Simple Circuit Detects Airflow

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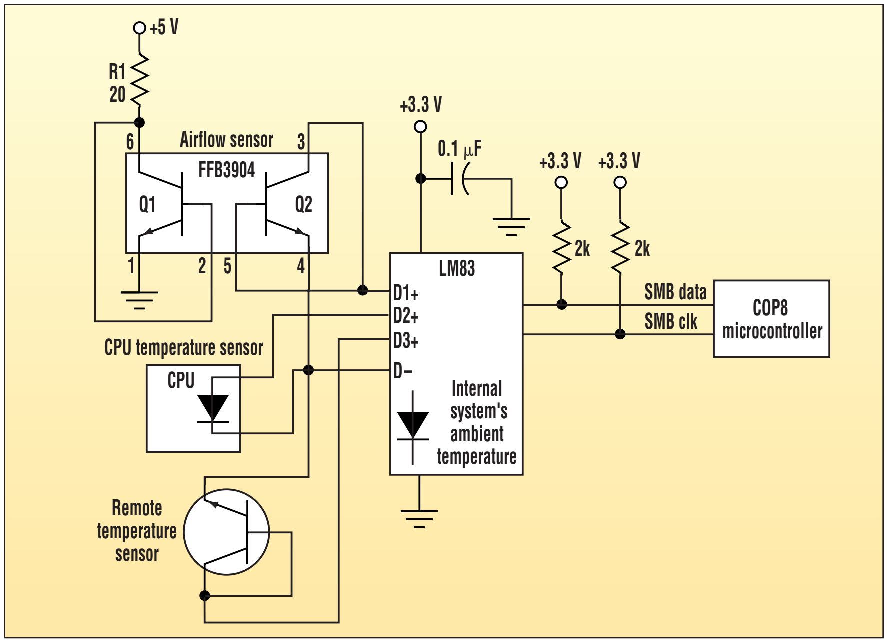
Moving air provides a better conductive path and cooling method for hot components than stagnant air. Therefore, airflow is a critical parameter in systems where heat build-up is a concern. The circuit shown is unique because it wasn't designed to measure absolute temperature or fan speed *(Fig. 1)*. Instead, it's used to (indirectly) measure airflow.

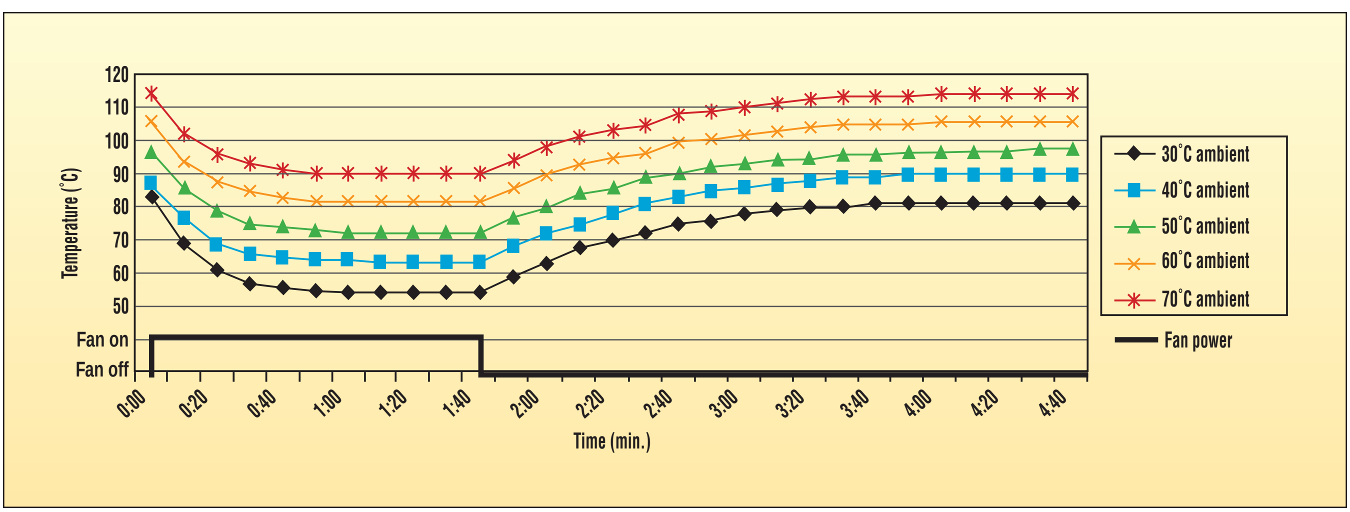
In this circuit, Q1 dissipates a constant power level, elevating the die temperature of the Q1/Q2 pair above ambient. Using the remote sensing capabilities of the LM83, the diode-connected Q2 senses the die temperature. R1 keeps the power dissipated in Q1 at approximately 190 mW.

As air moves across the transistor-pair package, the thermal resistance between the package and surrounding air is lowered and the part is cooled. Should the airflow decrease or stop, the thermal resistance will increase and the die will heat up. The LM83 can be programmed to generate an interrupt when changes in die temperature are detected. This, in turn, enables the sensor to flag changes in the thermal resistance (that is, airflow).

In the application of this circuit, there will be differences in measured temperature drop. These variations will depend on the power dissipated in Q1 as well as the volume of airflow across the transistor pair. A 20-Ω resistor is used to induce a power dissipation of 190 mW.



1. This airflow monitor is unique in that it's designed to measure airflow, not absolute temperature or fan speed. Here Q2 is used to sense the change in the thermal resistance of Q1.



2. When the fan is turned on, the presence of airflow across the Q1/Q2 pair causes the temperature delta to drop from 50°C to 20°C.

Consequently, a 50°C-above-ambient temperature is produced at the die when there's no airflow. Turning on the cooling fan reduces this delta by about 20° in 30 seconds *(Fig. 2)*. As the ambient temperature is raised from 30°C to 70°C the power dissipated in Q1 varies by about 10 mW. This results in a temperature error of less than 5°C as the ambient temperature changes.

For this circuit to function properly, some microcontroller assistance is required. Periodically, the microcontroller must take temperature measurements to account for any ambient temperature changes. The LM83's internal temperature sensor is ideal for this function, leaving its two remaining ports available for other functions. Also, a small-packaged transistor pair should be used.