

# ***SENSYLINK Microelectronics Inc.***

## ***(CT7431)***

### ***1-CH Remote and 1-CH Local Temperature Sensor***

***CT7431 is a 2-channels (1-channel Remote and 1-channel Local) Temperature Sensor with  $\pm 1^{\circ}\text{C}$  Accuracy, Auto Beta Compensation and SMBus Digital Interface.***

***It's ideally used in Temperature Sensing and Monitoring Systems, such as Computer, Server and Telecom Equipment System etc.***

## Description

The CT7431 is a 2-channel digital temperature sensor with ±1°C accuracy. Temperature data can be read out directly via SMBus interface by MCU or SOC chip.

CT7431 has two independent channels: 1 remote and 1 local. The remote channel could be connected to an external Diode, BJT transistor (diode-connected mode), or parasitic PNP BJT transistor inside the CPU, GPU, FPGA or SOC chip. Based on this, this chip can be used to monitor CPU, GPU, MCU, SOC, FPGA or DSP chip die and case temperature.

Each chip is calibrated in factory before shipment to customers. There is no need re-calibration anymore for ±1°C accuracy.

It includes a band-gap circuit, an analog to digital converter (ADC), a calibration unit with non-volatile memory and a digital interface block.

It integrates a 12-bit ADC, which can offer 0.0625°C resolution. The maximum temperature readout range can be extended from -64°C to 191°C by setting configuration1 register.

It has 2 logic output pin (ALERT and THERM) with open drain structure, which are active low as default. Also ALERT pin can be configured as THERM2 pin.

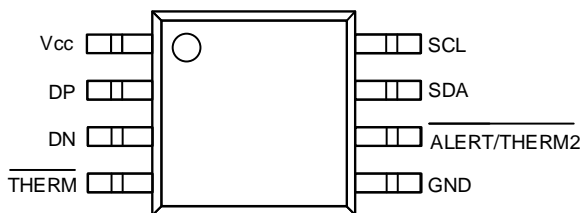
## Features

- Operation Voltage: 2.7V to 5.5V
- Average Operating Current: 16µA (Typ.) at 0.0625 Con/s, Vcc = 3.3V
- Shutdown Current: 3.0µA (Typ.)
- Temperature Accuracy without calibration for each channel: ±1°C from 0°C to 100°C
- 12 bit ADC for 0.0625°C resolution
- Digital interface compatible with SMBus and I<sup>2</sup>C
- Temperature Range up to from -64°C to 191°C by setting RANGE bit as 1
- Programmable high/low-limit ALERT and THERM Temperature with Hysteresis
- Automatic beta compensation, Serial Resistance Cancellation, n-Factor correction and Thermal Diode Fault Detection for each remote channel
- Support SMBus ALERT Response Address (ARA)
- Multiple Slave address options
- CT7431A SMBus slave address is determined by the pull-up resistor on the THERM pin
- Temperature Range:
  - 40°C to 125°C for sensor chip,
  - 50°C to 150°C for remote diodes
- Available package: MSOP-8, DFN3x3-8

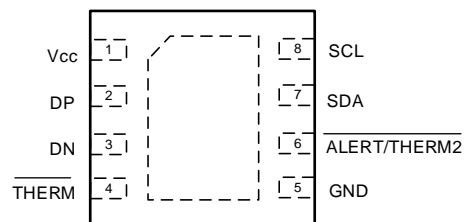
## Applications

- Computer (Desktop & Notebook)
- Server
- Telecom Equipment Embedded applications

## PIN Configurations (Top View)



MSOP-8 (Package Code, MM)



DFN3x3-8 (Package Code, DN)

## Typical Application

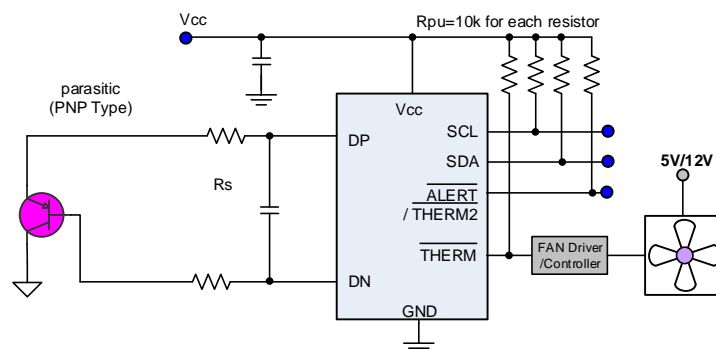


Figure 1. Typical Application of CT7431

## Pin Description

PIN No.	PIN Name	Description
1	Vcc	Power supply input pin, using 0.1uF low ESR ceramic capacitor to ground
2	DP	Remote channel positive input pin, it could be positive node of diodes, or BJT transistor (diode-connected mode). It is recommended to use bypass capacitor (Cd = 100pF) plus serial resistor (Rs =50 ohm) to remove noise between DP and DN pin.
3	DN	Remote channel negative input pin, it could be negative node of diodes, or BJT transistor (diode-connected mode). It is recommended to use bypass capacitor (Cd = 100pF) plus serial resistor (Rs =50ohm) to remove noise between DP and DN pin.
4	<b>THERM</b>	Thermal output pin, open drain with active low. Need a pull-up resistor to Vcc. For CT7431A The resistor value determinates slave address. If the measured temperature exceeds THERM-limit (programmable by user), this pin will be activated. This pin can be used to control fan on/off.
5	GND	Ground pin.
6	<b>ALERT/THERM2</b>	Alert output pin, open drain with active low. Need a pull-up resistor to Vcc. If the measured temperature drops below the low-limit or exceeds high-limit, this pin will be activated. Also this pin can be used as 2 <sup>nd</sup> THERM pin.
7	SDA	Digital interface data input or output pin, need a pull-up resistor in application.
8	SCL	Digital interface clock input pin, need a pull-up resistor in application.

## Function Block

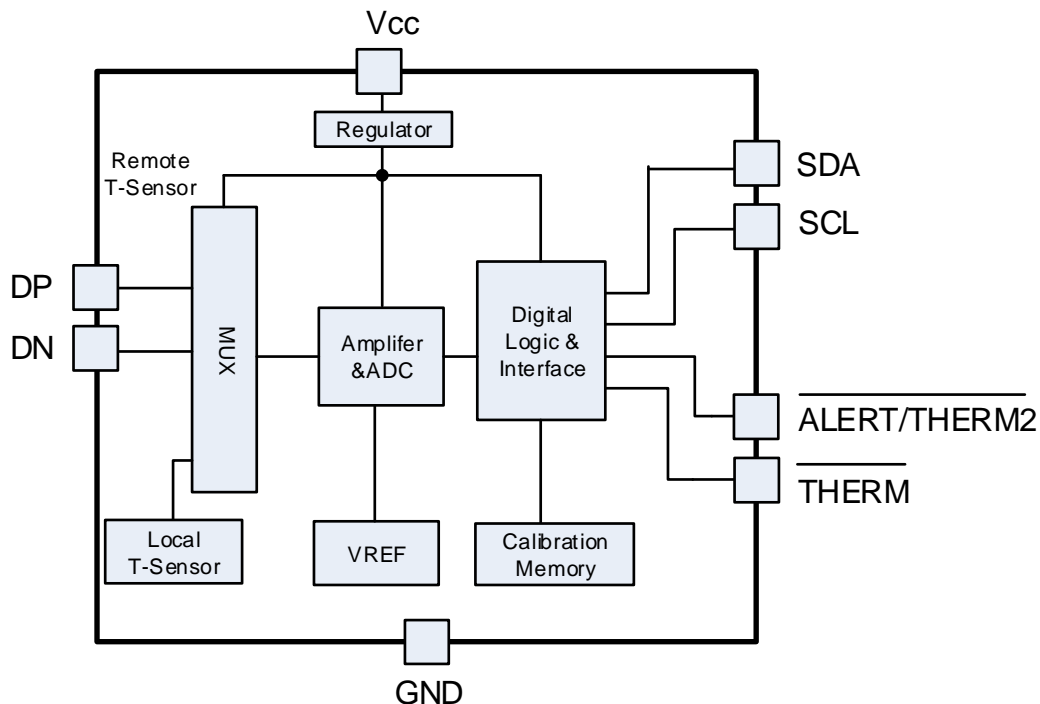
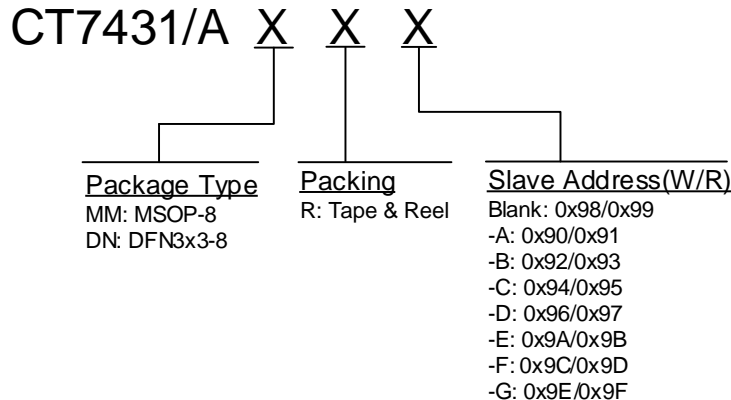


Figure 2. CT7431 Function Block

**±1°C 2-CH (1-CH Remote and 1-CH Local) Digital Temperature Sensor with Automatic Beta Compensation**
**Ordering Information (Note 1)**


Order PN	Slave Address(W/R) <sup>3</sup>	Accuracy	Green <sup>1</sup>	Package	Marking ID <sup>2</sup>	Packing	MPQ	Operation Temperature
CT7431MMR	0x98/0x99	±1°C	Halogen free	MSOP-8	7431 YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431MMR-A	0x90/0x91	±1°C	Halogen free	MSOP-8	SANA YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431MMR-B	0x92/0x93	±1°C	Halogen free	MSOP-8	SANB YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431MMR-C	0x94/0x95	±1°C	Halogen free	MSOP-8	SANC YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431MMR-D	0x96/0x97	±1°C	Halogen free	MSOP-8	SAND YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431MMR-E	0x9A/0x9B	±1°C	Halogen free	MSOP-8	SANE YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431MMR-F	0x9C/0x9D	±1°C	Halogen free	MSOP-8	SANF YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431MMR-G	0x9E/0x9F	±1°C	Halogen free	MSOP-8	SANG YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431AMMR	XXX1_100(w/r)	±1°C	Halogen free	MSOP-8	7431A YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431AMMR-A	XXX1_000(w/r)	±1°C	Halogen free	MSOP-8	SAPA YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431AMMR-B	XXX1_001(w/r)	±1°C	Halogen free	MSOP-8	SAPB YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431AMMR-C	XXX1_010(w/r)	±1°C	Halogen free	MSOP-8	SAPC YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431AMMR-D	XXX1_011(w/r)	±1°C	Halogen free	MSOP-8	SAPD YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431AMMR-E	XXX1_101(w/r)	±1°C	Halogen free	MSOP-8	SAPE YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431AMMR-F	XXX1_110(w/r)	±1°C	Halogen free	MSOP-8	SAPF YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431AMMR-G	XXX1_111(w/r)	±1°C	Halogen free	MSOP-8	SAPG YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431DNR	0x98/0x99	±1°C	Halogen free	DFN3x3-8	7431 YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431DNR-A	0x90/0x91	±1°C	Halogen free	DFN3x3-8	SAQA YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431DNR-B	0x92/0x93	±1°C	Halogen free	DFN3x3-8	SAQB YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431DNR-C	0x94/0x95	±1°C	Halogen free	DFN3x3-8	SAQC YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431DNR-D	0x96/0x97	±1°C	Halogen free	DFN3x3-8	SAQD YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431DNR-E	0x9A/0x9B	±1°C	Halogen free	DFN3x3-8	SAQE YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431DNR-F	0x9C/0x9D	±1°C	Halogen free	DFN3x3-8	SAQF YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431DNR-G	0x9E/0x9F	±1°C	Halogen free	DFN3x3-8	SAQG YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431ADNR	XXX1_100(w/r)	±1°C	Halogen free	DFN3x3-8	7431A YWWAXX	Tape & Reel	3,000	-40°C~+125°C

**±1°C 2-CH (1-CH Remote and 1-CH Local) Digital Temperature Sensor with Automatic Beta Compensation**

CT7431ADNR-A	XXX1_000(w/r)	±1°C	Halogen free	DFN3x3-8	SARA YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431ADNR-B	XXX1_001(w/r)	±1°C	Halogen free	DFN3x3-8	SARB YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431ADNR-C	XXX1_010(w/r)	±1°C	Halogen free	DFN3x3-8	SARC YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431ADNR-D	XXX1_011(w/r)	±1°C	Halogen free	DFN3x3-8	SARD YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431ADNR-E	XXX1_101(w/r)	±1°C	Halogen free	DFN3x3-8	SARE YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431ADNR-F	XXX1_110(w/r)	±1°C	Halogen free	DFN3x3-8	SARF YWWAXX	Tape & Reel	3,000	-40°C~+125°C
CT7431ADNR-G	XXX1_111(w/r)	±1°C	Halogen free	DFN3x3-8	SARG YWWAXX	Tape & Reel	3,000	-40°C~+125°C

**Note 1:**

1. Sensylink can meet RoHS 2.0/REACH requirement. So most package types Sensylink offers only states halogen free, instead of lead free.
2. Marking ID includes 2 rows of characters. In general, the 1<sup>st</sup> row of characters are part number, and the 2<sup>nd</sup> row of characters are date code plus production information.
3. For CT7431A, Slave Address high 3bit is XXX, which means that the address of I<sup>2</sup>C is determined by the external pull-up resistance of THERM pin. For specific I<sup>2</sup>C address, please refer to 1.6.1 Slave Address.



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