Evaluation Board User Guide

EVAL-ADPL31610-AZ

Evaluates: ADPL31610A and ADPL31610B in a -12V Output Voltage Application

General Description

The *EVAL-ADPL31610-AZ* evaluation board provides proven designs to evaluate the performance of the ADPL31610A and ADPL31610B, inverting DC/DC converters in ThinSOT.

The ADPL31610A/B include a 1A integrated switch allowing high current outputs to be generated in a small footprint. The ADPL31610A switches at 1.2MHz while the ADPL31610B switches at 2.2MHz. These high switching frequencies enable the use of small, low-cost capacitors and inductors.

The EVAL-ADPL31610-AZ evaluation board features two application circuits with ADPL31610A and ADPL31610B. Both are configured to a -12V output voltage, operating within a nominal input voltage of 5V. The ADPL31610A application circuit can deliver upto 150mA at V_{IN} = 5V and ADPL31610B application circuit can deliver upto 120mA at V_{IN} = 5V.

The ADPL31610 data sheet must be read in conjunction with this user guide to properly use or modify the evaluation board.

Features and Benefits

- ADPL31610A: V_{OUT} = -12V, I_{OUT} = 150mA at V_{IN} = 5V
- ADPL31610B: V_{OUT} = -12V, I_{OUT} = 120mA at V_{IN} = 5V
- Resistor Programmable Output Voltage
- Features a Current-Limited, Fixed Off-Time Control Scheme
- Internal Compensation and Soft-Start
- Proven PCB Layout
- Fully Assembled and Tested

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

Quick Start

Required Equipment

- One 10V, 1A DC power supply
- Digital multimeters (DMM)
- Load resistors capable of sinking upto 150mA at -12V output with 5V input voltage
- Load resistors capable of sinking upto 120mA at -12V output with 5V input voltage

Procedure

The evaluation board is fully assembled and tested. Use the following steps to verify the board operation.

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

- ADPL31610A:
  - Ensure that the JP101 jumper is in the ON position.
  - Disable the power supply and set the input power supply to 5V.
  - Connect the positive terminal of the power supply to the V_{IN} PCB pad and the negative terminal to the nearest GND PCB pad.
  - Connect the load terminals between V_{OUT} pad and the nearest GND PCB pad.
  - Connect the DMM across the V_{OUT} PCB pad and the nearest GND PCB pad.
  - Turn on the input power supply.
  - Enable the load.
  - Verify that the DMM displays the expected terminal voltage with respect to GND.
- ADPL31610B:
  - Ensure that the JP201 jumper is in the ON position.
  - Disable the power supply and set the input power supply to 5V.
  - Connect the positive terminal of the power supply to the V_{IN} PCB pad and the negative terminal to the nearest GND PCB pad.
  - Connect the load terminals between V_{OUT} pad and the nearest GND PCB pad.
  - Connect the DMM across the V_{OUT} PCB pad and the nearest GND PCB pad.
  - Turn on the input power supply.
  - Enable the load.
  - Verify that the DMM displays the expected terminal voltage with respect to GND.

One Analog Way, Wilmington, MA 01887-2356, U.S.A. | Tel: 781.329.4700

EVAL-ADPL31610-AZ Evaluation Board Configuration

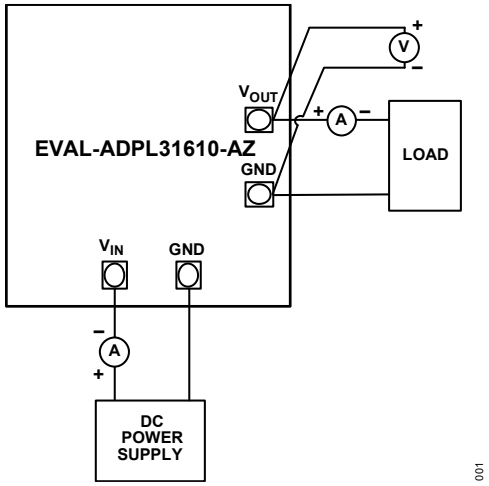

Figure 1. EVAL-ADPL31610-AZ Evaluation Board Connections

Typical Performance Characteristics

T_A = 25°C, all measurements are in reference to *EVAL-ADPL31610-AZ Evaluation Board Schematic Diagram*, unless otherwise noted.

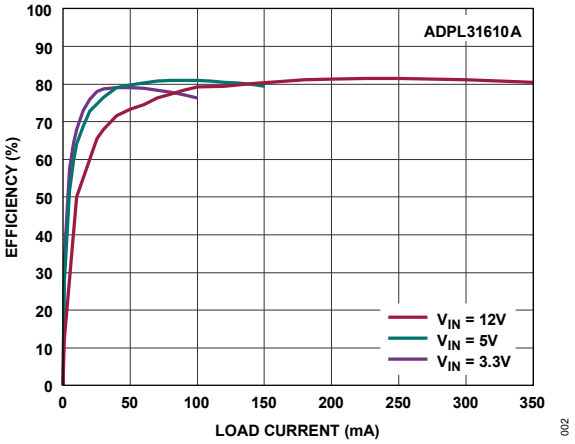

Figure 2. ADPL31610A - Efficiency vs. Output Current

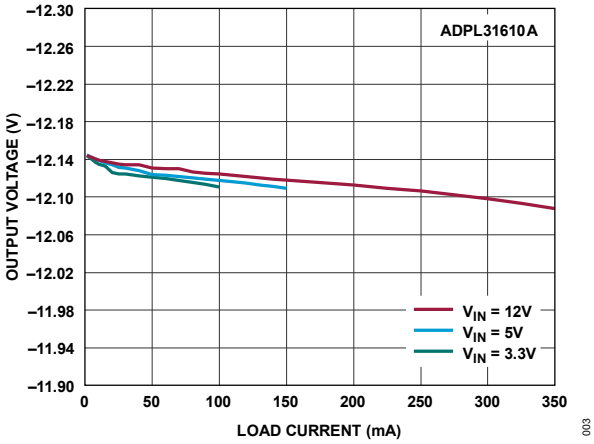

Figure 3. ADPL31610A - Output Voltage vs. Output Current

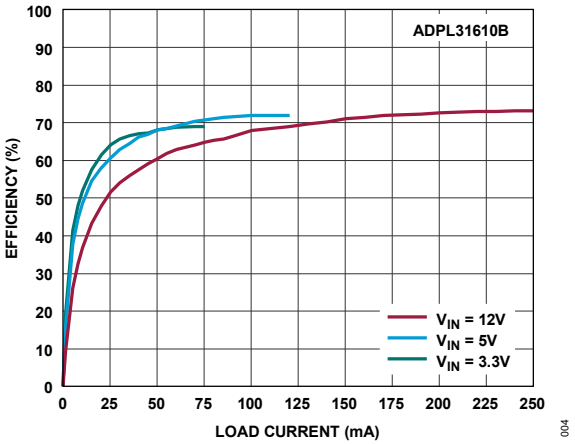

Figure 4. ADPL31610B - Efficiency vs. Output Current

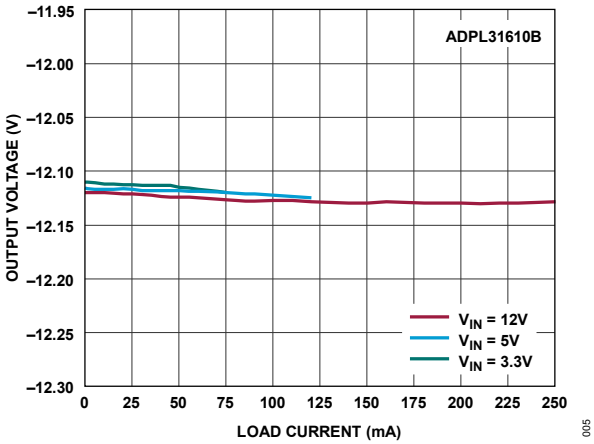

Figure 5. ADPL31610B - Output Voltage vs. Output Current

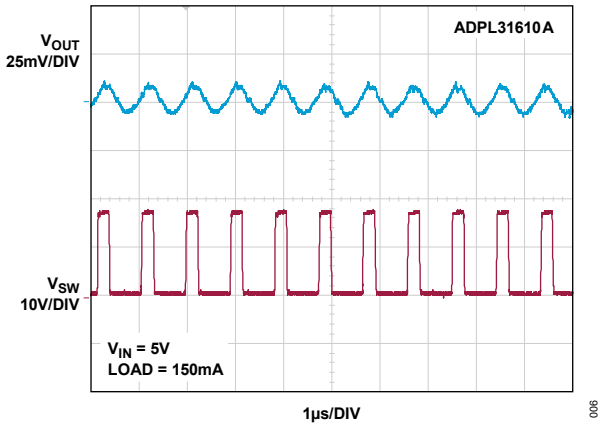

Figure 6. ADPL31610A - Steady State Operation

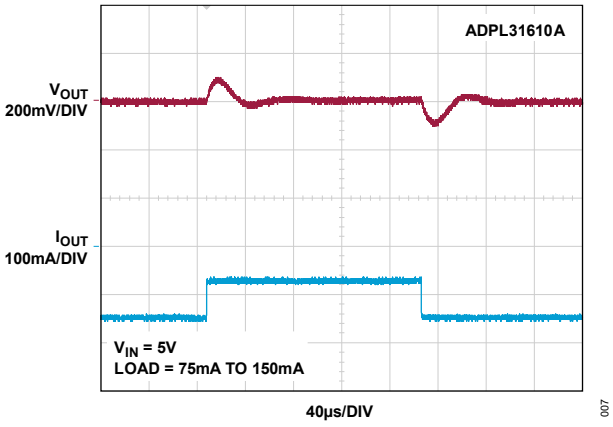

Figure 7. ADPL31610A - Transient Response

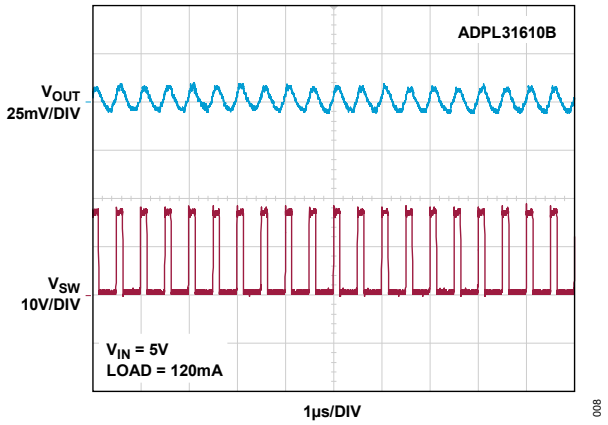

Figure 8. ADPL31610B – Steady-State Operation

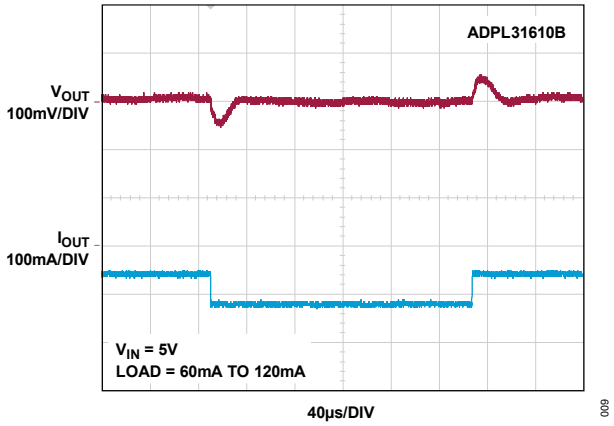

Figure 9. ADPL31610B - Transient Response

Detailed Description

The EVAL-ADPL31610-AZ evaluation board is designed to demonstrate the salient features of ADPL31610A and ADPL31610B, 1.2MHz/2.2MHz inverting DC/DC converters in ThinSOT. The evaluation board is preset for -12V output. The ADPL31610A can deliver upto 150mA at input voltage of 5V and the ADPL31610B can deliver upto 120mA at input voltage of 5V.

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

The EVAL-ADPL31610-AZ evaluation board offers jumpers JP101 and JP201 for the $\overline{\text{SHDN}}$ pin feature. For ADPL31610A, when jumper JP101 is connected across pins 1-2, the ADPL31610A is enabled. To disable, install the shunt across pins 2-3. Similarly, for ADPL31610B, when jumper JP201 is connected across pins 1-2, the ADPL31610B is enabled. To disable, install the shunt across pins 2-3. See *Table 1* for jumper settings.

Table 1. Jumper Connection Guide (JP101 and JP201)

SHUNT POSITION	$\overline{\text{SHDN}}$ PIN	OUTPUT
1-2	Connected to the GND	OFF
2-3*	Connected to V_{IN}	ON

**Default position*.

Adjusting Output Voltage

The ADPL31610A and ADPL31610B devices feature an adjustable output voltage. On the EVAL-ADPL31610-AZ evaluation board, both devices are configured to provide a –12V output. The output voltage is set through resistor divider networks: R103 and R104 for the ADPL31610A, and R203 and R204 for the ADPL31610B. Refer to the *ADPL31610 data sheet* for more details.

Input Capacitor Selection

The input capacitors, C102 and C202, reduce current peaks drawn from the input power supply and reduce the switching frequency ripple at the input. Refer to the *Capacitor Selection* section in the *ADPL31610 data sheet* for more details. The input capacitor is chosen to be 4.7µF for ADPL31610A and 2.2µF for ADPL31610B.

Output Capacitor Selection

The ADPL31610A uses output capacitor C105 as 4.7µF/50V and the ADPL31610B uses output capacitor C205 and C206 as 2.2µF/25V. Refer to the *Capacitor selection* section in the *ADPL31610 data sheet* for more details.

Diode Selection

The EVAL-ADPL31610-AZ evaluation board circuit 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 *ADPL31610 data sheet* for more details.

Hot Plug-In and Long Input Cables

The EVAL-ADPL31610-AZ evaluation board provides an electrolytic capacitor to dampen input voltage peaks and oscillations that can arise during hot-plug-in and/or due to long input cables. These capacitors limit the peak voltage at the input of the DC-DC converters when the evaluation board is powered directly from a precharged capacitive source or an industrial backplane printed circuit board (PCB). Long input cables between an input power source and the evaluation board circuit can cause input voltage oscillations due to the inductance of the cables. The equivalent series resistance (ESR) of the electrolytic capacitor helps damp out the oscillations caused by long input cables.

Ordering Information

PART	TYPE
EVAL-ADPL31610-AZ	Evaluation Board

Z = RoHS-compliant part.

Component Suppliers

SUPPLIER	WEBSITE
Murata Americas	www.murata.com
Coilcraft	www.coilcraft.com
Nichicon	www.nichicon.com
Vishay	www.vishay.com
Onsemi	www.onsemi.com

Note: *When contacting these component suppliers, indicate that the ADPL31610 is used.*

EVAL-ADPL31610-AZ Evaluation Board Bill of Materials

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER, PART NUMBER
1	2	C101, C201	Capacitors, Aluminum, 33µF, 16V, 20%	Nichicon, PCJ1C330MCL1GS
2	2	C102, C105	Ceramic Capacitors, X7R, 4.7µF, 50V, 10%, 1206	Murata, GRM31CR71H475KA12
3	2	C103, C203	Ceramic Capacitors, X7R, 1µF, 35V, 10%, 0805	Taiyo Yuden, MSASG21GSB7105KTNA01
4	1	C104	Ceramic Capacitor, C0G, 22pF, 50V, 10%, 0402	Murata, GRM1555C1H220JA01J
5	1	C204	Ceramic Capacitor, C0G, 33pF, 50V, 10%, 0402	Murata, GRM1555C1H330JA01D
6	3	C202, C205, C206	Ceramic Capacitors, X7R, 2.2µF, 25V, 10%, 1206	Murata, GRM31MR71E225KA93L
7	1	D101	Diode Schottky, 30V, 0.5A	Onsemi, MBR0530T1G
8	1	D201	Diode Schottky, 40V, 0.5A	Onsemi, MBR0540T1G
9	1	L101	Inductor, SMD, 4P, 10µH, 20%, 1.48A	Coilcraft, LPD5030-103MRC
10	1	L201	Inductor, SMD, 4P, 3.3µH, 30%, 1.06A	Coilcraft, LPD4012-332NRC
11	4	R101, R102, R201, R202	Resistors, 100kΩ, 1%, 1/16W, 0402	Vishay, CRCW0402100KFKED
12	1	R103	Resistors, 110kΩ, 1%, 1/16W, 0402	Vishay, CRCW0402110KFK
13	1	R203	Resistors, 105kΩ, 1%, 1/16W, 0402	Vishay, CRCW0402105KFK
14	2	R104, R204	Resistors, 13.3kΩ, 1%, 1/16W, 0402	Vishay, CRCW040213K3FK
15	1	U101	ADPL31610A IC	Analog Devices IC, ADPL31610AUJZ-RL
16	1	U201	ADPL31610B IC	Analog Devices IC, ADPL31610BUJZ-RL
17	2	JP101, JP201	Connectors, Male, Through hole, 3Pins	Sullins, PBC03SABN

EVAL-ADPL31610-AZ Evaluation Board Schematic Diagram

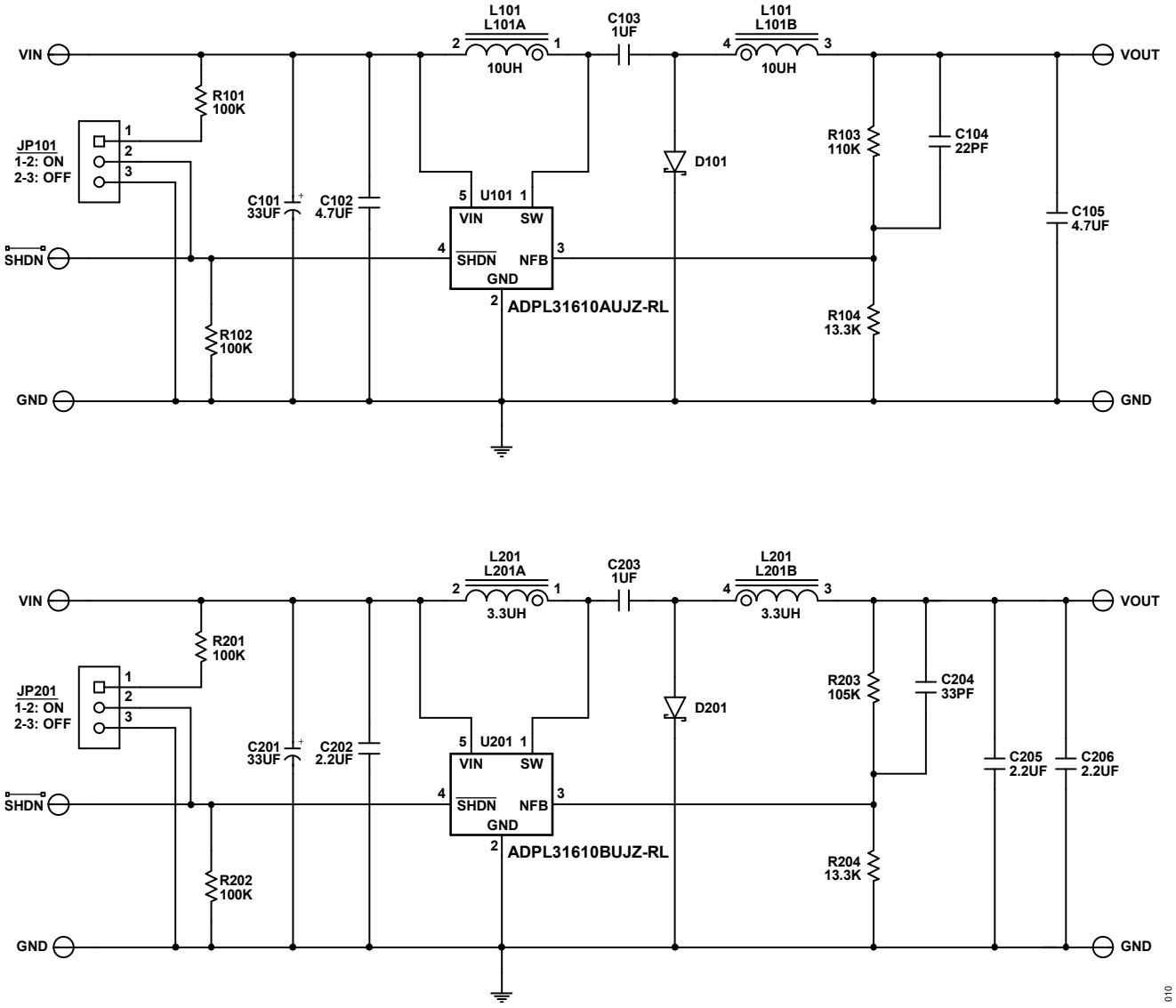

Figure 10. EVAL-ADPL31610-AZ Evaluation Board Schematic Diagram

EVAL-ADPL31610-AZ Evaluation Board PCB Layout Diagrams

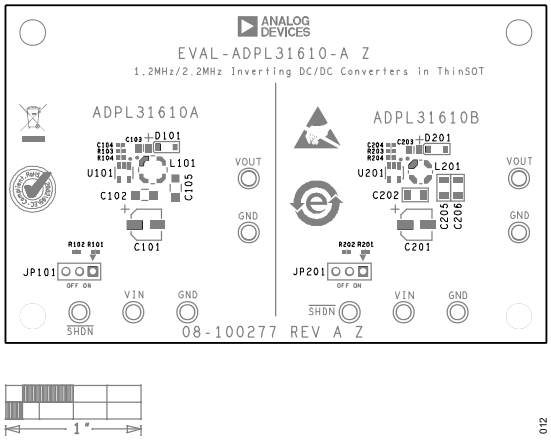

Figure 11. EVAL-ADPL31610-AZ Evaluation Board Component Placement Guide—Top Silkscreen

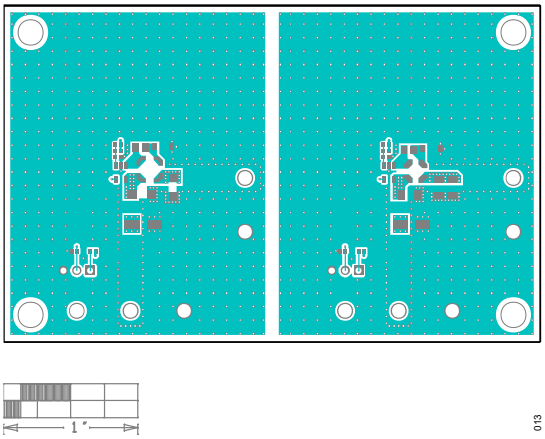

Figure 12. EVAL-ADPL31610-AZ Evaluation Board PCB Layout—Layer 1

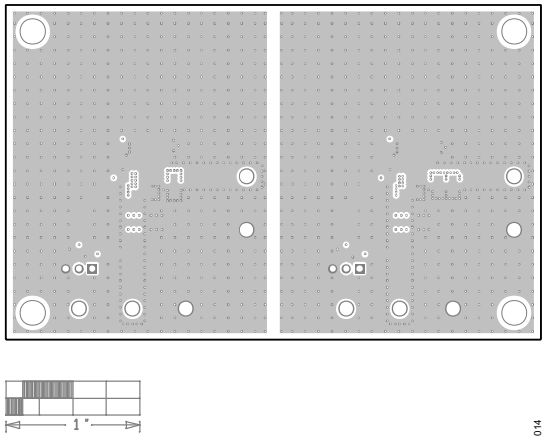

Figure 13. EVAL-ADPL31610-AZ Evaluation Board PCB Layout—Layer 2

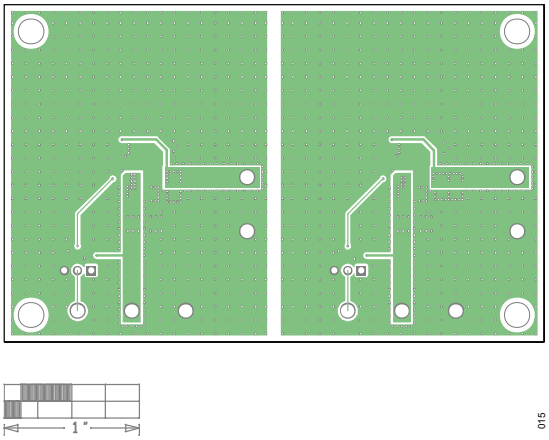

Figure 14. EVAL-ADPL31610-AZ Evaluation Board PCB Layout—Layer 3

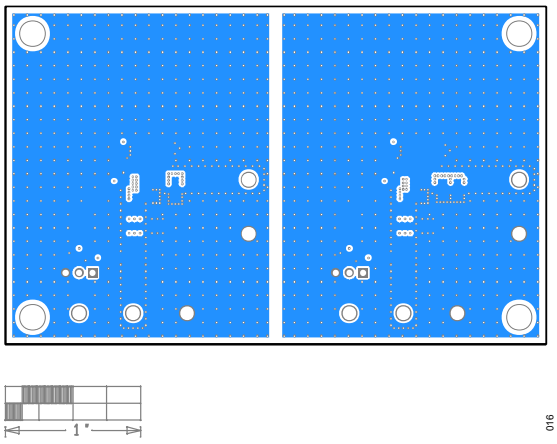

Figure 15. EVAL-ADPL31610-AZ Evaluation Board PCB Layout—Layer 4

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	01/26	Initial Release	—

Notes