LT1999: High Voltage, Bidirectional Current Sense Amplifier

DESCRIPTION

Demonstration circuit 1698A features the LT1999, a high voltage, bi-directional current sense amplifier.

The demo board amplifies the voltage drop across an on board current sense resistor. The output voltage is a bi-directional signal that is centered on the V_{REF} voltage and is proportional to the current through the sense resistor. The output is scaled by one of three fixed gain options. The gain options are: 10V/V (DC1698A-A), 20V/V (DC1698A-B) and 50V/V (DC1698A-C). The input voltage range is from –5V to 80V (independent of the device supply voltage) allowing the part to be used for high or low side current sensing. The LT1999 requires a separate 5V supply voltage.

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

PERFORMANCE SUMMARY

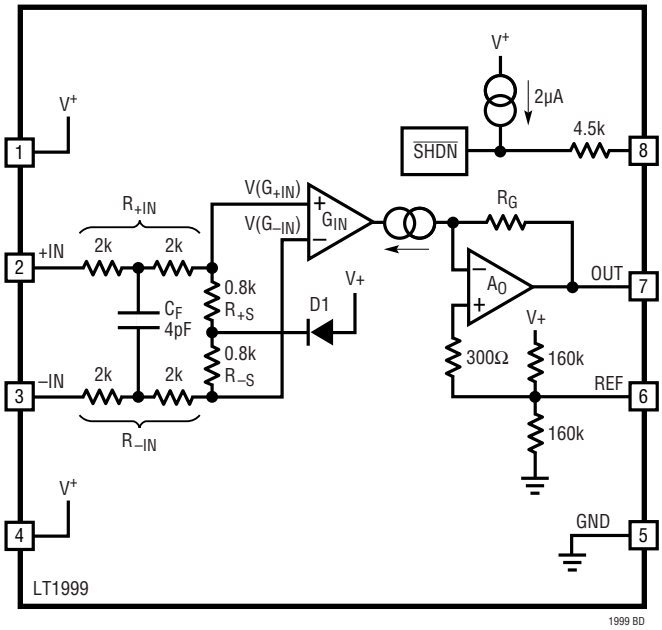
Table 1. Performance Summary (T_A = 25°C)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_S	Supply Range		4.5		5.5	V
V_{CM}	CM Input Voltage Range		–5		80	V
CMRR	Common Mode Rejection Ratio	V_{CM} = 0V , 7V_{P-P}, f = 100kHz	80	100		dB
V_{OUT}	Swing Output High (with Respect to V^+) Swing Output Low (with Respect to V^-)	R_{LOAD} = Open R_{LOAD} = Open		5 150	125 225	mV mV
V_{OSI}	Input Referred Offset Voltage	T_A = 25°C, V_{CM} > 5.5V		550		µV
I_Q	V^+ Quiescent Current	V_{CM} > 5.5V		1.55		mA
V_{REF}	Open Circuit Voltage	V_S = 5V	2.44	2.5	2.55	V
V_{REFIN}	REF Pin Input Range		1.25		V^+ – 1.5	V

OPERATING PRINCIPLES

The LT1999 operates by amplifying the voltage drop across a user selected sense resistor. The voltage across the resistor is amplified by a fixed gain of 10V/V, 20V/V or 50V/V(LT1999-10,LT1999-20,LT1999-50) and is level shifted to the OUT pin of the device. The voltage difference and polarity with respect to the V_{REF} pin voltage indicates the magnitude and direction of the current in the sense resistor.

BLOCK DIAGRAM



QUICK START PROCEDURE

Demonstration circuit 1698 is easy to set up and evaluate the performance of the LT1999. Refer to Figure 1 for proper measurement equipment setup and follow the procedure:

1. With power off, connect a power supply to V^+ and the common to GND. This supply should be between 4.5V and 5.5V. Connect a second supply's positive terminal to the V_{SENSE}^+ and connect its common to the circuit ground. The second supply's (load supply) output voltage can range from –5V to 80V.
2. With power off, connect the load to the V_{SENSE}^-. If the load power source does not have accurate current readout a DMM may be connected in series with the load as shown in Figure 1.
3. Connect a voltmeter to the V_{OUT} terminal, with the common connected to the V_{REF} terminal. An oscilloscope can also be used to monitor Vout with respect to ground.
4. Turn on the power supply to the device and the load supply.
5. Measure the output voltage with respect to V_{REF}. The output voltage will be proportional to the load and with the factory set sense resistor will equal 0.5V per 1A.

QUICK START PROCEDURE

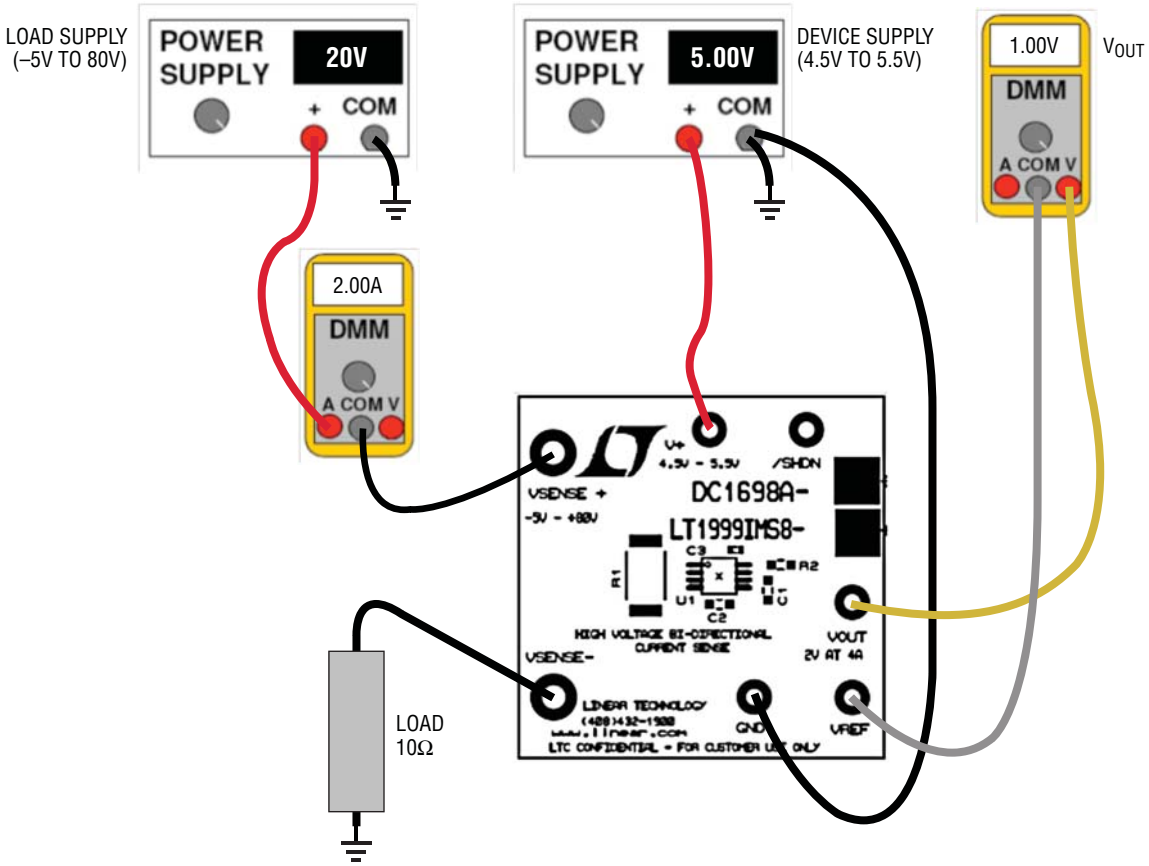
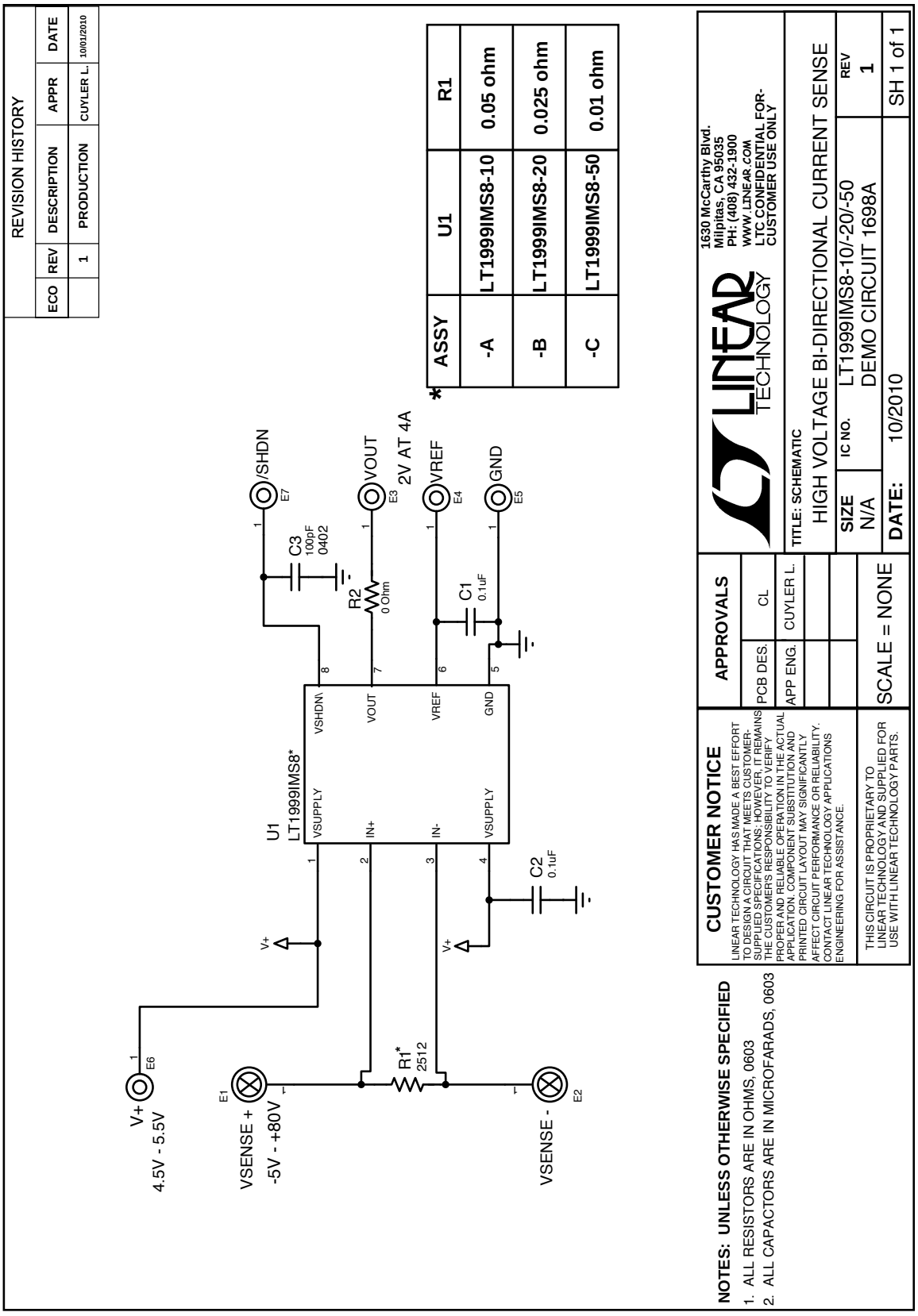


Figure 1. Proper Measurement Equipment Setup

PARTS LIST

ITEM	QUANTITY	REFERENCE	DESCRIPTION	MANUFACTURER'S PART NUMBER
General BOM				
1	2	C1, C2	Capacitor, 0.1µF 10% 25V X7R 0603	AVX, 06033C104KAT2A
2	1	C3	Capacitor, 100pF 10% 16V X7R 0402	AVX, 0402YC101KAT2A
3	1	R2	Resistor, 0Ω 0603 1% 1/16W	YAGEO, RC0603FR-070RL
DC1698A-A				
1	1	DC1698A	General BOM	
2	1	R1	Resistor, 0.05Ω 1% 2512 2W	SEI, CSRN2512FT50L0
3	1	U1	IC, LT1999IMS8-10	Linear Technology, LT1999IMS8-10#PBF
DC1698A-B				
1	1	DC1698A	General BOM	
2	1	R1	Resistor, 0.025Ω 1% 2512 1W	Vishay, WSL2512R0250FEA
3	1	U1	IC, LT1999IMS8-20	Linear Technology, LT1999IMS8-20#PBF
DC1698A-C				
1	1	DC1698A	General BOM	
2	1	R1	Resistor, 0.01Ω 1W 1% 2512 SMD	Vishay, WSL2512R0100FEA
3	1	U1	IC, LT1999IMS8-50	Linear Technology, LT1999IMS8-50#PBF

SCHEMATIC DIAGRAM



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