Evaluation Board User Guide

EVAL-ADPL31613-AZ

Evaluates: ADPL31613 in a ±12V Output Voltage Application

General Description

The *EVAL-ADPL31613-AZ* evaluation board is a dual-output converter featuring the *ADPL31613* in both boost and inverter configurations. Both converters are powered from the same 4.5V to 10V input source. The Boost converter outputs 12V at 300mA, and the Inverter outputs -12V at 200mA. The evaluation board demonstrates small size and a low component count. The ADPL31613 operates with inputs up to 16V, but on this evaluation circuit the input is limited by the boost output magnitude. In a Boost converter, the input needs to be less than the output.

The EVAL-ADPL31613-AZ is designed so that the Inverting converter can be easily configured as a Boost converter. Instructions are included in the *EVAL-ADPL31613-AZ Schematic Diagram*. Both circuits are designed to demonstrate the soft-start feature, the advantages of the 1.2MHz switching frequency, and the internal 38V/1.3A switches.

Both outputs of this evaluation board can be modified to handle higher voltages. The evaluation board is intended for space-conscious applications such as digital cameras, cellular phones, palmtop computers, PC cards, miniature disk drives, X Digital Subscriber Line (xDSL) power supplies, flash memory products, local 5V or 12V supplies, and Liquid-Crystal Display (LCD) displays.

Features and Benefits

- V_{OUT1} = 12V at I_{OUT1} = up to 300mA
- V_{OUT2} = -12V at I_{OUT} = up to 200mA
- V_{IN} Range = 4.5V to 10V
- Fixed Frequency 1.2MHz Operation
- Resistor Programmable Output Voltage
- Current Mode Control, Internal Compensation and Soft-Start
- Proven Printed Circuit Board (PCB) Layout
- Fully Assembled and Tested

***Ordering Information* appears at end of data sheet.**

Quick Start

Required Equipment

- One 12V, 2A DC Power Supply
- Digital Multimeters (DMM)
- Load Resistors Capable of Sinking up to 300mA at -12V Output and 200mA at -12V

Procedure

The EVAL-ADPL31613-AZ is fully assembled and tested. Use the following steps to verify the board operation.

Note: Do not turn on the power supply until all the connections are completed.

1. Ensure that the J1 and J2 jumpers are in the ON position.
2. Disable the power supply and set the input power supply at a voltage between 4.5V to 10V.
3. Connect the positive terminal of the power supply to the V_{IN} PCB pad and the negative terminal to the nearest PGND PCB pad.
4. Connect the positive terminal of Load 1 to the V_{OUT1} pad and the negative terminal to the nearest PGND PCB pad.
5. Connect the positive terminal of Load 2 to the V_{OUT2} pad and the negative terminal to the nearest PGND PCB pad.

   Caution: Do not enable the Load until the power supply is turned on.
6. Connect the DMM across the V_{OUT1} PCB pad and the nearest PGND PCB pad.
7. Connect the DMM across the V_{OUT2} PCB pad and the nearest PGND PCB pad.
8. Ensure that the J1 and J2 jumpers are in the ON position.
9. Turn on the input power supply.
10. Enable the load.
11. Verify that the DMM displays the expected terminal voltage with respect to PGND.

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EVAL-ADPL31613-AZ Photo

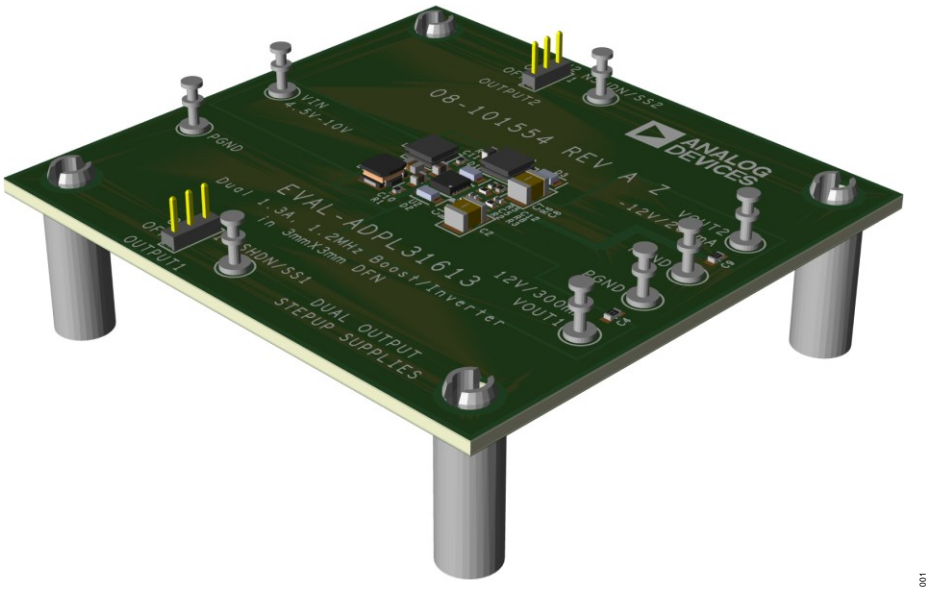

Figure 1. EVAL-ADPL31613-AZ Photo

EVAL-ADPL31613-AZ Evaluation Board Configuration

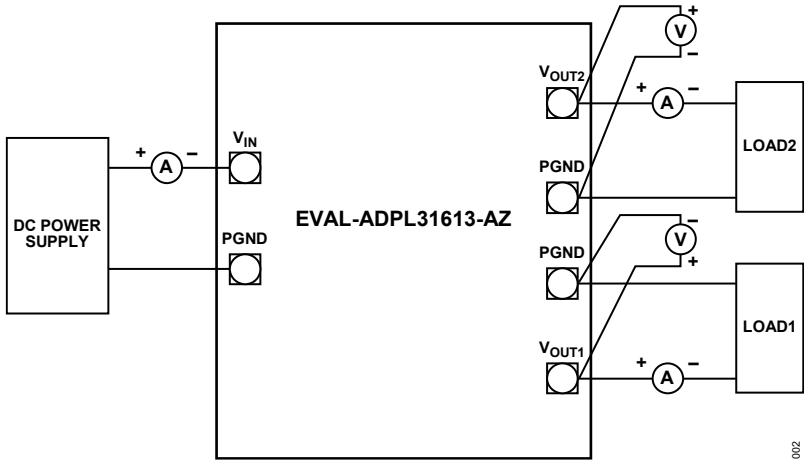

Figure 2. EVAL-ADPL31613-AZ Evaluation Board Connections

Typical Performance Characteristics

T_A = 25°C; all measurements are in reference to *EVAL-ADPL31613-AZ Schematic Diagram*, unless otherwise noted.

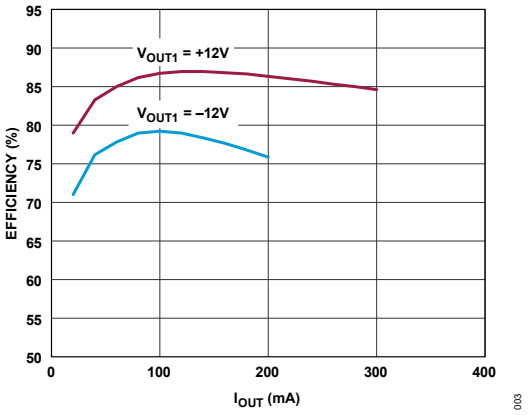

Figure 3. Efficiency vs. Output Current

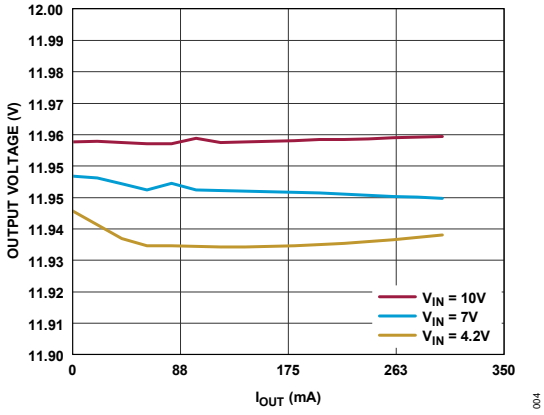

Figure 4. Output Voltage vs. Output Current

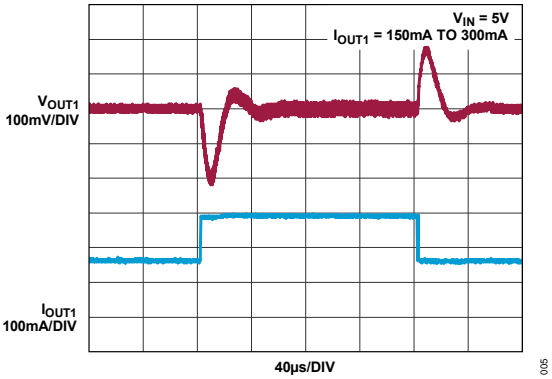

Figure 5. Transient Response

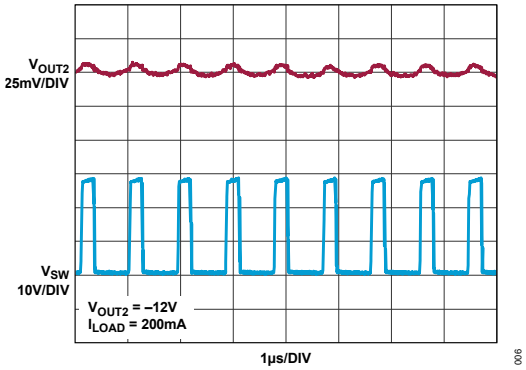

Figure 6. Steady-State Operation

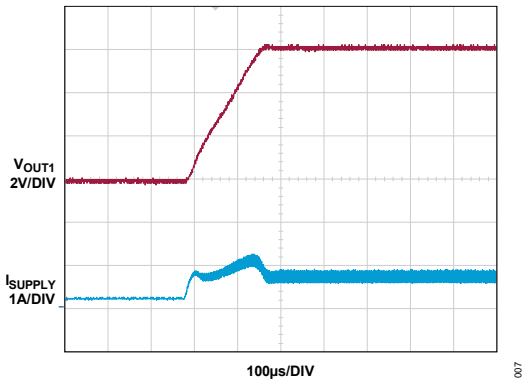

Figure 7. Start-up Waveform

Detailed Description of Hardware

The EVAL-ADPL31613-AZ is designed to demonstrate the salient features of the ADPL31613, a 1.2MHz inverting DC/DC converter, in a 10-lead, 3mm × 3mm dual flat no-lead (DFN) package. The evaluation board is preset for a 12V output delivering up to 300mA and a -12V output delivering up to 200mA.

$\overline{\text{SHDN}}$ Programming

The EVAL-ADPL31613-AZ includes jumpers J1 and J2 to support the $\overline{\text{SHDN}}$ pin functionality. *W*hen jumper J1 is connected across pin 1 to pin 2, V_{OUT1} is enabled. To disable, install the shunt across pin 2 to pin 3. Similarly, when jumper J2 is connected across pin 1 to pin 2, V_{OUT2} is enabled. To disable, install the shunt across pin 2 to pin 3. See *Table 1* for jumper settings.

Table 1. Jumper Connection Guide (J1 and J2)

JUMPER	DEFAULT CONNECTION	FEATURE
J1	**1 to 2**	V_{OUT1} – **ON**
J1	2 to 3	V_{OUT1} – OFF
J2	**1 to 2**	V_{OUT2} – **ON**
J2	2 to 3	V_{OUT2} – OFF

Default options are bold.

Setting Output Voltage

The EVAL-ADPL31613-AZ features an adjustable output voltage. On the EVAL-ADPL31613-AZ evaluation board, both devices are configured to provide a ±12V output. The output voltage is set through resistor divider networks: R4 and R2 for the +12V, R8 and R3 for the -12V. Refer to the *ADPL31613 data sheet* for more details.

Switching Frequency and Inductor Selection

Select an inductor L1, L2, or L3 that can handle at least 1.4A without saturating and ensure that the inductor has a low direct current resistance (DCR) and copper-wire resistance to minimize I^2R power losses. Refer to the *Switching Frequency and Inductor Selection* section in the *ADPL31613 data sheet* for more details.

Capacitor Selection

The ADPL31613 uses output capacitor C2,C8 as 10µF/50V for +12V and -12V respectively. Refer to the *Capacitor Selection* section in the *ADPL31613 data sheet* for more details.

Diode Selection

The EVAL-ADPL31613-AZ uses a low-leakage rectifier diode to further minimize input current at light loads and no load. Refer to the *Diode Selection* section in the *ADPL31613 data sheet* for more details.

Hot Plug-In and Long Input Cables

The EVAL-ADPL31613 evaluation board includes an electrolytic capacitor to dampen input voltage peaks and oscillations that can occur during hot-plug-in and/or with long input cables. These capacitors limit the peak input voltage of the DC-DC converters when the evaluation board is powered directly from a precharged capacitive source or an industrial backplane PCB. Long input cables between the power source and the evaluation board circuit can cause input voltage oscillations due to cable inductance. The equivalent series resistance (ESR) of the electrolytic capacitor helps dampen oscillations caused by long input cables.

Ordering Information

PART	TYPE
EVAL-ADPL31613-AZ	Evaluation Board

Z = RoHS Compliant Part.

The evaluation boards are preconfigured with an adjustable ADPL31613.

EVAL-ADPL31613-AZ Bill of Materials

ITEM	QTY	REFERENCE	DESCRIPTION	MANUFACTURER, PART NUMBER
1	2	C1, C12	Ceramic capacitor, 100pF, 25V, 10%, C0G 0402	AVX Corporation, 04023A101KAT2A
2	2	C10, C11	Ceramic capacitor, 0.33µF, 16V, 10%, X5R 0603	AVX Corporation, 0603YD334KAT2A
3	2	C2, C8	Ceramic capacitor, 10µF, 16V, 10%, X5R 1210	AVX Corporation, 1210YD106KAT2A
4	1	C3	Ceramic capacitor, SMD (0805), 4.7µF, 10%, 25V, X5R	Murata, GRM219R61E475KA73D
5	2	C4, C9	Ceramic capacitor, SMT (0603), 1µF, 10%, 16V, X7R	Kemet, C0603C105K4RACTU
6	1	C5	Capacitor, 0402, X5R dielectric, 0.1µF, 10%, 16V	Kyocera, 0402YD104KAT2A
7	1	C6	Ceramic capacitor, SMD, 0603, 1µF, 10%, 25V, X7R	Kyocera, 06033C105KAT2A
8	2	D2, D3	Schottky barrier diode rectifier, 1A	Vishay, MSS1P2L-M3/89A
9	2	J1, J2	Connectors; male, straight, through hole, 3P; Low-Profile Header	Samtec Inc, TMM-103-02-L-S
10	1	L1	Surface-mount technology (SMT) inductor (1515), Power-shielded wirewound, 10µH, 100kHz, 0.18Ω direct current resistance (DCR), 1.25A, AEC-Q200	Murata, LQH44PH100MPRL
11	2	L2, L3	Surface-mount device (SMD) inductor; 4040; Wire-wound ferrite power inductors; 15µH; 20%; 0.75W	Taiyo Yuden, LSXND4040MKL150MDG
12	2	R1, R7	Resistor, SMT (0402), 4.7kΩ, 5%, ±200PPM/°K, 0.0630W	Vishay, CRCW04024K70JNED
13	1	R2	Resistor, SMT (0402), 4.99kΩ; 1%, ±100PPM/°C; 0.0630W	Vishay, CRCW04024K99FKED
14	1	R3	Resistor, SMD, 15kΩ, 1%, 1/16W, 0402, AEC-Q200	Vishay, CRCW040215K0FKEk
15	1	R4	Resistor, SMD, 54.9kΩ, 1%, 1/10W, 0402, AEC-Q200	Panasonic, ERJ-2RKF5492X
16	1	R5	Resistor, SMD, 0Ω, jumper 1/16W, 0402	Yageo, RC0402JR-070RL
17	1	R8	Resistor, SMD, 182kΩ, 1%, 1/10W, 0402, AEC-Q200	Panasonic, ERJ-2RKF1823X
18	1	U2	IC; SMT; ADPL31613CPZ-RL	Analog Devices, Inc.,

EVAL-ADPL31613-AZ Schematic Diagram

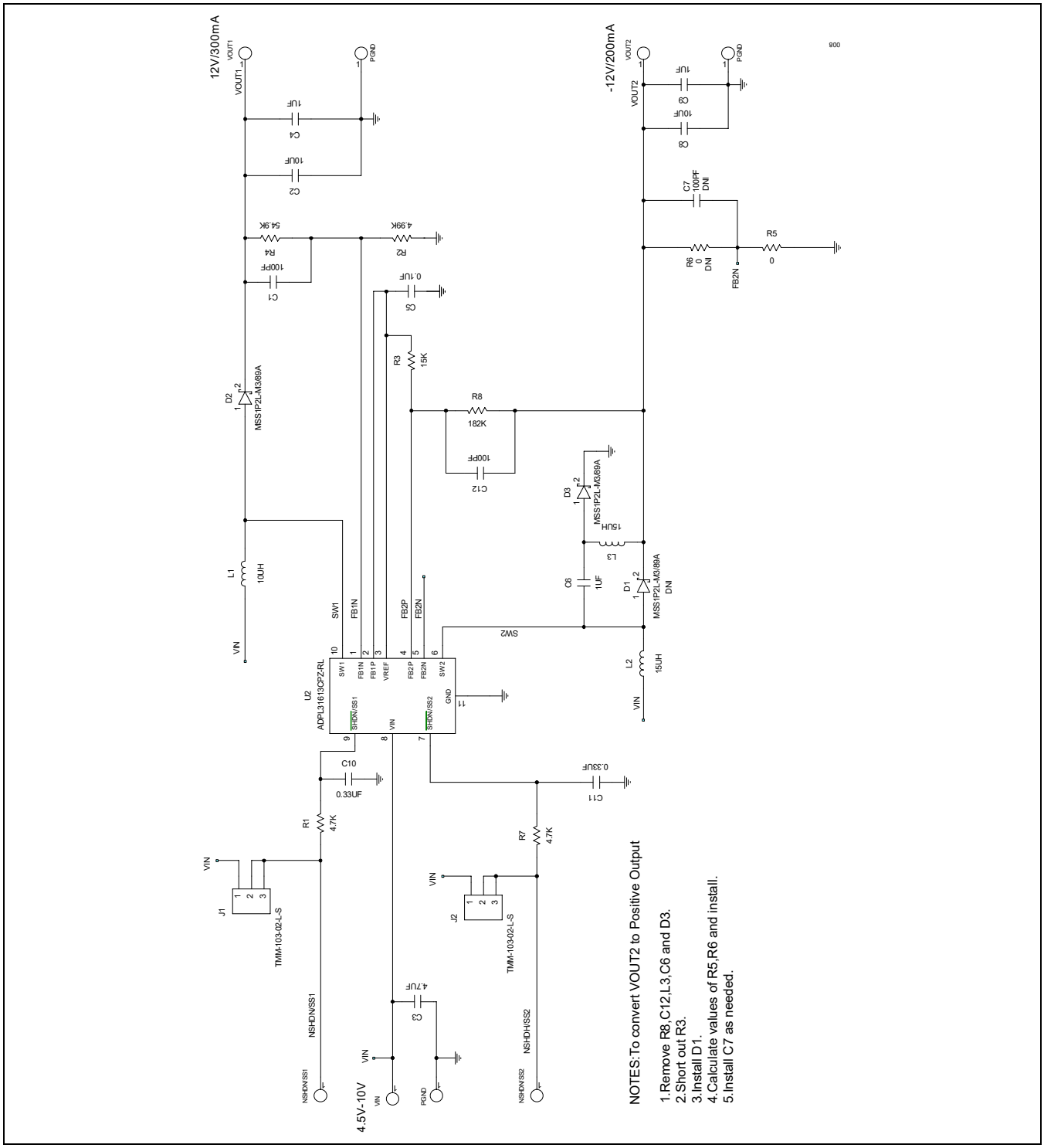

Figure 8. EVAL-ADPL31613-AZ Schematic Diagram

EVAL-ADPL31613-AZ PCB Layout

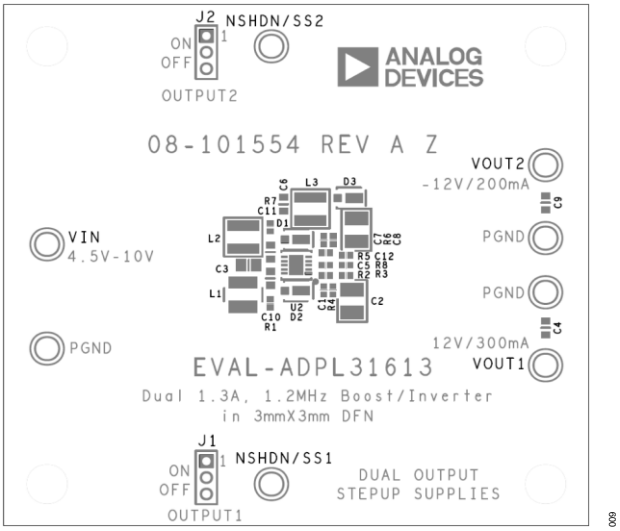

Figure 9. EVAL-ADPL31613-AZ Component Placement Guide—Top Silkscreen

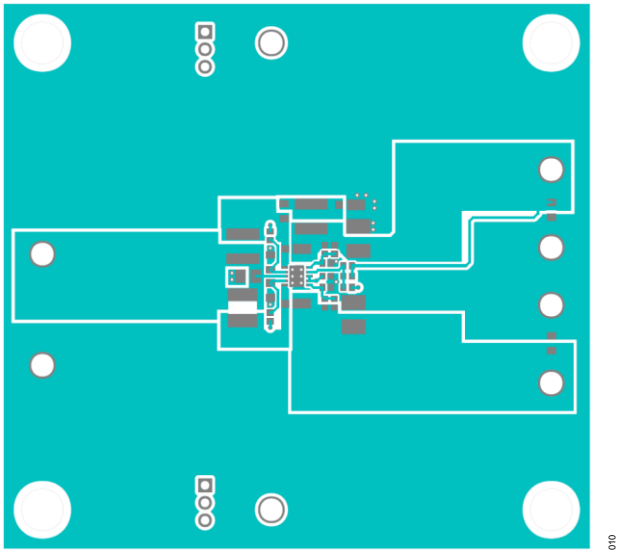

Figure 10. EVAL-ADPL31613-AZ PCB Layout—Layer 2

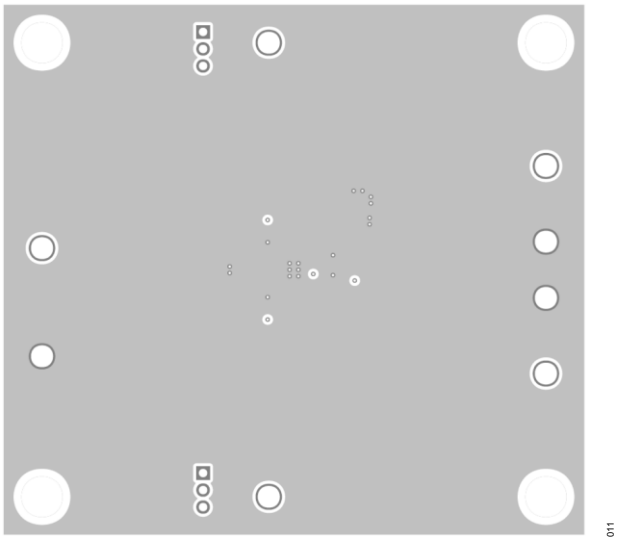

Figure 11. EVAL-ADPL31613-AZ PCB Layout—Top View

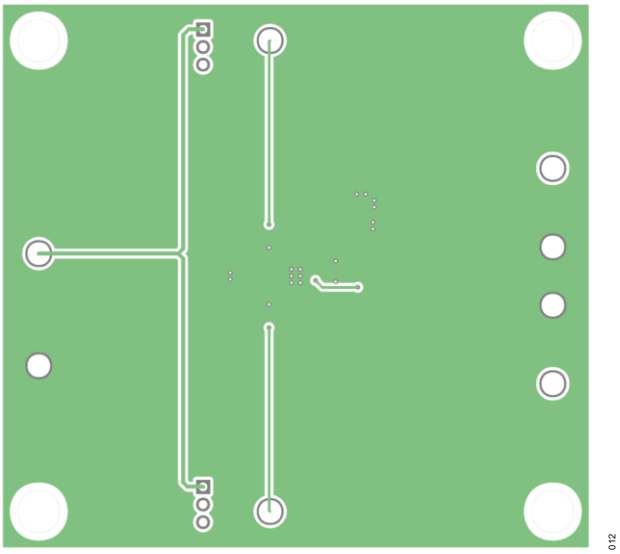

Figure 12. EVAL-ADPL31613-AZ PCB Layout—Layer 3

EVAL-ADPL31613-AZ PCB Layout (continued)

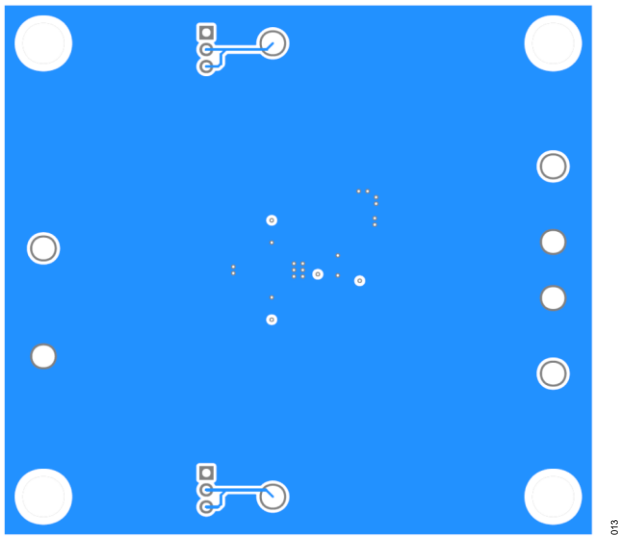

Figure 13. EVAL-ADPL31613-AZ PCB Layout—Bottom View

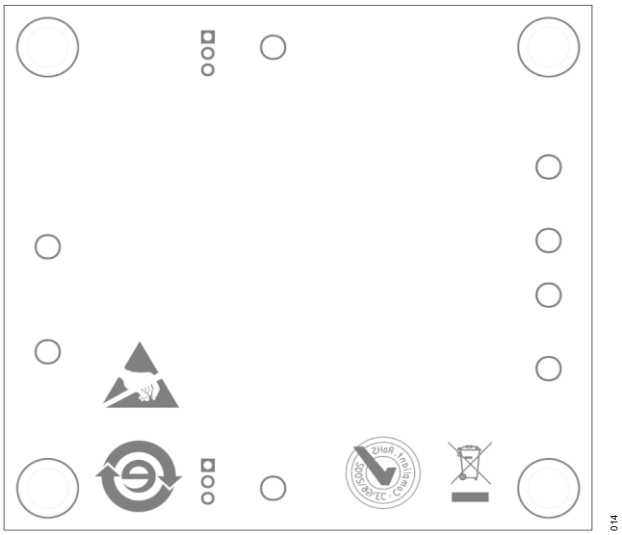

Figure 14. EVAL-ADPL31613-AZ Component Placement Guide—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	07/26	Initial release	—

Notes