Manuals+ — User Manuals Simplified.

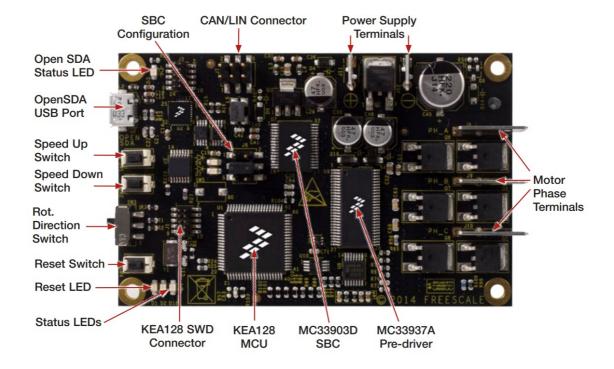# NXP KEA128BLDCRD 3-Phase Sensorless BLDC Reference Design User Guide

Quick Start Guide

KEA128BLDCRD
3-phase Sensorless BLDC Motor Control Reference Design using Kinetis KEA128

Contents

Get to Know:

3-phase Sensorless BLDC Motor Control Reference Design using Kinetis KEA128

Reference Design Features

Hardware

- KEA128 32-bit ARM® Cortex® -M0+ MCU (80-pin LQFP)
- MC33903D system basis chip
- MC33937A FET pre-driver
- LIN & CAN connectivity support
- OpenSDA programming/debugging interface
- 3-phase BLDC motor, 24 V, 9350 RPM, 90 W, Linix 45ZWN24-90-B

Software

- Sensorless control using back-EMF zero-crossing detection
- Closed-loop speed control and dynamic motor current limitation
- DC bus overvoltage, undervoltage and overcurrent detection
- Application built upon Automotive Math and Motor Control Library Set for Cortex® -M0+ functions
- FreeMASTER run-time debugging tool for instrumentation/visualization
- Motor Control Application Tuning (MCAT) tool

Step-by-Step Installation Instructions

1. **Install CodeWarrior Development Studio**

   CodeWarrior Development Studio for Microcontrollers installation file is included on the supplied media for your convenience. The most recent version of CodeWarrior for MCUs (Eclipse IDE) can be downloaded from freescale.com/CodeWarrior.

2. **Install FreeMASTER**

   FreeMASTER run-time debugging tool installation file is included on the supplied media for your convenience. For FreeMASTER updates, please visit freescale.com/FREE MASTER.

3. **Download**

   Application Software

   Download and install the reference design application software available at freescale.com/KEA128BLDCRD.

4. **Connect the Motor**

   Connect the Linux 45ZWN24-90-B 3-phase BLDC motor to the motor phase terminals.

5. **Connect the**

   Power Supply

   Connect the 12 V power supply to the power supply terminals. Keep the DC supply voltage within the range of 8 to 18 V. The DC power supply voltage affects the maximum motor speed.

6. **Connect the USB Cable**

   Connect the reference design board to the PC using the USB cable. Allow the PC to automatically configure the USB drivers if needed.

7. **Re-program the MCU using CodeWarrior**

   Import the downloaded reference design application project in the CodeWarrior Development Studio:

   1. Start the CodeWarrior application
   2. Click File – Import
   3. Select General – Existing Projects into Workspace
   4. Select "Select root directory" and click Browse
   5. Navigate to the extracted application directory:
   KEA128BLDCRD\SW\KEA128_ BLDC_Sensorless and click OK
   6. Click Finish
   7. Click Run – Run, select KEA128_FLASH_OpenSDA configuration when prompted

8. **FreeMASTER Setup**

   • Start the FreeMASTER application
   • Open the FreeMASTER project
   KEA128BLDCRD\SW\KEA128_BLDC_Sensorless\KEA128_BLDC_Sensorless.pmp by clicking File – Open Project…

• Set up the RS232 communication port and speed in the menu Project – Options… Set the communication speed to 115200 Bd.

The COM port number can be found using Windows Device Manager under "Ports (COM & LPT)" section as "OpenSDA –CDC Serial Port (**http://www.pemicro.com/opensda**) (COMn)".

• Click the red STOP button in the FreeMASTER toolbar or press Ctrl+K to enable the communication. Successful communication is signalized in the status bar as "RS232;COMn;speed=115200".

Application Control in FreeMASTER

1. Click App Control in the Motor Control Application Tuning tool tab menu to display the application control page.
2. Select the rotation direction using SW3 on the reference design board.
3. To start the motor, click either the ON/OFF flip-flop switch or press the switch SW1 on the board.
4. Set the required speed by changing the "required speed" variable value manually in the variable watch window, by double clicking the speed gauge, or by pressing the switch SW1 (speed up) or switch SW2 (speed down) on the board.
5. Automatic motor speed stimulus can be enabled by double clicking the "Speed Response [requiredSpeed]" in the Variable Stimulus pane.
6. The speed response of the motor can be observed by clicking the Speed Scope in the Project Tree pane. Additional scopes and a back-EMF voltage recorder are also available.
7. To stop the motor, click the ON/OFF flip-flop switch or press the switches SW1 and SW2 on the board simultaneously.
8. In case of pending faults, click the green Clear Faults button or press the switches SW1 and SW2 on the board simultaneously.

   Faults present in the system are signalized by the red fault indicators. Pending faults are signalized by small red circle indicators next to the respective fault indicator, and by the red status LED on the reference design board.

Jumper Options

The following is a list of all jumper options. The default installed jumper settings are shown in the white text within red boxes.

Jumper	Option	Setting	Description
J6	System Basis Chip Mode and RESET Interconnect Configuration	2-Jan	MC33903D Debug mode enable
		4-Mar	MC33903D Fail-safe mode enable
		6-May	MC33903D/KEA128 RESET interconnection enable

Headers and Connectors List

Header/ Connector	Description
J1	Kinetis KEA128 Serial Wire Debug (SWD) header
J2	OpenSDA micro USB A-B connector
J3	Kinetis K20 (OpenSDA) JTAG header
J7	CAN and LIN physical interface signal header
J8, J9, J10	Motor phase terminals (J8 – phase A, J9 – phase B, J10 – phase C)
J11, J12	12 V DC power input terminals (J11 – 12 V, J12 – GND)
J13	Braking resistor terminal (not assembled)

Support

Visit **freescale.com/support** for a list of phone numbers within your region.

Warranty

Visit **freescale.com/warranty** for complete warranty information.

For more information, visit
freescale.com/KEA128BLDCRD

> *freescale*
> *Kinetis*

Documents / Resources

NXP KEA128BLDCRD 3-Phase Sensorless BLDC Reference Design [pdf] User Guide
KEA128BLDCRD, 3-Phase Sensorless BLDC Reference Design, KEA128BLDCRD 3-Phase Sensorless BLDC Reference Design, Sensorless BLDC Reference Design, BLDC Reference Design, Reference Design

References

- **Support | NXP Semiconductors**

- [Returns and Warranty Information | NXP Semiconductors](#)
- [PEmicro | Experts in Embedded tools for Flash Programming and Development](#)

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