

## User Guide for ADP322/ADP323 Evaluation Board

### FEATURES

**Bias voltage range ( $V_{BIAS}$ ): 2.5 V to 5.5 V**

**LDO input voltage range ( $V_{IN1}/V_{IN2}, V_{IN3}$ ): 1.8 V to 5.5 V**

**Output current range: 0 mA to 200 mA per output**

**Output voltage accuracy:  $\pm 1\%$**

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

### GENERAL DESCRIPTION

The [ADP322/ADP323](#) evaluation board is used to demonstrate the functionality of the ADP322/ADP323 series of linear regulators.

Simple device measurements, such as line and load regulation, dropout voltage, and ground current, can be demonstrated with two voltage supplies, a few voltmeters, current meters, and load resistors.

For more details about the ADP322/ADP323 linear regulators, see the ADP322/ADP323 data sheet.

### EVALUATION BOARD

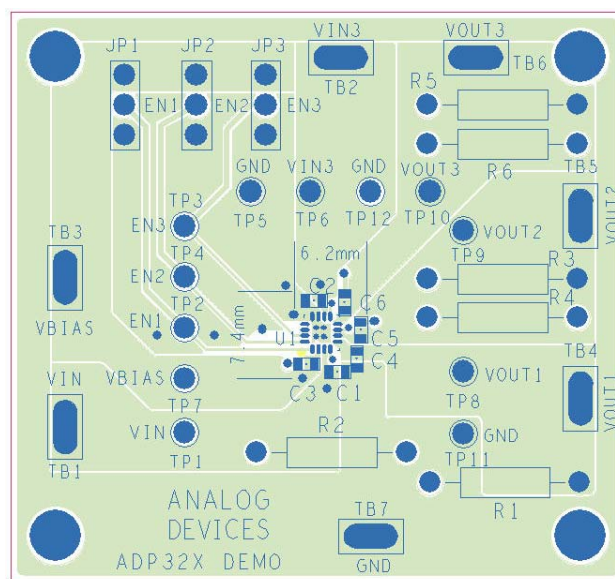


Figure 1. ADP322/ADP323 Evaluation Board

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REVISION HISTORY

10/10—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE AND SCHEMATIC

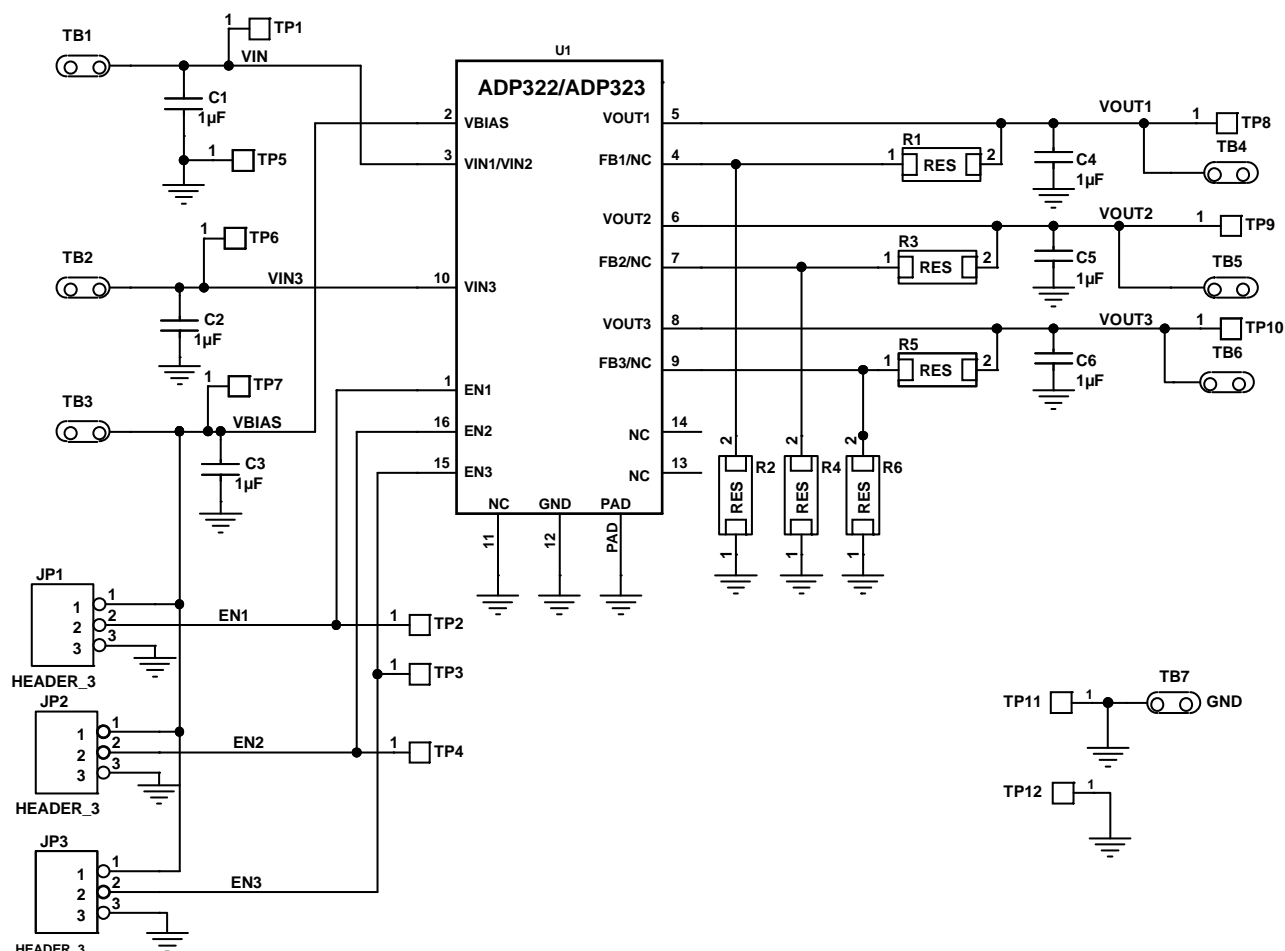


Figure 2. ADP322/ADP323 Evaluation Board Schematic

09259-002

Table 1. Evaluation Board Hardware Components

Component	Function	Description
U1 <sup>1</sup>	Linear regulator	ADP322/ADP323 low dropout linear regulator.
C1, C2, C3, C4, C5, C6	Input capacitor	1 µF input bypass capacitor, 0402 or 0603 case.
JP1, JP2, JP3	3-pin jumper	These jumpers connect EN1, EN2, and EN3 to VBIAS for automatic startup.
R1, R2, R3, R4, R5, R6	Resistor	Resistors for setting output voltage for the ADP323, 0603 size. Short R1, R3, and R5 to connect the output voltage to the feedback input for the ADP322.

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

## OUTPUT VOLTAGE MEASUREMENTS

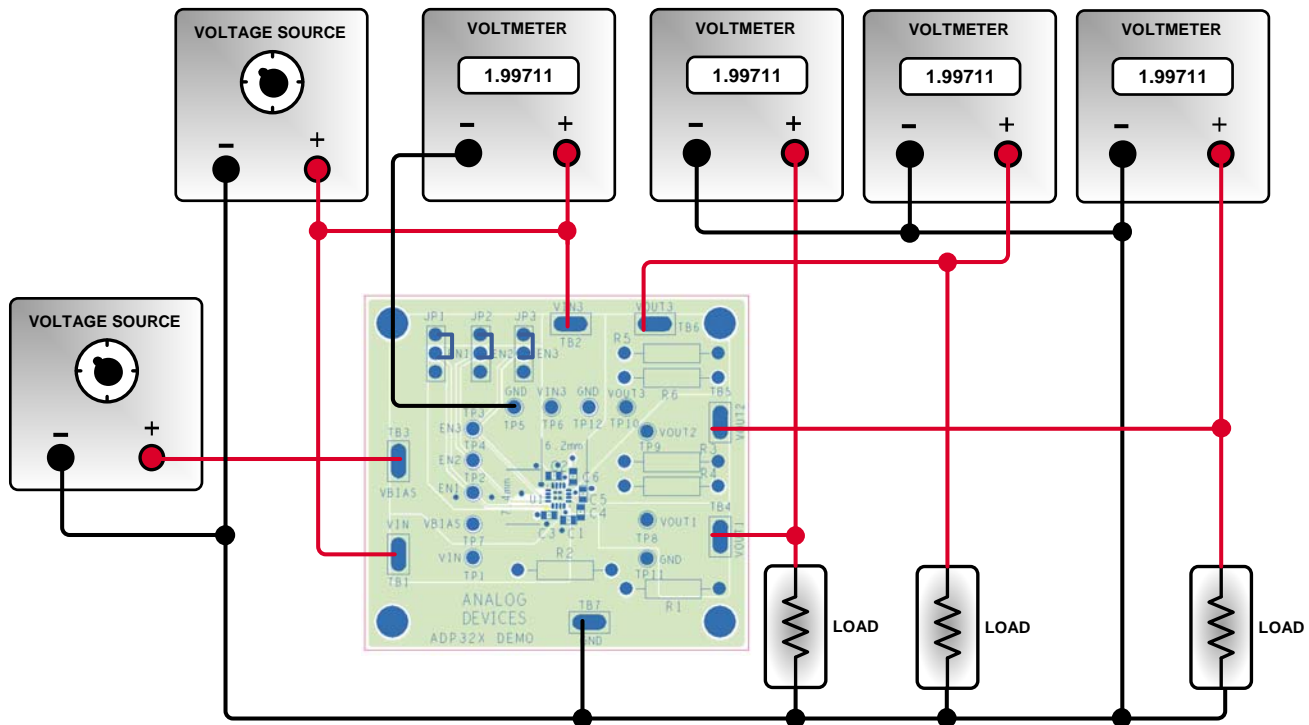


Figure 3. Output Voltage Measurement Setup

Figure 3 shows how the evaluation board can be connected to a voltage source and voltmeters 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 be used as an alternative. In addition, ensure that the voltage source can supply enough current for the expected load levels.

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

1. Insert R1, R2, R3, R4, R5, and R6 to set voltages for an [ADP323](#). If an [ADP322](#) is used, short R1, R3, and R5 to connect the output voltages to the feedback input for each LDO.
2. Insert Jumpers JP1, JP2, and JP3 for automatic startup.
3. Connect the negative terminal (–) of the voltage sources to one of the GND pads on the evaluation board.
4. Connect the positive terminal (+) of the main voltage source to the VIN and VIN3 pads of the evaluation board.
5. Connect the positive terminal (+) of the bias voltage source to the VBIAS pad of the evaluation board. Set the bias voltage supply to a voltage from 2.5 V to 5.5 V.
6. Connect a load between VOUT1, VOUT2, and/or VOUT3 and one of the GND pads.

7. Connect the negative terminal (–) of the voltmeters to one of the GND pads.
8. Connect the positive terminal (+) of the voltmeters to VOUT1, VOUT2, and/or VOUT3 and VIN/VIN3.

The voltage sources can now be turned on.

### LINE REGULATION MEASUREMENTS

For line regulation measurements, the regulator's outputs are monitored while its input is varied. For good line regulation, the outputs must change as little as possible with varying input levels. To ensure that the device is not in dropout mode during this measurement,  $V_{IN}$  must be varied between  $V_{OUTNOM} + 0.5\text{ V}$  (or 1.8 V, whichever is greater) and  $V_{INMAX}$ , where  $V_{OUTNOM}$  is the highest of the three output voltages. For example, for an ADP322/ADP323 with a fixed 1.8 V output,  $V_{IN}$  must be varied between 2.3 V and 5.5 V. This measurement can be repeated under different load conditions. Figure 4 shows the typical line regulation performance of the ADP322/ADP323 with a fixed 1.8 V output.

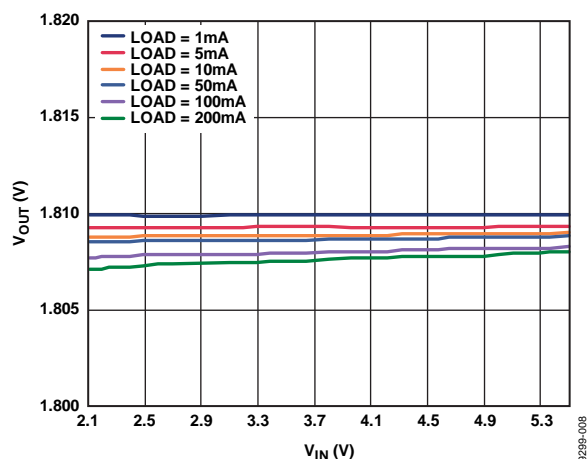


Figure 4. Output Voltage vs. Input Voltage

### LOAD REGULATION MEASUREMENTS

For load regulation measurements, the regulator's outputs are monitored while the loads are varied. For good load regulation, the outputs must change as little as possible with varying load. The input voltage must be held constant during this measurement. The load currents can be varied from 0 mA to 200 mA per output. Figure 5 shows the typical load regulation performance of a single 1.8 V output of the [ADP322/ADP323](#) for an input voltage of 2.3 V to 5.5 V.

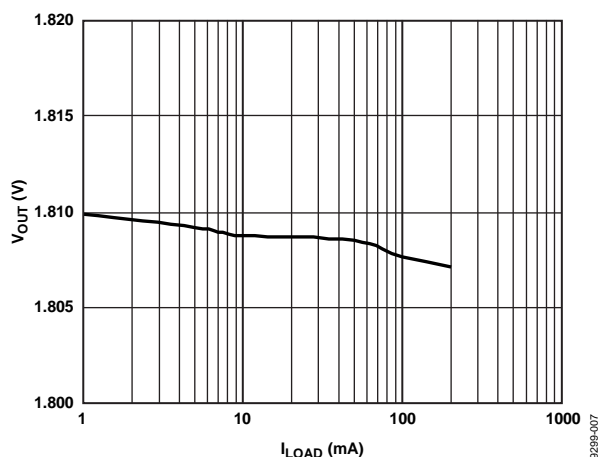
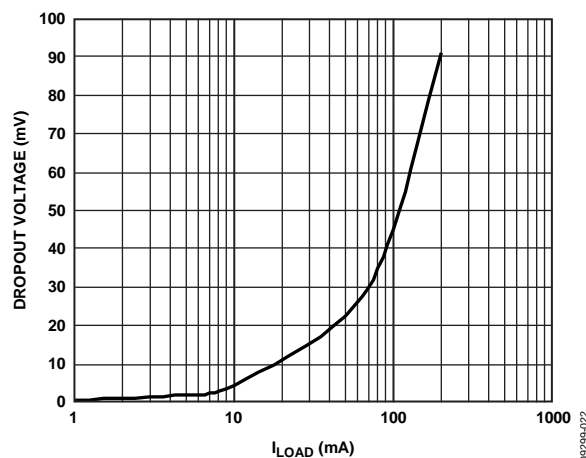


Figure 5. Output Voltage vs. Load Current

### DROPOUT VOLTAGE MEASUREMENTS

Dropout voltage can be measured using the configuration shown in Figure 3. 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 to output voltages above 1.8 V. Dropout voltage increases with larger loads.

For more accurate measurements, an additional voltmeter 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 6 shows the typical curve of the dropout voltage measurement with different load currents.

Figure 6. Dropout Voltage vs. Load Current,  $V_{OUT} = 3.3\text{ V}$

## GROUND AND BIAS CURRENT MEASUREMENTS

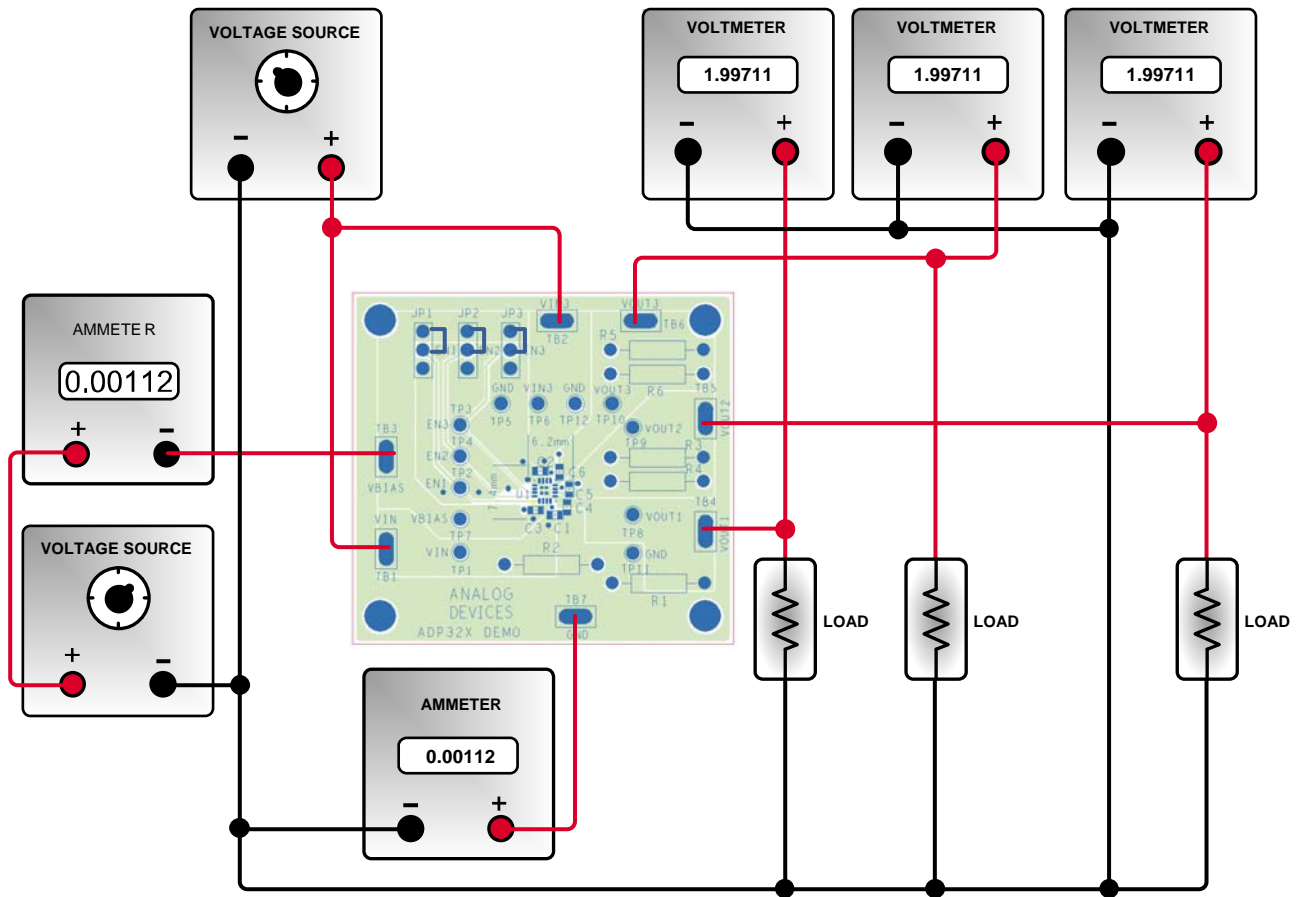


Figure 7. Ground and Bias Current Measurements Setup

Figure 7 shows how the evaluation board can be connected to a voltage source and ammeters for ground and bias 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 can supply enough current for the expected load levels.

Use the following steps to connect to a voltage source and ammeters:

1. Insert R1, R2, R3, R4, R5, and R6 to set voltages for an [ADP323](#). If an [ADP322](#) is used, short R1, R3, and R5 to connect the output voltages to the feedback input for each LDO.
2. Insert Jumpers JP1, JP2, and JP3 for automatic startup.
3. Connect the positive terminal (+) of the main voltage source to the VIN and VIN3 pads of the evaluation board.
4. Connect the negative terminal (–) of an ammeter to the VBIAS pad of the evaluation board.
5. Connect the positive terminal (+) of the bias voltage source to the positive terminal (+) of the ammeter connected to the VBIAS pad. Set the bias voltage supply to a voltage between 2.5 V and 5.5 V.
6. Connect the positive terminal (+) of the other ammeter to one of the GND pads of the evaluation board.
7. Connect the negative terminal (–) of the ammeter connected to GND to the negative (–) terminal of the main voltage source.
8. Connect a load between VOUT1, VOUT2, and/or VOUT3 and the negative (–) terminal of the main voltage source.

The voltage sources can now be turned on.

### GROUND CURRENT MEASUREMENT

Ground current measurements can determine how much current the internal circuits of the regulator consume while the circuits perform the regulation function. To be efficient, the regulator must consume as little current as possible. Typically, the regulator uses the maximum current when supplying its largest load level (200 mA per output). Figure 8 shows the typical ground current consumption for various load levels as a function of the input voltage for all three outputs set to 1.2 V and loaded equally.

The ground current for the ADP323 also includes the current through the output voltage setting dividers, R1 and R2, R3 and R4, and R5 and R6.

When the device is disabled (EN1, EN2, and EN3 = GND), ground current drops to less than 1  $\mu\text{A}$ .

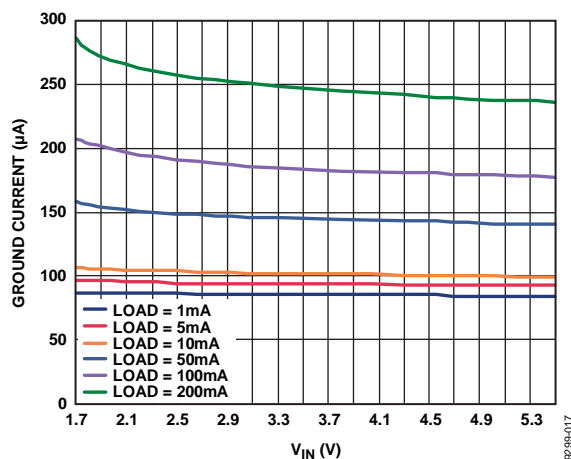


Figure 8. Ground Current vs. Input Voltage, All Outputs Loaded Equally, ADP322

## BIAS CURRENT MEASUREMENT

Bias current measurements can determine how much current the regulator's internal bias circuits consume while the circuits

perform the regulation function. The bias current typically does not vary much with the load current or input voltage. Figure 8 shows the typical bias current consumption for various load levels at a bias voltage of 4 V for all three outputs loaded equally.

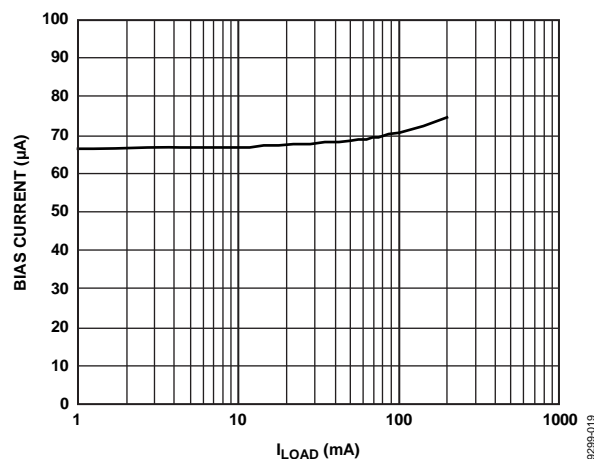


Figure 9. Bias Current vs. Load Current, All Outputs Loaded Equally, ADP322

## PRINTED CIRCUIT BOARD LAYOUT CONSIDERATIONS

Heat dissipation from the package can be improved by increasing the amount of copper attached to the pins of the [ADP322/ADP323](#).

Place the input capacitor as close as possible to the VIN (VIN1/VIN2), VIN3, VBIAS, and GND pins. Place the output capacitors as close as possible to the VOUT1, VOUT2, VOUT3, and GND pins. Use 0402 or 0603 size capacitors and resistors to achieve the smallest possible footprint solution on boards where space is limited.

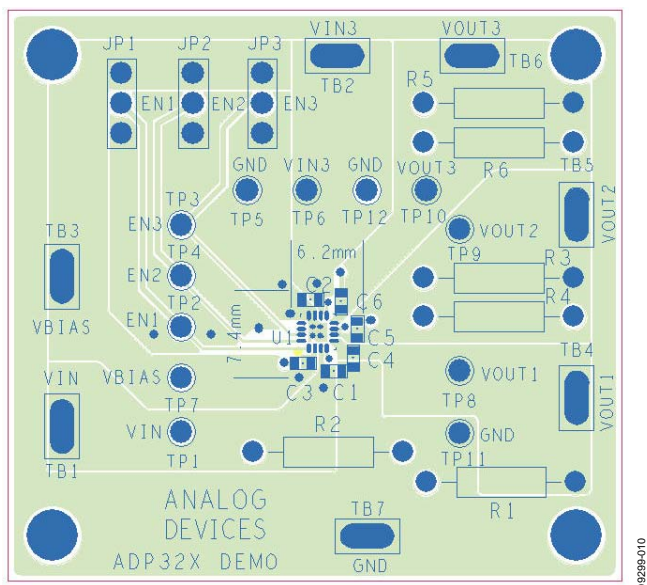


Figure 10. Typical Board Layout, Top Side

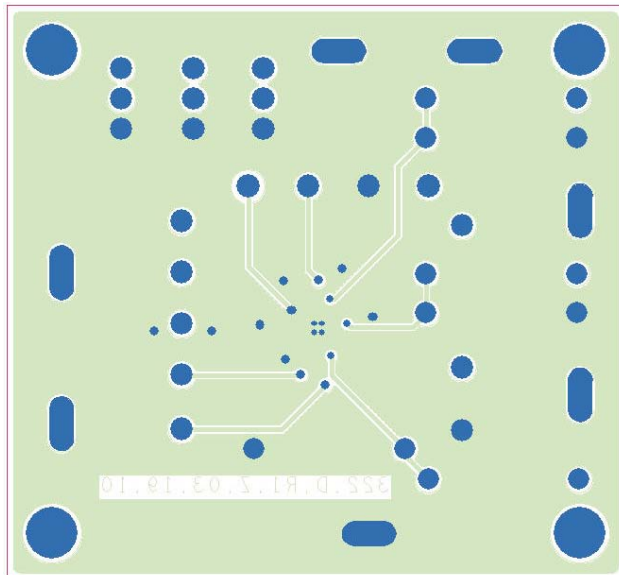


Figure 11. Typical Board Layout, Bottom Side

## ORDERING INFORMATION

### BILL OF MATERIALS

Table 2.

Qty	Reference Designator	Description	Manufacturer/Vendor	Vendor Part No.
6	C1, C2, C3, C4, C5, C6	Capacitor, MLCC, 1.0 $\mu$ F, 10 V, 0402, X5R	Murata or equivalent	GRM155R61A105KE15
3	JP1, JP2, JP3	Header, single, STR, 3 pins	Sullins Connector Solutions	PEC03SAAN
6	R1, R2, R3, R4, R5, R6	Resistor, 1%, 0603 case	Vishay	CRCW0603xxxxF
1	U1	IC, LDO regulator	Analog Devices, Inc.	ADP322/ADP323

### RELATED LINKS

Resource	Description
<a href="#">ADP322</a>	Product Page, ADP322 Fixed Output, Triple, 200 mA, Low Noise, High PSRR Voltage Regulator
<a href="#">ADP323</a>	Product Page, ADP323 Adjustable Output, Triple, 200 mA, Low Noise, High PSRR Voltage Regulator

**NOTES**

## NOTES

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**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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