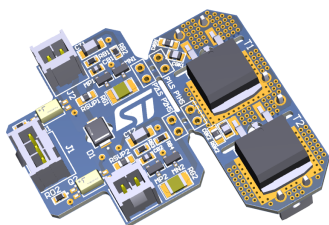


## Active discharge and diagnostic for 400 V power bus



### Product summary

2 x TN4035HA-8GY

### Features

- 400 V active discharge
- Discharge capacitance up to 3 mF
- Compatible with discharge resistor of 0.2  $\Omega$  or greater
- Insulated SCR gate driver with opto transistors
- Require a 12 V insulated supply
- Implement 2 SCR in series to allow diagnostic

### Applications

- High voltage capacitive discharge
- Battery management system (BMS)
- Power distribution Unit (PDU)
- Uninterruptible power supply (UPS)
- Battery charger

### Description

The STDES-DIS001V1 reference design allows you to evaluate silicon controlled rectifier TN4035HA as a discharge switch. It is suitable to discharge capacitance up to 3mF connected on 400 Vbus (800 V max.).

This active discharge can be controlled thanks to an insulated gate drive implemented with opto-transistors. Thanks to TN4035HA peak current capability, the discharge resistor can be reduce to 0.2  $\Omega$  in order to perform the discharge in few milliseconds.

2x TN4035HA are implemented on the reference design. One connected in High side and another connected on low side. The mid point of these SCRs can be used in order to diagnose that both SCRs are functional before discharge. Also the diagnostic can be done after discharge to verify the SCRs have not been damaged during the discharge.

Thanks to their excellent peak current rating TN4035HA are recommended for fast active discharge of EV high voltage power bus.

# 1 Getting started

Figure 1. Pictograms



**Danger:** Use the *STDES-DIS001V1* board only after applying a fire-resistant cover. The cover is not included in the board package.

There is a danger of serious personal injury, property damage, or death due to electrical shock and burn hazards if the kit or components are improperly used or installed incorrectly.

**Warning:** The kit is not electrically isolated from the high-voltage supply AC-DC input. The evaluation board is directly linked to the mains voltage. No insulation is ensured between the accessible parts and the high voltage. All measurement equipment must be isolated from the mains before powering the board.

When using an oscilloscope with the evaluation board, it must be isolated from the AC line. This prevents shock from occurring as a result of touching any single point in the circuit, but does not prevent shock when touching two or more points in the circuit.

**Caution:** During assembly, testing, and operation, the evaluation board poses several inherent hazards, including bare wires, moving or rotating parts and hot surfaces. All operations involving transportation, installation, use, and maintenance must be performed by skilled technical personnel who are familiar with the installation, use, and maintenance of power electronic systems.

The board has to be connected directly on the mains. Non-isolated parts at high-voltage levels are present on both sides of the PCB.

The high current flowing through the two SCRs generates heat: the board temperature can reach up to 150 °C at full power. Be aware that, due to the thermal inertia, the board could remain hot even after the current flow.

**Workarea safety:**

- The work area must be clean and tidy
- Do not work alone when boards are powered
- Protect the area against any unauthorized access by putting suitable barriers and signs
- A system architecture that supplies power to the evaluation board must be equipped with additional control and protective devices in accordance with the applicable safety requirements (that is, compliance with technical equipment and accident prevention rules).

**Electrical safety:**

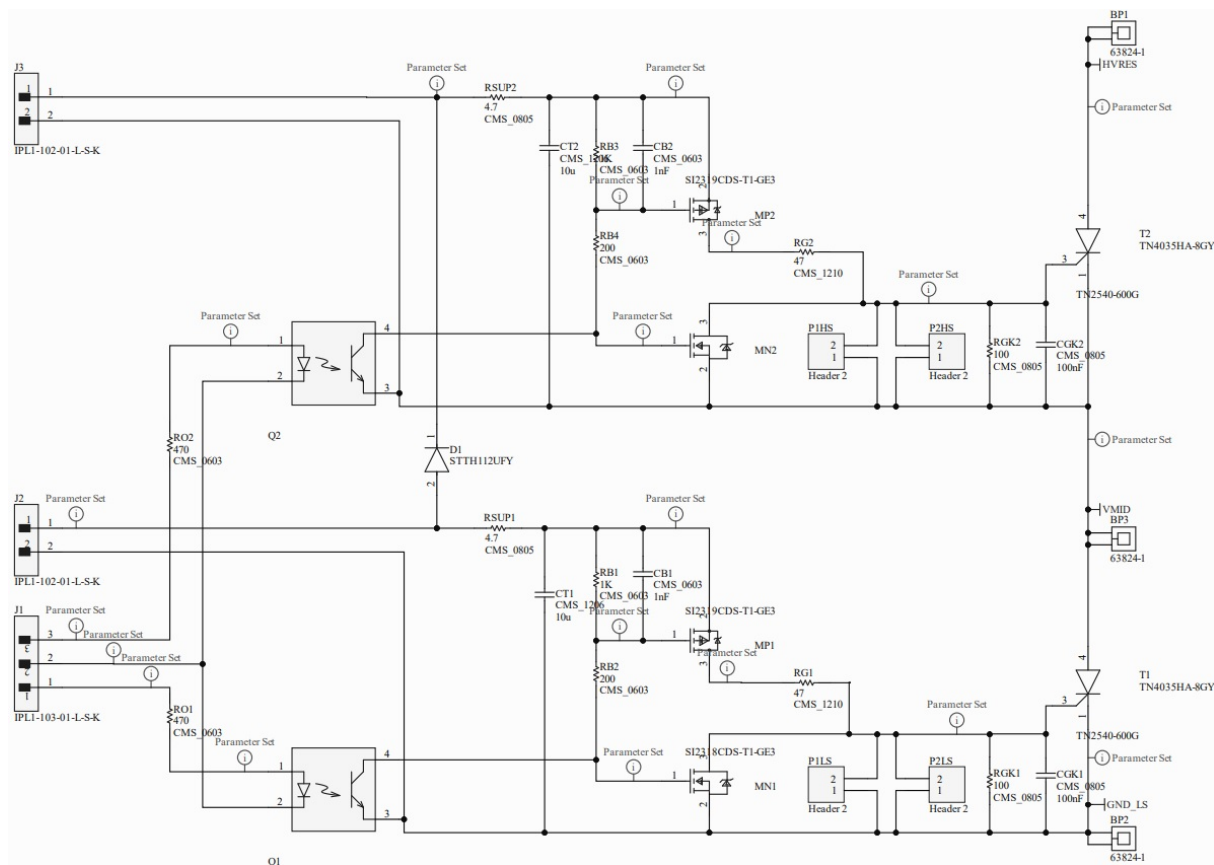
- Remove the power supply from the evaluation board and electrical loads before performing any electrical measurement
- Arrange measurement setup, wiring, and configuration, paying attention to the high voltage section
- Once the setup is complete, power the board. Fuse protection is not included with this evaluation board.

**Danger:** Do not touch the evaluation board when it is powered or immediately after it has been disconnected from the voltage supply as several parts and power terminals containing potentially energized capacitors need time to discharge, and heat-sink and transformers may still be very hot.

**Personal safety:**

- Always wear suitable personal protective equipment, such as insulating gloves and safety glasses
- Take adequate precautions and install the board to prevent accidental touch
- Use protective shields, such as an insulating box with interlocks.

**Figure 2. STDES-DIS001V1 Schematic**



### 3 Layout

Figure 3. Top metal

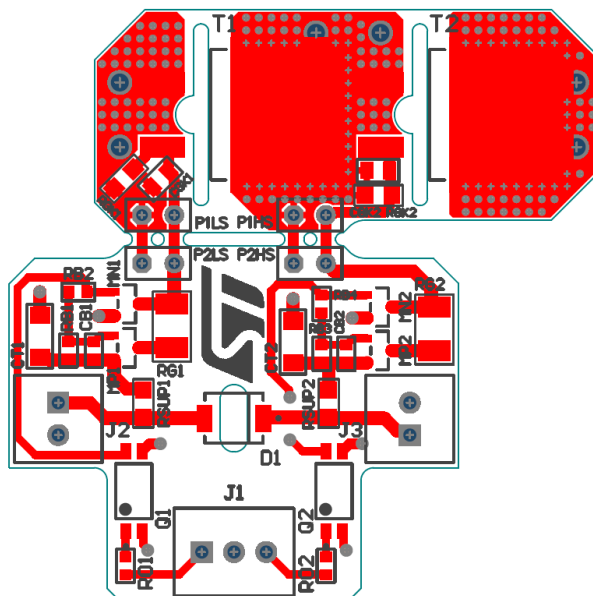


Figure 4. Bottom metal

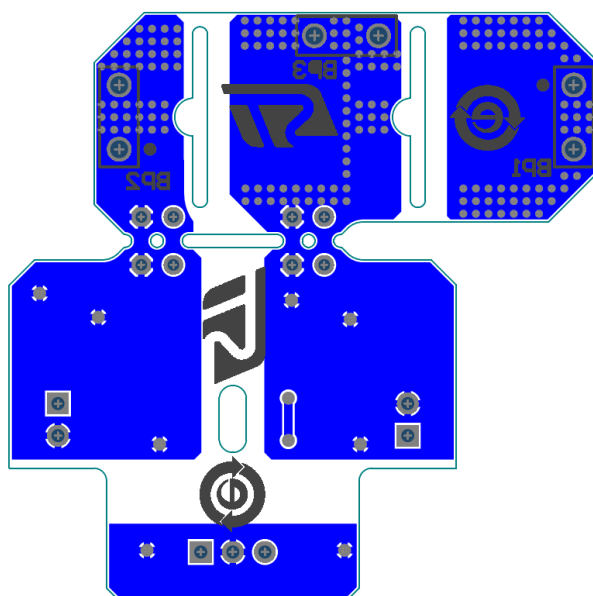


Figure 5. Top solder

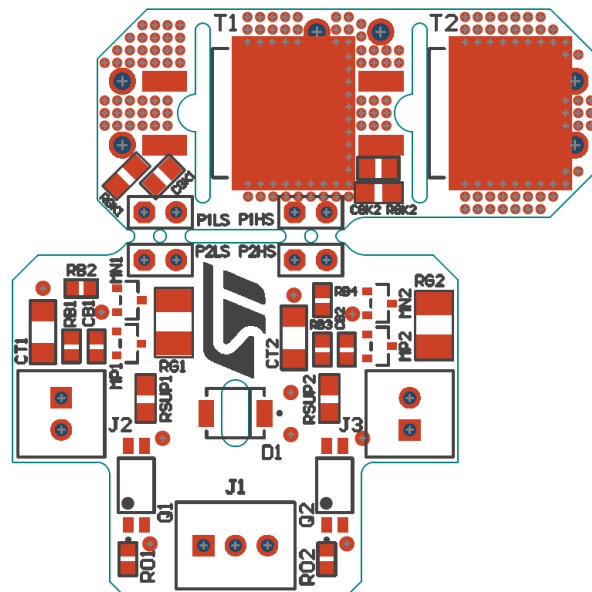


Figure 6. Bottom solder

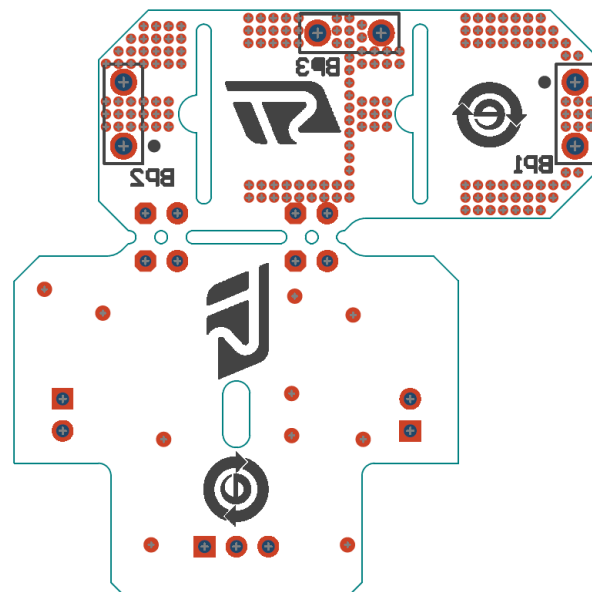
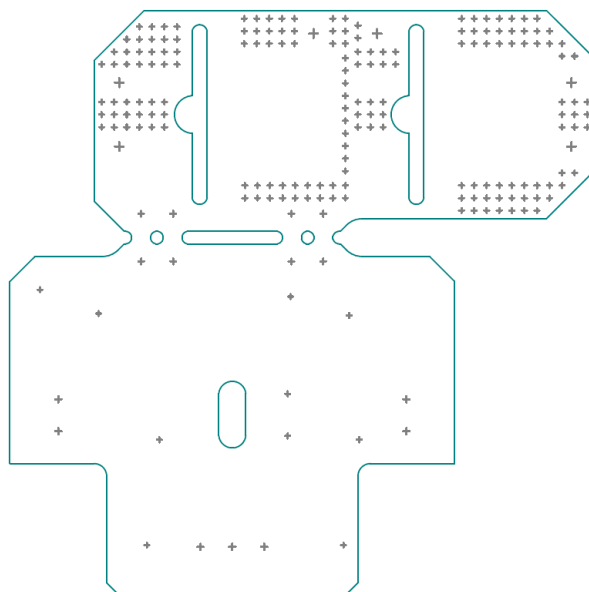


Figure 7. Drill



## 4 PCB stack-up

Figure 8. Layers stack-up

Board Stack Report					
Stack Up		Layer Stack			
Layer	Board Layer Stack	Name	Material	Thickness	Constant
1		Top Paste			
2		Top Overlay			
3		Top Solder	SM-001	0.025mm	4
4		Top Layer	Copper	0.070mm	
5		Dielectric 1	Core-043	1.499mm	4.3
6		Bottom Layer	Copper	0.070mm	
7		Bottom Solder	SM-001	0.025mm	4
8		Bottom Overlay			
9		Bottom Paste			
Height : 1.689mm					

## 5 Standard view

Figure 9. Top view

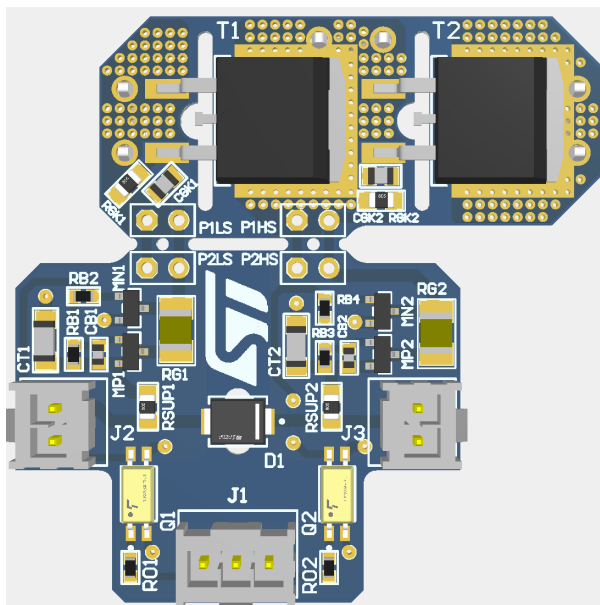
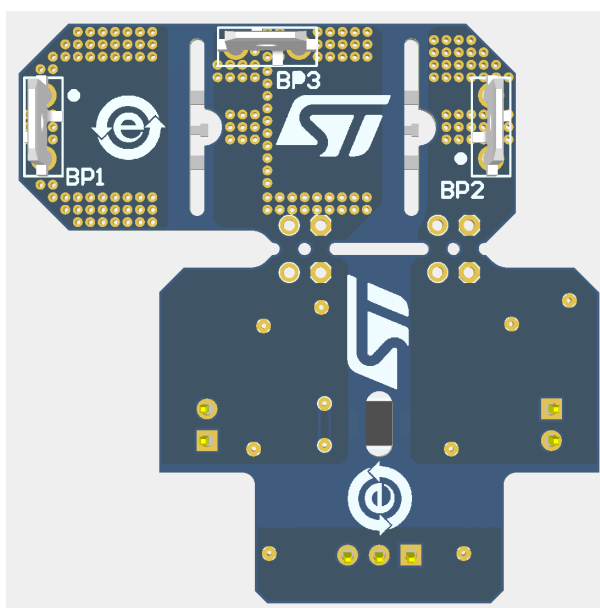


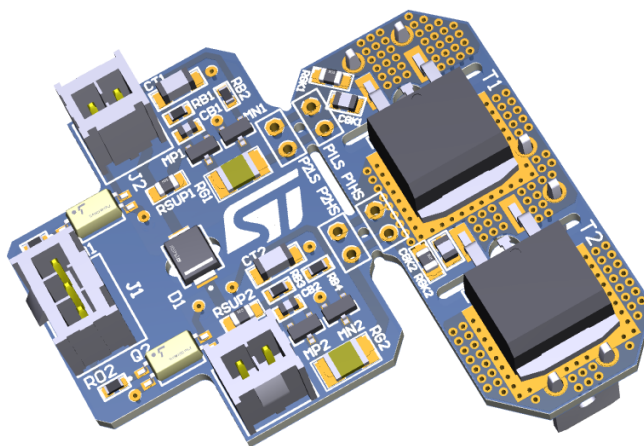
Figure 10. Bottom view



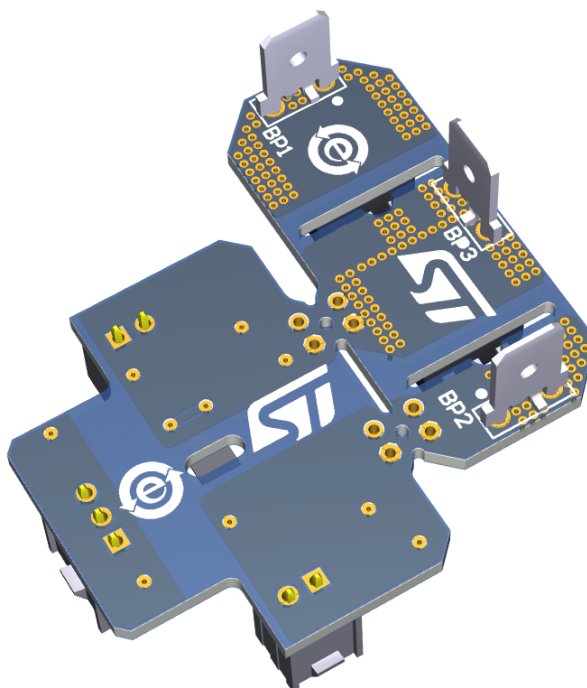


## 6 3D views

**Figure 11. Top view (3D)**



**Figure 12. Bottom view (3D)**



## Revision history

**Table 1. Document revision history**

Date	Revision	Changes
08-Jun-2023	1	Initial release.
25-Jul-2024	2	Added <a href="#">Section 1: Getting started</a> .

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