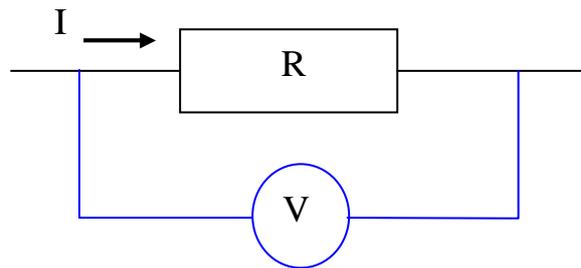


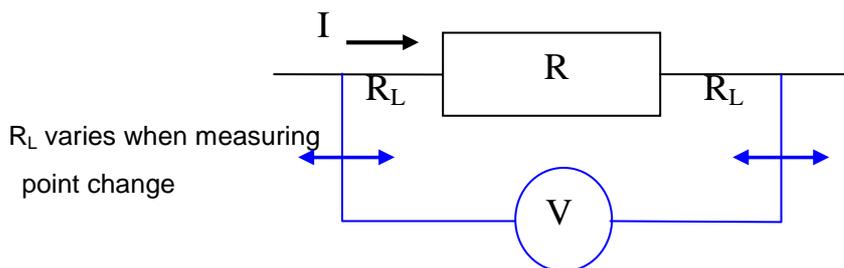
## MELF Resistor vs. CHIP Resistor - 4-terminal Current Sense Resistor Application

In order to measure current in an electrical circuit, we would let the current pass a low-resistance resistor, measure the voltage drop (named V) across both ends of the resistor with an IC, and apply Ohm's Law  $I = V/R$  to calculate the passing current I.

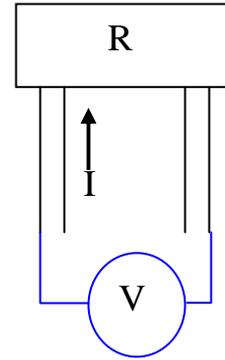
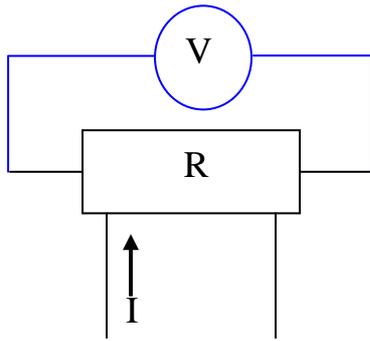
The described circuit would generally appear as follow:



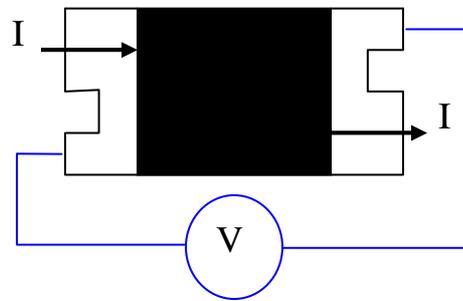
In fact, when measuring the voltage drop across the resistor, the total resistance the current passes through includes both the resistor resistance (named R) and the lead wire resistance (named  $R_L$ ), causing inaccurate current measurements. Each time when the measuring points change,  $R_L$  value varies as a result. The farther measuring point is from the resistor, the higher  $R_L$  value we would get. This effect of  $R_L$  value change is particularly obvious in the case of low-resistance current sense resistors. For SMD type of resistor,  $R_L$  is the resistance created by the solder paste.



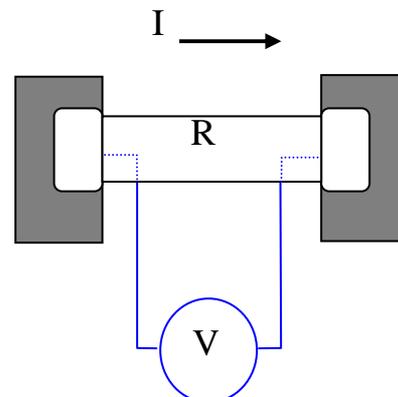
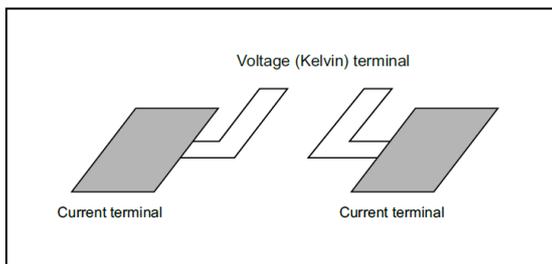
In order to reduce  $R_L$  impact on measurement of voltage drop, we need to fixate the measuring points. Therefore, two extra lead-wires are fixed on a 4-terminal current sense resistor, so the  $R_L$  would be a constant value for voltage measurement purpose.



The typical chip type of 4-terminal current sense resistor combines voltage terminals and current terminals, not only fixing the measuring points but also shortening the distance from measuring points to the resistor. This way,  $R_L$  is constant and lower and the current measurement is more accurate.



With a special layout that makes voltage terminals very close to resistor caps, like 4-terminal chip-type, MELF type of current sense resistor (for example, Firstohm's CSM series) can also minimize  $R_L$  value so the measured voltage drop  $V$  is closer to the actual  $I \times R$ . Furthermore, application and production of MELF type is less complex, lowering the related costs.



MELF type of current sense resistors not only exert the same features as chip type of 4-terminal current sense resistors but also inherit those advantages of MELF resistors - anti-surge, vibration-resistance, and good heat dissipation.