

Precision, Gain Selectable High Side Current Sense Amplifier

DESCRIPTION

Demonstration Circuit 1114 is an Precision, Gain Selectable High Side Current Sense Amplifier featuring the LT6100.

This demo board amplifies a current-sense resistor voltage-drop, providing a precision uni-polar output voltage proportional to load current. The demo circuit is equipped with jumpers to facilitate setting the pin-strapped gain configuration. The LT6100 is unique in that it is powered from a low voltage (down to 2.7V) while it measures current of an Over-The-Top[®] higher voltage power bus (1.4V or more above V_{CC}). This device is

especially suitable for measuring battery system current since the monitoring-input current draws become negligible when V_{CC} is powered down.

The key performance characteristics of the LT6100 and DC1114 are shown in the Performance Summary below.

Design files for this circuit board are available. Call the LTC factory.

LT, Over-The-Top are registered trademarks of Linear Technology Corporation. Other product names may be trademarks of the companies that manufacture the products.

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

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Monitored Supply Input Range		$V_{CC} + 1.4V$	5...24	48	V
V_{CC}	Amplifier Supply Range		2.7	3...5	36	V
V_{MON}	Measurement Output Signal	$I_{OUT} = 5A$, Jumper settings: A4=VEE, A2=OUT		2.5		V
I_{OUT}	Output Current Range	Thermal limit of R_{SENSE}			7	A
I_{CC}	V_{CC} Supply Current	$V_{IN} = V_{CC} + 1.4V$, $I_{OUT} = 0A$		60	130	μA
I_{INQ}	V_{IN} Quiescent Current	$V_{IN} = V_{CC} + 1.4V$, $I_{OUT} = 0A$		10		μA
I_{INSD}	V_{IN} Current during Shutdown	$V_{CC} = 0V$, $I_{OUT} = 0A$, $V_{IN} \leq 48V$		1		nA
t_R	V_{MON} step-response time	I_{OUT} step from 0A to 5A		50		μs

OPERATING PRINCIPLES

The LT6100 operates by amplifying the voltage drop on a sense resistor placed in series with the power source of a load to be monitored. The sense inputs of the amplifier differentially measure the sense-resistor drop to control an internal variable current source that allows translation of the input information to a level referenced to V_{EE} (ground in this demo circuit). An internal post-amplifier provides additional gain and buffers the output signal.

The post-amplifier gain is established by the pin strap configuration of the part. In DC1114 as shipped, the sense resistor installed is 20m Ω and the pin strapping jumpers set the gain to 25V/V, so the nominal output scaling is 500mV per ampere of load current. Other scalings can be produced by simple jumper position changes on the demo circuit.

The DC1114 Schematic diagram is shown in Figure 2.

QUICK START PROCEDURE

Demonstration circuit 1114 is easy to set up to evaluate the performance of the LT6100. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Place jumpers in the following positions:

A4 to the VEE position

A2 to the OUT position

2. With power off, connect the load driving power supply positive to IN and the common to GND. This supply should be in the range of 4.1V to 48V. If this supply is not equipped with an accurate current readout, a DMM (set to measure Amperes) may be connected in series with the supply as shown in Figure 1.

NOTE. Be sure that the current capacity of the DMM is adequate to handle the intended load current.

3. With power off, connect the amplifier supply positive to VCC and the common to GND. This supply should be in the range of 2.7V to $V_{IN}-1.4V$.

4. Connect a voltmeter or oscilloscope probe to the MON terminal, with the common connection or ground clip tied to GND.

5. Connect a load to the OUT terminal (positive) and return (negative) to the common of the load driving power supply. The load may be a power resistor, active load instrument, or other circuit of interest.

6. Turn on the power supplies.

7. Check for an output voltage that corresponds to the load current. $V_{MON} = 0.5 \times I_{OUT}$ for the jumper settings indicated in step 1.

NOTE. At times when the load supply voltage is near or below the amplifier supply voltage, the MON output will become unpredictable (may assume a value anywhere between 0V and V_{CC}).

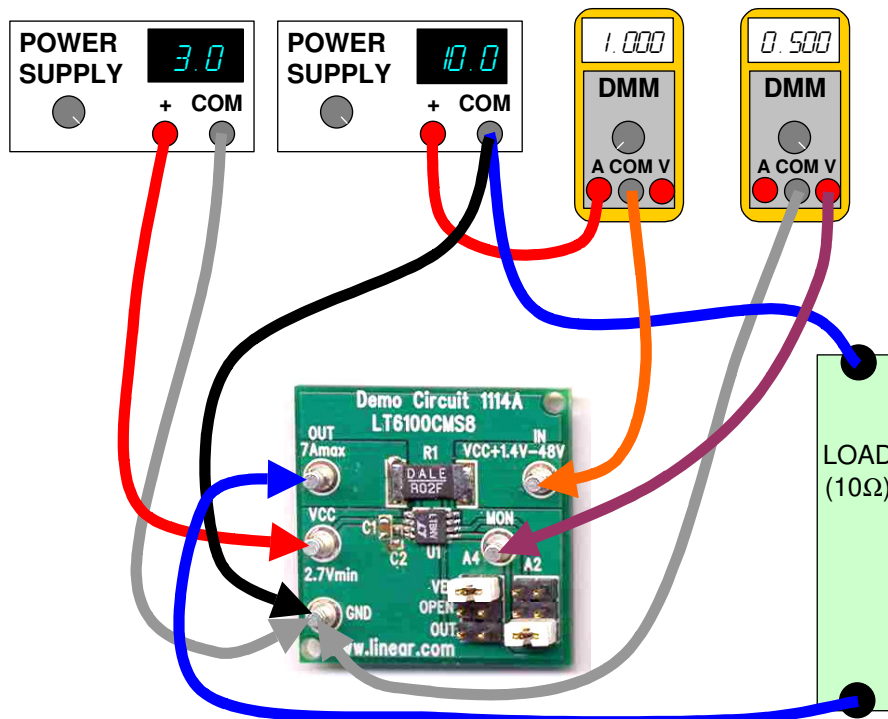


Figure 1. Proper Measurement Equipment Setup

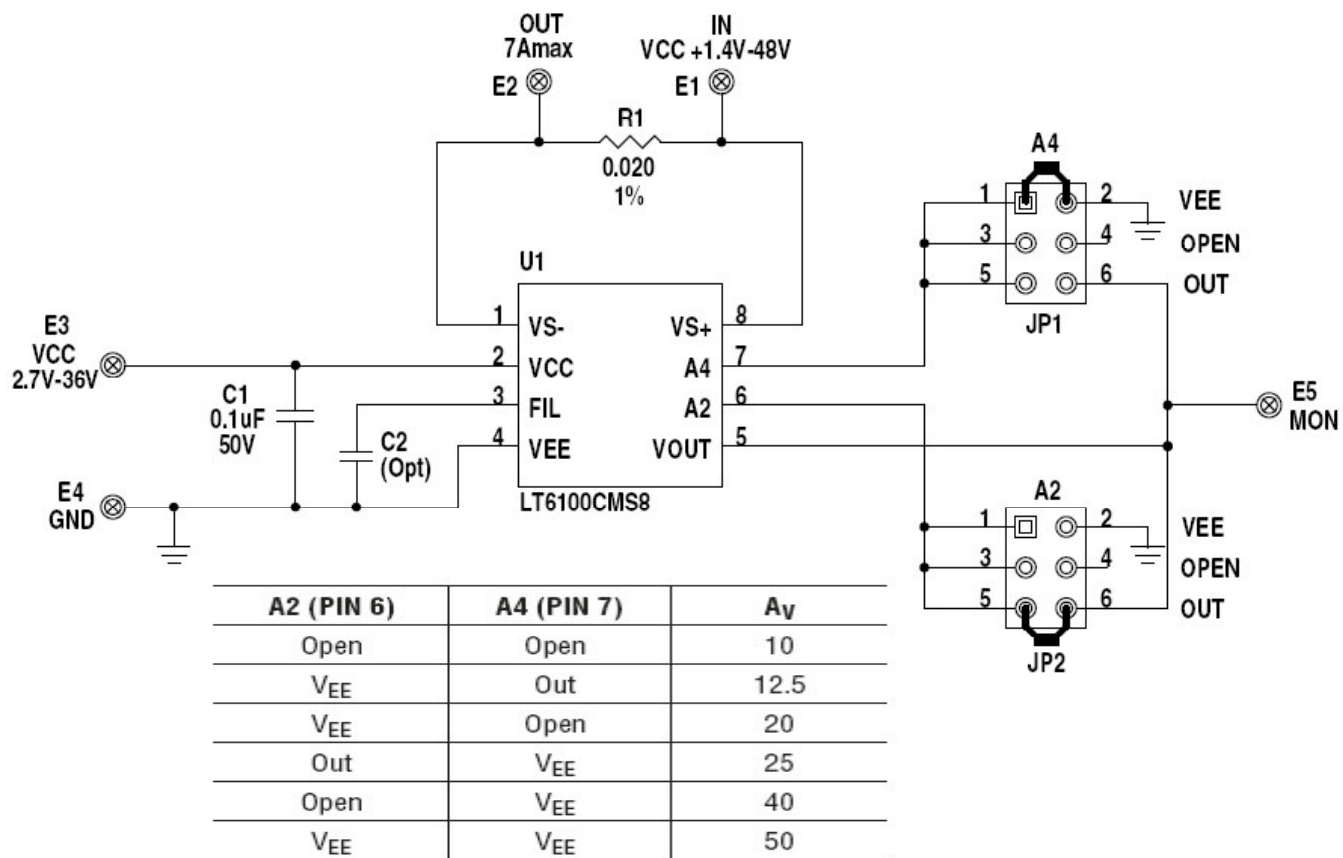


Figure 2. DC1114 Schematic Diagram