

## High Side Current Sense with Comparators and a 400mV Reference

### DESCRIPTION

Demonstration circuit 2193A features the LT®6119, a high side current sense amplifier with comparators and a 400mV reference.

The demo board circuit amplifies the voltage across an onboard current sense resistor, to provide a precision unipolar voltage output that is proportional to the sensed current. The board has two onboard comparators with latching outputs and an integrated 400mV reference that sets the threshold for the comparators. There are two versions of the board, A and B. The version determines the available comparator inputs. The DC2261A-A (LT6119-1) has an inverting and a noninverting comparator input available while the DC2261A-B (LT6119-2) has two inverting inputs

available. The demonstration board includes circuitry to guarantee that the comparator resets on power up. The current sense gain and current fault limits are set by on board resistors. The default gain is set at 10V/A and the comparators are set to trip at current thresholds of 50mA and 300mA.

The key performance specifications are listed in the table below.

**Design files for this circuit board are available at**  
<http://www.linear.com/demo/DC2261A>

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### PERFORMANCE SUMMARY

Specifications are at  $T_A = 25^\circ\text{C}$

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
$V_{IN}$	Input Supply Range		2.7		60	V
$V_{OUTA}$	Measured Output Signal	$I_{LOAD} = 100\text{mA}$		1		V
$I_{LOAD}$	Output Load Current Range	Thermal Limit of $R_{SENSE}$			3	A
$I_Q$	IN Quiescent Current	$V_{IN} = 12\text{V}$		600		$\mu\text{A}$
$I_{THR1}$	Comparator1 Threshold	$V_{OUTA} = 3\text{V}$		300		mA
$I_{THR2}$	Comparator2 Threshold	$V_{OUTA} = 0.5\text{V}$		50		mA

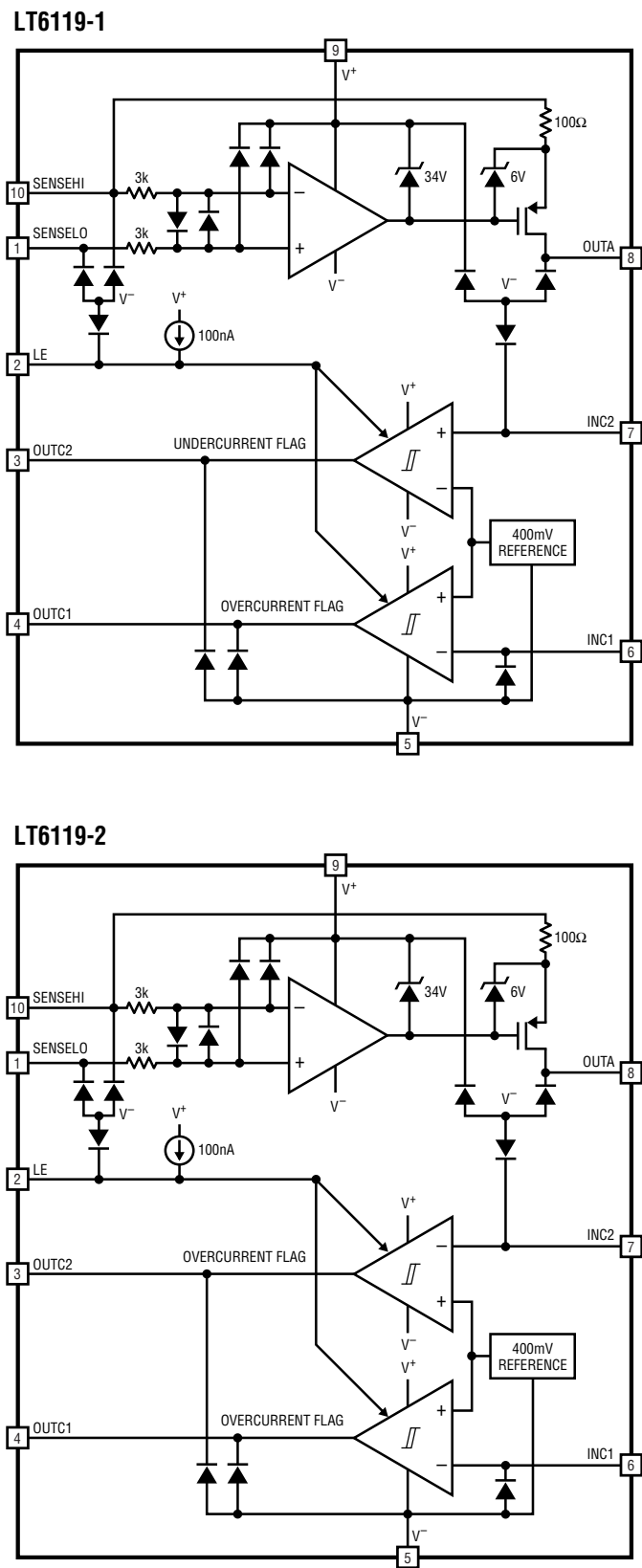
### OPERATING PRINCIPLES

The LT6119 operates by amplifying the voltage drop across a sense resistor that is in series with the load. The sense inputs of the amplifier differentially measure the sense resistor voltage drop to control an internal variable current source that allows translation of the input voltage level to a level referenced to the GND. The circuit gain is set by the ratio of the output resistor to the input resistor. The comparator thresholds are set by the internal reference and the current trip points are set by dividing the output

resistance into a network of three resistors. The RC filter connected to the latch enable (LE) pin guarantee that the latch enable pin is held low long enough on start-up to reset the comparator output on power on.

The DC2261A is shipped with a 100m $\Omega$  sense resistor. The amplifier gain is configured for 100V/V, providing an overall circuit gain of 10V/A. The current fault thresholds are set at 50mA and 300mA.

BLOCK DIAGRAM



## QUICK START PROCEDURE

With the demonstration circuit, it is easy to set up and evaluate the performance of the LT6119. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. With the power off, connect the power supply positive to IN and the common to GND. With default settings the supply can range from 2.7V to 60V. If the supply does not have an accurate current readout, a DMM may be connected in series with the supply as shown in Figure 1.
2. Connect a voltmeter or oscilloscope to the OUTA with the common input connected to ground.
3. Turn on the power supply. The comparator outputs start in a known state as shown in the following table if there is no load attached.

PART	OUTC1	OUTC2
DC2261A-A LT6119-1	High	Low
DC2261A-B LT6119-2	High	High

4. Connect a load to the demo board OUT terminal (positive) and ground. The load may be a power resistor, active load instrument or a circuit of interest.
5. Measure the output voltage and confirm that it corresponds to the load current.  $V_{OUTA} (V) = 10 \cdot I_{LOAD}(A)$  for the factory installed resistors.
6. If able, sweep load current from 0A to 300mA to verify the operation of the comparators. Use the reset push button to reset latched comparator outputs.

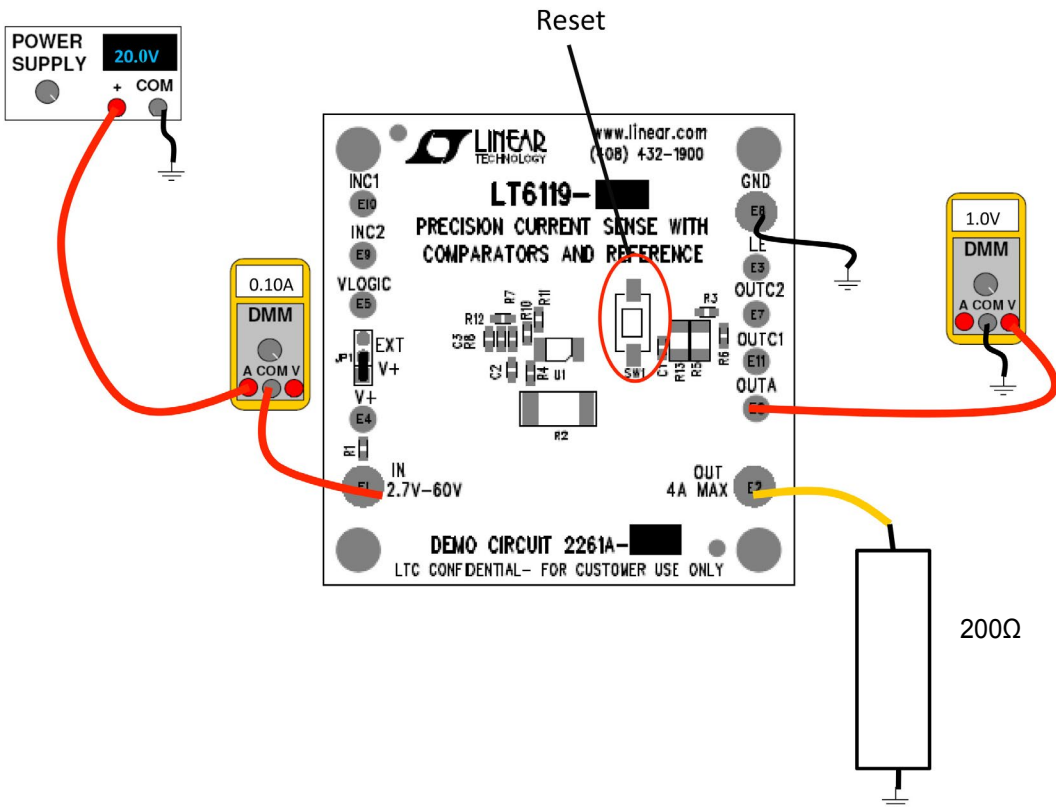


Figure 1. Test Setup

## CURRENT SENSE GAIN

The gain of the LT6119 current sense amplifier is set by the ratio of  $R_{OUT}$  and  $R_{IN}$  resistors. In the demo circuit this means that the gain is set by the ratio of  $(R_{OUT})/R_4$ , where  $R_{OUT} = (R_7 + R_{10} + R_{11}) \parallel R_8(OPT)$ . The default values are  $R_7 = 2k$ ,  $R_{10} = 6.65k$ ,  $R_{11} = 1.33k$ , and  $R_8$  is not installed. This provides a gain of 9.98k/100. By installing the optional resistor,  $R_8$ , the gain can be reduced. The gain error is primarily set by the precision of the resistors used:

The provided resistors are a 1% tolerance which will dominate the gain error. To reduce system gain error, the resistors can be replaced with 0.1% resistors.

### Jumper Summary

JP1: The Logic supply jumper has two settings.

- $V^+$ : the comparator output is tied to the  $V^+$  supply
- EXT: the comparator output is tied to an external supply on the VLOGIC Turret

### Optional Settings

1. To power the LT6119 from a supply separate from the load, remove  $R_1$  and connect the power supply to the  $V^+$  turret.
2. There are a number of optional components that allow the DC2193 to be tailored to a specific application:
  - A) To free comparator inputs INC1 and INC2 for other use, remove  $R_7$ ,  $R_{10}$  and  $R_{11}$  and install  $R_8$ . Connect LE turret as required.
  - B) To add filtering to the amplifier output, install  $C_3$ .
  - C) If driving the LE turret from an external source, pressing the reset button, SW1 will short the signal. A resistor can be added at  $R_{13}$  to help isolate the external signal.



# DEMO MANUAL DC2261A

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This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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