Temperature compensation in LCDs

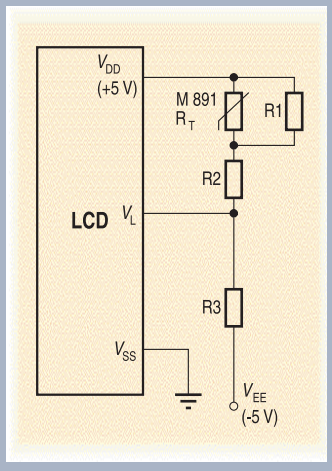

Fig. 2 Temperature compensation for small LCDs drawing low contrast current.

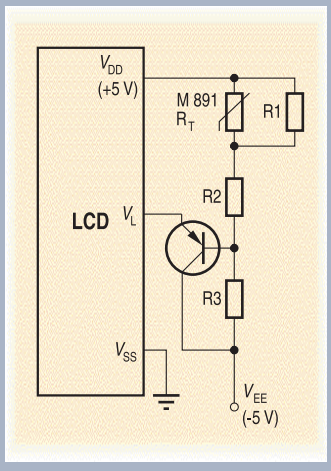

Fig. 3 Temperature compensation for large LCDs with high current requirements.

How LCDs work

Liquid crystal displays (LCDs) are widely used in modern electronic devices such as mobile and wireline telephones, pagers, calculators, watches, portable CD players and numerous instruments. LCDs are passive devices which operate by manipulating ambient light. An LCD consists of two plates of thin glass separated by a layer of liquid crystal fluid.
The liquid crystal material is a mixture of fluid with a large number of long cylindrically shaped crystals. The inner surfaces of the glass plates are patterned with the transparent electrodes, the outer surfaces are bonded to sheets of polarized material to create the desired visual effect when the field voltage is applied to the electrodes.

SUMMARY

NTC thermistors have vast potential for temperature measurement in automation and control applications. The specimen circuits presented here illustrate their versatility.

Depending on circuit design, NTC thermistors with rated resistances from 3.3 to 68 kΩ are used (10 kΩ with 5% tolerance is most common). Type M891 from Siemens Matsushita Components is ideal for this application.
In some fans, the control circuit is combined with the electronic motor commutation circuit and assembled in the rotor of the motor.

NTC thermistors in LCDs

As the fluid used in liquid crystal displays is sensitive to temperature, LCD modules have a limited operating temperature range. If a constant voltage is applied, LCD contrast increases with temperature. On the other hand, low temperature means low contrast. In fact, the threshold voltage of the liquid crystal has a negative temperature coefficient characteristic of typically 6 mV per kelvin. Some method is therefore needed to maintain optimum contrast over a wide temperature range. This problem can best be solved with NTC thermistors.

Temperature range of LCD modules

LCD modules are available for two temperature ranges – standard and extended. Standard displays are intended for indoor use, extended displays for outdoors and rugged environments. Standard displays can be operated in the range from 0 to 50 °C and normally require no temperature compensation because variation of contrast with temperature is only slight. In extended modules, however, which operate between –20 and +70 °C , a compensation circuit is often used.

Temperature compensation with NTC thermistors

The NTC thermistor should be physically mounted as close to the glass as possible for accurate temperature measurement. Figs. 2 and 3 depict two practical temperature compensation circuits.
The circuit in Fig. 2 is normally used in small LCD modules that draw only a low contrast current. Rated at 15 kΩ, NTC thermistor M891 from Siemens Matsushita Components is used as the temperature sensor. Resistor R1 with a typical value of 510 kΩ linearizes the voltage curve of V_L over temperature.
The circuit in Fig. 3 is used in large LCDs requiring relatively high current. A pnp transistor (BC558) is connected as an emitter follower to provide the drive current to the LCD contrast voltage input.

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