

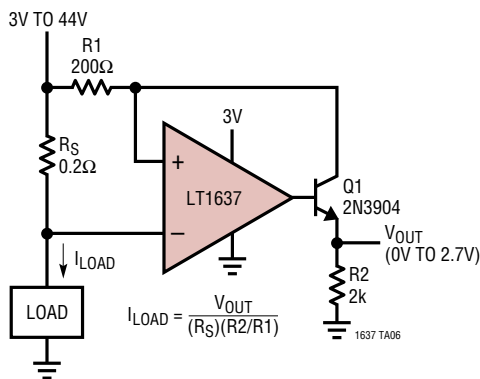
# APPLICATION NOTE 105: Current Sense Circuit Collection

## High Voltage

Monitoring current flow in a high voltage line often requires floating the supply of the measuring circuits up near the high voltage potentials. Level shifting and isolation components are then often used to develop a lower output voltage indication.

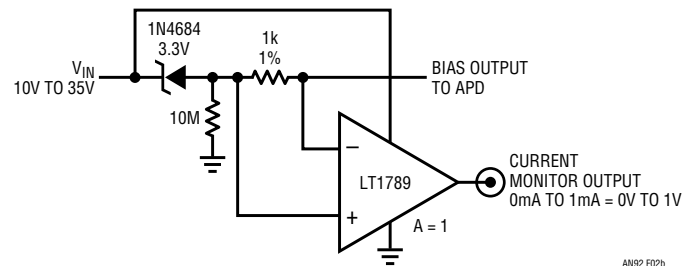
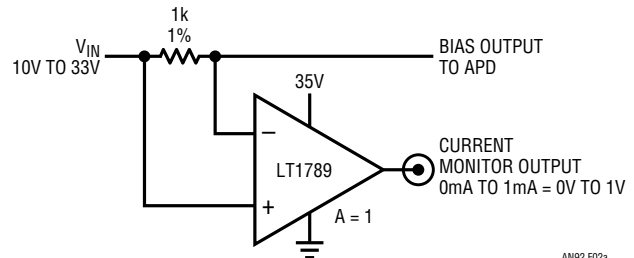
To see other chapters in this Application Note, return to the [Introduction](#).

## Over-The-Top Current Sense



This circuit is a variation on the “classic” high-side circuit, but takes advantage of Over-the-Top input capability to separately supply the IC from a low-voltage rail. This provides a measure of fault protection to downstream circuitry by virtue of the limited output swing set by the low-voltage supply. The disadvantage is  $V_{OS}$  in the Over-the-Top mode is generally inferior to other modes, thus less accurate. The finite current gain of the bipolar transistor is a source of small gain error.

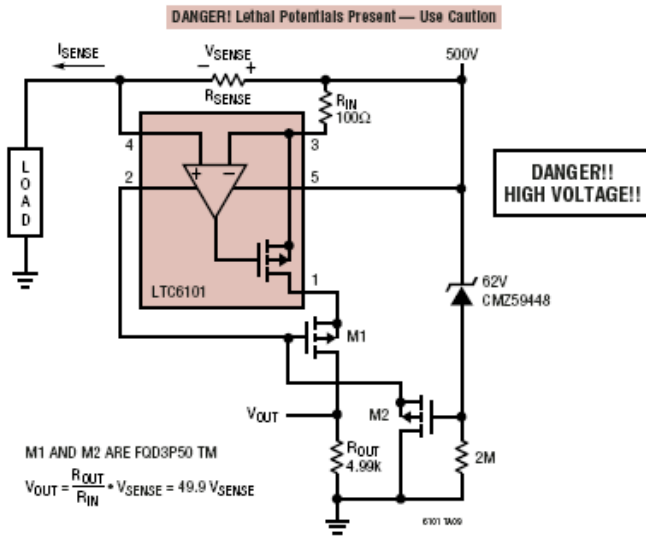
## Measuring bias current into an Avalanche Photo Diode (APD) using an instrumentation amplifier.



The upper circuit uses an instrumentation amplifier (IA) powered by a separate rail (>1V above  $V_{IN}$ ) to measure across the 1kΩ current shunt. The lower figure is similar but derives its power supply from the APD bias line. The limitation of these circuits is the 35V maximum APD voltage, whereas some APDs may require 90V or more. In the single-supply configuration shown, there is also a dynamic range limitation due to  $V_{OL}$  to consider. The advantage of this approach is the high accuracy that is available in an IA.

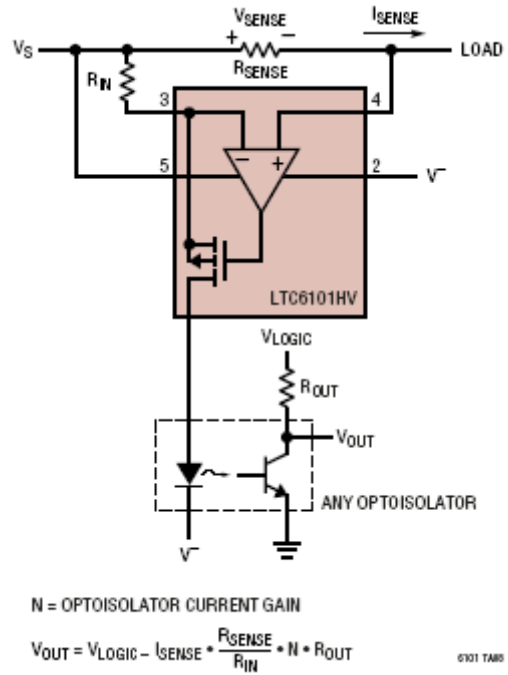
# APPLICATION NOTE 105: Current Sense Circuit Collection

## Simple 500V Current Monitor



Adding two external Mosfets to hold off the voltage allows the LTC6101 to connect to very high potentials and monitor the current flow. The output current from the LTC6101, which is proportional to the sensed input voltage, flows through M1 to create a ground referenced output voltage.

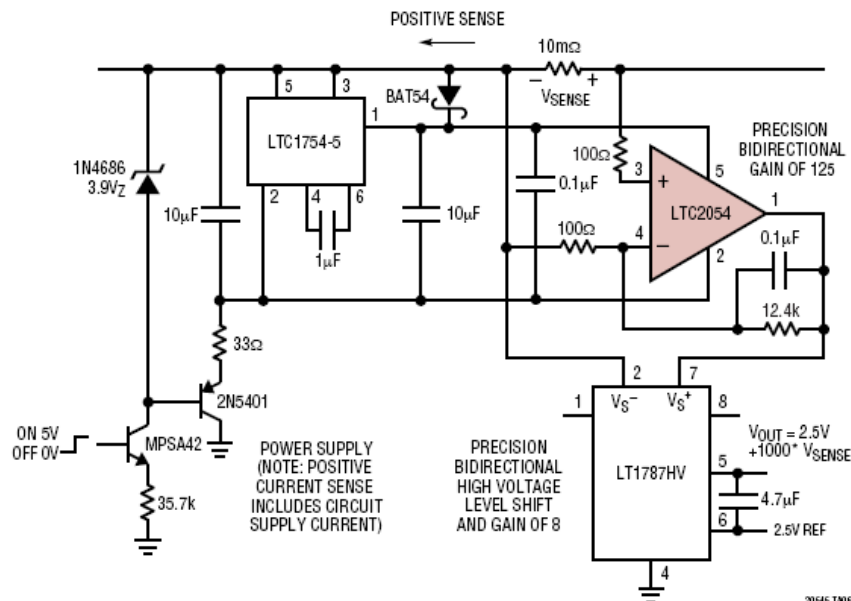
## 48V Supply Current Monitor with Isolated Output and 105V Survivability



The HV version of the LTC6101 can operate with a total supply voltage of 105V. Current flow in high supply voltage rails can be monitored directly or in an isolated fashion as shown in this circuit. The gain of the circuit and the level of output current from the LTC6101 depends on the particular opto-isolator used.

# APPLICATION NOTE 105: Current Sense Circuit Collection

## Low Power, Bidirectional 60V Precision Hi Side Current Sense



Using a very precise zero-drift amplifier as a pre-amp allows for the use of a very small sense resistor in a high voltage supply line. A floating power supply regulates the voltage across the pre-amplifier on any voltage rail up to

the 60V limit of the LT1787HV circuit. Overall gain of this circuit is 1000. A 1mA change in current in either direction through the 10mΩ sense resistor will produce a 10mV change in the output voltage.