



ABSTRACT

This document is provided with the DRV824x-Q1EVM and DRV814x-Q1EVM customer evaluation module (EVM) as a supplement to the Automotive DRV824x-Q1 H-Bridge and DRV814x-Q1 Half-Bridge Motor Driver datasheets. This user's guide details the hardware implementation of the EVM and how to install the software packages.

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Trademarks

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1 Introduction

1.1 Overview

The DRV824x and DRV814x family of devices are a fully integrated H-bridge and half-bridge drivers, respectively, intended for a wide range of automotive applications. The DRV824x device can be configured as a single H-bridge driver, or two independent half-bridge drivers. Designed in Texas Instruments' proprietary high power BiCMOS process technology node, this monolithic die device in a power package offers excellent power handling and thermal capability while providing compact package size, ease of layout, EMI control, accurate current sense, robustness and diagnostic capability. The DRV824x and DRV814x family of devices each has an identical pin function with scalable $R_{DS(ON)}$ (current capability) to support different loads with minimal design changes within their respective family (H-bridge or half-bridge).

The device integrates an N-channel output stage, charge pump regulator, high side current sensing and regulation, current proportional output, and protection circuitry. A low-power sleep mode is provided to achieve ultra-low quiescent current draw by shutting down most of the internal circuitry. The device offers voltage monitoring and load diagnostics as well as protection features against output over current and device over temperature. Fault conditions are indicated on the nFAULT pin. The device is available in two interface variants - hardware ("HW") and SPI. The HW variant uses strapping resistors for fixed configuration. The SPI variant offers more flexibility in device configuration and fault observability with an external controller.

1.1.1 Purpose and Scope

This document is designed to be used as a startup guide and to supplement the DRV824x-Q1EVM and DRV814x-Q1EVM ("EVM"). The scope of this document is to provide the user with a guide to evaluate the DRV824x-Q1 and/ or DRV814x-Q1 device using a Graphical User Interface (GUI). The GUI application is required to control the EVM. This document covers the required EVM connections, configuration, and steps to acquire and use the GUI application for a successful evaluation.

2 Evaluation Hardware Overview



CAUTION

Hot surfaces on the EVM include the DRV824x-Q1 or DRV814x-Q1 device (U1) and the area surrounding it.

When operating the EVM at the maximum device specifications and a high ambient temperature, external cooling fans may be required to minimize potential fire hazard, personal injury, or both.

2.1 Connections Overview

The major blocks of the EVM include the DRV824x-Q1 or DRV814x-Q1 driver, MSP430G2553 microcontroller (MCU) controlling the driver, and MSP430F5528 (EZFET_LITE) for UART and JTAG communications over USB.

The EVM is designed for an input supply from 4.5 to 36 V at the rated peak drive current for each device (refer to device datasheet). The DRV824x-Q1 or DRV814x-Q1 device provides current to a brushed DC motor or other load. The MCU communicates with the GUI via the EZFET_LITE USB to Virtual COM Port (VCP) to control the DRV824x-Q1 or DRV814x-Q1 device.

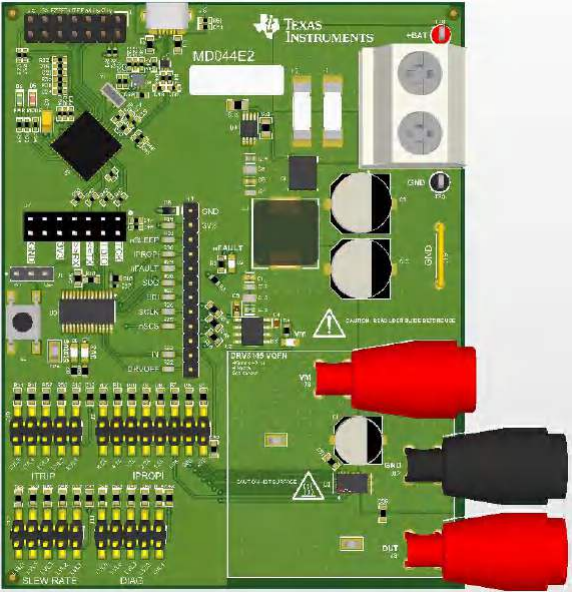
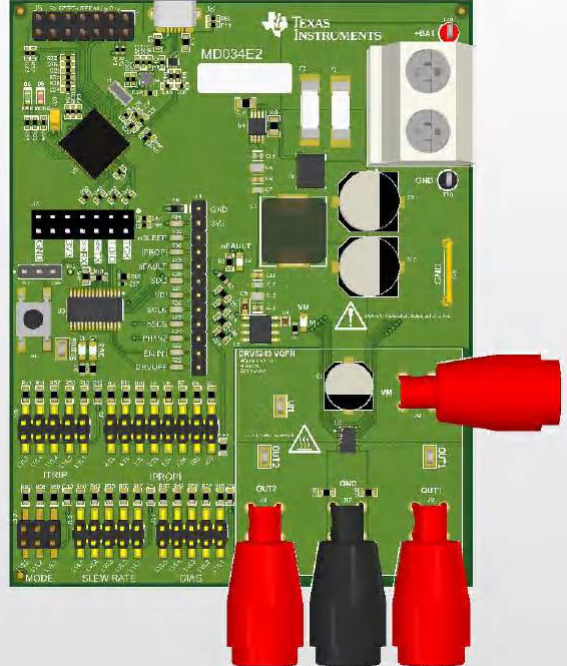
2.2 Connection Details

See [Table 2-1](#) for a brief comparison of both the DRV824x-Q1EVM and DRV814x-Q1EVM in the VQFN HotRod™ package. The 28-pin leaded package (HVSSOP or HTSSOP) version of EVM leverages much of the same design and is also covered by this document. From a firmware and GUI perspective, the two package options are interchangeable. The 40x40mm lower-right quadrant of the EVM is modified to the H-bridge and half-bridge devices. The DRV814x-Q1 VQFN device orientation is rotated for better power and thermal characteristics, taking advantage of the busbar-like footprint of the HotRod™ package.

A supply voltage ranging from +4.5 VDC to +36 VDC from a battery or a DC voltage source is connected to the voltage supply pins. This connection includes fuse, reverse polarity, and transient protection.

The OUT1 and OUT2 banana jacks on the DRV824x-Q1EVM can be connected to a brushed motor, inductor, or latched relay coil when used in PWM or phase/enable (PH/EN) mode. When used in independent half-bridge mode, the OUT1 pin can drive one load and the OUT2 pin can drive a second load.

Table 2-1. DRV814x-Q1EVM and DRV824x-Q1EVM Comparison

<p><i>DRV814x-Q1EVM</i></p> <ul style="list-style-type: none"> • Single half-bridge output in VQFN HotRod™ package • SPI and Hardware control variants 	<p><i>DRV824x-Q1EVM</i></p> <ul style="list-style-type: none"> • H-bridge/ dual independent half-bridge outputs in VQFN HotRod™ package • SPI and Hardware control variants
	

2.2.1 Common Connectors and Headers Across all EVM Variants

Figure 2-1 shows a larger view of the DRV824x-Q1EVM. Because the DRV814x-Q1EVM shares much of the same design, only the DRV824x-Q1EVM is referenced.

The micro-USB connection at the top of the EVM is used for GUI communications, and MCU firmware updates. Main supply input A supply voltage ranging from +4.5 VDC to +36 VDC from a battery or a DC voltage source is connected to the large screw thermal block (fused and reverse polarity protection).

Connect the bi-directional brushed-DC motors to the OUT1 and OUT2 banana jacks. Ground and VM supply connections are provided as a convenience for high-side or low-side switched loads (for example, unidirectional brushed DC motor or solenoid).

Note

VM has a small voltage drop with respect to the main supply due to the N-channel MOSFET in the reverse protection circuit.

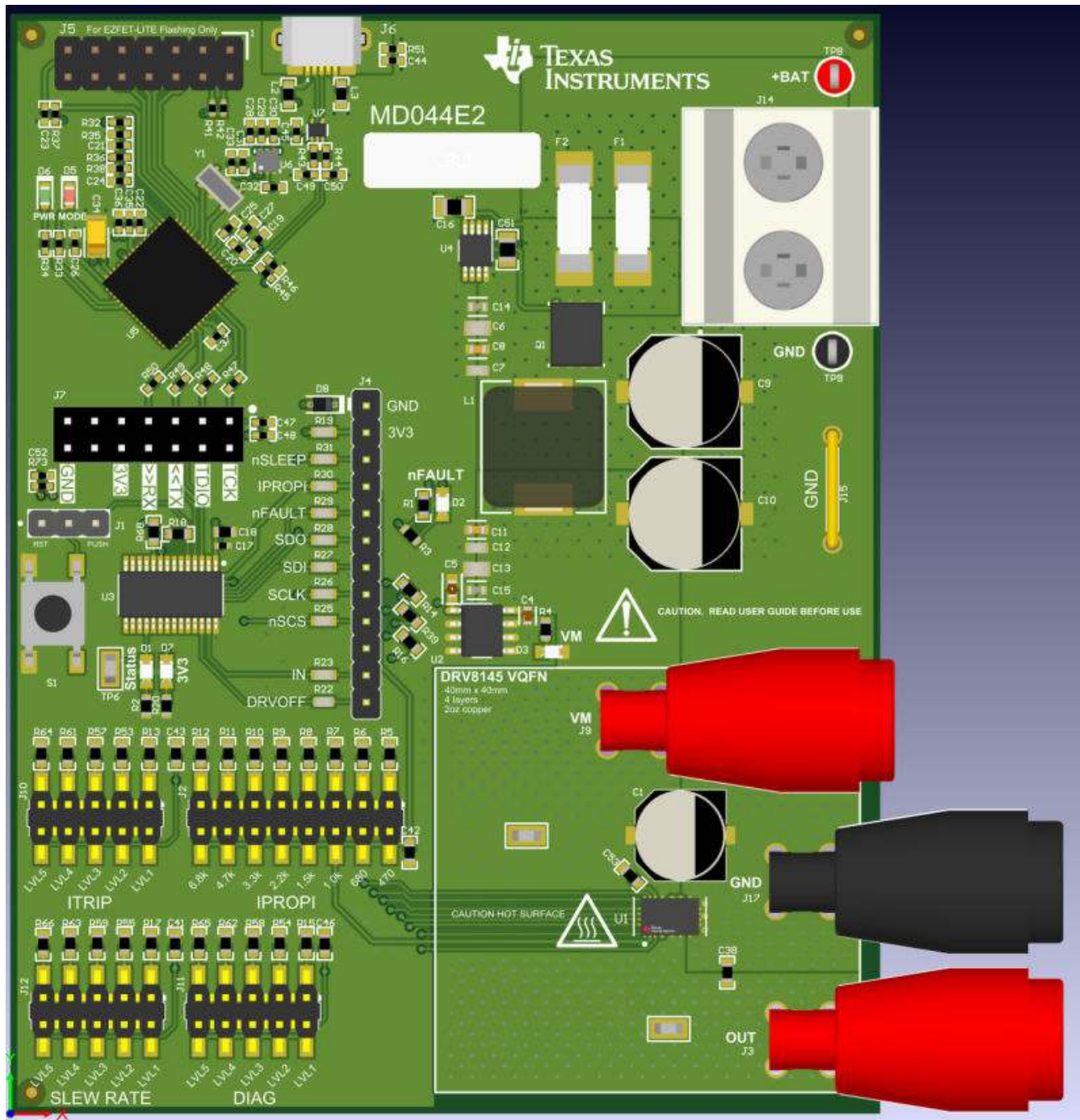


Figure 2-1. DRV824x-Q1EVM

Note

DRV824x-Q1EVMs with HVSSOP package driver device has OUT1 and OUT2 silk screen labels interchanged. This misprint will be fixed in the next revision of these EVMs. Furthermore, all new EVMs will have a two row header for J4

2.2.2 MCU Reset and User Button

The small tactile push button is typically used to reset the MCU [Figure 2-2](#). Typically resetting the MCU is not necessary, however the MCU will automatically clear the nFAULT indicator on initial power-up if you find the fault indicator is set due to cycling the power on the external supply. This is normal (nFAULT will always come up asserted on the DRV824x and DRV814x devices).

A jumper should be installed shorting pins 1 and 2 on header J1 for the MCU reset function. If a firmware reset is necessary, the push button is pressed once and released. Following a reset, a proper startup is indicated by the blinking STATUS LED. If the jumper is moved to pins 2 and 3 on J1, this routes the button to a spare GPIO pin on the MSP430 MCU, and can be used for your own purposes in the firmware. Beginning with version 0.22 of the firmware, an interrupt subroutine (ISR) has been assigned to this GPIO input, and will automatically put the DRV824x device in PH/EN mode, and energize the output OUT1 terminal (or OUT terminal of the DRV814x device) at 25% duty cycle on the first press of the User button with a 12 V power supply connected to the connector J14, BAT+ and GND screw terminals. Pressing the button again will disable the output. This can be repeated with the same on/ off behavior. This can be useful as a quick out-of-box test of the EVM without a computer or USB connection. You can connect a brushed DC motor across OUT1 and OUT2 terminals of the DRV824x EVM or OUT and GND of the DRV814x EVM, or simply an oscilloscope.

Note

No diagnostics are enabled in this simple test case – open load detection is not active

When in this test mode, the STATUS LED (D1) will be fully on when the output is active, and will return to approximately 1 Hz blinking when the output is off with an SPI EVM or an approximately 0.1 Hz blinking with an HW EVM. After completion of the standalone EVM testing it is recommended to position the jumper settings back to pins 1 and 2.

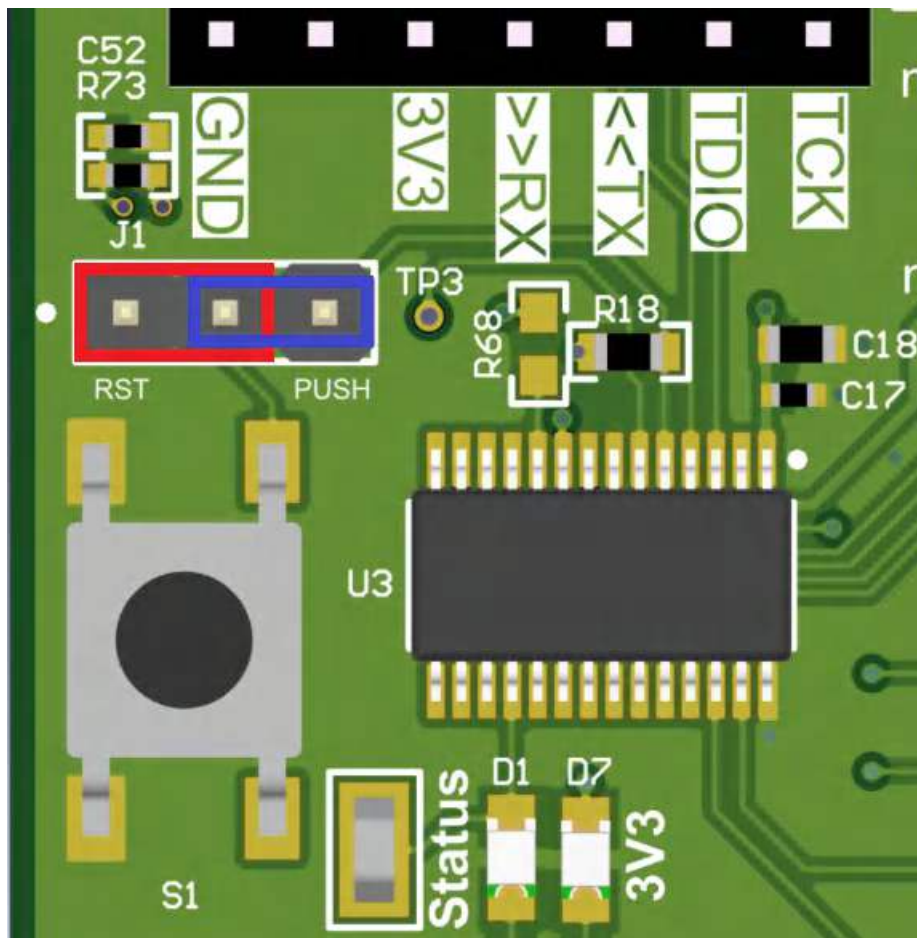


Figure 2-2. MCU Reset and User Button

2.2.3 Communication Interfaces

The micro-USB connection is the primary communication interface from your PC to the EVM GUI Application. [Figure 2-3](#) illustrates connection associated with communications between the EVM and GUI, as well as firmware programming (some components have been removed from the picture for clarity).

The EZFET_LITE (based on the Texas Instruments MSP430F5528) is programmed at the factory with firmware that implements UART and JTAG over USB.

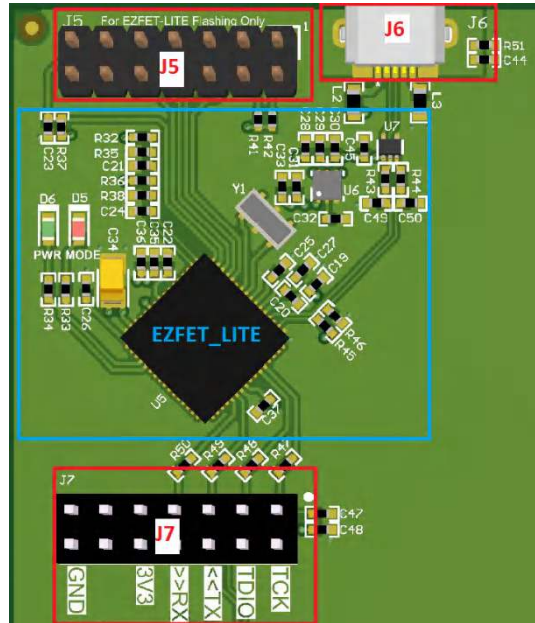


Figure 2-3. EVM Communication Connections

Table 2-2 describes each communication connection.

Table 2-2. Communication Description

Designator	Description
J5	MSP430 14-pin JTAG interface. Used for programming EZFET_LITE firmware on MSP430F5528 during manufacturing and not used during normal user operation.
J6	Micro-USB interface for main MCU (MSP430G2553). Both UART and JTAG are routed over this connection.
J7	These headers route communications and 3.3 V to the main MCU. Jumpers should be installed on 3V3, RX, TX, TDIO and TCK positions.

2.2.4 Supply Input

Figure 2-4 illustrates the portions of the EVM associated with the main supply input powering the DRV824x-Q1 or DRV814x-Q1 device, and the associated loads. Starting from the upper-left, and working clockwise around the image:

- Supply reverse polarity protection. The Texas Instruments LM74610QDGKRQ1 drives a Texas Instruments CSD18513Q5A 40 V 100 A N-channel MOSFET.
- Fuses.

Note

DRV8243-Q1 EVMs only has a single fuse populated

- Not pictured (underside): TVS diode.
- High current supply input with screw terminals. Supply shall be between +4.5 VDC to +36 V. Test points are provided.
- Pi filter section comprising two 50 V 150 uF capacitors and a 1 mH inductor (misc. passive components omitted from image for simplicity).

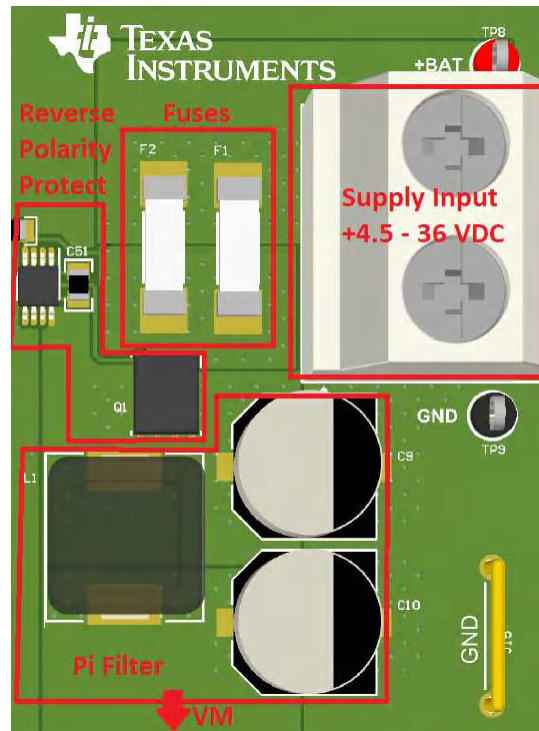


Figure 2-4. Main Supply Section

2.2.5 Current Limit Header (RIPROPI)

The DRV824x and DRV814x family of devices integrate a current sense output using current mirrors on the low-side power MOSFETs on the IPROPI device pin. The IPROPI pin sources a small current proportional to the current in the high side MOSFETs (current sourced out of the IPROPI pin). The IPROPI current can be converted to a proportional voltage using an external resistor (R_{IPROPI}). The integrated current sensing allows the DRV824x and DRV814x devices to limit the output current with a fixed off-time PWM chopping scheme and provides load information to an external controller to detect changes in load or stall conditions. The integrated current sensing outperforms traditional external shunt resistor sensing by providing current information even during the off-time slow decay recirculating period. Additionally, BOM cost and PCB area is reduced by eliminating a large external power shunt resistor. The off-time PWM current regulation level can be configured during motor operation through the ITRIP function to limit the load current accordingly to the system demands.

Selecting the R_{IPROPI} value must be done in conjunction with the ITRIP level (configured through SPI or external jumper selection depending on SPI or hardware device variant) and is governed by the following relationship:

$$ITRIP \text{ (AMPS)} = V_{ITRIP_LVL} / R_{IPROPI} * A_{IPROPI} \tag{1}$$

Example (Typical values from DRV8245-Q1 datasheet; A_{IPROPI} will vary by part number):

$V_{ITRIP_LVL6} = 2.97V$	$ITRIP = \frac{2.97V}{1000\Omega} * 6600 A/A$
$R_{IPROPI} = 1000\Omega$	$ITRIP = 19.6A$
$A_{IPROPI} = 6600 A/A$ (DRV8245, DRV8145)	

Refer to the *Electrical Characteristics CURRENT SENSE AND REGULATION* table in device datasheet for R_{IPROPI} values matching the output capability of the device installed on your EVM.

Figure 2-5 shows the header with user selectable R_{IPROPI} values.

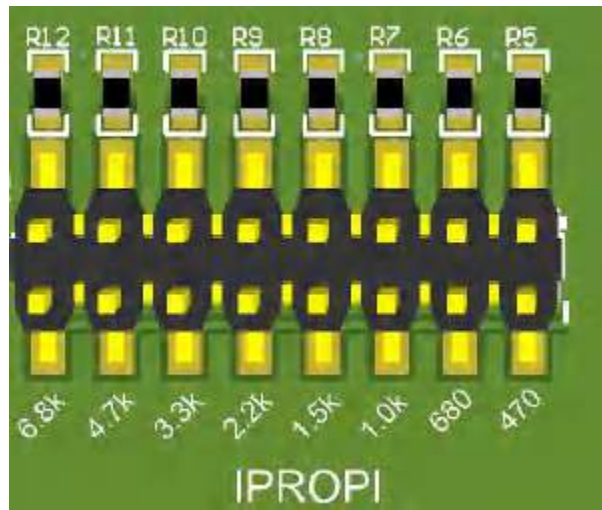


Figure 2-5. R_{IPROPI} Header

2.2.6 Device Signal and Control Header

The J4 header [Figure 2-6](#) is provided for users who wish to interface an external control solution and is also a convenient means for probing all device control signals. When interfacing with an external control solution, remove the associated 0-ohm resistors immediately adjacent to the silk screen label.

Note

PH/IN2 signal is not present on DRV814x-Q1EVM variants. Refer to your EVM schematic for more details.

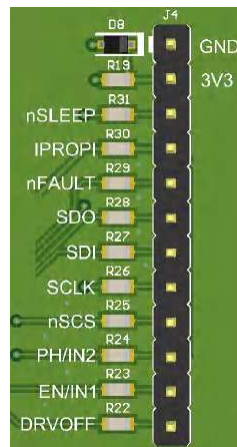


Figure 2-6. DRV824x-Q1EVM Signal and Control Header

2.3 LED Indicators

[Figure 2-7](#) shows the physical location of each LED indicator on the EVM. Placement is the same for all EVMs in the family.

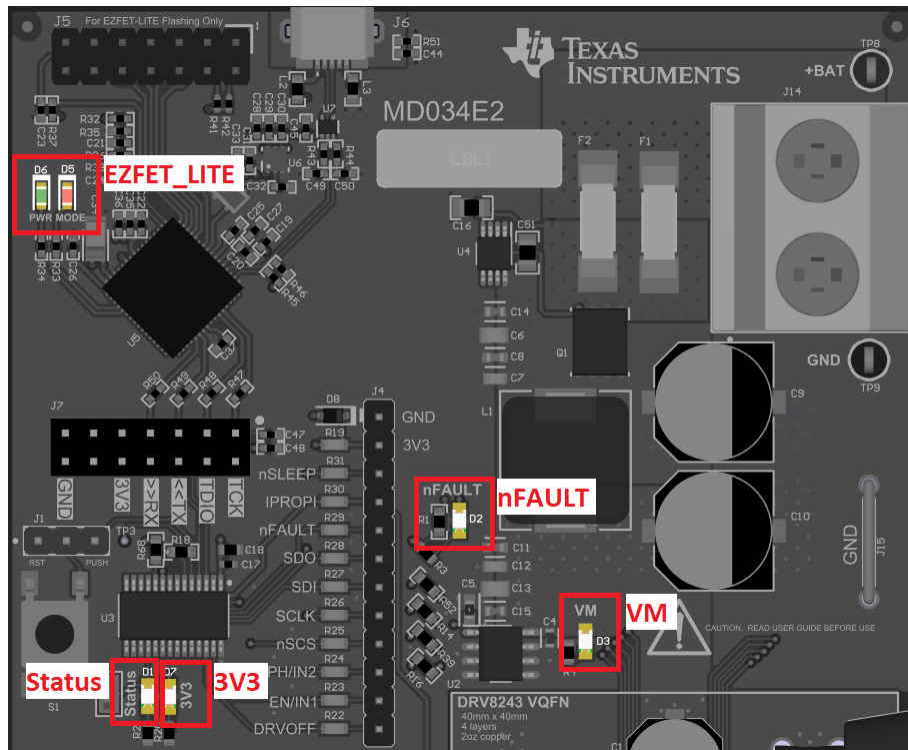


Figure 2-7. EVM LED Indicators

Refer to [Table 2-3](#) for descriptions of each LED on the EVM

Table 2-3. EVM LED Indicators and their Functions

Designator	Label	Description
D1	Status	Indicates MCU execution and DRV status. Flashing approximately 0.1 Hz: DRV in sleep mode Flashing approximately 1 Hz: DRV ready, outputs disabled Continuously on: DRV output enabled/ active Alternating with nFAULT: MCU abort exception
D2	nFAULT	Indicates fault condition. Normally off. It is also normal to briefly see this LED flash when the MCU becomes active, or RESET is pressed. This LED may flash continuously until VM power supply is turned on.
D3	VM	VM supply indicator. Normally on if supply connected to +BAT input.
D5	MODE	EZFET_LITE mode indicator. Normally on during GUI control. On/ flashing when using JTAG interface.
D6	PWR	EZFET_LITE power indicator (must be active for GUI control).
D7	3V3	3.3 V for MCU (must be active for GUI control).

2.4 Headers and connectors (Hardware device variant)

Figure 2-8 shows all configuration jumpers for the DRV824xH-Q1 hardware variant. DRV814xH-Q1 features the same jumpers, with the exception of "MODE". Each "LVL" silkscreen label directly corresponds to the datasheet description. Changing the jumper within "MODE" allows the user to use the driver in PH/EN, PWM, and Independent Half-Bridge mode. Please refer to the device datasheet for more information regarding pin LVL settings and associated configuration.

Note

IPROPI is common to both hardware and SPI EVM/ device variants and performs the same function.

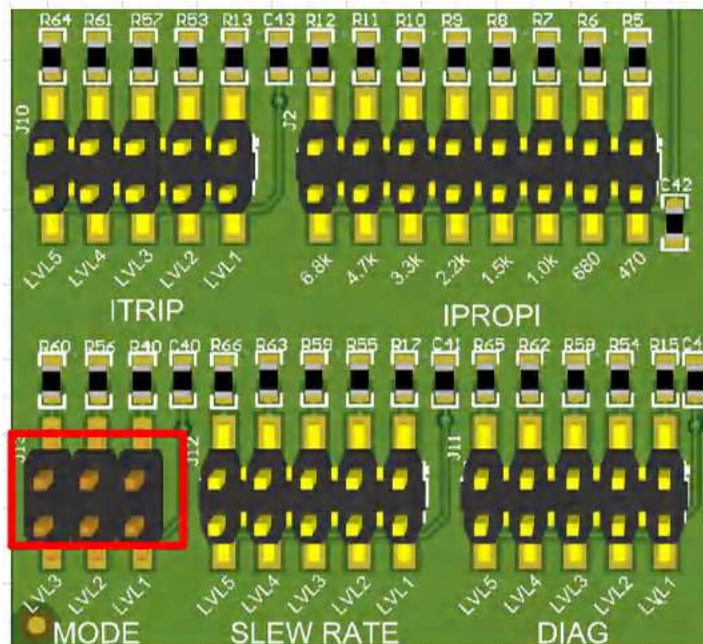


Figure 2-8. DRV824x and DRV814x Hardware variant configuration jumpers

2.5 Headers and connectors (SPI variant)

The and DRV824xS-Q1 and DRV814xS-Q1 SPI device variants omit all headers associated with the hardware variant described in the previous section.

3 EVM GUI Control Application

The GUI application is written with Texas Instruments' GUI Composer, and can be run directly from a Chrome-based web browser, or installed onto your computer. Because GUI Composer apps are written with a NodeJS backend, the GUI application is cross-platform compatible by design. This document only covers installation on a PC for sake of brevity, but Mac and Linux users can find installers in the [GUI Composer Gallery](#).

3.1 MSP430 FET Drivers

The MSP430 FET Drivers are required for the operating system to properly enumerate the JTAG and UART ports created by the EZFET_LITE. The latest drivers can be found here: [MSP430 FET Drivers](#)

Download the driver package corresponding to your operating system, extract the archive, and run the installer.

In Windows, two new ports should be enumerated when the EVM is connected [Figure 3-1](#):

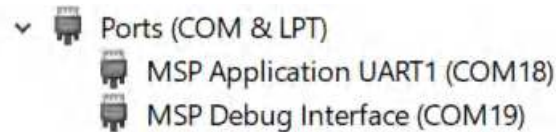


Figure 3-1. MSP430 EZFET_LITE enumerated USB ports

Successful installation will also show Texas Instruments as the driver publisher ([Figure 3-2](#)):

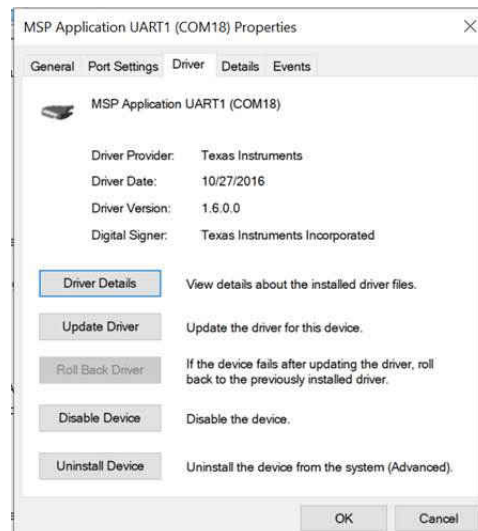


Figure 3-2. MSP Application UART Driver Properties

3.2 Cloud-based GUI

To launch the GUI application from your Chrome-based browser:

1. Navigate to [DRV824x_DRV814x-Q1EVM-GUI](#).
2. When presented with the list of available GUIs, launch the latest version by clicking in the tile anywhere that is not related to an icon for downloading the installer or GUI Composer. Refer to [Figure 3-3](#):



Figure 3-3. TI GUI Composer Gallery Results for Launching or Downloading Local Installer

Hardware setup and operation of the GUI is the same as the desktop version, and is consolidated in the following EVM GUI Operation section.

3.3 Local Installation

Follow these instructions for downloading and installing the latest version of the EVM GUI application:


1. The DRV824x_DRV814x-Q1EVM Software *slvc821a.zip* can be downloaded from the EVM product folder on ti.com. The software downloaded from the EVM product folder contains two zip files, one for the EVM firmware source code and another for the EVM GUI application Windows installer. The EVM GUI application installer can also be downloaded from the TI GUI Composer Gallery, [DRV824x_DRV814x-Q1EVM-GUI](#).
2. From the gallery, click the  icon in the latest version and select the installer for your operating system (Windows, Linux or Mac). Refer back to [Figure 3-3](#) in the previous section for a visual depiction of the Gallery page.
3. Decompress the .zip file.
4. From the decompressed archive, run the installer “DRV824x_DRV814x-Q1EVM-GUI-x.y.z.setup-win_x.y.z.exe (refer to [Figure 3-4](#)). If you have not installed the GUI Composer Runtime, the installer will take care of this for you. The installer contents will look slightly different for each OS, but should be self-explanatory.



Figure 3-4. GUI Application Archive Contents

5. You are now ready to run the GUI application on your local machine after completing the hardware setup in the next section.

4 EVM GUI Operation

4.1 Hardware Setup

Follow these steps to setup the EVM prior to launching the GUI:

1. It is advised to make any jumper configuration changes prior to powering the EVM. The hardware device variant will latch MODE, SLEW RATE and DIAG jumper settings after power-up and/ or coming out of sleep (ITRIP takes effect immediately, however).

For the SPI device variant, it is still advised to make your IPROPI selection prior to powering the EVM.
2. Connect micro-USB cable to J6 ([Figure 2-3](#)). The digital portion of the EVM will become active. LEDs D6 and D7 will illuminate. The nFAULT LED D2 may blink at a fast rate to indicate the absence of VM power supply. For proper GUI application operation it is important to connect the EVM USB cable to a computer prior to applying +BAT power to the EVM. For standalone EVM testing a USB connection is not necessary.
3. With the +BAT external supply outputs disabled, connect +BAT supply to the screw terminals on the EVM (J14), observing polarity ([Figure 2-4](#)).
4. Energize the +BAT supply. VM LED D3 will illuminate. If VM LED does not illuminate, verify polarity and check fuse(s) are installed and have continuity. Power consumption will be on the order of 10mA @ +12VDC input. Significantly higher or lower may indicate a hardware problem if the fuse and supply polarity are correct.
5. The EVM is ready to be used with the GUI application ([Section 4.2](#)). In certain situations, such as while disconnecting and reconnecting VM power before the power supply capacitors are fully discharged a proper firmware reset may not happen. A proper reset is indicated by the STATUS LED D1 blinking at a rate of approximately 1 Hz for the SPI variant EVMs and approximately 0.1 Hz for the HW variant EVMs. If the Status LED is not blinking as expected, press the reset push button once with jumper J1 installed in the RST position. Do not unplug the USB cable while the VM power is active. If you do, switch off the VM power, wait until it is fully discharged and proceed to step 2.
6. The latest version of the GUI application is bundled with the latest version of the EVM firmware. It is recommended to do a firmware update before selecting and connecting to an EVM variant using the GUI application. The firmware update procedure is described in the [Section 4.3.4](#) section of this User's Guide.

4.2 Launching the DRV824x_DRV814x-Q1EVM GUI Application

Whether using the desktop or web version of the GUI, the user experience and steps covered below is the same. These steps assume the hardware setup steps in the previous section have already been completed.

1. Launch the GUI application
2. From the screen referenced in [Figure 4-1](#), select the EVM variant connected using the icons on the right.

Note

The 'S' and 'H' part number decorators – these indicate either the SPI or Hardware variant of the device.

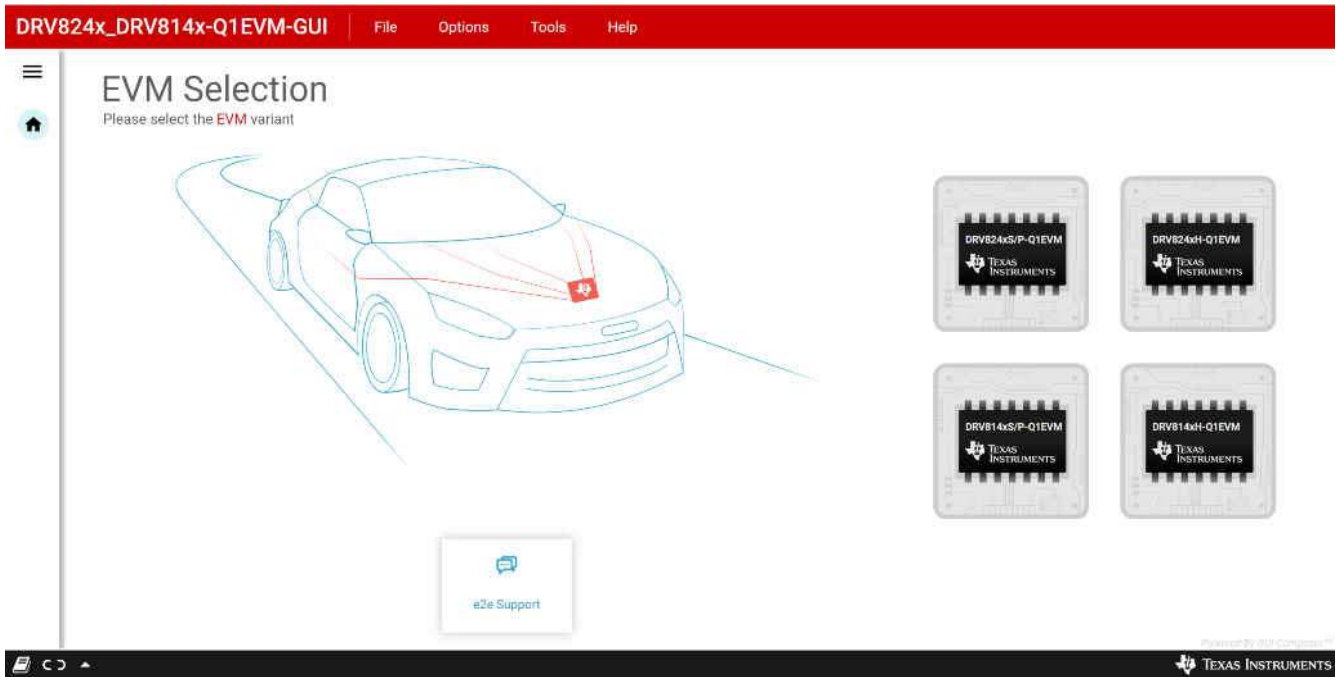


Figure 4-1. DRV824x_DRV814x-Q1EVM GUI Home Screen

- After clicking the correct EVM type, the GUI application initiates communications with the EVM. Connection confirmation is displayed as shown below in [Figure 4-2](#):

Note

If the EVM GUI does not register a successful connection after multiple attempts do a firmware update and then select an EVM variant for connecting using the GUI application.

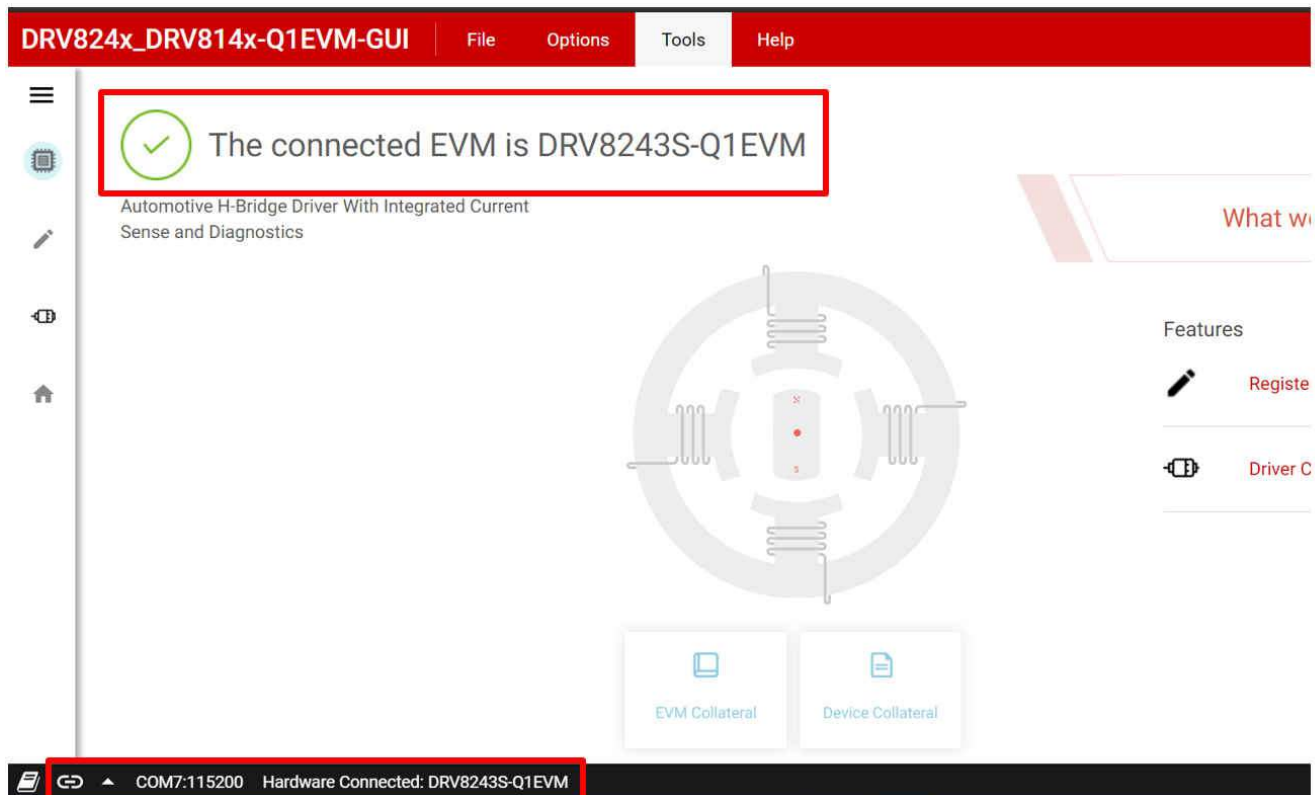


Figure 4-2. Successful EVM Connection

4. At this point, the user sets-up the EVM for device evaluation:
 - Register Map page for the SPI device variants for read/ write access of register bit fields.
 - Driver Control page with configuration and diagnostic options.
 - GUI Home page to re-select the EVM if necessary.

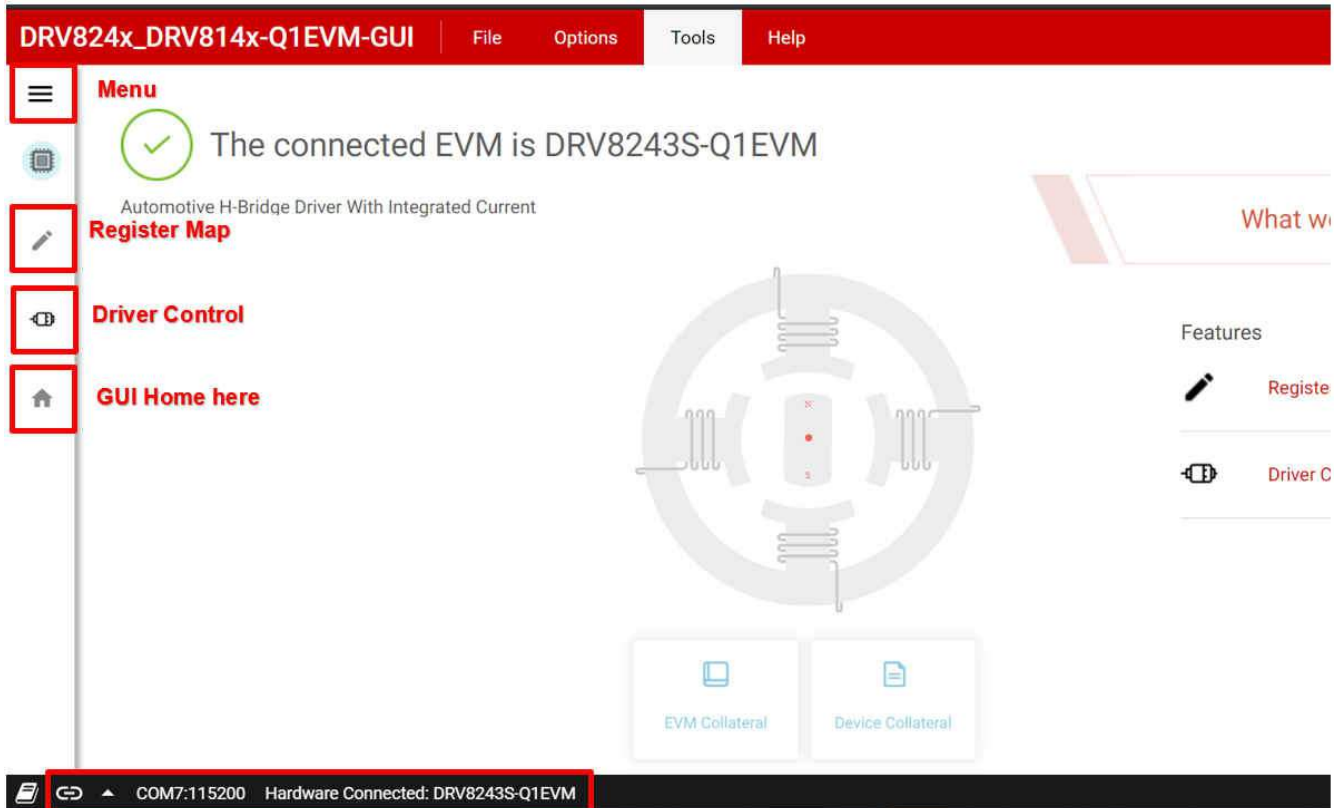


Figure 4-3. DRV824x_DRV814x-Q1EVM GUI Navigation

4.3 Using the DRV824x_DRV814x-Q1EVM GUI Application

4.3.1 Register Map Page (SPI Device Variant)

The Register Map page shown below in [Figure 4-4](#) allows the user to read/ write values to individual fields. Register read-back is read "Every 1 sec" by default. Enabling this will start periodically polling the device registers. "Off " mode enables a manual read. Auto-read set to "off" is helpful for reducing SPI chatter when using a logic analyzer or performing EMC measurements.

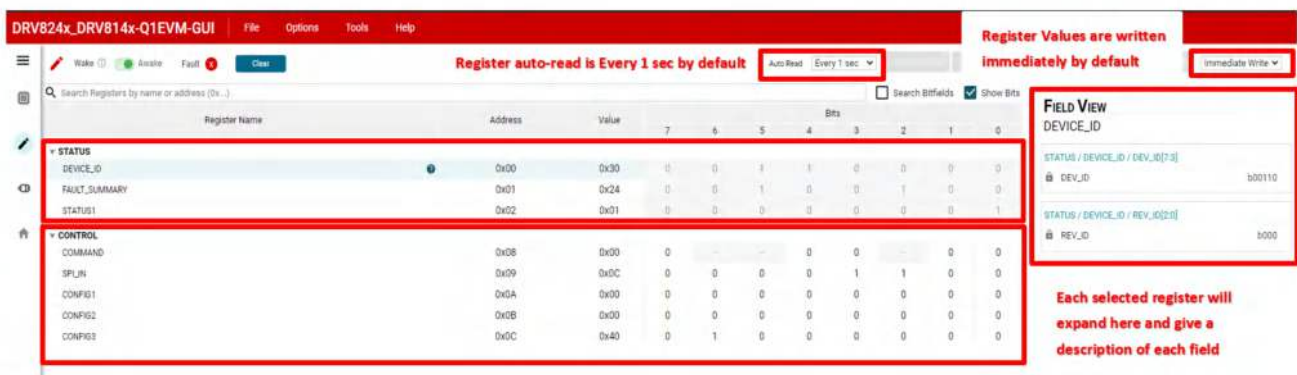


Figure 4-4. SPI device variant Register Map Page

4.3.2 Driver Control Page (SPI Device Variant)

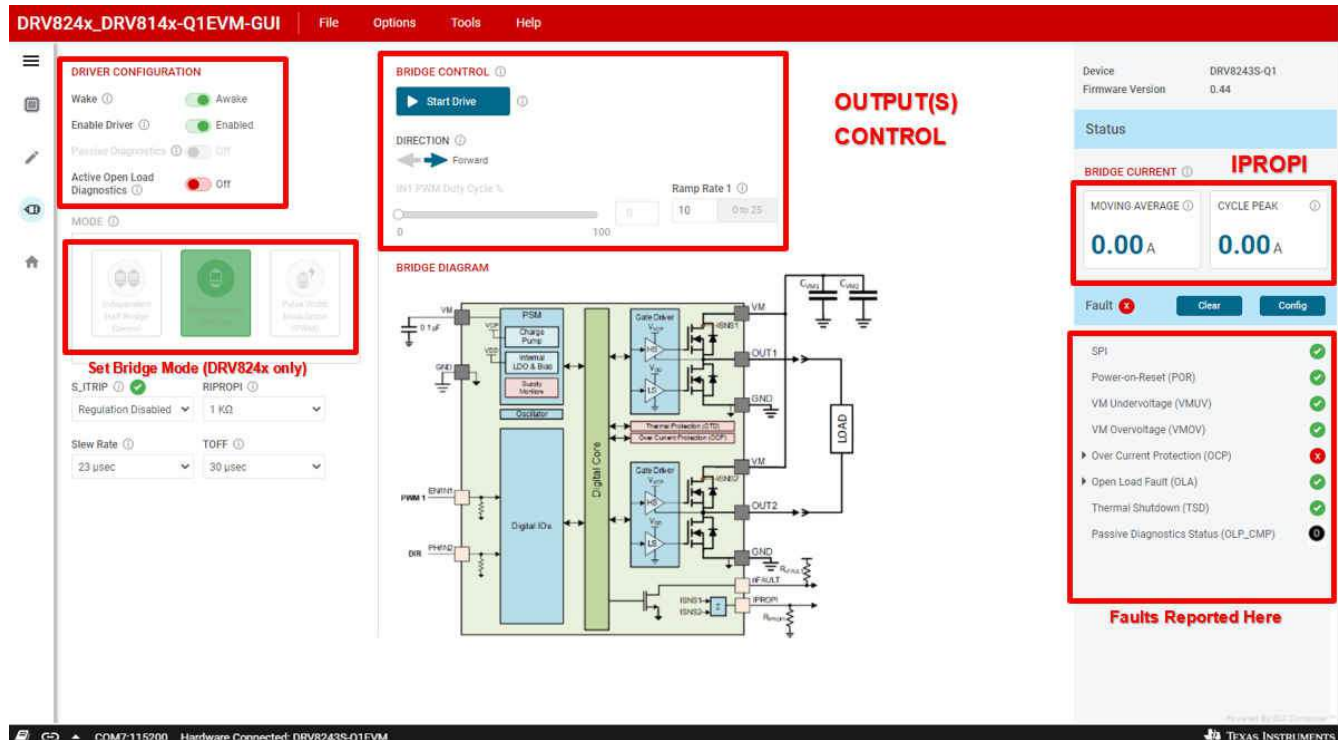


Figure 4-5. Driver Control Page

Starting from left to right in Figure 4-5, we have:

- **WAKE** The wake widget controls the nSleep device which directly controls the nSleep pin. The user cannot switch between modes when the device is asleep in SPI mode, and the default for the SPI variant is "awake."
- **ENABLE DRIVER** Directly controls the DRVOFF pin. When the bridge control is active, the user cannot change between modes or observe the passive diagnostics.
- **MODE** Programs the S_MODE register and will alter the appearance of the **BRIDGE CONTROL** depending on your selection. There is a difference in **MODE** options between the DRV824x and DRV814x device families. The DRV814x devices only operate in one fixed mode where the user can only switch between high side and low side load connections. The high side connection connects the load between VM and OUT while the low side connection connects the load between OUT and GND as can be seen in Figure 4-6

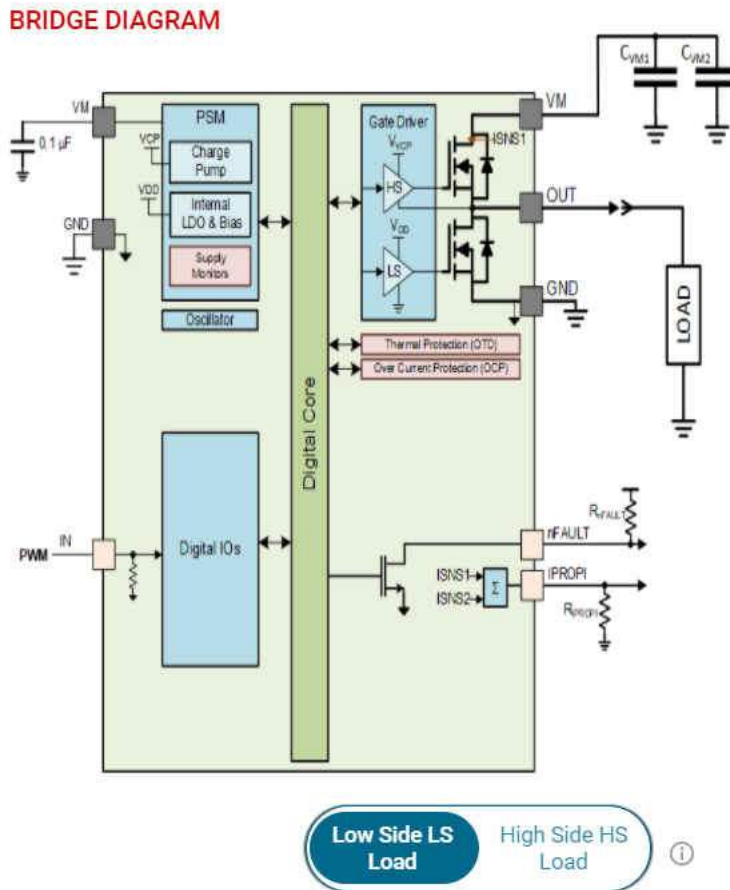


Figure 4-6. DRV814x High Side and Low Side Connections

In the DRV824x devices, Phase/Enable mode only has one duty cycle slider while the Independent Half-bridge mode and PWM mode each have two sliders.

When changing between modes, there will be a "Load Connection Warning" popup. If the load is incorrectly connected and the user attempts to run the motor on the GUI it can damage the device and may cause harm to the user. This is especially important when in Independent Half-Bridge mode. The load connection warning will appear every time the user selects a new mode or repeatedly selects the current mode. [Figure 4-7](#) shows the pop-up window for the Independent Half-Bridge mode selection.

Note

With the DRV824x devices, the GUI allows to switch between high side and low side load connection only using the Independent Half-Bridge mode selection pop-up window.

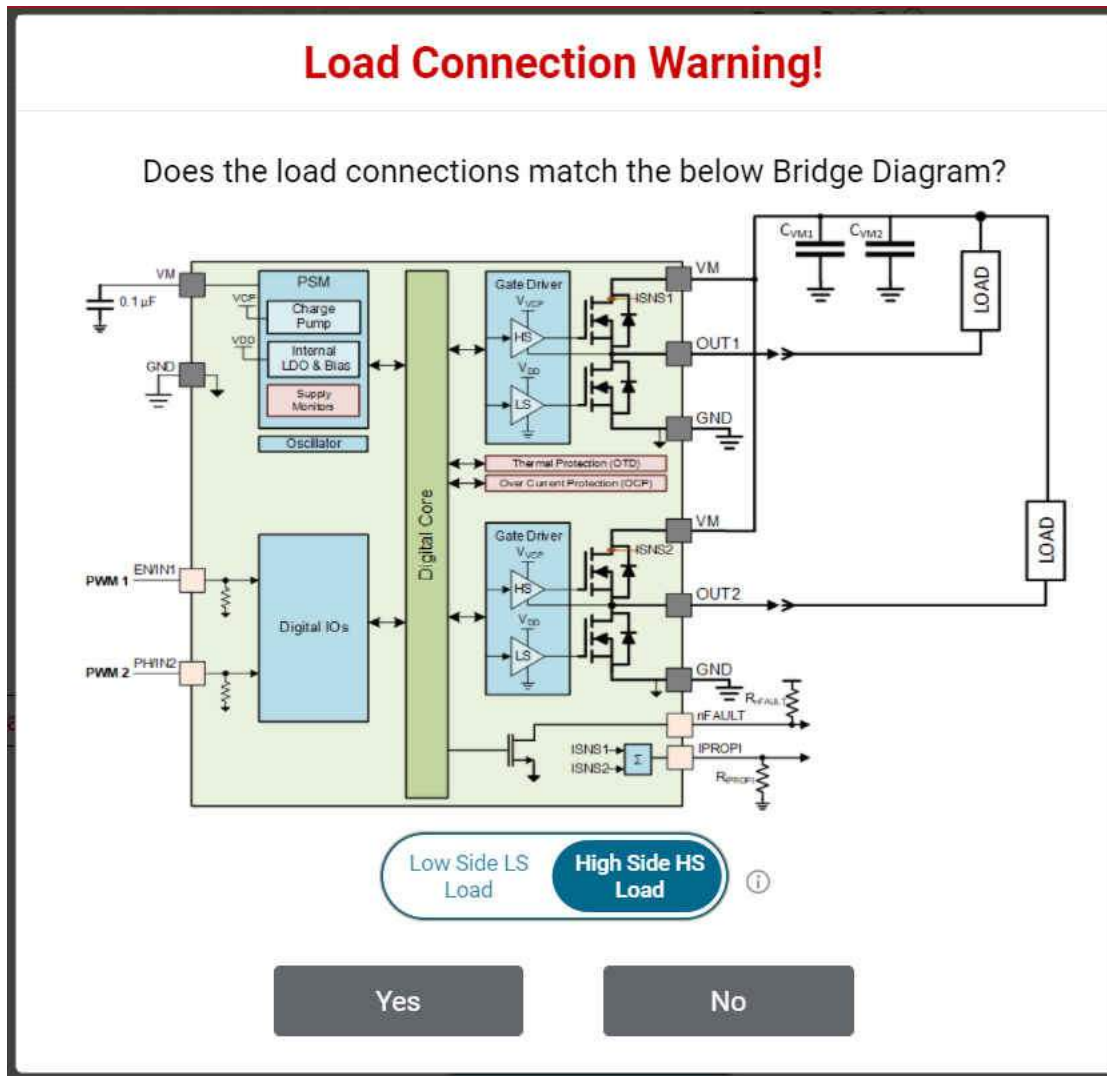


Figure 4-7. DRV824x Independent Half-Bridge Mode High Side and Low Side Load Connection

Note

DRV824x-Q1EVMs with HVSSOP package driver device has OUT1 and OUT2 silk screen labels interchanged. This misprint will be fixed in the next revision of these EVMs.

- **BRIDGE CONTROL** The Start Drive button allows the software state machine to start running on the MCU. Prior to starting, the user may wish to tweak the desired direction, ramp rate, slew rate, as well as check for

Start Drive

properly connected load connections. After pressing , the duty cycle slider(s) become available for modification. The output will automatically soft-start using the Ramp Rate parameter.

- **PASSIVE/ACTIVE DIAGNOSTICS** The SPI variant features both passive and active diagnostics. The passive diagnostics also known as Off-line Passive (OLP), may only be used when **ENABLE DRIVER** is disabled (Off-state). It will show up in a separate pop-up window as can be seen in [Figure 4-8](#). A representative table from the device datasheet is displayed in this window for guidance to perform the passive diagnostics. Each row of the table covers a specific combination of user input selection, the corresponding OLP setup and load status inference from the OLP_CMP comparator output on the nFAULT pin. See device datasheet for more details. The required S_DIAG selection can be made using the GUI for SPI devices. The required DIAG jumper setting must be done when **WAKE** is Asleep for HW devices prior to enabling passive diagnostics. The nSLEEP and DRVOFF inputs are logic 1 while observing passive diagnostics. Inputs for EN/IN1 and PH/IN2 are selected using the switches in the GUI. It may take a few seconds for the pull up, pull down

resistors, and the OLP_CMP output status to update due to the latency between the EVM hardware and the GUI application.

Off-state(Passive) Diagnostics

X

Off-state (Passive) diagnostics table - PH/EN or PWM mode (Full Bridge)											
USER INPUTS on PIN / Register bits				OLP SET UP				OUTPUT on nFAULT / OLP_CMP bit			
nSLEEP	DRVOFF	EN/IN1	PH/IN2	OUT1	OUT2	CMP REF	OUTx Selected	Normal	Open	GND Short	VM Short
1	1	1	0	ROLP_PU	ROLP_PD	VOLP_REFH	OUT1	0	1	0	1
1	1	0	1	ROLP_PU	ROLP_PD	VOLP_REFL	OUT2	1	0	0	1
1	1	1	1	ROLP_PD	ROLP_PU	VOLP_REFL	OUT2	1	1	0	1

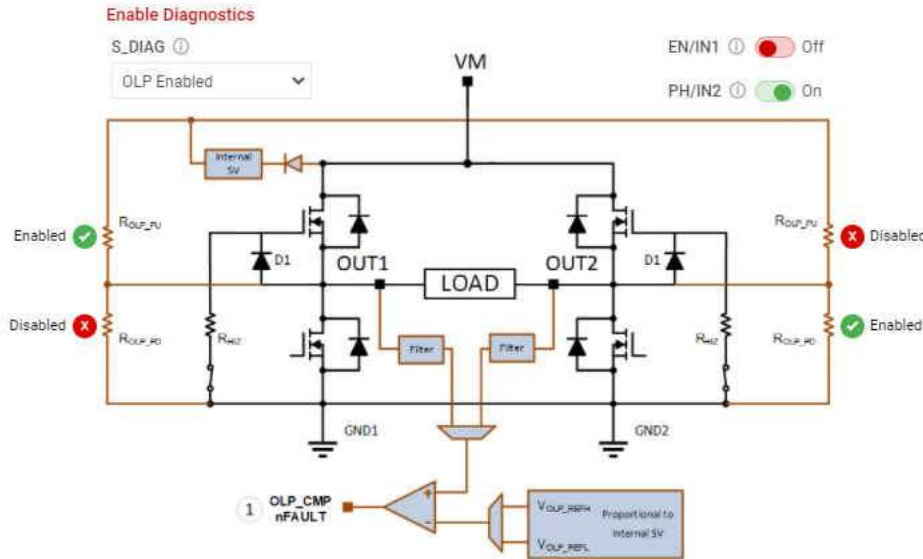


Figure 4-8. Passive Diagnostics Pop-Up Window

The Active Open Load Diagnostics are only for High-Side loads with the DRV824x device, Independent Half-Bridge mode, and the DRV814x Half-Bridge device. The Active Diagnostics not exist in the Hardware variants.

- **FAULTS** Press the clear button to clear all the latched faults. Next to the clear button is the **CONFIG** button for SPI variants. This button allows the user to have more control over the modification of fault reporting. For example, selecting **Automatic Retry** would allow the faults to clear without any manual interference.
- **BRIDGE CURRENT** The Bridge Current displays moving average and cycle peak load current values calculated from a window of samples of the voltage V_{IPROPI} ($V_{IPROPI} = R_{IPROPI} \times I_{PROPI}$) on the IPROPI output. Each periodic window of samples is referred to as a cycle. The samples are captured using the integrated 10-bit analog to digital converter in the MCU of the EVM. The displayed values are only indicative of the load current during the sampling window. The IPROPI analog output pin available on the header J4 of the EVM can be used for accurate real-time measurement using a multimeter or for capturing the load current waveform using an oscilloscope. Current scaling is done by selecting a desired R_{IPROPI} resistor with the IPROPI jumper setting on the current limit header J2 of EVM. See [Section 2.2.5](#). Match the R_{IPROPI} setting on the GUI with the IPROPI jumper setting of the EVM.

Every control also has a help tip associated with it to quickly help the user while running the GUI.

4.3.3 Driver Control Page (HW Device Variant)

There are a few other minor differences between the SPI and HW device variant which are noted below:

- **WAKE** For the Hardware variant, it is necessary for the jumpers to be selected while the device is asleep, and the default for the HW variant is "asleep". If the user makes changes to the jumpers while the device is awake, the device will not recognize those changes.
- **ENABLE DRIVER** Directly controls the DRVOFF pin. When the bridge control is active the user cannot observe the passive diagnostics.

- **MODE** In Hardware variant, mode change must occur through jumpers while the GUI **WAKE** control is Asleep. See [Figure 2-8](#). Level 1 is PH/EN Mode, Level 2 is Independent Half-Bridge Mode, and Level 4 is PWM mode, as can be observed in the device datasheet. For Level 4, there is no jumper. The jumper settings for these Mode changes may be observed in [Section 2.4](#). For Independent Half-Bridge Mode, the user **must** correctly connect for either High-Side Load or Low-Side Load as can be observed in [Figure 4-6](#).
- **PASSIVE/ACTIVE DIAGNOSTICS** The Active Diagnostics controls don't exist on hardware devices. Only the Passive Diagnostics may be observed.



CAUTION

Driving an incorrectly connected load could result in permanent damage to the device, fire, or other damage.

When operating the EVM at the maximum device specifications and higher ambient temperature, external cooling fans may be required to minimize potential fire hazard, personal injury, or both.

4.3.4 Updating Firmware

Your EVM includes the ability to update the MCU firmware controlling the DRV824x-Q1/ DRV814x-Q1 device without any additional hardware. There should be a pop-up every time the GUI Driver Control page is selected after an EVM connection is made and if a new update becomes available as can be seen in [Figure 4-4](#).

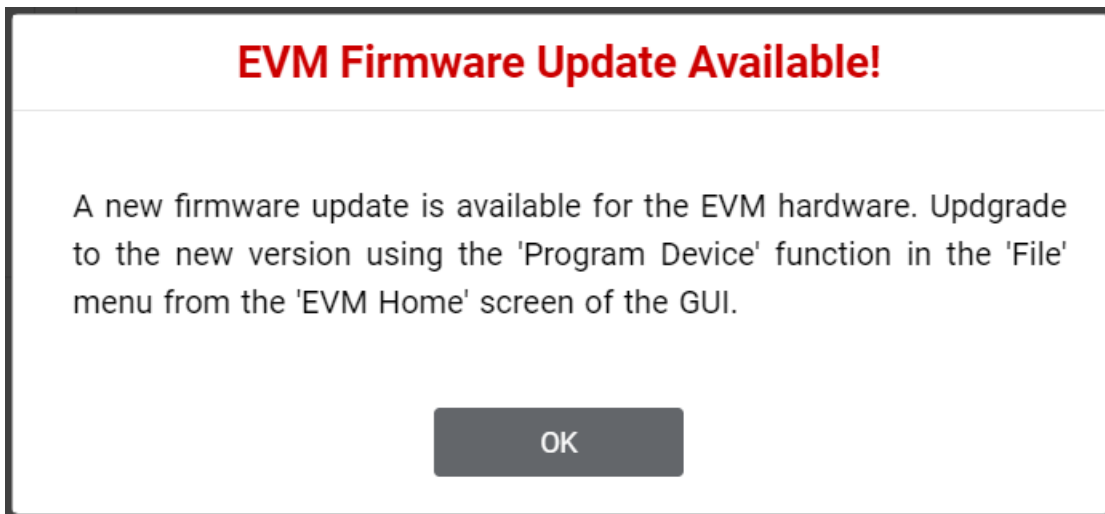


Figure 4-9. EVM Firmware Update Pop-up

The user can update the EVM to the latest firmware by simply going to File -> Program Device from either the EVM Home Page or the Driver Control page as shown in [Figure 4-10](#).



Figure 4-10. Update Firmware

5 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision A (July 2021) to Revision B (May 2023) Page

- Added Note about OUT1 and OUT2 silk screen labels.....4
-

Changes from Revision * (April 2021) to Revision A (July 2021) Page

- Overview contents updated.....2
 - Updated LED Functions Description.....9
 - Updated Images for new version.....12
 - Updated Connection Sequencing.....14
 - Updated EVM GUI operation description and Images for version 0.4.0.....14
 - Updated GUI Application images for version 0.4.016
 - Bullet Points for Passive/Active Diagnostics, Fault and Bridge Current.....17
 - Updated Image and Instructions in Updating Firmware Section.....21
-

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