*User's Guide*

# *HALL-TRIGGER-EVM User's Guide*


**ABSTRACT**

This EVM uses the DRV5056 linear Hall-effect sensor to implement a trigger that outputs a varying voltage based on how far the trigger is pressed. These types of triggers are well-suited for use in cordless power tools or any other end equipment that use trigger displacement information. The design uses a contactless approach that reduces wear and tear compared to traditional mechanical-based triggers, thereby increasing product lifetime. The DRV5032 low-power Hall-effect switches are used along with a load switch to keep the system in a low power standby mode when the trigger is not pressed. In addition, an optional magnetic field protection feature is available that disables the voltage output when a strong, external magnetic field is present.


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## Trademarks

All trademarks are the property of their respective owners.

# 1 Introduction

In this EVM, a contactless trigger is implemented using Hall-effect sensors, which reduces wear and tear compared to traditional triggers that use potentiometers and mechanical switches. This design includes 3D-printed trigger module with embedded magnet for illustrating a Hall-based trigger press mechanism. In this implementation, a magnet is placed so that it moves along with the trigger. As the trigger is pressed, the magnet approaches a DRV5056 linear Hall sensor, which translates the sensed magnetic flux density from the moving magnet into an output voltage. Since the sensed magnetic flux density and output voltage varies with the location between the magnet and the linear Hall sensor, the output voltage provides information on the location of the magnet, and therefore, the trigger displacement. This design translates up to 10 mm of trigger displacement into an output voltage.

A TPS22917 load switch is used to disconnect power to the linear Hall sensor and other components if the trigger is not pressed. To wake up the system to enter active mode, the design uses the DRV5032 Hall-effect switch for detecting when the trigger displacement exceeds the turn-on distance. When the sensed magnetic flux density of the wake-up Hall-effect switch exceeds the magnetic operating point ($B_{OP}$) of the switch, the output of the Hall-effect switch is asserted low, which triggers the load switch to reconnect power to the linear Hall sensor.

In addition to the wake-up Hall-effect switch, additional DRV5032 Hall-effect switches are present for implementing optional protection against external magnetic fields. If these additional Hall-effect switches detect strong external magnetic fields, the design automatically disconnects power to the linear Hall sensor to disable the sensor's output, thereby preventing the EVM from accidentally turning ON due to strong external magnetic fields.

This protection also turns OFF a currently ON EVM when strong magnetic fields are present. Each of the tamper Hall sensors can be individually disabled, which enables the user to select the number of Hall sensors needed for their system based on their sleep current consumption and external magnetic field protection requirements.

This EVM supports standalone operation or connection to external systems for in-system evaluation. In standalone operation, the design is powered from AAA batteries that are inserted into the battery holder that comes with the HALL-TRIGGER-EVM. To illustrate status, the following LEDs are used:

- LEDs on the output of each Hall-effect switch.
- An LED added to the VCC input of the linear Hall sensor for indicating when the system is woken up from its sleep mode and the linear Hall sensor is powered.
- An LED that changes its brightness based on how far the trigger is pressed.

For connecting to external systems for in-system evaluation, a TPS70933 LDO is included in the design to convert external battery voltages from 5 V to 30 V down to a 3.3-V rail that powers the design. Instead of connecting the DRV5056 power to the load switch output, the design can also be reconfigured so that the DRV5056 is powered from an external 3.3-V rail.

## 2 Installation Instructions

This hardware comes with an empty battery holder that is placed inside the 3D printed trigger module. Figure 2-1 shows the 3D model of the trigger module (please note that the spring and the battery holder wires are not shown in the image).

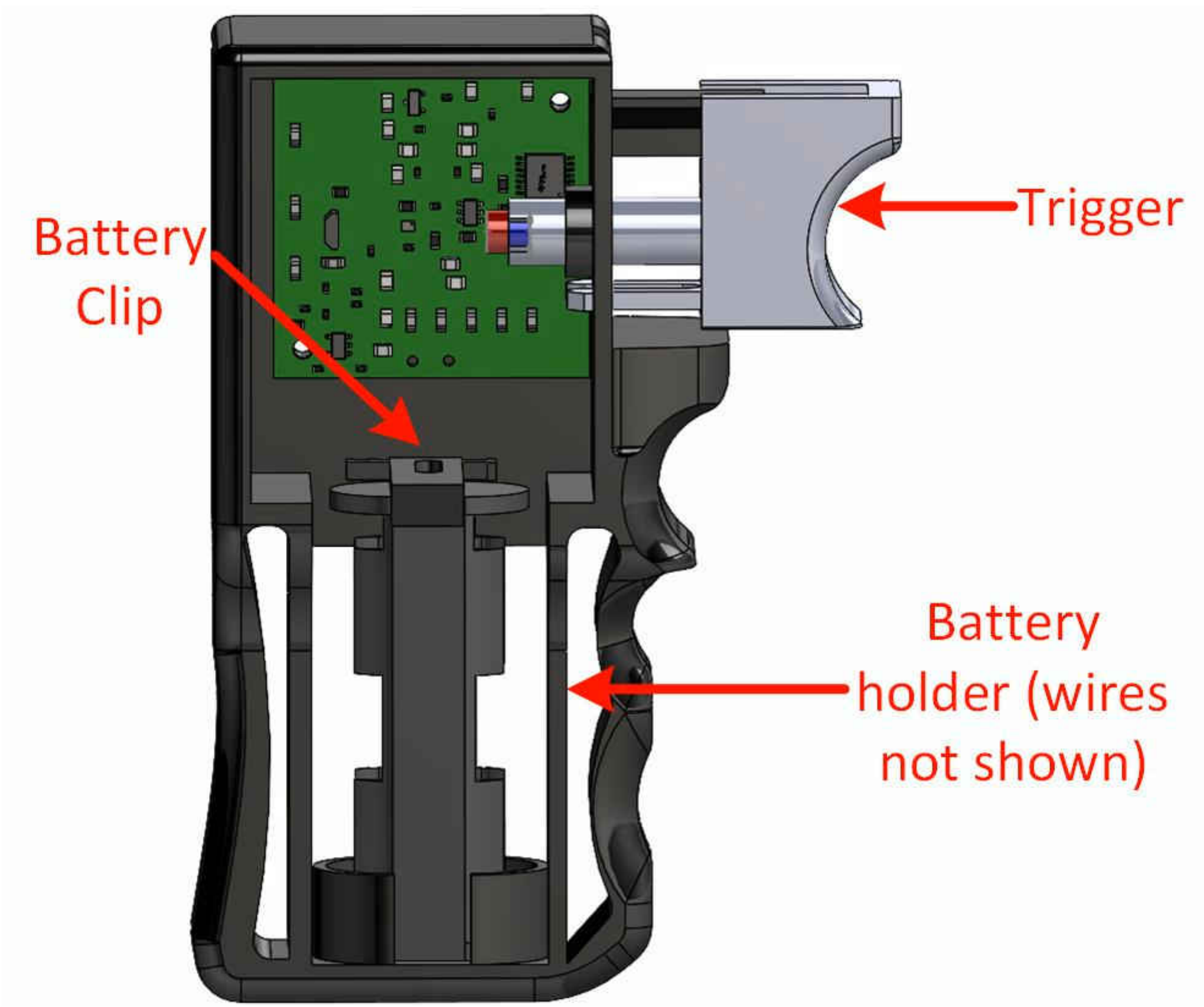


**Figure 2-1. Front View With Battery Holder Inside Trigger Module**

To use this design, batteries must be placed inside the battery holder. Batteries can be installed by first pushing the battery clip upwards and simultaneously taking the battery holder outside of the trigger module. Figure 2-2 shows a 3D model with the battery holder placed outside the trigger module. After the battery holder is outside the trigger module, install the two AAA batteries into the battery holder. Finally, the battery holder should be placed back into the trigger module by pressing the click upwards while placing the battery holder back into the trigger module until the battery holder is inside the trigger module again (see Figure 2-1).

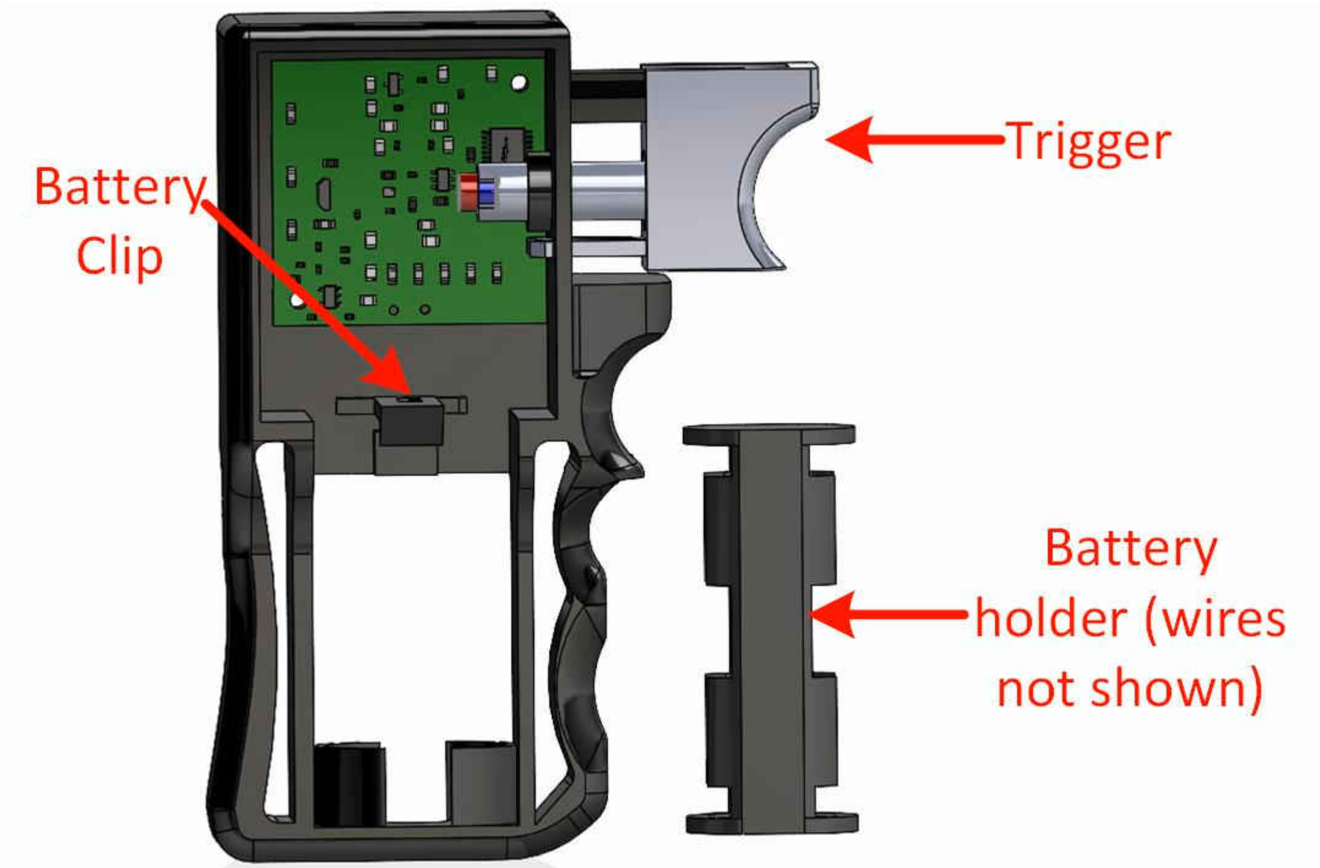


**Figure 2-2. Front View With Battery Holder Outside Trigger Module**

The design can be used in stand-alone mode by pressing the trigger in Figure 2-1 to the left and observing the state of the LEDs on the board. When the trigger displacement reaches a certain distance threshold, the system is waked up from sleep mode. LEDs D1, D2, and LPWR will be ON when the system is in active mode and LEDs D3 and D4 will be OFF. In addition, the TRIG LED will change its brightness based on how far the trigger is pressed. The further the trigger is pressed, the brighter the TRIG LED will appear. Please note that the trigger cannot be pressed to reach a full displacement distance of 10 mm due to the spring preventing the trigger from being fully pressed.

If an external magnetic field is detected by switch U3, LED U3 will be on and the system will be placed in sleep mode. Similarly, if an external magnetic field is detected by switch U4, LED U4 will be turned ON and the system will also be placed in sleep mode. As an alternative to viewing the state of the LED, the outputs of the different Hall sensors can also be observed by measuring the output voltage at the corresponding test points on the board.

# 3 Schematic

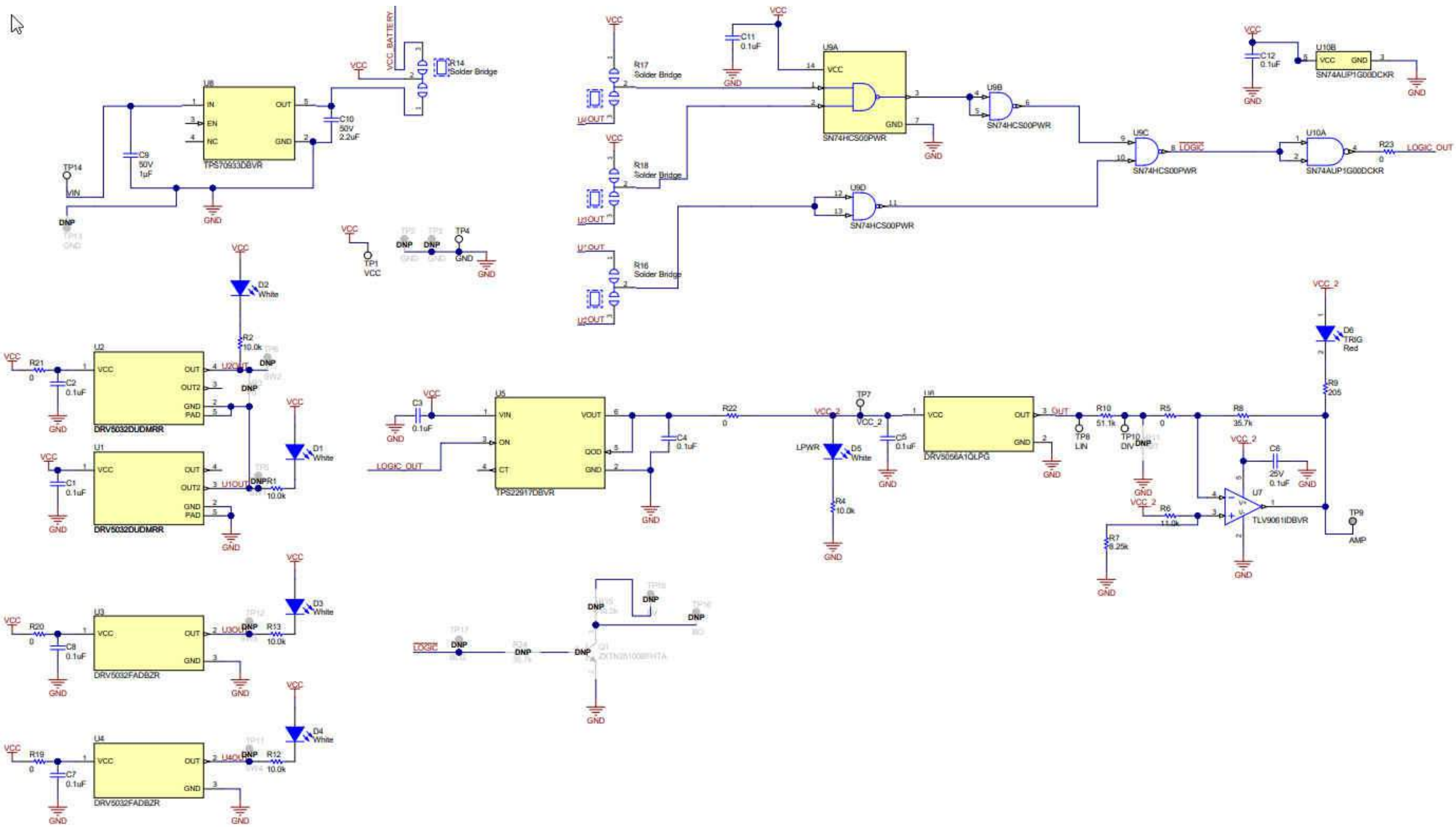


Figure 3-1. Schematic Page 1

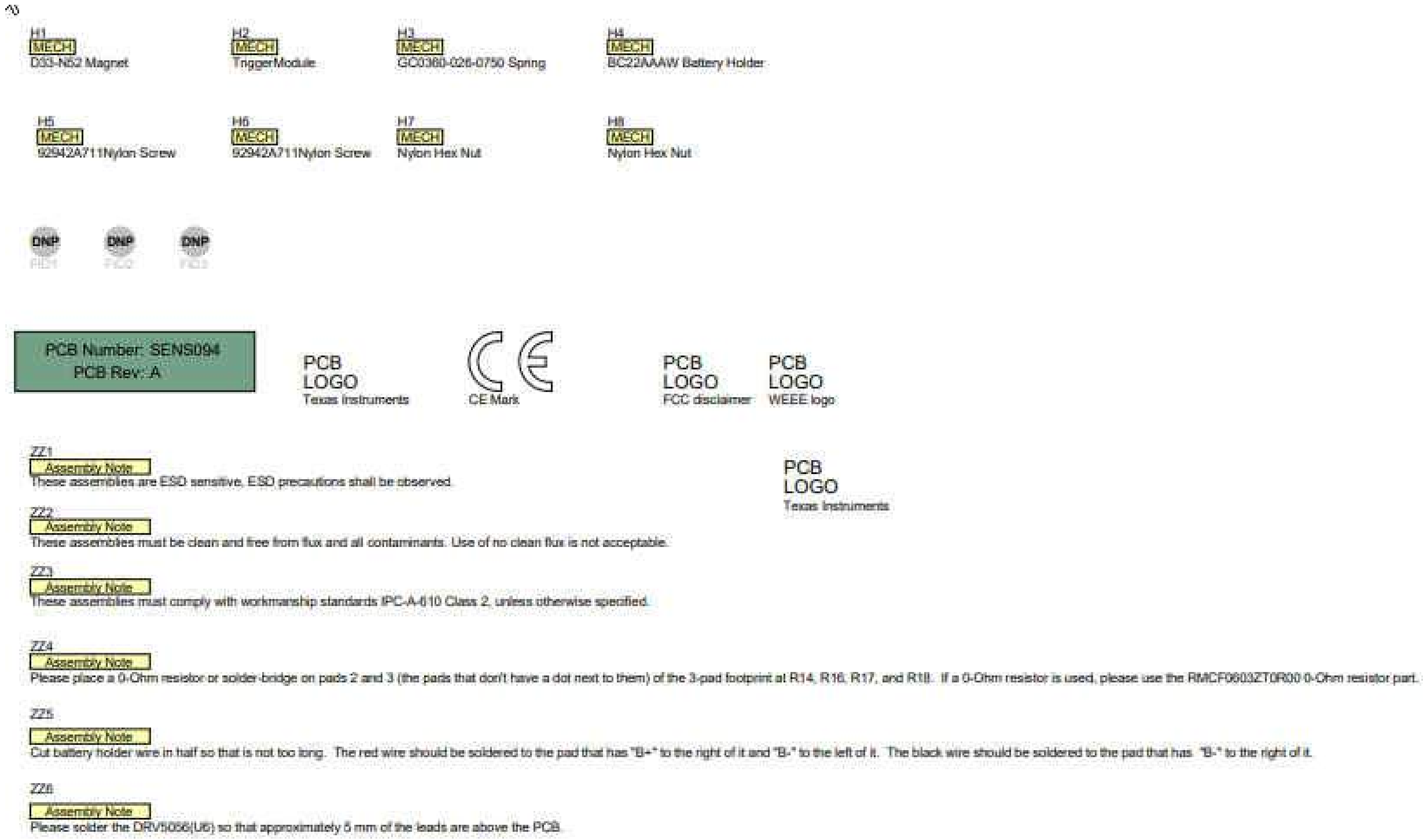


**Figure 3-2. Schematic Page 2**