

## Precision, Gain Selectable High Side Current Sense Amplifier

### DESCRIPTION

Demonstration Circuit 1192 is a Precision, Gain Selectable High Side Current Sense Amplifier featuring the LT6105.

This demo board amplifies a current-sense resistor IR-drop, providing a precision uni-polar output voltage proportional to load current. The LT6105 is powered from a supply voltage (from 2.85V up to 36V) while it measures current of a voltage power bus (0V to 44V). This device is suitable for measuring battery system current since the monitoring-input current draws become negligible when  $V_{CC}$  is powered down. Its 0V and up input range makes it

suitable for measuring supply bus loading as they are brought up. When provided with a negative supply, it is capable of monitoring negative supplies.

The key performance characteristics of the LT6105 and DC1192 are shown in the Performance Summary below.

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

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

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
$V_{IN}$	Monitored Supply Input Range		-0.3	0... 44	44	V
$V_{CC}$	Amplifier Supply Range		2.85	3... 28	36	V
$A_V$	Voltage Gain	$R_{IN1} = R_{IN2} = 100, R_{OUT} = 4.99k$		50		V/V
$A_Z$	Total Current to Voltage Gain	$R_{SENSE} = .020 \text{ Ohm}$		1		V/A
$V_{OUT}$	Output Voltage Range	$V_+ = 3V$		2		V
$I_{MAX}$	Maximum Sense Current	Thermal limit of $R_{SENSE}$ (2Watts)			10	A
$I_{CC}$	$V_+ (=V_{CC})$ Supply Current	$V_+ = 36V, V_{S+} = 3V, V_{SENSE} = 0V$		150	250	$\mu\text{A}$
$I_{BIAS}$	$V_{S+}$ Bias Current	$V_{S+} = 3V, V_{SENSE} = 0V$		15	25	$\mu\text{A}$
$I_{INPD}$	$V_{S+}$ Current during Power Down	$V_+ = 0V, V_{S+} = 44V, V_{SENSE} = 0V$		.001	1	$\mu\text{A}$
$t_R$	$V_{MON}$ step-response time	$I_{OUT}$ step from 0A to 5A		50		$\mu\text{s}$

### OPERATING PRINCIPLES

The LT6105 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 DC1192 as shipped, the sense resistor installed is 20m $\Omega$  and the resistors set the gain to 50V/V, so the nominal output scaling is 1V per Ampere of load current. Other scalings can be produced by changing the resistors.

The DC1192 Schematic diagram is shown in Figure 2.

## QUICK START PROCEDURE

Demonstration circuit 1192 is easy to set up to evaluate the performance of the LT6105. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. With power off, connect the load driving power supply positive to SOURCE and the common to GND. This supply should be in the range of 0V to 44V. If this supply is not equipped with an accurate current read-out, 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.

2. With power off, connect the amplifier supply positive to VCC and the common to GND. This supply should be in the range of 2.85V to 36V.

3. Connect a voltmeter or oscilloscope probe to the Vout terminal, with the common connection or ground clip tied to GND.
4. Connect a load to the TO LOAD 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.
5. Turn on the power supplies.
6. Check for an output voltage that corresponds to the load current:  $V_{MON} = 1.0 \times I_{OUT}$ .

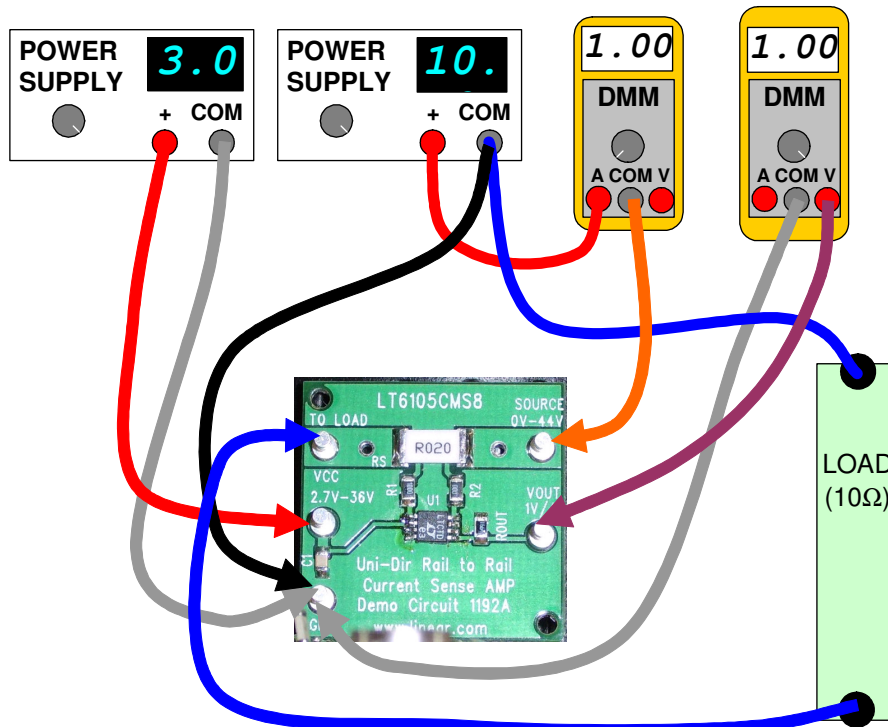
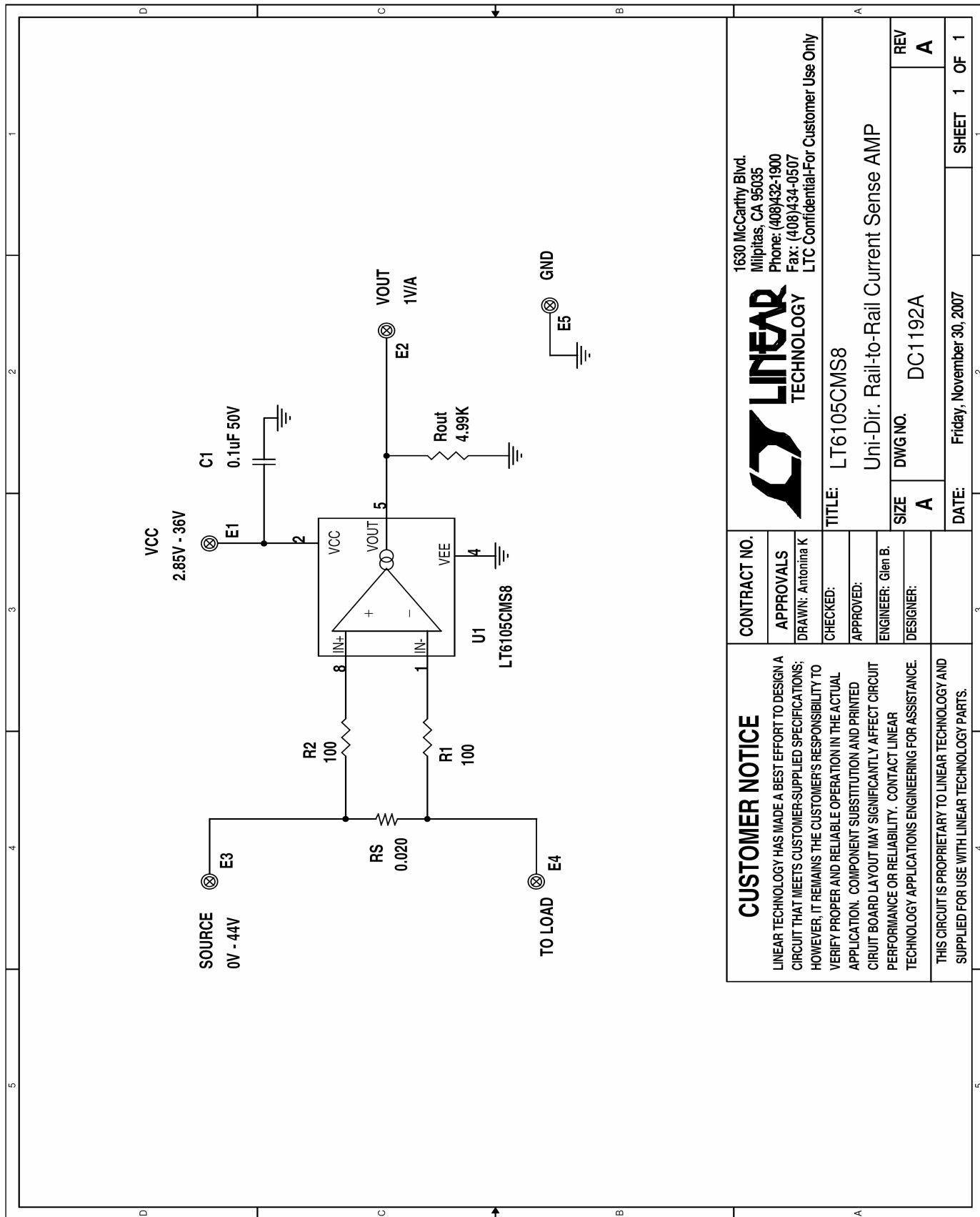


Figure 1. Proper Measurement Equipment Setup



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<b>APPROVALS</b>		<b>LINEAR TECHNOLOGY</b>	
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CHECKED:		Uni-Dir. Rail-to-Rail Current Sense AMP	
APPROVED:		SIZE	REV
ENGINEER: Glen B.		A	A
DESIGNER:		DWG NO.	DC1192A
		DATE:	Friday, November 30, 2007
			SHEET 1 OF 1

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