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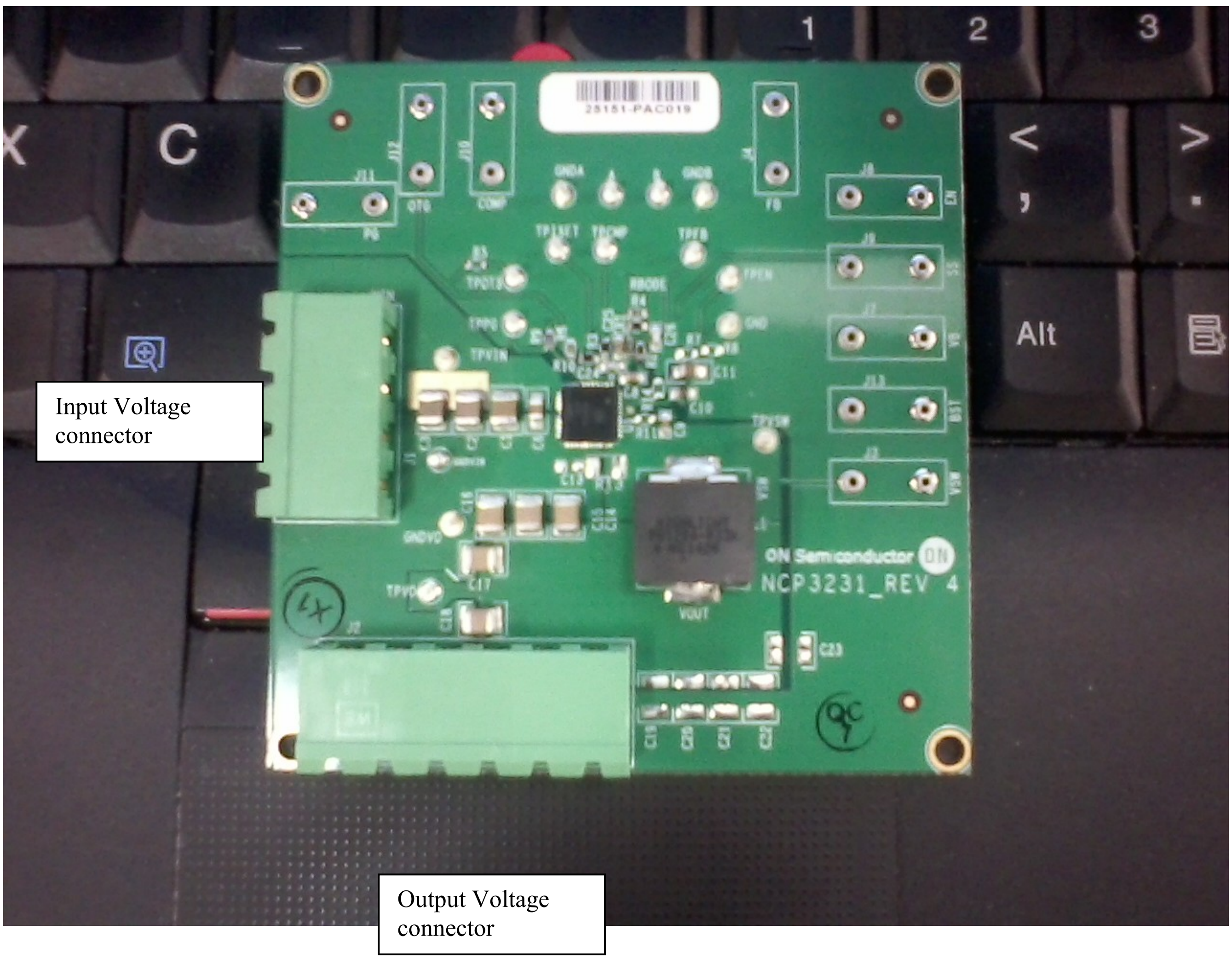
Test Procedure for the NCP3231GEVB Evaluation Board

I. Description and scope – This document applies to the NCP3231 Rev. 4.1 Evaluation Board (EVB) PCB fab with an NCP3231 or NCP3231A High Current Synchronous Buck Converter IC soldered into the QFN-40 footprint.

This document is intended to assist the user in applying power and testing the assembly.

II. EVB Photo – Below is a photo of the standard NCP3231GEVB.



The EVB has two large green receptacles – one (4-pin) for input voltage and one (6-pin) for output voltage. The mating connectors should have been shipped with the board. The mating connectors have screw terminal connections to allow single wires to be attached to the connector pins and then the connector can be plugged into the corresponding receptacle on the EVB. Because of the potentially high currents involved, we advise that the gauge of the individual wires be at least 20 AWG x 4 for the input voltage and 18 AWG x 6 for the output voltage.

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III. Setup and Procedure – Using the mating connectors provided, connect a power supply capable of 20 V and 10 A to the input voltage connector (J1). Set the input voltage to ~5 V and the current limit to 2 A or less. Connect the mating connector for the output voltage (J2) to the EVB and the other end to an electronic load capable of sinking at least 40 A, which is greater than the typical current limit of the NCP3231 EVB.

After verifying the correct input and load connections and verifying the input voltage and current limit settings of the input supply, turn on power to the EVB. If no values were changed on the EVB prior to this, the output voltage should be 3.3 V ±10 mV. Connect an oscilloscope probe to the TPVSW test point and verify that the switching frequency is 500 kHz ±5 kHz. At this time you may also start raising the input supply voltage up to the maximum of 18 V to verify that the EVB will operate at that voltage.

To test the current limit of the EVB, set the electronic load to 25 A. Increase the current limit of the input supply to at least 15 A and set the input voltage to a value of 12 V. This is a good starting point for testing the current limit.

With the EVB operating with these conditions, turn on the load and verify that the EVB can source the typical maximum of 25 A. Slowly increase the load setting until current limit is reached and the EVB enters hiccup operation. This can be detected by observing the switch node waveform on the oscilloscope and noting when the waveform has long periods of no switching activity. The scope's time base may need to be slowed to ~ 1 ms/div. in order to observe this correctly. This behavior can also be detected by noting that the output voltage will be ~0 V. Releasing the load will cause the EVB re-start and return to the regulated output voltage.

The typical current limit is 33-35 A. This value is highly dependent on the low-side MOSFET on resistance, so this will not be an exact number or necessarily the same from board to board.

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IV. Making adjustments – The NCP3231GEVB can be modified in a couple of significant ways. An important adjustment is the output voltage. The output voltage is preset to 3.300 V with R1 = 20 kΩ and R2 = 4.42 kΩ. In order to change the output voltage, the value of R2 can be changed via the following formula:

R2 = R1/((Vout/0.6)-1),

where 0.6 V is the VREF of the controller, R1 = 20 k and Vout is the desired output voltage.

One final adjustment which will be discussed here is the low-side over-current protection function (LS OCP). This protection is set by a resistor at the RSET pin. A temperature-compensated 30 uA current source develops a voltage at this pin that is compared internally to a reference voltage. When that reference voltage is exceeded, the device skips up to three on-time cycles after which the device enters the hiccup mode.

According to the device data sheet, the RSET value is determined by the following formula, minus the temperature coefficients:

RSET = 2 x I_L x $R_{DS(ON)}$/33 uA,

where I_L = peak inductor current and $R_{DS(ON)}$ = the on-resistance of the low side switch (use the typical value of 1.5 milli-ohms). Choosing a peak current limit of ~45 A, the RSET value is ~4.12 kΩ. Accounting for the blanking time of 150 ns would scale the resistor value slightly higher. A value of 5.11 kΩ was ultimately chosen for the basic EVB.

This ends the instructions for powering up and testing the NCP3231GEVB. Questions or comments may be sent to antonio.germano@onsemi.com.