

NCP45491IMNGEVB

NCP45491 Evaluation Board User's Manual



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Eval Board User's Manual

Introduction

This user's manual provides detailed information regarding the configuration and use of the NCP45491IMNGEVB Evaluation board. The evaluation board serves as a demonstration of NCP45491 general functionality for single chip mode featuring power monitoring of 4 channels. The evaluation board also provides a means of quick prototyping for specific applications.

Features

- NCP45491
- Connectors for 4 High Current Supplies and Loads
- Configuration Options for Shunt Current and Gain Settings
- Appropriate Test Loops for Easy Evaluations

QUICK START

Recommended Equipment

Before beginning, the following equipment is needed:

- 4 DC Power Supplies (2 capable of at least 7 V, 2 capable of at least 13 V to support current evaluation board setup)
- 4 DC Loads (up to at least 2 A)
- Function Generator
- Oscilloscope
- Digital Multi-meter
- SMA to BNC Cables Recommended for Connection to DIFF_OUTN, DIFF_OUTP, and MUX_SEL

Board Setup

The assembled evaluation board targets Bus Voltages and Shunt Currents shown in Tables 1 and 2. VBUS1 ties to both channel 1 and channel 3 bus voltage inputs. VBUS2 ties to both channel 2 and channel 4 bus voltage inputs. Refer to the schematic and layout diagrams found in [Appendix A](#) and [Appendix B](#) respectively as needed.

Table 1. BUS VOLTAGE SETUP

Channel	Target Bus Voltage	Bus Divider
1 (VBUS1)	12 V	1/60 V/V
2 (VBUS2)	6 V	1/30 V/V
3 (VBUS1)	12 V	1/60 V/V
4 (VBUS2)	6 V	1/30 V/V

Table 2. SHUNT CURRENT SETUP

Channel	Shunt Current	Shunt Gain
Load 1	0.5 A	400 mV/A
Load 2	5 A	40 mV/A
Load 3	0.5 A	400 mV/A
Load 4	5 A	40 mV/A

The specific resistor configuration populated on the board facilitate these gain settings. The nominal differential amplifier gain is 2 V/V. Therefore, the expected differential output for any channels voltage or current can be calculated as follows:

- For Bus Voltage:

$$\text{Diff Output} = \text{Bus Voltage} \cdot \frac{R4}{R4 + R3} \cdot 2 \quad (\text{eq. 1})$$

- For Load Current:

$$\text{Diff Output} = \text{Load Current} \cdot \text{Channel Shunt Gain} \cdot 2$$

$$\text{Diff Output} = I_{\text{Load}} \cdot \frac{R2 + R_{\text{sense}}}{R1} \cdot 2 \quad (\text{eq. 2})$$

These gain settings can be adjusted by changing the bus divider resistors, and the shunt current network resistors as desired.

Board Connections & Jumper Settings

The following board to bench equipment connections are required for demonstration of 4 channel power monitoring. Make all board connections with supplies and loads disabled. Take adequate precautions when working with high current and high voltage applications. Table 3 below defines all default board connections and their purpose.

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Table 3. EVALUATION BOARD DEFAULT CONNECTIONS

Connection	Connect To...	Purpose
VBUS1 (banana)	12 V supply	Provides channel 1 and channel 3 bus voltages
VBUS2 (banana)	6 V supply	Provides channel 2 and channel 4 bus voltages
LOAD1 & GND (banana)	0.5 A load current (24 Ω 1W resistor)	Provides channel 1 load current
LOAD2 & GND (banana)	2 A load current (3 Ω 12 W resistor)	Provides channel 2 load current
LOAD3 & GND (banana)	0.5 A load (24 Ω 1W resistor)	Provides channel 3
LOAD4 & GND (banana)	2 A load current (3 Ω 12 W resistor)	Provides channel 4 load current
VCC & GND	3.3 V	Provides NCP45491 supply
MUX_SEL (sma)	3.3 V to 0 V signal generator	Channel mux select input
EN (sma/header)	3.3 V to 0 V signal generator or tied to GND	NCP45491 enable input. Active low
DIFF_OUT_P (sma)	Oscilloscope	Differential output (positive)
DIFF_OUT_N (sma)	Oscilloscope	Differential output (negative)

NOTES:

- All connections to the board have an accompanying ground connection. Use all ground connections with the evaluation board being the center of a star ground to avoid ground loops.
- Connect to DIFF_OUT* signals with either 2 SMA to BNC cables to an oscilloscope (where the subtraction of the 2 signals give the differential voltage), or connect to the DIFF_OUT* test loops with a twisted pair or differential probe. Connecting in this manner will mitigate noise via EMI.
- SH_INx inputs need to be driven to a voltage between VCC and 26 V, even for unused channels. Jumpers 1, 2, 5, and 8 provide a means to connect unused channels to VCC. If a channel is not in use, the jumper should be switched to the VCC position and the SH_Ox jumper should be removed to float the SH_Ox pin.

Table 4 below defines all default jumper connections and their purpose.

Table 4. DEFAULT JUMPER DEFINITION

Jumper	Default Setting	Function
J1	Shorted [1,2]	Connects channel 1 bus voltage. [2,3] connection sets bus voltage to 3.3 V
J2	Shorted [1,2]	Connects channel 1 bus voltage. [2,3] connection sets bus voltage to 3.3 V
J5	Shorted [1,2]	Connects channel 1 bus voltage. [2,3] connection sets bus voltage to 3.3 V
J8	Shorted [1,2]	Connects channel 1 bus voltage. [2,3] connection sets bus voltage to 3.3 V
J3	Shorted	SH_O2
J4	Shorted	SH_O1
J6	Shorted	SH_O3
J7	Shorted	SH_O4
J20	Shorted [1,2]	SKIP input connection
J21	Open	MODE_SEL input connection
J10	Open	SMD jumper that can be shorted to tie EN to GND

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APPENDIX B – BILL OF MATERIALS

Table 5. BILL OF MATERIALS

Designator	Footprint	Value	Quantity	Digikey P/N
BG_REF_OUT, BS_IN1, BS_IN2, BS_IN3, BS_IN4, BS_OK, BS_REF, CM_REF_IN, DIFF_OUTN, DIFF_OUTP, GND2, GND3, GND4, GND5, GND6, SH_IN1, SH_IN2, SH_IN3, SH_IN4, SH_O1, SH_O2, SH_O3, SH_O4	Test_Point	Test loop	23	36-5009-ND
C1, C2, C3, C4, C5	SMD_0805	No placement	5	N/A
C6, C7, C8, C10, C11	SMD_0805	0.1 μ F	5	490-8049-1-ND
C9	SMD_0805	0.01 μ F	1	1276-1015-2-ND
DIFF_OUT_N, DIFF_OUT_P, EN, MUX_SEL	SMB_V-RJ45	SMB/SMA Strai	4	WM5543-ND
GND7, GND8, GND9, GND10, GND11, GND12, LOAD1, LOAD2, LOAD3, LOAD4, VBUS1, VBUS2, VCC	Bannana_Connec	Banana Con	13	J587-ND
J1, J2, J5, J8, J20, J21	10th" header	3 pins	6	732-5316-ND
J3, J4, J6, J7, J10, J100	10th" header	10" header	6	732-5315-ND
R12, R18	SMD_1206	118 k Ω	2	P118KFCT-ND
R15, R20, R16, R21	SMD_1206	2 k Ω	4	P2.0KBCCT-ND
Rsense1, Rsense2, Rsense3, Rsense4	SMD_1206	5 m Ω	4	RHM.005ALCT-ND
R1, R2, R3, R4	SMD_1206	100 Ω	4	P100BCCT-ND
R5, R6, R8	SMD_1206	66.5 k Ω	3	311-66.5KFRCT-ND
R9	SMD_1206	10 k Ω	1	RNCP1206FTD10K0CT-ND
R14, R23, R24	SMD_1206	0 Ω	3	HCJ1206ZT0R00CT-ND
R7, R25	SMD_1206	100 k Ω	2	RHM100KICT-ND
R13, R19	SMD_1206	57.6 k Ω	2	P57.6KAACT-ND
R11, R26	SMD_1206	12.4 Ω	2	311-12/4FRCT-ND
R10, R17	SMD_1206	2.5 Ω	2	541-2.49UCT-ND
U1	NCP45491	N/A	1	NCP45491

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APPENDIX C – NCP45491 EVALUATION BOARD LAYOUT

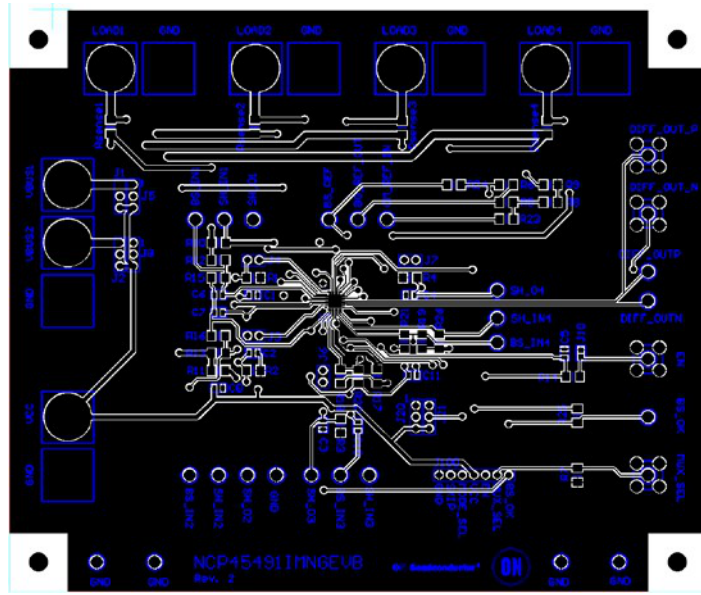


Figure 2. PCB Front (Top Metallization)

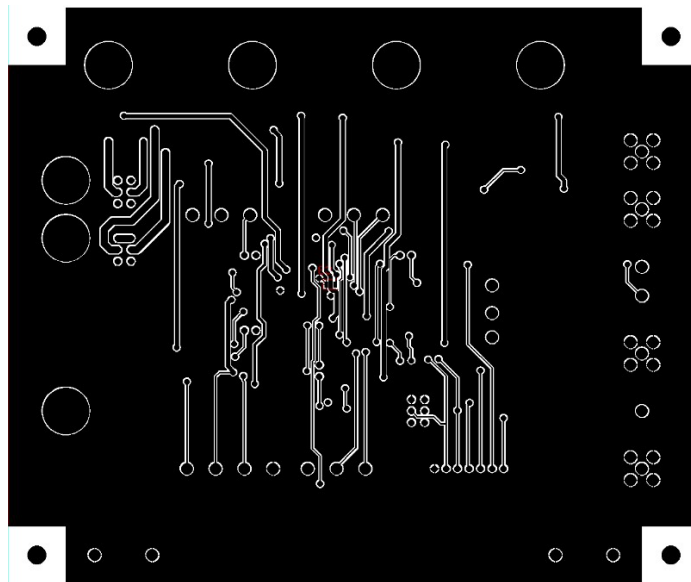


Figure 3. PCB Backside (Bottom Metallization)

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