Evaluates: ADPL86610
4.5V to 60V, 250mA, Current-Limiter with OV, UV, and Reverse Protection

ADPL86610 Evaluation Kit

General Description

The ADPL86610 evaluation kit (EV kit) is a fully assembled and tested circuit board that demonstrates the ADPL86610 4.5V to 60V, 250mA, current-limiter with overvoltage (OV), undervoltage (UV), and reverse protection in a 10-pin Thin dual flat no lead-exposed pad (TDFN-EP) package. The EV kit can be configured to demonstrate adjustable overvoltage, undervoltage, different current-limit types, and different current-limit thresholds.

Features

- 4.5V to 60V Operating-Voltage Range
- Features a Transient-Voltage-Suppression (TVS) Diode across the Input and a Schottky Diode across the Output Terminals
- Evaluates UVLO, OVLO, Three Current-Limit Types, and Current-Limit Threshold
- Undervoltage-Lockout (UVLO) programmed to 4.5V
- Overrvoltage-Lockout (OVLO) programmed to 36V
- Jumper-Configurable Current-Limit (Selected as 250mA by Default)
- Current-Limit Mode Set To Autoretry by default
- Proven Printed Circuit Board (PCB) Layout
- Fully Assembled and Tested

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

Quick Start

Recommended Equipment

- ADPL86610 EV kit
- 60V DC power supply
- Multimeters
- Adjustable load (0A to 1A)
- USB-A male to USB-B male cable or 5V DC power supply

Equipment Setup and Test Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation.

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

1) Verify that all jumpers are in their default positions.
2) Connect the USB cable to J1 from a computer or connect a 5V-DC power supply to TP3.
3) Verify that LED1 is on.
4) Set the 60V DC power supply to 5V and connect to IN (J2/TP6). Verify that OUT (J3/TP8) is 5V.
5) Gradually increase the DC power-supply voltage and verify that OUT voltage goes down and $\overline{UVOV}$ goes low when input reaches approximately 36V.
6) Gradually decrease the DC power-supply voltage and verify that OUT comes back and $\overline{UVOV}$ goes high when the input reaches approximately 34.8V.
7) Set the DC power-supply voltage to 24V and connect the adjustable load between the OUT and GND terminals and a multimeter in series to measure the current. Gradually increase the load current and verify that the OUT goes down and the $\overline{FLAG}$ goes low when the load current increases above 250mA.
8) The jumper JU1 can be configured to change the current limit as given in Table 2. Verify various current limit operations by repeating step 7.

CAUTION: When applying a negative input to V_{IN}, the negative input test should be performed when the output capacitors are fully discharged and V_{BUS} is not supplied.

319-101122; Rev 0; 10/25

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Detailed Description

The EV kit circuit can be configured to evaluate user-defined UVLO and OVLO thresholds using resistor-dividers. The overcurrent threshold is determined by external resistors connected to the SETI pin and is jumper-configurable through jumper JU1. Using jumper JU4, the EV kit circuit can be configured to evaluate different current limit types (Autoretry, Continuous, and Latch-off). LED1 on the EV kit indicates the availability of logic power for annunciation signals ($\overline{UVOV}$ and $\overline{FLAG}$) and EN.

The EV kit provides on-board output capacitors to enable a demonstration of the ADPL86610 protection features.

Input-Power Supply

The EV kit is powered by a user-supplied 4.5V to 60V power supply connected between J2/TP6 (INPUT POWER) and GND.

Enable

To enable the device, connect a USB-A male connector from the computer to the USB-B female connector, J1, or an external 5V supply to TP3 and GND. This provides 5V to V_{BUS} and to the EN pin (JU5 connects V_{BUS} to EN by default). Choose the JU5 setting to enable or disable operation of the ADPL86610 (see Table 1).

UVLO/OVLO Threshold

The UVLO threshold for input voltage is set through the R9, R10 resistive divider. Use the following equation to calculate the value of R10 for a required undervoltage threshold level:

$$R10 = \frac{R9}{\left(\frac{V_{UVLO}}{V_{REF}} - 1\right)}$$

where R9 can be chosen as 2.2MΩ, V_{REF} is 1.5V, and V_{UVLO} is the required undervoltage protection threshold.

The OVLO threshold for input voltage is set through the R11, R12 resistive divider. Use the following equation to calculate the value of R12 for a required overvoltage threshold level:

$$R12 = \frac{R11}{\left(\frac{V_{OVLO}}{V_{REF}} - 1\right)}$$

where R11 can be chosen as 2.2MΩ, V_{REF} is 1.5V, and V_{OVLO} is the required overvoltage protection threshold.

Current-Limit Threshold

The EV kit features a jumper (JU1) to select the current-limit threshold. Install a jumper as shown in Table 2 to change the current-limit threshold.

Table 1. Enable (JU5)

JUMPER	SHUNT POSITION	DESCRIPTION	ADPL86610 STATUS
JU5	1 to 2*	EN pin connected to V_{BUS}	ON
	2 to 3	EN pin connected to GND	OFF
	Open	EN pin floating	ON

**Default position.*

Table 2. Current-Limit Threshold (JU1)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1 to 2	Current limit 10mA
	3 to 4	Current limit 100mA
	5 to 6*	Current limit 250mA
	7 to 8	Current limit adjustable

**Default position.*

Current-Limit Type Select

The EV kit features jumper JU4 to select different current-limit responses. See Table 3 for jumper settings.

Output-Load Capacitor

Use JU6 to connect the OUT pins to the OUT test point (TP8). Use jumper JU7 to connect the output to the 330µF capacitors. See Table 4 for jumper settings.

Table 3. Current-Limit Type Select (JU4)

JUMPER	SHUNT POSITION	DESCRIPTION
JU4	1 to 2	Latch-off
	2 to 3	Continuous
	Open*	Autoretry

**Default position.*

Table 4. Output Load Capacitor (JU7)

JUMPER	SHUNT POSITION	DESCRIPTION
JU7	Installed	OUT connected to C4 and C5.
	Not installed*	OUT not connected to C4 and C5.

**Default position.*

ADPL86610 EV Kit Performance Report

(V_{IN} = 24V, C_{IN} = 0.47µF, C_{OUT} = 4.7µF, unless otherwise noted.)

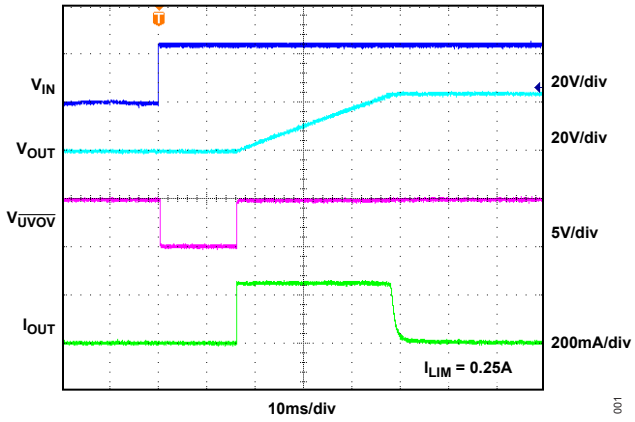

Figure 1. Power-Up Response with 330µF Capacitor at No Load

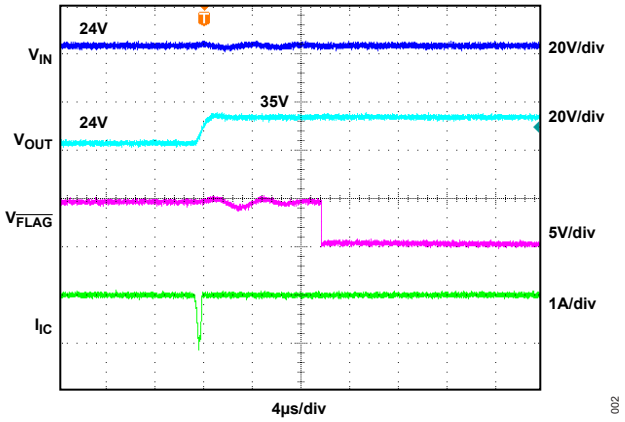

Figure 2. Reverse-Blocking Response

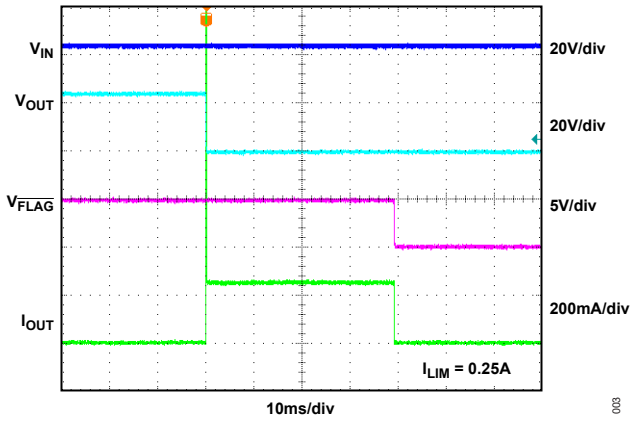

Figure 3. Output Short-Circuit Response

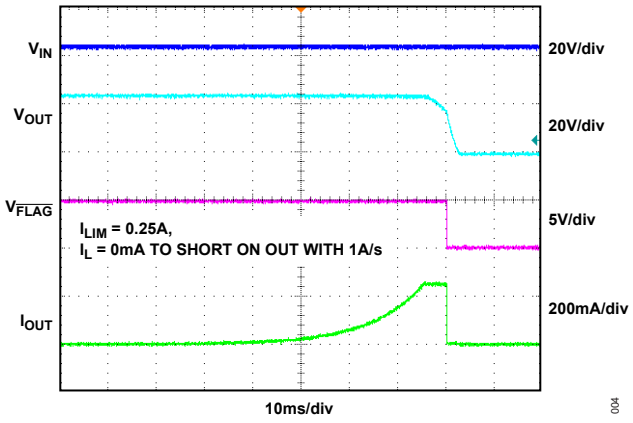

Figure 4. Current-Limit Response

ADPL86610 EV Kit Performance Report (continued)

(V_{IN} = 24V, C_{IN} = 0.47µF, C_{OUT} = 4.7µF, unless otherwise noted.)

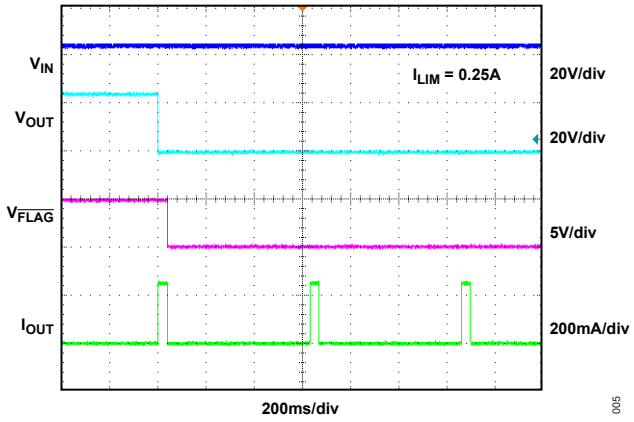

Figure 5. Autoretry Current-Limit Response

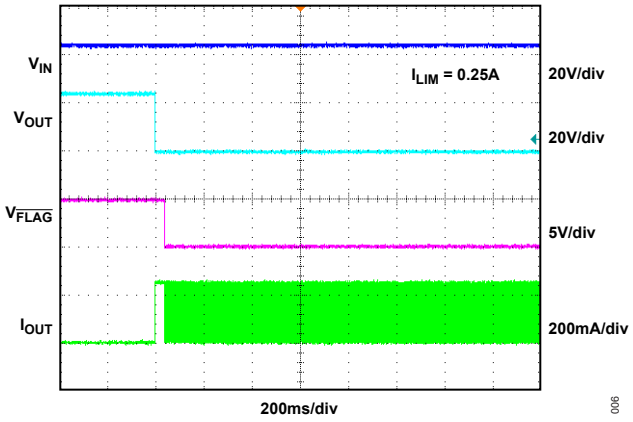

Figure 6. Continuous Current-Limit Response

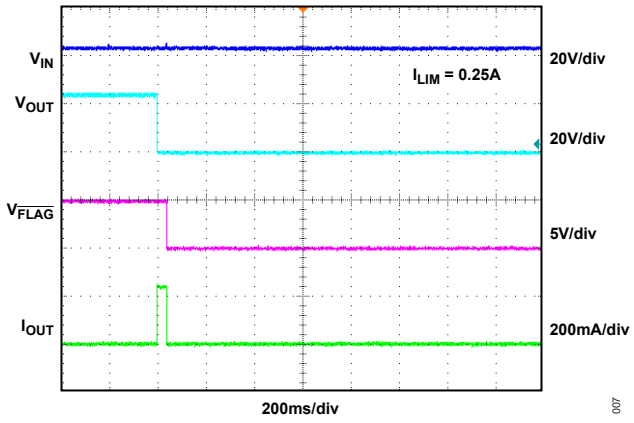

Figure 7. Latch-Off Current-Limit Response

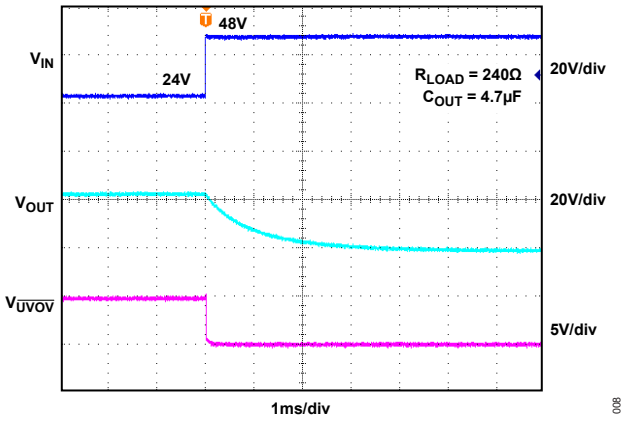

Figure 8. Overvoltage Fault Response

Ordering Information

PART	TYPE
ADPL86610EVKIT#	EV Kit

#Denotes RoHS-compliant

ADPL86610 EV Kit Bill of Materials

PART REFERENCE	QTY	DESCRIPTION	MANUFACTURER PART NUMBER
C1	1	1µF 10%, 50V X5R ceramic capacitors (0603)	Samsung CL10A105KB8NNNC
C2	1	0.47µF 10%, 100V X7R ceramic capacitors (0805)	Murata GRM21BR72A474KA73L
C3	1	4.7µF 10%, 100V X7R ceramic capacitors (1210)	Kemet C1210C475K1R2C, Murata GRM32ER72A475KE14
C4	1	330µF 20%, 50V aluminium (10mm)	Panasonic EEU-EB1H331
D1	1	TVS Diode, 600W (SMB)	Bourns SMBJ40CA
D2	1	Power Schottky Diode, 60V, 5A (SMC)	Diodes Incorporated B560CQ-13-F
D3	1	Power Schottky Diode, 60V, 1A (SMA)	Diodes Incorporated B160-13-F
J1	1	USB-B connector	FCI Connect 61729-0010BLF
J2, J3	2	2-Pin Green PC Terminal Block	Degson Electronics DG128-5.0-02P-14
JU1	1	2x4 Dual-Row Header, 0.1" centers, cut to fit	Sullins Connector PBC04DAAN
JU3, JU6, JU7	3	2-Pin Single-Row Header, 0.1" centers, cut to fit	Sullins Connector PEC02SAAN
JU4, JU5	2	3-Pin Single-Row Header, 0.1" centers, cut to fit	Sullins Connector PEC03SAAN
LED1	1	Green LED (1206)	Kingbright APT3216SGC
R1	1	1kΩ 1% resistors (0603)	—
R2, R3	2	10kΩ 1% resistors (0402)	—
R4	1	150kΩ 5% resistor (0402)	—
R5, R13	2	5kΩ 0.1% resistors (0402)	—
R6	1	30kΩ 1% resistors (0402)	—
R7	1	3kΩ 1% resistors (0402)	—
R8, R15	2	1.2kΩ 1% resistors (0402)	—
R9, R11	2	2.2MΩ 5% resistors (0402)	—
R10	1	1.1MΩ 1% resistors (0402)	—
R12	1	95.3kΩ 1% resistors (0402)	—
R14	1	20kΩ 1% resistors (0402)	—
R16	1	25kΩ Trimmer Potentiometers	Bourns 3296Y-1-253LF
TP1, TP9, and TP11 to TP13	5	White Test Point	Keystone Electronics Corp 5002
TP2, TP4, TP5, TP7	4	Black Test Point	Keystone Electronics Corp. 5001
TP3, TP6, TP8	3	Red Test Point	Keystone Electronics Corp. 5000
TP10	1	Green Test Point	Keystone Electronics Corp. 5116
U1	1	4.5V to 60V, 250mA, Current-Limiter with OV, UV, and Reverse Protection (10-pin TDFN-EP, 3mm x 3mm)	ADPL86610ATB+
C5	0	Not Installed; 330µF 20%, 50V aluminium (10mm)	Panasonic EEU-EB1H331
D4	0	Not Installed; TVS Diode, 600W (SMB)	Bourns SMBJ40CA
PCB	1	PCB: ADPL86610 Evaluation Kit	—

ADPL86610 EV Kit Schematic Diagram

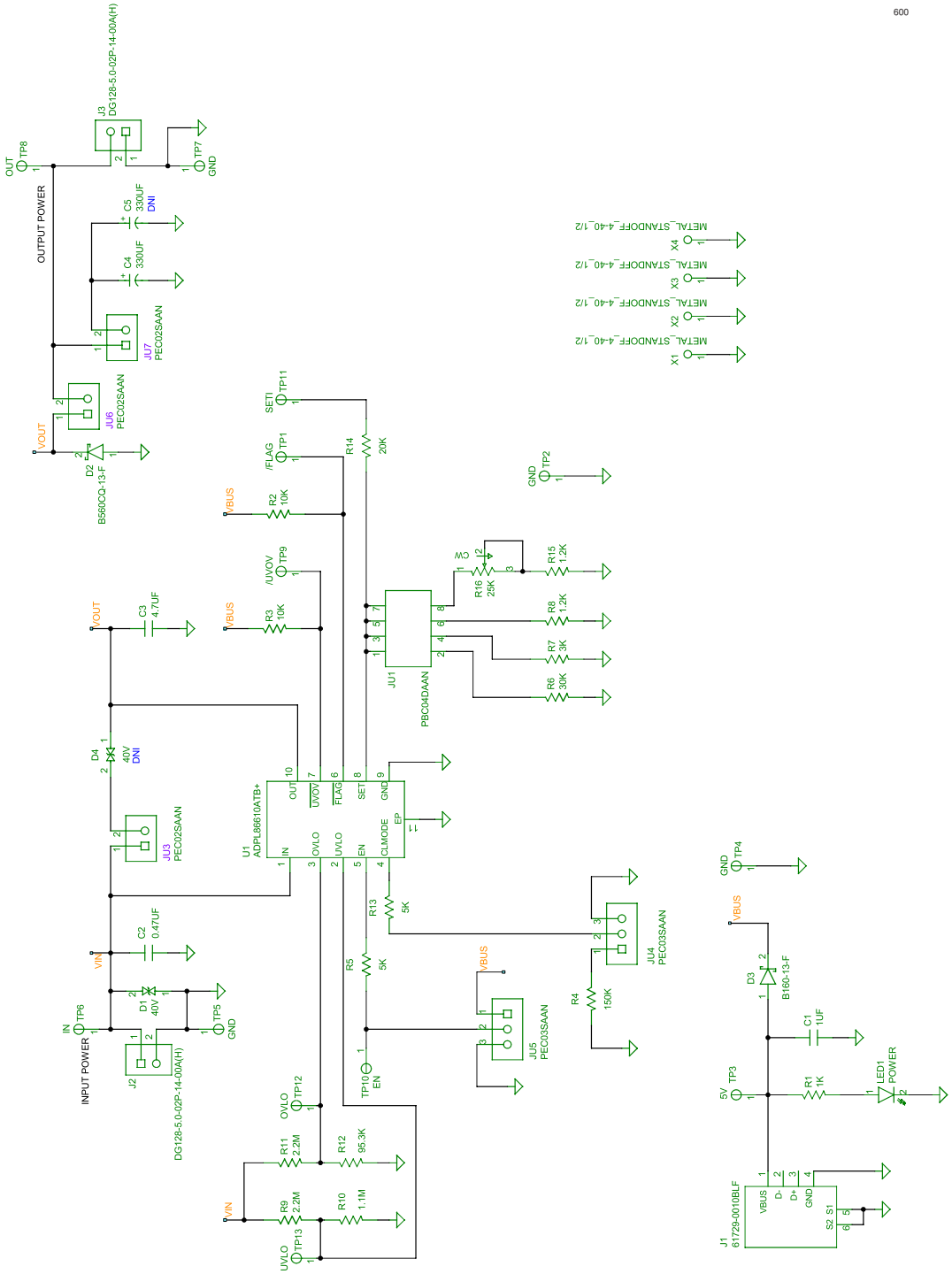

Figure 9. ADPL86610 EV kit Schematic Diagram

ADPL86610 EV Kit PCB Layout Diagrams

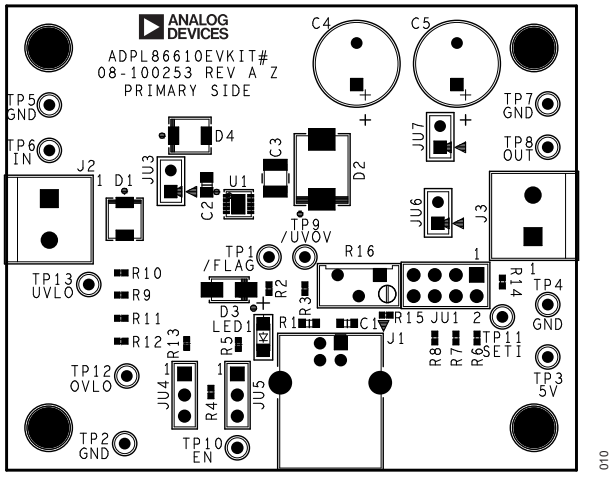

Figure 10. ADPL86610 EV Kit PCB Layout—Top Silkscreen

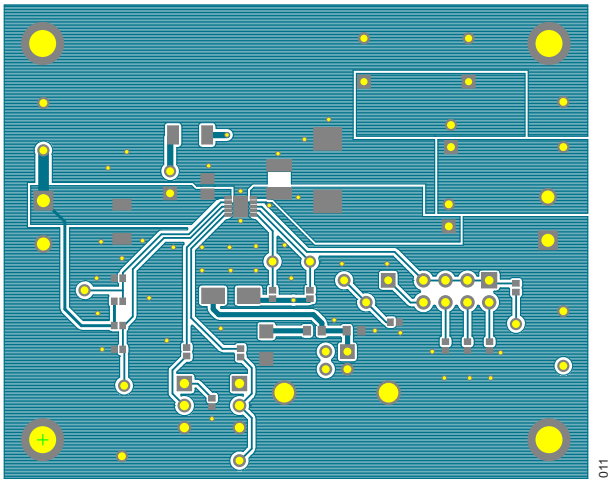

Figure 10. ADPL86610 EV Kit PCB Layout—Top Layer

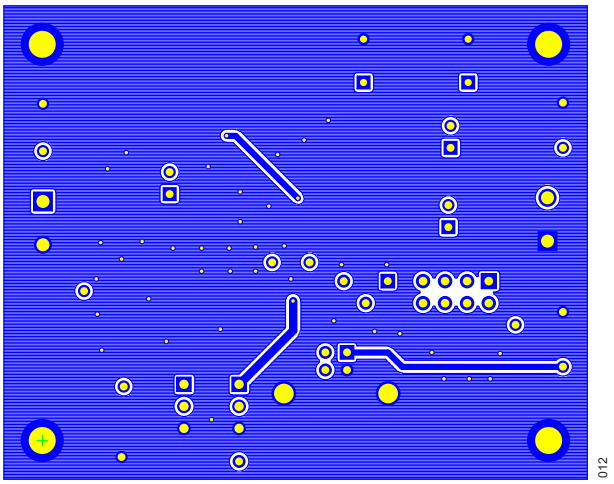

Figure 12. ADPL86610 EV Kit PCB Layout—Bottom Layer

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	10/25	Initial release	—