

Signetics

# AN106

## Using the DAC08 Without Negative Supply

T-51-09.03

Application Note

Linear Products

**USING THE DAC08 WITHOUT A NEGATIVE SUPPLY**

The DAC08 can be used without a negative supply if a few precautions are observed:

1.  $V_{CC}$  must be in the range of 10V to 30V.
2.  $V_{REF(-)}$  must be at least 3V more positive than Pin 3 at all times.
3. Pins 2 and 4 must always be at least 5V above Pin 3 for reference currents up to 2mA, and at least 8V above Pin 3 for reference currents above 2mA.
4. Pin 1 must be at least 5V above Pin 3.

Figure 1 shows the DAC08 in a circuit without a negative supply with two MC1489s used as level shifters. The need for level shifters is implied from requirement 4 above, since the logic threshold is about 1.35V above Pin 1.  $V_O$  must be the same potential as the positive logic supply because of the internal circuitry of the MC1489.

If  $V_{REF(+)}$  is a very stable source with no ripple or noise,  $R_1$  and  $R_2$  can be a single resistor. The same is true of  $R_3$  and  $R_4$  if  $V_{REF(-)}$  is a very stable source. Resistor values are determined as follows:

$$R_1 + R_2 = \frac{V_{REF(+)} - V_{REF(-)}}{I_{REF}}$$

$$R_3 + R_4 = R_1 + R_2$$

where  $I_{REF}$  is reference current through  $R_1$  and  $R_2$

(Pin 14 is at  $V_{REF(-)}$  potential)

The value of the compensation capacitor,  $C_C$ , is determined by the relationship:

$$C_C = 15 (R_1 + R_2)$$

where  $C_C$  is in pF and  $R_1$  and  $R_2$  are in  $k\Omega$ .

$V_O$  (DAC08 Pin 1 and MC1489 Pin 7) must be at least 5V for DAC08 reference currents at or below 2mA, and at least 8V for reference currents above 2mA.  $V_O$  must also be equal to the positive potential of the logic supply, as mentioned above. It should be noted that the MC1489 inverts the logic inputs.

**EXAMPLE**

Power supply voltages of +5V and +15V are available and the input logic is TTL. The need is for a DAC with a full-scale output of 2mA.

- $V_O$  is set to +5V
- $V_{CC}$  for the DAC08 and the MC1489 are set to +15V
- If  $V_{REF(+)}$  and  $V_{REF(-)}$  are set to +15V and +5V respectively,

$$R_1 + R_2 = \frac{15 - 5}{I_{REF}} = \frac{10V}{2mA} = 5k\Omega$$

- $R_3 + R_4$  should also add up to  $5k\Omega$ .
- $C_C$  is  $15(5)pF = 75pF$ .

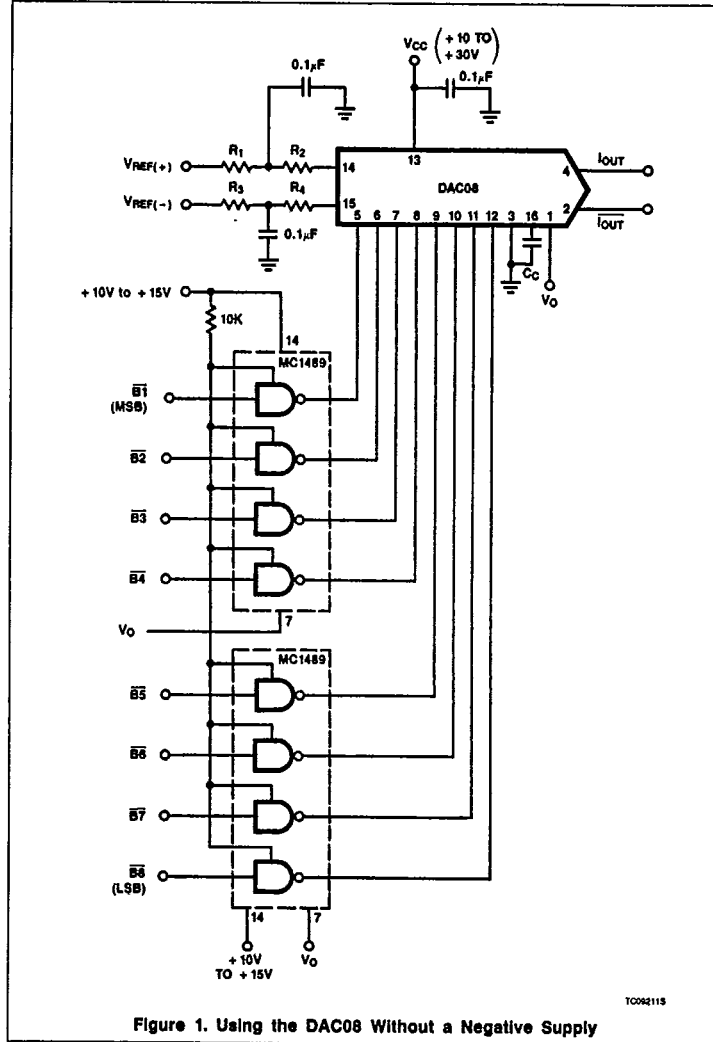


Figure 1. Using the DAC08 Without a Negative Supply

TC092115