TruTherm™ Technology
National’s Thermal Management Position

National is the #1 Solution Provider of Choice

- Industry leader in accuracy, reliability and packaging
- Our thermal management solutions improve system performance, reliability and extend product life
- Extensive Portfolio of Sensors
  - Analog, Thermostats, Remote Diode
  - Digital, System Hardware Monitors
Introducing TruTherm™ Technology

• TruTherm stands for “True Thermal Measurement” and is the brand name for National’s new temperature monitoring technology

• TruTherm™ technology is an improved method of measuring temperature on integrated circuits designed in sub-micron (90nm & below) processes
Problem Statement

• Complex integrated circuits such as microprocessors, graphics processors and FPGAs are being designed in smaller sub-micron geometries to reach higher speeds & integration

• Internal thermal diodes connect to external temperature sensors to accurately monitor temperature, but in sub-micron geometries, readings based on these diodes vary greatly from processor to processor

• Traditional approaches to accurately monitor the thermal diodes are no longer sufficient to achieve high-accuracy targets
TruTherm™ Technology Benefits

Highly accurate temperature readings for sub-micron integrated circuits

- Improves overall temperature accuracy for all systems

- Extends system life by reducing the chances of device overheating

- More accurate temperature readings enable precise fan control methods, resulting in quieter systems and lower acoustic noise
Temperature Measurement Without TruTherm™ Technology

9 different 90nm processors measured with the same traditional remote diode temperature sensor (6°C spread in accuracy)
Temperature Measurement With TruTherm™ Technology

Temperature Measurement Variations reduced to less than 0.5 °C!
Temperature Measurement Without TruTherm™ Technology

11 different 65nm processors measured with the same traditional remote diode temperature sensor (3°C spread in accuracy)
Temperature Measurement With TruTherm™ Technology

Temperature Measurement Variations reduced to less than 0.5°C!
LM95231 with TruTherm™ Technology

- High-precision, 2 remote and local digital temperature sensor
- Features a precision sigma-delta analog-to-digital converter for reduced sensitivity to noise and includes digital filtering and remote diode fault detection
- Compatible with the SMBus 2.0 and I2C bus specifications
- Space-saving 8-pin MSOP package
LM95235 with TruTherm™ Technology

- High-precision, 1 remote and local digital temperature sensor
- Features a diode model selection bit to select between a typical Intel® processor on a 65 nm or 90 nm process or MMBT3904, as well as an offset register for maximum flexibility and best accuracy
- Three TCRIT outputs with limit comparison registers
- Compatible with the SMBus 2.0 specifications
- Space-saving 8-pin MSOP package
LM94 with TruTherm™ Technology

- Hardware Monitor with PI Loop Fan Control for Server Management
- Measures temperature of four remote diode connected transistors as well as its own die and 16 power supply voltages
- Dynamic Vccp monitoring with support for VRD10, 10.2 and 11 specifications
- GPIOs, VRD_HOT, and PROCHOT digital functions for Server Management
- Compatible with the SMBus 2.0 specifications with block read/writes
- 56-pin TSSOP package
Summary

• **TruTherm™ technology revolutionizes temperature measurement accuracy for sub-micron integrated circuits.**

• **The LM95231, LM95235 and LM94 are first in a family of TruTherm technology-based products by National Semiconductor**
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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
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