DRV8873xEVM User's Guide

This document is provided with the DRV8873xEVM customer evaluation module (EVM) as a supplement to the *DRV8873-Q1 Automotive H-Bridge Motor Driver* data sheet and *DRV8873 H-Bridge Motor Driver* data sheet. This user's guide details the hardware implementation of the EVM and how to install the software packages.

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1 Introduction

1.1 Overview

The DRV8873 device is an integrated driver IC for driving a brushed DC motor in automotive applications. Two logic inputs control the H-bridge driver, which consists of four N-channel MOSFETs that drive motors bi-directionally with up to 10-A peak current. The DRV8873 operates from a single power supply and supports a wide input supply range from 4.5 V to 38 V.

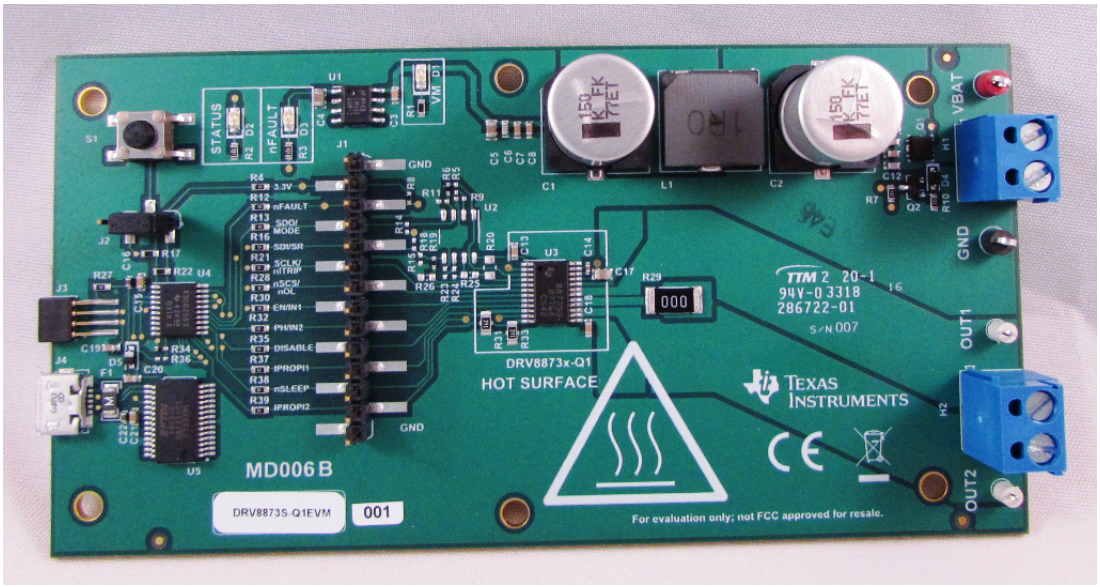

Figure 1. DRV8873S-Q1EVM shown (Actual Board May differ)

A PH/EN or PWM interface allows simple interfacing to controller circuits. Alternatively, independent half-bridge control is available to drive two solenoid loads.

A current mirror allows the controller to monitor the load current. This mirror approximates the current through the high-side FETs, and does not require a high-power resistor for sensing the current.

A low-power sleep mode is provided to achieve very-low quiescent current draw by shutting down much of the internal circuitry. Internal protection functions are provided for undervoltage lockout, charge pump faults, overcurrent protection, short-circuit protection, open-load detection, and overtemperature. Fault conditions are indicated on an nFAULT pin and through the SPI registers.

1.2 Purpose and Scope

This document is designed to be used as a startup guide and to supplement the DRV8873x-Q1EVM and DRV8873xEVM. This document is intended for the engineers involved in the design, implementation, and validation of DRV8873 device. The scope of this document is to provide the user with a guide to evaluate the DRV8873 device using GUI control. This document covers the hardware (HW) connections required between the DRV8873xEVM and the GUI. When the HW connections are complete, the user is required to download and open the GUI to control the DRV8873 device.

2 Hardware and Software Overview

WARNING

Hot surfaces on the DRV8873xEVM include the DRV8873 device (U1) and the area surrounding it.

When operating the DRV8873xEVM between 4-A and 6-A, the device overtemperature warning should be monitored for overtemperature warnings. The nFAULT pin indicates when the device temperature has increased above 140°C and is approaching thermal shutdown. As with any elevated temperatures, normal precautions must be followed to avoid direct contact with the hot surface of the DRV8873xEVM when used in the 4-A to 6-A load range.

To minimize potential fire hazard, personal injury, or both, externally provided fans may be required to adequately cool customer-provided loads depending on loading conditions.

2.1 Hardware Connections Overview

The major blocks of the DRV8873xEVM include the DRV8873 driver, the MSP430G2553 microcontroller (MCU), the LM9036QMX-3.3/NOPB 3.3-V LDO regulator, and the USB communication. The DRV8873xEVM is designed for an input supply from 4.5 to 38 V and up to 10-A peak drive current.

The DRV8873 device driver is used to provide the current to the motor or other load. The MCU communicates with the GUI to control the DRV8873 device.

2.2 Connection Details

Figure 2 shows the power connector and motor phase connector. A supply voltage ranging from 4.5 V to 38 V from a battery or a DC voltage source is connected to the voltage supply pins. The OUT1 and OUT2 pins can be connected to a single motor winding, inductor, or latched relay coil when used in PWM or 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.

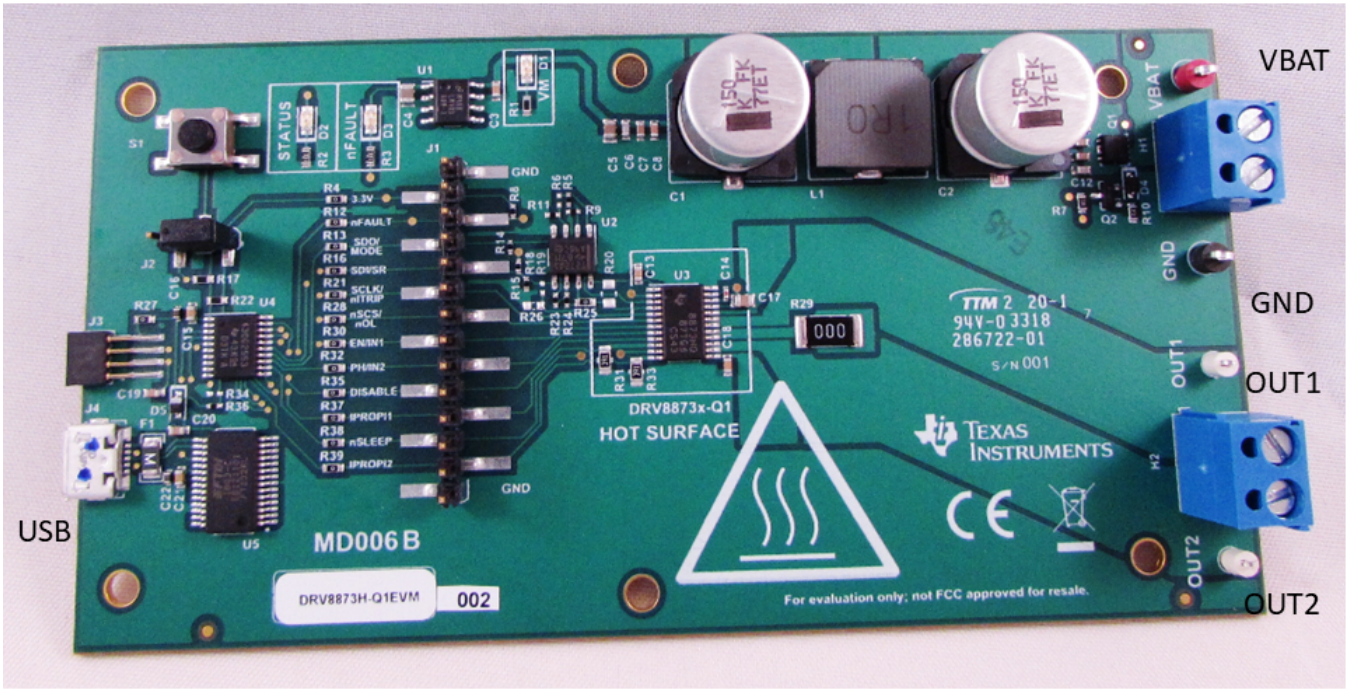

Figure 2. EVM Connections (Actual Board May Differ)

2.3 LED Lights and Switch Functions

Two LED switches and one push-button switch are available on the DRV8873xEVM to notify the user of different motor statuses and to control the operation of the motor. The STATUS LED will blink at a regular interval to provide an indication the MSP430G2553 MCU is powered and code is running. The nFAULT LED will light when the DRV8873 device detects an abnormal condition, such as overcurrent, overtemperature, or open load.

The S1 switch is configured to reset the MSP430G2553 MCU. By moving the J2 jumper to the alternate position, the switch can be used as a general-purpose input if user-supplied code is installed.

2.4 Optional EVM heatsink and circuitry

The DRV8873xEVM was designed to accept an optional heatsink to the bottom of the board. This allows evaluation of the device at higher currents. The Advanced Thermal Solutions heatsink, part number *ATS-1109-C1-R0* is available at distributors. TI also recommends use of a thermally conductive insulator between the board and heatsink, such as *Berquist SPK10-0.006-AC-11.512*.

The H variant of the DRV8873xEVM includes an dual channel operation amplifier that is not required for normal operation of the device. The operational amplifier is used to translate 3 voltage levels from the 3.3V domain to 3 voltage levels in the 5V DRV8873 DVDD domain. These voltages are used to control the operational mode and output slew rates. In normal operation of the device, resistors should be used to select the desired operational mode and output slew rates.

2.5 Additional circuitry placed on the Hardware version

The hardware variation of the EVM has a dual channel operational amplifier (opamp) placed on the board. This opamp is used to convert the 0-V, a mid voltage, and 3.3-V output of the MSP430G2553 to 0V, twice the mid voltage, and DVDD using the DVDD voltage.

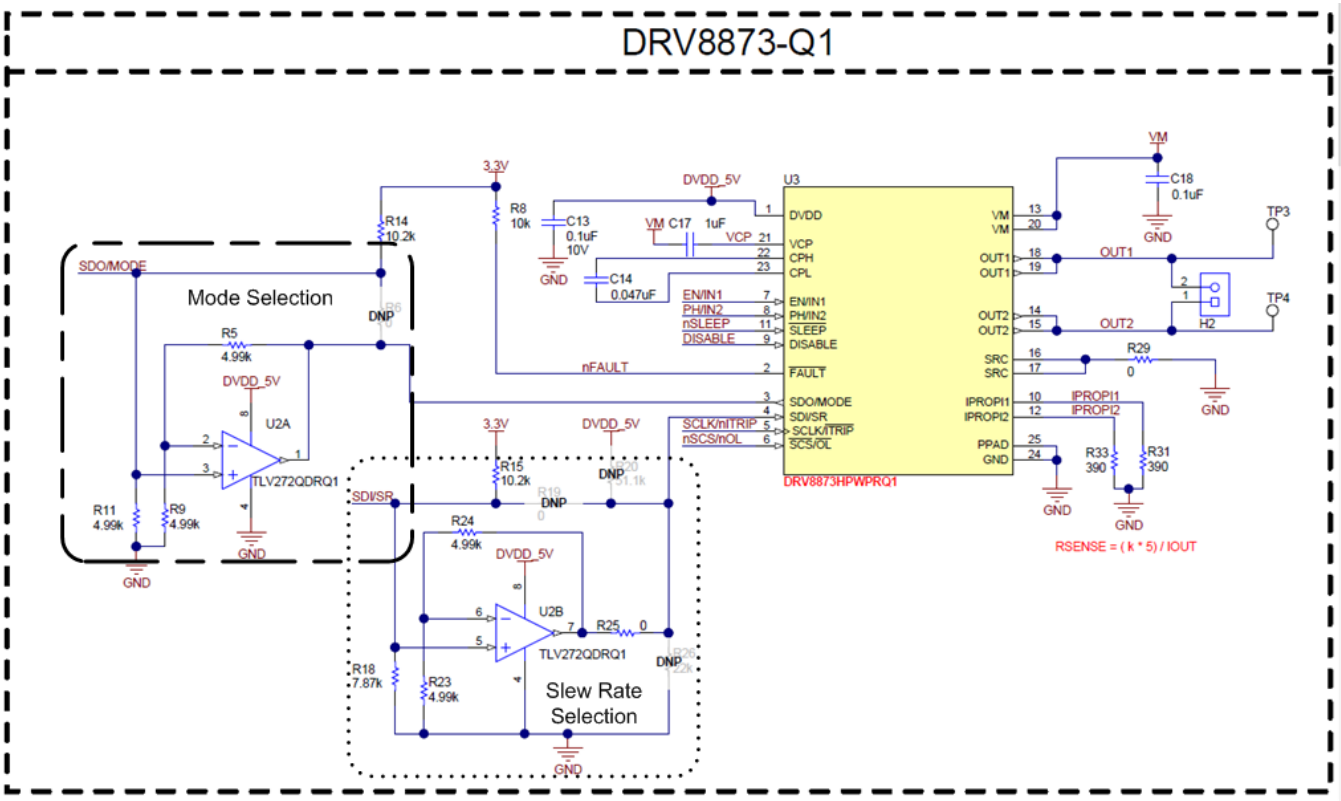

Figure 3. Mode and Slew Rate Selection Circuitry of Hardware variation

The SR pin of the Hardware variant can be manually configured to test any of the six slew rate settings. To manually set the slew rate of the DRV8873H-Q1EVM, perform the following steps:

- Remove R25 to isolate the output of the opamp from the MODE pin
- Populate R20 to connect to DVDD or
- R26 to connect to ground

The DRV8873HEVM SR pin circuitry is similar to the circuitry used in the DRV8873H-Q1EVM. The resistor designators are different. To manually set the slew rate of the DRV8873HEVM, perform the following steps:

- Remove R23 to isolate the output of the opamp from the MODE pin
- Populate R18 to connect to DVDD or
- R24 to connect to ground

NOTE: If manually configuring the slew rate, the GUI pulldown is not applicable.

3 GUI Application

The GUI is used to control the DRV8873xEVM through USB commands. The commands are sent from the computer to the FTDI FT233RL device, which converts USB commands to UART commands. The UART commands are received by the MSP430G2553 MCU.

3.1 Installation

Follow these steps to install the GUI application:

Step 1. Double click on the *Setup_DRV8873x-y.y.y_EVM.exe* file. The y.y.y values shown may change as the GUI is updated.

Step 2. Click the *Yes* button in the *User Account Control Window* to continue (see Figure 4).

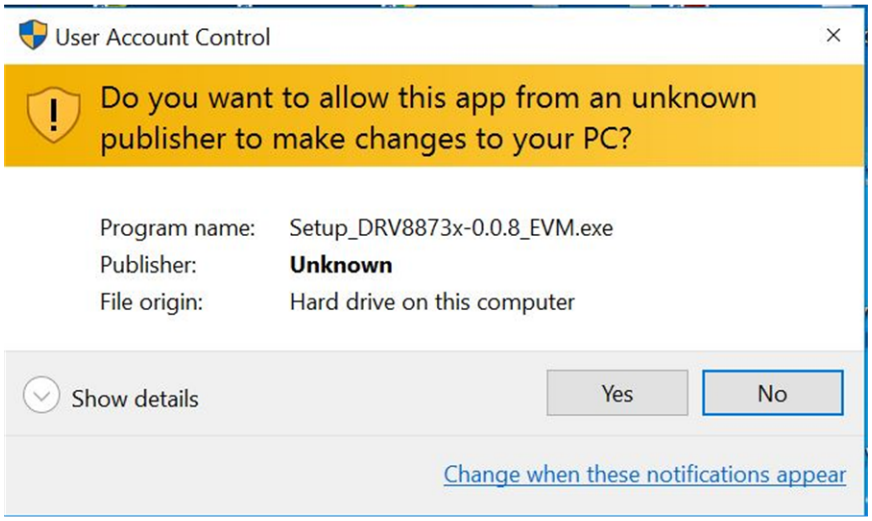

Figure 4. User Account Control

Step 3. Click the *Next* button in the *Setup - DRV8873x* window (see Figure 5).

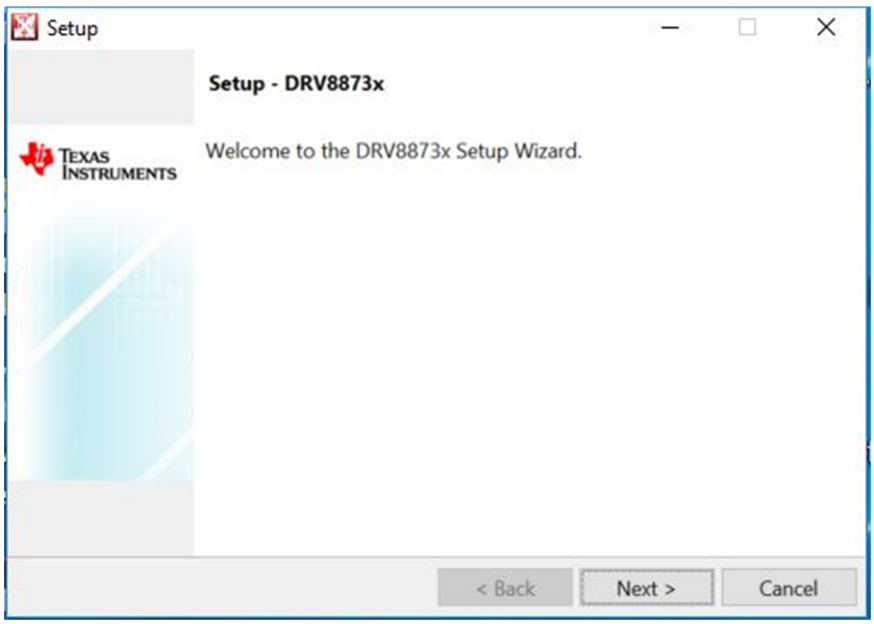

Figure 5. Setup DRV8873x Window

Step 4. Review the license agreement (see Figure 6).

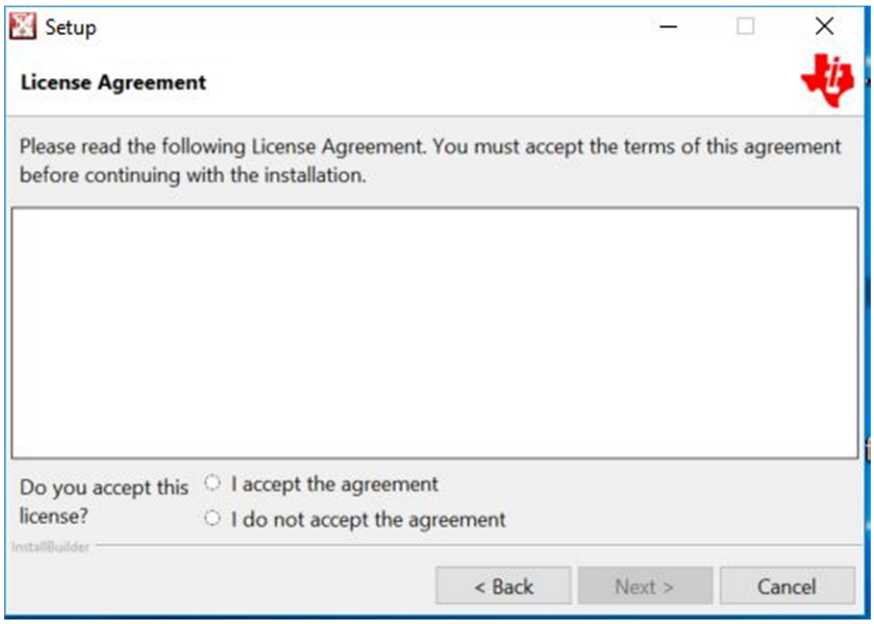

Figure 6. License Agreement

Step 5. Click the *I accept the agreement* radio button if accepted and then click the *Next* button (see Figure 7).

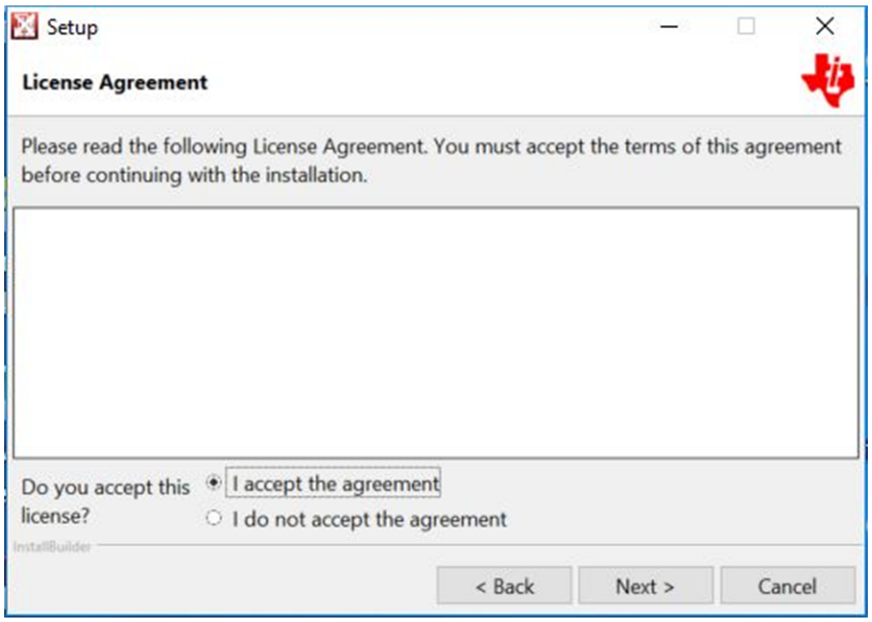

Figure 7. Accepted License Agreement

Step 6. Select the installation directory. TI recommends using the default installation directory. Click the *Next* button when the directory is determined (see Figure 8).

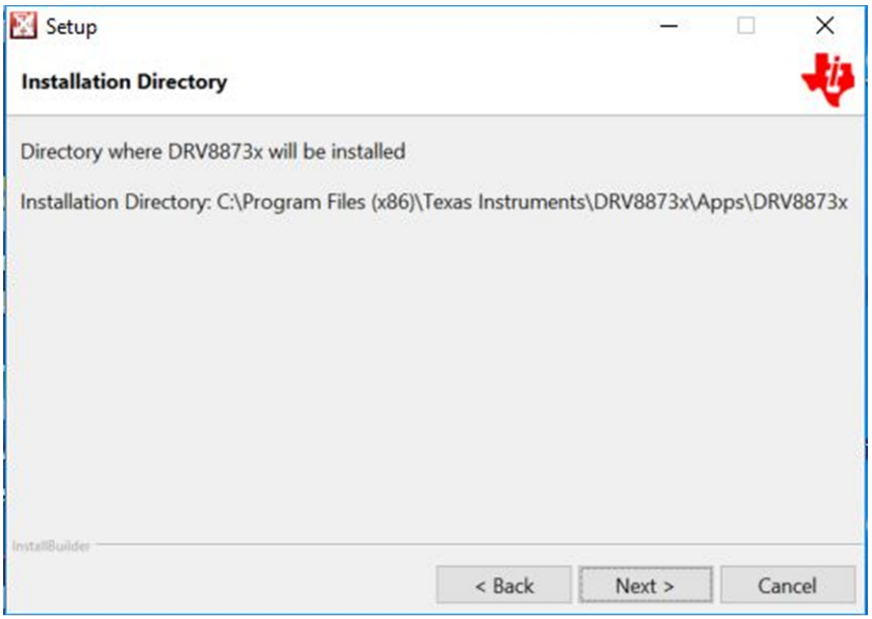

Figure 8. Installation Directory

Step 7. Click the *Next* button in the *Ready to Install* window to begin the installation (see Figure 9).

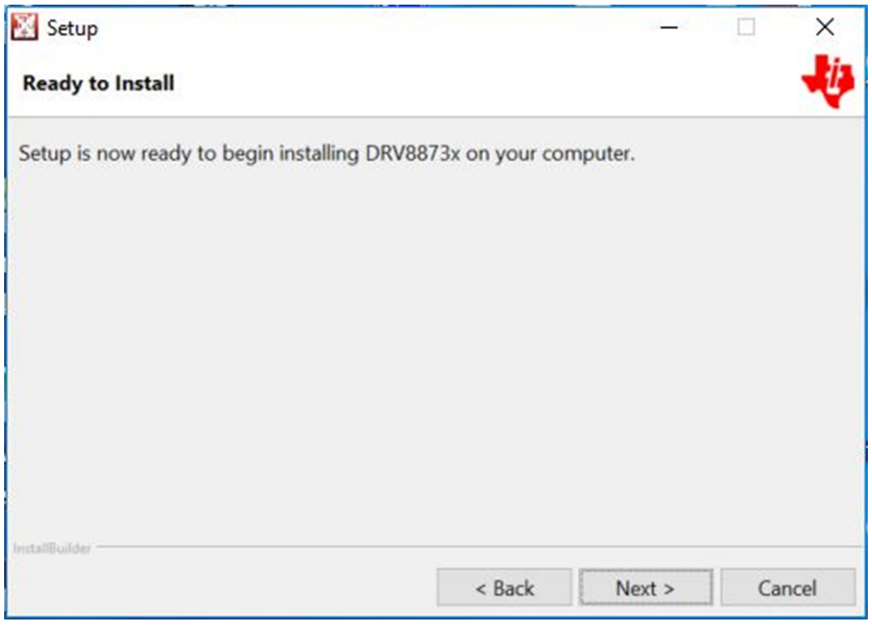

Figure 9. Ready to Install

Step 8. Click the *Yes* button to enable desktop entries or the *No* button to disable desktop entries (see Figure 10).

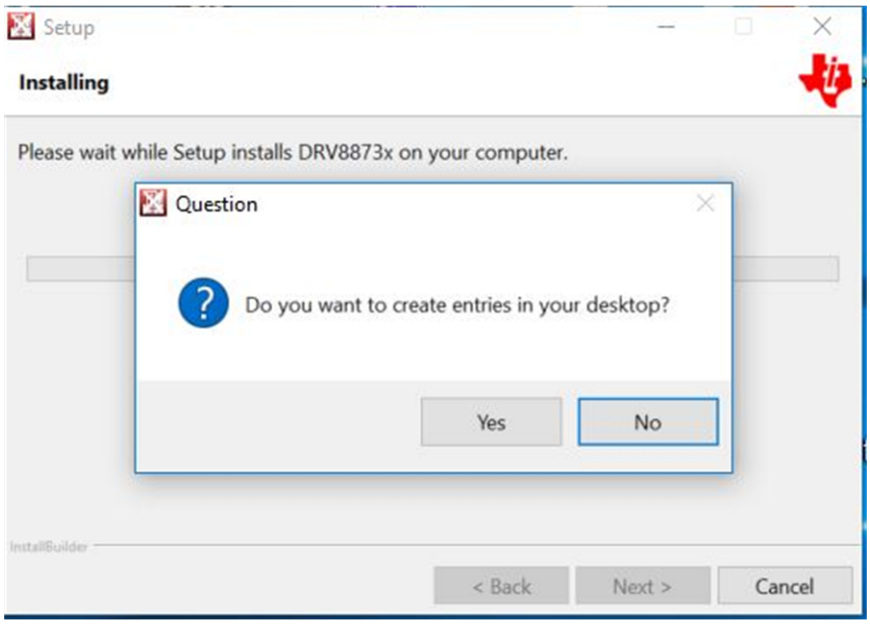

Figure 10. Desktop Icons

When the installation begins, the *Installing* window shows the installation progress (see Figure 11).

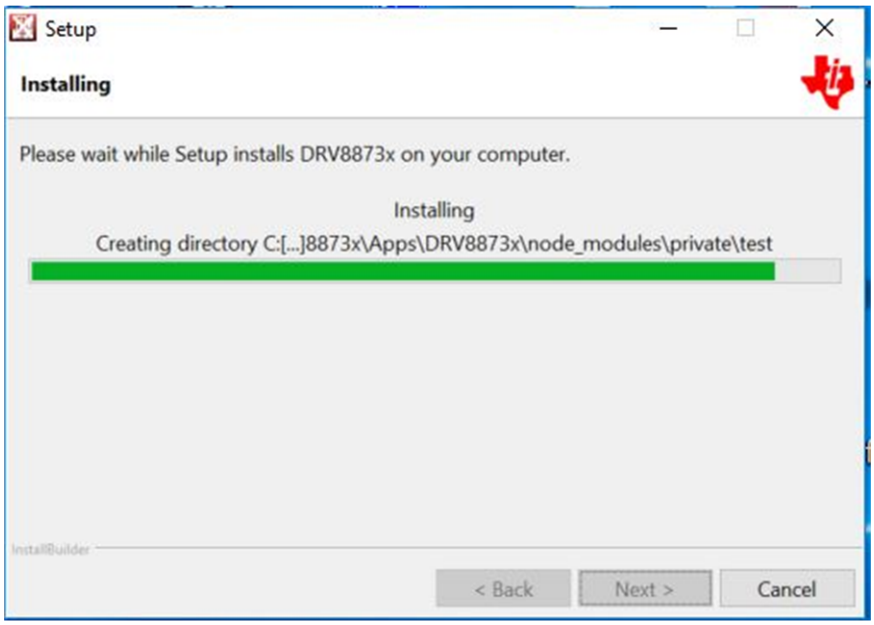

Figure 11. Installation Progress

The installation is now complete.

Step 9. Click the *Finish* button to close the installer and begin using the GUI (see Figure 12).

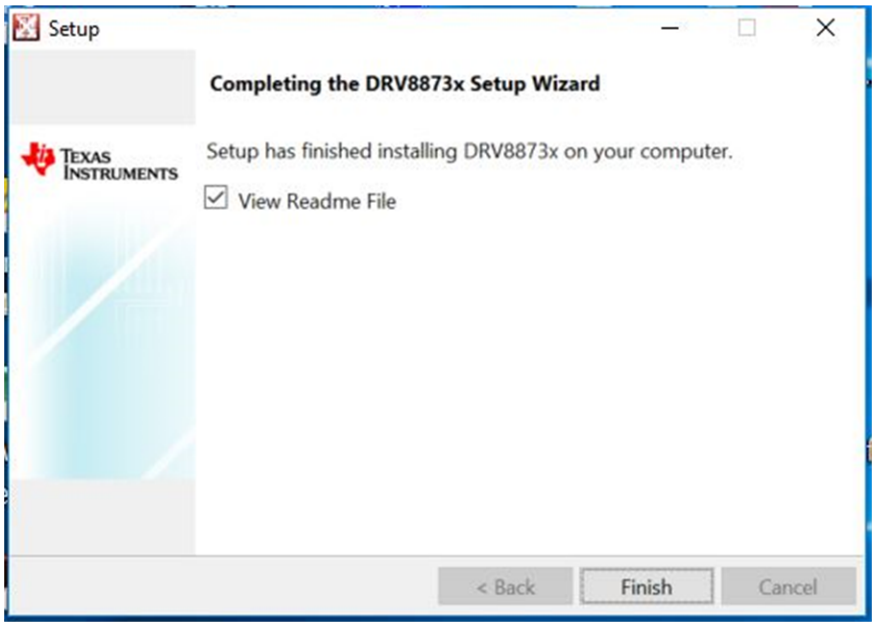

Figure 12. Installation Complete

4 GUI Operation

The DRV8873xEVM GUI along with DRV8873xEVM facilitate control of brushed DC motors. The DRV8873xEVM 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 current, and monitoring the device fault status. The GUI can also be used to test the motor for best performance using various parameters available in the *Motor Control* page.

4.1 Hardware Setup

The hardware required to run the DRV8873xEVM is a micro-USB cable and a power supply from 4.5 to 38 V. Follow these steps to start up the DRV88873xEVM:

Step 1. Connect the positive output of the DC power supply to the VM screw terminal and the negative output to the GND screw terminal.

Step 2. Use the OUT1 and OUT2 screw terminals to connect to the desired loads.

Step 3. Connect a micro-USB cable to the DRV8873xEVM and computer.

Step 4. Turn on the power supply and power up the printed circuit board (PCB).

4.2 Launching the DRV8873xEVM GUI

To launch the GUI, click on the DRV8873x 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 DRV8873x EVM icon.

For a guide on the different attributes of the DRV8873xEVM GUI, refer to the *DRV8873xEVM GUI User's Guide*. Figure 13 shows an example of the GUI.

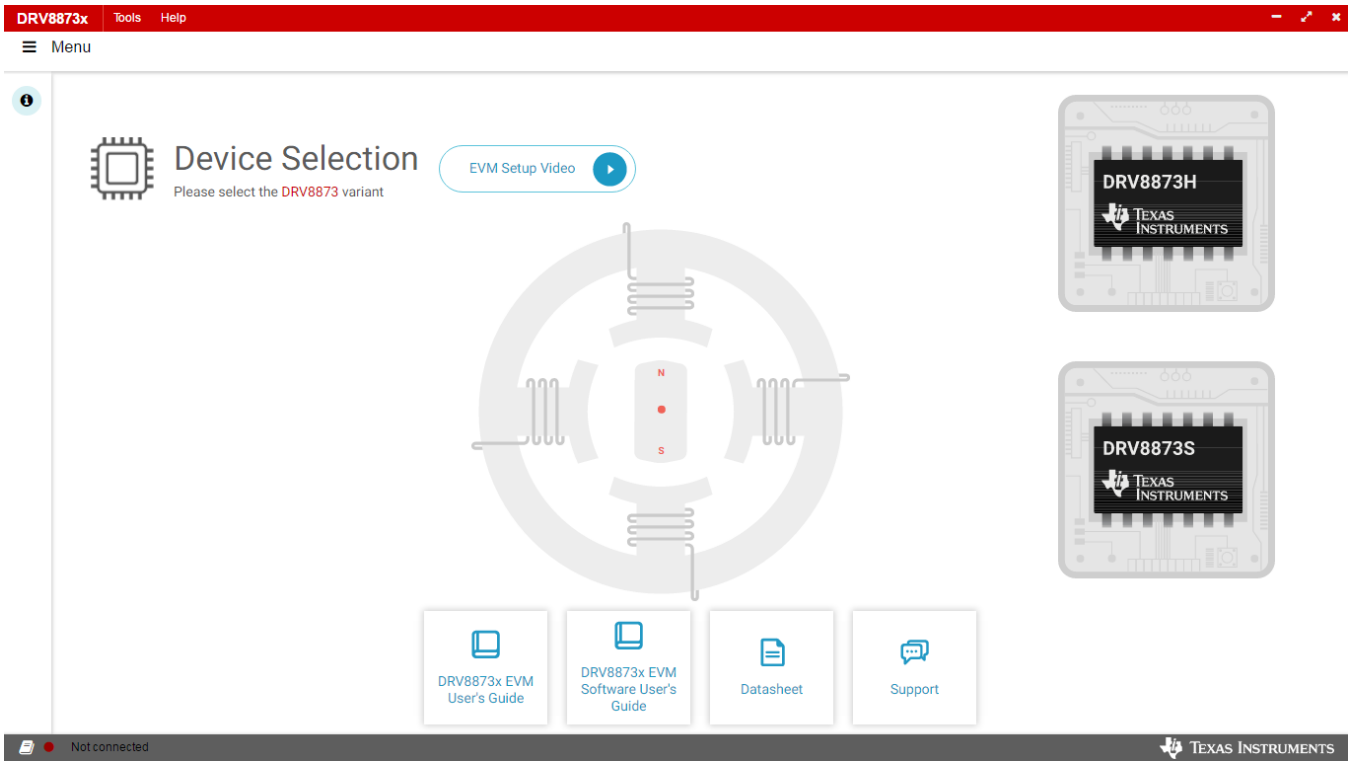

Figure 13. Example of DRV8873x GUI Open

Revision History

DATE	REVISION	NOTES
August 2018	A	Updated to reflect latest EVMs (S and H variants)
December 2018	B	Updated to include DRV8873

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