

## Evaluating the ADP194 High-Side Power Switch

### FEATURES

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

Low  $R_{DS(on)}$  of 80 mΩ at 1.8 V

Low input voltage range of 1.1 V to 3.6 V

1 amp continuous operating current

Operating temperature range:  $T_j = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### GENERAL DESCRIPTION

The ADP194CB-EVALZ is used to demonstrate the functionality of the ADP194 power switch.

Simple device measurements such as VIN to VOUT resistance ( $R_{DS(on)}$ ), ground current, and off state current can be demonstrated with just a single voltage source, a voltmeter, an ammeter, and a load resistor.

Full details about the [ADP194](#) regulators are available in the ADP194 data sheet, which should be consulted when using the ADP194CB-EVALZ.

### EVALUATION BOARD

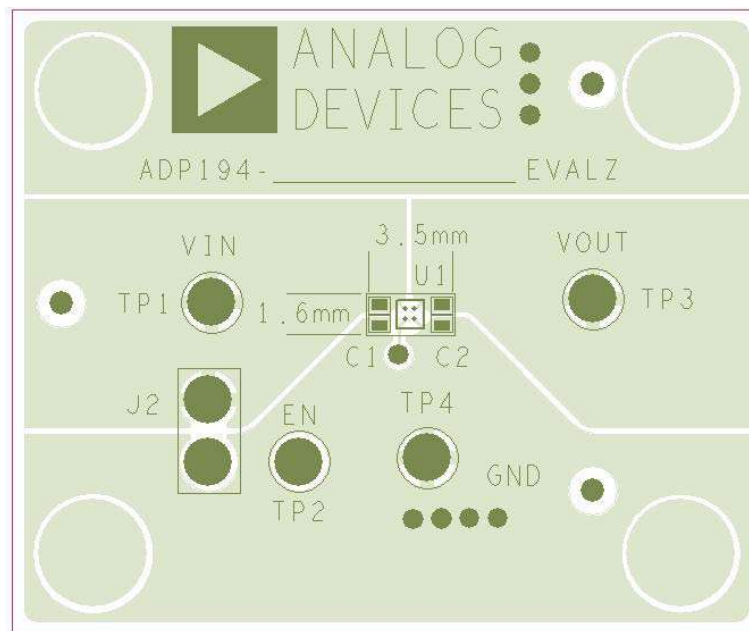


Figure 1.

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**REVISION HISTORY**

**5/11—Revision 0: Initial Version**

## EVALUATION BOARD SCHEMATIC AND HARDWARE

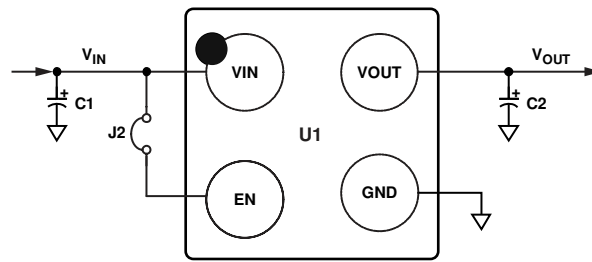


Figure 2. Evaluation Board Schematic

00561-002

Table 1. Evaluation Board Hardware Components

Component	Function	Description
U1	Power switch	ADP194ACBZ-R7. High-side power switch.
C1	Input capacitor	0.1 $\mu$ F Input Bypass Capacitor. Optional to improve transient performance. Connect C1 from VIN to GND.
C2	Output capacitor	0.1 $\mu$ F Output Capacitor. Optional to improve transient performance. Connect C2 from VOUT to GND.
J2	Jumper	Jumper. Connects EN to VIN for automatic startup.

### VIN TO VOUT RESISTANCE ( $R_{DS_{ON}}$ )

$R_{DS_{ON}}$  can be measured using the configuration shown in Figure 4.  $R_{DS_{ON}}$  is defined as the input-to-output voltage differential divided by load current.

The voltmeter reading divided by the load current value gives the equivalent  $R_{DS_{ON}}$  value. For more accurate measurements, a second 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 3 shows a typical curve of  $R_{DS_{ON}}$  measurements with different load currents.

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

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 voltmeter to one of the VOUT pad.
5. Connect the positive terminal (+) of the voltmeter to the VIN pad.

The voltage source can now be turned on. If J1 is inserted (connecting EN to VIN for automatic startup), the switch powers up.

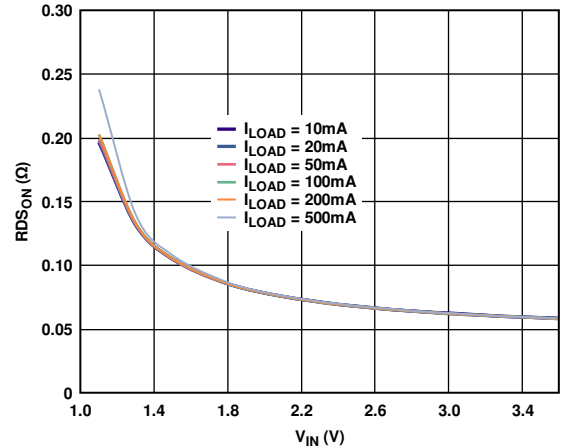


Figure 3.  $R_{DS_{ON}}$  vs. Input Voltage,  $V_{IN}$

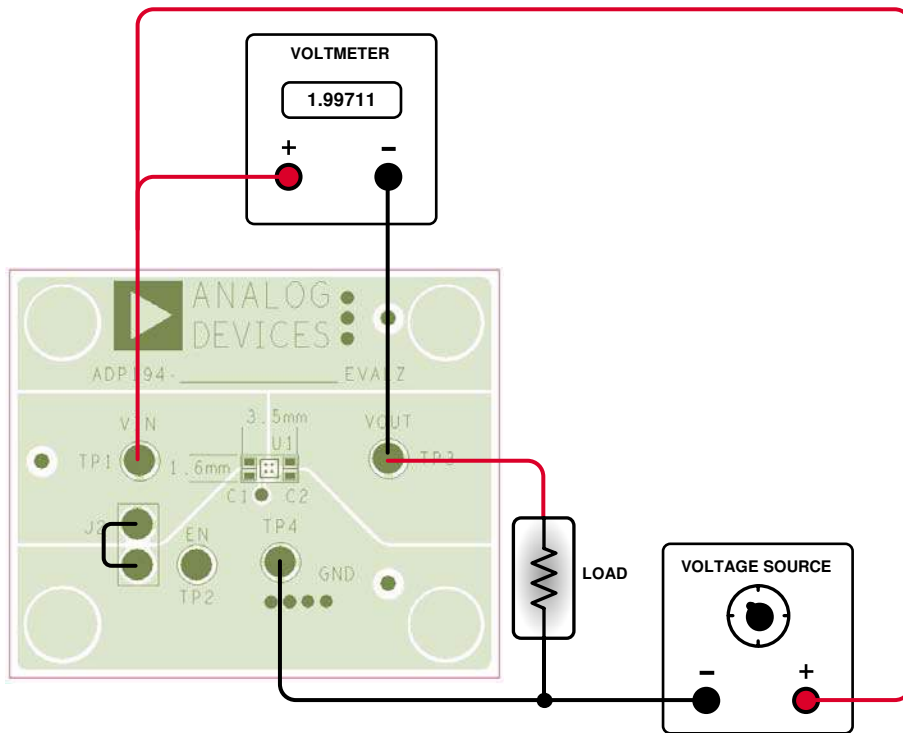


Figure 4.  $R_{DS_{ON}}$  Measurement

## GROUND CURRENT MEASUREMENT

Figure 6 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. If voltmeters are connected at the input or output terminals, subtract the current resulting from the shunt resistance of the voltmeter for accurate ground current measurement.

Use the following 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 the GND pad 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.

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

## GROUND CURRENT CONSUMPTION

Ground current measurement is a way of determining how much current the internal circuits of the regulator are consuming while performing the power switch function. To be efficient, the power switch must consume as little current as possible. Figure 5 shows the typical ground current consumption for various load levels.

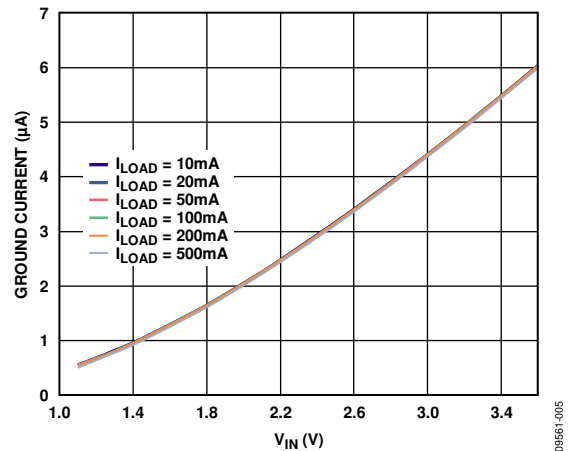


Figure 5. Ground Current vs. Input Voltage,  $V_{IN}$

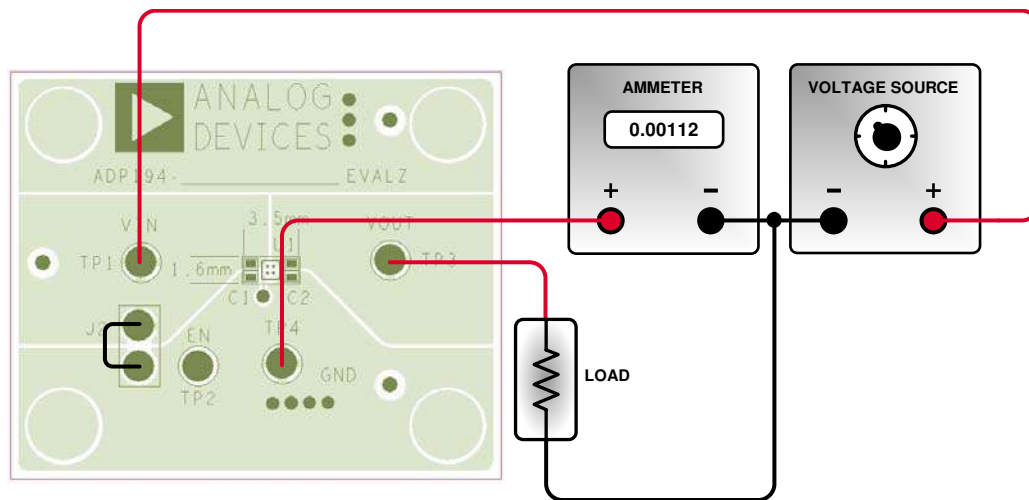


Figure 6. Ground Current Measurement

## SHUTDOWN CURRENT MEASUREMENT

Figure 8 shows how the evaluation board can be connected to a voltage source and an ammeter for shutdown current measurements. The ammeter 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.

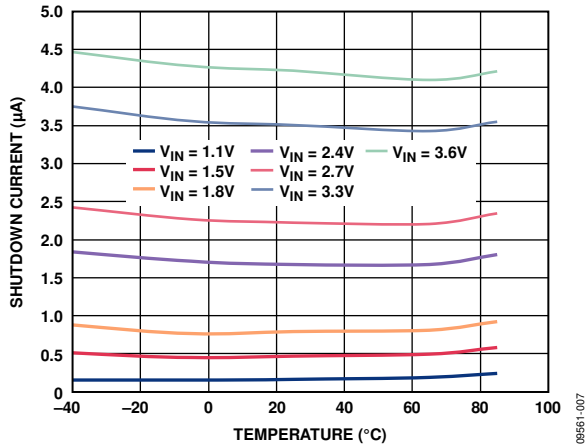


Figure 7. Shutdown Current vs. Temperature and Input Voltage, V<sub>IN</sub>

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

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

The voltage source can now be turned on.

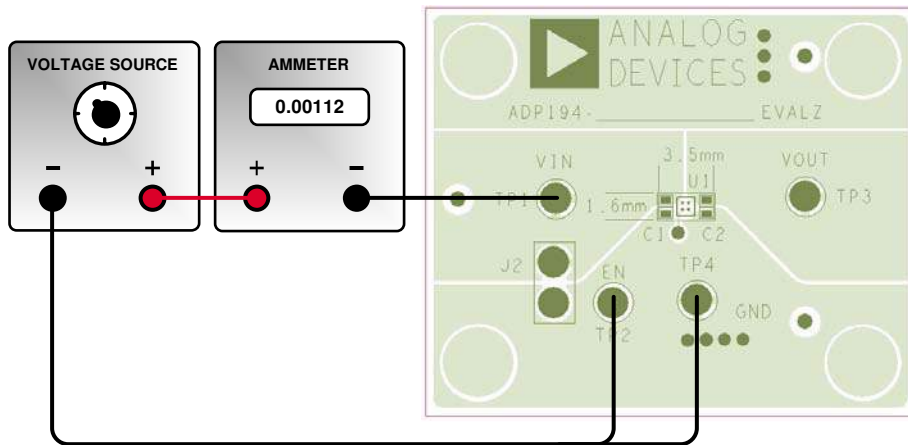


Figure 8. Shutdown Current Measurement

**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-36-ND
1	U1	IC, power switch	Analog Devices, Inc.	ADP194ACBZ-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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