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 $V_{\text{sense}}$ 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 ($V_{\text{EE}}$). 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.
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.

### Related Parts

| MAX4172 Low-Cost, Precision, High-Side Current-Sense Amplifier | Free Samples |

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