Application Brief

Current Monitoring With Positive and Negative Currents on LM5177x Devices

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Introduction

The LM5177, LM51770, and LM51772 are asynchronous buck-boost controllers, which offer current monitoring features with a current sense resistor connected to the ISNSP and ISNSN pins. With the current monitor feature, a control system, such as a uController, measures the current into the application or from the supply and use this information for additional functions, such as observing and sending warn signals to a host system, or adding an additional control loop.

Depending on the device, the sensed current is represented as an *easy to measure* voltage on the IMONOUT, or the CDC pin of the device.

The integrated transconductance amplifier converts the voltage measured on the sense resistor into a proportional current provided on the IMONOUT or CDC pin. With the attached resistor, this signal is transformed into voltage which is measured with an ADC and processed by a uController.

The integrated transconductance amplifier works in both directions, providing positive and negative current signals. For negative output current, a bias voltage need to be supplied on the IMONOUT or CDC pin, instead of a resistor to the AGND. This bias signal is generated by using the VCC signal, VCC2 signal, or a Reference Voltage, such as a uController.

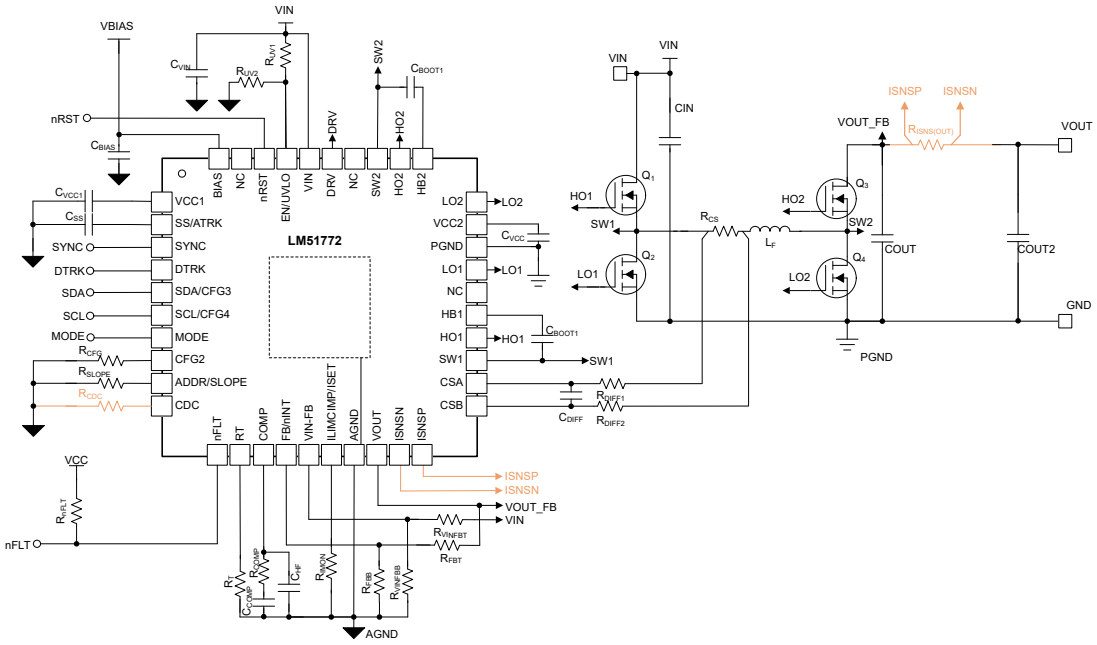

Figure 1. Block Diagram Showing Application of the LM51772 to Output the Current Monitor Signal

Figure 2 and Figure 3 show the connection of the resistor divider on the current monitor output. In Figure 3 the V_{CC} of the controller is used as reference voltage but R_{IMON1} can also connect to a reference voltage, such as from the uController, if higher accuracy is required.

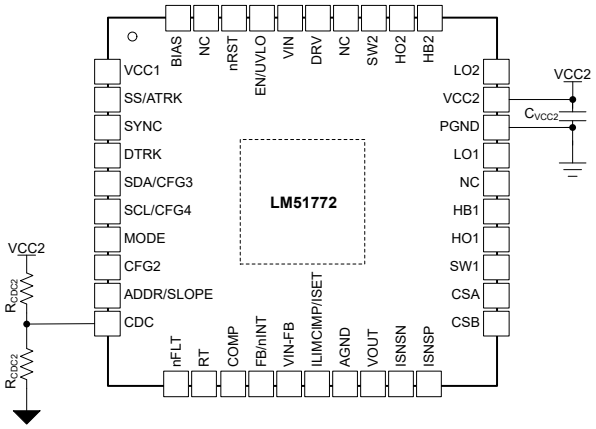

Figure 2. Using CDC on LM51772 to Output Current Monitor Signal

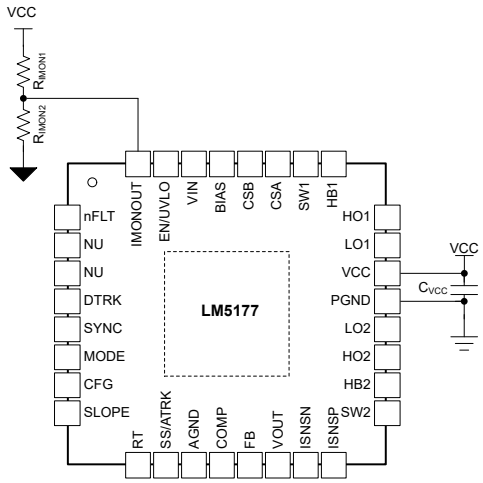

Figure 3. Using IMONOUT on LM5177 to Output Current Monitor Signal

Calculation of the R_{IMONx} Resistor

The corresponding monitor output voltage is calculated with Equation 1 or Equation 2.

$$V_{IMON} = \frac{R_{IMON2} \times V_{CC} - I_{IMON,\,OUT} \times R_{IMON1} \times R_{IMON2}}{R_{IMON1} + R_{IMON2}} \quad (1)$$

With:

$$R_{IMON1} = R_{IMON2} \quad (2)$$

$$I_{IMON,\,OUT} = (V_{ISNSP} - V_{ISNSN}) \times g_{m,\,CDC} \quad (3)$$

$$I_{IMON,\,OUT} = I_{RSNS} \times R_{SNS} \times g_{m,\,CDC} \quad (4)$$

Equation 1 results in:

$$V_{IMON} = \frac{V_{CC} - (I_{RSNS} \times R_{SNS} \times g_{m,\,CDC}) \times R_{IMON2}}{2} \quad (5)$$

Measurement Results

Figure 4 shows the output of the IMONOUT signal related to the positive and negative output current. In Figure 4, a voltage of 2.4V corresponds to 0A output current.

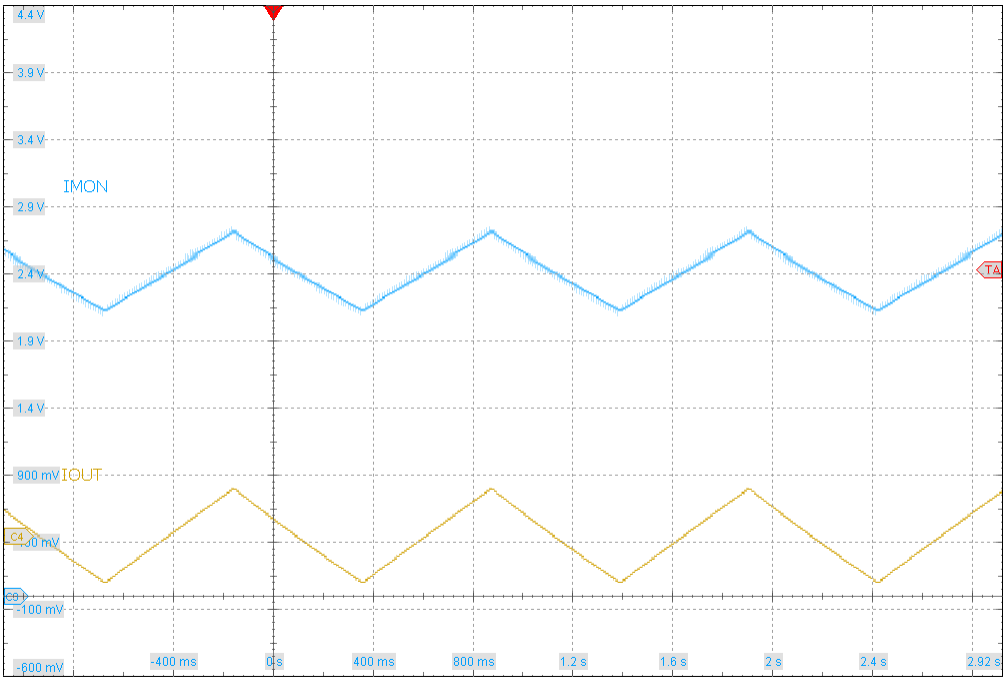

Figure 4. Scope Plot Showing Output Current and Current Monitor Signals

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