ADPL44001 Evaluation Kit

Evaluates: ADPL44001

General Description

The ADPL44001 evaluation kit (EV kit) is a fully assembled and tested circuit board that demonstrates the performance of the ADPL44001 high-voltage, ultra-low quiescent current linear regulator. The EV kit operates over a wide input voltage range of 4V to 40V and provides up to 100mA load current. It draws only 8µA supply current under no-load conditions. The device is simple to use and easily configurable with minimal external components. It features overload current protection and thermal shutdown.

The EV kit consists of two circuits: one circuit is installed with the ADPL44001AZT+ in a 6-pin, compact TSOT package. The second circuit is installed with the ADPL44001ATT+ in a 6-pin (3mm x 3mm) TDFN package.

Features and Benefits

- Wide 4V to 40V Input Voltage Range
- Jumper Configurable 12V, 5V, and 3.3V Outputs
- Up to 100mA Load Current Capability
- 8µA No-Load Supply Current
- Active-High, Enable Input
- PGOOD Output for Regulator Output Voltage Monitoring
- Overload Protection
- Overtemperature Protection
- Proven PCB Layout
- Fully Assembled and Tested

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

Quick Start

Required Equipment

- ADPL44001EVKIT# EV kit
- 40V, 0.2A DC power supply
- Electronic load up to 100mA
- Digital voltmeter (DVM)

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 shunts are installed between pins 1 and 2 of jumper JU101 and JU201 (EN).
2. Place a shunt on JU102 or JU103, JU202 or JU203, depending on the desired output voltage (see *Table 2* for details).
3. Set the electronic load to constant-current mode, 100mA, and disable the electronic load.
4. Connect the electronic load's positive terminal to the V_{OUT} PCB pad. Connect the negative terminal to the GND PCB pad.
5. Connect the voltmeter across the V_{OUT} and GND PCB pads.
6. Set the power-supply output to greater than the selected output voltage. Disable the power supply.
7. Connect the power-supply output to the V_{IN} PCB pad. Connect the supply ground to the GND PCB pad.
8. Turn on the power supply.
9. Enable the electronic load and verify that output voltage is at 3.3V or 5V with respect to GND.
10. Vary the input voltage from 4V to 40V.
11. Vary the load current from 1mA to available maximum load current (from thermal dissipation calculation, see the *Available Output Current Calculation* section for more details) and verify that output voltage is 3.3V or 5V with respect to GND.

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

ADPL44001 EV Kit Board Configuration

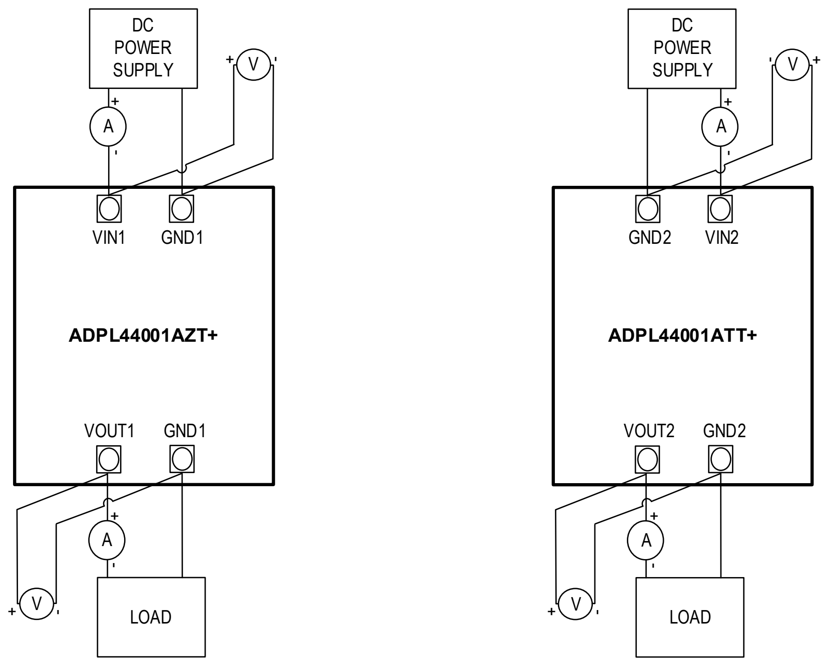


Figure 1. ADPL44001 EV Kit Connections

Detailed Description of Hardware

The ADPL44001EVKIT# is a fully assembled and tested circuit board that demonstrates the performance of the ADPL44001 high-voltage, ultra-low quiescent current linear regulator. The EV kit operates over a wide input-voltage range of 4V to 40V and provides up to 100mA load current. It draws only 8μA supply current under no-load conditions. The EV kit is simple to use and easily configurable with minimal external components. It features overload current protection and thermal shutdown.

The EV kit includes an EN PCB pad and JU101, JU201 to enable control of the converter output. Jumpers JU102, JU202 and JU103, JU203 are provided for selecting the output voltage of the converter. PGOOD PCB pad is available for monitoring the PGOOD output.

Enable Control (JU101, JU201)

The EN PCB pad of the EV kit serves as an on/off control. See Table 1 to configure JU101 or JU201.

Table 1. Enable Control (EN)

JU101 AND JU201 SHUNT POSITION	EN PIN	OUTPUT
1-2*	Connected to VIN	Enabled
2-3	Connected to GND	Disabled

**Default position.*

Active-Low, Open-Drain PGOOD Output (PGOOD)

The EV kit provides a PCB pad to monitor the status of the PGOOD output. PGOOD goes high when the output voltage rises above 92% (typ) of its nominal regulated output voltage. PGOOD goes low when the output voltage falls below 89.5% (typ) of its nominal regulated voltage. The voltage on the PGOOD pin should not exceed 5V. If the output voltage is greater than 5V, calculate the value of resistance R106 or R206 from the following equation:

$$R206 = \frac{500}{V_{OUT} - 5} k\Omega$$

Output Voltage Setting

The output voltage can be programmed from 0.6V to 39V. If the output voltage is neither 5V or 3.3V, calculate the value of R104 or R204 using the following equation. Place a shunt on one of JU102 or JU202, JU103 or JU203, and JU104 or JU204, according to Table 2.

$$R204 = 98.3 \times (V_{OUT} - 0.6) k\Omega$$

Table 2. Output Voltage

OUTPUT VOLTAGE	PLACE SHUNT ON
V_{OUT} = 5V	JU102, JU202*
V_{OUT} = 3.3V	JU103, JU203
User Programmable	JU104
V_{OUT} = 12V	JU204

Default position.

Output Capacitor Selection

The voltage rating of the output capacitor installed on the board C103 is 10V and C203 is 16V. If the programmed output voltage is greater than 10V or 16V, an output capacitor with a higher voltage rating should be installed.

Available Output Current Calculation

Ensure that the junction temperature of the ADPL44001 does not exceed +125°C under the operating conditions specified for the power supply.

At a particular operating condition, the power loss that led to the temperature rise of the part is estimated as follows:

$$P_{LOSS} = (V_{IN} - V_{OUT}) \times I_{LOAD}$$

where, V_{IN} is the input voltage, V_{OUT} is the output voltage, and I_{LOAD} is the load current.

ADPL44001ATT+ Package thermal resistance measured on the ADPL44001EVKIT# EV kit with no airflow is:

$$\theta_{JA} = 42°C/W$$

ADPL44001AZT+ Package thermal resistance measured on the ADPL44001EVKIT# EV kit with no airflow is:

$$\theta_{JA} = 110°C/W$$

The junction temperature of the ADPL44001 can be estimated at any given maximum ambient temperature (T_{A_MAX}) from the equation below:

$$T_J = T_{A\_MAX} + \left(\theta_{JA} \times P_{LOSS}\right)$$

Calculate the maximum allowable output current in mA using the following formula:

$$I_{LOAD(MAX)} = \frac{\left(125 - T_{A\_MAX}\right)}{\theta_{JA} \times (V_{IN} - V_{OUT})}$$

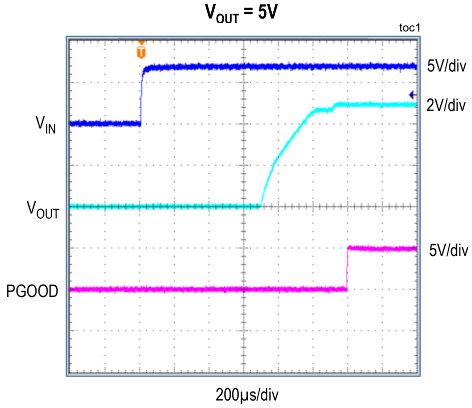
Example: T_{A_MAX} = +70°C, V_{IN} = 24V, V_{OUT} = 5V.

$$I_{LOAD(MAX)} = \frac{(125-70)}{0.042 \times (24-5)} \cong 69mA$$

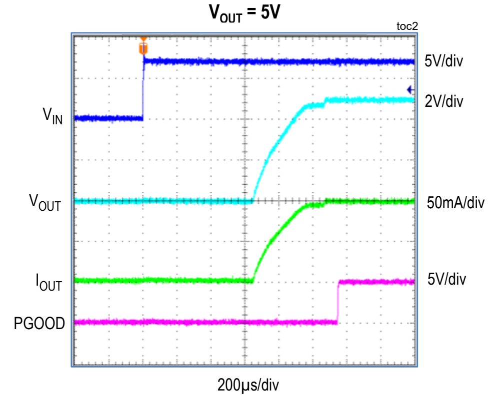
EV Kit Performance

(V_{IN} = 7V, T_A = +25°C, unless otherwise noted.)

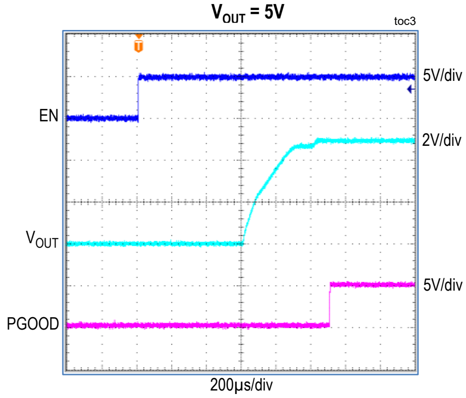
STARTUP RESPONSE WITH NO LOAD
V_{OUT} = 5V



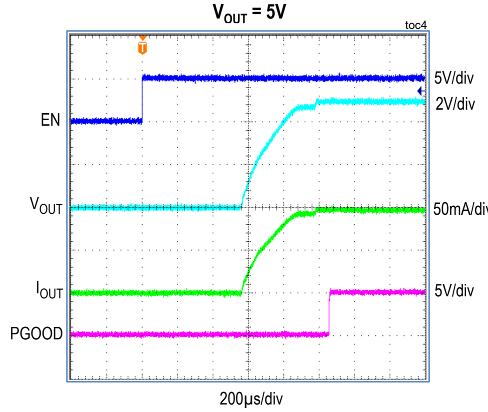
STARTUP RESPONSE WITH 100mA LOAD
V_{OUT} = 5V



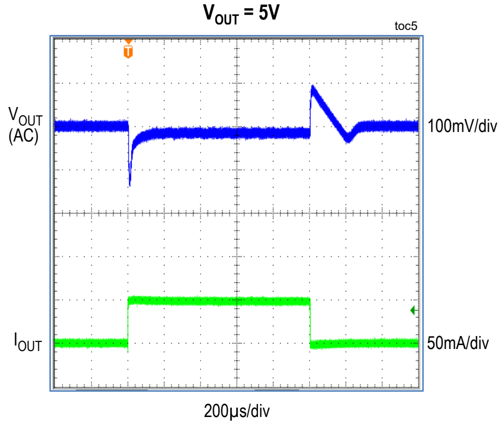
STARTUP RESPONSE WITH ENABLE
NO LOAD
V_{OUT} = 5V



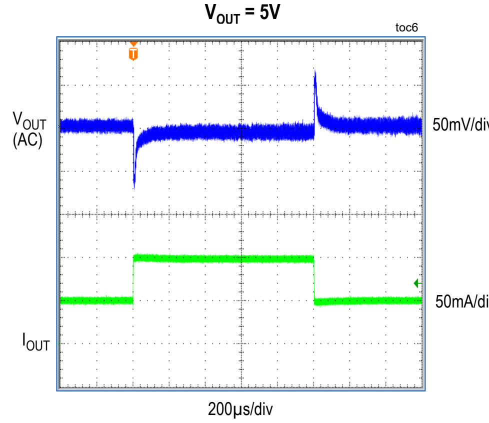
STARTUP RESPONSE WITH ENABLE
AND 100mA LOAD
V_{OUT} = 5V



LOAD TRANSIENT BETWEEN 1mA AND 100mA
V_{OUT} = 5V



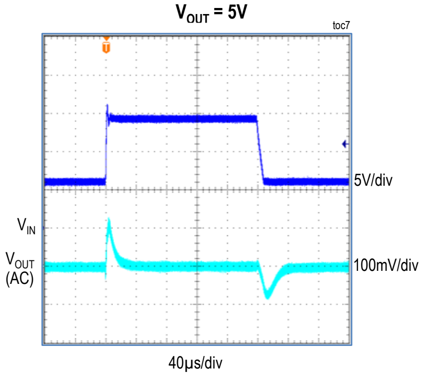
LOAD TRANSIENT BETWEEN 50mA AND 100mA
V_{OUT} = 5V



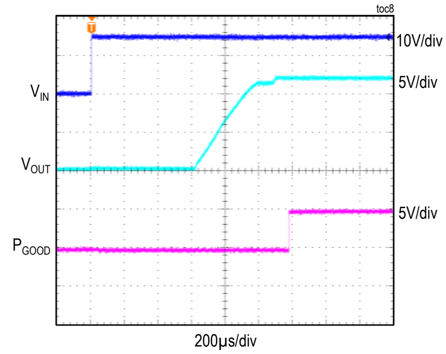
EV Kit Performance (continued)

(V_{IN} = 7V, T_A = +25°C, unless otherwise noted.)

INPUT VOLTAGE STEP RESPONSE
WITH 100mA LOAD CURRENT
V_{OUT} = 5V

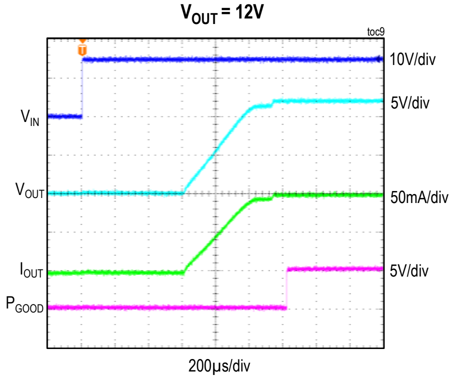


STARTUP RESPONSE WITH NO LOAD
V_{OUT} = 12V



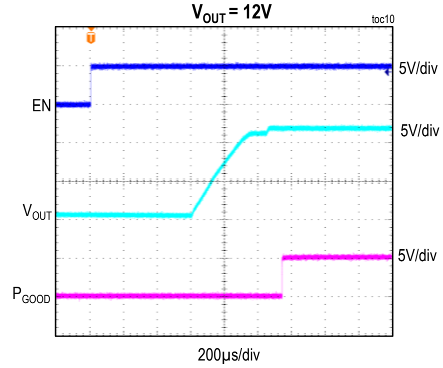
CONDITIONS: V_{IN} = 15V

STARTUP RESPONSE WITH 100mA LOAD
V_{OUT} = 12V



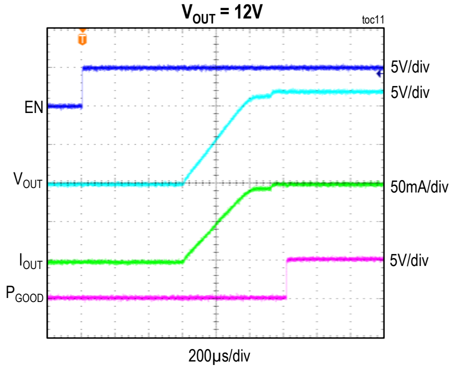
CONDITIONS: V_{IN} = 15V

STARTUP RESPONSE WITH ENABLE
NO LOAD
V_{OUT} = 12V



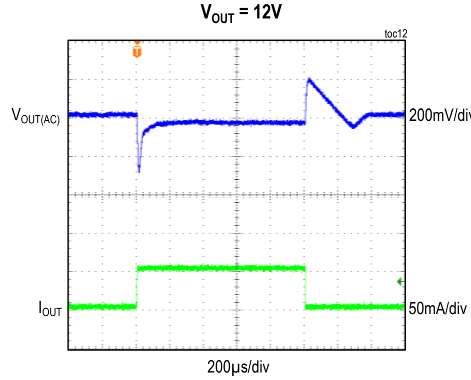
CONDITIONS: V_{IN} = 15V

STARTUP RESPONSE WITH ENABLE
AND 100mA LOAD
V_{OUT} = 12V



CONDITIONS: V_{IN} = 15V

LOAD TRANSIENT BETWEEN 1mA AND 50mA
V_{OUT} = 12V

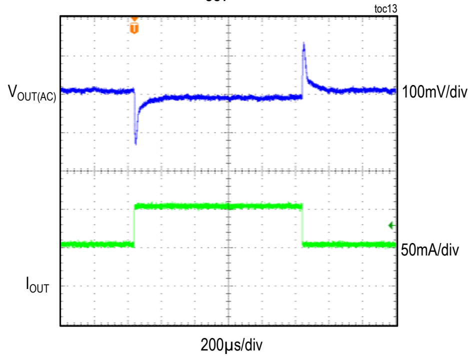


CONDITIONS: V_{IN} = 15V

EV Kit Performance (continued)

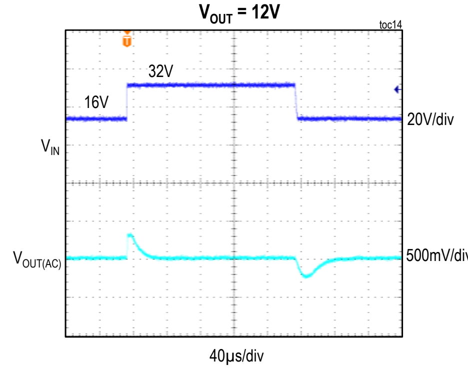
(V_{IN} = 7V, T_A = +25°C, unless otherwise noted.)

LOAD TRANSIENT BETWEEN 50mA AND 100mA
V_{OUT} = 12V

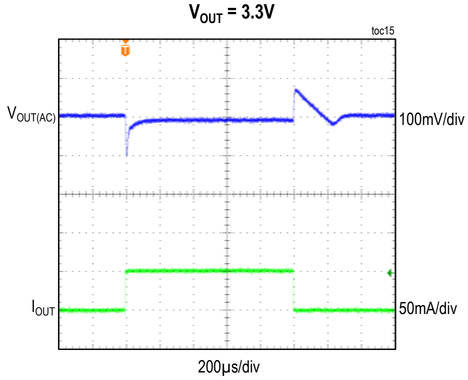


CONDITIONS: V_{IN} = 15V

INPUT VOLTAGE STEP RESPONSE
WITH 100mA LOAD CURRENT
V_{OUT} = 12V

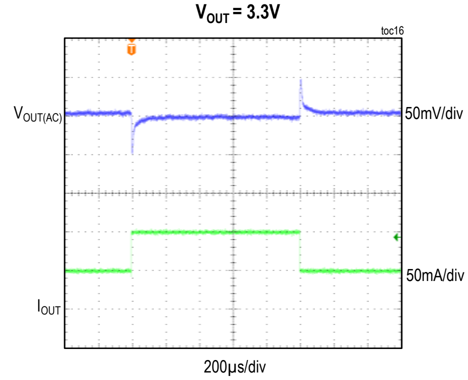


LOAD TRANSIENT BETWEEN 1mA AND 50mA
V_{OUT} = 3.3V



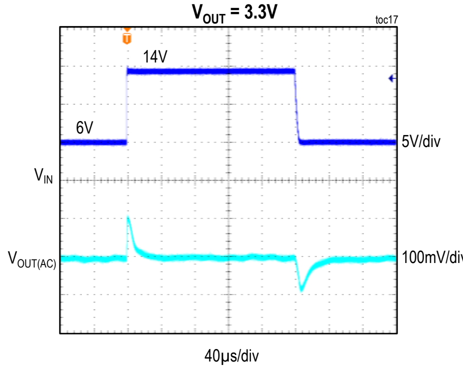
CONDITIONS: V_{IN} = 6V

LOAD TRANSIENT BETWEEN 50mA AND 100mA
V_{OUT} = 3.3V



CONDITIONS: V_{IN} = 6V

INPUT VOLTAGE STEP RESPONSE
WITH 100mA LOAD CURRENT
V_{OUT} = 3.3V



Component Suppliers

SUPPLIER	WEBSITE
Murata Americas	www.murata.com
Panasonic	www.industrial.panasonic.com

Ordering Information

PART	TYPE
ADPL44001EVKIT#	EV Kit

#Denotes RoHS-compliance.

ADPL44001 EV Kit Bill of Materials

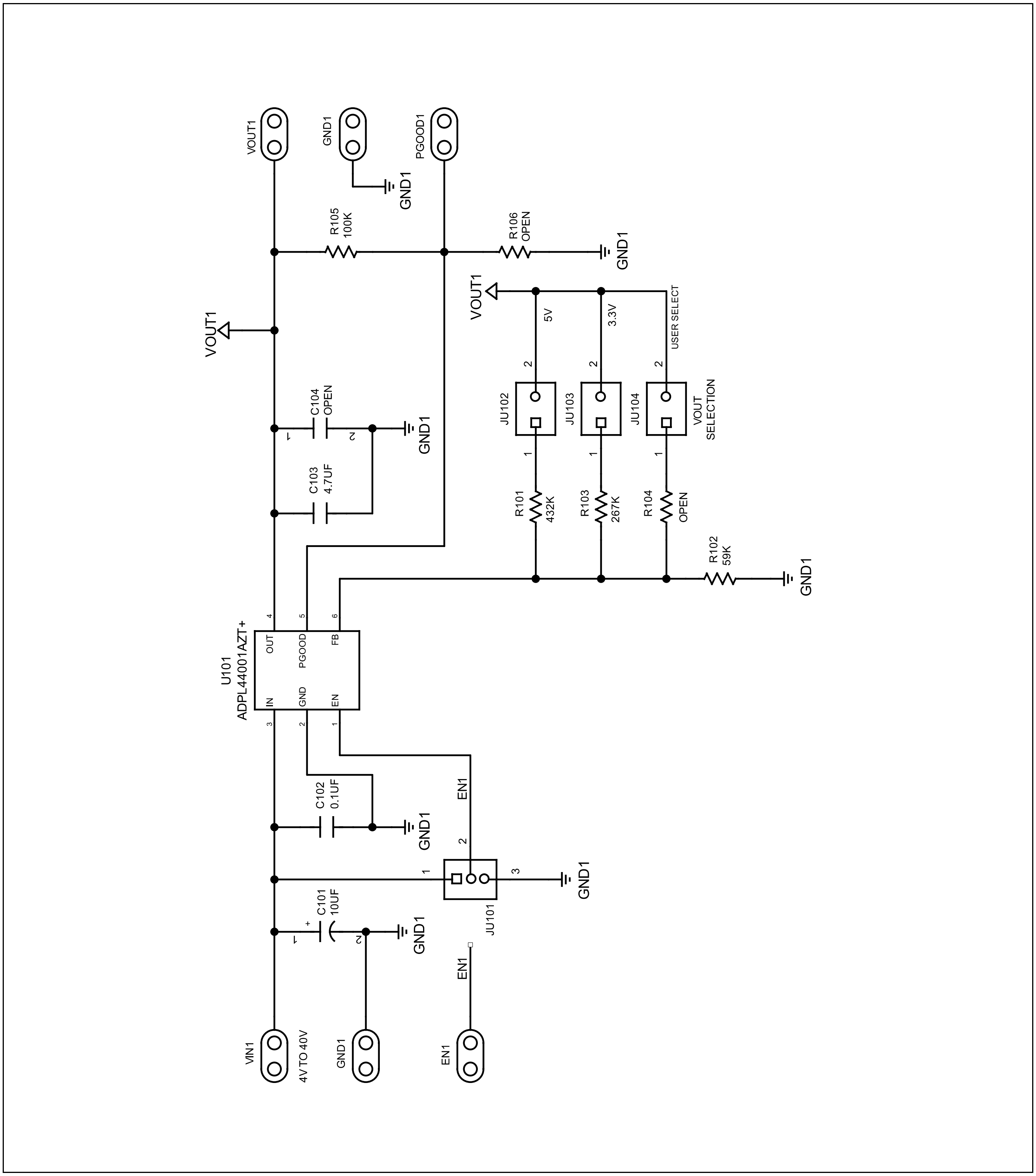
ADPL44001AZT+

ITEM	DESIGNATOR	DESCRIPTION	QTY	MANUFACTURER PART NUMBER
1	C101	10µF ±20%, 80V, Electrolytic Capacitor	1	PANASONIC EEE-FK1K100XP
2	C102	0.1µF ±10%, 100V, X7R, 0603	1	MURATA GRM188R72A104KA35
3	C103	4.7µF ±10%, 10V, X7R, 0805	1	MURATA GRM21BR71A475KA73
4	R101	432kΩ ±1%, 0402	1	
5	R102	59kΩ ±1%, 0402	1	
6	R103	267kΩ ±1%, 0402	1	
7	R105	100kΩ ±1%, 0402	1	
8	U101	4V to 40V, 100mA, Ultra-Low Quiescent Current, Linear Regulator (6 TSOT)	1	ANALOG DEVICES ADPL44001AZT+

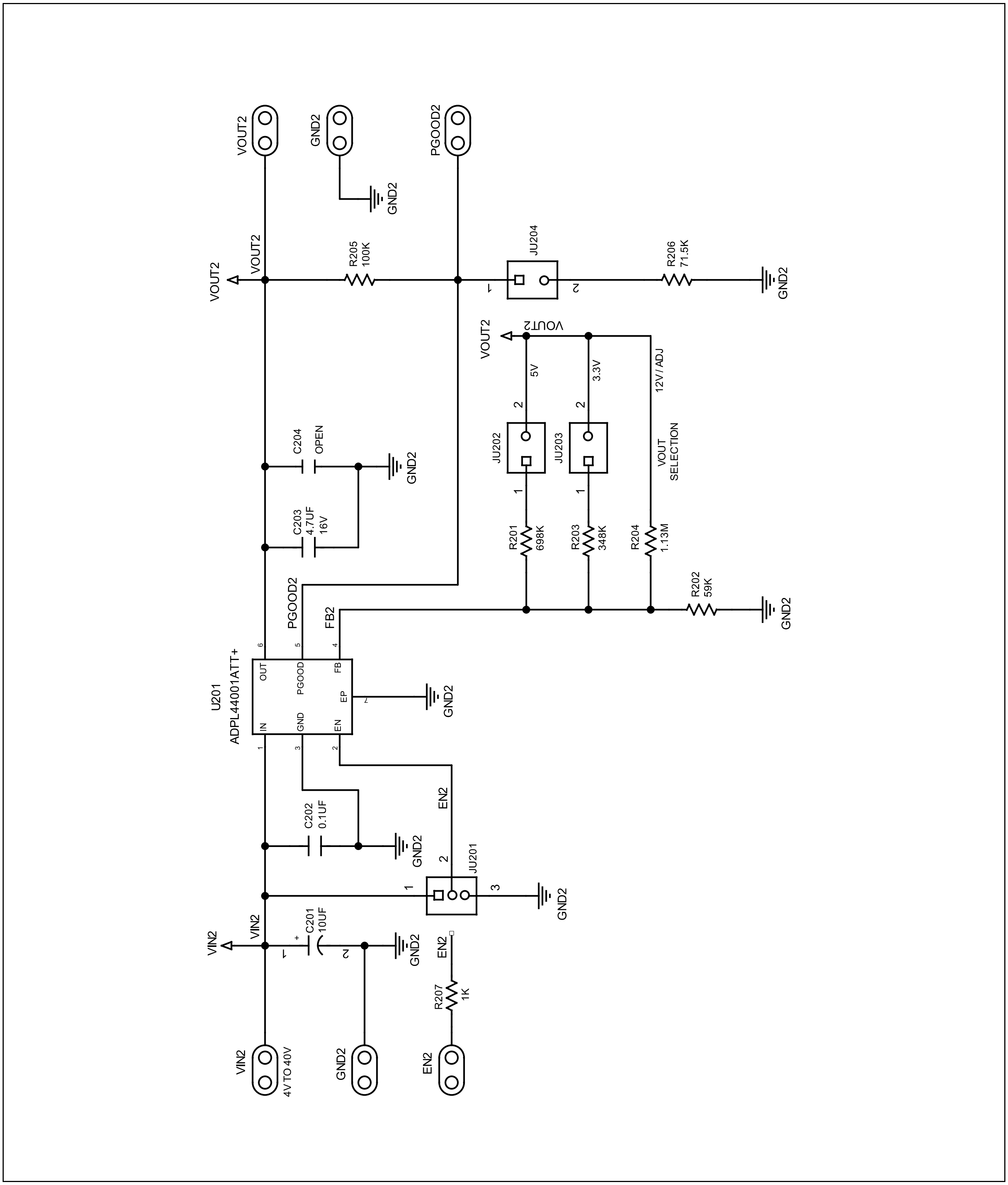
ADPL44001ATT+

ITEM	DESIGNATOR	DESCRIPTION	QTY	MANUFACTURER PART NUMBER
1	C201	10µF ±20%, 80V, Electrolytic Capacitor	1	PANASONIC EEE-FK1K100XP
2	C202	0.1µF ±10%, 100V, X7R, 0603	1	MURATA GRM188R72A104KA35
3	C203	4.7µF ±10%, 16V, X7R, 0805	1	MURATA GRM21BR71C475KA73
4	R201	698kΩ ±1%, 0402	1	
5	R202	59kΩ ±1%, 0402	1	
6	R203	348kΩ ±1%, 0402	1	
7	R204	1.13MΩ ±1%, 0402	1	
8	R205	100kΩ ±1%, 0402	1	
9	R206	71.5kΩ ±1%, 0402	1	
10	R207	1kΩ ±1%, 0402	1	
11	U201	4V to 40V, 100mA, Ultra-Low Quiescent Current, Linear Regulator (6 TDFN-EP)	1	ANALOG DEVICES ADPL44001ATT+

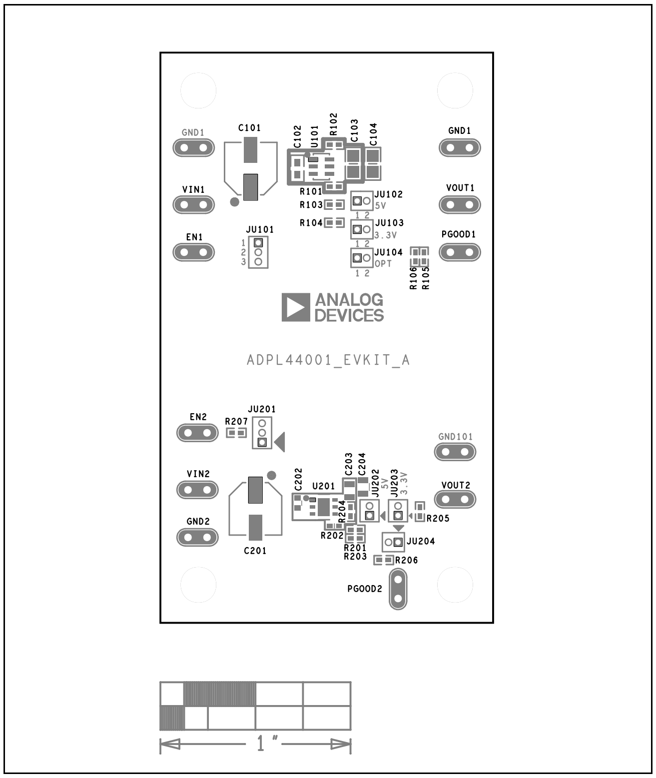
ADPL44001 EV Kit Schematic



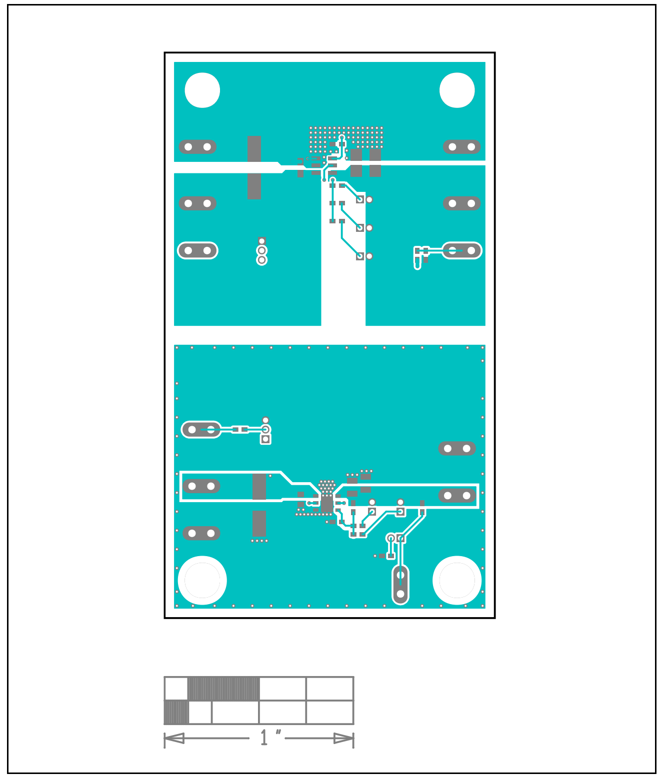
ADPL44001 EV Kit Schematic (continued)



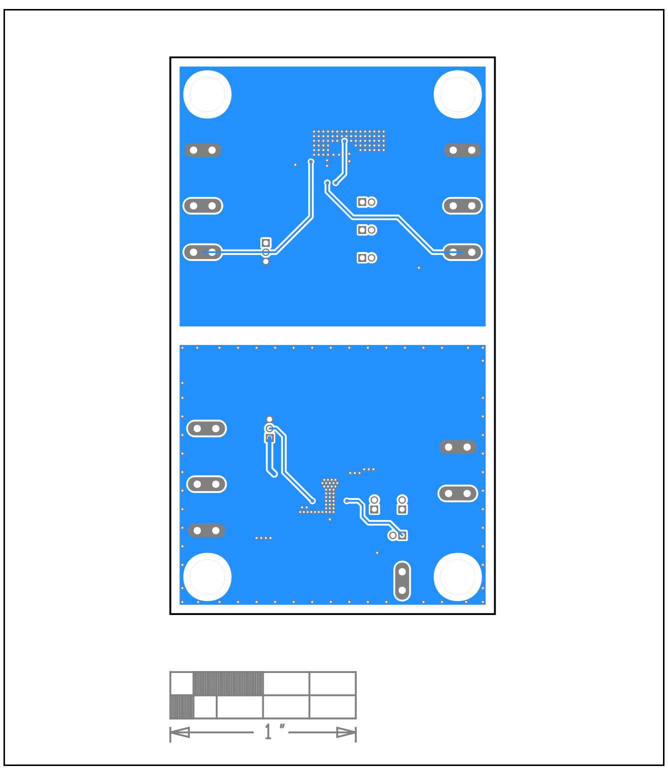
ADPL44001 EV Kit PCB Layout



ADPL44001EVKIT—Top Silkscreen



ADPL44001EVKIT—Layer 1



ADPL44001EVKIT—Layer 2

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	08/24	Initial release	—

Notes