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Mailing Address: PO Box 11400 • Tucson, AZ 85734 • Street Address: 6730 S. Tucson Blvd. • Tucson, AZ 85706
Tel: (602) 746-1111 • Twx: 910-952-111 • Telex: 066-6491 • FAX (602) 889-1510 • Immediate Product Info: (800) 548-6132

LOW POWER SUPPLY VOLTAGE OPERATION OF REF102 10.0V PRECISION VOLTAGE REFERENCE

By R. Mark Stitt (602) 746-7445

Two of the most important specifications for a voltage reference are noise and stability with time. The zener-based REF102 10.0V voltage reference has much better noise and stability than band-gap-based references.

An advantage that band-gap-based references have in some applications is the ability to operate from lower voltage power supplies. This is because the basic band gap voltage is approximately 1.2V as compared to 6V to 8V for a zener diode. As a 10.0V reference, the REF102 requires a minimum 11.4V V_S. If the higher performance of a REF102 is required, there are several options for operation on lower supply voltages.

If a negative supply is available, it may be possible to operate the REF102 on a positive supply as low as 4.5V. Another option is to use one of the simple DC/DC converter circuits shown to operate the REF102 from a single +5V power supply.

The simplest option for reduced supply operation of a REF102 is to add a unity-gain inverter to make a ±5.0V reference as shown in Figure 1. This allows the REF102 to be used on ±9V power supplies, for example. The minimum voltage for V+ is actually 6.4V (the output of the REF102 can operate within 1.4V of its positive supply).

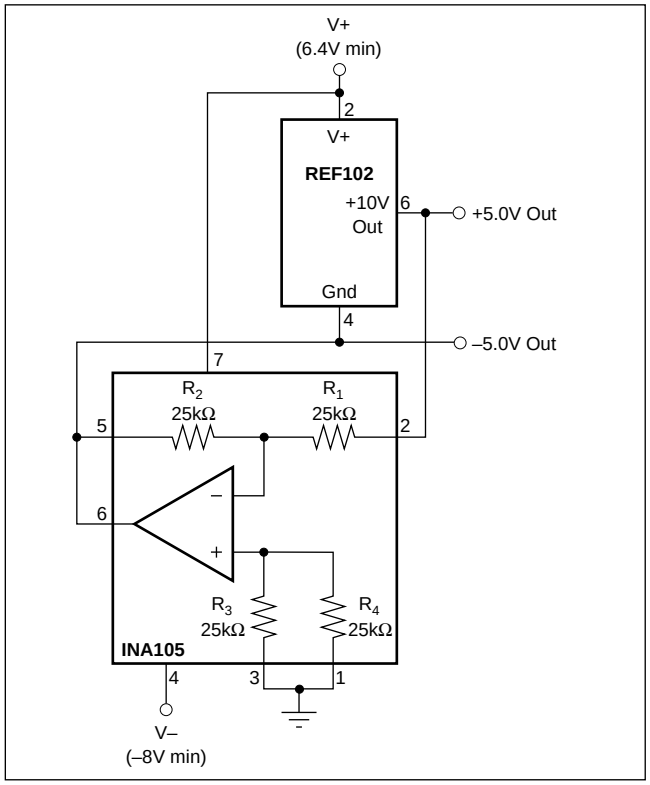

FIGURE 1. ±5.0V Reference Using REF102 Can Operate on $+V_S$ = +6.4V, $–V_S$ = –8V.

The minimum negative supply depends on the amplifier used for the unity-gain inverter. With an INA105 difference amp used for the unity-gain inverter, the negative power supply must be at least –8V.

To operate the REF102 on a minimum $+V_S$ of 4.5V, use an INA106 gain-of-10 difference amplifier for the inverter as shown in Figure 2. With the INA106, the reference outputs are +1.0V and –9.0V. The 4.5V minimum $+V_S$ rating is due to the output swing limit of the INA106. The negative supply must be at least –12V.

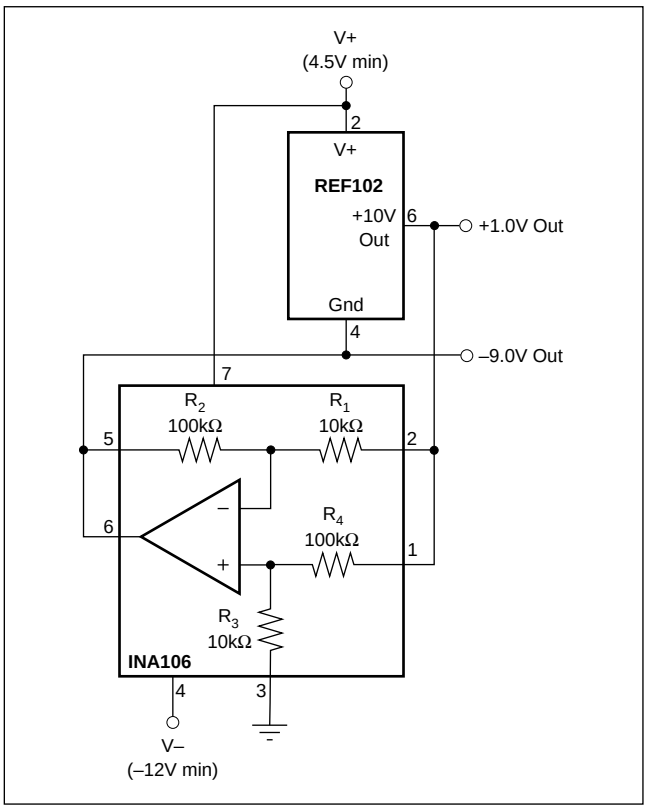

FIGURE 2. +1.0V, –9.0V Reference Using REF102 Can Operate on $+V_S$ = +4.5V, $–V_S$ = –12V.

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When only a single +5V power supply is available, the REF102 can be operated by boosting the 5V supply with one of the many inexpensive DC/DC converter chips available.

A single 5V supply can be boosted to a regulated 15V with a flyback converter as shown in Figure 3. The Maxim MAX643 is basically a self-contained DC/DC converter in an 8-pin plastic DIP. The only additional components needed to convert 5V to a regulated 15V are a single external inductor and a few bypass capacitors. R_6 and C_3 add additional ripple filtering. Good results were obtained with an inductor made from 16 turns of #16 wire on a TDK HC52 T5-10-2.5 core. See the Maxim data sheet for more information regarding the DC/DC converter.

Another option is to boost a single 5V supply to ±10V to drive a ±5.0V reference as shown in Figure 4. The Maxim MAX681 is a completely self-contained DC/DC converter using charge-pump techniques to convert 5V to ±10V.

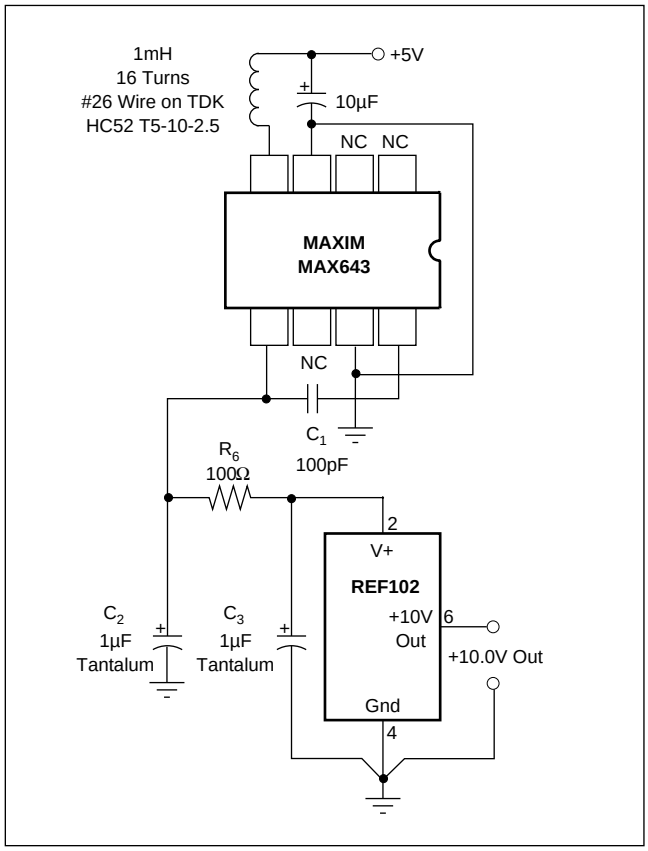

FIGURE 3. +10.0V Reference Using REF102 Can Operate on Single +5V Power Supply.

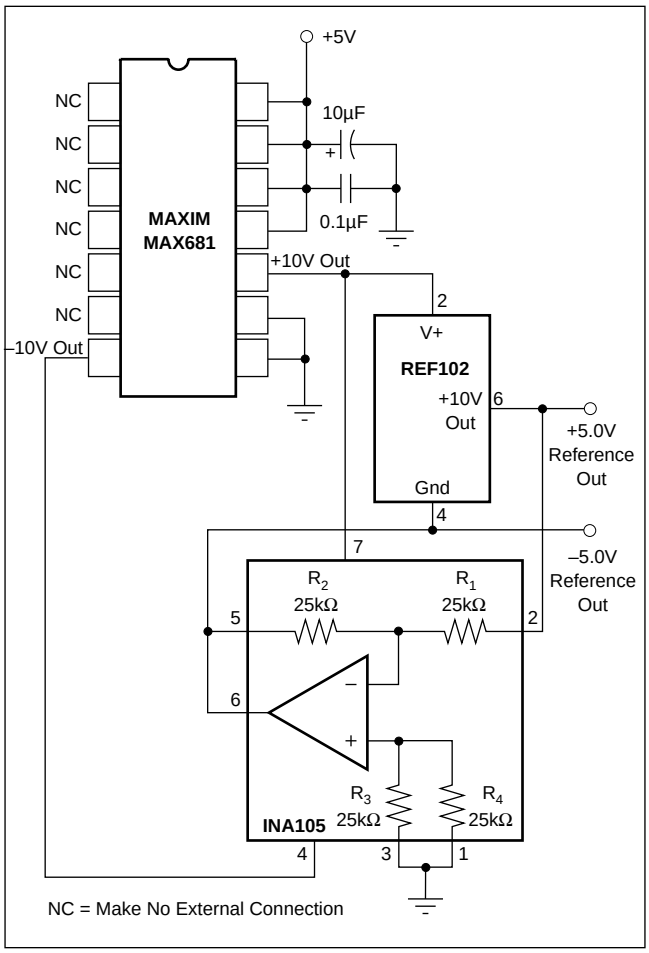

FIGURE 4. ±5.0V Reference Using REF102 Can Operate on Single +5V Power Supply.

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