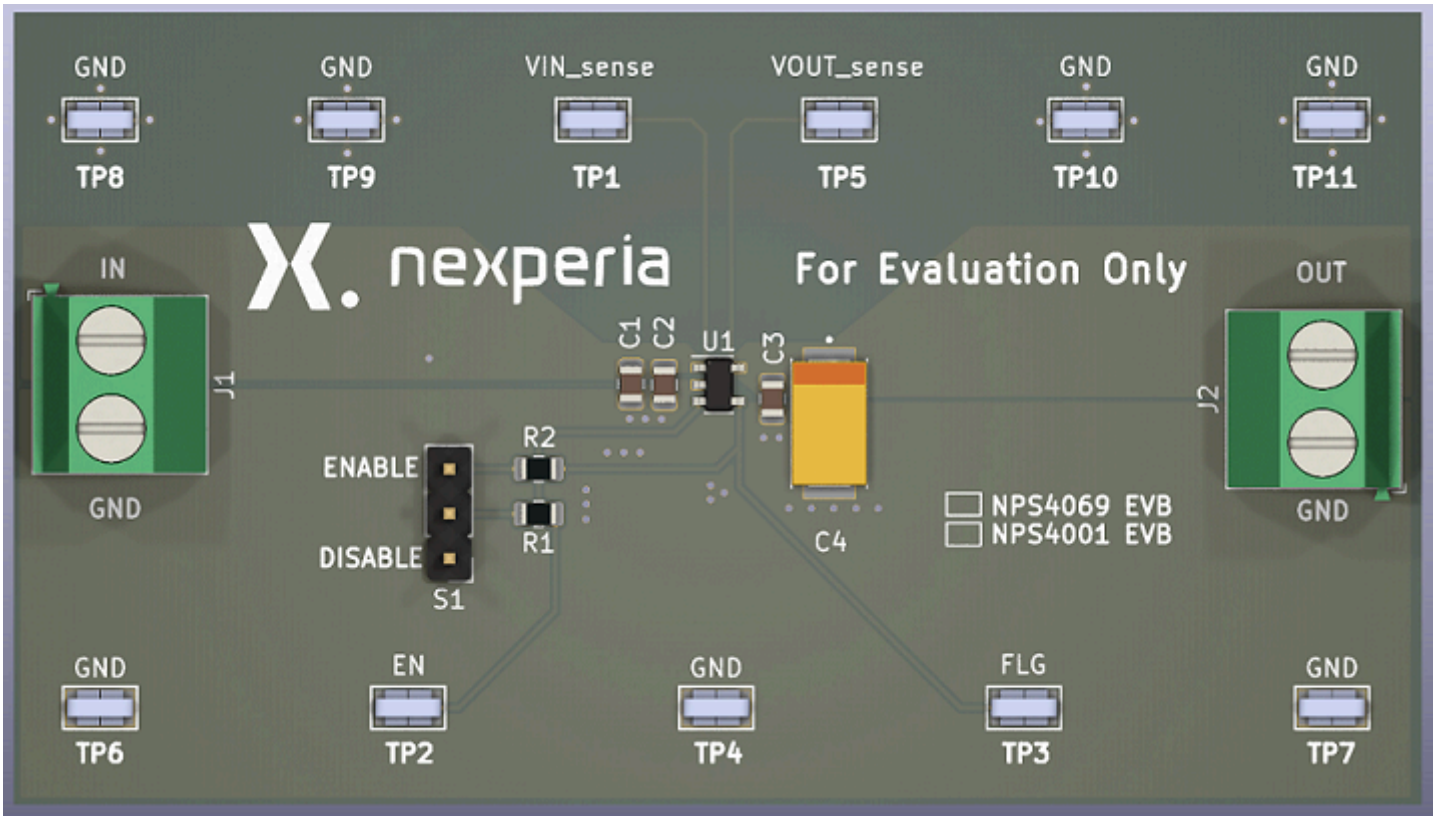
UM90030

Rev. 1.0 — 19 February 2024

user manual

NEVB-NPS4069 / NEVB-NPS4001 load switch evaluation board



Abstract: The NEVB-NPS4069 and NEVB-NPS4001 are two-layer PCBs containing either the NPS4069 or the NPS4001 load switch device. The VIN and VOUT connections to the device and the PCB layout routing are capable of handling high continuous currents and provide a low-resistance pathway into and out of the device under test. Test point connections allow the EVB user to control the device with user-defined test conditions and make accurate RON measurements.

Keywords: Load switch, evaluation board (EVB)

nexperia

1. Introduction

The NEVB-NPS4069 and NEVB-NPS4001 evaluation boards are dedicated PCBs featuring either the Nexperia load switch IC NPS4069 or the NPS4001. The boards feature a 2-layer PCB with a substantial ground layer. The PCB layout routing is capable of handling high continuous currents and provides a low-resistance pathway into and out of the device under test. The test points are designed as separate voltage sensing connections on the PCB for accurate voltage and R_{ON} measurements where the test results are not influenced by voltage drops created by the load current.

Input and output connections are provided with convenient test-point connection pins as well as robust solder pins. There are several connection terminals for GND and test points at the input and output of the load switch to allow a simple and very convenient connection of scope probes.

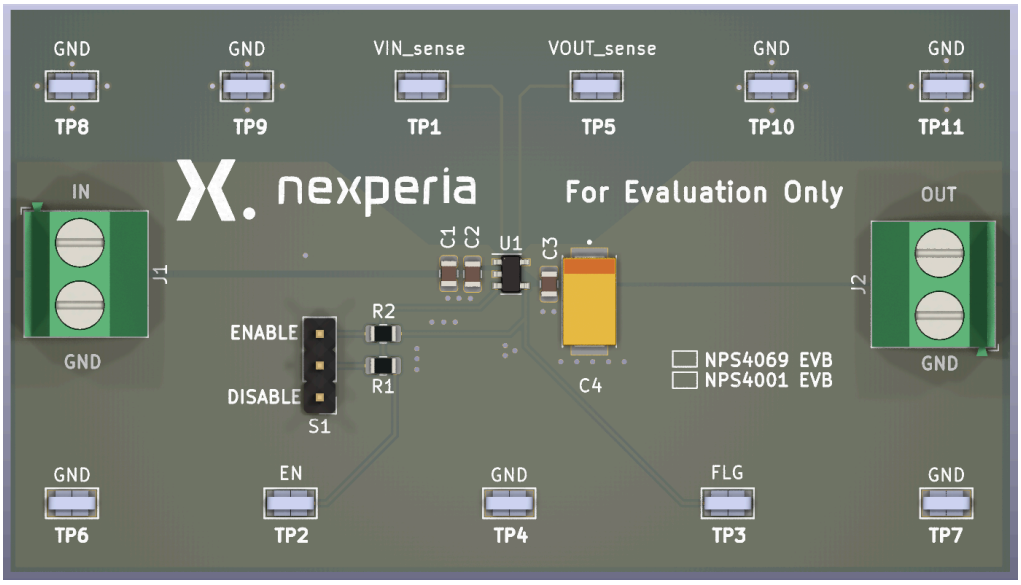


Fig. 1. NEVB-NPS4069 / NEVB-NPS4001 evaluation board for load switch IC NPS4069 or NPS4001

1.1. NEVB-NPS4069 key parameters

- EVB name = NEVB-NPS4069
- Device = NPS4069
- EVB input voltage range (VIN): 2.5 V to 5.5 V
- EVB maximum continuous current = 1.5 A RMS continuous (NPS4069)
- EVB features:
  - Soft start
  - Over temperature protection
  - Quick output discharge
  - Active reverse voltage detection

1.2. NEVB-NPS4001 key parameters

- EVB name = NEVB-NPS4001
- Device = NPS4001
- EVB input voltage range (VIN): 2.5 V to 5.5 V
- EVB maximum continuous current = 2 A RMS continuous (NPS4001)
- EVB features:
  - Soft start
  - Over temperature protection
  - Quick output discharge
  - Active reverse voltage detection

1.3. Features

- Input voltage can be supplied via the test points J1 (VIN), VIN can range from 2.5 V to 5.5 V.
- A test load can be connected to terminal TP5 (VOUT_sense) and any of the GND test points.
- Alternatively, there are GND test points at TP4, TP6, TP7, TP8, TP9, TP10, and TP11.
- Decoupling capacitors are connected to VIN at the input of the EVB and close to the load switch IC. The same holds for the output.
- The enable pin (ON) has a smart pull-down resistor built in which disables the load switch if the enable pin is not terminated. For an activated load switch, the pull-down resistor is decoupled. This avoids current flowing through a pull-down that is not needed for the high state of the control input.
- VIN_sense and VOUT_sense are used when accurate measurements of the input or output are required. Make R_{ON} measurements using these sense connections when measuring the voltage drop from VIN to VOUT.

2. Schematic

Fig. 2 shows the schematic diagram of the NEVB-NPS4069 evaluation board. The components, solder pins, connectors and test points described in the feature list above can be found here.

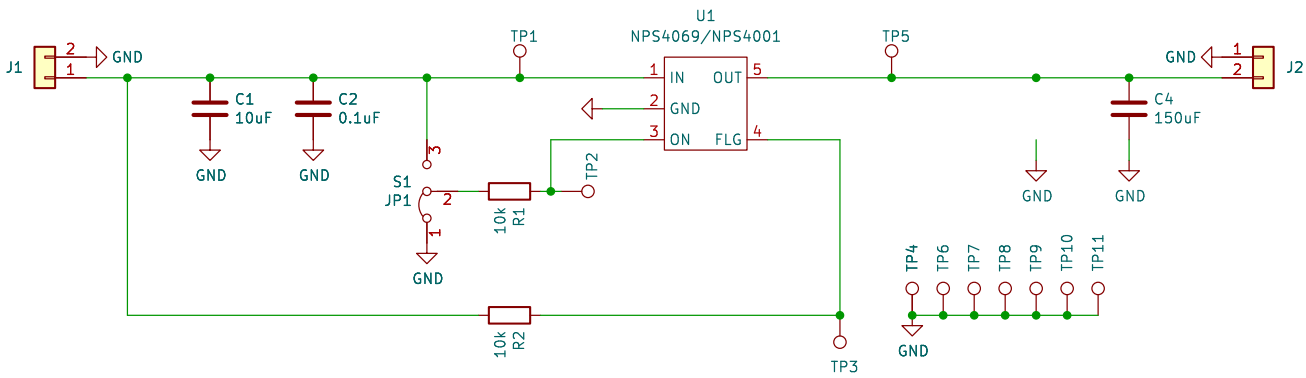
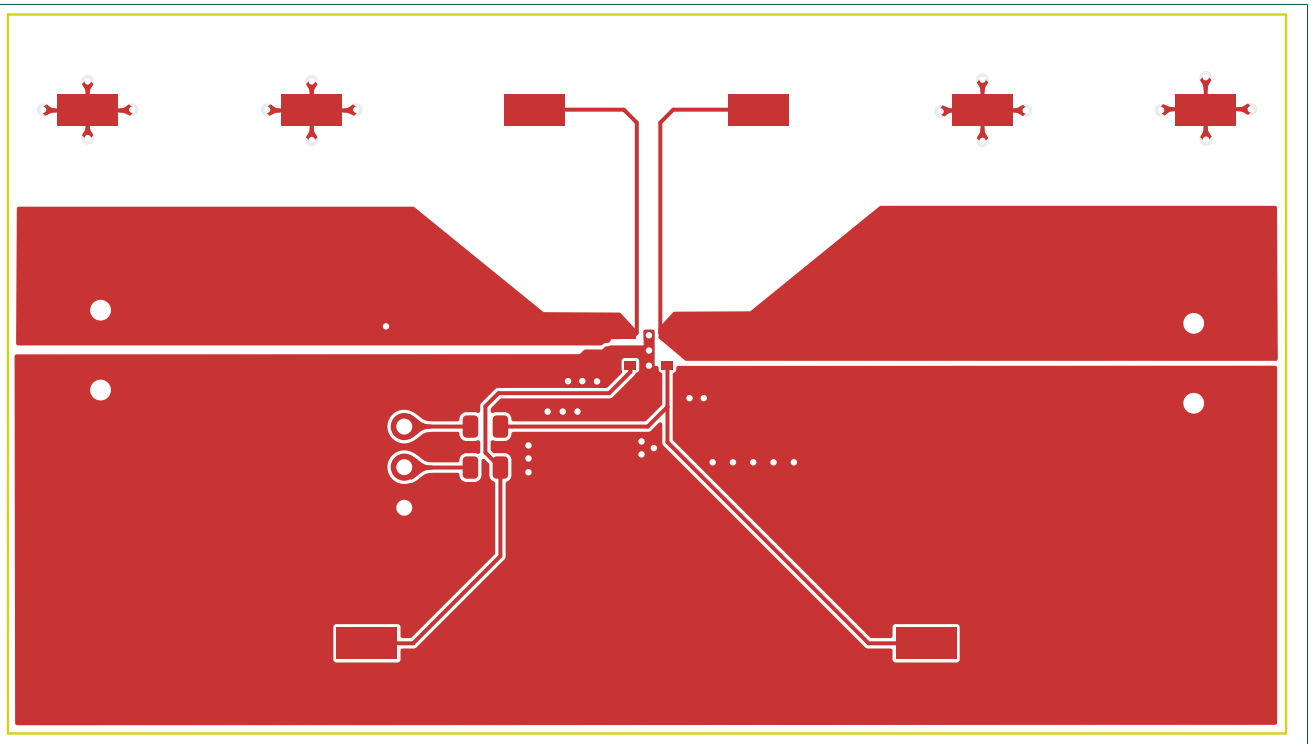


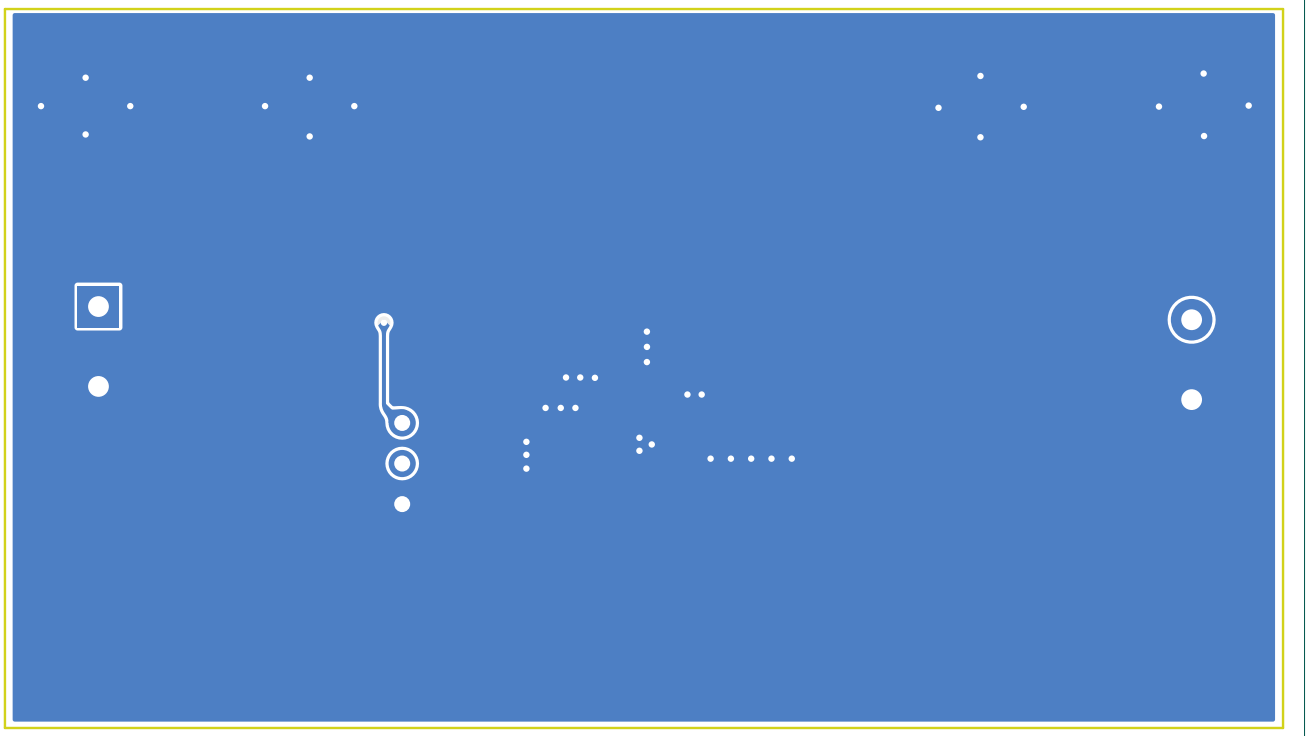
Fig. 2. NEVB-NPS4069 / NEVB-NPS4001 schematic diagram

3. PCB layout

Fig. 3 shows the PCB layout of the NEVB-NPS4069 / NEVB-NPS4001. The PCB has two copper layers, the top copper layer is shown in a), the bottom layer is shown in b). Fig. 4 shows the PCB silkscreen.



a) top copper layer



b) bottom copper layer

Fig. 3. NEVB-NPS4069 / NEVB-NPS4001 PCB layout

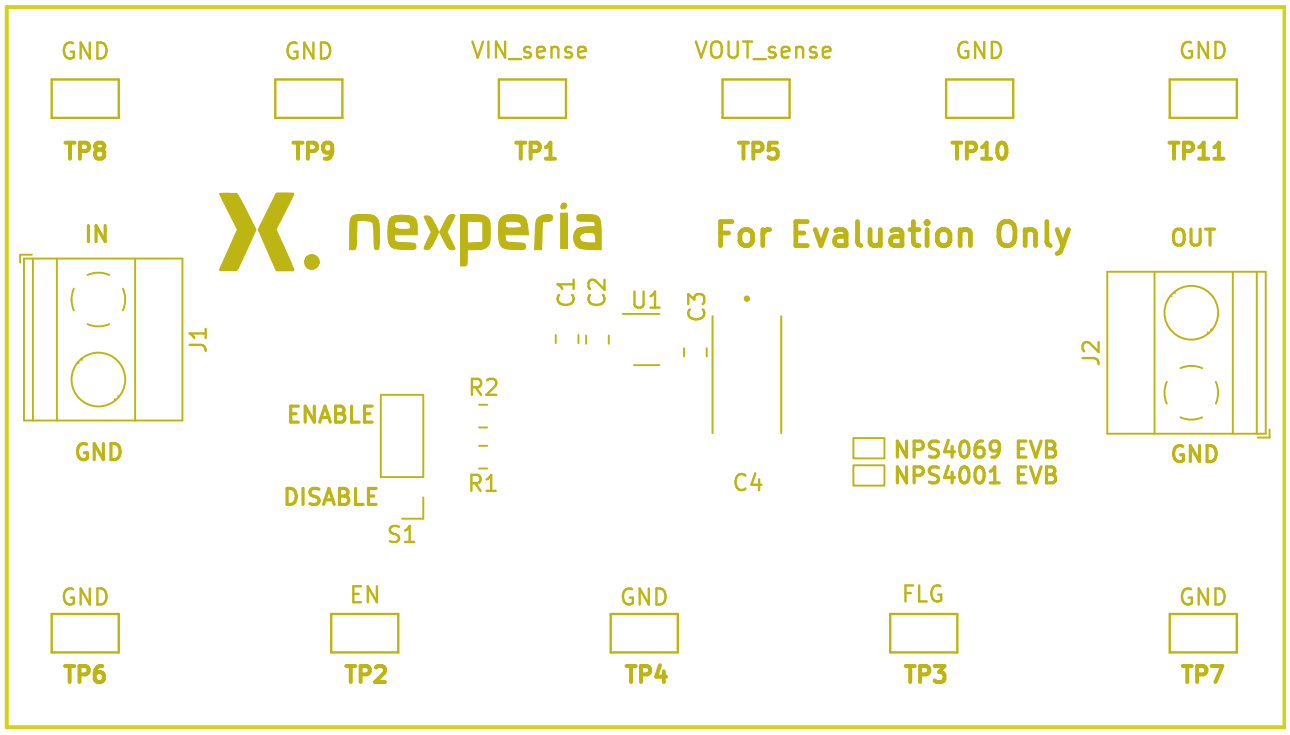


Fig. 4. NEVB-NPS4069 / NEVB-NPS4001 PCB silkscreen

4. Bill of Materials (BOM)

Table 1. NPS4069EVB / NEVB-NPS4001 Bill of Materials

Reference designator	Quantity	Description	MFG	MFG P/N
-	1	Printed Circuit Board		PCB
C1	1	10uF+/-10% 16V X6S 2 0805	Samsung	CL21X106KOQNNNE
C2, C3	2	0.1 µF ±10% 10V Ceramic Capacitor 0805 (2012 Metric)	Taiyo Yuden	LM212SD104KG-T
J1, J2	2	TERM BLK 2POS SIDE ENTRY 5MM PCB	Phoenix Contact	1715022
R1, R2	2	RES 10K OHM 1% 1/8W 0805	Stackpole	RNCS0805BKE10K0
S1	1	CONN HEADER VERT 3POS 2.54MM	TE connectivity	5-14278-3
TP1 - TP11	11	PC TEST POINT MINIATURE	Keystone	5019
U1	1	NPS4069 / NPS4001	Nexperia	NPS4069 / NPS4001

5. Set up and operation

The NEVB-NPS4069 / NEVB-NPS4001 board is easy to set up and operate. This chapters gives some instructions for proper use.

5.1. Input supply

The input voltage source VIN is connected to the points J1(IN), VIN. This is where the positive lead is connected. The points J1(GND), J2 (GND), TP4, TP6, TP7, TP8, TP9, TP10, and TP11. are the ground connections.

For experiments with higher current, the cables from the power supply to the EVB should be adequate regarding resistance in order to avoid higher voltage losses from the power supply to the load switch board

5.2. Load switch output

Loads at the output can be connected via the test points labeled OUT. The direct ground connections are appropriately labeled across the EVB.

5.3. Enable control

Connector S1 connects the enable input (ON) of the load switch IC to either VIN or GND, hence turning the load switch IC on or off. External control signals can be applied via S1 pin 2 from an external function generator for example see Fig. 5.

The limits from the data sheet must be obeyed for the voltage applied at the enable pin. Furthermore, make sure S1 pin 2 isn't jumpered to pins 1 or 3.

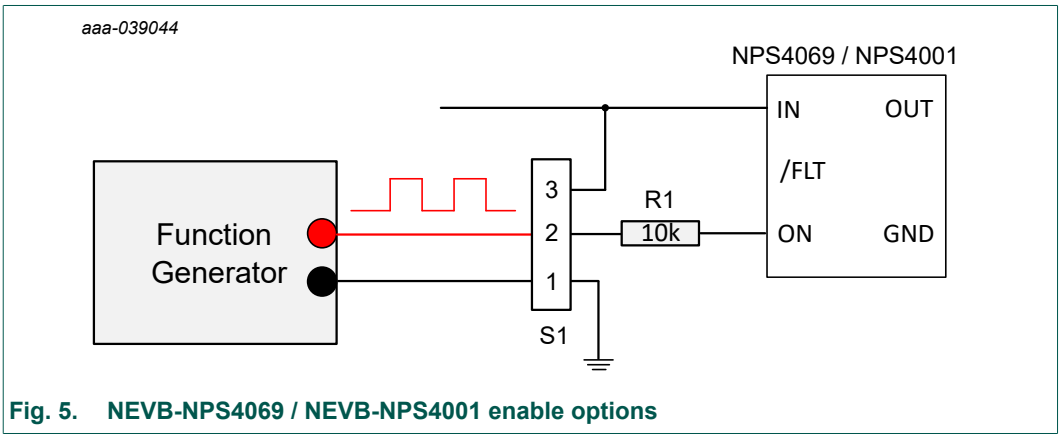


Fig. 5. NEVB-NPS4069 / NEVB-NPS4001 enable options

5.4. Voltage sense test points

The NEVB-NPS4069EVB / NEVB-NPS4001 includes test points for VIN and VOUT, these are labelled VIN_SENSE andVOUT_SENSE. These test pins allow for precise measurement of the input and output voltages at the package pins of the load switch IC. At these test points there is no influence from voltage losseson the PCB due by to on-board wiring. R_{on} can be evaluated with exact results at these test points as:

$$R_{ON} = \frac{(VIN\_Sense - VOUT\_Sense)}{I_{OUT}} \quad (1)$$

5.5. Start-up operation

To start operating the NEVB-NPS4069 / NEVB-NPS4001, connect a power supply with 2.5 V to 5.5 V to VIN. The loadswitch needs to be enabled by applying a jumper to S1 pins 3 and 2 or applying a high-level input signal to the enable pin as described in Section 5.3. With a load connected to the VOUT terminals, a maximum continuous output current of 1.5 A (NPS4069) and 2 A (NPS4001) can be supported.

6. Test configurations

6.1. Dynamic parameter testing

Dynamic parameters like the smooth turn-on of the NPS4069 and NPS4001 can be measured at VOUT_SENSE. with an oscilloscope. At S1 pin 2 the enable signal can be accessed and used as trigger signal.

Fig. 6 shows the oscilloscope connection points for measurement of VOUT and triggering from the enable input VIN. With the same set-up the fall time of VOUT can be tested. Experiments with the QOD feature can be performed.

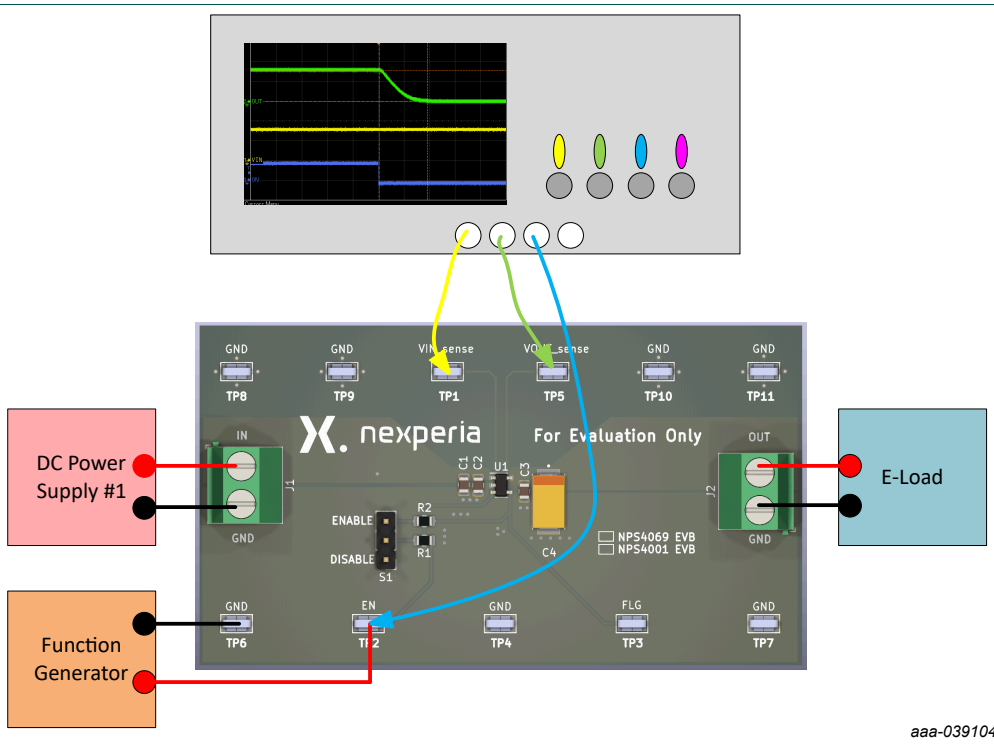


Fig. 6. Measurement set-up for dynamic parameters e.g. VOUT rise and fall times

7. Revision history

Table 2. Revision history

Revision number	Date	Description
1.0	2024-02-19	Initial version.

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