

## Evaluating the **ADP7183** and **ADP7185** Ultralow Noise, High PSRR, Low Dropout Linear Regulators

### FEATURES

Input voltage range:  $-2.0\text{ V}$  to  $-5.5\text{ V}$

Output current range

**ADP7183:**  $0\text{ mA}$  to  $-300\text{ mA}$

**ADP7185:**  $0\text{ mA}$  to  $-500\text{ mA}$

Output voltage accuracy

**ADP7183:**  $\pm 2.6\%$

**ADP7185:**  $\pm 2.2\%$

Operating temperature range:  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$

Adjustable option voltage set with two external resistors

( $R_1$  and  $R_2$ ),  $V_{\text{OUT}} = -0.5\text{ V} \times (1 + R_1/R_2)$

### GENERAL DESCRIPTION

The **ADP7183** and **ADP7185** evaluation boards demonstrate the functionality of the **ADP7183** and **ADP7185** series of linear regulators.

Simple device measurements such as line and load regulation, dropout voltage, and ground current can be demonstrated with only a single voltage supply, a voltmeter, an ammeter, and load resistors.

For full details on the **ADP7183** and **ADP7185** linear regulators, see **ADP7183** and **ADP7185** data sheet, which must be consulted in conjunction with this user guide when using these evaluation boards.

### ADP7183 AND ADP7185 EVALUATION BOARDS

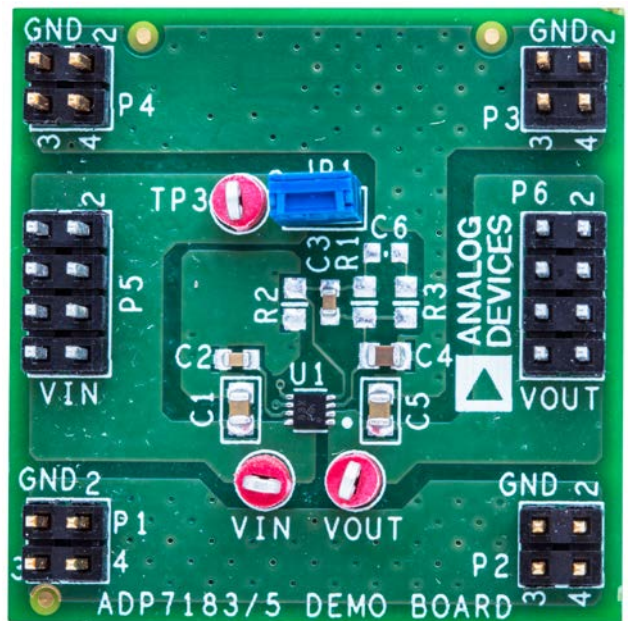


Figure 1. **ADP7183** and **ADP7185** Fixed  $V_{\text{OUT}}$  Board

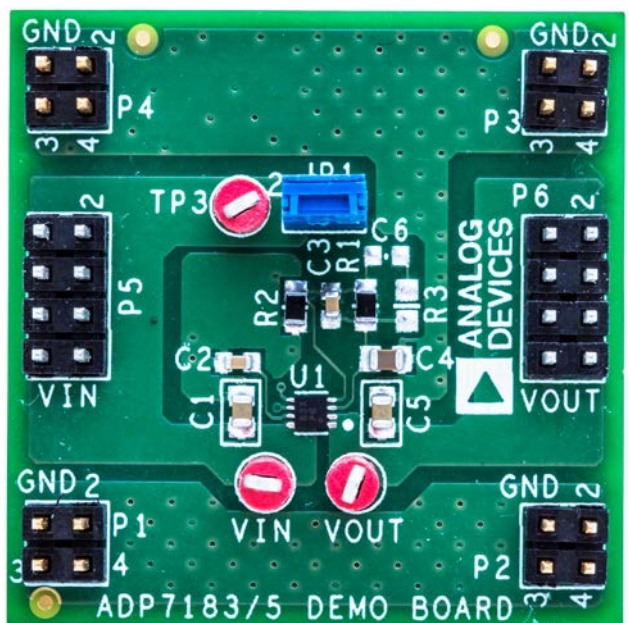


Figure 2. **ADP7183** and **ADP7185** Adjustable  $V_{\text{OUT}}$  Board

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## REVISION HISTORY

### 5/2017—Rev. 0 to Rev. A

Added ADP7185 .....	Throughout
Changes to Title, Features Section, and General Description ....	1
Changes to Figure 1 and Figure 2.....	1
Changes to Figure 5, Load Regulation Measurements Section, and Figure 6.....	5
Changes to Ground Current Consumption Section and Figure 8...	6

### Changed Schematics and Silkscreens Section to Evaluation

Board Schematics and Artwork Section.....	7
Changes to Figure 9 and Figure 10.....	7
Changes to Table 2.....	9

### 10/2016—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE

### EVALUATION BOARD CONFIGURATIONS

The [ADP7183](#) and [ADP7185](#) evaluation boards are supplied with different components, depending on which version (fixed or adjustable) of the evaluation board is ordered. Components common to both versions are C1, C2, C3, C4, C5, and JP1. The R1 and R2 resistors set the output voltage of the adjustable evaluation board. Figure 9 and Figure 10 show the schematics of these evaluation board configurations, and Table 1 describes the hardware components.

The [ADP7183](#) and [ADP7185](#) fixed option uses a  $-3.3$  V output model. Do not connect R1 and R2 for the fixed output option.

The adjustable output of the [ADP7183](#) and [ADP7185](#) has a range of  $-0.5$  V to  $-4.5$  V. The output voltage is set by

$$V_{OUT} = -0.5 \text{ V} \times (1 + R1/R2)$$

With the values shown in Figure 10, the output voltage is approximately  $-2.5$  V.

**Table 1. Evaluation Board Hardware Components**

Component	Description
U1	<a href="#">ADP7183</a> and <a href="#">ADP7185</a> linear regulators. For the fixed output option, U1 uses the $-3.3$ V output option of the <a href="#">ADP7183</a> and <a href="#">ADP7185</a> . For the adjustable output option, U1 uses the adjustable option of the <a href="#">ADP7183</a> and <a href="#">ADP7185</a> and is set to $-2.5$ V.
C1	Input bypass capacitor ( $C_{IN}$ ), $4.7 \mu\text{F}$ , 0805 size.
C2	Regulator capacitor ( $C_{REG}$ ), $1 \mu\text{F}$ , 0603 size.
C3	Output voltage reference feedback capacitor ( $C_{AFB}$ ), $0.01 \mu\text{F}$ , 0603 size.
C4	Low noise reference voltage capacitor ( $C_A$ ), $1 \mu\text{F}$ , 0805 size.
C5	Output capacitor ( $C_{OUT}$ ), $4.7 \mu\text{F}$ , 0805 size.
JP1	Jumper (connects EN to VIN for automatic startup).
R1, R2	Part of the external resistor divider (composed of R1 and R2 that sets the output voltage for the adjustable option).

## VOLTAGE, REGULATION, AND CURRENT MEASUREMENTS

### OUTPUT VOLTAGE MEASUREMENTS

Figure 4 shows how the evaluation boards can be connected to a voltage source and a voltmeter 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 that is adequate to handle the power expected to dissipate 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 the evaluation boards to a voltage source and voltmeter:

1. Connect the positive terminal (+) of the voltage source to one of the GND pads on the evaluation boards.
2. Connect the negative terminal (–) of the voltage source to the VIN pad on the evaluation boards.
3. Connect a load between the VOUT pad and one of the GND pads on the evaluation boards.
4. Connect the positive terminal (+) of the voltmeter to the VOUT pad on the evaluation boards.
5. Connect the negative terminal (–) of the voltmeter to one of the GND pads on the evaluation boards.

When these steps are completed, the voltage source can be turned on. If J1 is inserted (connecting EN to VIN for automatic startup), the regulator powers up.

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

### DROPOUT VOLTAGE MEASUREMENTS

Use the configuration shown in Figure 4 to measure the dropout voltage. The dropout voltage is defined as the input to output voltage differential when the input voltage is set to the nominal output voltage. The ADP7183 and ADP7185 enter dropout mode only for output voltages of at least –2.5 V. For lower voltage outputs, the ADP7183 and ADP7185 enter undervoltage lockout (UVLO) and shuts down. The dropout voltage increases with larger loads.

For accurate measurements, use a second voltmeter to monitor the input voltage across the input capacitor. The input supply voltage may need adjusting to account for IR drops, especially when using large load currents. Figure 3 shows the typical curve of the dropout voltage measurements with different load currents.

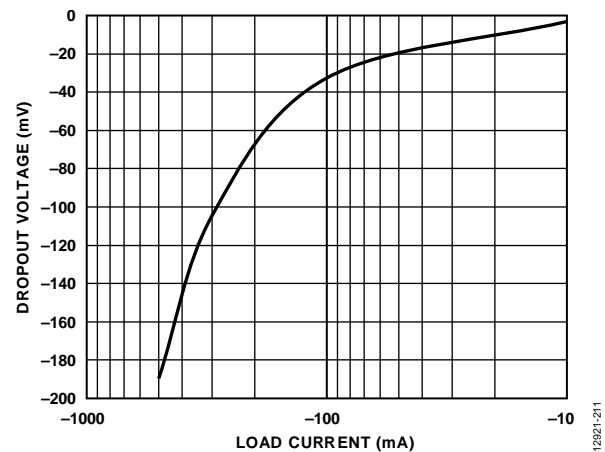


Figure 3. Dropout Voltage vs. Load Current ( $I_{LOAD}$ ),  $V_{OUT} = -3.3$  V,  $T_A = 25^\circ\text{C}$

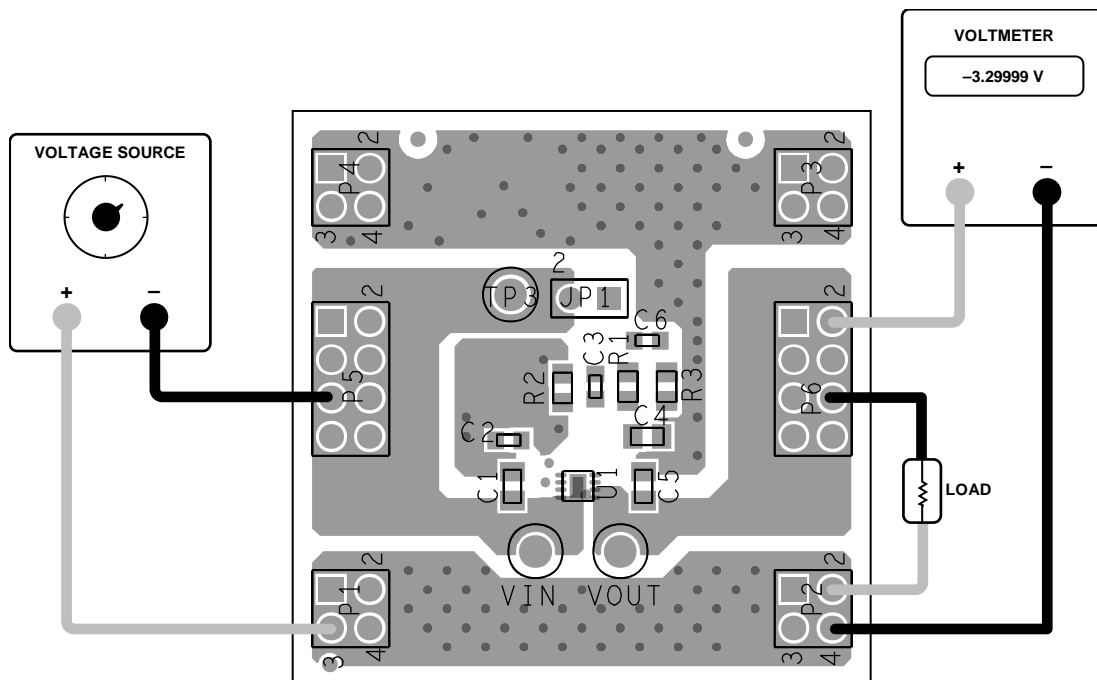


Figure 4. Output Voltage Measurement Setup

## LINE REGULATION MEASUREMENTS

For line regulation measurements, the output of the regulator is monitored while its input is varied. For optimal line regulation, the output must change as little as possible with varying input levels. To ensure that the device is not in dropout mode during line regulation measurement,  $V_{IN}$  must be varied between  $V_{OUT} - 0.5$  V (or  $-2$  V, whichever is greater) and  $-5.5$  V. For example, for an ADP7183 or ADP7185 with a fixed  $-3.3$  V output,  $V_{IN}$  must vary between  $-3.8$  V and  $-5.5$  V. Note that this measurement can be repeated under different load conditions. Figure 5 shows the typical line regulation performance of an ADP7183 or ADP7185 with a fixed  $-3.3$  V output.

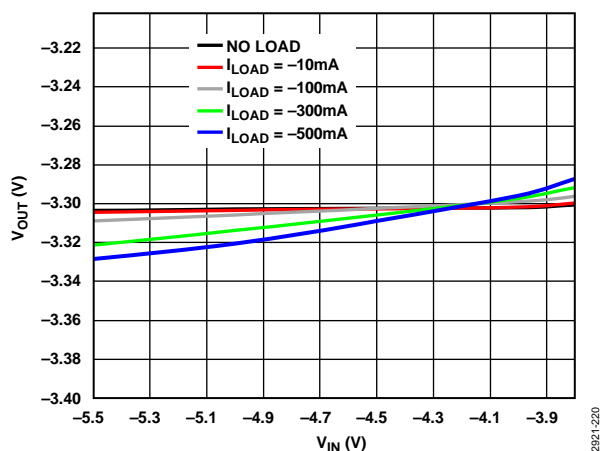


Figure 5. Output Voltage ( $V_{OUT}$ ) vs. Input Voltage ( $V_{IN}$ ) at  $V_{OUT} = -3.3$  V,  $T_A = 25^\circ\text{C}$

## LOAD REGULATION MEASUREMENTS

For load regulation measurements, while the load varies, monitor the output of the regulator. For optimal load regulation, the output must change as little as possible with varying loads. Hold the input voltage constant during load regulation measurement. The load current can be varied from 0 mA to  $-300$  mA for the ADP7183 and from 0 mA to  $-500$  mA for the ADP7185. Figure 6 shows the typical load regulation performance of an ADP7183 or ADP7185 with a fixed  $-3.3$  V output for an input voltage of  $-3.8$  V.

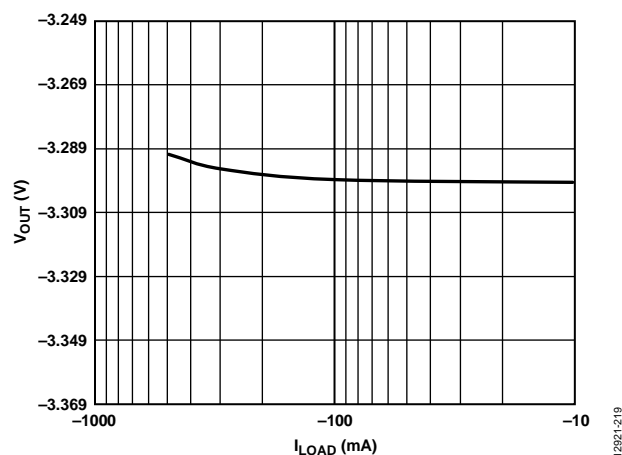


Figure 6. Output Voltage ( $V_{OUT}$ ) vs. Load Current ( $I_{LOAD}$ ) at  $V_{IN} = -3.8$  V,  $V_{OUT} = -3.3$  V,  $T_A = 25^\circ\text{C}$

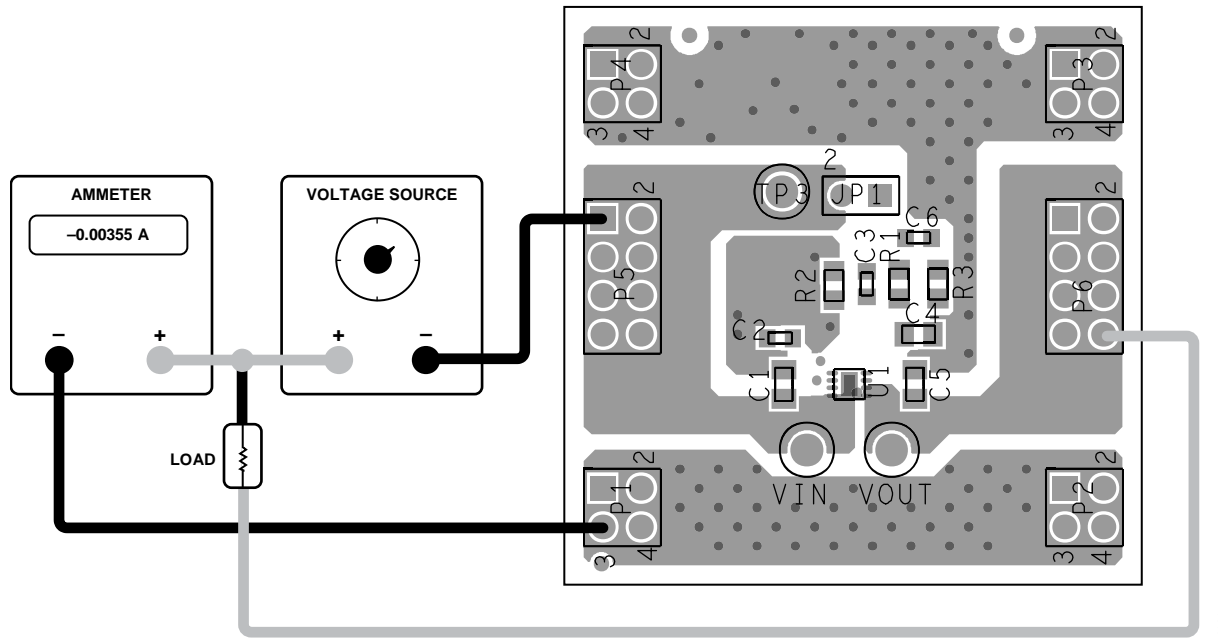


Figure 7. Ground Current Measurement Setup

## GROUND CURRENT MEASUREMENTS

Figure 7 shows how to connect the [ADP7183](#) and [ADP7185](#) evaluation board to a voltage source and an ammeter for ground current measurements.

Use a resistor as the load for the regulator. Ensure that the resistor has a power rating that is adequate to handle the power expected to dissipate across it. As an alternative, use an electronic load. Ensure that the voltage source can supply enough current for the expected load levels.

Follow these steps to connect the evaluation board to a voltage source and ammeter:

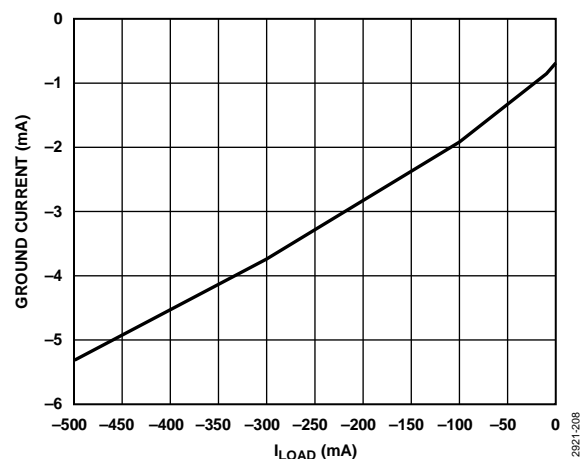
1. Connect the negative terminal (–) of the voltage source to the VIN pad on the evaluation board.
2. Connect the negative terminal (–) of the ammeter to one of the GND pads of the evaluation board.
3. Connect the positive terminal (+) of the ammeter to the positive terminal (+) of the voltage source.
4. Connect a load between the positive terminal (+) of the voltage source and the VOUT pad of the evaluation board.

When these connection steps are completed, turn on the voltage source. If J1 is inserted (connecting EN to VIN for automatic startup), the regulator powers up.

## Ground Current Consumption

Ground current measurements can determine how much current the internal circuits of the regulators consume while the circuits perform the regulation function. To be efficient, the regulators must consume as little current as possible. Typically, the regulators use the maximum current when supplying their largest load level (–300 mA for the [ADP7183](#) and –500 mA for the [ADP7185](#)). Figure 8 shows the typical ground current consumption for the various load levels at  $V_{OUT} = -3.3\text{ V}$  and  $T_A = 25^\circ\text{C}$ .

When the device is disabled (EN = GND), the ground current drops to less than  $2\text{ }\mu\text{A}$ .

Figure 8. Ground Current vs. Load Current ( $I_{LOAD}$ ),  $V_{OUT} = -3.3\text{ V}$ ,  $T_A = 25^\circ\text{C}$

## EVALUATION BOARD SCHEMATICS AND ARTWORK

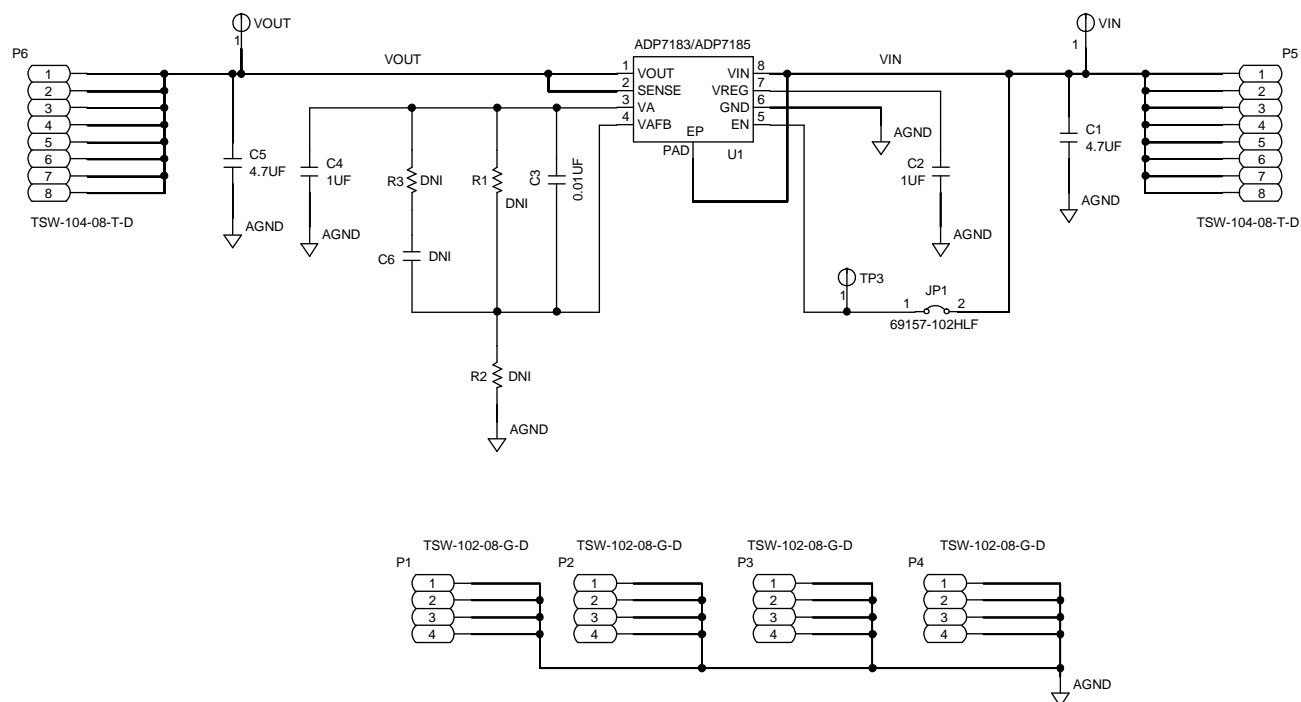


Figure 9. ADP7183 and ADP7185 Evaluation Board Fixed Output Schematic

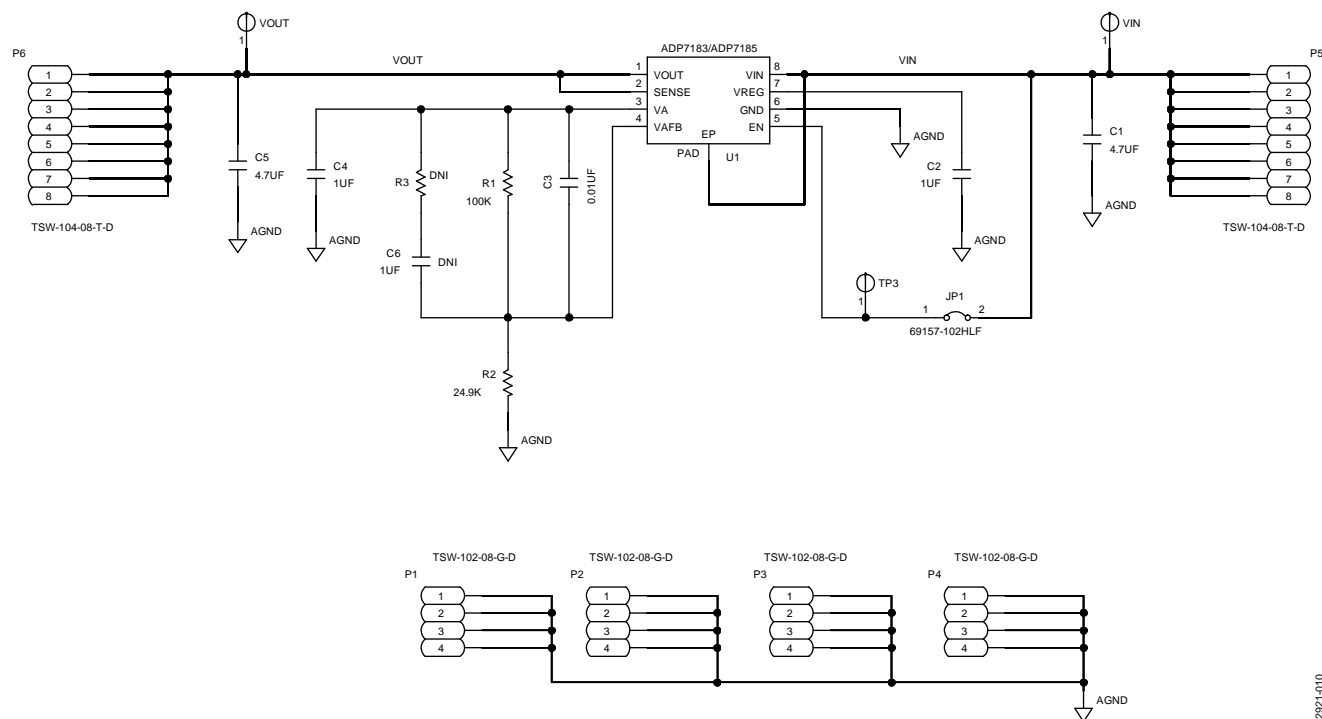


Figure 10. ADP7183 and ADP7185 Evaluation Board Adjustable Output Schematic

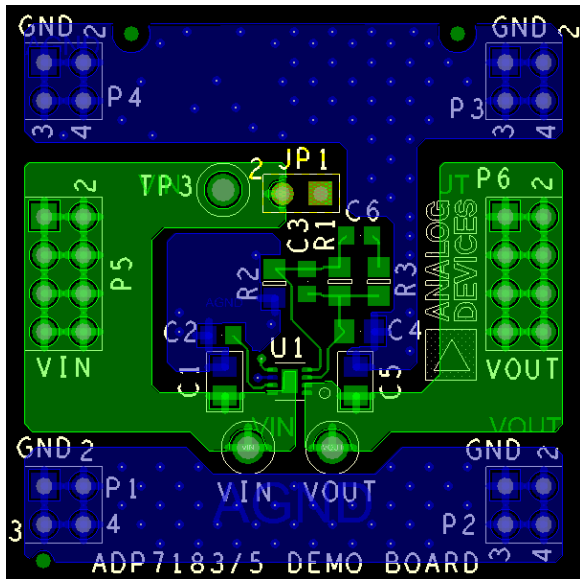


Figure 11. ADP7183 and ADP7185 Evaluation Board Top Layer

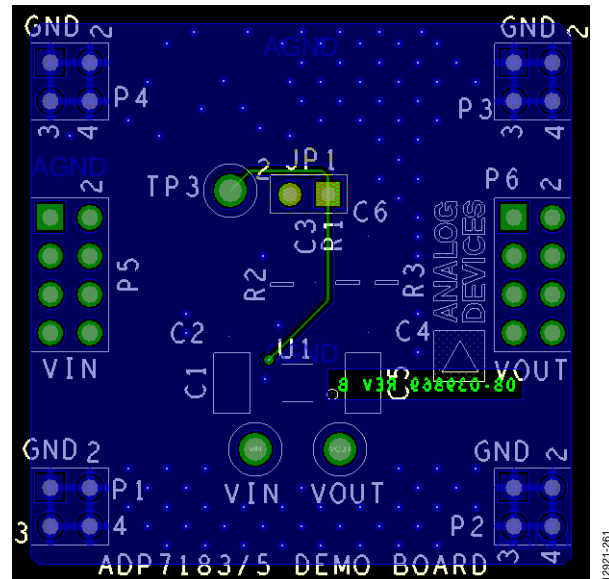


Figure 12. ADP7183 and ADP7185 Evaluation Board Bottom Layer



## ORDERING INFORMATION

### BILL OF MATERIALS

Table 2.

Reference Designator	Description	Manufacturer	Part No.
C1, C5	Capacitors, multilayer ceramic capacitor (MLCC), 4.7 $\mu$ F, 25 V, 0805, X5R	Murata (or equivalent)	GRM21BR61E475KA12L
C2	Capacitor, MLCC, 1 $\mu$ F, 25 V, 0603, X5R	Murata (or equivalent)	GRM188R61E105KA12D
C3	Capacitor, MLCC, 0.01 $\mu$ F, 16 V 0603, X7R	Murata (or equivalent)	GRM188R71C103KA
C4	Capacitor, MLCC, 1 $\mu$ F, 25 V, 0805, X7R	Murata (or equivalent)	GCM21BR71E105KA56L
C6	Do not install (DNI)	Not applicable	Not applicable
JP1	Header/jumper, single, straight, two pins	FCI	69157-102HLF
R1	Resistor, 0805, 100 k $\Omega$ , 1% tolerance (do not install on the fixed model)	Any manufacturer	Depends on manufacturer
R2	Resistor, 0805, 24.9 k $\Omega$ , 1% tolerance (do not install on the fixed model)	Any manufacturer	Depends on manufacturer
R3	Do not install (DNI)	Not applicable	Not applicable
U1	Analog Devices IC, ultralow noise, high PSRR, LDO linear regulators that include the following devices: <a href="#">ADP7183-3.3-EVALZ</a> <a href="#">ADP7183-ADJ-EVALZ</a> <a href="#">ADP7185-3.3-EVALZ</a> <a href="#">ADP7185-ADJ-EVALZ</a>	Analog Devices, Inc.	<a href="#">ADP7183ACPZN3.3-R7</a> <a href="#">ADP7183ACPZN-R7</a> <a href="#">ADP7185ACPZN3.3-R7</a> <a href="#">ADP7185ACPZN-R7</a>

**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.

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