

## Evaluating the **ADP199** High-Side Load Switch

### FEATURES

**Ultrasmall, 0.8 mm × 0.8 mm, 4-ball, 0.4 mm pitch WLCSP**

**Low RDS<sub>ON</sub> of 40 mΩ**

**Low input voltage range of 0.9 V to 3.6 V**

**500 mA continuous operating current**

**Operating temperature range: T<sub>J</sub> = -40°C to +85°C**

### GENERAL DESCRIPTION

The **ADP199** evaluation board (ADP199CB-EVALZ) is used to demonstrate the functionality of the **ADP199** high-side load switch.

Simple device measurements such as V<sub>IN</sub> to V<sub>OUT</sub> resistance (RDS<sub>ON</sub>), ground current, and shutdown current can be demonstrated with only a single voltage source, a voltage meter, a current meter, and a load resistor.

Complete information about the **ADP199** high-side load switch is available in the **ADP199** data sheet, which should be consulted when using the ADP199CB-EVALZ.

### EVALUATION BOARD

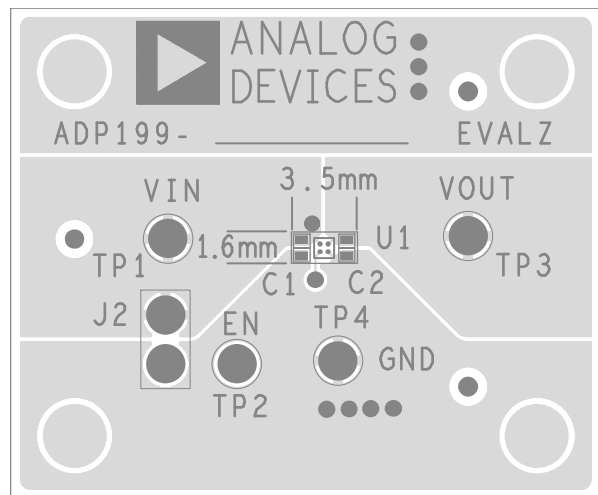


Figure 1.

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**REVISION HISTORY****11/11—Revision 0: Initial Version**

## EVALUATION BOARD SCHEMATIC AND HARDWARE

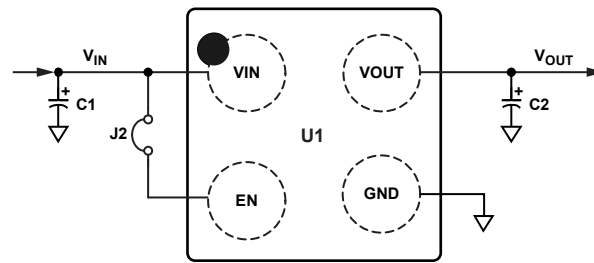


Figure 2. Evaluation Board Schematic

10294-002

Table 1. Evaluation Board Hardware Components

Component	Function	Description
U1	Load switch	ADP199ACBZ-R7 high-side load switch.
C1	Input capacitor	Input bypass capacitor, 0.1 $\mu$ F. Optional to improve transient performance. Connect C1 from VIN to GND.
C2	Output capacitor	Output capacitor, 0.1 $\mu$ F. Optional to improve transient performance. Connect C2 from VOUT to GND.
J2	Jumper	Jumper. Connects EN to VIN for automatic startup.

## V<sub>IN</sub> TO V<sub>OUT</sub> RESISTANCE (R<sub>DS(ON)</sub>) MEASUREMENTS

R<sub>DS(ON)</sub> is defined as the input-to-output voltage differential divided by load current. The voltage meter reading divided by the load current value gives the equivalent R<sub>DS(ON)</sub> value.

R<sub>DS(ON)</sub> can be measured using the configuration shown in Figure 4. 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 3 shows a typical curve of R<sub>DS(ON)</sub> measurements with different load currents.

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

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

5. Connect the positive terminal (+) of the voltage meter to the VIN pad on the evaluation board.

The voltage source can now be turned on. If J2 is inserted (connecting EN to VIN for automatic startup), the switch powers up.

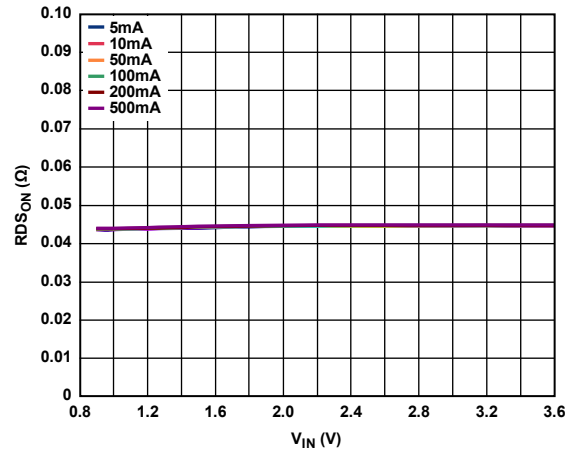


Figure 3. R<sub>DS(ON)</sub> vs. Input Voltage (V<sub>IN</sub>)

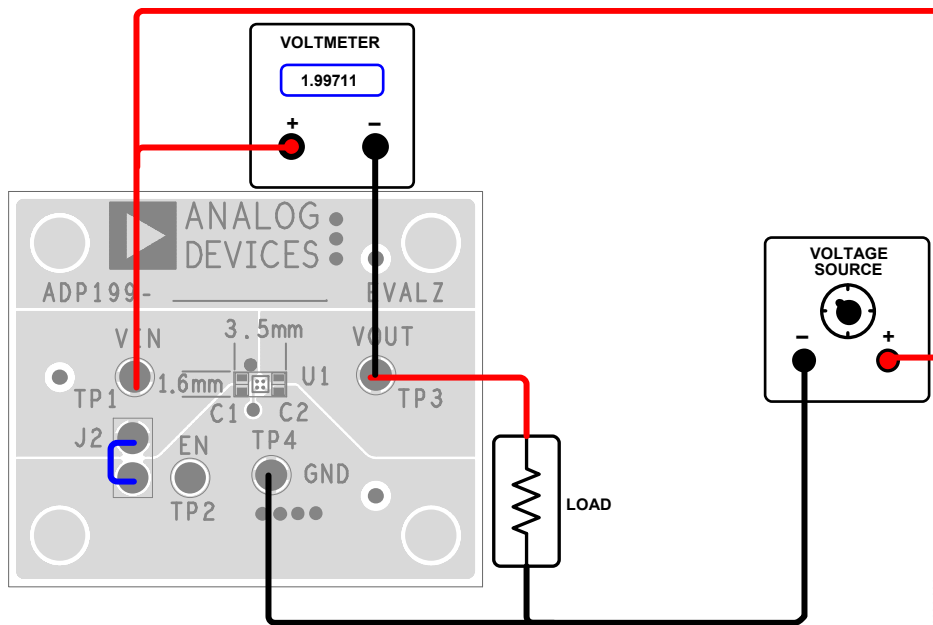


Figure 4. R<sub>DS(ON)</sub> Measurement

## GROUND CURRENT MEASUREMENTS

Figure 6 shows how the evaluation board can be connected to a voltage source and a current meter (ammeter) for ground current measurements. A resistor can be used as the load for the switch. 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. If voltage meters are connected at the input or output terminals, subtract the current resulting from the shunt resistance of the voltage meter for accurate ground current measurement.

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

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

The voltage source can now be turned on. If J2 is inserted (connecting EN to VIN for automatic startup), the switch powers up.

## GROUND CURRENT CONSUMPTION

Ground current measurements can determine how much current the internal circuits of the switch consume while the circuits perform the load switch function. To be efficient, the load switch must consume as little current as possible.

Figure 5 shows the typical ground current consumption for various load levels.

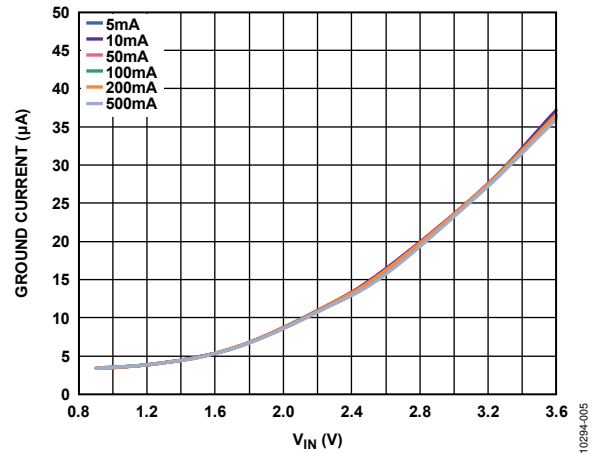


Figure 5. Ground Current vs. Input Voltage (VIN)

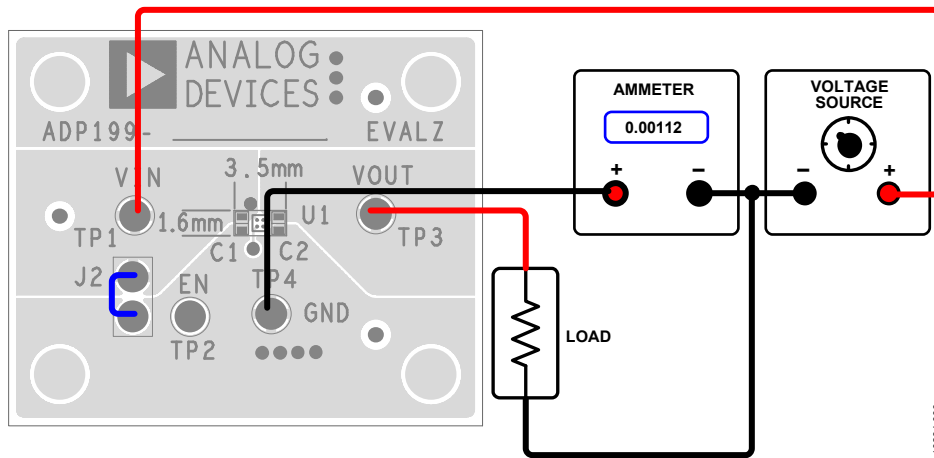


Figure 6. Ground Current Measurement

## SHUTDOWN CURRENT MEASUREMENTS

Figure 8 shows how the evaluation board can be connected to a voltage source and a current meter (ammeter) for shutdown current measurements. The current meter can also be connected to the VIN pad to measure the ground current, which is equal to the shutdown current when EN is tied to ground. Figure 7 shows the typical shutdown current consumption for various input voltages.

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

1. Connect the positive terminal (+) of the voltage source to the positive terminal (+) of the current meter.
2. Connect the negative terminal (-) of the voltage source to the GND pad and the EN pad on the evaluation board.
3. Connect the negative terminal (-) of the current meter to the VIN pad on the evaluation board.

The voltage source can now be turned on.

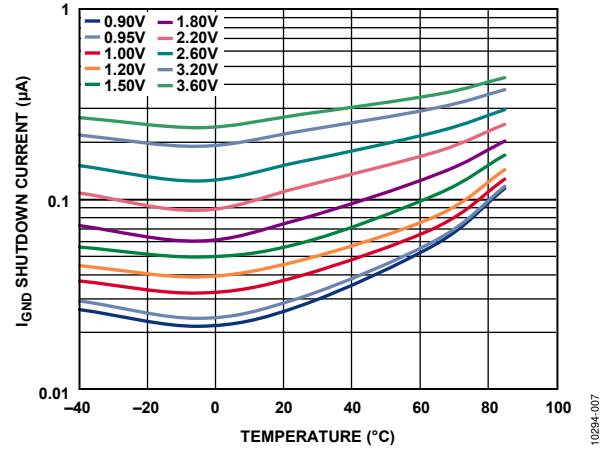


Figure 7. Shutdown Current vs. Temperature and Input Voltage ( $V_{IN}$ )

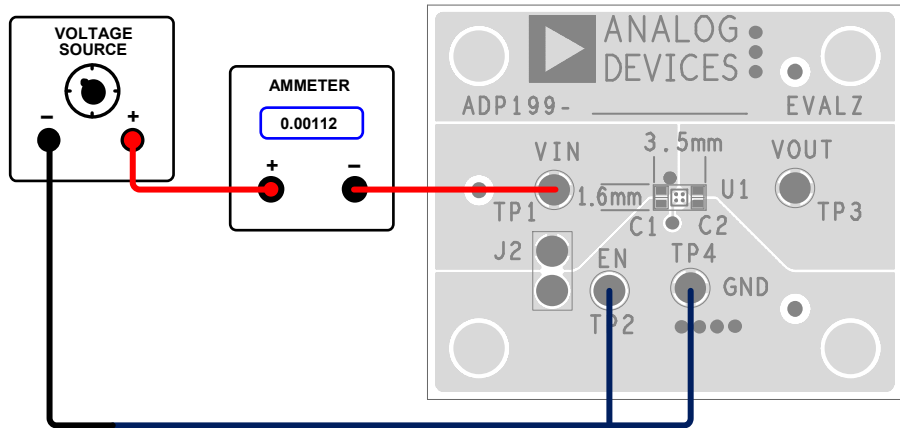


Figure 8. Shutdown Current Measurement

**ORDERING INFORMATION****BILL OF MATERIALS**

Table 2.

<b>Qty</b>	<b>Reference Designator</b>	<b>Description</b>	<b>Manufacturer/Vendor</b>	<b>Part No.</b>
2	C1, C2	Capacitor, MLCC, 0.1 $\mu$ F, 10 V, 0402, X5R	Murata or equivalent	GRM155R61A104KA01D
1	J2	Header, single, STR, two pins	Digi-Key Corp.	S1012E-02-ND
1	U1	IC, load switch	Analog Devices, Inc.	ADP199ACBZ-R7

## NOTES

**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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