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Thermal sensors based on transistors

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Abstract

This paper reviews various methods of utilizing bipolar transistors and integrated circuits as temperature transducers. Starting with a study of the temperature dependence of the base-emitter voltages of bipolar transistors, the properties of single-transistor temperature sensors are discussed. Next, integrated circuits that generate an accurate output current or voltage proportional to the absolute temperature (PTAT) are presented, along with a novel type of integrated circuit that generates an output voltage on a $^{\circ}\text{C}$, $^{\circ}\text{F}$ or an arbitrary scale. The accuracy, stability and calibration problems of the different transducers are discussed and compared with each other. Finally, a smart IC sensor with on-chip microcomputer interfacing is described.

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