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## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



## EVAL-ADP1706/ADP1707/ADP1708

### FEATURES

- Input voltage range: 2.5 V to 5.5 V**
- Output current range: 0 mA to 1 A**
- Output voltage accuracy:  $\pm 1\%$**
- Operating temperature range:  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$**
- External soft start (ADP1706)**
- Track mode (ADP1707)**
- Adjustable output voltages (ADP1708)**

### GENERAL DESCRIPTION

The ADP1706/ADP1707/ADP1708 evaluation board is used to demonstrate the functionality of the ADP1706, ADP1707, and ADP1708 series of linear regulators. Depending on what component combinations are used, the evaluation board can be used for ADP1706 fixed output voltage devices with soft start, ADP1707 fixed output voltage devices with tracking, or ADP1708 adjustable output voltage devices.

Simple device measurements such as line and load regulation, dropout, and ground current can be demonstrated with just a single voltage supply, a voltage meter, a current meter, and load resistors.

For more details about the [ADP1706/ADP1707/ADP1708](http://www.analog.com) linear regulators, visit [www.analog.com](http://www.analog.com).

### EVALUATION BOARDS

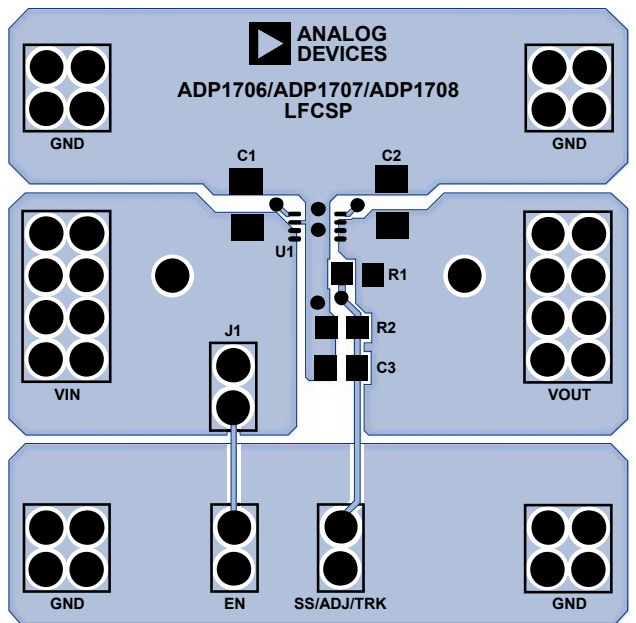


Figure 1. Evaluation Board Layout, LFCSP Package

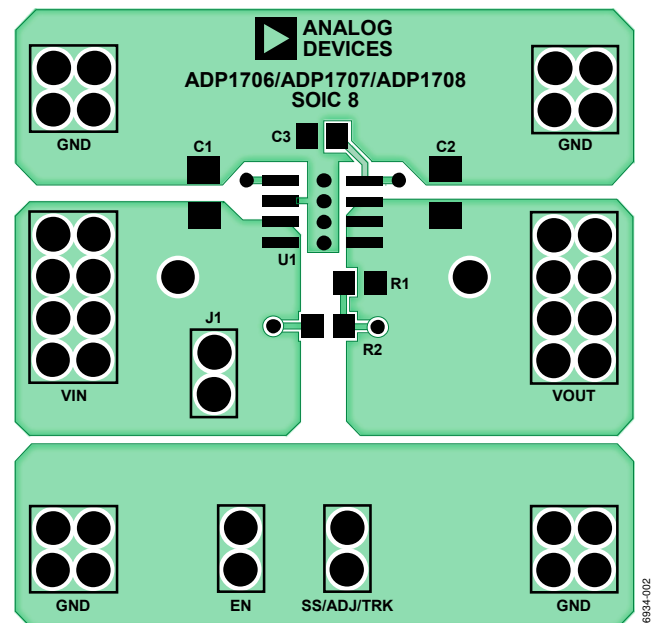


Figure 2. Evaluation Board Layout, SOIC Package

#### Rev. 0

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## REVISION HISTORY

7/07—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE AND SCHEMATIC

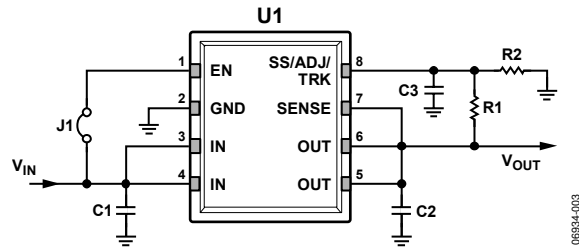


Figure 3. Evaluation Board Schematic

Table 1. Evaluation Board Hardware Components

Component	Function	Description
U1 <sup>1</sup>	Linear regulator	ADP1706/ADP1707/ADP1708 Low Dropout Linear Regulator.
C1	Input capacitor	4.7 $\mu$ F Input Bypass Capacitor.
C2	Output capacitor	4.7 $\mu$ F Output Capacitor. Required for stability and transient performance.
C3 <sup>2</sup>	Soft start capacitor	10 nF Soft Start Capacitor for the ADP1706. Soft start capacitor determines $V_{OUT}$ ramp-up time during startup.
R1, R2 <sup>3</sup>	Output voltage adjust resistors	External Resistors. Used to set $V_{OUT}$ with the ADP1708.
J1	Jumper	Jumper. Connects EN to IN for automatic startup.

<sup>1</sup> Component varies depending on the evaluation board type ordered.

<sup>2</sup> Present only on boards with the ADP1706.

<sup>3</sup> Present only on boards with the ADP1708.

## EVALUATION BOARD CONFIGURATIONS

The ADP1706/ADP1707/ADP1708 evaluation boards come supplied with different components depending on which version is ordered. Components common to all versions are C1, C2, and J1.

### ADP1706 FIXED OUTPUT WITH SOFT START

The evaluation board supplied with the ADP1706 has the additional C3 soft start capacitor. This capacitor controls the rise time when the output voltage starts up. Figure 4 shows the schematic of this evaluation board configuration.

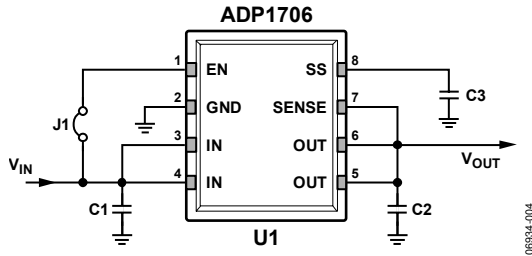


Figure 4. ADP1706 Fixed Output with Soft Start

### ADP1707 FIXED OUTPUT WITH TRACKING

The evaluation board supplied with the ADP1707 does not have C3, R1, or R2 populated. The user can instead connect an external voltage to the SS/ADJ/TRK pad of the evaluation board to use the track function. Figure 5 shows the schematic of this evaluation board configuration.

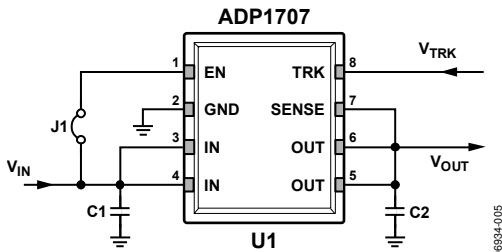


Figure 5. ADP1707 Fixed Output with Tracking

### ADP1708 ADJUSTABLE OUTPUT

The evaluation board supplied with the ADP1708 has additional R1 and R2 resistors to set the output voltage. Figure 6 shows the schematic of this evaluation board configuration.

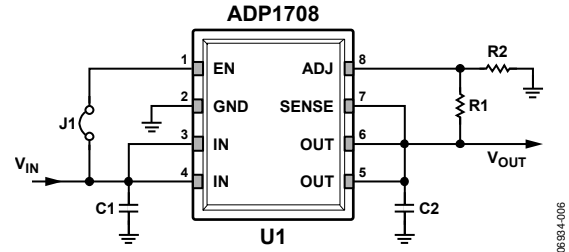


Figure 6. ADP1708 Adjustable Output

The output voltage is set based on the following equation:

$$V_{OUT} = 0.8 V \left( 1 + \frac{R1}{R2} \right)$$

For example, if R1 = 10 kΩ and R2 = 4.99 kΩ, then V<sub>OUT</sub> is 2.403 V.



## OUTPUT VOLTAGE MEASUREMENTS

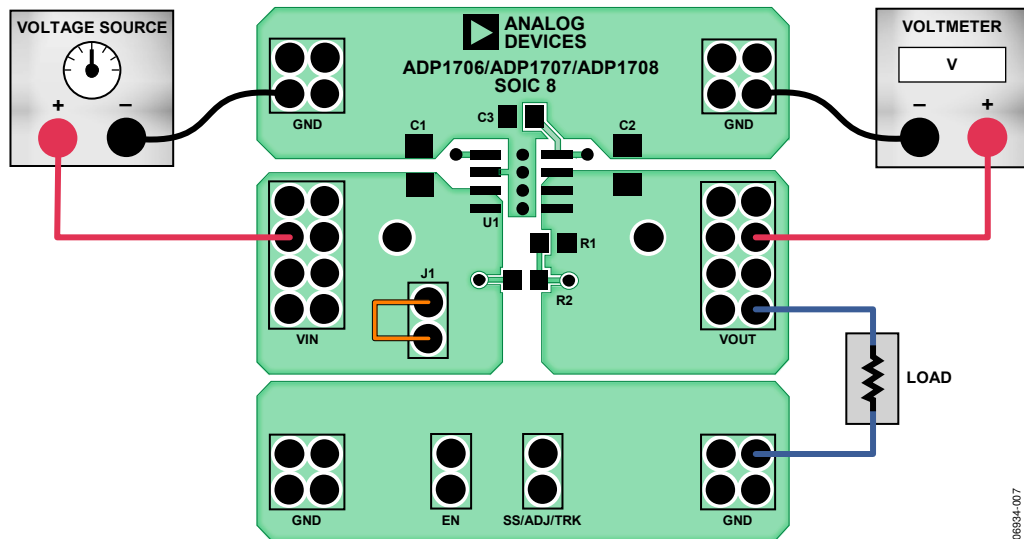


Figure 7. Output Voltage Measurement

Figure 7 shows how the evaluation board can be connected to a voltage source and a voltage meter for basic output voltage accuracy measurements. A resistor can be used as the load for the regulator. Ensure that the resistor has a power rating adequate to handle the power expected to be dissipated across it. An electronic load can also be used as an alternative. Ensure that the voltage source can supply enough current for the expected load levels.

Follow these steps to connect to a voltage source and voltage meter:

1. Connect the negative terminal (-) of the voltage source to one of the GND pads on the evaluation board.
2. Connect the positive terminal (+) of the voltage source to the VIN pad of the evaluation board.
3. Connect a load between the VOUT pad and one of the GND pads.
4. Connect the negative terminal (-) of the voltage meter to one of the GND pads and the positive terminal (+) of the voltage meter to the VOUT pad.
5. The voltage source can now be turned on. If J1 is inserted (this connects EN to VIN for automatic startup), then the regulator powers up.

If the load current is large, the user needs to connect the voltage meter as close as possible to the output capacitor to reduce the effects of IR drops.

## LINE REGULATION

For line regulation measurements, the regulator's output is monitored while its input is varied. For good line regulation, the output must change as little as possible with varying input levels. To ensure that the device is not in dropout during this measurement,  $V_{IN}$  must be varied between  $V_{OUT_{NOM}} + 0.6\text{ V}$  (or 2.5 V, whichever is greater) and  $V_{IN_{MAX}}$ . For example, for an ADP1706 with fixed 3.3 V output,  $V_{IN}$  needs to be varied between 3.9 V and 5.5 V. This measurement can be repeated under different load conditions. Figure 8 shows the typical line regulation performance of an ADP1706 with fixed 3.3 V output.

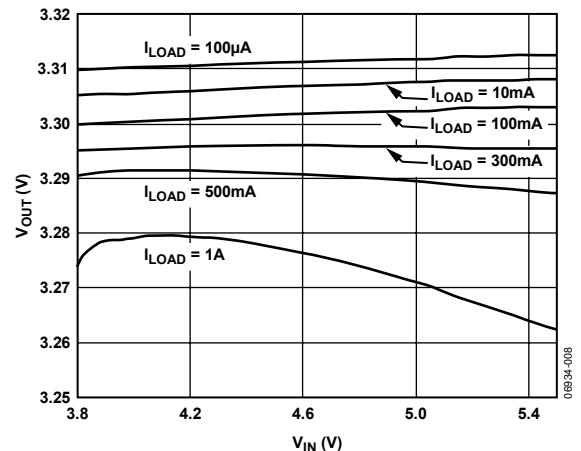


Figure 8. Output Voltage vs. Input Voltage

## LOAD REGULATION

For load regulation measurements, the regulator's output is monitored while the load is varied. For good load regulation, the output must change as little as possible with varying load. The input voltage must be held constant during this measurement. The load current can be varied from 0 mA to 300 mA. Figure 9 shows the typical load regulation performance of an ADP1706 with fixed 3.3 V output for an input voltage of 3.8 V.

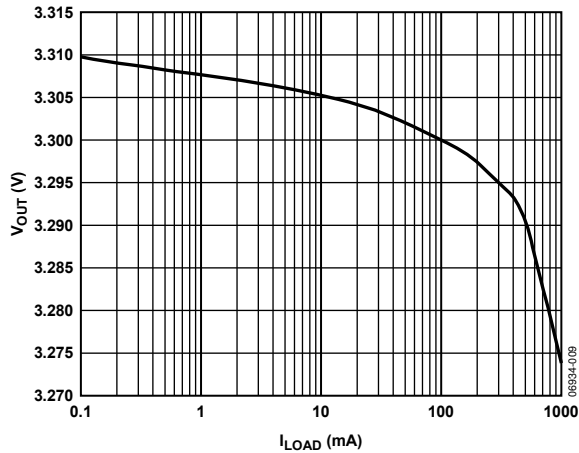


Figure 9. Output Voltage vs. Load Current

## DROPOUT VOLTAGE

Dropout voltage can be measured using the configuration shown in Figure 7. Dropout voltage is defined as the input-to-output voltage differential when the input voltage is set to the nominal output voltage. This applies only for output voltages above 2.5 V. Dropout voltage increases with larger loads. For more accurate measurements, a second voltage meter can be used to monitor the input voltage across the input capacitor. The input supply voltage may need to be adjusted to account for IR drops, especially if large load currents are used. Figure 10 shows a typical curve of dropout voltage measurements with different load currents.

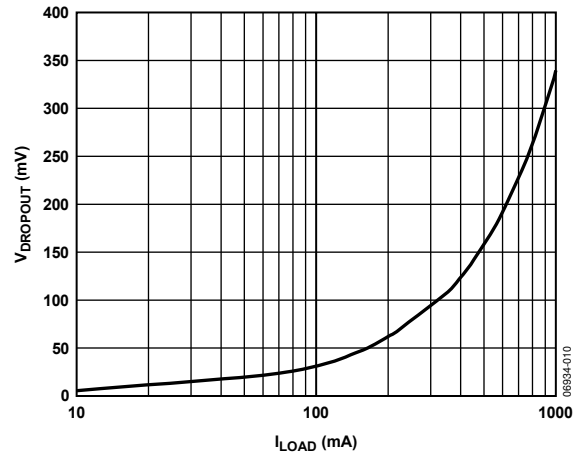


Figure 10. Dropout Voltage vs. Load Current

## GROUND CURRENT MEASUREMENTS

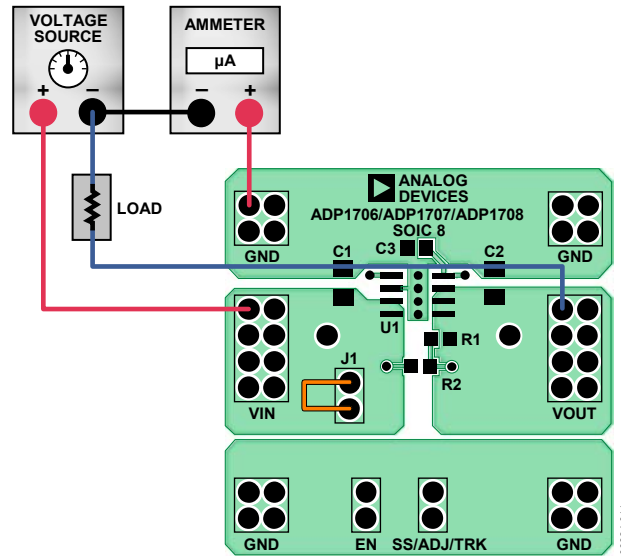


Figure 11. Ground Current Measurement

Figure 11 shows how the evaluation board can be connected to a voltage source and an ammeter for ground current measurements. A resistor can be used as the load for the regulator. Ensure that the resistor has a power rating adequate to handle the power expected to be dissipated across it. An electronic load can be used as an alternative. Ensure that the voltage source used can supply enough current for the expected load levels.

Follow these steps to connect to a voltage source and ammeter:

1. Connect the positive terminal (+) of the voltage source to the VIN pad on the evaluation board.
2. Connect the positive terminal (+) of the ammeter to one of the GND pads of the evaluation board.
3. Connect the negative terminal (-) of the ammeter to the negative (-) terminal of the voltage source.
4. Connect a load between the VOUT pad of the evaluation board and the negative (-) terminal of the voltage source.
5. The voltage source can now be turned on. If J1 is inserted (this connects EN to VIN for automatic startup), then the regulator powers up.

### GROUND CURRENT CONSUMPTION

Ground current measurements are a way of determining how much current the regulator's internal circuits are consuming while performing the regulation function. To be efficient, the regulator needs to consume as little current as possible.

Typically, the regulator uses the maximum current when supplying its largest load level (1 A). Figure 12 shows the typical ground current consumption for various load levels at  $V_{IN} = 3.8$  V.

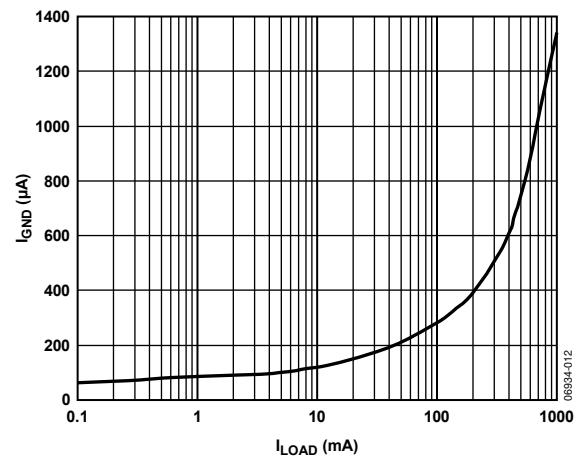


Figure 12. Ground Current vs. Load Current

When the device is disabled ( $EN = GND$ ), ground current drops to less than  $1 \mu A$ .

Note that larger ground current levels occur when using an evaluation board with R1 and R2 present.



# EVAL-ADP1706/ADP1707/ADP1708

## ORDERING INFORMATION

### BILL OF MATERIALS

Table 2.

Qty	Reference Designator	Description	Manufacturer/Vendor	Vendor Part No.
2	C1, C2	Capacitor, MLCC, 2.2 $\mu$ F, 16 V, 0805, X5R	Murata or equivalent	GRM21BR61C225KA88
1	C3	Capacitor, MLCC, 10 nF, 16 V, 0805, X5R	Murata or equivalent	GRM21BR72A103KA01
2	R1, R2	Resistor, 10 k $\Omega$ , 1%, 0805	Vishay Dale or equivalent	CRCW080510K0FKEA
1	J1	Header, single, STR, 2 pins	Digi-Key Corp.	S1012E-36-ND
1	U1	IC, LDO regulator	Analog Devices, Inc.	ADP1706ACPZ-3.3-R7 or ADP1707ACPZ-3.3-R7 or ADP1708ACPZ-R7

### ORDERING GUIDE

Model	Output Voltage	Description
ADP1706-3.3-EVALZ <sup>1</sup>	3.3 V	ADP1706 Fixed 3.3 V Output with Soft Start Evaluation Board
ADP1707-3.3-EVALZ <sup>1</sup>	3.3 V	ADP1707 Fixed 3.3 V Output with Track Mode Evaluation Board
ADP1708-EVALZ <sup>1</sup>	Adjustable, but set to 1.6 V	ADP1708 Adjustable Output Evaluation Board

<sup>1</sup> Z = RoHS Compliant Part.

### ESD CAUTION



**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.