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APPLICATION NOTE 2011

High-Side Positive Current Sensor Monitors Negative Supply

Abstract: This application note uses a high-side current-sense amplifier to monitor the current from a negative supply voltage. The circuit uses the IC's wide common-mode input range to amplify a small V_{sense} signal at the negative supply and level shift it up to a positive output voltage.

All dedicated current-sense amplifiers are designed for high-side sensing on a positive supply, but you can adapt them to monitor a negative supply (**Figure 1**). The positive supply pin (V_+) connects to the system's positive supply, and the ground pin (GND) connects to the negative supply (V_{EE}). That arrangement monitors the negative supply while providing a positive output voltage for the external interface (typically an A/D converter). The RS_+ pin of the current-sense amplifier (U1) connects to the load, and the RS_- pin connects to the negative supply.

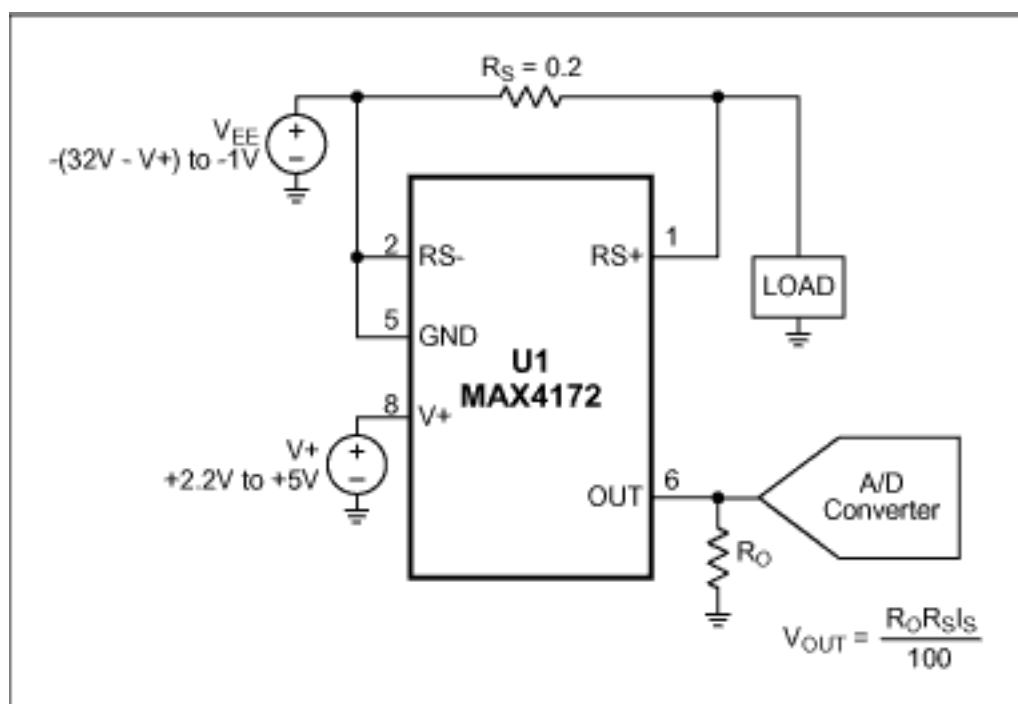


Figure 1. Connecting this positive-supply-current monitor (U1) as shown lets it monitor a negative current while generating a positive output voltage for the ADC.

U1's current-source output drives a current that is proportional to load current flowing to ground (not to the GND pin). Output resistor R_O converts the current to a voltage, which is then digitized by an ADC (optional):

$$V_{OUT} = \frac{R_O R_S I_S}{100}$$

The maximum output voltage is limited by saturation in the internal transistors (which occurs at approximately $V_+ - 1.2V$). Thus, V_+ must exceed the full-scale output by at least 1.2V. If, for instance, the full-scale output is 1V, then $V_+ \geq +2.2V$. To meet the device's maximum and minimum operating voltages, $0 \geq V_{EE} \geq -(32 - V_+)$ and

$(V_+ - V_{EE}) \geq +3V$. **Figure 2** shows the variation of current-measurement accuracy with load current.

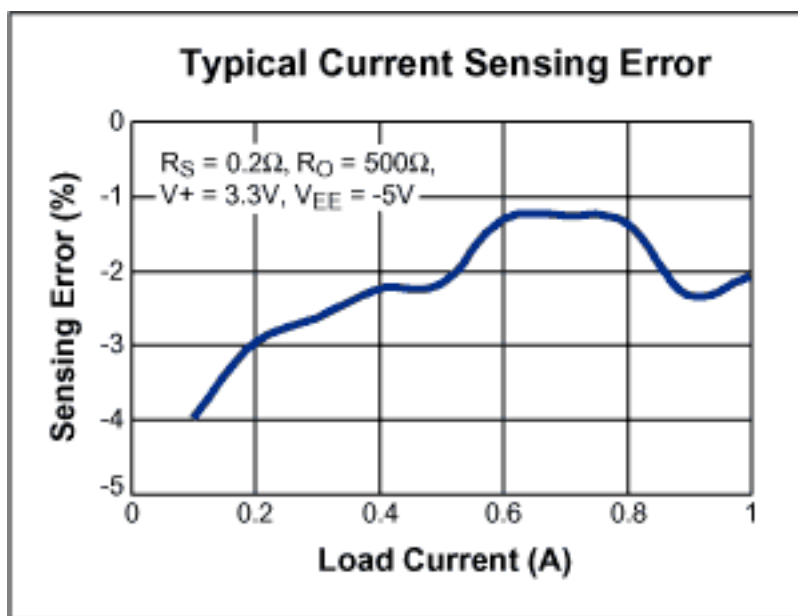


Figure 2. The Figure 1 current-sensing error varies with load current as shown.

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