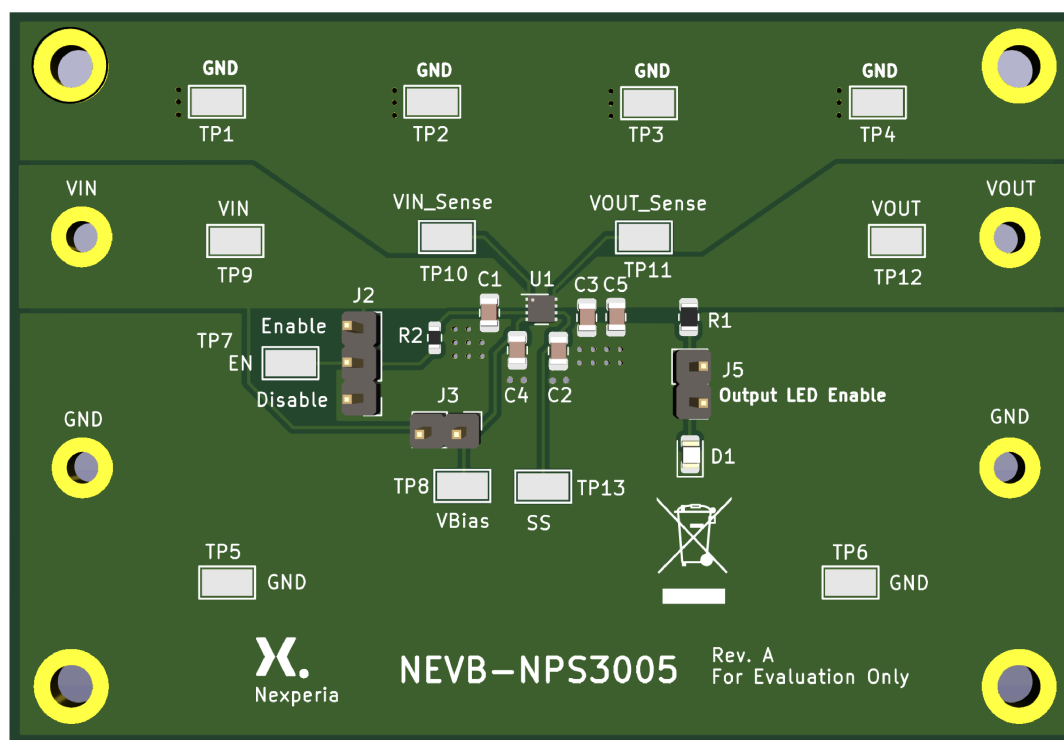




NPS3005 0.5 V to 5.5 V, 6 A, 15 mΩ, single channel load switch with soft start evaluation board



Abstract:

The NEVB-NPS3005 is a two-layer PCB containing the NPS3005 load switch device. The VIN and VOUT connections to the device and the PCB layout routing can handle continuous high current, and provide a low-resistance pathway into and out of the device under tests. Test point connections allow board users to control the device with user-defined test conditions and take accurate RON measurements.

Keywords:

NPS3005, load switch, evaluation board (EVB)

1. Introduction

1.1. Short description

The NEVB-NPS3005 is a dedicated PCB featuring Nexperia's load switch IC NPS3005. The board is a two-layer PCB with a substantial ground layer. The PCB layout routing can handle continuous high current and provide a low-resistance pathway into and out of the device under tests. The test points are designed as separated voltage sensing connections on the PCB for accurate voltage and R_{ON} measurements. The test results are not affected by voltage drops created by the load current.

Solid input and output connections are provided with convenient test-point pins and robust soldered pins. There are several connection terminals for GND and test points on the IN and OUT pins to allow a simple and convenient connection of scope probes.

Major key parameters are listed below, such as the input voltage supply range, maximum continuous load current and the most important features of the load switch:

- EVB name: NEVB-NPS3005
- Device name: NPS3005
- Input voltage range: 0.5 V to 5.5 V
- Maximum load current (I_{MAX}): 6 A
- Quick output discharge (adjustable)
- Enable pin supports down to 1.2 V
- Adjustable soft start
- Over-temperature protection (thermal shutdown)

1.2. Features

- Input voltage can be supplied via the test point H2 (VIN) or test point VIN1 and VIN2. V_{IN} ranges from 0.5 V to 5.5 V.
- A test load can be connected to terminal H3 and test point VOUT2 (VOUT). Alternatively, there are GND test points at H1, H5, H6, H7, and H8.
- 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 (EN) has a smart pull-down built-in resistor that disables the load switch if the enable pin is not terminated. For an activated load switch, the pull-down resistor is decoupled. This prevents the current from flowing through a pull-down resistor 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. Take R_{ON} measurements using these sense connections when measuring the voltage drop from VIN to VOUT.
- A shorting jumper can be placed across J5 to enable the LED indicator. The LED only functions when V_{OUT} is greater than 2 V. It is recommended to disable the LED when taking measurements.
- VBIAS and J3 are the VBIAS input for the device. A shorting jumper can be connected through J3 to connect VIN to VBIAS. An external source can be applied to VBIAS by removing the jumper and connecting a supply to VBIAS1.

2. Schematic

Fig. 1 shows the schematic diagram of the NEVB-NPS3005. The components, soldering pins, connectors and test points described in the [Features](#) list can be found here.

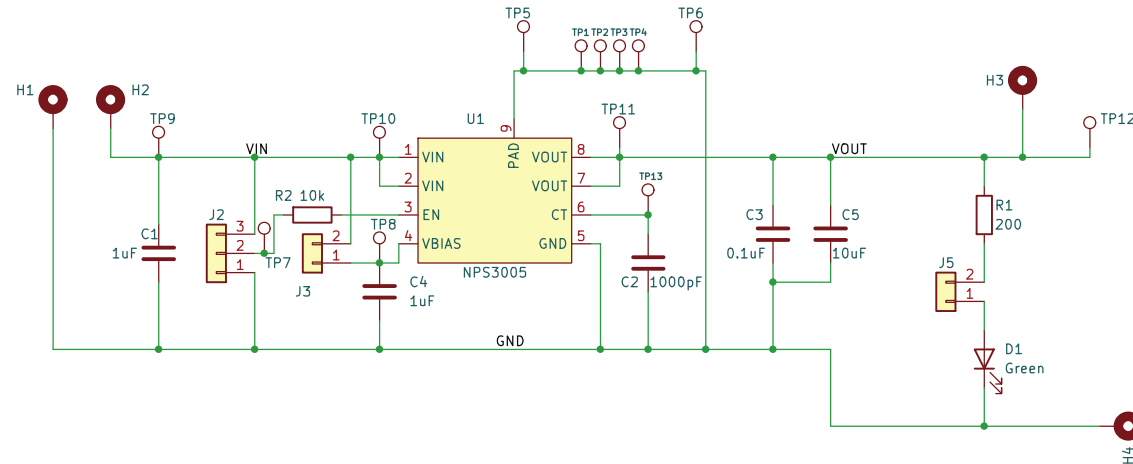


Fig. 1. NEVB-NPS3005 schematic diagram

3. PCB layout

Figure 2 and Figure 3 depict the PCB layers of the NEVB-NPS3005.

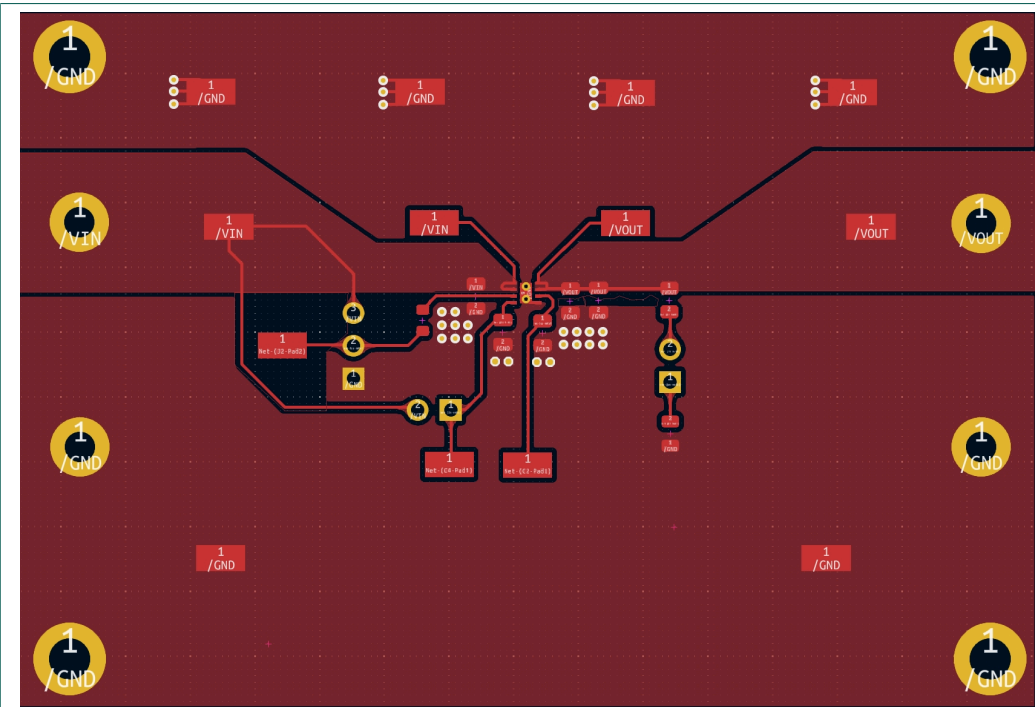


Fig. 2. NEVB-NPS3005 top layer

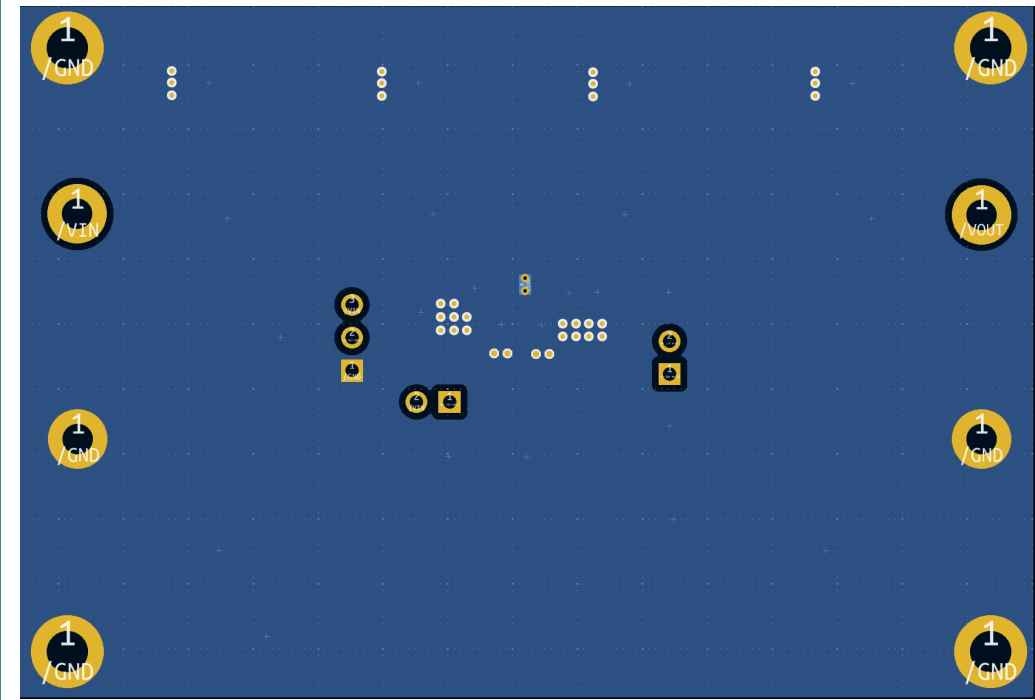


Fig. 3. NEVB-NPS3005 bottom layer

4. Set up and operation

The NEVB-NPS3005 is easy to set up and operate. This section gives instructions for proper use.

4.1. Input supply

The input voltage source VIN is connected to the point H2 (IN), VIN1 or VIN2. The positive lead is connected to VIN.

The points H1 (GND), H5, H6, H7, H8 are the ground connections.

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

4.2. Load switch output

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

4.3. Enable control

J2 connects the enable input EN of the load switch IC to either VIN or GND to turn the load switch IC on or off. External control signals can be applied via J2 pin 2 from an external function generator as shown in Fig.4.

The voltage applied on the enable pin should remain within the range of limiting values described in the [NPS3005 data sheet](#). Make sure that J2 pin 2 is not connected to pin 1 or 3.

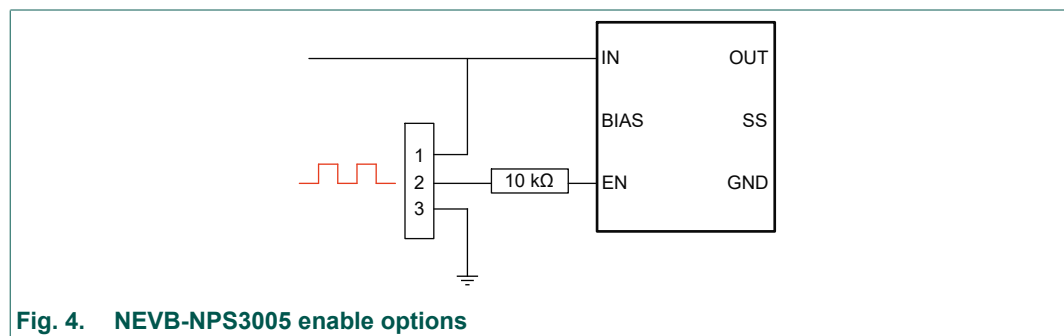


Fig. 4. NEVB-NPS3005 enable options

4.4. Voltage sense test points

The NEVB-NPS3005 includes two test points for VIN and VOUT, they are labelled as VIN_Sense and VOUT_Sense. The test pins allow for precise measurement of the input and output voltage on the IN and OUT pins. At these test points, there is no impact from voltage losses on the PCB due to on-board wiring. R_{ON} can be calculated at these test points as:

$$R_{ON} = \frac{VIN_Sense - VOUT_Sense}{I_{OUT}}$$

4.5. Start-up operation

To start operating the NEVB-NPS3005, connect a power supply of 0.5 V to 5.5 V to VIN. The load switch needs to be enabled by applying a jumper to J3 pin 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 6 A can be supported by the NPS3005.

5. Major test configurations

5.1. Measurement set-up for on-resistance

The EVB supports accurate measurement of the load switch IC on-resistance as described in [Section 4.5](#).

[Fig. 5](#) shows connections for a voltmeter, input voltage source and load.

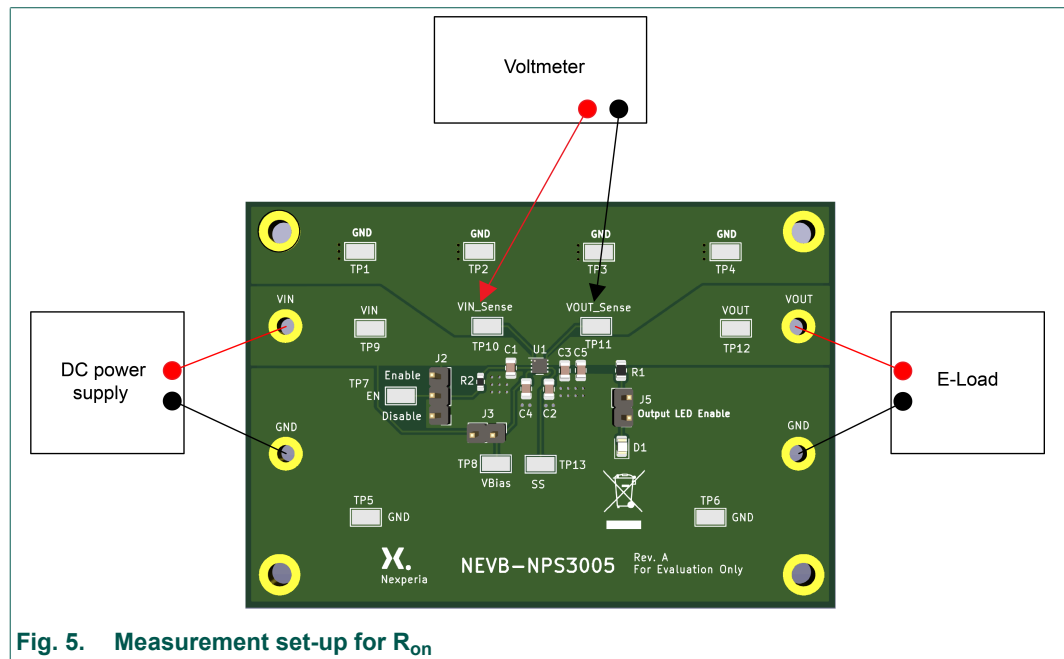


Fig. 5. Measurement set-up for R_{on}

5.2. Dynamic parameter testing

Dynamic parameters like the smooth turn-on of the NPS3005 can be measured at VOUT_Sense with an oscilloscope. At J2 pin 2, the enable signal can be accessed and used as a trigger signal.

[Fig. 6](#) shows the oscilloscope connection points for measurement of V_{OUT} and triggering from the enable input VIN. With the same set-up, the fall time of V_{OUT} can be tested. Experiments with the QOD feature can be performed.

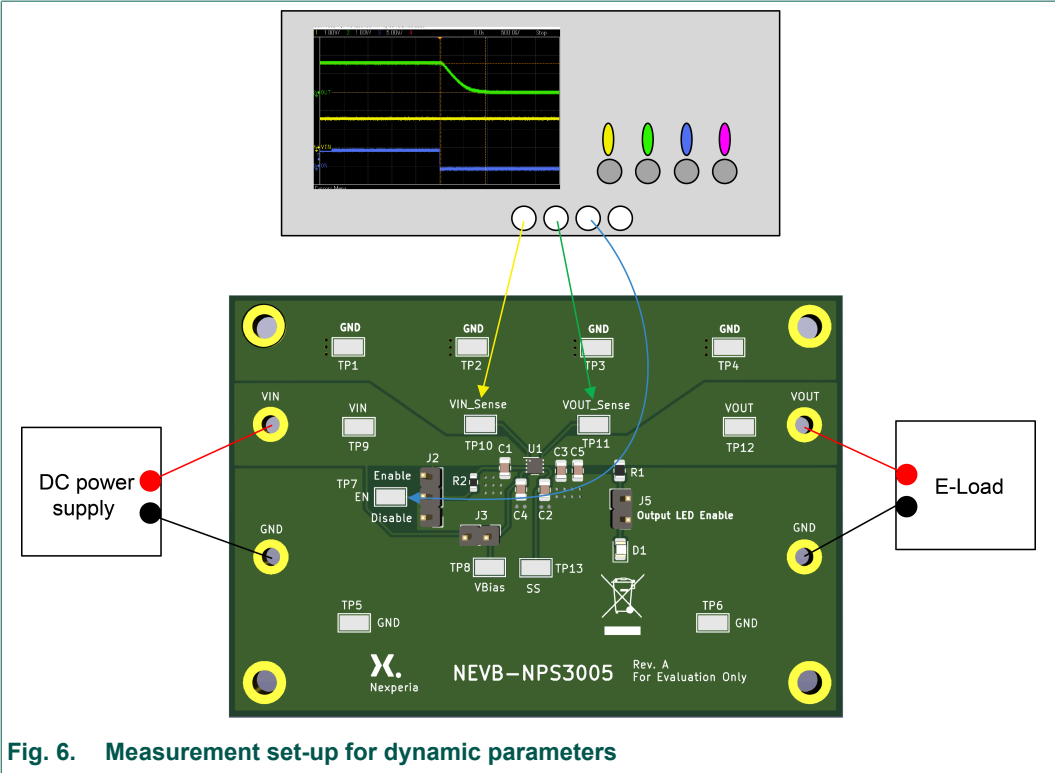


Fig. 6. Measurement set-up for dynamic parameters

6. Bill of materials (BOM)

Table 1. Bill of materials

Designator	Description	Part name	Manufacturer	Quantity
C1, C4	CAP, CER, 1 μF, 25 V, X7R, 0805	CL21B105KAFNNNE	Samsung ElectroMechanics	2
C2	CAP, CER, 1000 pF, 50 V, X7R, 0805	08055C102KAT2A	KYOCERA AVX	1
C3	0.1 μF, ±10%, 10 V, Ceramic Capacitor, 0805 (2012 Metric)	LMK212SD104KG-T	Taiyo Yuden	1
C5	CAP, CER, 10 μF, 16 V X5R, 0805	CL21A106KOQNNNE	Samsung ElectroMechanics	1
D1	LED, green, diffused, 0805, SMD	LG R971-KN-1	ams-OSRAM USA INC	1
H1, H2, H3, H4	PC Pin, Terminal Connector Through Hole, Gold, 0.079" (2.01 mm) Dia	5233-0-00-15-00-00-08-0	Mill-Max Manufacturing Corp	4
J2	CONN HEADER VERT, 3 POS, 2.54 mm	5-146278-3	TE Connectivity AMP Connectors	1
J3, J5	CONN HEADER VERT, 2 POS, 2.54 mm	5-146278-2	TE Connectivity AMP Connectors	2
R1	RES, 200 Ω, 0.01%, 1/8 W, 0805	RNCF0805TKY200R	Stackpole Electronics Inc	2
R2	RES, 10 kΩ, 0.1%, 1/8 W, 0603	RNCP0603FTD10K0	Stackpole Electronics Inc	1
R4	RES, 191 kΩ, 1%, 1/8 W, 0805	RC0805FR-07191KL	YAGEO	1
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10	PC test point miniature	5019	Keystone Electronics	10
U1	NPS3005GP	NPS3005GP	Nexperia	1

7. Revision history

Table 2. Revision history

Revision number	Date	Description
UM90055 v. 1	202506011	Initial version

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For sales office addresses, please send an email to: salesaddresses@nexperia.com

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