Differences in signal processing between the SMT160-30 and the SMT172.

The SMT160-30 is replaced by the novel SMT172. Concerning the specifications of both the sensors it is easy to see the SMT160-30 was designed in the late 80's while the SMT172 is the sensor for the future. In this article a brief summary is given about the differences and similarity between both the sensors.

Power supply

Vcc

Both the sensors have a duty cycle output signal. The SMT160-30 has a Vcc range of 4.7 to 7 V. while the new SMT172 has a voltage range of 2.7 to 5.5 V. This means supply voltage wise in the traditional 5V power supply range both the sensors are identical. Due to the used technology a power supply voltage of more than 5.5 V. will destroy the sensor.

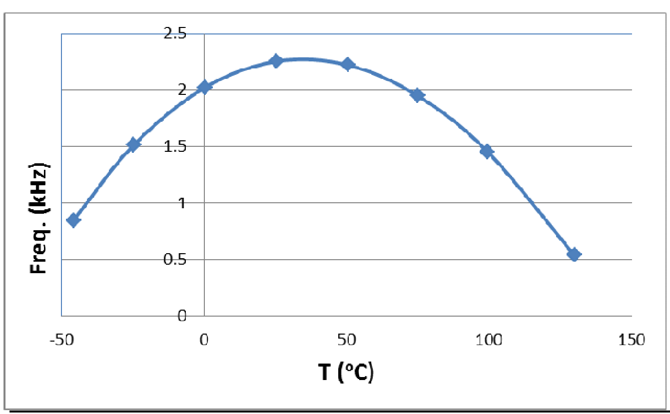
Supply current.

Due to the new design the power supply current is dramatically reduced to 50 µA. This yields when the sensor is activated continuously. In case one measurement per second this supply current is reduced to almost zero. Some encapsulation have a power down pin. With this pin the outputs of more sensors can be switched in parallel and the sensor is selected by the PD pin.

Output signal.

Frequency

Considering the output signal. From the specs it can be read the output frequency (which does not contain temperature information) of both devices are different in range. In the 5 V. area of the old sensor the sensors frequency is equal to the one of the SMT172. For the much lower Vcc the frequency of the SMT172 will deviate for the old sensor.



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Duty Cycle.

The duty cycle of both the old sensor and the new one is similar. Inside the new sensor there are circuits to compensate for all kind of non-idealities. That means by switching (similar to CAZ amplifiers) of current sources, references and inputs of opamps a very high accuracy is obtained. In case you do the classical way of sampling the output signal (must be over more than 8 periods of the sensor, so > 10 ms fi,.) there is no difference in the temperature representation. Also the accuracy of the sensor measurement will be the same or better related to the accuracy of the old sensor. If measured over a very short time in the old way the output of the temperature can move over about 0.3 C in a temperature stable situation. This effect will not be seen when measuring over more sensors periods. In case there is a possibility to change the software a little bit, one can reach a much better accuracy due to the fact the maximum benefit of the internal switching can be used. See therefor the specifications of the SMT172.

In brief:

- start measuring on a negative edge of the duty-cycle output.
- Calculate after each period the duty-cycle
- Measure over a multiple of 8 periods(minimal 1set of 8)
- The mean value of the duty cycle is used to calculate the temperature with the known formula.

In this way an accuracy of the sensor can be obtained of about 0.25 °C in the range of -10 to 100 °C and 0.8 in the range of -40 to 140 °C.

By means of a second order formula between the duty cycle and the temperature an accuracy of better than 0.1 C can be obtained in the temperature range of -10 to 100 °C. See therefore the addendum on the specifications of the SMT172. Due to the fact of the internal switching the noise of the sensor is very low. With a measurement (sampling) time of around a second a measurement noise of < 0.4 mK can be achieved. As we know this, it is very hard to measure and check but for special applications we can support you with your setup.

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