DEVKIT-MOTORGD
QUICK START GUIDE (QSG)

Ultra-Reliable MCUs for Industrial and Automotive Applications

www.nxp.com/DEVKIT-MOTORGD
Contents

• Step-by-Step Installation Instructions
• How to Spin the Motor
• Hardware: DEVKIT-MOTORGD Board
  - Features
  - Overview
  - Pinout and Jumper Settings
  - Power Supply
  - Order Information
  - EMC Requirements Note

• Documentation
• Recommendations
Step-by-Step Installation Instructions

In this quick start guide, you will learn how to set up the DEVKIT-MOTORGD board and run the default program.

1. **Install Software and Tools**
   - Install S32 Design Studio IDE for base board (S32K144EVB-Q100 or DEVKIT-MPC5744P).
   - See Software Installation Guide (SWIG) from S32K144EVB-Q100 or DEVKIT-MPC5744P Quick Start Package.

2. **Program Base Board**
   - Connect one end of the USB cable to the PC and the other end to the micro-B connector on DEVKIT-MPC5744P/S32K144EVB-Q100.
   - Allow the PC to automatically configure the USB drivers.
   - Flash motor control program to base board.

3. **Plug in MOTORGD**
   - Plug in DEVKIT-MOTORGD to base board.
   - Make sure base board is configured to be powered externally.
   - DEVKIT-MOTORGD must supply power to base board.
   - Plug in motor to phase and Hall sensors of DEVKIT-MOTORGD

4. **Learn More About the DEVKIT-MOTORGD**
   - Read release notes and documentation on the nxp.com/DEVKIT-MOTORGD
How to Spin a Motor: Power the Base Board

- This example uses DEVKIT-MPC5744P as base board
- Base board can be powered by USB or external supply
  - Check base board jumpers
  - This slide shows settings for external power
- Plug in USB to base board for programming
- Plug in power supply if base board configured to be externally powered
How to Spin a Motor: Program the Base Board

- Load the motor control program onto base board
- Use S32DS
  - Refer to S32K144EVB-Q100 or DEVKIT-MPC5744 SWIG
- Online tutorial on installing software using Model Based Design Toolbox
How to Spin a Motor: Remove the USB

- Unplug the USB and external supply from base board
- DEVKIT-MOTORGD will power base board
How to Spin a Motor: Configure Base Board Jumpers

• Make sure base board is configured to be powered externally
• S32K144EVB-Q100: Short J107.1-2
How to Spin a Motor: Plug in DEVKIT-MOTORGD

• Plug DEVKIT-MOTORGD onto base board
How to Spin a Motor: Power Shield and Base Board

- Plug in barrel connector to DEVKIT-MOTORGD
- DEVKIT-MOTORGD also powers base board
How to Spin a Motor: Connect Phase Outputs (Linix)

- Connect the phase outputs

- NXP recommends and uses the Linix 45ZWN24-40 BLDC motor for evaluation purposes

- Alternative motor: Nanotec DB41M024030-A

- NXP example:
  - PHA – White
  - PHB – Blue
  - PHC – Green
How to Spin a Motor: Connect Hall Sensor (Sensored Only) (Linix)

• Plug in Hall sensor if motor control program requires Hall sensor JP1
How to Spin a Motor: Nanotec Alternative

- The [Nanotec DB41M024030-A](#) is an alternative to the Linix 45ZWN24-40.
- It comes with its wires in a bunch.
- Two groups:
  - 3 thick wires (phases): Red, Yellow, Black
  - 5 slender wires (hall sensor): Red, Black, White, Green, Blue
How to Spin a Motor: Connect Phase Outputs (Nanotec)

• If you are running the NXP example on the Nanotec DB41M024030-A connect:
  - PHA – Yellow
  - PHB – Red
  - PHC – Black
How to Spin a Motor: Connect Hall Sensor (Nanotec)

- The Nanotec DB41M024030-A’s hall sensor follows same color coding as the Linix 45ZWN24-40’s hall sensor
- Connect the wires in the same order (from “JP1” label):
  - Red
  - Black
  - White
  - Green
  - Blue
  - No wire
- You may need to install headers of your choice for better connection
How to Spin a Motor: Run the Motor

• If you use NXP’s software example, motor will automatically start spinning after a few seconds
• Press SW1 to speed up
• Press SW2 to slow down/reverse
DEVKIT-MOTORGD Board: Features

- Gate Driver Unit MC34GD3000EP
- 3-Phase Bridge
  - Output Parameters: 3 phase outputs, 10-18V, 5A phase current (RMS)
- Hall Encoder
- Arduino™ UNO R3 footprint-compatible with expansion “shield” support
- Easy access to the MCU I/O header pins for prototyping
- Flexible power supply options
  - 10-18V External power supply
- Supports DEVKIT-MPC5744P and S32K144EVB
- NXP recommends and uses the Linix 45ZWN24-40 or Nanotec DB41M024030-A BLDC motor for evaluation purposes

- Box includes:
  - DEVKIT-MOTORGD Shield
- Downloads include:
  - Quick Start Guide
  - Application notes
The DEVKIT-MOTORGD is an ultra-low-cost development platform for motor control. Features include easy access to all base board I/Os and a standard-based form factor compatible with the Arduino™ pin layout, providing a broad range of expansion board options. The shield can be powered by an external supply from 10V to 18V.
**DEVKIT-MOTORGD Board : Pinout**

**Arduino Compatibility**
The internal rows of the I/O headers on the DEVKIT-MOTORGD are arranged to fulfill Arduino™ shields compatibility.

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>PORT</th>
<th>PIN</th>
<th>FUNCTION</th>
<th>PORT</th>
<th>PIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>GD_INT</td>
<td>J2</td>
<td>19</td>
<td>GD_INT</td>
<td>J2</td>
<td>20</td>
</tr>
<tr>
<td>OC_OUT</td>
<td>J2</td>
<td>17</td>
<td>OC_OUT</td>
<td>J2</td>
<td>18</td>
</tr>
<tr>
<td>NC</td>
<td>J2</td>
<td>15</td>
<td>NC</td>
<td>J2</td>
<td>16</td>
</tr>
<tr>
<td>GND</td>
<td>J2</td>
<td>13</td>
<td>GND</td>
<td>J2</td>
<td>14</td>
</tr>
<tr>
<td>SPI_SCLK</td>
<td>J2</td>
<td>11</td>
<td>SPI_SCLK</td>
<td>J2</td>
<td>12</td>
</tr>
<tr>
<td>SPI_MISO</td>
<td>J2</td>
<td>09</td>
<td>SPI_MISO</td>
<td>J2</td>
<td>10</td>
</tr>
<tr>
<td>SPI_MOSI</td>
<td>J2</td>
<td>07</td>
<td>SPI_MOSI</td>
<td>J2</td>
<td>08</td>
</tr>
<tr>
<td>SPI_CS_B</td>
<td>J2</td>
<td>05</td>
<td>SPI_CS_B</td>
<td>J2</td>
<td>06</td>
</tr>
<tr>
<td>BRAKE_PWM</td>
<td>J2</td>
<td>03</td>
<td>BRAKE_PWM</td>
<td>J2</td>
<td>04</td>
</tr>
<tr>
<td>NC</td>
<td>J2</td>
<td>01</td>
<td>NC</td>
<td>J2</td>
<td>02</td>
</tr>
<tr>
<td>PWMC_LS</td>
<td>J1</td>
<td>15</td>
<td>PWMC_LS</td>
<td>J1</td>
<td>16</td>
</tr>
<tr>
<td>PWMC_HS</td>
<td>J1</td>
<td>13</td>
<td>PWMC_HS</td>
<td>J1</td>
<td>14</td>
</tr>
<tr>
<td>PWMB_LS</td>
<td>J1</td>
<td>11</td>
<td>PWMB_LS</td>
<td>J1</td>
<td>12</td>
</tr>
<tr>
<td>PWMB_HS</td>
<td>J1</td>
<td>09</td>
<td>PWMB_HS</td>
<td>J1</td>
<td>10</td>
</tr>
<tr>
<td>PWMA_LS</td>
<td>J1</td>
<td>07</td>
<td>PWMA_LS</td>
<td>J1</td>
<td>08</td>
</tr>
<tr>
<td>PWMA_HS</td>
<td>J1</td>
<td>05</td>
<td>PWMA_HS</td>
<td>J1</td>
<td>06</td>
</tr>
<tr>
<td>GD_RST_B</td>
<td>J1</td>
<td>03</td>
<td>GD_RST_B</td>
<td>J1</td>
<td>04</td>
</tr>
<tr>
<td>GD_EN</td>
<td>J1</td>
<td>01</td>
<td>GD_EN</td>
<td>J1</td>
<td>02</td>
</tr>
</tbody>
</table>

**J1**

**J2**
**Arduino Compatibility**

The internal rows of the I/O headers on the DEVKIT-MOTORGD are arranged to fulfill Arduino™ shields compatibility.

### J3 Pinout

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>PORT</th>
<th>PIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>J3-02</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J3-04</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J3-06</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J3-08</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J3-10</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J3-12</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J3-14</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J3-16</td>
<td>NC</td>
</tr>
</tbody>
</table>

### J4 Pinout

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>PORT</th>
<th>PIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>J4-02</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J4-04</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J4-06</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J4-08</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J4-10</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J4-12</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J4-14</td>
<td>NC</td>
</tr>
<tr>
<td>NC</td>
<td>J4-16</td>
<td>NC</td>
</tr>
</tbody>
</table>

**FUNCTION**

<table>
<thead>
<tr>
<th>PIN</th>
<th>PORT</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>J3-01</td>
<td>J_VDC</td>
<td>VDC</td>
</tr>
<tr>
<td>J3-03</td>
<td>MC_VCC</td>
<td>5V</td>
</tr>
<tr>
<td>J3-05</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>J3-07</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>J3-09</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>J3-11</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td>J3-13</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td>J3-15</td>
<td>J_VDC</td>
<td>VDC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PIN</th>
<th>PORT</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>J4-01</td>
<td>DCBI</td>
<td>Current</td>
</tr>
<tr>
<td>J4-03</td>
<td>DCBV</td>
<td>Voltage</td>
</tr>
<tr>
<td>J4-05</td>
<td>BEMF_A/PHA_I</td>
<td>Feedback/Output</td>
</tr>
<tr>
<td>J4-07</td>
<td>BEMF_B/PHB_I</td>
<td>Feedback/Output</td>
</tr>
<tr>
<td>J4-09</td>
<td>BEMF_C/PHC_I</td>
<td>Feedback/Output</td>
</tr>
<tr>
<td>J4-11</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>J4-13</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>J4-15</td>
<td>NC</td>
<td>NC</td>
</tr>
</tbody>
</table>
Arduino Compatibility
The internal rows of the I/O headers on the DEVKIT-MOTRGD are arranged to fulfill Arduino™ shields compatibility.
DEVKIT-MOTORGD supports power through an external 10-18V power supply, 12V being the most common. NXP does not directly sell 12V power supplies. You can obtain a power supply through a third-party.

Power supply specifications:
- Fully regulated Switching Power Supply
- Input Voltage 100-240V AC 50/60Hz
- Output 12V 1A/2A DC
- Plug size: 5.5mm x 2.1 mm, Center Positive

12V must be used for CAN and LIN/UART communication.
DEVKIT-MOTORGD Board : Order Information

Follow this link to order this board.

You can also do a search in NXP.com and look for “DEVKIT-MOTORGD”

SRP = $49 USD
To comply with EMC requirements, you must attach the included ferrite clamp to the motor wires connecting to terminal block J13 of the DEVKIT-MOTORGD board. The clamp must be installed at the end of the motor wires closest to the DEVKIT-MOTORGD board.

The following outlines how to install the ferrite clamp.
EMC Requirements Note – Step 1

Using the provided tool, open the ferrite clamp by inserting it in the two slots on the clamp.
EMC Requirements Note – Step 2

Loop the motor wires through and around the ferrite clamp so that the motor wires pass through the ferrite clamp twice. The maximum distance from the board is 2.5 inches.
EMC Requirements Note – Step 3

Close the ferrite clamp carefully, ensuring none of the wires are pinched by the ferrite material and/or ferrite clamp housing.
Documentation and Reference Material

• Documentation Links
  – MOTORGD Schematic (TBA)
  – MOTORGD Factsheet (TBA)
  – Model-Based Design

• Software Suites
  – Automotive Math and Motor Control Library Set for S32K14x
  – Automotive Math and Motor Control Library Set for MPC574xP

• Reference Manuals
  – MPC574xP Reference Manual
Recommendations

• Keep S32 Design Studio IDE and OpenSDA firmware Up-to-date for best results

• Post Technical Questions on NXP community for MPC5xxx.

• Useful Links:
  - MPC5744P Webpage
  - S32K Webpage
  - DEVKIT-MOTOROGD Webpage
  - S32K144EVB-Q100 Webpage
  - DEVKIT-MPC5744P Webpage
  - nxp.com/community