

Quick Start Guide

MCSPTe1AK144

S32K144 Development Kit for 3-Phase PMSM
and BLDC Motor Control

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S32K144 DEVELOPMENT KIT FOR 3-PHASE PMSM AND BLDC MOTOR CONTROL

40 W PM Motor
Part Number: 45ZWN24-40

DEVKIT-MOTORDG Board
Part Number: DEVKIT-MOTORDG

S32K144 Evaluation Board
Part Number: S32K144EVB-Q100

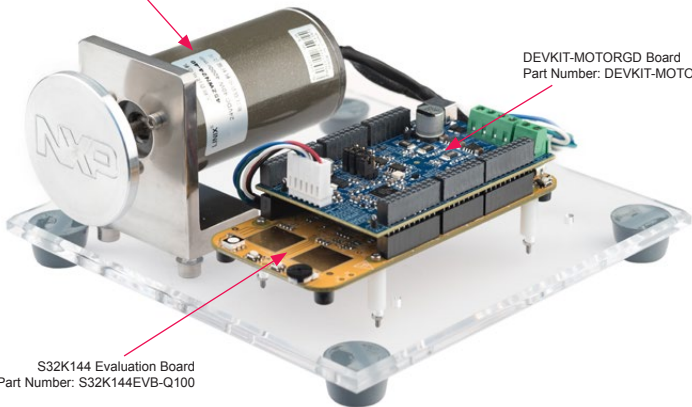


Figure 1: S32K144 development kit for 3-phase PMSM and BLDC motor control

GET TO KNOW THE S32K144EVb

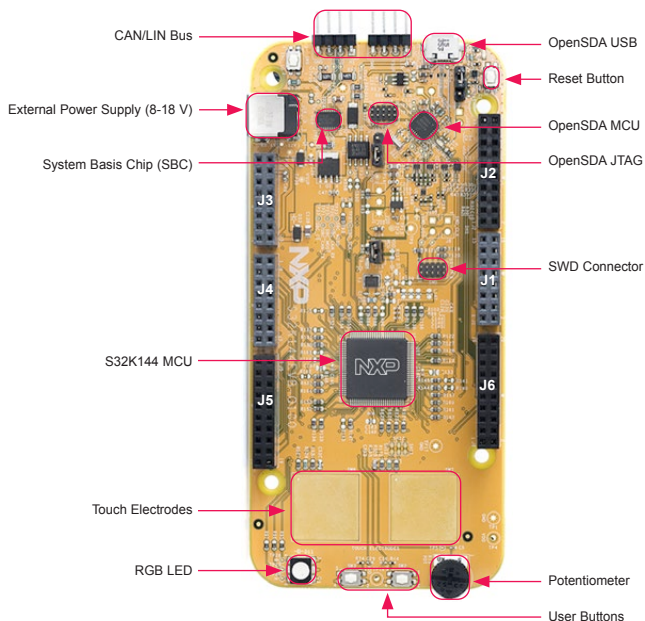


Figure 2: S32K144 evaluation board

Quick Start Guide

GET TO KNOW DEVKIT-MOTORGD

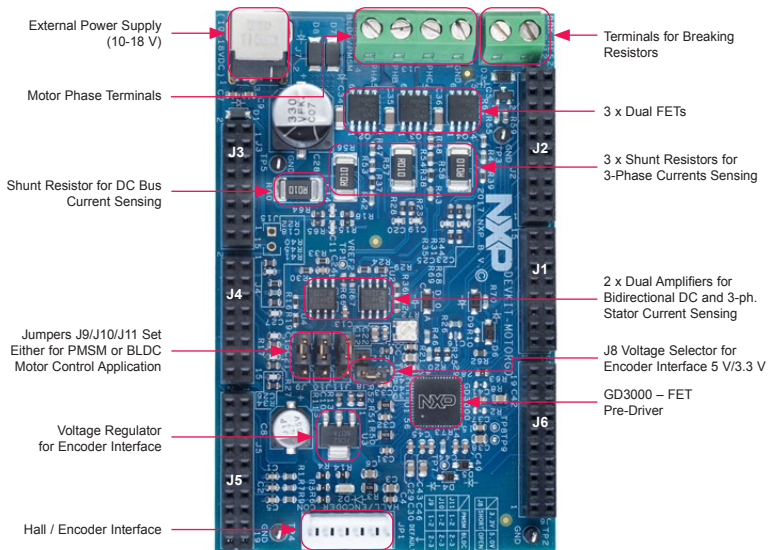


Figure 3: DEVKIT-MOTORGD board

HEADER/PINOUT FOR PMSM MOTOR CONTROL

S32K144EVB controls DEVKIT-MOTORGD through inner pins of the I/O headers. Inner pins of the I/O headers are Arduino compatible. Pins in red are configurable, this is the pin configuration for **PMSM** motor control (see jumper options on page 11).

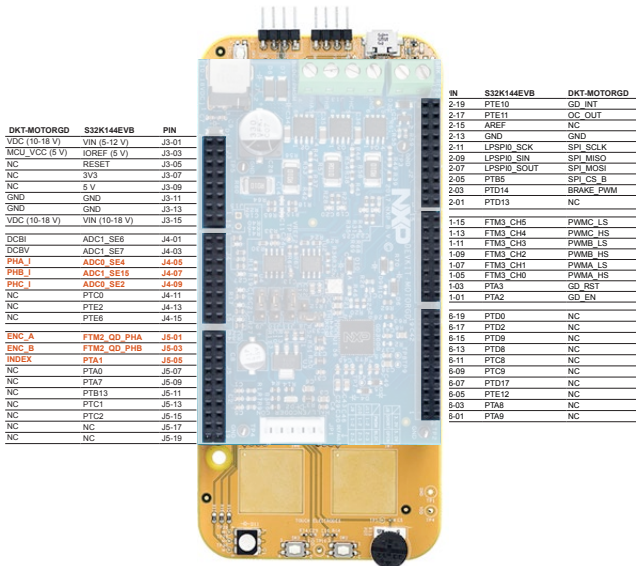


Figure 4: S32K144EVB + DEVKIT-MOTORGD pin assignment

HEADER/PINOUT FOR BLDC MOTOR CONTROL

S32K144EVB controls DEVKIT-MOTORGD through inner pins of the I/O headers. Inner pins of the I/O headers are Arduino compatible. Pins in red are configurable, this is the pin configuration for **BLDC** motor control (see jumper options on page 11).

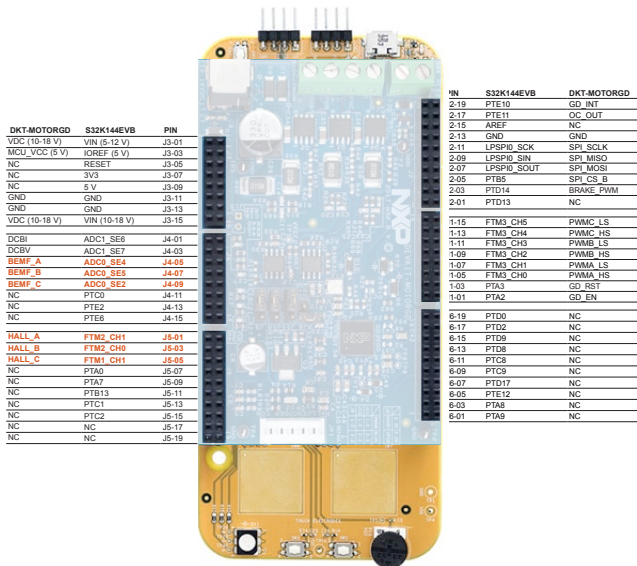


Figure 5: S32K144EVB + DEVKIT-MOTORGD pin assignment

MCSPT1AK144 FEATURES

Hardware

- **S32K144EVB**—S32K144 evaluation board with LIN and CAN connectivity support, OpenSDA programming/ debugging
- **DEVKIT-MOTORGD**—up to 12 V/5 A 3-phase power stage board based on SMARTMOS GD3000 pre-driver with condition monitoring and fault detection
- **Low-Cost PM Motor**—3-phase PM motor equipped with HALL sensor, 24 VDC, 4000 RPM, 40 W, 45ZWN24-40
- **USB cable**
- **12 VDC power supply**

Software

- **Automotive Motor Control Algorithms**

— Field-oriented control (FOC) with field weakening for sinusoidal motor type (PMSM)

— Six-step commutation control for trapezoidal motor type (BLDC)

- **Evaluation version of the Automotive Math and Motor Control Library Set**

—Control algorithm built on blocks of precompiled software library

- **FreeMASTER and MCAT**

—Application tuning and variables tracking at different levels of the control structure

- **Design Studio and SDK**

—Example software created in the S32 Design Studio for Arm® built on S32 SDK software

- **SDK - Processor Expert®**

—MCU peripherals initialization generated by Processor Expert (PEX)

STEP-BY-STEP INSTALLATION INSTRUCTIONS

1 Download Software



Download installation software and documentation at nxp.com/AutoMCDevKits.

2 Install S32 Design Studio IDE for Arm®

Download and install S32 Design Studio IDE for Arm available at nxp.com/S32DS-Arm.

3 Install FreeMASTER

Download and install FreeMASTER run-time debugging tool available at nxp.com/FreeMASTER.

4 Configure S32K144EVB and DEVKIT-MOTORGD boards

Ensure default S32K144EVB and DEVKIT-MOTORGD jumper options (page 11).

Place DEVKIT-MOTORGD jumpers J9, J10, J11 to position 1-2 for PMSM application or 2-3 for BLDC application (page 11).

Ensure that motor phase wires are in order: white, blue, green from phase A to phase C.

5 Connect the Power Supply

Connect the 12 V power supply to the power supply terminals on DEVKIT-MOTORGD board.

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 S32K144EVB to the PC using the USB cable. Allow the PC to automatically configure the USB drivers if needed.

STEP-BY-STEP INSTALLATION INSTRUCTIONS CONTINUED

7 Select Application and MCU Programing

Select appropriate PMSM or BLDC motor control application from the installed directory NXP\MCSPT1AK144\sw.

Select one of the next two steps (8 or 9) for MCU programming.

8 Re-program the MCU using MSD Flash Programmer

Copy and paste or drag and drop the Motorola S-record *.srec file from the project folder to the S32K144EVB disk drive. The software is directly programmed into the flash memory of the S32K144 MCU and executed automatically.

9 Reprogram the MCU using S32 Design Studio

Import the installed application software project in the S32 Design Studio for Arm®:

- Select **General–Existing Projects into Workspace.**
 - Navigate to the installed application directory: **NXP\MC_DevKits\MCSPT1AK144\sw**, choose appropriate project and click **OK.**
 - Click **Finish.**
 - Click **Run – Debug.**
- ### 10 FreeMASTER Setup
- Start the FreeMASTER application
 - Open *.pmp FreeMASTER project from the project folder **<selected project> FreeMASTER_control** by clicking **File – Open Project.**
 - Click the green **GO!** button in the FreeMASTER toolbar or press **CTRL+G** to enable the communication.
 - Successful communication is signalized in the status bar at very bottom as “RS232 UART Communication;COMn; speed = 115200”.

APPLICATION CONTROL

1 Click **App Control tab** in the MCAT tool menu to display the application control page. When the power supply is connected to the DEVKIT-MOTOGD board, the application is in a **READY** state indicated by the green LED on S32K144EVB board. RGB LED also indicates:

- **READY, INIT** states lighting green LED
- **CALIB, ALIGN** states flashing green LED
- **RUN** state lighting blue LED
- **FAULT** state lighting red LED

2 In case of pending faults, click the fault button **Clear FAULT** on the FreeMASTER MCAT Control Page, or alternatively press and hold **SW2** and **SW3** buttons on S32K144EVB board simultaneously.

3 Start the application by pressing the **ON/OFF** button on the FreeMASTER MCAT control page or by pressing switch **SW2/SW3** on S32K144EVB to initiate clockwise/counter clockwise rotor spinning direction.

4 Set required speed by changing the **Speed Required** variable value manually in the variable watch window, by clicking **speed gauge**, or by pressing the switch **SW2/SW3**.

5 To stop the application, click the **ON/OFF** button on the FreeMASTER MCAT control page or press and hold **SW2** and **SW3** buttons on S32K144EVB board simultaneously.

S32K144EVB JUMPER OPTIONS

| JUMPER | OPTION | SETTING | DESCRIPTION |
|-----------|----------------|---------|---|
| J104 | Reset signal | 1-2 | Reset signal to OpenSDA, use to enter into Open SDA Bootloader mode |
| | | 2-3 | Reset signal direct to the MCU, use to reset S32K144 (default) |
| J107 | Board powering | 1-2 | S32K144 powered by 12 V power source (default) |
| | | 2-3 | S32K144 powered by USB micro connector |
| J109/J108 | CAN | OPEN | CAN termination resistor is disconnected |
| | | SHORT | CAN terminator resistor is connected (default) |

DEVKIT-MOTORGD JUMPER OPTIONS

| JUMPER | OPTION | SETTING | DESCRIPTION |
|------------|------------------------|---------|---|
| J8 | HALL/Encoder interface | Short | Voltage level for HALL/Encoder interface is 3.3 V |
| | | Open | Voltage level for HALL/Encoder interface is 5.0 V (default) |
| J9/J10/J11 | Motor type | 1-2 | Bidirectional 3-phase current sensing for PMSM FOC (sinusoidal) motor control |
| | | 2-3 | 3-phase back-EMF voltage sensing for BLDC six-step (trapezoidal) sensorless motor control |

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WARRANTY

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Get Started

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