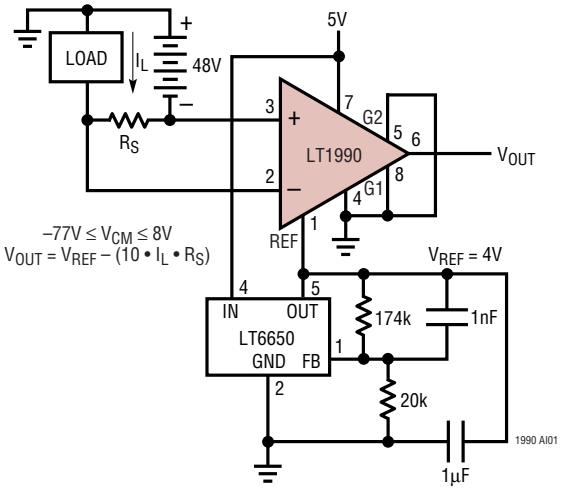
Negative Voltage

This chapter discusses solutions for negative voltage current sensing.

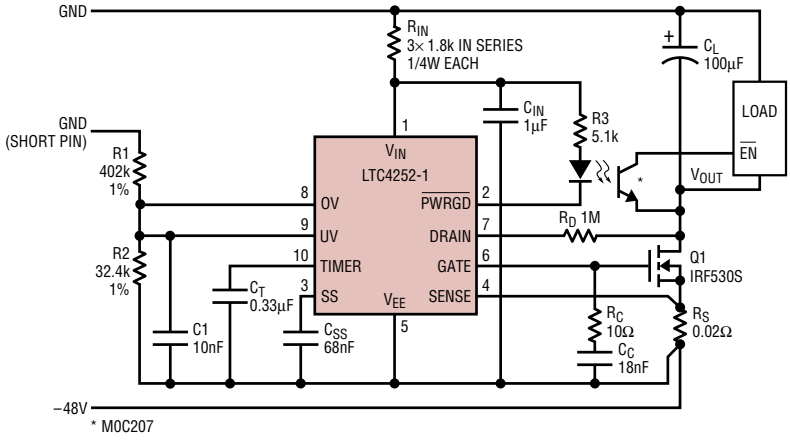
To see other chapters in this Application Note, return to the Introduction.

Telecom Supply Current Monitor



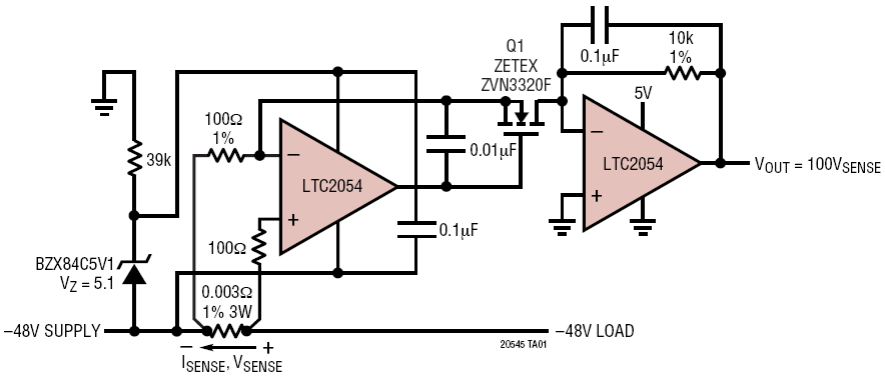
The LT1990 is a wide common-mode range difference amplifier used here to amplify the sense resistor drop by 10. To provide the desired input range when using a single 5V supply, the reference potential is set to approximately 4V by the LT6650. The output signal moves downward from the reference potential in this connection so that a large output swing can be accommodated.

–48V Hot Swap Controller



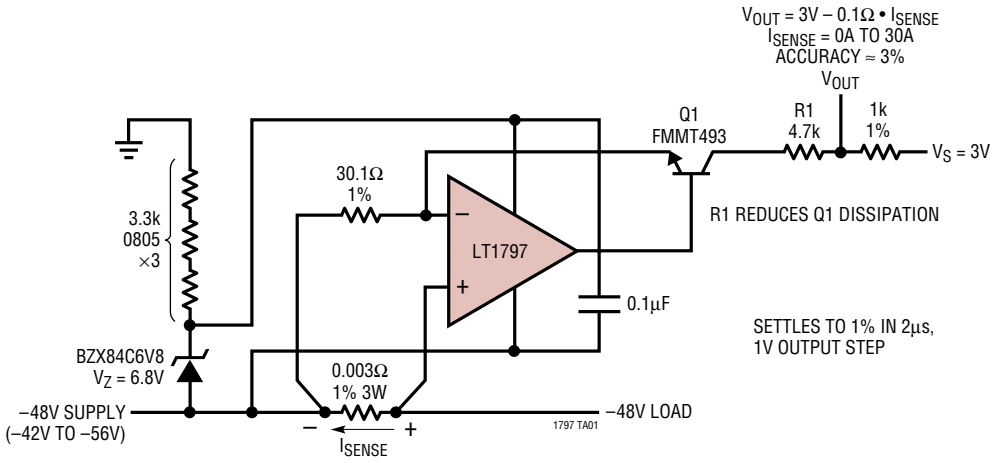
This load protecting circuit employs low-side current sensing. The N-MOSFET is controlled to soft-start the load (current ramping) or to disconnect the load in the event of supply or load faults. An internal shunt regulator establishes a local operating voltage.

–48V Low Side Precision Current Sense



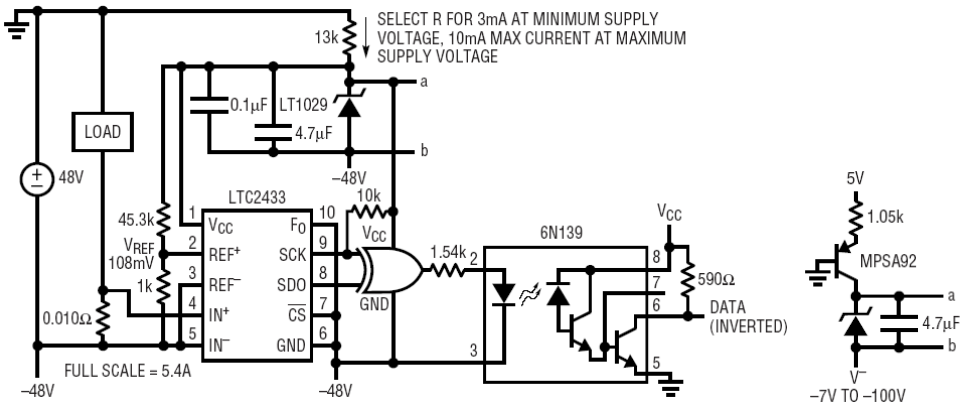
The first stage amplifier is basically a complementary form of the "classic" high-side current sense, designed to operate with telecom negative supply voltage. The Zener forms an inexpensive "floating" shunt-regulated supply for the first op amp. The N-MOSFET drain delivers a metered current into the virtual ground of the second stage, configured as a trans-impedance amplifier (TIA). The second op amp is powered from a positive supply and furnishes a positive output voltage for increasing load current. . A dual op amp cannot be used for this implementation due to the different supply voltages for each stage. This circuit is exceptionally precise due to the use of Zero Drift op amps. The scaling accuracy is established by the quality of the user-selected resistors. Small-signal range is limited by V_{OL} in single-supply operation of the second stage.

Fast Compact –48V Current Sense

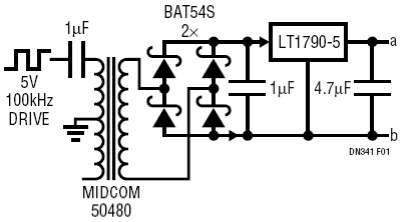


This amplifier configuration is essentially the complementary implementation to the classic high-side configuration. The op amp used must support common-mode operation at its lower rail. A "floating" shunt-regulated local supply is provided by the Zener diode, and the transistor provides metered current to an output load resistance (1kΩ in this circuit). In this circuit, the output voltage is referenced to a positive potential and moves downward when representing increasing –48V loading. Scaling accuracy is set by the quality of resistors used and the performance of the NPN transistor.

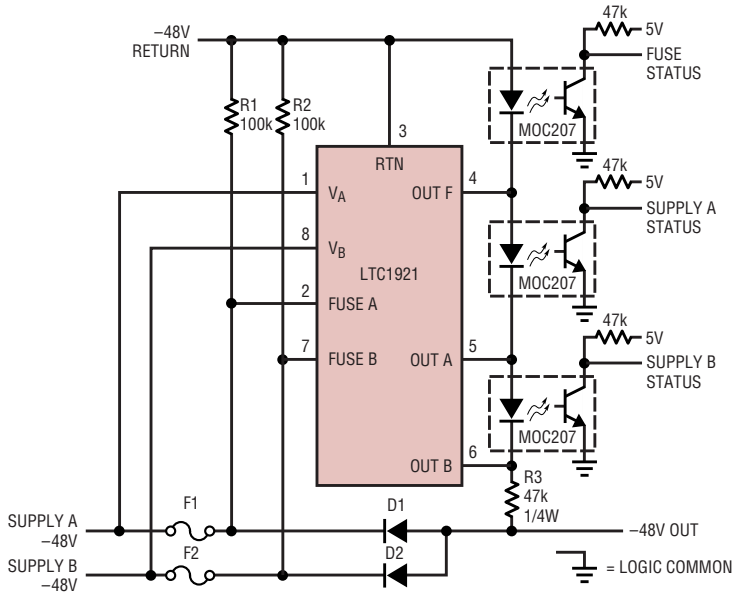
–48V Current Monitor



In this circuit an economical ADC is used to acquire the sense resistor voltage drop directly. The converter is powered from a "floating" high-accuracy shunt-regulated supply and is configured to perform continuous conversions. The ADC digital output drives an opto-isolator, level-shifting the serial data stream to ground. For wider supply voltage applications, the 13k biasing resistor may be replaced with an active 4mA current source such as shown to the right. For complete dielectric isolation and/or higher efficiency operation, the ADC may be powered from a small transformer circuit as shown below.



Simple Telecom Power Supply Fuse Monitor



V_A	V_B	SUPPLY A STATUS	SUPPLY B STATUS
OK	OK	0	0
OK	UV OR OV	0	1
UV OR OV	OK	1	0
UV OR OV	UV OR OV	1	1

OK: WITHIN SPECIFICATION
OV: OVERVOLTAGE
UV: UNDERVOLTAGE

$V_{FUSE\ A}$	$V_{FUSE\ B}$	FUSE STATUS
$= V_A$	$= V_B$	0
$= V_A$	$\neq V_B$	1
$\neq V_A$	$= V_B$	1
$\neq V_A$	$\neq V_B$	1*

0: LED/PHOTODIODE ON
1: LED/PHOTODIODE OFF
*IF BOTH FUSES (F1 AND F2) ARE OPEN, ALL STATUS OUTPUTS WILL BE HIGH SINCE R3 WILL NOT BE POWERED

The LTC1921 provides an all-in-one telecom fuse and supply-voltage monitoring function. Three opto-isolated status flags are generated that indicate the condition of the supplies and the fuses.