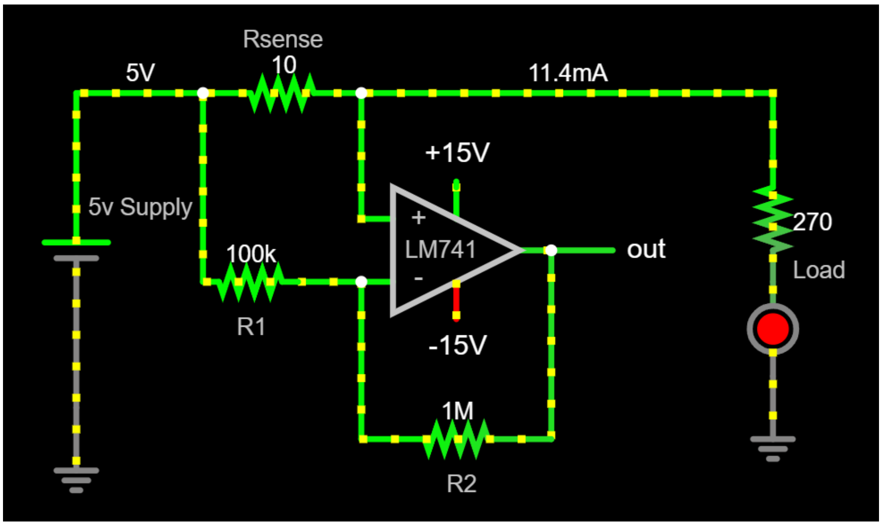
High Side Battery Current Sensor Calculation Explanation



This circuit comes out of datasheet of MCP6041, typical application on page 1.

The formula for converting output of high-side current measurements to current is given by:

$$I_{DD} = \frac{V_{DD} - V_{OUT}}{A_V . R\Omega}$$

This are the example values and:

- IDD is the current.
- VDD is the supply voltage , 5V in our example.
- Vout is the op-amp output voltage, 3.741V in our example (this can be a negative voltage).
- Av is the voltage gain, 10 V/V in our example.
- R is the resistance, 10Ω in our example. (Can use a different R(Rsense) value)

Let's substitute these values into the formula:

$$I_{DD} = \frac{5\text{v} - 3.741\text{V}}{10\frac{V}{V} . 10\Omega}$$

The Vdd – Vout is self explaining I think, so will not explain who subtraction works. :D

The expression "10 V/V" represents the voltage gain (Av) of the amplifier in the circuit. This means that for every 1 volt of input, the amplifier will output 10 volts.

So, with a voltage gain of 10 and a resistance of 10Ω, the calculation goes like this: 10 (gain) * 10Ω = 100.
We can consider 100 as equivalent to 100Ω; it's essentially the same.
(V. drop Rs x 10 == V. Gain op-amp x 10)
Now we have known voltage and ohm values, and these can be easily converted to current using Ohm's Law.

To relate voltage and resistance to current, we can use Ohm's Law: I = E/R.
For example, if E = 1V and R = 10Ω, the current (I) would be 0.1A (1/10 = 0.1).

Now, calculating 5V−3.741V gives 1.259V. With a gain of 10 (10V/V) and a 10Ω resistance, the overall division is 100 (10 gain * 10Ω = 100). So we get the following final sum of;

$$I_{DD} = \frac{1.259\text{V}}{100}$$

Now, the op-amp output has been converted into a current of 0.01259A or 12.59mA.

$$I_{DD} = 0.01259\text{A}$$

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