

EE 230 design - Temperature indicator circuit

Design and build a circuit that takes the signal from a temperature measurement sensor (Texas Instruments LM35) and produces a visual indication of the certain temperature levels. The circuit will behave slightly differently, depending on whether the temperature is rising or falling.

As the temperature increases:

- A green LED will be lit for temperatures below 40°C. It will turn off when the temperature becomes greater than 40°C.
- An orange LED will turn on when the temperature increases past 40°C. (i.e. When the green LED turns off.)
- A red LED will turn on when the temperature increases past 100°C.

When temperature is decreasing.

- Once the red LED has been turned on, it will not turn off until the temperature decreases below 80°C.
- Once the orange LED turns on, it will not turn off until the temperature drops below 30°C.
- The green LED will turn on again when the orange LED turns off (at 30°C).

Comments / Testing / Reporting

- You can obtain an LM35 sensor from GT. However, you don't really *need* the sensor in order to design the indicator circuit. You can easily mimic the electric behavior of the LM35 using a variable DC voltage source, since the output of the sensor is a DC voltage that is proportional to temperature in degrees Celsius : $v_o = (10 \text{ mV}/^\circ\text{C}) * T$, where T is the temperature in °C. However, at the end, it is fun to have an LM35 to put into the circuit as a finishing touch to your design. In using a DC source as a surrogate for the sensor, you might want to use a voltage divider circuit to divide down a larger DC voltage in order to make testing easier.
- Even though we have not studied LEDs in 230 yet, they are available in your lab kits and are easy to use. If you are unsure about them, your lab instructors can show you how to hook them up. Don't forget the limiting resistors!
- Since the voltage from the sensor is quite small, you might want to amplify it on the way to the comparators. This will make setting the comparator switching points easier.
- Your lab supervisor will test your circuit. In particular you should demonstrate that the LEDs turn on and off at the correct input voltages. (The supervisor will be using a voltage source to serve in place of the sensor during testing, as described above.)

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- Write a short report that includes: (One report for the group.)
 1. a circuit diagram,
 2. a photo of your circuit
 3. a written description of the design of the circuit,
 4. the measured switching points for each of the LED sections, and
 5. any additional comments about the performance (or lack thereof) of your circuit.
 6. You might consider making a short video of your circuit under operation. This is not required, but you can do it if your lab supervisor is willing to accept it as the part of your report. (Note: A video would complement to the written report – it does not replace the written report.)
- Here is an extra challenge. (Not required.) Make the orange LED turn off when the red LED turns on.