BOOST-DRV8848

This document is provided with the BOOST-DRV8848 dual brushed-motor BoosterPack™ as a supplement to the DRV8848 datasheet (SLLSEL7). This application report details the hardware setup and operation of the BoosterPack.

Contents

1 Hardware Views 2
2 Introduction to the BOOST-DRV8848 3
2.1 Features 3
2.2 Pinout 4
3 Operating the Booster Pack 5
3.1 Requirements 5
3.2 Launchpad Configuration 5
3.3 Hardware Connection 6
4 Brushed Motor Demo Application 7
4.1 Introduction 7
4.2 Setting up the BOOST-DRV8848 Firmware 7
4.3 Setting up the BOOST-DRV8848 GUI 10
4.4 Spinning the Brushed Motor 11
5 Hardware Files (Schematic/Gerber) 14

List of Figures

1 BOOST-DRV8848 2
2 BOOST-DRV8848 on Top MSP430G2 LaunchPad 2
3 DRV8848 Solution Size 3
4 BOOST-DRV8848 Pinout 4
5 MSP-EXP430G2 Jumper Location 5
6 Target Configuration 7
7 Target Configuration Setup 8
8 Launch Selected Configuration 8
9 Connect Target Selection 9
10 Load Program Selection 9
11 Load Program Complete 9
12 Existing CCS Eclipse Projects 10
13 BOOST-DRV8848 GUI 11
14 GUI (Normal Mode) 12
15 GUI (Parallel Mode) 13
16 Parallel Mode Operation 14

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1 Hardware Views

Figure 1 illustrates the BOOST-DRV8848 and Figure 2 pictures the BOOST-DRV8848 connected to the MSP430G2 LaunchPad™.

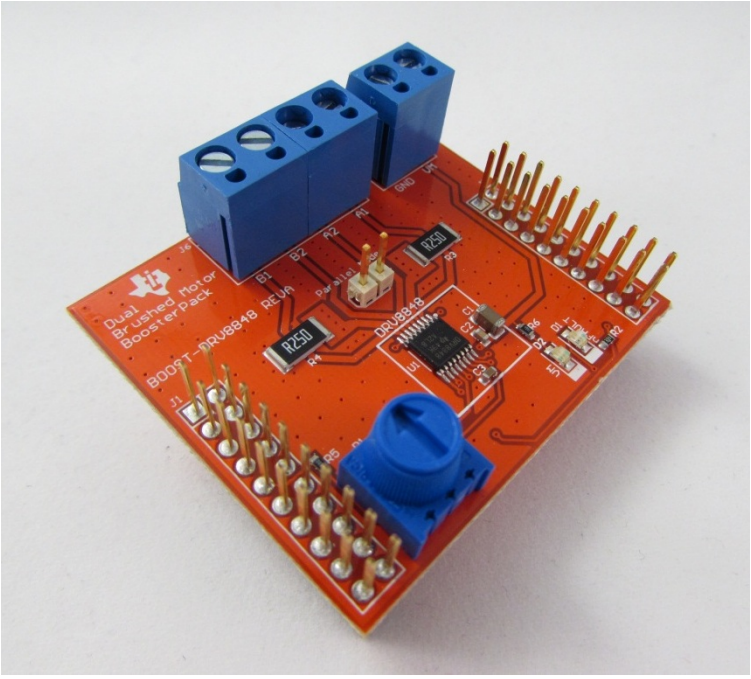


Figure 1. BOOST-DRV8848

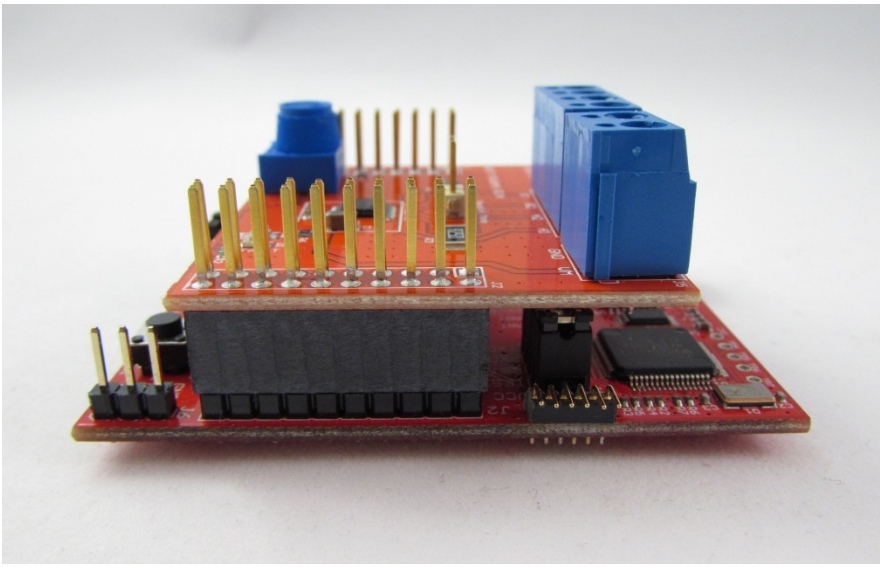


Figure 2. BOOST-DRV8848 on Top MSP430G2 LaunchPad

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2 Introduction to the BOOST-DRV8848

The BOOST-DRV8848 is a dual brushed DC motor BoosterPack based on the DRV8848 dual H-bridge motor driver. This BoosterPack provides a fully-protected, brushed DC motor drive stage in order to evaluate your motor application.

2.1 Features

- Complete dual brushed DC motor drive stage in a small form factor (1.75 in x 2.0 in)
- High output current per H-bridge
  - 2-A peak
  - 1-A RMS
- Parallel mode available for higher current
- Wide power supply voltage range 4.0 V – 18.0 V
- Fully-protected drive stage including overcurrent, short-circuit, over-temperature, and undervoltage with reporting through the nFAULT pin
- Highlights the compactness of the DRV8848 solution
- Combine with TI LaunchPad kits to create a complete brushed DC motor drive and control platform
- Optimized for the MSP-EXP430G2 LaunchPad with a user-friendly application to get the motor spinning in minutes

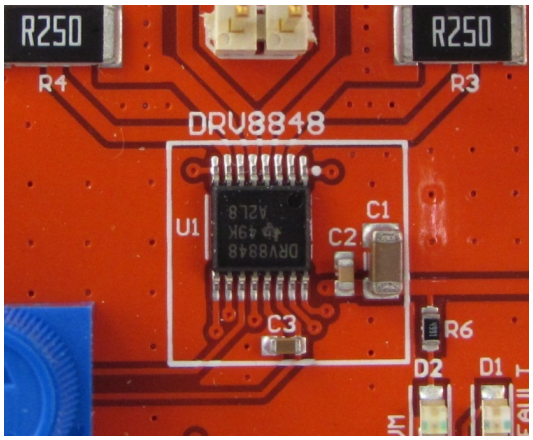


Figure 3. DRV8848 Solution Size

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2.2 Pinout

The LaunchPad interfaces to the BoosterPack over the LaunchPad headers (J1 and J2). Figure 4 gives an overview of the various control and feedback signals.

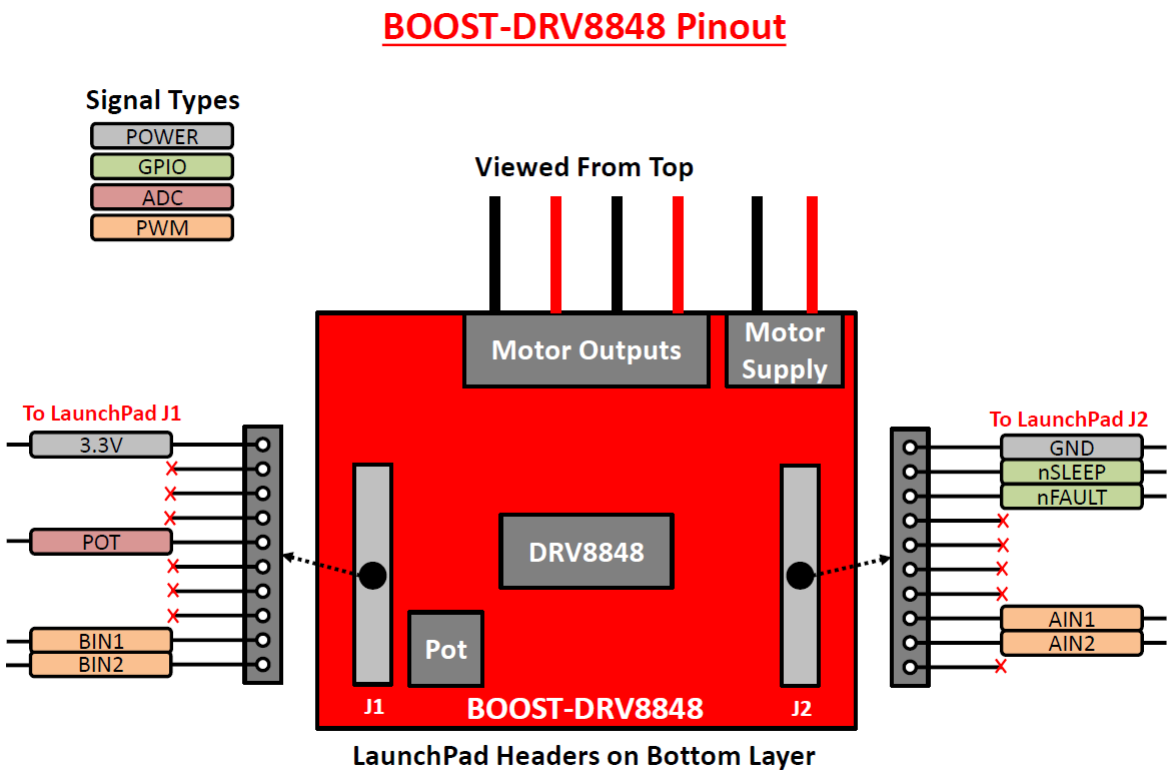


Figure 4. BOOST-DRV8848 Pinout

- Powered by an external power supply (4 V–18 V) that is connected to the terminal block header (J5)
- 4-pin terminal block header (J6) for connecting two brushed DC motors
- Parallel mode jumper in order to supply 2x current to a single brushed DC motor
- Fault reporting through the nFAULT signal and LED
- Onboard potentiometer for setting the current limit voltage (VREF)

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3 Operating the Booster Pack

3.1 Requirements

The dual brushed DC motor BoosterPack is not a standalone evaluation board and requires a compatible LaunchPad kit to provide the appropriate control signals. In addition to the dual brushed DC motor BoosterPack and a compatible LaunchPad, you will require one/two brushed DC motors and sufficient power supply.

3.2 Launchpad Configuration

For the MSP-EXP430G2 LaunchPad, keep the P1.0 (LED1) and P1.6 (LED2) jumpers for correct operation of the *Status* indication of the BoosterPack firmware. Align the TXD and RXD jumpers horizontally for operation of the hardware UART with the software application.

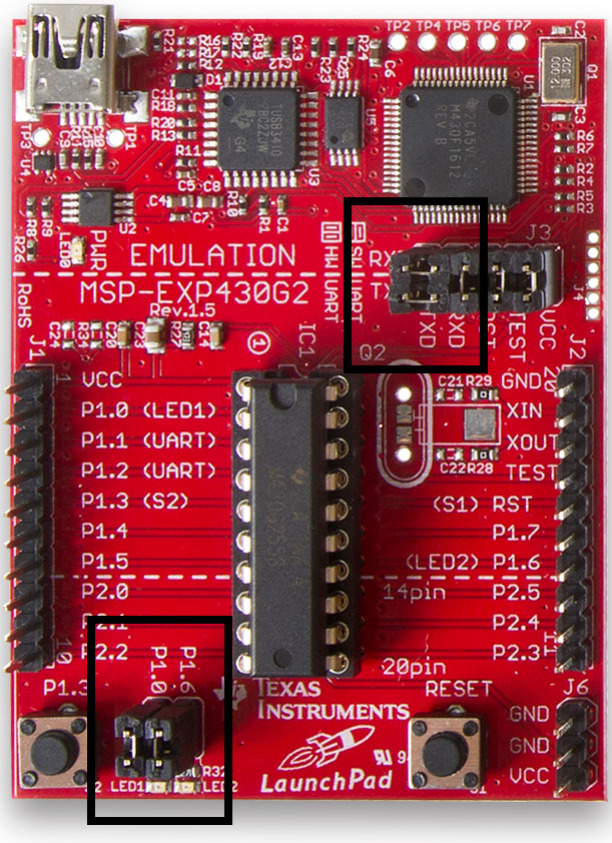


Figure 5. MSP-EXP430G2 Jumper Location

For other LaunchPads, ensure that the appropriate jumpers are configured on pins that the BOOST-DRV8848 BoosterPack utilizes.

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3.3 Hardware Connection

1. Plug the dual brushed DC motor BoosterPack onto the LaunchPad as shown in Figure 2. The MSP430G2 LaunchPad will dock with the outer row of the 20-pin headers. The inner row is provided to maintain compatibility with 40-pin LaunchPads. **Orient the terminal block headers towards the USB connector.**
2. Connect the brushed motors to the **terminal block header J6**.
3. Connect the power supply that will power the brushed motor BoosterPack's DRV8848 to the **terminal block header J5**. The connections have been labeled **VM** and **GND**. For full performance, ensure as much current as your motor may demand is supplied. The brushed motor BoosterPack has a designed operating range from **4.0–18 V, up to 1-A RMS/2 A peak for each H-Bridge**.
4. Enable the power supply.
5. Enable the controller and spin the motor! The BOOST-DRV8848 dual brushed DC motor BoosterPack, combined with a TI LaunchPad, will provide a complete brushed DC motor evaluation platform. With the MSP-EXP430G2 LaunchPad and a MSP430G2553, you can take full advantage of TI's **pre-written brushed motor control application (see Section 4 for additional details)**.

NOTE: At high currents the drive stage can increase to high temperatures.

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4 Brushed Motor Demo Application

4.1 Introduction

As previously mentioned, the BOOST-DRV8848 dual brushed DC motor BoosterPack has been optimized to work together with the MSP430G2 Launchpad to provide a complete brushed motor evaluation platform. With the demo application provided, the brushed motor can be up and spinning in minutes. **To get started with TI's pre-written brushed control application, follow the steps outlined in the next section.**

4.2 Setting up the BOOST-DRV8848 Firmware

1. Load the BOOST-DRV8848 brushed motor control application onto the MSP430G2553 by first downloading the latest version of Code Composer Studio™ (CCS). This application was developed in CCS v6.0.0. http://processors.wiki.ti.com/index.php/Download_CCS.
2. Obtain the BOOST-DRV8848 firmware and GUI, by downloading the *BOOST-DRV8848 Hardware and Software Files* from the tool folder, www.ti.com/tool/boost-drv8848. This zip folder contains the complete hardware design files, including the Altium source files, Gerbers, BOM, and schematic, as well as the Brushed DC Motor Demo firmware and GUI.
3. Flash the MSP430G2553 on the MSP430G2 LaunchPad with the firmware provided. The MSP430G2 LaunchPad, an MSP430G2553, and mini-USB cable are required. The flash can be done in one of the following two ways:
4. Method 1: Loading the binary .out file (preferred)
   - Open Code Composer Studio.
   - Select **View -> Target Configuration** (Figure 6)
   - Right click on the **User Defined** folder and select **New Target Configuration** (Figure 6)
   - Give the *Target Configuration* a name and select **Finish**

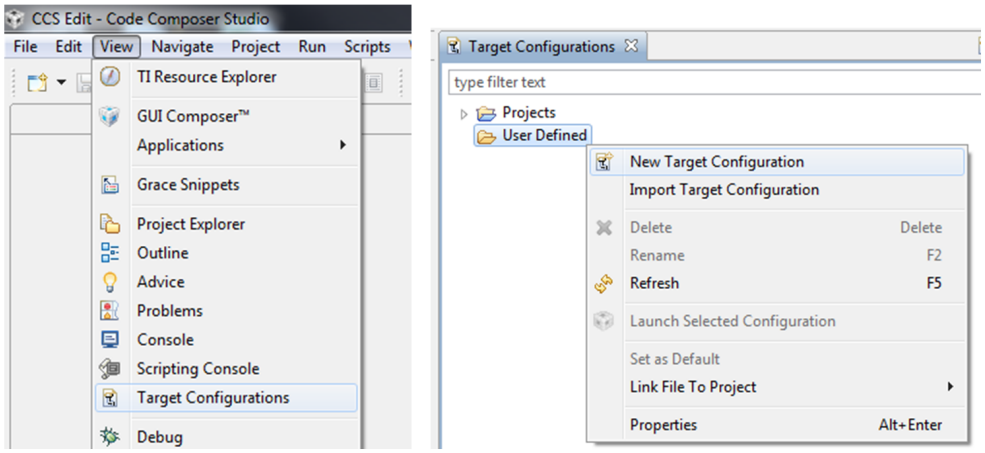


Figure 6. Target Configuration

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- Set up the *Target Configuration* as shown in Figure 7. Save the *Target Configuration* file.

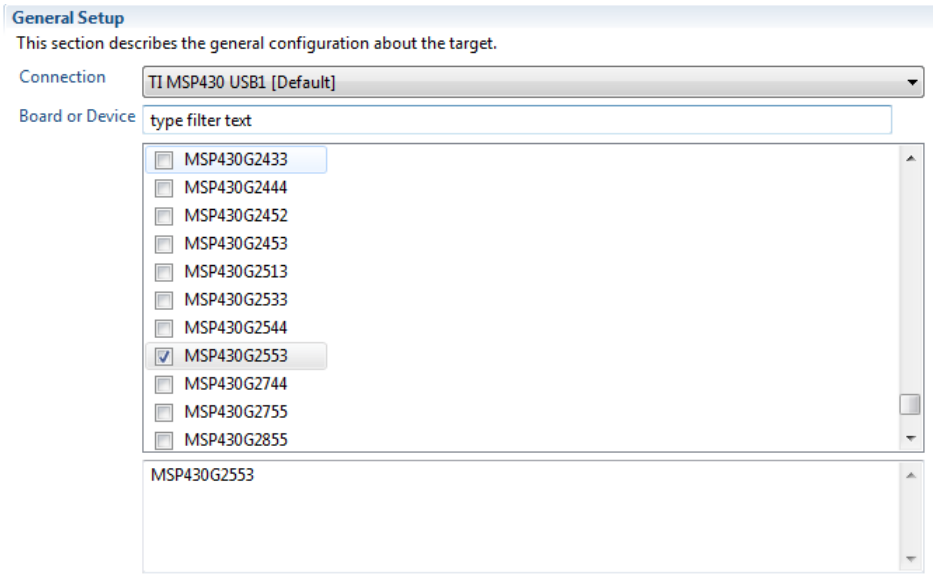


Figure 7. Target Configuration Setup

- Go back to **View -> Target Configurations**
- Right click the newly-created *Target Configuration* file and select **Launch Selected Configuration** (see Figure 8)

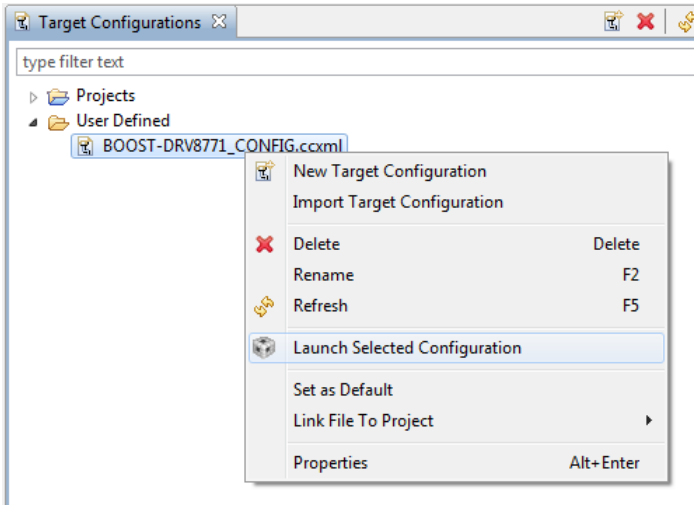


Figure 8. Launch Selected Configuration

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- In the *Debug Menu*, right click on the **TI MSP430 USB1_0** connection and select **Connect Target** (see Figure 9)

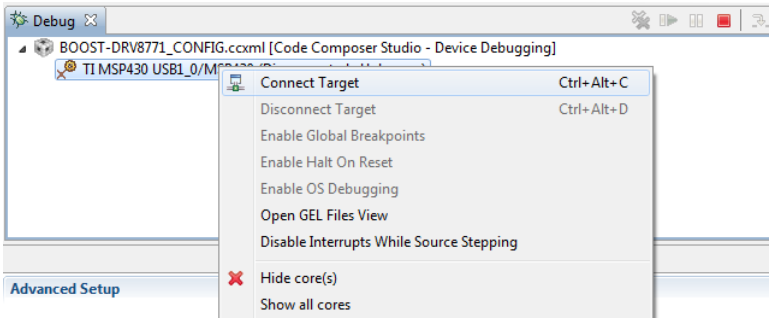


Figure 9. Connect Target Selection

- After the device connects, go to **Run -> Load -> Load Program** (see Figure 10). Browse to the **BOOST-DRV8848 Hardware and Software Files** folder that was downloaded from the tool folder. Go into the *Application* subdirectory and then go into the GUI subdirectory. Select the **appProgram.out** file (Application\BOOST-DRV8848_GUIvX.X\appProgram.out).

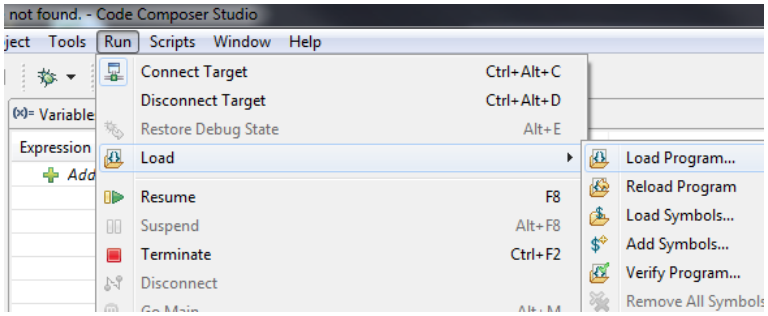


Figure 10. Load Program Selection

- After a short delay, the appProgram.out file is loaded onto the MSP430G2553 (see Figure 11). An error message may display saying that the source was not found. Receiving this message is OK, as long as the binary was loaded.

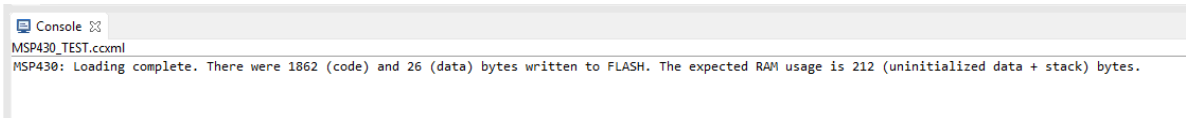


Figure 11. Load Program Complete

- Close CCS

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5. Method 2: Flashing the project through CCS debugger
   - Open Code Composer Studio
   - **Go to File -> Import**
   - Select **Existing CCS Eclipse Projects** under the **Code Composer Studio** tab

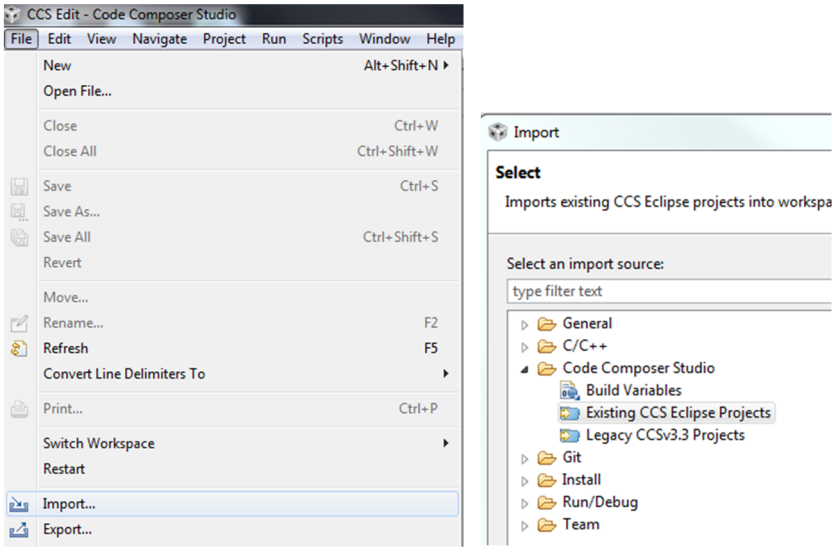


Figure 12. Existing CCS Eclipse Projects

   - Check the **Copy projects into workspace** option and then browse to the **BOOST-DRV8848_FIRMWAREvX.X** directory located with the *Application* folder within the **BOOS-DRV8848 Hardware and Software Files** folder. The project should now show up in the **Discovered Projects** section. Ensure that it is checked and select **Finish**.
   - Select the BOOST-DRV8848_FIRMWAREv1.0 project in the **Project Explorer** and click the **Debug** icon.
   - CCS now builds the project and loads it onto the MSP430G2533.
   - Update the binary file that the GUI is referencing (since CCS has recompiled it). Replace the **appProgram.out** file (Application\BOOST-DRV8848_GUIvX.X\appProgram.out) with the **BOOST-DRV8848_FIRMWAREvX.X.out** file (Application\BOOST-DRV8848_FIRMWAREvX.X\Debug\BOOST-DRV8848_FIRMWAREvX.X.out). Delete the old “appProgram.out” and rename the new file to “appProgram.out
   - Close CCS

4.3 Setting up the BOOST-DRV8848 GUI

1. To the run the BOOST-DRV8848 GUI, first download the latest version of the GUI Composer Runtime. Register for a TI account if you don’t already have one. Select the appropriate version for your operating system and follow the installation instructions.

   http://processors.wiki.ti.com/index.php/Category:GUI_Composer#GUI_Composer_Downloads
2. After installing the GUI Composer Runtime, copy the BOOST-DRV8848_GUIvX.X folder, located in the *Application* directory of the BOOST-DRV8848 Hardware and Software Files folder and paste this folder into the GUI Composer webapps folder located in the “C:\ti\guicomposer\webapps\” directory. If a non-default installation directory was selected in Step 1, the top-level directory may differ.
3. To run the GUI, double click the BOOST-DRV8848_GUIvX.X.exe file within the BOOST-DRV8848_GUIvX.X folder of the webapps directory. A shortcut to this .exe can be created in order to start it from other file locations.

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NOTE: Ensure that the GUI "exe" is exactly two levels below the GUI Composer "webapps" folder. The GUI will not start if this is incorrect. The path should look similar to this "C:\ti\guicomposer\webapps\BOOST-DRV8848_GUIvX.X\BOOST-DRV8848_GUIvX.X.exe".

If a non-default installation directory was selected in Step 1, the top-level directory may differ.

4.4 Spinning the Brushed Motor

After a successful launch of the BOOST-DRV8848_GUIvX.X.exe, the screen in Figure 13 should pop up. A small period of time may be needed before the GUI connects and the GUI Widgets populate (red X's appear on the widgets while the GUI is connecting). If the GUI does not load after a few minutes (X's disappear), a connection issue may have occurred. Try restarting the application.

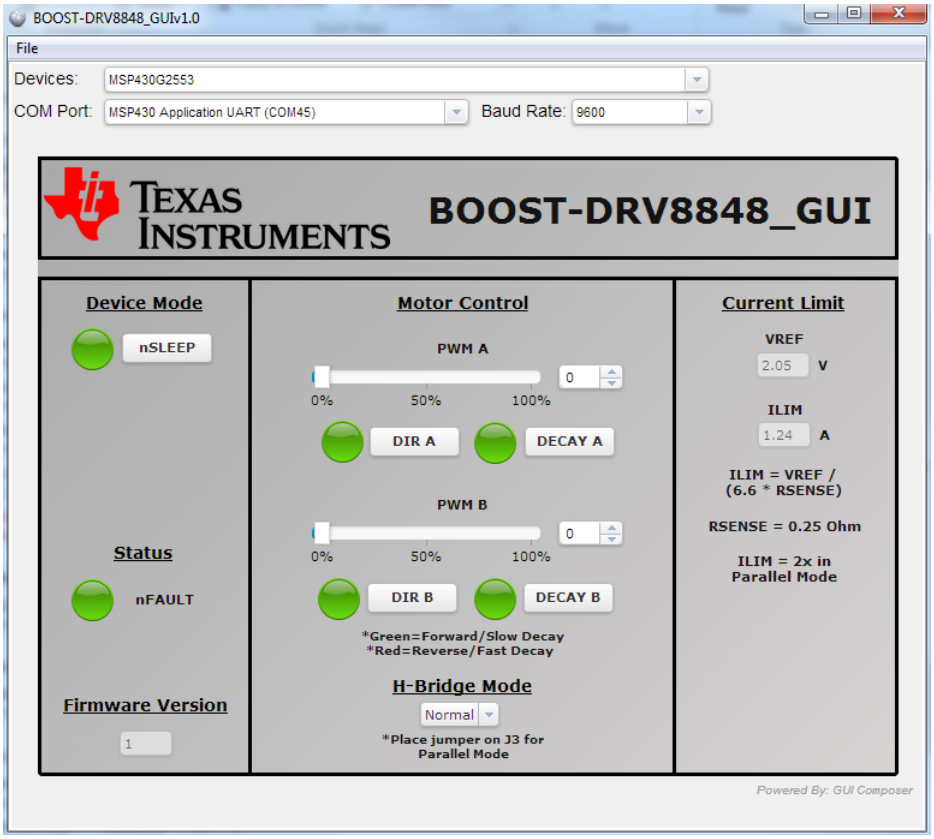


Figure 13. BOOST-DRV8848 GUI

4.4.1 Quick Start

1. Set the **nSLEEP** pin high in order to enable the DRV8848 device.
2. If you want to operate just one motor with twice the output current of the DRV8848, switch to **Parallel Mode**. The device operates in **Normal Mode** per default. In *Parallel Mode*, a jumper must be placed on **J3**.
3. Ensure the **Current Limit** is set for your motor requirements. The **Current Limit** can be adjusted with the **VREF** potentiometer (R1).
4. Adjust the speed of the attached motor by sliding the bars for the **PWM duty cycle**.
5. Choose the decay mode and the direction of the motor by setting the respective buttons **DECAY** and **DIR** for the desired motor.

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4.4.2 GUI Walkthrough (Normal Mode)

Figure 14 illustrates the GUI in normal mode.

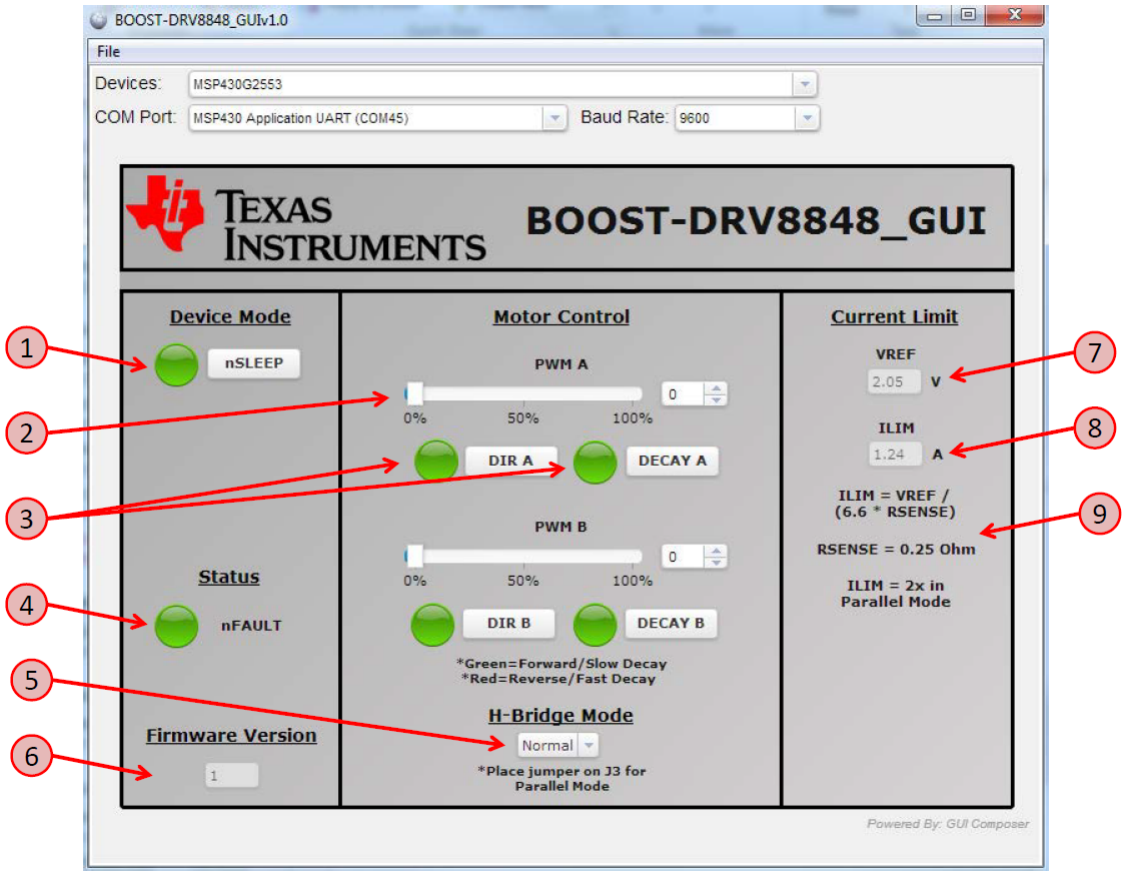


Figure 14. GUI (Normal Mode)

The numeric labels indicated in Figure 14 are described in the following numbered list:

1. The nSLEEP button directly controls the nSLEEP pins of the DRV8848. Red indicates LOW (0 V) and green indicates HIGH (3.3 V). Logic HIGH to enable device, logic LOW to enable low power sleep mode and reset all internal logic.
2. The PWM slide controls the duty cycle of the applied voltage to the motor. The duty cycle directly affects the speed of the motor.
3. The DIR and DECAY buttons control the direction and decay mode of the motor. See the DRV8848 datasheet SLLSEL7 for more information on decay modes.
4. nFAULT will assert when the DRV8848 is reporting a FAULT condition. See the DRV8848 datasheet for more information on the various FAULT conditions.
5. The DRV8848 can operate two brushed DC motors simultaneously with an output current up to 1-A RMS. The DRV8848 can also parallel the outputs to deliver 2x the current to a single motor. This button controls the DRV8848 output mode. Place the J3 jumper on the BoosterPack.
6. Revision number reported by the firmware
7. The voltage set by the R1 potentiometer on the BoosterPack (resistor divider from DVDD). This voltage controls the current limit of the DRV8848.
8. Calculated current limit for the DRV8848
9. The equation for determining the current limit from the VREF voltage and RSENSE resistance.

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4.4.3 GUI Walkthrough (Parallel Mode)

Figure 15 illustrates the GUI in parallel mode.

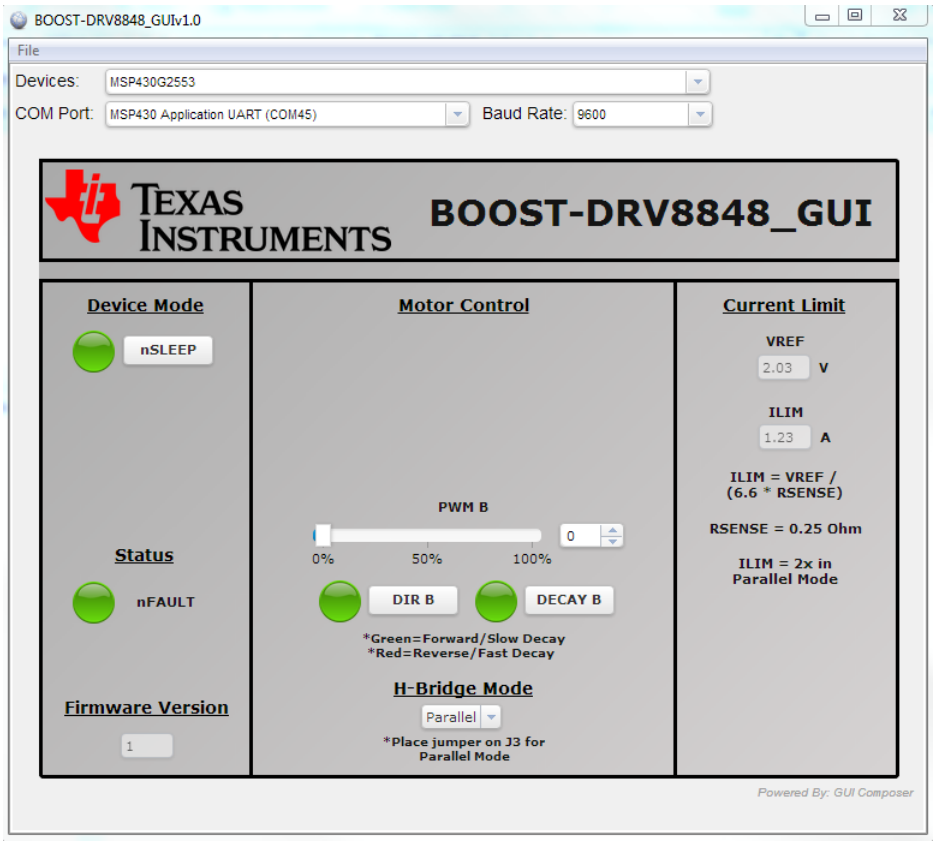


Figure 15. GUI (Parallel Mode)

- In Parallel Mode, both outputs are controlled through the B motor inputs.

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- See Figure 16 for the schematic connections. You must parallel the outputs from the terminal block header (J6).

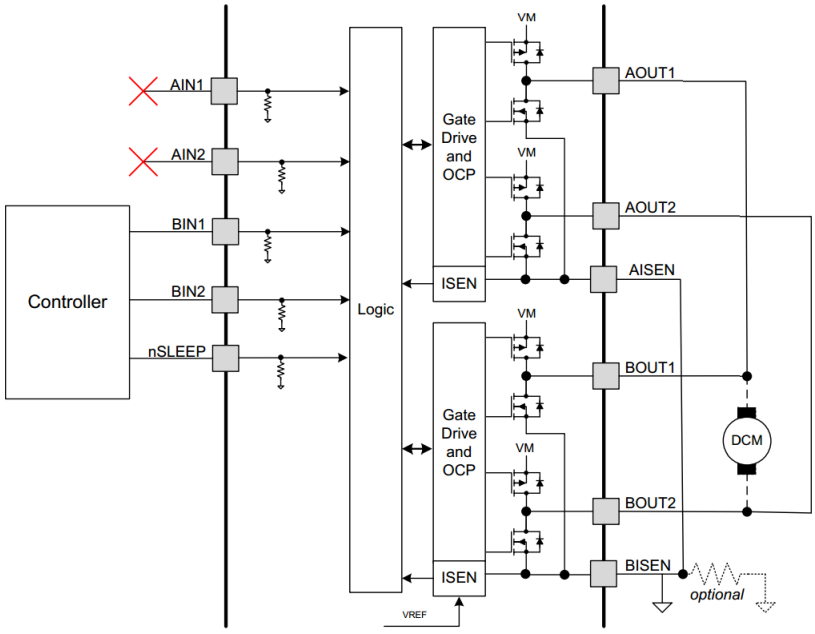


Figure 16. Parallel Mode Operation

5 Hardware Files (Schematic/Gerber)

The complete design files can be found in the tool folder (http://www.ti.com/tool/boost-drv8848) including the schematic, gerbers, layout files, PCB views, and bill of materials.

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