

## AD8210 Bidirectional Operation Using a 3.3 V External Reference

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### INTRODUCTION

One of the key features of the **AD8210** bidirectional current sense amplifier is the ability to offset the output to a voltage between 0 V (GND) to  $V_S$  (supply voltage). This allows the user to monitor current flowing in both directions through the input shunt resistor while still operating with a single 5 V supply. Typically, bidirectional operation is achieved by tying one  $V_{REF}$  pin to the supply while the other is tied to GND. In this mode, the output of the **AD8210** starts at  $V_S/2$  and goes up or down depending on the direction of the current at its inputs.

The **AD8210** output can also be offset using an external reference with a voltage range of  $0\text{ V} \leq V_{REF} \leq V_S$ . The configuration shown in Figure 1 makes use of the 3.3 V ADC supply and offsets the output of the **AD8210** for bidirectional operation.

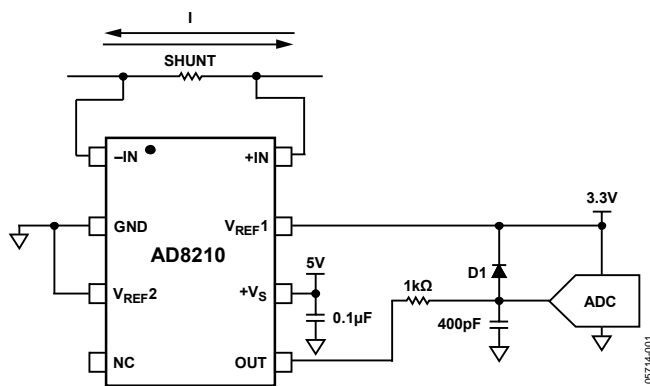


Figure 1. Bidirectional Operation Using an External Reference

By tying the  $V_{REF1}$  pin to the A/D supply and the  $V_{REF2}$  pin to GND (see Figure 1), the output of the **AD8210** is offset to half of the 3.3 V reference, or 1.65 V. It is important to note that while the output of the **AD8210** can be referenced to any voltage within its supply range, the **AD8210** supply voltage must remain 5 V. This means that regardless of the output offset voltage, the output range of the **AD8210** must still be 0.05 V to 4.9 V. Calculations should be made so that the **AD8210** output does not exceed the input range of the converter. Diode D1 is an optional component that can be used to protect the input of the converter from excessive overdriving. If D1 is used as shown in Figure 1, then the maximum voltage at the input of the converter would be a diode drop of 0.7 V (or 0.4 V if a Schottky diode is used) above the 3.3 V supply.

Additionally, by using this external 3.3 V supply, the **AD8210** can operate in unidirectional mode. This can be achieved by connecting both  $V_{REF}$  pins to the external 3.3 V supply of the converter. In this case, the output of the **AD8210** starts at 3.3 V.

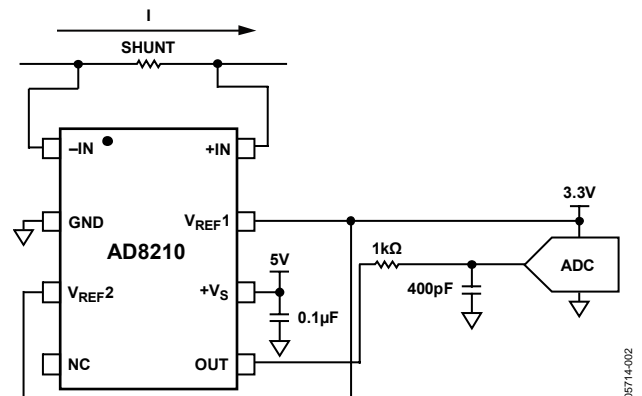


Figure 2. Unidirectional Operation Using an External Reference

When operating in this manner, the current through the input shunt resistor should flow from the negative input (Pin 1) to the positive input (Pin 8). As the current across the shunt resistor increases, the output correspondingly moves from 3.3 V down to 0.05 V.

**AN-815**

**NOTES**