

## Single-Component Thermometers

### Introduction

The DMS-20 and DMS-30 Series of 3½ digit voltmeters are ideal for constructing very accurate digital thermometers with only a single external component—the LM34 or LM35 solid-state, temperature-transducer IC's. The LM34 and LM35, both available from National Semiconductor, are rugged three-terminal devices designed to make temperature measurements in degrees Fahrenheit or Celsius, respectively. They are both available in either TO-92 or TO-46 packages and cost approximately \$2 (US) in 100-piece quantities.

The dc output voltage of both devices is linearly proportional to their ambient temperature, i.e., at +77°F (+25°C), the LM34's output is 0.77Vdc while the LM35's is 0.25Vdc. Neither device requires any external calibration or trimming circuits to provide typical accuracies of ±½°F (±¼°C) at room temperature and ±1½°F (±¾°C) over a full –50 to +300°F (–55 to +150°C) operating temperature range. However, although the LM34 and LM35 are specified to operate below 32°F (0°C), the DMS Series meters have an operating temperature range of 0 to +60°C (+32 to +140°F).

### External Connections

As previously noted, it is very important that any meter used with the LM34/35 not be put into an environment that is outside the meter's

specified operating temperature range. Care should be taken when making connections to the LM34/35. The point at which the wires attach to the LM34/35 should be kept at the same temperature as the body of the LM34/35. This will ensure that the connections themselves do not affect the overall measurement accuracy by acting as heat sinks and drawing heat away from the LM34/35's package.

### Power Supply Requirements

Figure 1 shows the connections required for 5V-powered meters, while Figure 2 shows the connections for 9V-powered LCD meters. The input voltage range of all meters must be ±2 Volts ("–1" part number suffix). For 5V operation, any DMS-20, DMS-30 or DMS-40 model—with LCD or LED displays—can be used with either temperature sensor. For 9V operation, only the DMS-30LCD-1-9 can be used, and only with the connections shown in Figure 2. The 9V power source can either be a line-operated dc supply or a battery. The power requirement for the LM34/35 is typically 70µA while the DMS-30LCD-1-9 has a current drain of only 350µA.

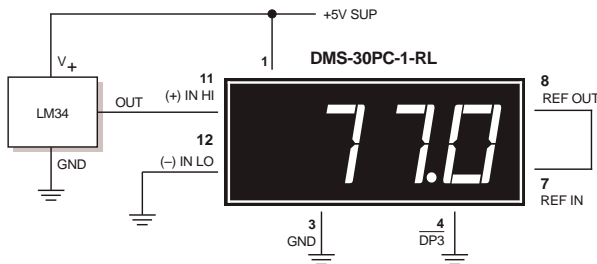


Figure 1. LM34 Fahrenheit Display Using DMS-30PC-1-RL

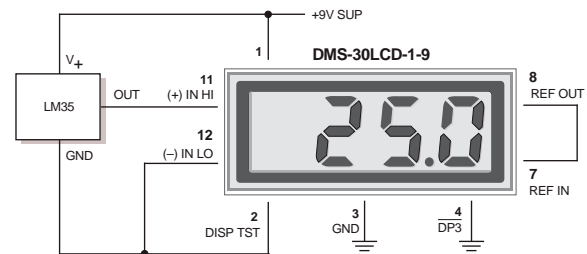


Figure 2. LM35 Celsius Display Using DMS-30LCD-1-9