New "Three Pack" IC Makes Temperature Control Even Easier!

Javier Solorzano
Senior Applications Engineer
Touchstone Semiconductor, Inc.

When the temperature in a room rises to a certain level, it may become an uncomfortable place to be. A fan can help, but we do not want the fan on at all times, only when the temperature rises above a particular threshold. This can be achieved by building a simple circuit with an op amp, a comparator, and a voltage reference as was done in a previous design idea titled: "Three Very-Low-Current Analog ICs Make a USB-Powered Thermostat." Now, by using an analog IC that combines all three functions in one package, a simple temperature-controlled fan circuit can be built with minimal external component count.

Measurement Set-Up

A temperature-controlled fan application circuit can be designed using a single analog IC, such as the Touchstone TS12011 IC as shown in Figure 1. The IC is powered from a 2.5V voltage from a buck converter that can also be used to drive other important ICs such as a microcontroller. The buck converter input voltage is 6V and is generated by four 1.5V AA batteries. Furthermore, the batteries power any LM35 temperature sensor and a silicon-controlled rectifier (SCR) to control fan operation. The temperature sensor provides an output voltage that is linearly proportional to ambient temperature in Celsius. For every one (1) degree Celsius increase/decrease in temperature, the temperature sensor's output voltage increases/decreases by 10mV.

In this application circuit, the fan is set to turn on when the temperature rises to 26.5°C. For instance, at a temperature of 26.5°C, the temperature sensor will generate an output voltage of 265mV that will in turn generate a HIGH state at the output of the comparator and the FAN will turn on. For testing purposes, an external power supply was substituted for the temperature sensors. Figure 2 shows the complete circuit where a demo board is used along with the IC.

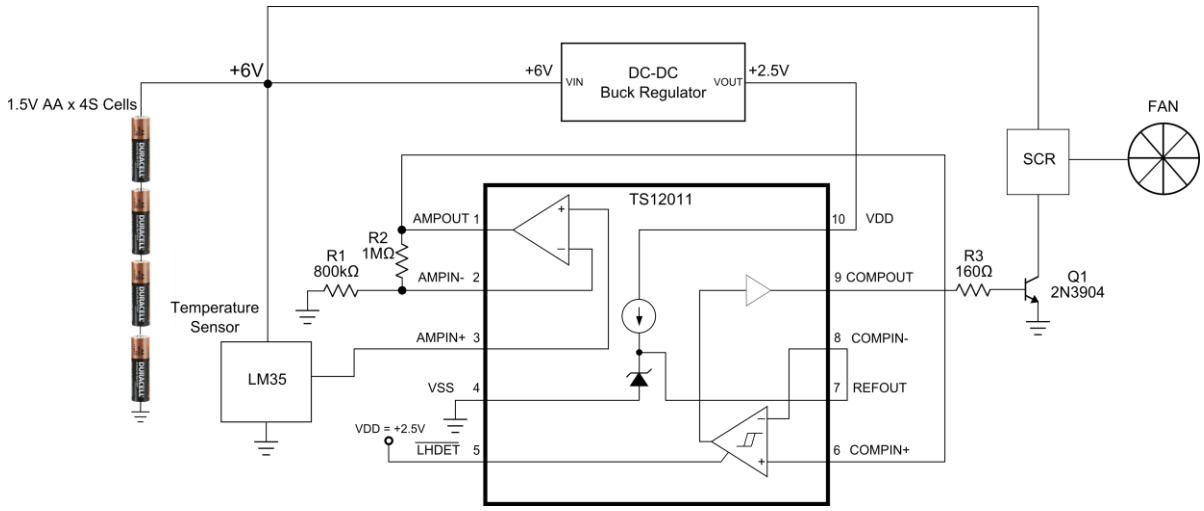

Figure 1. TS12011 Temperature-Controlled Fan Circuit

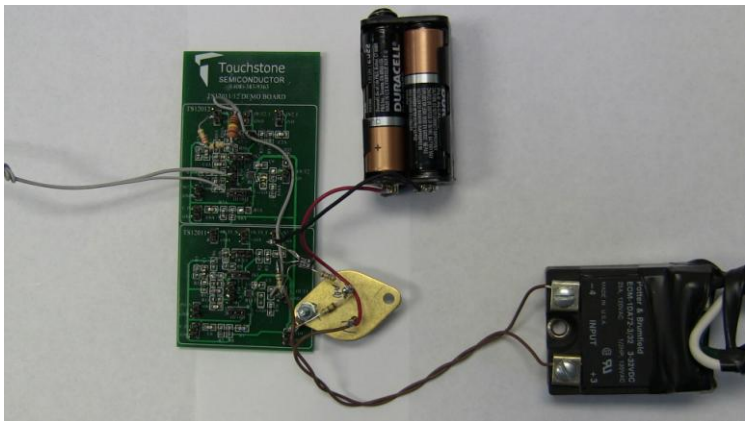

Figure 2. TS12011 Temperature Controlled Fan Circuit

Results

When the power supply voltage applied to the input of the op amp reaches approximately 265mV, the fan turns on successfully. A 265mV voltage corresponds to a temperature of 26.5°C.

Considerations

Some multi-function analog ICs, like the TS12011, make available a comparator latch function. In this IC, the $\overline{\text{LHDET}}$ pin is useful for capturing one-time events. While this function was not explicitly used in this application, the $\overline{\text{LHDET}}$ pin was connected to V_{IN} thereby disabling one-time-latch operation. For a detailed explanation of this function, please refer to the video referenced below.

Conclusion

In summary, the application circuit described herein achieves a three primary goals: a) reducing the total number of analog ICs used from 4 to 2, thereby saving significant pcb area; b) low-supply-voltage operation from 0.8V to 2.5V; and c) reducing the supply current consumed by the op amp/reference/comparator functions to 1.5µA.

For additional information, please follow the links to the corresponding product pages:

- TS12011 Product Information
- TS12011 Video

Contact: Touchstone Semiconductor Applications
Applications@TouchstoneSemi.com
+1 (408) 383-9363