Variable, Linear Current Source Operates on 5V

The circuit described uses a current-sense amplifier and low-dropout linear regulator to make an adjustable current source with a compliance of zero to 5V. The control voltage can come from a separate voltage input or can be generated under digital control using a 10 or 12 bit, serial or parallel, D to A converter.

The current regulator of **Figure 1** features a low-dropout voltage regulator (IC2) whose voltage feedback is derived from the input current by a current-sense amplifier (IC1). This connection allows the regulator IC to oppose any change in output current. When powered from 5V, the current source has a compliance range of 0V to 4.7V.

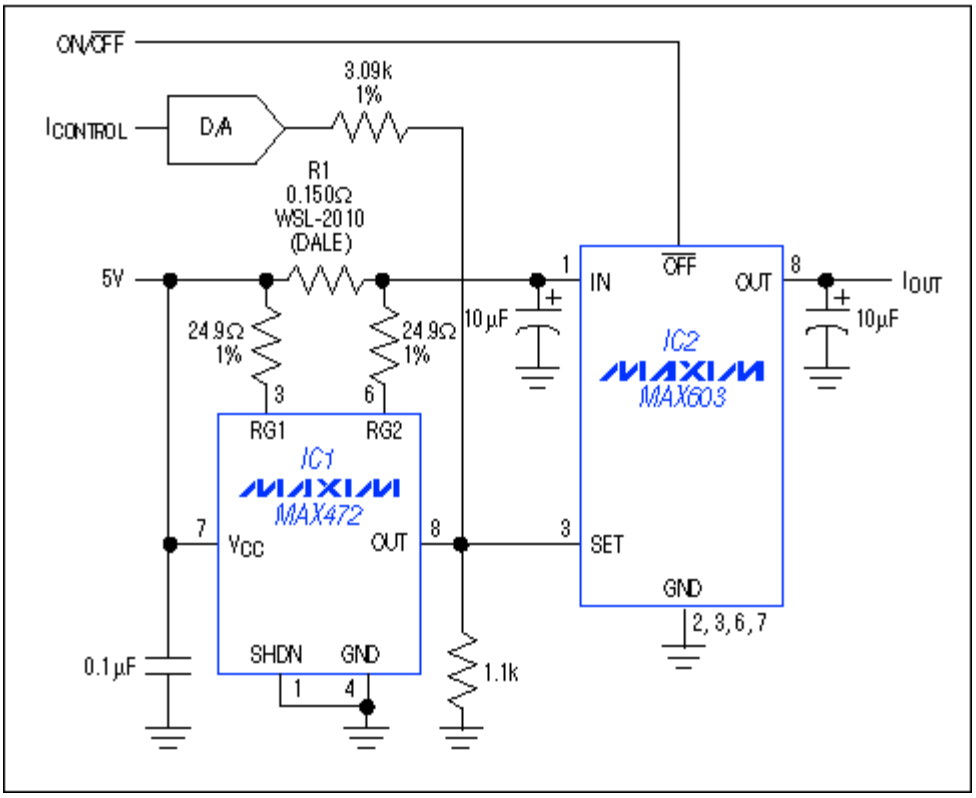

Figure 1. IC1 converts R1 current to a proportional output voltage, enabling the voltage regulator (IC2) to produce a regulated output current.

To set a specific, regulated I_{OUT} level between 0mA and 250mA, apply 0V to 5V at ICONTROL: 0V sets I_{OUT} = 250mA, and 5V sets I_{OUT} = 0mA. Alternatively, a D/A converter

can provide digital control of I_{OUT}. For 12-bit resolution (60µA per LSB), use a parallel-input MAX530 or a serial-input MAX531. For 10-bit resolution (250µA per LSB), use a parallel-input MAX503 or a serial-input MAX504.

You should take care not to exceed the package power-dissipation rating for IC2. At room temperature the rating is 1.8W, so a reasonable limit (with safety factor) is 1.5W. The internal dissipation is simply the programmed current times the voltage difference between the input (pin 1) and output (pin 8). Under worst-case conditions, therefore, (I_{OUT} = 250mA, output grounded, and a dissipation limit of 1.5W), the input voltage can be as high as 6V (i.e., 6V x 250mA = 1.5W).

A similar idea appeared in the 12/95 issue of Electronic Engineering (UK).

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