Advance Information



User's Guide SLVUB97–October 2017

# BOOSTXL-DRV8304H EVM User's Guide

This document is provided with the BOOSTXL-DRV8304H customer evaluation module (EVM) as a supplement to the *DRV8304 38-V Three-Phase Smart Gate Driver* data sheet. The scope of this document is to provide the user with a guide to evaluate the DRV8304 device with the MSP430F5529 LaunchPad<sup>™</sup> development kit.

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#### **Trademarks**

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#### 1 **Overview**

The BOOSTXL-DRV8304H evaluation module (EVM) is an application board designed to allow easy evaluation of the DRV8304 device. The DRV8304 device is a gate driver IC for three-phase motor drive applications. The DRV8304 device provides three high-accuracy trimmed and temperature-compensated half bridge drivers, each capable of driving a high-side and low-side N-type MOSFET.

The DRV8304 device is used in motor control applications that require a high degree of integrated protection, diagnosis, and monitoring. Both SPI (DRV8304S) and hardware (DRV8304H) interface variants provide detailed fault reporting and flexible parameter settings such as current control options for slew-rate control of the gate drivers and various protection features.

This EVM uses a compact and modular form factor for ease of use and is designed to dock with compatible Texas Instruments LaunchPad development kits, or other MCUs for a complete motor-control system. Along with the hardware of the DRV8304 device, the MSP430F5529 microcontroller has loaded reference software that provide the necessary gating pulses to the DRV8304 device to control BLDC motors.



Figure 1. LaunchPad<sup>™</sup> and BOOSTXL-DRV8304H EVM

#### 1.1 Purpose and Scope

This document is designed to be used as a startup guide and to supplement the DRV8304 and MSP430F5529 BLDC motor control demo code kit. This document is intended for the engineers involved in the design, implementation, and validation of DRV8304x and MSP430F5529 reference software.

The scope of this document is to provide the user with a guide to evaluate the DRV8304 device with an MSP430F5529 LaunchPad development kit. This document covers the hardware (HW) connections required between the BOOSTXL-DRV8304H EVM and LaunchPad development kit. When the HW connections are done, the user is required to download the required tools and software (SW) to spin the motor. The following sections provide step-by-step details on the installing the CCS tool, importing the DRV8304 project into CCS, building the project, debugging the project, and spinning the motor, see Section 2.2.

This reference SW comprises trapezoidal sensored and sensorless algorithms for BLDC motor control. For additional information on the algorithms used, refer to *BOOSTXL-DRV8304x Sensored Software User's Guide* and *BOOSTXL-DRV8304x Sensorless Software User's Guide*.

# 2 Hardware and Software Overview

# 2.1 Hardware Overview

# 2.1.1 Features

The following lists the BOOSTXL-DRV8304H EVM features:

- Operating supply range from 6 V to 38 V
- Three CSD88584Q5DC N-channel NexFETs driven by the gate driver
- Protected phase voltages provided to header pins through a voltage divider
- Connector available for Hall sensor inputs connected to the MSP430<sup>™</sup> MCU. The 3.3-V supply to the Hall sensors is derived by the LMR16006XDDCR buck converter
- Includes sample code for MSP430F5529 LaunchPad

# 2.1.2 BOOSTXL-DRV8304H EVM Overview

Figure 2 shows the major blocks of the hardware on the BOOSTXL-DRV8304H EVM.



Figure 2. Hardware Connections Overview



- Power Supply (J1): valid input supply voltages from 6 V to 38 V from a battery or a DC voltage source.
- DRV8304 (U3): 3-phase automotive gate driver with three integrated current shunt amplifiers.
- Drive Stage (U1, U2, U5): 3x CSD88584Q5DC N-channel NexFETs driven by the gate driver.
- LMR16006 (U4): DC/DC buck regulator with 3.3-V output used to support external hall sensors, not required for device operation.
- To Motor (J2): switching nodes of the 3-phase bridges for motor connection.
- LEDs (3P3V[D4], nFault[D1]): shows the status of the board.



#### 2.1.3 Pinout and Jumper Overview

Figure 3 shows the various jumper labels on the BOOSTXL-DRV8304H EVM.



**Figure 3. Connections Overview** 



Figure 4 shows the various jumper connection pinouts from the BOOSTXL-DRV8304H EVM to the MCU.



Viewed From Top

Figure 4. BOOSTXL-DRV8304H Jumper Connectors Pinout

# 2.1.4 Connecting the BOOSTXL-DRV8304H EVM to the LaunchPad™

Follow these steps when connecting the BOOSTXL-DRV8304H EVM to the LaunchPad

- Step 1. Make sure nothing is connected to the board, and no power is being supplied.
- Step 2. Connect the BOOSTXL-DRV8304H connectors J1/J3 and J2/J4, onto the MSP430F5529 LaunchPad development kit (see Figure 1).
- Step 3. Connect a USB cable to the PC and directly to the MSP430F5529 LaunchPad development kit.
- Step 4. Connect the three phases of the BLDC motor to the three-phase motor socket, J2 (the pins are labeled A, B, and C), provided on the BOOSTXL-DRV8304H EVM board (see Figure 3).



Step 5. Connect the supply voltage ranging from 6 V to 38 V from a battery or a DC-voltage source to



the voltage supply pin, J1.

Step 6. Confirm that the 3P3V LED is turned on and the nFAULT LED turned off after powering the device (see Figure 5).



Figure 5. EVM Showing the Position of LEDs

# 2.1.5 Hardware, Software, and Tools Required for Evaluation

The software, hardware, and tools required to optimally evaluate the reference software code with the BOOSTXL-DRV8304H EVM are listed as follows:

- BOOSTXL-DRV8304H EVM
- MSP430F5529 LaunchPad development kit
- Voltage supply from 6 V to 38 V
- Code Composer Studio<sup>™</sup> software V.6.1 and above
- BOOSTXL-DRV8304H reference software development package
- BOOSTXL-DRV8304H GUI software

# 2.1.6 Interfacing DRV8304x and MSP430F5529 LaunchPad™

The DRV8304 device has 40 pins with different functions. These pins are interfaced with the MSP430F5529XL LaunchPad development kit which is mapped appropriately to receive the functionality of the BoosterPack<sup>™</sup> plug-in module. These 40 pins are grouped into 4 ports. Table 1 and Table 2 list the interfacing of these ports with the MSP430F5529 device.

J4 Pin Number	BOOSTXL-DRV8304H Function	MSP430F5529 Function	Description	
1	INHA	P2.5, TA2.2	Secondary function, Timer 2 comparator output to generate PWM for A phase high-side switches	
2	GND	GND	ADC GND connections	
3	INLA	P2.4, TA2.1	Secondary function, Timer 2 comparator output to generate PWM for A phase low-side switches	
4	HALLA	P2.0, SPI enable	Hall sensor A from motor	
5	INHB	P1.5, TA0.4	Secondary function, Timer 1 comparator output to generate PWM for B phase high-side switches	
6	HALLB	P2.2, I/O PIN with Interrupt	Hall sensor B from motor	
7	INLB	P1.4, TA0.3	Secondary function, Timer 1 comparator output to generate PWM for B phase low-side switches	
8	No function	P7.4, I/O pin	No function	
9	INHC	P1.3, TA0.2	Secondary function, Timer 1 comparator output to generate PWM for C phase high-side switches	
10	No function	RST	No function	
11	INLC	P1.2, TA0.1	Secondary function, Timer 1 comparator output to generate PWM for C phase low-side switches	
12	SDI	P3.0, UCBOSIMO	Secondary function for data input to DRV8304S	
13	MODE	P4.3, I/O pin	Sets the input control mode, 4-level input pin (DRV8304H devices only)	
14	SDO	P3.1, UCBOSOMI	Secondary function for data output from DRV8304S	
15	LED	P4.0, I/O pin	Visual feedback for faults.	
16	HALLC	P2.6, I/O pin With Interrupt	Hall sensor C from motor enable the gate driver and current shunt amplifiers	
17	SHUNT	P3.7, I/O pin	This pin is pulled high for 3 shunt variant and pulled low for single shunt variant	
18	nSCS/GAIN	P2.2, I/O PIN with Interrupt	Active low enables serial interface communication and sets the gain of the shunt amplifiers, 4-level input pin (DRV8304H devices only)	
19	VARIANT	P8.2, I/O pin	Pulled low for DRV8304H, high for DRV8304S devices	
20	CAL	P8.1, I/O pin	Pull logic high to internally short all amplifier inputs together	

Table 2. BOOSTXL-DRV8304H J	5 Pin	Connections
-----------------------------	-------	-------------

J5 Pin Number	BOOSTXL-DRV8304H Function	MSP430F5529 Function	Description	
1	3.3 V	3.3 V	3.3-V LaunchPad supply	
2	No function	5 V	5-V supply	
3	VSENVM	P6.5, ADC channel – A5	Sensing VCC supply voltage	
4	GND	GND	ADC - GND connections	
5	No function	P3.4, I/O PIN	Software debug pins (optional)	
6	VSENA	P6.0, ADC channel – 0	Sensing A phase voltage	
7	No function	P3.3, I/O PIN	Software debug pins (optional)	
8	VSENB	P6.1, ADC channel – 1	Sensing B phase voltage	
9	ENABLE	P1.6, I/O pin with Interrupt	Logic low to enter a low-power sleep mode	
10	VSENC	P6.2, ADC channel – 2	Sensing C phase voltage	
11	POT	P6.6, ADC channel – A6	Optional POT to vary the voltage 0-3.3 V on pin	
12	ISENC	P6.3, ADC channel – 3	Sensing C phase current	
13	SCLK	P3.2, UCBOCLK – SPI CLK	Secondary function for pin SPI CLK	
14	ISENB	P6.4, ADC channel – 4	Sensing B phase current	
15	nFAULT	P2.7, I/O pin with Interrupt	Pulled logic low during a fault condition	
16	ISENA	P7.0, ADC channel – 12	Sensing A phase current	
17	No function	P4.2, I/O pin	Software debug pins (optional)	
18	IDRIVE	P3.6, I/O pin	Sets gate drive peak current, 7-level input pin (DRV8304H devices only)	
19	No function	P4.1, I/O pin	Software debug pins (optional)	
20	VDS	P3.5, I/O pin	Sets VDS monitor threshold voltage, 7-level input pin (DRV8304H devices only)	

#### 2.1.7 Hardware Connections for Hall Sensor Operation

Table 3 lists the signal connections from the Hall sensor of the motor connected to jumper J3 on the BOOSTXL-DRV8304H EVM.

Signal Description Equivalent on BOOSTXL-DRV8304H	
GND	J3–1(-)
Hall C	J3–2(C)
Hall B	J3–3(B)
Hall A	J3–4(A)
V3P3	J3–5(+)

# Table 3. Hall Sensor Signal Connections to the BOOSTXL-DRV8304H EVM

# 2.2 Software and Tools Overview

### 2.2.1 Installing CCS for Software Evaluation

Code Composer Studio (CCS) versions 5.x.x and 6.x.x were used and tested for DRV8304X reference code. Install an authorized version from www.ti.com/tool/ccstudio.

**NOTE:** A myTI login account is required to download CCS as well as the SDK package. This section describes the installation procedure for CCS5.4; however, installing other versions of CCS v5.x, including CCS, v6.x is similar.



After following the required steps to download the CCS installer, the ccs\_setup\_5.4.0.00091.exe file should be located in the specified download directory. Figure 6 shows this file.



#### Figure 6. Downloaded Executable for Code Composer Studio Installation

Follow the installation process listed:

- Step 1. Run the installer by double clicking the *ccs\_setup\_win32.exe* file.
- Step 2. Read through and accept the license agreement to proceed with the installation (see Figure 7).

💱 Code Composer Studio v6 Setup				
License Agreement				
Please read the following license agreement carefully.				
Code Composer Studio 6.1 Software License Agreement				
IMPORTANT - PLEASE READ THE FOLLOWING LICENSE AGREEMENT CAREFULLY. THIS IS A LEGALLY BINDING AGREEMENT. AFTER YOU READ THIS LICENSE AGREEMENT, YOU WILL BE ASKED WHETHER YOU ACCEPT AND AGREE TO THE TERMS OF THIS LICENSE AGREEMENT. DO NOT CLICK "I ACCEPT" UNLESS: (1) YOU ARE AUTHORIZED TO ACCEPT AND AGREE TO THE TERMS OF THIS LICENSE AGREEMENT ON BEHALF OF YOURSELF AND YOUR COMPANY; AND (2) YOU INTEND TO ENTER INTO AND TO BE BOUND BY THE TERMS OF THIS LEGALLY BINDING AGREEMENT ON BEHALF OF YOURSELF AND YOUR COMPANY.				
•				
$\odot$ I accept the terms of the license agreement.				
I do not accept the terms of the license agreement.      Print				
Texas Instruments				
< Back Next > Finish Cancel				

Figure 7. CCS License Agreement

Step 3. Choose a destination directory. Using the default (c:\ti) removes a step in the SDK installation procedure (see Figure 8).

💱 Code Composer Studio v6 Setup	X
Choose Installation Location Where should Code Composer Studio v6 be installed?	
To change the main installation folder click the Browse button.	
CCS Install Folder	
c\ti ▼	Browse
Texas Instruments	
< Back Next > Finish	Cancel

#### Figure 8. Default Installation Location for CCS

Step 4. Choose the processor architectures to install (see Figure 9). For the DRV83xx, the MSP430 and C28x are the only needed processor packages. The compiler tools



are required. Ensure that the box for	ne TI MSP430 Com	<i>piler Tool</i> is checked.
---------------------------------------	------------------	-------------------------------

😳 Code Composer Studio v6 Setup	
Processor Support Select Product Families to be installed.	
<ul> <li>□ MSP Ultra Low Power MCUs</li> <li>□ MSP430 Ultra Low Power MCUs</li> <li>□ MSP432 Ultra Low Power MCUs</li> <li>□ TI MSP430 Compiler</li> <li>□ GCC ARM Compiler</li> <li>□ GCC ARM Compiler</li> <li>□ TI C28x Compiler</li> <li>□ TI ARM Compiler</li> <li>□ GCC ARM Compiler</li> <li>□ GCC ARM Compiler</li> <li>□ SimpleLink Wireless MCUs</li> <li>□ 32-bit ARM MCUs</li> <li>□ Stellaris Device Support</li> </ul>	Description Processor Architectures included: MSP430, MSP432
□ Select All	Install Size: 969.43 MB. Download Size: 323.14 MB.
Texas Instruments < Back	Next > Finish Cancel

Figure 9. Processors Supported by CCS

Step 5. Select the emulator components to install.

For the provided tool, the MSP430 USB FET emulator is required.

Step 6. Review the installation size and click the *Finish* button to begin installation of the CCS software (see Figure 10).

Code Composer Studio v6 Setup	X
Select Debug Probes Select the debug probes you want installed and probes you want to leave out.	d deselect the debug
<ul> <li>TI XDS Debug Probe Support</li> <li>Blackhawk Debug Probes</li> <li>Spectrum Digital Debug Probes and Board</li> <li>MSP430 USB FET</li> <li>Tiva/Stellaris ICDI Debug Probe</li> </ul>	Description Drivers and support files for Spectrum Digital JTAG debug probes and development boards.
□ Select All	Install Size: 1292.65 MB. Download Size: 430.88 MB.
Texas Instruments 	> Finish Cancel

Figure 10. Components Available for Installation



- Step 7. Choose add-on software (this step is optional).
- Step 8. Review the installation and click the *Finish* button to finalize (see Figure 11).

Code Composer Studio v6 Setup					
App Center Texas Instruments					
There are additional products and features ("add-ons") available from the CCS App Center. Selected add-ons will be downloaded in the background and installed by the App Center when you run Code Composer Studio for the first time.					
<ul> <li>Tools (for App Center background downkd MSP430 GCC</li> <li>EVE Compiler</li> <li>Software (for App Center background downkd MSPWare</li> <li>GUI Composer</li> </ul>					
Select All     Install Size: 1292.65 MB.					
Download Size: 430.88 MB.					
Texas Instruments					
< Back Next > Finish Cancel					

Figure 11. Emulators Available for Installation

Step 9. After the installation is complete, click the *Finish* button to exit the set-up.

#### 2.2.2 Installing DRV8304 Reference Software Development Package

The DRV8304 reference software contains the files required to program DRV8304 devices along with the MSP430F5529 using CCS v5.x or CCS v6.x. All of these files are included in the installation package. To access this package, contact the DRV8x applications team or the respective field-sales engineer.

Install the reference software development package using these steps:

Step 1. Double click the executable file (.exe) for the DRV8304 reference software installer (see Figure 12).

S DRV8304-0.9.0-windows-installer.exe

#### Figure 12. DRV8304 Firmware Installer Executable File

Step 2. Follow the prompts to select another language from the default of English (see Figure 13).

Language Selection
Please select the installation language
English - English 🔻
OK Cancel

#### Figure 13. Language Selection



Step 3. Click the Next button on the DRV8304 installer welcome screen (see Figure 14).



Figure 14. Setup Home Screen

Step 4. Read though and accept the license agreement to proceed with the installation (see Figure 15).

🐮 Setup	x
License Agreement	
Please read the following License Agreement. You must accept the terms of this agreem before continuing with the installation.	ient
Source and Object Code Software Distribution License Agreement	
IMPORTANT PLEASE CAREFULLY READ THE FOLLOWING LICENSE AGREEMENT, WHICH IS LEGALLY BINDING. AFTER YOU READ IT, YOU WILL BE ASKED WHETHER YOU ACCEPT AND AGREE TO ITS TERMS. DO NOT CLICK I ACCEPT UNLESS: (1) YOU WILL USE THE LICENSED MATERIALS FOR YOUR OWN BENEFIT AND PERSONALLY ACCEPT, AGREE TO AND INTEND TO BE BOUND BY THESE TERMS; OR (2) YOU ARE AUTHORIZED TO, AND INTEND TO BE BOUND BY, THESE TERMS ON BEHALF OF YOUR COMPANY.	4
Do you accept this license? I accept the agreement InstallBuilder	
< Back Next > Cance	

Figure 15. DRV8304 Software License Agreement



Step 5. Choose the destination location for the example CCS projects and the documentation (see Figure 16). This destination can be set to any location in the PC.

🐔 Setup		
Choose Destination Fo	lder for DRV8x Firmware Installation	4
Setup will install DRV8x	Firmware in the following folder.	
to install to this folder,	click Next. To install to a different folder, sele	ect another folder.
Destination Folder C	ti\DRV8304_EVM_BLDC_FW_0.9.0	2
InstallBuilder		
and	< Back	ext > Cancel

Figure 16. Setup Destination Folder

Step 6. Select each DRV83x component to install (see Figure 17).

📲 Setup							
Select Components	4						
Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue.							
☑ DRV8304	Click on a component to get a detailed description						
InstallBuilder	Cancel						
	Cancel						

Figure 17. Select DRV8304 Setup Components





📲 Setup	
Exit Code Composer Studio Application	4
	Code Composer Studio should be installed before installing this SDK. If Code Composer Studio is already installed then make sure it is not running during SDK installation.
InstallBuilder	Next > Cancel

Figure 18. Warning Message to Close CCS

- Step 8. Continue with the installation process.
- Step 9. Click the *Next* button to install after reviewing the settings.
- Step 10. Click the *Finish* button when the files are successfully installed in the destination folder (see Figure 19).



Figure 19. Firmware Setup Complete



#### 2.2.3 Creating or Importing a DRV8304 Project Into CCS

When the CCS software is started, the user must first select a workspace. A workspace is the structure in which projects are kept. Multiple projects can be saved in one workspace. After importing an existing project, the user can explore the features of CCS to become familiar with the IDE. Follow these steps to import the provided project:

Step 1. Double click the CCS icon to open the application. A CCS icon is placed on the desktop after installation.



Figure 20. Open CCS Application

- Step 2. Select the location and name of the workspace. The location and naming convention can be changed. (see Figure 21).
- Step 3. Click the OK button to accept.

🐳 Workspace Launcher	x
Select a workspace	
Code Composer Studio stores your projects in a folder called a workspace. Choose a workspace folder to use for this session.	
<u>W</u> orkspace: C:\Users\a0132555.ENT\workspace_v6_1_3 ▼ Browse	
Use this as the default and do not ask again OK Cancel	

Figure 21. Workspace Selection

After selecting the workspace, the CCS software opens displaying a welcome menu.



Step 4. Import a project either from the welcome menu by selecting *Import Project* or go to the *Project* menu and select *Import Existing CCS Eclipse Project* (see Figure 22).

lle Edit View Navigate	Project Run Scripts Window Help		🗈 🗔 CCS Edit
Packages: Welcome Address:	Build All Build Project Build Configurations Build Working Set	Ctri+B	
We You can	Clean Build Automatically Show Build Settings Add Files	er Studio v5	Î
*	Import Existing CCS Eclipse Project     Import Legacy CCSv3.3 Project     Properties     Examples     ULP.Ac     Welcor	rer I Analyzer Wisor ne to Grace 2	
	Import Project Tutorial	Videos	
	Support		
	Web Resources		

Figure 22. Importing CSS Project

- Step 5. In the new window that appears showing the import options, click the *Browse…* button and find the provided projects through the folder browser. These projects are located in the SDK installation directory. The default location of the root folder is under C:\ti (see Figure 23). When selected, the provided project appears under *Discovered Projects*.
- Step 6. Make sure the correct box is checked and then click the *Finish* button (see Figure 23).

Import CCS Eclipse Project	th - mohilanial uvukt okt len:						
Select CCS Projects to Im Select a directory to search	<b>iport</b> for existing CCS Eclipse projects.						
Select search-directory:	C:\ti\DRV8304_EVM_BLDC_FW_0.9.0	Browse					
Select archive file:		Browse					
Discovered projects:							
DRV8304_MSP4	30F5529_Trapezoidal_Sensored_BLDC_[C:\ti\DRV8304_EVM_BLDC_FW_0.9.0\DRV8304_	Select All					
DRV8304_MSP4	30F5529_Trapezoidal_Sensorless_BLDC [C:\ti\DRV8304_EVM_BLDC_FW_0.9.0\DRV8304	Deselect All					
		Refresh					
•	•						
Automatically import referenced projects found in same search-directory							
Copy projects into works	Copy projects into workspace						
Open the <u>Resource Explorer</u> to browse available example projects							
?	Finish	Cancel					

Figure 23. Select Projects to Import



When the projects are imported to the workspace, the project should appear in the *Project Explorer* window as shown in Figure 24.

F	ile	Edit	View	Navigate	Project	Run	Scripts	Window	Help
1	2	- II		- 7	Ø 🎋	- 14	•	*> 🗘	-
	<u></u> P	roject	t Explore	er 🖾			E \$		
	D 🕻	🗳 Dr	V8304_N	/ISP430F552	9_Trapezo	idal_Se	nsored_B	LDC	
	⊿ 🚪	🗳 DR	<mark>.</mark>	MSP430F5	529_Trap	ezoidal	Sensor	ess_BLDC	[Acti
		⊳ 🖓	Binaries	s					
		Þ 🖻	Include	es :					
		Þ 🗁	Debug						
		Þ 🗁	driverli	b					i
		Þ 🗁	mathlib	0					
		Þ 🗁	mdbus	erial					
		Þ 🗁	targetC	onfigs					
		Þ 🗁	USB_AP	Ы					
		Þ 🗁	USB_ap	p					
		Þ 🗁	USB_co	onfig					
		> <b>.h</b>	dataTy	peDefinitio	n.h				
		⊳ .€	DRV83x	x_MSP430F	5529_trap	sensor	less_main	.c	
		D .C	global.	c					
		> .h	global.ł	h					
		⊳ .€	Init.c						
		⊳ <b>.h</b>	Init.h						
		. 🖻	10	1 (L. L.					

Figure 24. Project Explorer

Step 7. Explore the project files, build the project to create an image to be downloaded on the MSP430F5529 hardware, and download the project from here. Make sure the MSP430F5529 is connected to the PC through USB interface before downloading the code.

File	Edit	View	Navio	nate	Project	Run
<b>C</b> 3	- 🛛	® :	≪ -	- 校	A	-   [

Figure 25. Build and Debug

Step 8. When the CCS software is connected to the device, run the program from CCS to execute the program in hardware by clicking the green play button (see Figure 26). Click the red stop button (see Figure 26) to disconnect from the device debugger.

File Edit View	Project To	ools Run Scripts	Window Help		
🖻 – 🛛 🖬 🕷		). 🔿 . e 📳 🏷 🖉	J 🕶 🖹 🕅 🗞 🕶	🕹 💣 🕶 🚴	
<b>☆</b> Debug ⊠					

Figure 26. Run and Pause Debug Session



- Step 9. Start a new project by clicking on the *File* menu, selecting *New*, and then *CCS Project*. A new window appears. Complete these steps to proceed:
  - 1. Fill in the Project Name text field.
  - 2. Under the Family drop-down menu, select MSP430x5xx.
  - 3. Select *MSP430F5529* from the *Variant* drop-down menu and the specific device in the adjoining field.

New CCS Pro	oject	- 1.48	Company Trade Tor-	_ <b>D</b> X		
CCS Project						
Create a new	CCS Project.					
Project name:	DRV8x_Sample_Project					
Output type:	Dutput type: Executable					
Use default location						
Location:	C:\Users\a0132555\workspace_v	5_4\DR	/8305_MSP430F5529_de	B <u>r</u> owse		
Device						
<u>F</u> amily:	MSP430			•		
<u>V</u> ariant:	MSP430x5xx Family	✓ MSP430F5529				
Connection:	TI MSP430 USB1 [Default]			•		
<ul> <li>Advanced s</li> <li>Project tem</li> </ul>	ettings plates and examples					
type filter tex	rt	Creates an empty project fully initialized				
4 📄 Empty	Projects	for t cont	ne selected device. The pr ain an empty 'main.c' sour	oject will ce-file.		
😤 Emp	ty Project (with main c) -					
🗟 Emp	ty Assembly-only Project					
A 📑 Basic E	xamples					
Blink	k The LED			<b>T</b>		
?	< <u>B</u> ack 1	lext >	Finish	Cancel		

Figure 27. New CCS Project



#### 2.2.4 Updating the MSP430 USB-FET

After the reference project is imported and selected in the CCS software, the provided software builds and runs on the MSP430 device. The device is programmed by the MSP430 USB-FET. When this device is used, the CCS software automatically detects the firmware version and notifies of an update. The process takes a few minutes, let the update finish before unplugging the USB cable or closing CCS. Figure 28 and Figure 29 show the update process.

# CAUTION

To help prevent any device damage, wait for the update to finish before unplugging the MSP430 device or closing CCS.

<b>® п</b> м	ISP430 USB1/MSP430	X
2	Error initializing emulator: A firmware update is required for the MSP430 Debug Interface (MSP-FET430UIF). Click the "Update" button to update the firmware and launch your debug session.	*
	DO NOT UNPLUG THE INTERFACE DURING THE UPDATE.	~
	<u>Cancel R</u> etry Update <u>Ignore</u>	

# Figure 28. Error Initializing Emulator

Up	idating Firmware	
1	Updating Firmware	
Erasi	ing Firmware(TI MSP430 USB1/MSP430)(Cannot be canceled)	
A	Iways r <u>u</u> n in background	
	Run in Background Cancel	Details >>

Figure 29. Updating LaunchPad<sup>™</sup> Development Kit Firmware

#### 2.2.5 GUI Application

#### 2.2.5.1 Installation

Follow these steps to install the GUI application:

- Step 1. Download and run the Setup\_DRV8304x-0.9.0\_EVM.exe installer file to install the GUI application.
- Step 2. Install the COM port driver for *TI MSP430 USB* (the firmware on MSP430F5529 LaunchPad development kit plug-in module).

This driver is automatically installed during the GUI installation process. Click the *Install* button when the window shown in Figure 30 appears during the GUI installation. If this pop-up does not appear, then the drivers are already installed.



Figure 30. TI MSP430 USB Installer

If the automatic driver installation fails for some reason, or if the *Don't Install* button was clicked, install the drivers manually. First, find the driver .inf file (msp430\_ti\_signed.inf) in the following folder: C:\Program Files (x86)\Texas Instruments\DRV8304x\TI MSP430 USB Driver. Right click on the .inf file and select the *Install* option. Follow the installation instructions to successfully install the driver.

If any issues occur during the driver installation steps or to learn more about the process, download and extract the *MSP430 USB Developers Package* from www.ti.com/tool/msp430usbdevpack and refer to the Microsoft® Windows ® 7 and Windows 8 sections in the document *Examples\_Guide\_MSP430\_USB.pdf*, based on the appropriate Windows. This document is found under the *MSP430USBDevelopersPackage\_5\_10\_00\_17\MSP430\_USB\_Software\Documentation* directory of the extracted *MSP430\_USB\_Developers Package*.

#### 2.2.5.2 Hardware Setup

The hardware required to run the motor control is an MSP430F5529 LaunchPad development kit, the BOOSTXL-DRV8304x BoosterPack plug-in module, a micro-USB cable, and a power supply with a DC output from 6 to 38 V. Follow these steps to start up the BoosterPack plug-in module:

- Step 1. Dock the BOOSTXL-DRV8304x BoosterPack plug-in module to the MSP430F5529 LaunchPad development kit through the two 40-pin headers J4 and J5.
- **NOTE:** Observe the correct polarity of the 40-pin LaunchPad headers. The MSP430F5529 LaunchPad header J1 should be connected to BOOSTXL-DRV8304x BoosterPack header J5 and MSP430F5529 LaunchPad header J2 should be connected to BOOSTXL-DRV8304x BoosterPack header J4.
- Step 2. Connect the three phases from the brushless DC motor to the J2 connector on the BOOSTXL-DRV8304x BoosterPack plug-in module. Phase A, B, and C are labeled in white silkscreen on the PCB top layer.



- **NOTE:** If using the sensored firmware on the MSP430F5529 LaunchPad development kit, connect a brushless DC motor Hall sensor input to header J3. If using sensorless firmware, header J3 can be left unconnected.
- **NOTE:** If using 1x PWM Mode with the **sensored firmware** R35, R36, and R37 must be populated with  $0-\Omega$  resistors.
- Step 3. Connect the DC power supply to header J1.
- **NOTE:** Observe the correct polarity of +VM and GND connections on the BOOSTXL-DRV8304x BoosterPack connection J1
- Step 4. Connect a micro-USB cable to the LaunchPad development kit and computer.
- Step 5. Turn on the power supply and power up the PCB.

#### 2.2.5.3 Launching BOOSTXL-DRV8304X EVM GUI

The BOOSTXL-DRV8304X EVM GUI facilitates the control of brushless DC motors. The BOOSTXL-DRV8304x GUI provides functionality for adjusting the speed and direction of the motor, setting various fault parameters such as voltage and current-protection limits, observing the motor drive speed, and monitoring the device fault status. The GUI can also be used to tune the motor for best performance using various parameters available in the motor control parameter page.

To launch the GUI, click on the BOOSTXL-DRV8304x EVM shortcut on the desktop or navigate to the Windows Start Menu and click *All Programs*. Navigate to the *Texas Instruments* folder and select the BOOSTXL-DRV8304x folder.

The Device *Launch* page (see Figure 31) is displayed to launch one of the 2 device variants (DRV8304S, DRV8304H). Click on one of the *Launch* buttons to launch either the **DRV8304S** or **DRV8304H** labels.

For a guide on the different attributes of the BOOSTXL-DRV8304x EVM GUI, refer to the BOOSTXL-DRV8304x GUI User's Guide.



Figure 31. BOOSTXL-DRV8304X EVM Device Launch

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