



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China





ZNEO CPU-Based Motor Control

MultiMotor Series Development Kit

User Manual

UM026204-0616

***MultiMotor
Series***



Warning: DO NOT USE THIS PRODUCT IN LIFE SUPPORT SYSTEMS.

LIFE SUPPORT POLICY

ZILOG'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF ZILOG CORPORATION.

As used herein

Life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

Document Disclaimer

©2016 Zilog, Inc. All rights reserved. Information in this publication concerning the devices, applications, or technology described is intended to suggest possible uses and may be superseded. ZILOG, INC. DOES NOT ASSUME LIABILITY FOR OR PROVIDE A REPRESENTATION OF ACCURACY OF THE INFORMATION, DEVICES, OR TECHNOLOGY DESCRIBED IN THIS DOCUMENT. ZILOG ALSO DOES NOT ASSUME LIABILITY FOR INTELLECTUAL PROPERTY INFRINGEMENT RELATED IN ANY MANNER TO USE OF INFORMATION, DEVICES, OR TECHNOLOGY DESCRIBED HEREIN OR OTHERWISE. The information contained within this document has been verified according to the general principles of electrical and mechanical engineering.

ZNEO is a trademark or registered trademark of Zilog, Inc. All other product or service names are the property of their respective owners.

Revision History

Each instance in the Revision History table below reflects a change to this document from its previous version.

Date	Revision Level	Description	Page No
Jun 2016	04	Added Z32F128 Module description and features	5 , 9 , 11 , 14 , 30 , 31
Jan 2015	03	Corrected footer in Appendix.	26-33
Oct 2014	02	Updated throughout based on debundling of the Opto-Isolated SmartCables from the MultiMotor Series development kits.	All
Oct 2013	01	Original issue	n/a

Table of Contents

Revision History	iii
Table of Contents	iv
List of Figures	vi
List of Tables	vii
Introduction	1
Kit Features	1
MCU Module	4
MCU Module Features	5
Z32F128 MCU	5
Z16FMC Series MCUs	6
Z8FMC16100 Series MCUs	7
Z51F3220 MCU	8
Connectors, Headers, Jumpers, and Switches	9
MultiMotor Series Development Board Connector	10
Signal Header	13
Debug Connector	14
UART Connector	15
I2C Connector	16
5VIN Connector	17
Jumper and Switch Settings	17
V _{BUS} Control Select Jumper	17
UART Flash Select Jumper	18
Sensor Select Jumper	18
Reset Switch	19
Stop/Run Switch	19
Direction Switch	19
Speed Potentiometer	19
Fault1 Switch	19
MultiMotor Series Development Board	20
MultiMotor Series Development Board Features	20
Connectors, Headers, Jumpers, and Switches	21
MCU Module Connector	22
Motor Phase Connector	22
Motor Position Sensor Connector	22
Tachometer Input Connector	23
External V _{BUS} Power Connector	23

Jumper and Switch Settings	24
Motor Type Selection (J4)	24
VBUS Selection: 24V (Internal) or External (J9)	24
Power MOSFETs and Gate Drivers	25
ZDS II IDE Support	26
Linux Motor Wiring Information	27
Appendix A. Schematic Diagrams	28
Customer Support	38

List of Figures

Figure 1.	A Fully Assembled MultiMotor Series Development Kit	2
Figure 2.	MultiMotor Series Motor Control Development Kit Block Diagram	3
Figure 3.	A Zilog Z16FMC MCU Module	4
Figure 4.	MultiMotor Series Development Board Connector, Z16FMC MCU Module 10	
Figure 5.	MultiMotor Series Development Board Connector, Z32F128 MCU Module . 11	
Figure 6.	Signal Header, Z16FMC MCU Module	13
Figure 7.	Signal Header, Z32F128 MCU Module	13
Figure 8.	Debug Connector, Z16FMC MCU Module	15
Figure 9.	UART Connector, Z16FMC MCU Module	16
Figure 10.	I2C Connector, Z51F3220 MCU Module	16
Figure 11.	MultiMotor Series Development Board	20
Figure 12.	External Power Connector	23
Figure 13.	MultiMotor Series Development Board Schematic, #1 of 2	28
Figure 14.	MultiMotor Series Development Board Schematic, #2 of 2	29
Figure 15.	Z32F128 MCU Module Schematic, #1 of 2	30
Figure 16.	Z32F128 MCU Module Schematic, #2 of 2	31
Figure 17.	Z16FMC MCU Module Schematic, #1 of 2	32
Figure 18.	Z16FMC MCU Module Schematic, #2 of 2	33
Figure 19.	Z8FMC16100 MCU Module Schematic, #1 of 2	34
Figure 20.	Z8FMC16100 MCU Module, #2 of 2	35
Figure 21.	Z51F3220 MCU Module Schematic, #1 of 2	36
Figure 22.	Z51F3220 MCU Module Schematic, #2 of 2	37

List of Tables

Table 1.	MCU Module Connectors, Jumpers, and Controls	9
Table 2.	MultiMotor Series Development Board Signals to the Z16FMC MCU Module 11	
Table 3.	Signal Header Pin Outputs	14
Table 4.	Debug Connector Signal Descriptions	15
Table 5.	UART Connector	16
Table 6.	I2C Connector	17
Table 7.	V _{BUS} Enable Jumper	17
Table 8.	V _{BUS} Enable Port	18
Table 9.	UART Flash Select Jumper Settings	18
Table 10.	Sensor Select Jumper Settings	18
Table 11.	Connectors, Jumpers, and Controls on the MultiMotor Series Development Board 21	
Table 12.	3-Phase Power Connector	22
Table 13.	Hall Sensor Connector	22
Table 14.	External V _{BUS} Power Connector	23
Table 15.	Motor Type Jumper	24
Table 16.	V _{BUS} Selection Jumper	24
Table 17.	Motor Wiring Information	27

Introduction

Zilog's MultiMotor Series Development Kit (ZMULTIMC100ZCOG) aids in the development of motor control applications using an assortment of Zilog MCUs aimed at the motor control environment. It provides an application-specific platform for creating a design using a Zilog motor control MCU. This development platform features a 3-phase MultiMotor Series Development Board connected to a Zilog MCU Module, which is available separately.

A 24 V DC/3200RPM 3-phase motor is included with the Kit. Several motor types are supported, including BLDC, PMSM, and ACIM. Control algorithms including sensored, trapezoidal, sinusoidal, Field Oriented Control (FOC), and sensorless block commutation are also supported in this MultiMotor Series.

► **Note:** This version of the MultiMotor Series Development Kit does not include a MultiMotor Series MCU Module, which must be purchased separately to use this kit. Each of Zilog's MultiMotor Series MCU modules features a different Zilog MCU capable of motor control and contains a debug connector to connect the board to a host development PC via an opto-isolated USB SmartCable.

Kit Features

The key features of the MultiMotor Series Development Kit include:

- 3-phase MultiMotor Series Development Board capable of driving multiple motor types
- Multiple MCU modules using different Zilog microcontrollers designed specifically for motor control (must be ordered separately)
- 3-phase, 24 V DC, 30 W, 3200RPM motor with Internal Hall Sensors capable of running in Sensored or Sensorless modes
- UART-to-USB adapter with opto-isolator
- Universal 24 V AC/DC power supply
- USB SmartCable with opto-isolator (must be ordered separately)

For MultiMotor Series Development Kit installation and setup instructions, refer to the [MultiMotor Series Development Kit Quick Start Guide \(QS0091\)](#). This document is available free for download from zilog.com.


 **Caution:** Zilog highly recommends using the Opto-Isolated SmartCable due to the higher voltages present on the MultiMotor Series Development Board which could be detrimental to a host computer.

Figure 1 shows the hardware required to fully utilize the MultiMotor Series Development Kit.

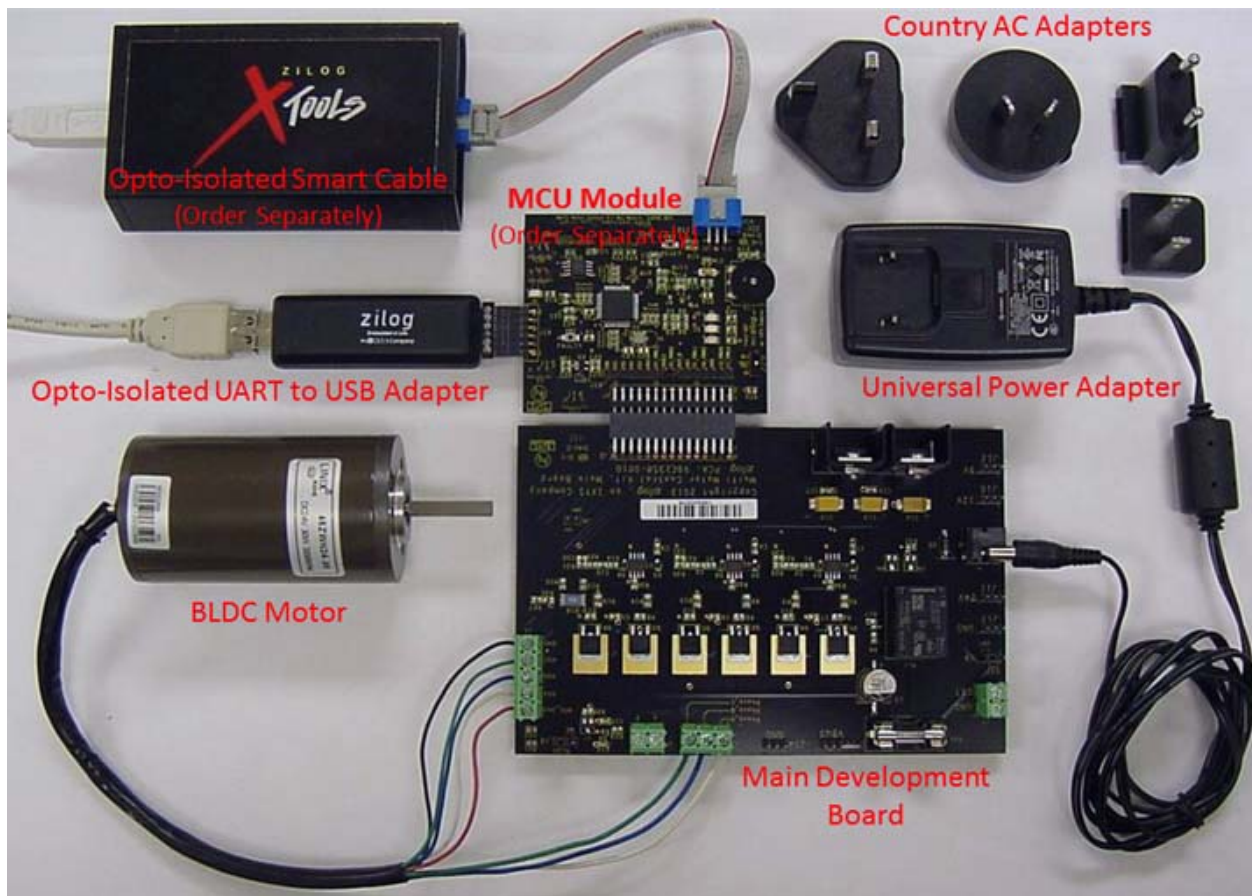


Figure 1. A Fully Assembled MultiMotor Series Development Kit

Figure 2 presents a basic block diagram of the MultiMotor Series Development Board and its companion MCU Module.

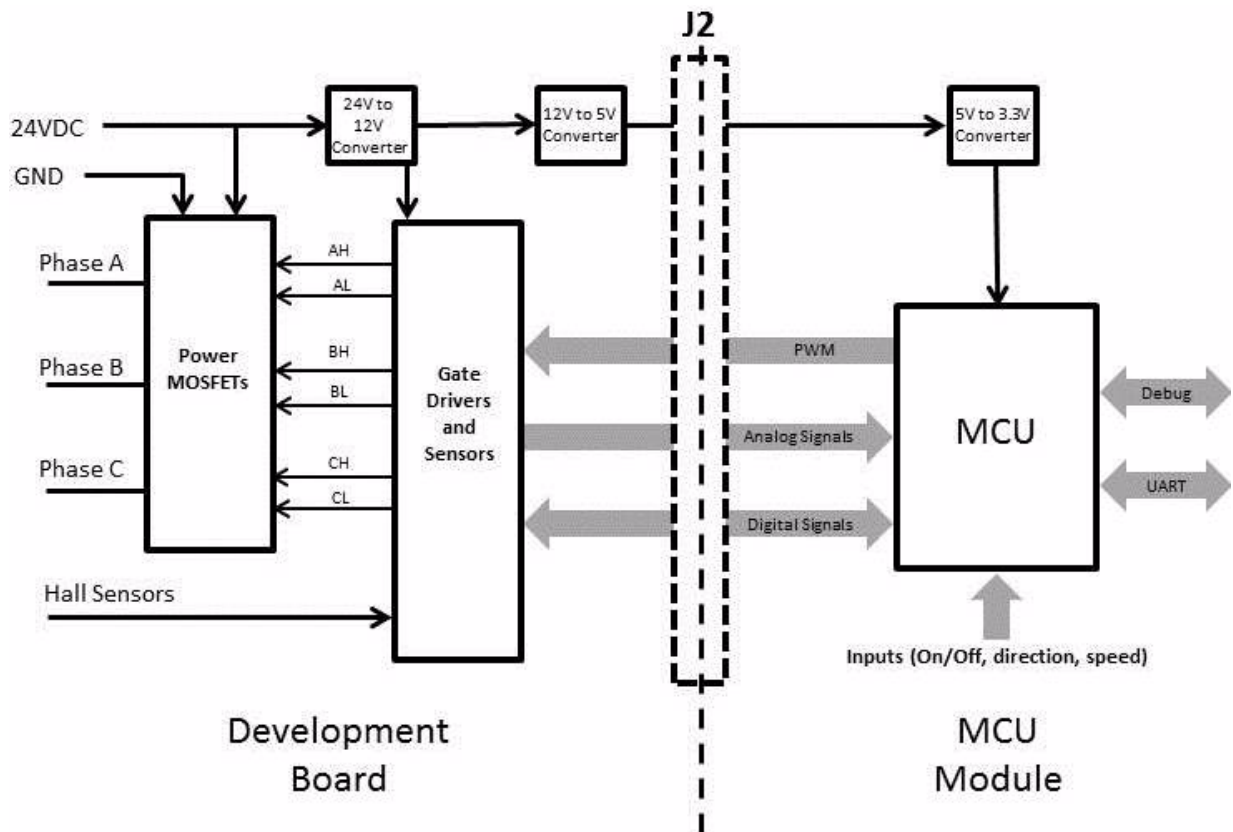


Figure 2. MultiMotor Series Motor Control Development Kit Block Diagram

MCU Module

Each Motor Control MCU Module features a Zilog MCU and measures approximately 2.5" x 3.0" as shown in Figure 3. It provides circuitry that interfaces the chip to an external development PC running the Zilog Developer Studio II (ZDSII) Integrated Development Environment (IDE), and to the 3-Phase MultiMotor Series Development Board.

► **Note:** The Z32F128 ARM Cortex MCU development is supported with third party development tools Keil MDK, IAR, and GCC for ARM Embedded. All of Zilog’s development for the Z32F128 MCU was accomplished with Keil MDK version 5.20.

The Z8051 MCU development was performed with the Keil C8051 development environment.

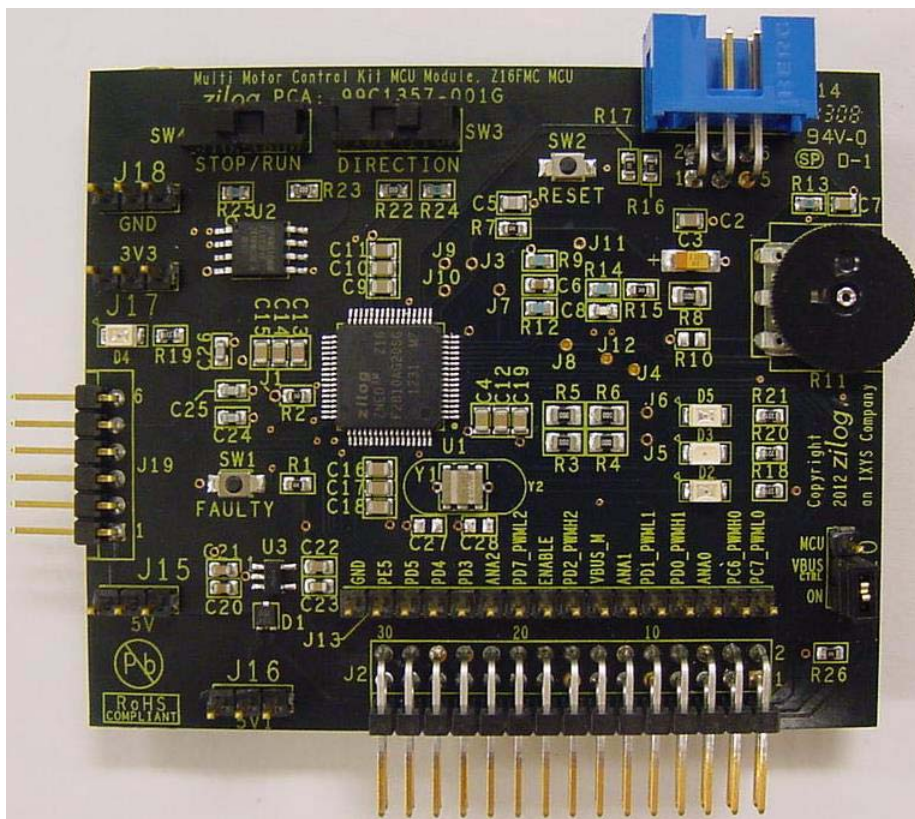


Figure 3. A Zilog Z16FMC MCU Module

MCU Module Features

The features of the MCU Module include:

- A Zilog MCU specifically designed for motor control applications
- Two SPDT switches to control DIRECTION and STOP/RUN
- One 5K potentiometer to control SPEED
- Green LED (illuminates when power is applied to the Board)
- General-purpose LEDs
- UART port
- 6-pin DBG interface
- Spansion SPI 32MB Flash Memory for datalogging on some modules
- 30-pin header for connecting to the 3-phase MultiMotor Series Development Board
- Multiple headers to allow easy access to all pertinent signals

Z32F128 MCU

The Z32F128 MCU, a member of the ZNEO32! Family of microcontrollers, is a cost-effective and high-performance 32-bit microcontroller. The Z32F128 MCU provides 3-phase PWM generator units which are suitable for inverter bridges, including motor drive systems. The two built-in channels of these generators control two inverter motors simultaneously. The key features of the Z32F128 MCU include:

- High performance low-power Cortex-M3 core
- 128 KB code Flash memory with cache function
- 12 KB SRAM
- 3-Phase Motor PWM with ADC triggering function
 - 2 channels
- 1.5Msps high-speed ADC with burst conversion function
 - 2 or 3 units with 16 channel input
- Built-in Programmable Gain Amplifier (PGA) for ADC inputs
 - 4 channels
- Built-in analog comparator
 - 4 channels
- System fail-safe function by clock monitoring
- XTAL OSC fail monitoring

- Precision internal oscillator clock (20MHz \pm 3%, and up to 80 MHz using PLL)
- Watchdog timer
- Six general purpose timers
- Quadrature encoder counter
- External communication ports: 4 UARTs, 2 I2Cs, 2 SPIs
- High current driving port for UART photo couplers
- Debug and emergency stop function
- Real-time monitoring function support for more effective development
- JTAG and Serial Wire Debug (SWD) in-circuit debugger
- Various memory size and package options
 - LQFP-80, LQFP-64
- Industrial grade operating temperature (-40 ~ +85°C)

To learn more about the Z32F128 MCU, refer to the [Z32F128 MCU Product Specification \(PS0345\)](#).

Z16FMC Series MCUs

The Z16FMC Series Flash microcontroller is based on Zilog's advanced ZNEO 16-bit CPU core. Optimized for motor control applications, these devices support the control of single- and multi-phase variable-speed motors. Target applications are large appliances, small appliances, and HVAC. The key features of the Z16FMC MCU include:

- 20MHz, 16-bit optimized single-cycle CISC core
- Up to 128KB of in-circuit programmable Flash memory
- 4KB internal RAM with 16-bit access
- Highly integrated digital/analog peripherals:
 - 12-bit PWM module with three complementary pairs or six independent PWM outputs
 - Fast 12-channel, 10-bit Analog-to-Digital Converter (ADC) for current sampling and back-EMF detection
 - Three standard 16-bit timers with capture, compare, and PWM capability
 - Analog comparator for current limiting or overcurrent shutdown
 - Operational amplifier
 - 4-channel DMA Controller

- Flexible communication interface including a UART with LIN and IrDA, I²C, and ESPI

- Oscillator supports either internal IPO or external crystals and ceramic resonators
- Up to 46 General-Purpose Input/Output (GPIO) pins
- Voltage Brown-Out/Power-On Reset (VBO/POR)
- Watchdog Timer (WDT) with internal RC oscillator
- Single-pin on-chip debugger

To learn more about the Z16FMC MCU, refer to the [Z16FMC Series Motor Control Product Specification \(PS0287\)](#) or the [Z16FMC Series Flash Microcontroller Product Brief \(PB0229\)](#). Each of these documents is available free for download from zilog.com.

Z8FMC16100 Series MCUs

The 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 multi-phase variable-speed motors. Target applications are large appliances, small appliances, and HVAC. The key features of the Z8FMC16100 MCU include:

- 20MHz Zilog eZ8 CPU core
- Up to 16KB Flash program memory
- 512B Register SRAM
- Highly-integrated digital/analog peripherals:
 - 12-bit pulse-width modulator (PWM) module with three complementary pairs or six independent PWM outputs with dead-band generation and fault trip input
 - 8-channel 10-bit Analog-to-Digital Converter (ADC) for current sampling and back-EMF detection
 - 16-bit timer with capture, compare, and PWM capability
 - Analog comparator for current limiting or overcurrent shutdown
 - Operational amplifier
 - Flexible communication interface including a UART with LIN and IrDA, I²C, and ESPI

- Oscillator supports either internal IPO or external crystals and ceramic resonators
- Up to 17 General-Purpose Input/Output (GPIO) pins

- Voltage Brown-Out/Power-On Reset (VBO/POR)
- Watchdog Timer (WDT) with internal RC oscillator
- Single-pin on-chip debugger

To learn more about the Z8FMC16100 MCU, refer to the [Z8FMC16100 Series Product Specification \(PS0246\)](#) or the [Z8FMC16100 Series Product Brief \(PB0166\)](#). Each of these documents is available free for download from zilog.com.

Z51F3220 MCU

The Z51F3220 MCU, a member of Zilog's new Z8051 product family, is an advanced CMOS 8-bit microcontroller with 32KB of Flash memory. This powerful microcontroller provides a highly flexible and cost-effective solution to many embedded control applications, including motor control. The key features of the Z51F3220 MCU include:

- 16MHz high-performance 8-bit CISC core
- Up to 32KB Flash program memory
- Highly-integrated digital/analog peripherals:
 - 10-bit pulse-width modulator (PWM) module with three complementary pairs of PWM outputs
 - 16-channel 12-bit Analog-to-Digital Converter (ADC) for current sampling and back-EMF detection
 - 16-bit timer with capture, compare, and PWM capability
 - Flexible communication interface including a UART, I²C, and SPI
 - LCD driver (21 segments/8 common)
- Oscillator supports either internal RC oscillator or external crystals and ceramic resonators
- Up to 42 General-Purpose Input/Output (GPIO) pins
- Voltage Brown-Out/Power-On Reset (VBO/POR)
- Watchdog Timer (WDT) with internal RC oscillator
- Two-wire on-chip debugger

To learn more about the Z51F3220 MCU, refer to the [Z51F3200 Series Product Specification \(PS0299\)](#) or the [Z51FM3220MCU Series Product Brief \(PB0239\)](#). Each of these documents is available free for download from zilog.com.

Connectors, Headers, Jumpers, and Switches

Multiple connectors, controls, and monitoring points are included on each MCU Module to allow easy monitoring and modification to fit user requirements. Table 1 identifies signal names and descriptions for each of these MCU modules.

Table 1. MCU Module Connectors, Jumpers, and Controls

Signal Name	MCU Module				Description
	Z32F128	Z16FMC	Z8FMC16100	Z51F3220	
Fault0	NMI	J1	J1	N/A	Input to the MCU (active Low).
Development Board Connector	J4	J2	J23	J1	30-pin connector between the MCU Module and the Development Board.
CS1+	PA3	J3	J3	J4	Current Sense 1: Positive.
CS1–	N/A	J4	J4	J5	Current Sense 1: Negative.
CS2+	J2	J5	N/A	N/A	Current Sense 2: Positive.
CS2–	J2	J6	N/A	N/A	Current Sense 2: Negative.
V _{REF}	CREF 1&2	J7	J23	N/A	ADC reference voltage.
Temperature	PA1	J8	J5	J7	Temperature reference signal.
COMPOUT	N/A	J9	N/A	J12	Comparator output.
CPINN	N/A	J10	N/A	N/A	Comparator input: Negative.
CPINP	PA0, PA1, PA2	J11	J8	N/A	Comparator input: Positive.
OPOUT	N/A	J12	J9	J9	Op-amp output.
Signal Header	J13	J13	J10	J8	Provides access to various signals.
Debug Connector	J1	J14	J14	J10	Debug.
5V	J7	J15	N/A	J14	5V DC header.
5V _{IN}	J7	J16	J16	J13	Independent 5V input.
3.3V	J3	J17	J17	N/A	3.3V DC header.
Ground	J9	J18	J18	J17, J19	Ground header.
UART Connector	J10	J19	J19	J18	Serial communication.
V _{BUS} Control Select	PA9	J20	J20	J6	Jumper: Manual or MCU V _{BUS} Enable.
Speed Potentiometer	R18	R11	R11	R12	To adjust motor speed.
Fault1	N/A	SW1	N/A	N/A	Switch to simulate a system fault.

Table 1. MCU Module Connectors, Jumpers, and Controls (Continued)

Signal Name	MCU Module				Description
	Z32F128	Z16FMC	Z8FMC16100	Z51F3220	
Reset	nReset PC10	SW2	SW2	SW1	MCU reset.
Direction Switch	SW5	SW3	SW3	SW2	Controls motor direction.
Stop/Run Switch	SW6	SW4	SW4	SW3	Controls motor on/off.
PC0	N/A	N/A	J6	N/A	Port C0.
UART/Flash Select	N/A	N/A	J21	N/A	Jumper: UART or Flash operation.
Sensor Select	SH2, SH3, SH4	N/A	J22	J2	Jumper.
LCD Connector	N/A	N/A	N/A	J15, J16	Optional LCD connector.
I ² C Connector	N/A	N/A	N/A	J20	4 pins for I ² C communication.

MultiMotor Series Development Board Connector

A 30-pin header connects I/O from the MCU Module to the 3-Phase MultiMotor Series Development Board. Figure 4 shows the header pin layout for the Z16FMC MCU Module. Figure 5 shows the header pin layout for the Z32F128 MCU Module.

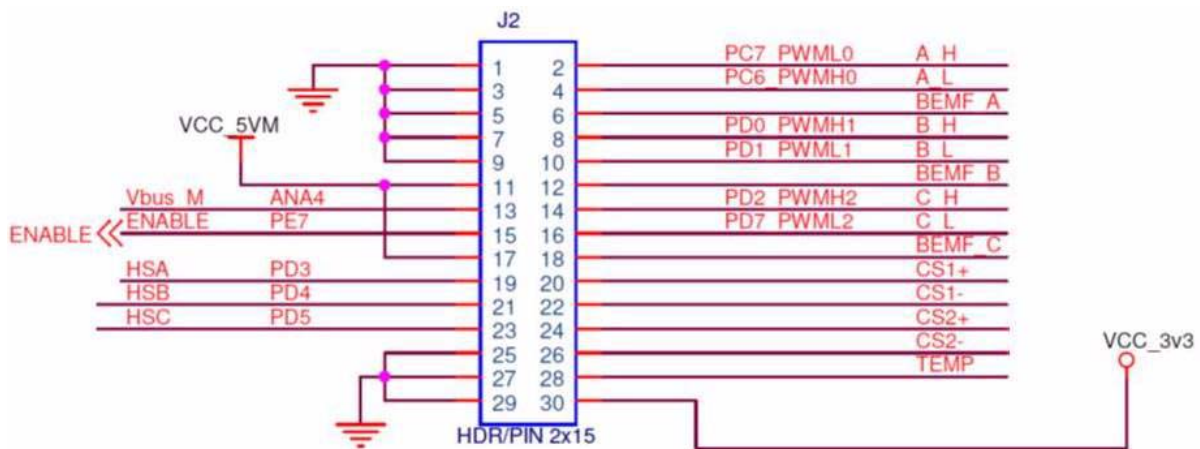


Figure 4. MultiMotor Series Development Board Connector, Z16FMC MCU Module

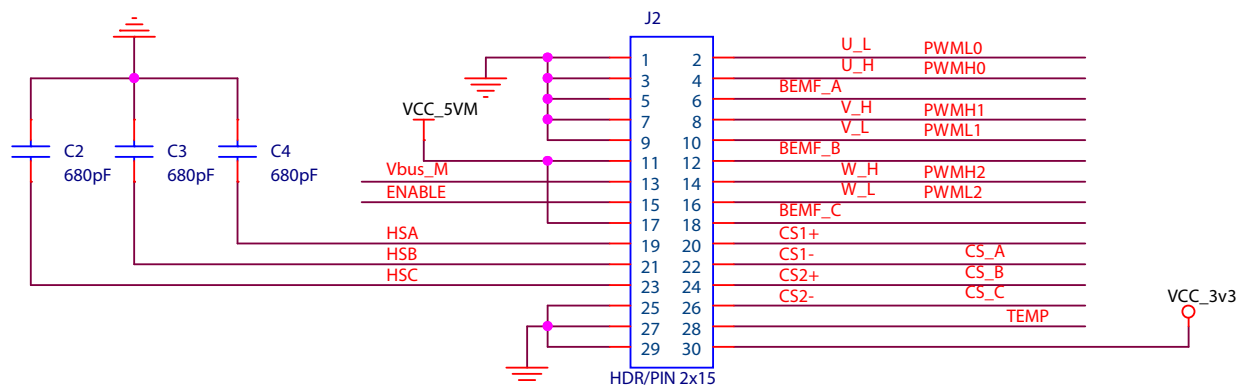


Figure 5. MultiMotor Series Development Board Connector, Z32F128 MCU Module

Table 2 identifies the 30-pin header signals and their functions as they relate to the Z16FMC MCU Module.

Table 2. MultiMotor Series Development Board Signals to the Z16FMC MCU Module

Signal	Pin	Direction (With Respect To MCU)	Description
GND	1	N/A	Ground.
PWML0	2	O	PWM Low output.
GND	3	N/A	Ground.
PWMH0	4	O	PWM High output.
GND	5	N/A	Ground.
BEMF A	6	I	Analog input to the ADC related to motor position when operating in Sensorless Mode.
GND	7	N/A	Ground.
PWMH1	8	O	PWM High output.
GND	9	N/A	Ground.
PWML1	10	O	PWM Low output.
V _{CC_5VM}	11	N/A	5V DC power to the MCU Module.
BEMF B	12	I	Analog input to the ADC related to motor position when operating in Sensorless Mode.
V _{BUS_M}	13	I	Analog input to the ADC proportional to the V _{BUS} voltage.
PWNH2	14	O	PWM High output.
ENABLE	15	O	Enables the V _{BUS} relay.

Table 2. MultiMotor Series Development Board Signals to the Z16FMC MCU Module (Continued)

Signal	Pin	Direction (With Respect To MCU)	Description
PWML2	16	O	PWM Low output.
V _{CC_5VM}	17	N/A	5V DC power to MCU Module.
BEMF C	18	I	Analog input to the ADC related to motor position when operating in Sensorless Mode.
HSA	19	I	Input to the MCU related to motor position when operating in Sensored Mode.
CS1+	20	I	Analog input to the ADC related to monitoring motor current.
HSB	21	I	Input to the MCU related to motor position when operating in Sensored Mode.
CS1-	22	I	Analog input to the ADC related to monitoring motor current.
HSC	23	I	Input to the MCU related to motor position when operating in Sensored Mode.
CS2+	24	I	Analog input to the ADC: not generally used.
GND	25	N/A	Ground.
CS2-	26	I	Analog input to the ADC: not generally used.
GND	27	N/A	Ground.
Temperature	28	I	Analog input to the ADC proportional to the temperature on the Development Board.
GND	29	N/A	Ground.
V _{CC_3v3}	30	N/A	3.3V DC power supplied to the Development Board.

Signal Header

Multiple signals are available on the MCU Modules's signal headers. Figure 6 shows the signal header pin layout for the Z16FMC MCU Module. Figure 7 shows the signal header pin layout for the Z32F128 MCU Module.

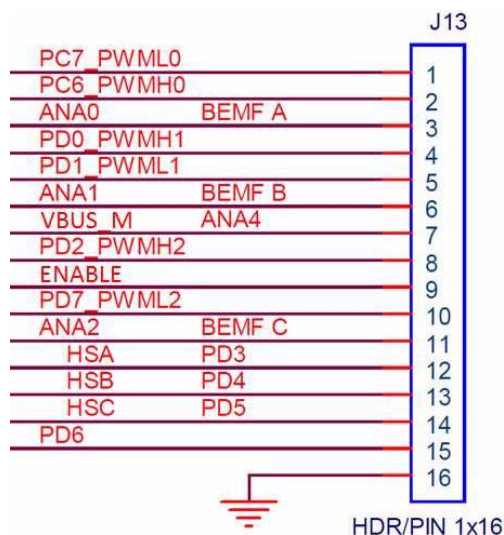


Figure 6. Signal Header, Z16FMC MCU Module

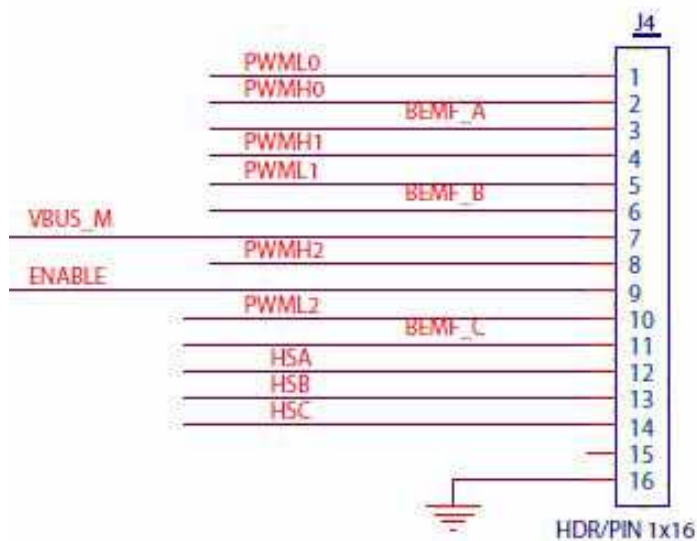


Figure 7. Signal Header, Z32F128 MCU Module

Table 3 identifies the signals headers and their pin functions for each MCU Module.

Table 3. Signal Header Pin Outputs

Pin	Z32F128 (J4)	Z16FMC (J13)	Z8FMC16100 (J10)	Z51F3220 (J8)
1	PWML0	PWML0	PWML0	PWML0
2	PWMH0	PWMH0	PWMH0	PWMH0
3	BEMF_A	BEMF_A	BEMF_A	BEMF_A
4	PWMH1	PWMH1	PWMH1	PWMH1
5	PWML1	PWML1	PWML1	PWML1
6	BEMF_B	BEMF_B	BEMF_B	BEMF_B
7	VBUS_M	V _{BUS_M}	V _{BUS_M}	V _{BUS_M}
8	PWMH2	PWMH2	PWMH2	PWMH2
9	ENABLE	ENABLE	ENABLE	ENABLE
10	PWML2	PWML2	PWML2	PWML2
11	BEMF_C	BEMF_C	BEMF_C	BEMF_C
12	HSA	HSA	HSA	HSA
13	HSB	HSB	HSB	HSB
14	HSC	HSC	HSC	HSC
15	N/A or NC	PD6	NC	TEMP
16	GROUND	GROUND	GROUND	GROUND

Debug Connector

A 6-pin debug connector is used in conjunction with the opto-isolated USB SmartCable included with the MultiMotor Series Development Kit. This debug connector is used in conjunction with ZDSII for programming and debug operations on the MCU Modules. Figure 8 shows the debug connector's pin layout for the Z16FMC MCU Module.

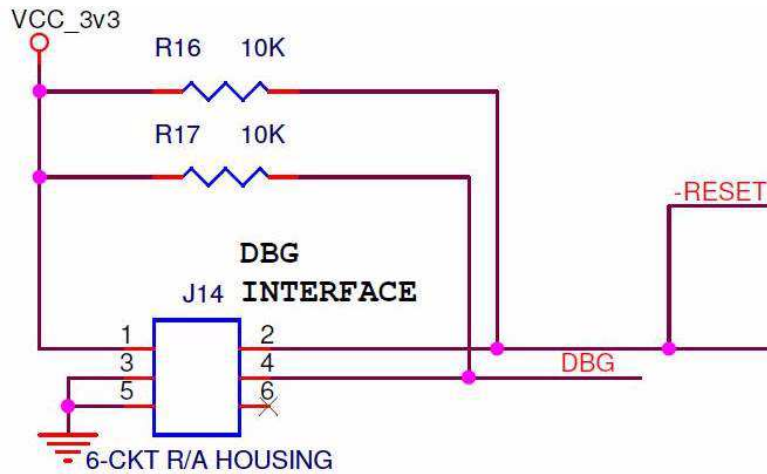


Figure 8. Debug Connector, Z16FMC MCU Module

Table 4 identifies the debug connector signals and their functions.

Table 4. Debug Connector Signal Descriptions

Signal	Pin	Direction (With Respect To The MCU)	Description
V _{CC_3v3}	1	N/A	3.3V DC Power.
RESET	2	N/A	Active Low.
GND	3	N/A	Ground.
DBG	4	I/O	Debug.
GND	5	N/A	Ground.
NC	6	N/A	No Connect.

UART Connector

A 6-pin UART connector is used in conjunction with the opto-isolated UART-to-USB adapter included with the MultiMotor Series Development Kit to allow the monitoring and control of the motor from a PC. Figure 9 shows the UART connector pin layout for the Z16FMC MCU Module.

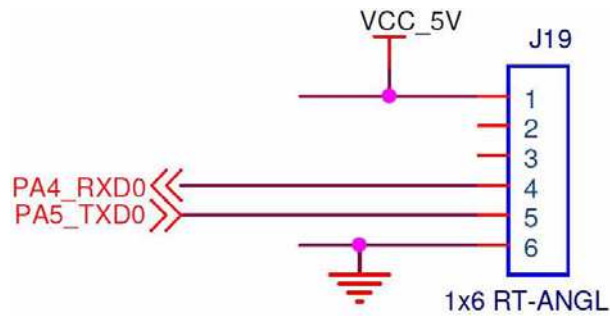


Figure 9. UART Connector, Z16FMC MCU Module

Table 5 identifies the UART connector pin signals and their functions.

Table 5. UART Connector

Signal	Pin	Direction (With Respect To The MCU)	Description
V _{CC_5V}	1	N/A	5V DC power.
NC	2	N/A	No connect.
NC	3	N/A	No connect.
RXD	4	I	Receive.
TXD	5	O	Transmit.
GND	6	N/A	Ground.

I²C Connector

On some MCU modules, a 4-pin connector is provided to access the I²C functions of the MCU. Figure 10 shows the I²C connector pin layout for the Z51F3220 MCU Module.

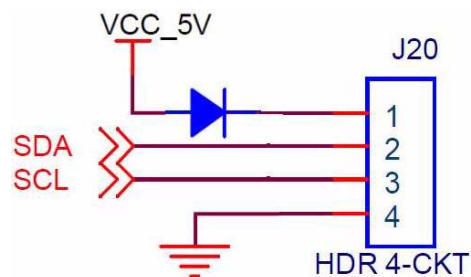


Figure 10. I²C Connector, Z51F3220 MCU Module

Table 6 identifies the I²C connector pin signals and their functions.

Table 6. I²C Connector

Signal	Pin	Direction (With Respect To The MCU)	Description
V _{CC} -5V	1	N/A	5V DC power.
SDA	2	I/O	Data.
SCL	3	I/O	Clock.
GND	4	N/A	Ground.

5V_{IN} Connector

For programming and debugging purposes, each MCU Module can be powered using a bench power supply without being attached to the MultiMotor Series Development Board. To power up the MCU Module in this manner, connect 5 V DC to the 5V_{IN} connector and ground, as indicated in [Table 1](#) on page 9.

Jumper and Switch Settings

This section presents multiple settings for the MCU Modules' jumpers and switches.

V_{BUS} Control Select Jumper

Under standard conditions, the V_{BUS} Control Select jumper should be in the ON position (1-2) to force the ENABLE signal High and cause the V_{BUS} relay on the MultiMotor Series Development Board to turn ON, thereby supplying bus voltage to the MOSFETs. If the jumper is in the MCU position (2-3), the ENABLE signal will be controlled by a GPIO from the MCU, as indicated in Table 7.

Table 7. V_{BUS} Enable Jumper

Jumper Position	1-2	2-3
ON	X	
MCU		X

Table 8 shows which GPIO controls this ENABLE signal, depending on the MCU Module being used. Using this ENABLE signal from the MCU serves to meet IEC 60730 Class B compliance requirements because the bus voltage can be turned off almost immediately if an error is detected.

Table 8. V_{BUS} Enable Port

Jumper	MCU Module		
	Z16FMC	Z8FMC16100	Z51F3220
V _{BUS} Control Select	PE7	PB7	P42

UART Flash Select Jumper

Due to pin limitations on some MCUs, the UART Flash Select jumper selects between access to the UART or to SPI memory, as indicated in Table 9.

Table 9. UART Flash Select Jumper Settings

	Jumper Locations			
	1-2	3-4	5-6	7-8
UART		X		X
SPI	X		X	



Caution: If the jumpers are placed in any combination other than those indicated in Table 9, the system may not function properly.

Sensor Select Jumper

Due to pin limitations on some MCUs, the Sensor Select jumper is used to select between operating in Sensored or Sensorless modes, as indicated in Table 10.

Table 10. Sensor Select Jumper Settings

Mode	Jumper Location					
	1-2	3-4	5-6	7-8	9-10	11-12
Sensored	X	X	X			
Sensorless				X	X	X



Caution: If the jumpers are placed in any combination other than those indicated in Table 10, the system may not function properly.