APPLICATION NOTE

The most important thing we build is trust

IRM Adaptive Loop Application Note

IRM ADAPTIVE LOOP APPLICANTION NOTE

The Adaptive Loop is a feature of the IRM module which may be used to compensate for output voltage changes as the load current varies. These voltage changes are due to current flowing through the output resistance of the iPOL and the PC board trace resistance. With no load on the iPOL, the IRM is set to regulate the input voltage to the iPOL to produce the desired output voltage. Then, as more current is drawn by the load, the output voltage at the load will drop because voltage is lost across output resistance of the iPOL and the PC board trace resistance in accordance with Ohm's Law. But as the iPOL load current increases, the current increase is reflected at its input, increasing the load current drawn from the IRM. The IRM senses this increase in load current and responds by increasing its output voltage slightly. This increase to the iPOL input voltage is transferred to its output, returning the load output voltage to its nominal value.

Since the output resistance of the iPOL will change as its temperature varies, each iPOL includes a thermistor temperature sensor. This thermistor is available at the RAL pin of the iPOL and may be connected to the IRM in order to have the IRM account for the temperature variations of resistance when compensating for the resistive drop.

Three resistors are used to adjust the Adaptive Loop. The first resistor, Rg, sets the scaling, or amount of voltage compensation applied as the load current increases. The remaining two resistors, $R_{AL}1$ and $R_{AL}2$, are used to set the amount of temperature correction applied to the Adaptive Loop Scaling.

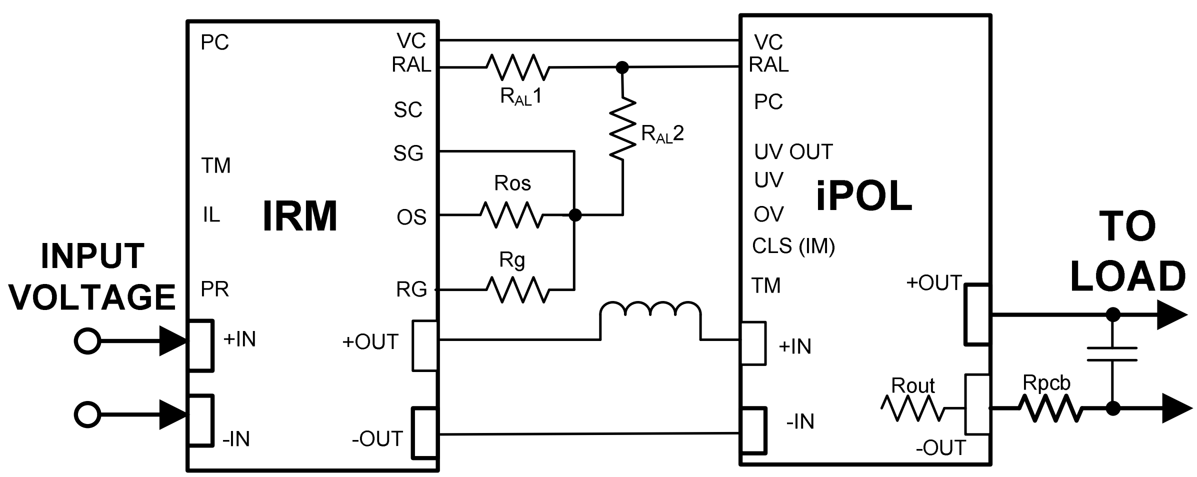


FIGURE 1 – ADAPTIVE LOOP PARAMETERS

SELECTING THE Rg RESISTOR

1) Determine the amount of compensation (Comp) needed. This depends on the total of the iPOL output resistance (Rout) plus the PC board trace resistance (Rpcb), the iPOL "K" factor, and the output voltage.

   Comp = 1.1 * (Rout + Rpcb) * (1/K) / Vout

   gives the compensation needed at the IRM internal reference in units of mV/A, where Rout is the iPOL rated output resistance in milli-ohms, Rpcb is the PC board trace resistance also in milli-ohms; K is the rated transformation ratio of the iPOL expressed as a reciprocal, e.g. 1/32; and Vout is the nominal output voltage of the iPOL.

2) The Rg resistor is then determined by using:

   Rg = - (Comp / 62) / [(Comp / 62) - 1] kΩ,

   where Comp is the amount of compensation as determined in Step 1, and 62 is a scaling constant.

The final value for Rg may need to be adjusted to account for the particular circumstances of each application.

EXAMPLE OF Rg RESISTOR SELECTION

For a Vout = 1 Volt a PDM613132 iPOL module is chosen, which has a voltage ratio K = 1/32. The nominal Rout for the PDM613132 module is 1.5 mΩ, while the PC board trace resistance (Rpcb) from the iPOL to the load is 0.1 mΩ. The amount of compensation needed is then

Comp = 1.1 * (Rout + Rpcb) * (1/K) / Vout,

Comp = 1.1 * (1.5 mΩ + 0.1 mΩ) * (32) / 1V,

Comp = 1.1 * (1.6) * (32) / 1,

Comp = 56.3 mV/A at the IRM internal reference.

The Rg resistor is then determined by

Rg = - (Comp / 62) / [(Comp / 62) - 1)] kΩ,

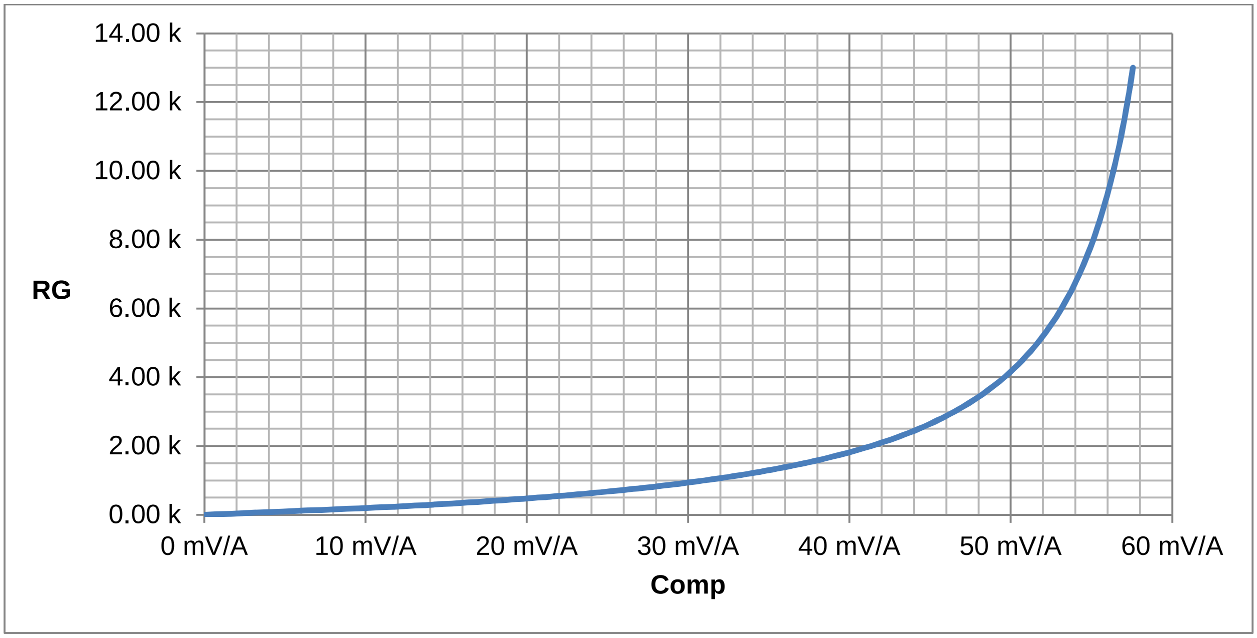
Rg = - (56.3 / 62) / [(56.3 / 62) - 1)] kΩ,

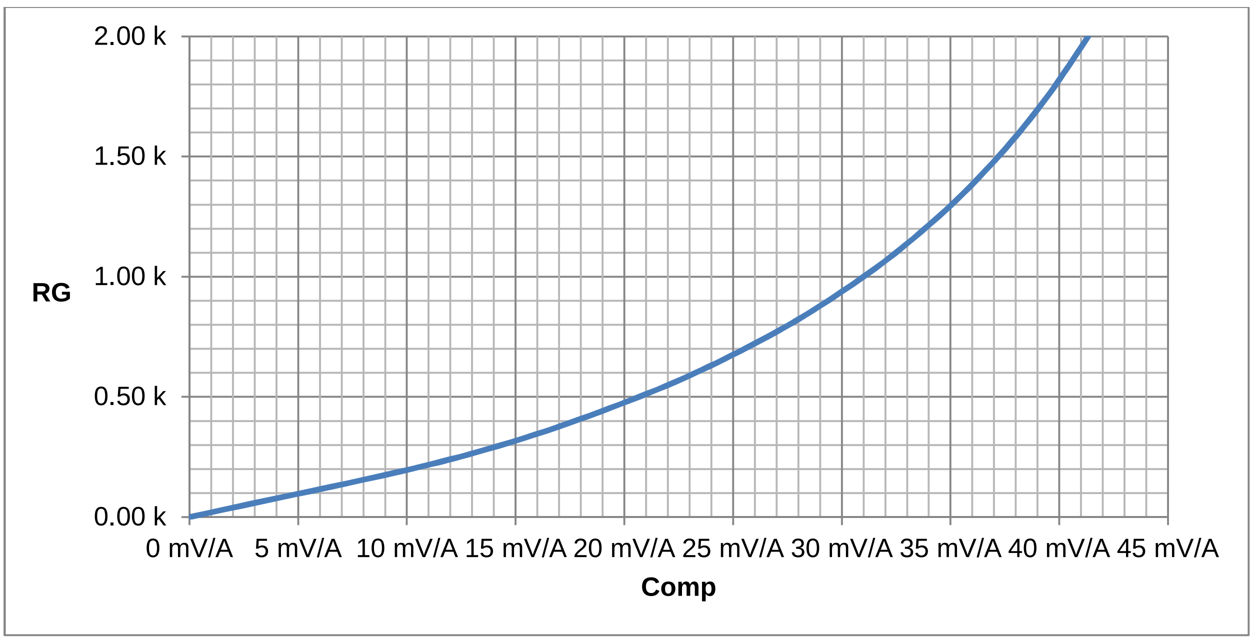
Rg = - (0.908) / [(0.908) - 1)] kΩ,

Rg = - (0.908) / [-0.092] kΩ,

Rg = 9.76 kΩ, using the closest standard value.

The following charts may also be used to select RG once Comp is determined:





ELECTING THE RAL RESISTORS

The RAL pin is used for iPOL temperature compensation. To use this function, connect a 10.0k resistor from the IRM RAL pin to the iPOL RAL pin, shown in the diagram as $R_{AL}1$. Also connect a 9.09k resistor from the iPOL RAL pin to the IRM SG pin, shown as $R_{AL}2$. If temperature compensation is not desired, connect a 15.8k resistor from the IRM RAL pin to the IRM SG pin only.

Cobham Semiconductor Solutions
35 S. Service Road
Plainview, NY 11803

E: info-ams@aeroflex.com
T: 800 645 8862