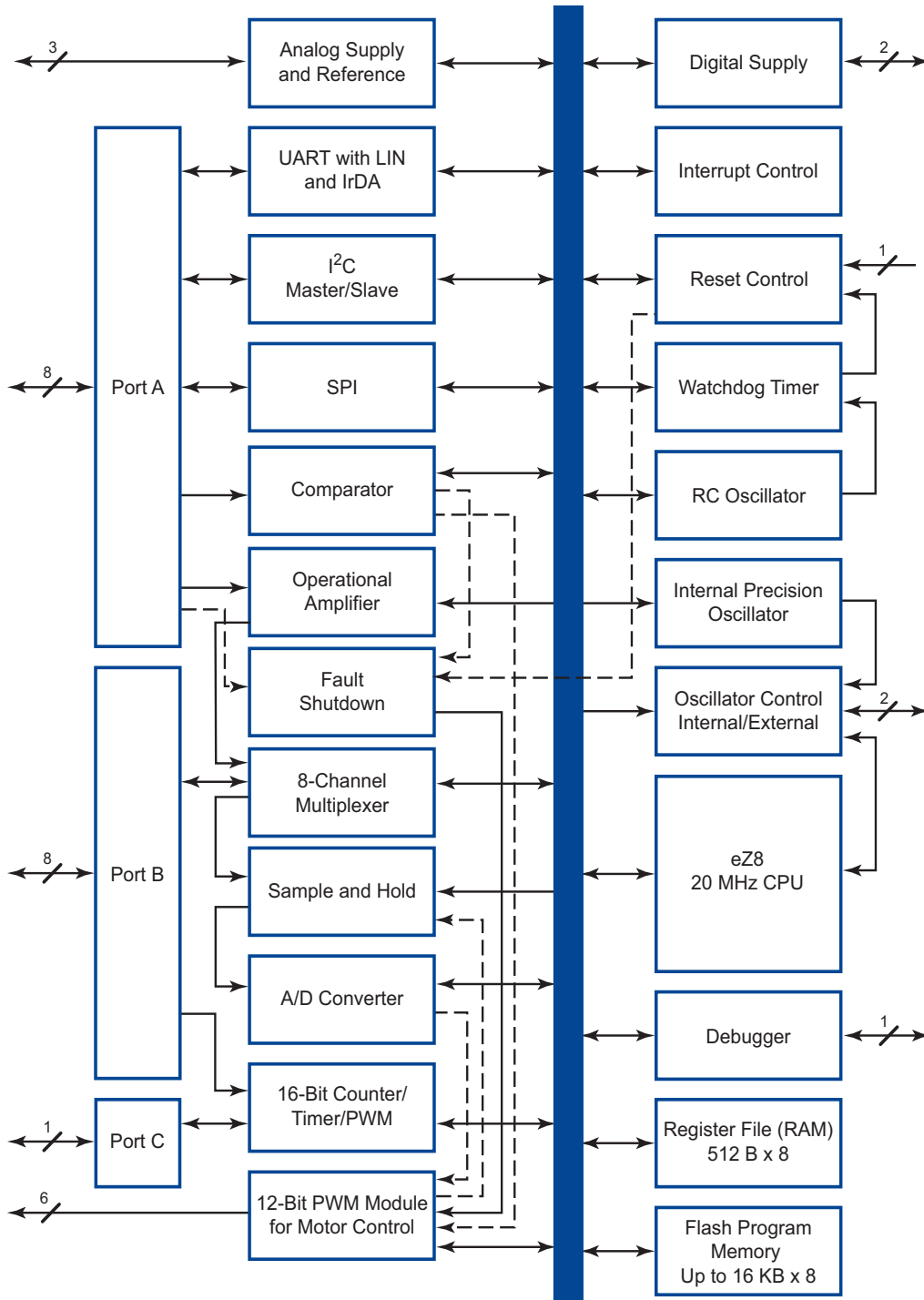


Figure 1. Z8FMC16100 Series MCU Block Diagram

## Ordering Information

Table 1 provides the basic features available for each device within the Z8FMC16100 Series product line. Table 2 provides ordering information for the Z8FMC16100 Series products, by part number. See [Part Number Suffix Designations](#) on page 6 for product numbering details.

**Table 1. Z8FMC16100 Series Part Selection Guide**

| Product Feature                                   | Z8FMC16100 | Z8FMC08100 | Z8FMC04100 |
|---|------------|------------|------------|
| Flash (KB)  | 16         | 8          | 4          |
| SRAM (B)  | 512        | 512        | 512        |
| General-Purpose I/O                               | 17         | 17         | 17         |
| Motor Control PWM Channels                        | 6          | 6          | 6          |
| ADC Inputs  | 8          | 8          | 8          |
| Operational Amplifier                             | Yes        | Yes        | Yes        |
| Comparator  | Yes        | Yes        | Yes        |
| 16-bit Standard Timers with Capture, Compare, PWM | Yes        | Yes        | Yes        |
| UART with support for LIN and IrDA                | Yes        | Yes        | Yes        |
| I <sup>2</sup> C                                  | Yes        | Yes        | Yes        |
| SPI Controller                                    | Yes        | Yes        | Yes        |
| Watchdog Timer                                    | Yes        | Yes        | Yes        |
| 5.5296 MHz Internal Precision Oscillator          | Yes        | Yes        | Yes        |

Each of the parts listed in Table 2 is available in a lead-free package that conforms to responsible environmental standards. For more information regarding ordering, contact your local Zilog<sup>®</sup> sales office. Zilog web site, [www.zilog.com](http://www.zilog.com), lists all regional offices and provides additional Z8FMC16100 Series product information.



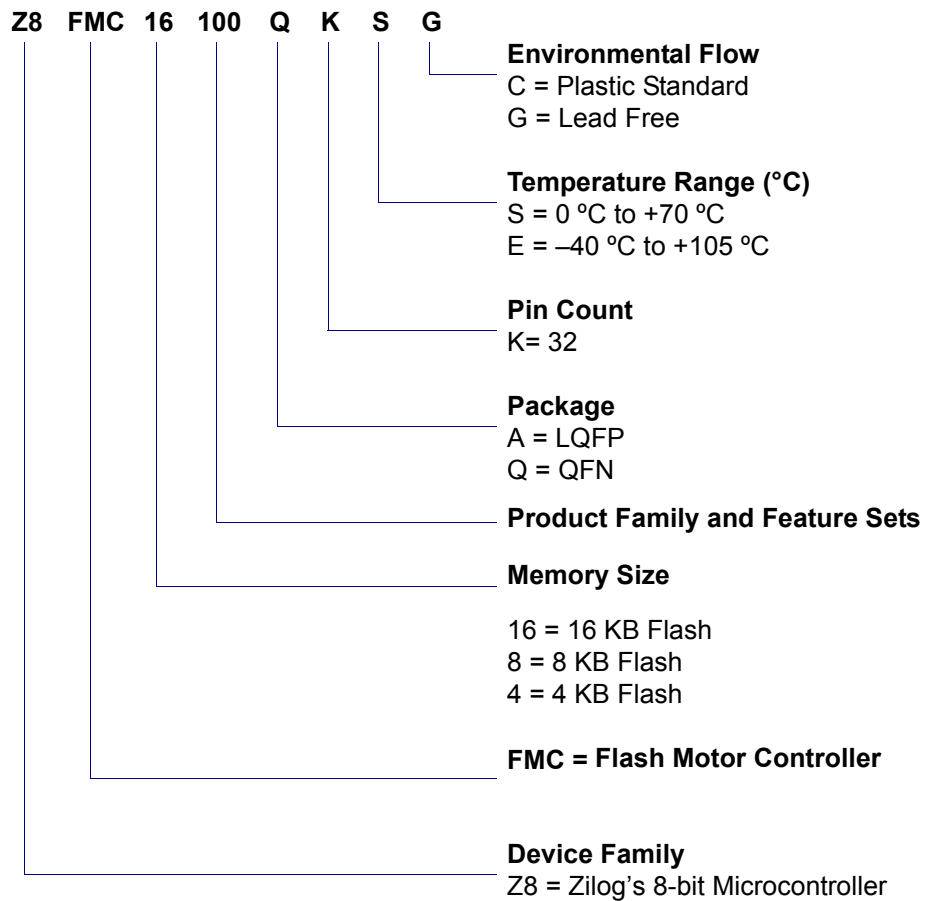
Table 2. Ordering Information for the Z8FMC16100 Series Products\*

| Part Number   | Flash<br>KB<br>(Bytes)  | SRAM<br>Bytes | GPIO | Max.<br>Speed<br>(MHz) | I <sup>2</sup> C/SPI | Trimmed<br>IPO | Package | Temp (°C)   |
|---|---|---------------|------|------------------------|----------------------|----------------|---------|-------------|
| <b>Z8FMC16100 with 16 KB Flash and 512 B SRAM</b>   |   |               |      |                        |                      |                |         |             |
| Z8FMC16100QKSG  | 16  | 512           | 17   | 20                     | I <sup>2</sup> C/SPI | Y              | QFN-32  | 0 to +70    |
| Z8FMC16100QKEG  | (16,384)  |               |      |                        |                      |                |         | -40 to +105 |
| Z8FMC16100AKSG  | 16  | 512           | 17   | 20                     | I <sup>2</sup> C/SPI | Y              | LQFP-32 | 0 to +70    |
| Z8FMC16100AKEG  | (16,384)  |               |      |                        |                      |                |         | -40 to +105 |
| <b>Z8FMC08100 with 8 KB Flash and 512B SRAM</b>   |   |               |      |                        |                      |                |         |             |
| Z8FMC08100QKSG  | 8   | 512           | 17   | 20                     | I <sup>2</sup> C/SPI | Y              | QFN-32  | 0 to +70    |
| Z8FMC08100QKEG  | (8,192)   |               |      |                        |                      |                |         | -40 to +105 |
| Z8FMC08100AKSG  | 8   | 512           | 17   | 20                     | I <sup>2</sup> C/SPI | Y              | LQFP-32 | 0 to +70    |
| Z8FMC08100AKEG  | (8,192)   |               |      |                        |                      |                |         | -40 to +105 |
| <b>Z8FMC04100 with 4 KB Flash and 512B SRAM</b>   |   |               |      |                        |                      |                |         |             |
| Z8FMC04100QKSG  | 4   | 512           | 17   | 20                     | I <sup>2</sup> C/SPI | Y              | QFN-32  | 0 to +70    |
| Z8FMC04100QKEG  | (4,096)   |               |      |                        |                      |                |         | -40 to +105 |
| Z8FMC04100AKSG  | 4   | 512           | 17   | 20                     | I <sup>2</sup> C/SPI | Y              | LQFP-32 | 0 to +70    |
| Z8FMC04100AKEG  | (4,096)   |               |      |                        |                      |                |         | -40 to +105 |
| <b>Z8FMC16100 Series Development Tools</b>  |   |               |      |                        |                      |                |         |             |
| Z8FMC160100KITG   | Z8FMC16100 Series Development Kit                                 |               |      |                        |                      |                |         |             |
| Z8FMC161000ZEM  | Z8 Encore! Z8FMC16100 Series In-Circuit Emulator Development Tool |               |      |                        |                      |                |         |             |
| ZUSBOPTSC01ZACG   | USB Opto-isolated Smart Cable Accessory Kit                       |               |      |                        |                      |                |         |             |
| <b>Z8FMC16100 Series Development Tools</b>  |   |               |      |                        |                      |                |         |             |
| *Factory programming of the devices in this table are available upon request from Zilog®. |   |               |      |                        |                      |                |         |             |



## Part Number Suffix Designations

Zilog part numbers consist of a number of components. This section describes an example part number, Z8FMC16100QKSG, to indicate each component's description.





**Warning:** DO NOT USE IN LIFE SUPPORT

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