1.6V Low-Voltage Communication, 9 Channels (1 Local Channel & 8 Remote Channels) Digital Temperature Sensor

1 Features

- Remote eight-channel diode temperature sensor
- Temperature range: −55°C to +150°C
- Temperature measurement accuracy (−40°C to +125°C):
  - Local channel: ±0.5°C
  - Remote channel: ±1°C
- Supply voltage range: 2.7V to 5.5V
- I2C communication voltage: 1.6V to 5.5V
- Low quiescent current (@3.3V, 27°C):
  - Local channel: 180μA
  - Remote channel: 360uA
  - Shutdown mode: 1.2μA
- Resolution: 16 bits, 0.0078125°C
- Digital output: compatible with SMBus, I2C interface
- Support register block read
- Remote diode: features series resistance elimination, η factor correction, temperature offset correction, open circuit detection and other functions

2 Applications

- Servers, computers and switches
- Secure data center
- Highly-integrated medical system
- Precision instruments and testing equipment
- MCU, GPU, FPGA, DSP and CPU temperature monitoring

3 Description

GD30TS308T is a high-precision, low-power digital temperature sensor compatible with SMBus and I2C interfaces. In addition to the local temperature of the chip, up to 8 remote diode areas can be monitored simultaneously. The typical application scenario of GD30TS308T is real-time remote temperature monitoring of complex systems such as MCU, GPU and FPGA. With functions such as series resistance elimination, programmable η factor correction, programmable temperature offset correction and programmable temperature threshold, GD30TS308T provides a reliable temperature monitoring solution with high precision and low power consumption.

The local channel and 8 remote channels of GD30TS308T can be independently programmed and controlled. When the temperature of the measured location exceeds the corresponding temperature threshold, an alarm will be triggered. Each channel of GD30TS308T has a programmable temperature threshold hysteresis setting to avoid repeated alarms caused by the measured temperature being near the temperature threshold.

The typical temperature measurement accuracy of the local channel and remote channel of GD30TS308T is ±0.5°C and ±1°C respectively, and both provide a temperature measurement resolution of 0.0078125°C and a temperature measurement range of −55°C to +150°C. The power supply voltage range of GD30TS308 is 2.7V to 5.5V, and it provides 3.00mm×3.00mm 16 Pin QFN package for integration into various systems.

Device Information[1]

PART NUMBER	PACKAGE	BODY SIZE (NOM)
GD30TS308T	QFN16	3.00mm × 3.00mm

1. For packaging details, see *Package Information* section.

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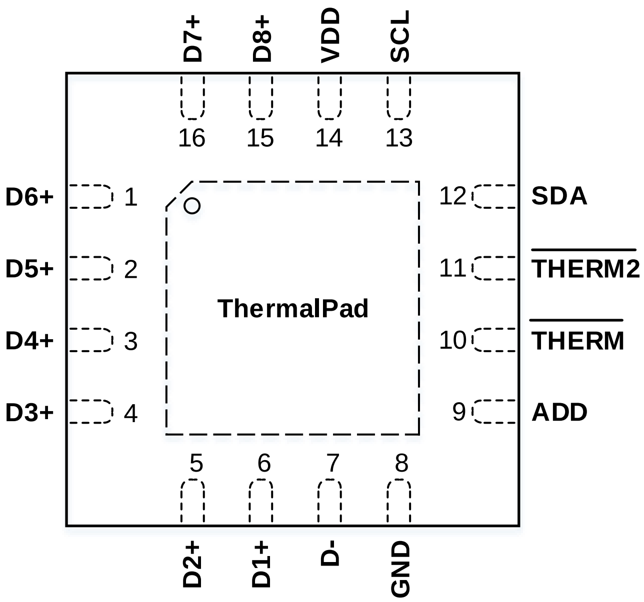
4 Device Overview

4.1 Pinout and Pin Assignment



4.2 Pin Description

PINS		PIN TYPE[1]	FUNCTION
NAME	NUM		
D8+	15	AI	Remote temperature measurement channel 8 positive input voltage pin. Please connect to D- when this channel is not used.
D7+	16	AI	Remote temperature measurement channel 7 positive input voltage pin. Please connect to D- when this channel is not used.
D6+	1	AI	Remote temperature measurement channel 6 positive input voltage pin. Please connect to D- when this channel is not used.
D5+	2	AI	Remote temperature measurement channel 5 positive input voltage pin. Please connect to D- when this channel is not used.
D4+	3	AI	Remote temperature measurement channel 4 positive input voltage pin. Please connect to D- when this channel is not used.
D3+	4	AI	Remote temperature measurement channel 3 positive input voltage pin. Please connect to D- when this channel is not used.
D2+	5	AI	Remote temperature measurement channel 2 positive input voltage pin. Please connect to D- when this channel is not used.
D1+	6	AI	Remote temperature measurement channel 1 positive input voltage pin. Please connect to D- when this channel is not used.
D-	7	AI	Remote temperature measurement 1 to 8 channels negative input

PINS		PIN TYPE[1]	FUNCTION
NAME	NUM		
			voltage pin.
GND	8	G	Chip ground pin.
ADD	9	DI	IIC slave address selection pin which can be connected to SDA, SCL, VDD and GND pins.
$\overline{\text{THERM}}$	10	DO	The first over-temperature alarm pin. Low active. Open-drain output, requires a pull-up resistor to connect to a 1.6V to 5.5 V power supply.
$\overline{\text{THERM2}}$	11	DO	The second over-temperature alarm pin. Low active. Open drain output, requires a pull-up resistor to connect to a 1.6V to 5.5 V power supply.
SDA	12	I/O	IIC communication serial data pin. Open drain output, requires a pull-up resistor to connect to a 1.6V to 5.5V power supply.
SCL	13	DI	IIC communication serial clock pin. Open drain output, requires a pull-up resistor to connect to a 1.6V to 5.5 V power supply.
VDD	14	P	Chip power pin. voltage range is 2.7V to 5.5 V.

1. P = power, G = Ground, DI = Digital input, AI = Analog input, DO = Digital Output, IO=input and output.

5 Parameter Information

5.1 Absolute Maximum Ratings

Exceeding the operating temperature range (unless otherwise noted)[1]

SYMBOL	PARAMETER	MIN	MAX	UNIT
V_+	Power Supply Voltage VDD	−0.3	6	V
	$\overline{THERM}$, $\overline{THERM2}$, SCL, SDA and ADD Pin Voltage	−0.3	6	V
	D1+ ~D4+ Pin Input Voltage	−0.3	((V+)+0.3) and ≤ 6	V
	D-	−0.3	0.3	V
T_J	Junction Temperature		150	°C
T_A	Operating Range	−55	160	°C
T_{stg}	Storage temperature	−60	150	°C

1. Unless otherwise specified, the specifications in the above table apply within the atmospheric temperature range. Stresses beyond the range may cause permanent damage to the device.

5.2 Recommended Operation Conditions

SYMBOL[1]	PARAMETER	MIN	TYP	MAX	UNIT
V_+	Power Supply Voltage	2.7	3.3	5.5	V
T_A	Operating Temperature	−50		150	°C

1. Unless otherwise specified, the specifications in the above table apply within the atmospheric temperature range.

5.3 Electrical Sensitivity

SYMBOL[1]	CONDITIONS	VALUE	UNIT
$V_{ESD(HBM)}$	Human Body Mode (HBM), per ANSI/ESDA/JEDEC JS-001	±2500	V
$V_{ESD(MM)}$	Machine Mode (MM), per JEDEC-STD Classification	300	V
LU	Latch-Up, Per JESD78F, Class IA	±200	mA

1. Unless otherwise stated, over operating free-air temperature range.

5.4 Electrical Characteristics

Unless otherwise specified, the following data are characteristics of the chip at −40°C to +125°C and the power supply voltage in the range of 2.7V to 5.5V.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
T_{RANGE}	Local Channel Temperature Measurement Accuracy	T_L = −40°C to +125°C VDD = 2.7V to 5.5V		±0.5	±1	°C
T_{ERROR}	Remote Channel Temperature Measurement Accuracy	T_L = 0°C to +80°C T_R = −40°C to + 125°C VDD = 2.7 ~ 5.5V		±0.5	±1	°C
		T_L = −40°C to +125°C T_R = −40°C to + 125°C VDD = 2.7V to 5.5V		±1	±1.5	°C
	Local Channel Supply Voltage Sensitivity	VDD = 2.7V to 5.5V		±0.05	±0.2	°C/V
	Remote Channel Supply Voltage Sensitivity	VDD = 2.7V to 5.5V		±0.1	±0.3	°C/V
	Resolution			0.0078125		°C
				16		bits
t_{CON}	Conversion Time	Single channel		16	17	ms
	Bias Current of Remote Temperature Measurement Probe	High		120		µA
		Medium		45		µA
		Low		7.5		µA
	η Value of Remote Temperature Measurement Probe			1.008		
f_C	Bus Communication Frequency	Fast mode	0.001		0.4	MHz
		High-speed mode	0.001		2.5	MHz
V_+	Power Supply Operating Voltage		2.7	3.3	5.5	V
I_Q	Quiescent Current	Local channel continuous conversion		180		µA
		Remote channel continuous conversion		360		µA
		Idle mode		20		µA
		Shutdown mode		1.2		µA

6 Functional Description

6.1 Chip Function Mode

6.1.1 Continuous Conversion Mode

The default operating mode of the GD30TS308T is continuous conversion mode. In this mode, GD30TS308T will perform continuous conversions in the order of local channel and remote 1~8 channels. Typical conversion time of each channel is 16ms. The REN8: REN1 bit and LEN bit in the configuration register (30h) will control the channel enable during the continuous conversion process. If some channels are not activated, the above unactivated channels will be skipped. The conversion rate bits CR2, CR1 and CR0 in the configuration register can configure GD30TS308T to different conversion rates. For details of the above configuration, please refer to *Configuration Register*.

All channels of GD30TS308T can output 16-bit temperature measurement results with a temperature measurement resolution of 0.0078125°C. Negative temperature measurement results will be presented in binary complement form, as shown in Table 1. The temperature measurement results of all channels of GD30TS308T are stored in the temperature register of the corresponding channel using two bytes. The recommended temperature measurement range of all channels of GD30TS308T is −50°C to 150°C.

Table 1. GD30TS308T 16-bit Temperature Measurement Data Format for all channels

Temperature (°C)	Digital Output (Binary)	Hexadecimal
−50	1110 0111 0000 0000	E700
−25	1111 0011 1000 0000	F380
−1	1111 1111 1000 0000	FF80
−0.5	1111 1111 1100 0000	FFC0
−0.0078125	1111 1111 1111 1111	FFFF
0	0000 0000 0000 0000	0000
0.0078125	0000 0000 0000 0001	0001
0.5	0000 0000 0100 0000	0040
1	0000 0000 1000 0000	0080
5	0000 0010 1000 0000	0280
10	0000 0101 0000 0000	0500
25	0000 1100 1000 0000	0C80
50	0001 1001 0000 0000	1900
100	0011 0010 0000 0000	3200
125	0011 1110 1000 0000	3E80
150	0100 1011 0000 0000	4B00

6.1.2 Shutdown Mode

Shutdown mode of GD30TS308T can conserve power by shutting down all device circuitry except the serial interface, thereby reducing the current of GD30TS308T to less than 1μA (typical). The shutdown mode is initiated when the SD bit in the configuration register (30h) is set to 1; after such configuration, GD30TS308T will terminate the current temperature conversion and immediately enter shutdown mode. To exit shutdown mode, write SD bit to 0, GD30TS308T will re-enter continuous conversion mode. In particular, writing the REN4: REN1 bit and the LEN bit in the configuration register to 0 at the same time also puts GD30TS308T into shutdown mode. Under this situation, to exit shutdown mode, write any one or more of the REN4: REN1 bit and the LEN bit to 1.

6.1.3 One-Shot Mode

GD30TS308T can be configured in One-Shot mode. When GD30TS308T is in shutdown mode (SD = 1), writing 1 to the OS bit in the configuration register (30h) can start a single temperature conversion. The specific channels included in this temperature conversion are determined by the values of the REN4: REN1 bit and the LEN bit. To ensure that the above single temperature conversion is carried out smoothly, at least one of the REN4: REN1 bit and the LEN bit should be written to 1. After the single temperature conversion is completed, GD30TS308T will return to the shutdown mode. When continuous temperature measurement is not required, this function can greatly reduce the power consumption of the chip.

6.1.4 Filter and Series Resistance Elimination

In actual use, it is recommended to input the four remote temperature measurement channel pins D1+ to D4+ and D-, connect a filter resistor RS of no more than 1kΩ in series, and cross-connect a filter capacitor CF of 100pF to 1nF, so that GD30TS308T can better filter out the irrelevant coupling signals between pins, as shown in Figure 7. In some specific applications, in order to obtain better remote temperature measurement accuracy, the size of the above filter resistor and capacitor can be appropriately adjusted. The recommended filter resistor and capacitor values are 50Ω and 100pF respectively.

GD30TS308T has a filter resistor elimination function, which can automatically eliminate the temperature measurement error caused by the above filter resistor. In actual use, it should be ensured that the filter resistor value is less than 1kΩ.

6.1.5 Sensor Misconnection Detection

GD30TS308T can detect the misconnection of remote temperature probes mounted on all remote channels. When the voltage of any D+ pin is higher than (VDD − 0.3V), GD30TS308T will determine that the pin is open, and the corresponding status bit RxOP in the remote channel open status register (23h) will be set to 1. At this time, the temperature measurement result of the remote channel will return 8000h (−256°C).

GD30TS308T can also detect any short-circuit misconnection between any D+ pin and GND. When any D+ pin is short-circuited to GND, the temperature measurement result of the remote channel will also return 8000h (−256°C), but the corresponding RxOP bit will still read as 0. When the remote temperature measurement function of GD30TS308T is not used, the D+ pin and D- pin of the corresponding channel must be shorted to prevent meaningless misconnection detection.

6.1.6 THERM Mode

GD30TS308T provides constant temperature monitoring mode $\overline{\text{THERM}}$ and $\overline{\text{THERM2}}$. In this mode, the temperature measurement results of the local channel and all remote channels of GD30TS308T are compared with the constant temperature threshold register of the corresponding channel inside the chip. The comparison result will change the corresponding constant temperature status register (21h, 22h) and the constant temperature pin. For details, see Table 4.

In THERM mode, the temperature measurement results of the local channel and remote channels 1 to 4 are compared with the corresponding THERM threshold registers (39h、42h、4Ah、52h、5Ah). If the temperature measurement result of a channel exceeds the corresponding value of the THERM threshold register, the corresponding status bit in the status THERM register will read as 1. The above status bits will always remain activated until the temperature measurement result of the corresponding channel is lower than the value that THERM threshold register minus THERM hysteresis register, after which the above status bits will read as 0. After any bit in the THERM status register is activated, THERM pins of the chip will be activated at the same time (THERM=0). THERM pins will always remain activated until all flag bits in the THERM status register are reset to 0, after which THERM pins will be reset to 1.

In THERM2 mode, the temperature measurement results of the local channel and remote channels 1 to 8 are compared with the corresponding THERM2 threshold registers (3Ah, 43h, 4Bh, 53 h, 5Bh, 63h, 6Bh, 73h, 7Bh). If the temperature measurement result of a channel exceeds the value of the corresponding THERM2 threshold register, the corresponding status bit in the THERM2 status register will read as 1. The above status bits will always remain activated until the temperature measurement result of the corresponding channel is lower than the value that THERM2 threshold register minus THERM hysteresis register, after which the above status bits will read as 0. After any bit in the THERM2 status register is activated, THERM2 pins of the chip will be activated at the same time (THERM2= 0). THERM2 pins will always remain activated until all flag bits in the THERM2 status register are reset to 0, after which THERM2 pins will be reset to 1.

The THERM and THERM2 modes of GD30TS308T share a THERM hysteresis register (38h) to prevent the thermostat status register and the thermostat pin from repeatedly jumping when the temperature measurement result is close to the value of the thermostat threshold register.

The above process is shown in Figure 1.

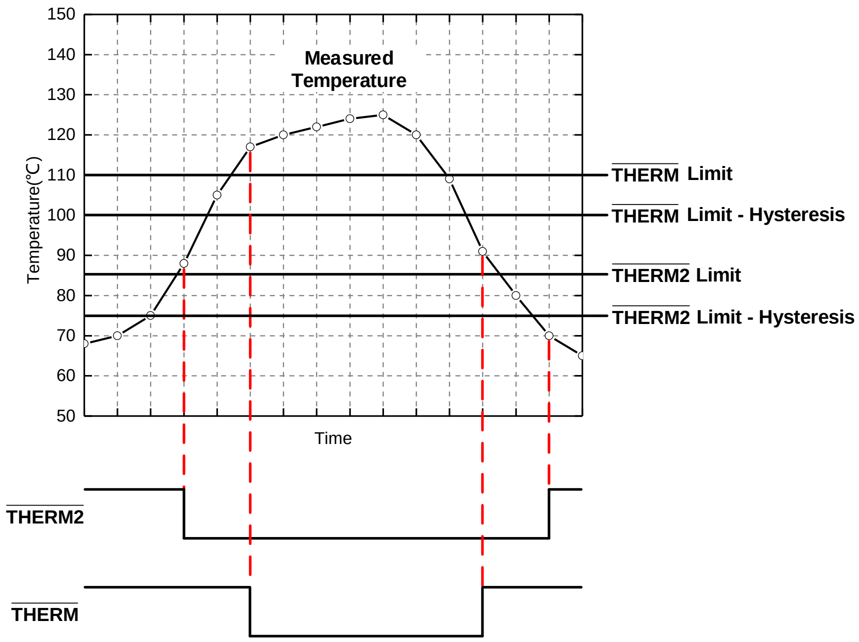


Figure 1. Status Variation of Constant Temperature Pins in Different Constant Temperature Modes

6.2 Serial Interface

6.2.1 Bus Overview

GD30TS308T is compatible with SMBus and I2C interfaces. In the SUMBus protocol, the device that initiates the transfer is called a master, and the devices controlled by the master are slaves. The bus must be controlled by a master device that generates the serial clock (SCL), controls the bus access, and generates the START and STOP conditions. To address a specific device, a START condition is initiated, indicated by pulling the data line (SDA) from a high- to low-logic level when the SCL pin is high. All slaves on the bus receive the 8-bits slave address on the rising edge of the clock, and the last bit indicates whether a read or write operation is intended. During the ninth clock pulse, the addressed slave generates an acknowledge and pulls the SDA pin low to respond to the master. A data transfer is then initiated and sent over eight clock pulses followed by an acknowledge bit. When all data are transferred, the master generate a STOP signal to end the communication by pulling SDA from low to high when SCL is high. During the data transfer, the SDA pin must remain stable when the SCL pin is high because any change in the SDA pin when the SCL pin is high is interpreted as a START or STOP signal.

GD30TS308T supports two-wire bus in fast mode (1kHz to 400kHz) or high-speed mode (1kHz to 2.5MHz). All data are transmitted with the MSB first.

6.2.2 Serial Bus Address

To communicate with GD30TS308T, the host must address the corresponding slave by sending slave address bytes. The slave address byte consists of seven address bits and a read-write (R/W) bit that indicates the intent of executing a read or write operation. GD30TS308T has an address pin that can generate up to four different slave addresses, allowing the host to address up to four different addresses of GD30TS308T on a single bus. Table 2 shows the connection method of the ADD pin corresponding to each slave address.

Table 2. Slave Addresses Corresponding to Four Different Connection Methods of ADD Pin

SLAVE ADDRESS	ADD PIN CONNECTION
1001000	GND
1001001	VDD
1001010	SDA
1001011	SCL

6.2.3 Low-Voltage Communication

The operating voltage of GD30TS308T is 2.7V to 5.5V. GD30TS308T supports the high level of the two-wire bus generated by the host to be lower (or higher) than the operating voltage of the chip. In this application scenario, the SCL and SDA pins of GD30TS308T can be connected to the power supply voltage of 1.6V to 5.5V through pull-up resistors, so that the high-level range of the two-wire bus controlled by the host is also 1.6V to 5.5V. GD30TS308T supports data transmission at any voltage within the respective voltage ranges of the chip (2.7V to 5.5V) and the two-wire bus (1.6V to 5.5V).

6.2.4 Writing and Reading Operation

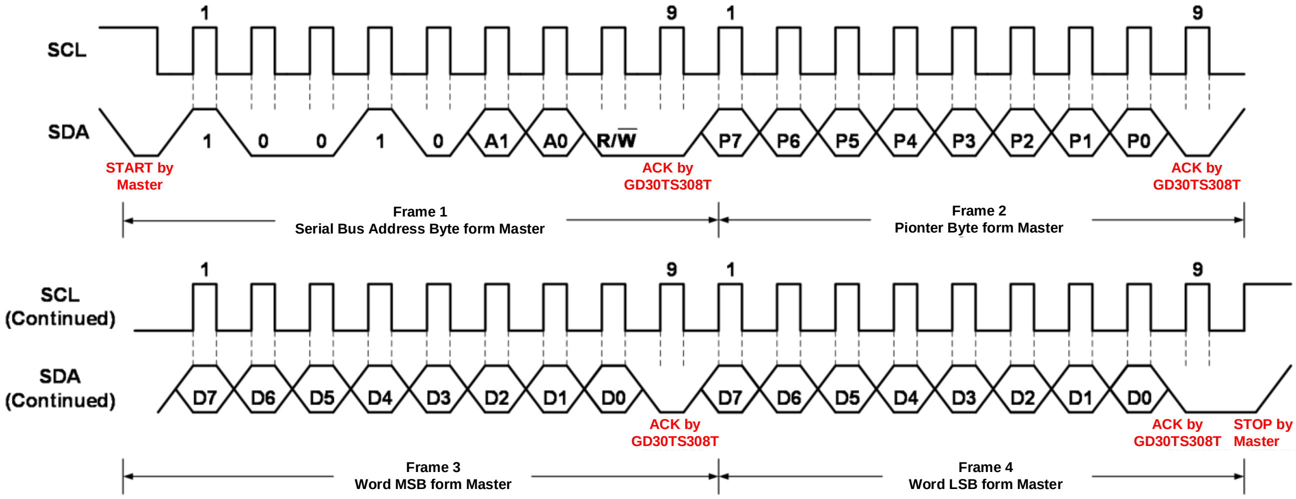


Figure 2. Two-wire Write Command Timing Diagram

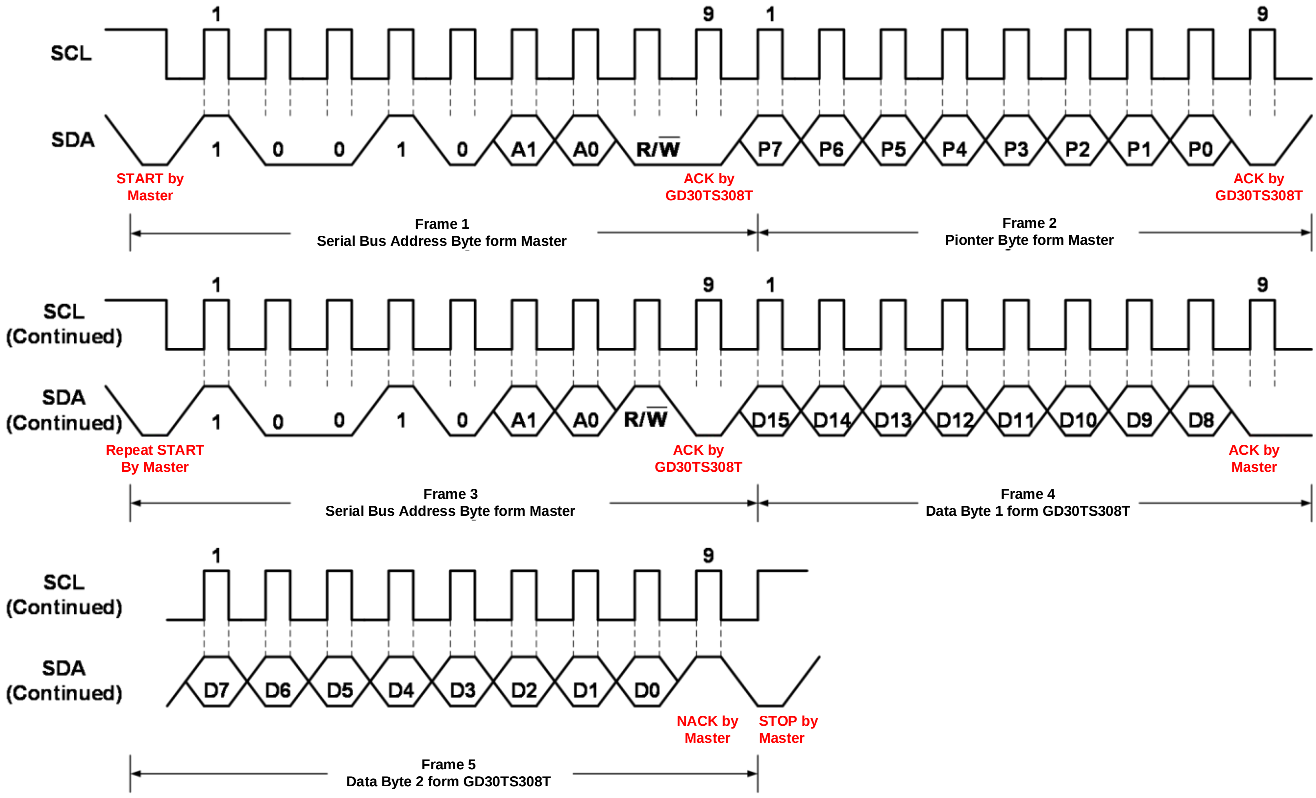


Figure 3. Two-wire Read Command (2 Byte) Timing Diagram

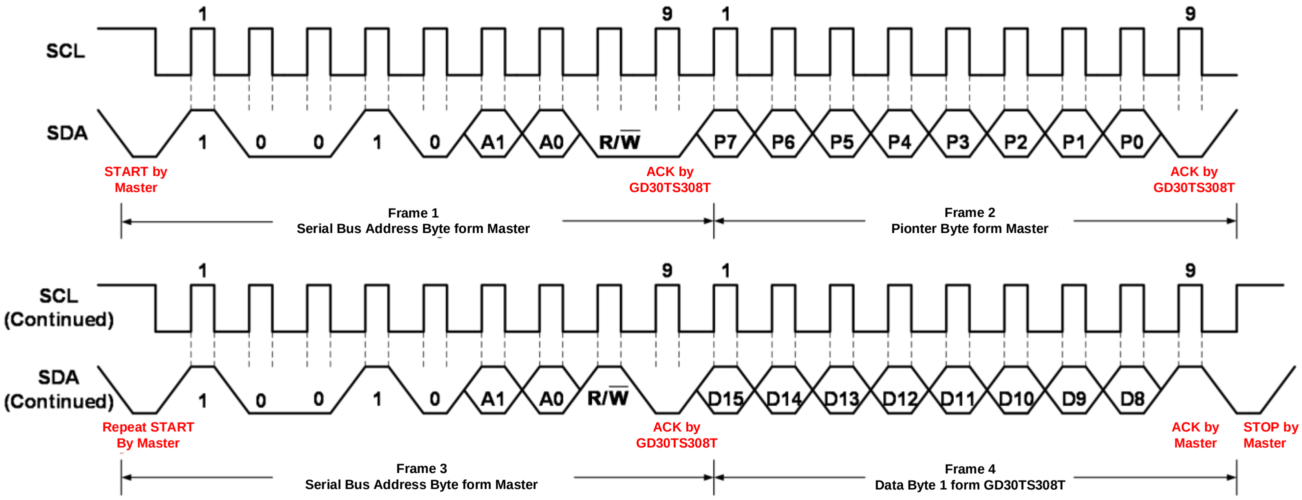


Figure 4. Two-Wire Read Command (1 Byte) Timing Diagram

GD30TS308T allows the host to access specific registers inside the chip by writing the target value into the pointer register.

When writing data to GD30TS308T, after sending the slave address byte with the low $R/\overline{W}$ bit, the corresponding pointer register byte needs to be sent to write the data into a specific register in GD30TS308T. Each write operation to GD30TS308T requires sending the pointer register byte.

When reading data from GD30TS308T, send the corresponding pointer register byte after sending the slave address byte with the low $R/\overline{W}$ bit; then the host generates the Start signal again and sends the slave address byte with the high $R/\overline{W}$ bit to start the read command. If you need to read data from the same register repeatedly, you do not need to send the pointer byte of the register repeatedly. GD30TS308T allows the host to automatically read data from the register specified by the previous pointer byte. When the data reading is completed, the host needs to send a NACK bit at the end of the last byte read to terminate the read operation. All internal registers in GD30TS308T are two bytes, and the MSB is transmitted first. If only a single byte (MSB) needs to be read, the NACK bit can be sent in advance at the end of the MSB transmission.

The above read and write operations are shown in Figure 2 to Figure 4.

6.2.5 Block Register Reads

GD30TS308T supports register reads. The register block storing the temperature output of each local and remote channel in GD30TS308T consists of 9 registers with pointers of 80h~88h. When the pointer register is written to any value between 80h~88h for reading operation, GD30TS308T will automatically add 1 to the pointer byte and read the values in the registers corresponding to each pointer byte respectively until the value in the 88h register is read out, as shown in Figure 5. In the above process, if the communication is terminated before the value in the 88h register is read out, the read command can be resent (without resending the pointer byte), and GD30TS308T will automatically add 1 to the pointer byte before the communication is terminated, and continue to read the data in the corresponding register, as shown in Figure 6.

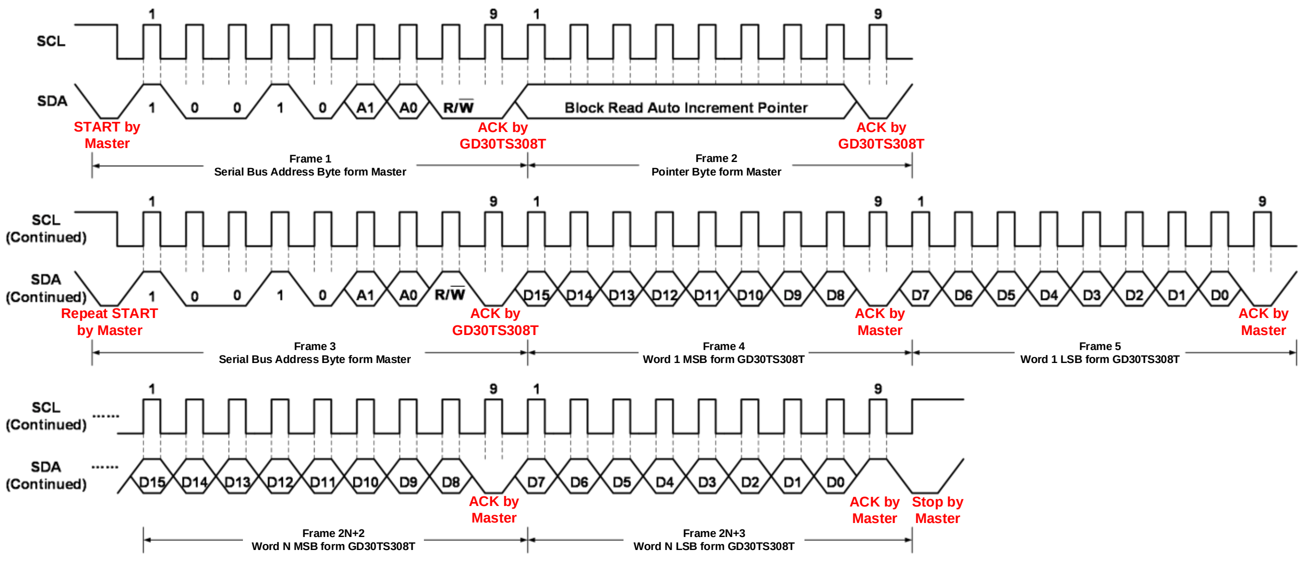


Figure 5. Timing Diagram of Two-line Register Block Reads

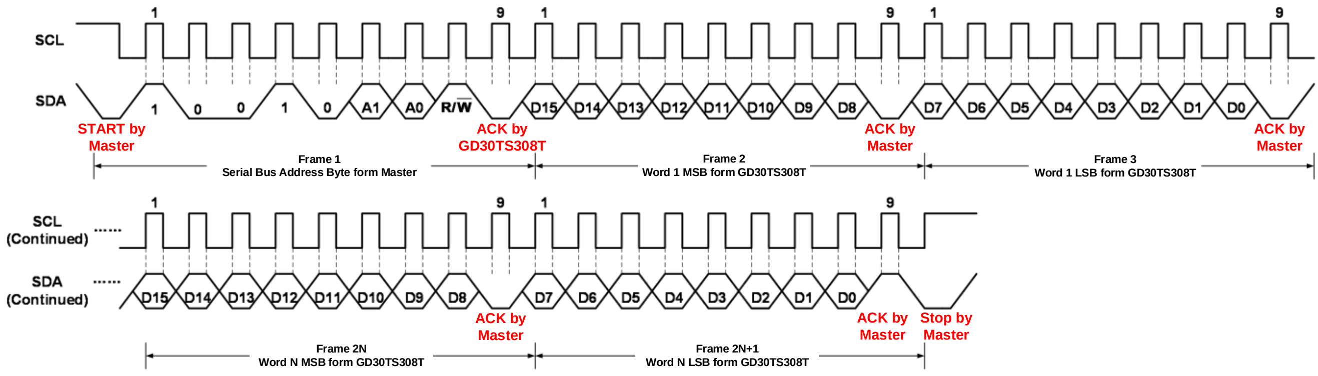


Figure 6. Timing Diagram of Two-line Register Block without Pointer Bytes

6.2.6 General Call Reset

Writing the RST bit (bit 15) of the GD30TS308T global reset register (20h) to 1 can reset all registers inside the chip to their power-on default values and terminate any current temperature conversion.

6.2.7 High-Speed Mode

GD30TS308T supports the two-wire bus to operate at frequencies above 400kHz, the host device must issue a high-speed mode host code (0000 1xxxb) as the first byte after a START condition to switch the bus to high-speed operation. GD30TS308T device does not acknowledge this byte, but it does switch the input filters on the SDA and SCL and the output filters on the SDA to operate in High-Speed mode, allowing the bus to transmit data at frequencies up to 2.75MHz. After the High-Speed mode host code is issued, the host transmits a two-wire device address to initiate a data transfer operation. The bus continues to operate in high-speed mode until a STOP condition occurs on the bus. Upon receiving the STOP condition, GD30TS308T switches the input and output filters back to fast-mode operation.

6.2.8 Time-Out Function

If SCL keeps low level for 18ms (typical) between START and STOP signals, GD30TS308T will reset its serial interface, release SDA and wait for START signal. To avoid activating time-out function, SCL's operating frequency should be more than 1kHz.

6.2.9 Time-Out Function

GD30TS308T provides a register lock function to reduce the possibility of wrong operation of some important internal registers. Register locking(C4h) can be configured to lock and unlock the register. See *Register Descriptions* for the registers that can be locked. The above registers will not respond to write operations during the lock period, but they can still be read. Writing 0x5CA6 to the lock register can lock the register, and the lock register reads 0x8000; writing 0xEB19 to the lock register can unlock the register, and the lock register reads 0x0000. GD30TS308T will return to the locked state after the chip is powered on again or responds to a global reset.

6.3 Register Descriptions

Table 3. GD30TS308T Register List

PTR	POR	Lock	GD30TS308T Functional Registers – BIT Description																Register
HEX	HEX	Y/N	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Description
00	0000	N	LT15	LT14	LT13	LT12	LT11	LT10	LT9	LT8	LT7	LT6	LT5	LT4	LT3	LT2	LT1	LT0	Local temperature
01	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temperature 1
02	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temperature 2
03	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temperature 3
04	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temperature 4
05	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temperature 5
06	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temperature 6
07	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temperature 7
08	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temperature 8
20	0000	N	RST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Software Reset Register
21	N/A	N	R8TH	R7TH	R6TH	R5TH	R4TH	R3TH	R2TH	R1TH	LTH	0	0	0	0	0	0	0	THERM Status
22	N/A	N	R8TH2	R7TH2	R6TH2	R5TH2	R4TH2	R3TH2	R2TH2	R1TH2	LTH2	0	0	0	0	0	0	0	THERM2 Status
23	N/A	N	R8OPN	R7OPN	R6OPN	R5OPN	R4OPN	R3OPN	R2OPN	R1OPN	0	0	0	0	0	0	0	0	Remote channel OPEN Status
30	0F9C	Y	REN8	REN7	REN6	REN5	REN4	REN3	REN2	REN1	LEN	OS	SD	CR2	CR1	CR0	BUSY	0	Configuration Register
38	0080	Y	0	HYS14	HYS13	HYS12	HYS11	HYS10	HYS9	HYS8	HYS7	HYS6	HYS5	HYS4	HYS3	HYS2	HYS1	HYS0	THERM hysteresis
39	7FC0	Y	LTH1_15	LTH1_14	LTH1_13	LTH1_12	LTH1_11	LTH1_10	LTH1_9	LTH1_8	LTH1_7	LTH1_6	LTH1_5	LTH1_4	LTH1_3	LTH1_2	LTH1_1	LTH1_0	Local temp THERM limit
3A	7FC0	Y	LTH2_15	LTH2_14	LTH2_13	LTH2_12	LTH2_11	LTH2_10	LTH2_9	LTH2_8	LTH2_7	LTH2_6	LTH2_5	LTH2_4	LTH2_3	LTH2_2	LTH2_1	LTH2_0	Local temp THERM2 limit
40	0000	Y	ROS15	ROS14	ROS13	ROS12	ROS11	ROS10	ROS9	ROS8	ROS7	ROS6	ROS5	ROS4	ROS3	ROS2	ROS1	ROS0	Remote temp 1 offset
41	0000	Y	RNC7	RNC6	RNC5	RNC4	RNC3	RNC2	RNC1	RNC0	0	0	0	0	0	0	0	0	Remote temp 1 η-factor correction
42	7FC0	Y	RTH1_15	RTH1_14	RTH1_13	RTH1_12	RTH1_11	RTH1_10	RTH1_9	RTH1_8	RTH1_7	RTH1_6	RTH1_5	RTH1_4	RTH1_3	RTH1_2	RTH1_1	RTH1_0	Remote temp 1 THERM limit
43	7FC0	Y	RTH2_15	RTH2_14	RTH2_13	RTH2_12	RTH2_11	RTH2_10	RTH2_9	RTH2_8	RTH2_7	RTH2_6	RTH2_5	RTH2_4	RTH2_3	RTH2_2	RTH2_1	RTH2_0	Remote temp 1 THERM2 limit
48	0000	Y	ROS15	ROS14	ROS13	ROS12	ROS11	ROS10	ROS9	ROS8	ROS7	ROS6	ROS5	ROS4	ROS3	ROS2	ROS1	ROS0	Remote temp 2 offset
49	0000	Y	RNC7	RNC6	RNC5	RNC4	RNC3	RNC2	RNC1	RNC0	0	0	0	0	0	0	0	0	Remote temp 2 η-factor correction
4A	7FC0	Y	RTH1_15	RTH1_14	RTH1_13	RTH1_12	RTH1_11	RTH1_10	RTH1_9	RTH1_8	RTH1_7	RTH1_6	RTH1_5	RTH1_4	RTH1_3	RTH1_2	RTH1_1	RTH1_0	Remote temp 2 THERM limit

PTR	POR	Lock	GD30TS308T Functional Registers – BIT Description																Register
HEX	HEX	Y/N	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Description
4B	7FC0	Y	RTH2_15	RTH2_14	RTH2_13	RTH2_12	RTH2_11	RTH2_10	RTH2_9	RTH2_8	RTH2_7	RTH2_6	RTH2_5	RTH2_4	RTH2_3	RTH2_2	RTH2_1	RTH2_0	Remote temp 2 THERM2 limit
50	0000	Y	ROS15	ROS14	ROS13	ROS12	ROS11	ROS10	ROS9	ROS8	ROS7	ROS6	ROS5	ROS4	ROS3	ROS2	ROS1	ROS0	Remote temp 3 offset
51	0000	Y	RNC7	RNC6	RNC5	RNC4	RNC3	RNC2	RNC1	RNC0	0	0	0	0	0	0	0	0	Remote temp 3 η-factor correction
52	7FC0	Y	RTH1_15	RTH1_14	RTH1_13	RTH1_12	RTH1_11	RTH1_10	RTH1_9	RTH1_8	RTH1_7	RTH1_6	RTH1_5	RTH1_4	RTH1_3	RTH1_2	RTH1_1	RTH1_0	Remote temp 3 THERM limit
53	7FC0	Y	RTH2_15	RTH2_14	RTH2_13	RTH2_12	RTH2_11	RTH2_10	RTH2_9	RTH2_8	RTH2_7	RTH2_6	RTH2_5	RTH2_4	RTH2_3	RTH2_2	RTH2_1	RTH2_0	Remote temp 3 THERM2 limit
58	0000	Y	ROS15	ROS14	ROS13	ROS12	ROS11	ROS10	ROS9	ROS8	ROS7	ROS6	ROS5	ROS4	ROS3	ROS2	ROS1	ROS0	Remote temp 4 offset
59	0000	Y	RNC7	RNC6	RNC5	RNC4	RNC3	RNC2	RNC1	RNC0	0	0	0	0	0	0	0	0	Remote temp 4 η-factor correction
5A	7FC0	Y	RTH1_15	RTH1_14	RTH1_13	RTH1_12	RTH1_11	RTH1_10	RTH1_9	RTH1_8	RTH1_7	RTH1_6	RTH1_5	RTH1_4	RTH1_3	RTH1_2	RTH1_1	RTH1_0	Remote temp 4 THERM limit
5B	7FC0	Y	RTH2_15	RTH2_14	RTH2_13	RTH2_12	RTH2_11	RTH2_10	RTH2_9	RTH2_8	RTH2_7	RTH2_6	RTH2_5	RTH2_4	RTH2_3	RTH2_2	RTH2_1	RTH2_0	Remote temp 4 THERM2 limit
60	0000	Y	ROS15	ROS14	ROS13	ROS12	ROS11	ROS10	ROS9	ROS8	ROS7	ROS6	ROS5	ROS4	ROS3	ROS2	ROS1	ROS0	Remote temp 5 offset
61	0000	Y	RNC7	RNC6	RNC5	RNC4	RNC3	RNC2	RNC1	RNC0	0	0	0	0	0	0	0	0	Remote temp 5 η-factor correction
62	7FC0	Y	RTH1_15	RTH1_14	RTH1_13	RTH1_12	RTH1_11	RTH1_10	RTH1_9	RTH1_8	RTH1_7	RTH1_6	RTH1_5	RTH1_4	RTH1_3	RTH1_2	RTH1_1	RTH1_0	Remote temp 5 THERM limit
63	7FC0	Y	RTH2_15	RTH2_14	RTH2_13	RTH2_12	RTH2_11	RTH2_10	RTH2_9	RTH2_8	RTH2_7	RTH2_6	RTH2_5	RTH2_4	RTH2_3	RTH2_2	RTH2_1	RTH2_0	Remote temp 5 THERM2 limit
68	0000	Y	ROS15	ROS14	ROS13	ROS12	ROS11	ROS10	ROS9	ROS8	ROS7	ROS6	ROS5	ROS4	ROS3	ROS2	ROS1	ROS0	Remote temp 6 offset
69	0000	Y	RNC7	RNC6	RNC5	RNC4	RNC3	RNC2	RNC1	RNC0	0	0	0	0	0	0	0	0	Remote temp 6 η-factor correction
6A	7FC0	Y	RTH1_15	RTH1_14	RTH1_13	RTH1_12	RTH1_11	RTH1_10	RTH1_9	RTH1_8	RTH1_7	RTH1_6	RTH1_5	RTH1_4	RTH1_3	RTH1_2	RTH1_1	RTH1_0	Remote temp 6 THERM limit
6B	7FC0	Y	RTH2_15	RTH2_14	RTH2_13	RTH2_12	RTH2_11	RTH2_10	RTH2_9	RTH2_8	RTH2_7	RTH2_6	RTH2_5	RTH2_4	RTH2_3	RTH2_2	RTH2_1	RTH2_0	Remote temp 6 THERM2 limit
70	0000	Y	ROS15	ROS14	ROS13	ROS12	ROS11	ROS10	ROS9	ROS8	ROS7	ROS6	ROS5	ROS4	ROS3	ROS2	ROS1	ROS0	Remote temp 7 offset
71	0000	Y	RNC7	RNC6	RNC5	RNC4	RNC3	RNC2	RNC1	RNC0	0	0	0	0	0	0	0	0	Remote temp 7 η-factor correction
72	7FC0	Y	RTH1_15	RTH1_14	RTH1_13	RTH1_12	RTH1_11	RTH1_10	RTH1_9	RTH1_8	RTH1_7	RTH1_6	RTH1_5	RTH1_4	RTH1_3	RTH1_2	RTH1_1	RTH1_0	Remote temp 7 THERM limit
73	7FC0	Y	RTH2_15	RTH2_14	RTH2_13	RTH2_12	RTH2_11	RTH2_10	RTH2_9	RTH2_8	RTH2_7	RTH2_6	RTH2_5	RTH2_4	RTH2_3	RTH2_2	RTH2_1	RTH2_0	Remote temp 7 THERM2 limit
78	0000	Y	ROS15	ROS14	ROS13	ROS12	ROS11	ROS10	ROS9	ROS8	ROS7	ROS6	ROS5	ROS4	ROS3	ROS2	ROS1	ROS0	Remote temp 8 offset
79	0000	Y	RNC7	RNC6	RNC5	RNC4	RNC3	RNC2	RNC1	RNC0	0	0	0	0	0	0	0	0	Remote temp 8 η-factor correction
7A	7FC0	Y	RTH1_15	RTH1_14	RTH1_13	RTH1_12	RTH1_11	RTH1_10	RTH1_9	RTH1_8	RTH1_7	RTH1_6	RTH1_5	RTH1_4	RTH1_3	RTH1_2	RTH1_1	RTH1_0	Remote temp 8 THERM limit
7B	7FC0	Y	RTH2_15	RTH2_14	RTH2_13	RTH2_12	RTH2_11	RTH2_10	RTH2_9	RTH2_8	RTH2_7	RTH2_6	RTH2_5	RTH2_4	RTH2_3	RTH2_2	RTH2_1	RTH2_0	Remote temp 8 THERM2 limit
80	0000	N	LT15	LT14	LT13	LT12	LT11	LT10	LT9	LT8	LT7	LT6	LT5	LT4	LT3	LT2	LT1	LT0	Local temperature (Block Register)

PTR	POR	Lock	GD30TS308T Functional Registers – BIT Description																Register
HEX	**HEX**	**Y/N**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**Description**
81	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temp 1 (Block Register)
82	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temp 2 (Block Register)
83	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temp 3 (Block Register)
84	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temp 4 (Block Register)
85	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temp 5 (Block Register)
86	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temp 6 (Block Register)
87	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temp 7 (Block Register)
88	0000	N	RT15	RT14	RT13	RT12	RT11	RT10	RT9	RT8	RT7	RT6	RT5	RT4	RT3	RT2	RT1	RT0	Remote temp 8 (Block Register)
C4	8000	N	Write 0x5CA6 to lock registers; Read back: 0x8000																Lock Register
			Write 0xEB19 to unlock registers; Read back: 0x0000																
FE	5449	N	0	1	0	1	0	1	0	0	0	1	0	0	1	0	0	1	Manufacturers Identification Register
FF	0468	N	0	0	0	1	0	1	0	0	0	1	1	0	1	0	0	0	Device Identification / Revision Register

6.3.1 Pointer Register

Table 3 shows the pointer register bytes corresponding to each register in GD30TS308T. The default value of the pointer register is 0000h. GD30TS308T reads the local temperature register by default. When writing data to a register not defined in Table 3, the chip will still return the ACK bit for the write operation, but the data will not be written into the chip; when reading data from a register not defined in Table 3, the chip will return FFFFh.

Table 4. $\overline{\text{THERM}}$ Status Register Bit Description

Bit Number	Bit Name	Description
15	R8TH	1 = Remote 8 channel temperature > the channel $\overline{\text{THERM}}$ threshold value
14	R7TH	1 = Remote 7 channel temperature > the channel $\overline{\text{THERM}}$ threshold value
13	R6TH	1 = Remote 6 channel temperature > the channel $\overline{\text{THERM}}$ threshold value
12	R5TH	1 = Remote 5 channel temperature > the channel $\overline{\text{THERM}}$ threshold value
11	R4TH	1 = Remote 4 channel temperature > the channel $\overline{\text{THERM}}$ threshold value
10	R3TH	1 = Remote 3 channel temperature > the channel $\overline{\text{THERM}}$ threshold value
9	R2TH	1 = Remote 2 channel temperature > the channel $\overline{\text{THERM}}$ threshold value
8	R1TH	1 = Remote channel 1 temperature > the channel $\overline{\text{THERM}}$ threshold value
7	LTH	1 = Local channel temperature > the channel $\overline{\text{THERM}}$ threshold value
6:0		0

Table 5. $\overline{\text{THERM2}}$ Status Register Bit Description

Bit Number	Bit Name	Description
15	R8TH2	1 = Remote 8 channel temperature > $\overline{\text{THERM2}}$ threshold value of the channel - $\overline{\text{THERM}}$ hysteresis register value
14	R7TH2	1 = Remote 7 channel temperature > the channel $\overline{\text{THERM2}}$ threshold value - $\overline{\text{THERM}}$ hysteresis register value
13	R6TH2	1 = Remote 6 channel temperature > the channel $\overline{\text{THERM2}}$ threshold value - $\overline{\text{THERM}}$ hysteresis register value
12	R5TH2	1 = Remote 5 channel temperature > the channel $\overline{\text{THERM2}}$ threshold value - $\overline{\text{THERM}}$ hysteresis register value
11	R4TH2	1 = Remote 4- channel temperature > the channel $\overline{\text{THERM2}}$ threshold value - $\overline{\text{THERM}}$ hysteresis register value
10	R3TH2	1 = Remote 3 channel temperature > the channel $\overline{\text{THERM2}}$ threshold value - $\overline{\text{THERM}}$ hysteresis register value
9	R2TH2	1 = Remote 2 channel temperature > the channel $\overline{\text{THERM2}}$ threshold value - $\overline{\text{THERM}}$ hysteresis register value
8	R1TH2	1 = Remote 1 channel temperature > the channel $\overline{\text{THERM2}}$ threshold value - $\overline{\text{THERM}}$ hysteresis register value
7	LTH2	1 = Local channel temperature > the channel $\overline{\text{THERM2}}$ threshold value - $\overline{\text{THERM}}$ hysteresis register value

Bit Number	Bit Name	Description
6:0		0

6.3.2 THERM Status Register

GD30TS308T has two THERM status registers, which respectively represent the comparison results between the temperature output of the chip local channel and remote channel and the corresponding channel THERM threshold register.

For THERM status register (21h), when the temperature measurement results of the local channel and the remote channel are higher than THERM values in the threshold registers (39h, 42h, 4Ah, 52h, 5Ah, 62h, 6Ah, 72h, 7Ah) of the corresponding channels, the LTH bit and the R1TH~R4TH bits will be read as 1 respectively; when the temperature measurement results of the above channels are lower than the values that THERM threshold register minus THERM hysteresis register (38h) of the corresponding channels, the LTH bit and the R1TH~R4TH bits will be reset to 0 respectively. The behavior of THERM2 status register (22h) is consistent with the THERM status register, see Table 4 and Table 5.

6.3.3 Remote Channel Open Status Register

GD30TS308T supports open circuit detection of temperature probes of all remote channels, and records the detection results in the remote channel open circuit status register, see Table 6. When a channel is detected as open circuit, the temperature measurement result of the channel will return 8000h (−256° C). This register will not directly affect the state of THERM and THERM2 pins, but will indirectly affect the and pins by changing the value of the THERM status register.

Table 6. Remote Channel Open Circuit Status Register Bit Description

Bit Number	Bit Name	Description
15	R8OPN	1 = Remote 8 channel temperature probe open circuit
14	R7OPN	1 = Remote 7 channel temperature probe open circuit
13	R6OPN	1 = Remote 6 channel temperature probe open circuit
12	R5OPN	1 = Remote 5 channel temperature probe open circuit
11	R4OPN	1 = Remote 4 channel temperature probe open circuit
10	R3OPN	1 = Remote 3 channel temperature probe open circuit
9	R2OPN	1 = Remote 2 channel temperature probe open circuit
8	R1OPN	1 = Remote 1 channel temperature probe open circuit
7:0		0

6.3.4 Configuration Register

The configuration register of GD30TS308T controls the enable of each channel, conversion rate, shutdown mode and One-Shot mode of the chip, and indicates whether the chip is in the conversion process. BUSY is a read-only bit, and the rest are read-write bits. See Table 7 for details.

Table 7. Configuration Register Bit Description

Bit Number	Bit Name	Description	POR Value
15：8	REN8:REN1	1 = Enable remote channel to realize temperature conversion	00001111
7	LEN	1 = Enable local channel to realize temperature conversion	1
6	OS	1 = Enable the channel to realize single temperature conversion	0
5	SD	1 = Start shutdown mode	0
4:2	CR2:CR0	Conversion rate control bits, see Table 9 for details	111
1	BUSY	1 = The chip is in temperature conversion (read only)	0
0		1 = Enable remote channel to realize temperature conversion	0

In the default register configuration, GD30TS308T will always perform continuous conversions in the order of local channel, remote 1 to 8 channels. If any bit in LEN or REN8: REN1 is written as 0, the temperature conversion of the channel corresponding to that bit will be skipped. If both LEN and REN8: REN1 are written as 0, the chip will enter shutdown mode, and the chip behavior is the same as if SD is written as 1 and OS bit is written as 0. See Table 8 for details of the above situation

Table 8. GD30TS308T Temperature Conversion Description

WRITE			READ			Function
REN<8:1> & LEN	OS	SD	REN<8:1> & LEN	OS	SD	
All are 0			All are 0	0	1	Shutdown mode
At least one digit is 1		0	The value written	0	0	Continuous conversion mode
At least one digit is 1	0	1	The value written	0	1	Shutdown mode
At least one digit is 1	1	1	The value written	1	1	One-shot conversion mode

The CR2:CR0 bit in the configuration register controls the temperature conversion rate of the GD30TS308T. When CR2:CR0 changes, the time of a single temperature conversion remains unchanged, but the time interval between two adjacent temperature conversions changes accordingly. For specific configurations, see Table 9 and Table 10. When CR2:CR0=111, there is no time interval between two adjacent temperature conversions, and the temperature conversion rate of the chip is determined by the number of enabled channels.

Table 9. GD30TS308T Temperature Conversion Rate Description

CR2:CR0	Frequency (Hz)	Time (s)
000	0.0625	16
001	0.125	8
010	0.25	4
011	0.5	2
100	1	1
101	2	0.5
110	4	0.25

CR2:CR0	Frequency (Hz)	Time (s)
111	There is no time interval between adjacent conversions. The single conversion time is shown in Table 10.	

Table 10. GD30TS308T Single Conversion Time

NUMBER OF REMOTE CHANNELS ENABLED	CONVERSION TIME (ms)	
	LOCAL DISABLED	LOCAL ENABLED
0	0	16
1	16	32
2	32	48
3	48	64
4	64	80

6.3.5 η Factor Correction Register

GD30TS308T supports remote temperature measurement using remote temperature probes with different η factors. By configuring the four η factor correction registers (41h、49h、51h、59h) according to the actual remote temperature probe used, a more accurate remote temperature measurement result can be obtained. The specific configuration of the η factor correction register is shown in Table 11; where η_{eff} is the η factor value of the actual remote temperature probe used, N is the value of the η factor correction register, and negative values are represented in binary complement form, with an adjustment range of -128 ~ +127. The corresponding relationship between the two is shown in the following formula:

$$\eta_{eff} = \frac{1.008 \times 2048}{2048 + N}, \quad N = \frac{1.008 \times 2048}{\eta_{eff}} - 2048 \qquad (1)$$

Table 11 shows the corresponding values of the η factor correction register under different η_{eff} values.

Table 11. η Factor Correction Register Bit Description

Binary	HEX	DECIMAL	ηeff
0111 1111	7F	127	0.949142
0000 1010	0A	10	1.003102
0000 1000	08	8	1.004078
0000 0110	06	6	1.005056
0000 0100	04	4	1.006035
0000 0010	02	2	1.007017
0000 0001	01	1	1.007508
0000 0000	00	0	1.008(Default)
1111 1111	FF	-1	1.008492
1111 1110	FE	-2	1.008985
1111 1100	FC	-4	1.009973
1111 1010	FA	-6	1.010962
1111 1000	F8	-8	1.011953
1111 0110	F6	-10	1.012946

Binary	HEX	DECIMAL	ηeff
1000 0000	80	-128	1.07520

6.3.6 Remote Temperature Offset Correction Register

All remote channels of GD30TS308T have remote temperature offset correction registers (40h, 48h, 50h, 58h, 60h, 68h, 70h, 78h) to store the correction value of the remote temperature offset of the channel. The value in this register is added to the result of the temperature conversion after each remote channel temperature measurement to form the final remote channel temperature, so as to further improve the accuracy of the remote channel temperature measurement result. The data format of this register is the same as that of the remote channel temperature register, with a temperature resolution of 0.0078125°C and a temperature range of −256°C to+255.9921875°C. Negative temperature is implemented using binary complement.

6.3.7 THERM Hysteresis Register

The THERM hysteresis register (38h) participates in the generation of the lower temperature limit in the constant temperature mode to prevent repeated alarms caused by the temperature measurement result being near the temperature threshold. $\overline{\text{THERM}}$ and $\overline{\text{THERM2}}$ modes share the same THERM hysteresis register. The resolution of this register is 0.0078125°C, the highest bit is always read as 0, and the temperature range is 0°C to +255.9921875°C.

6.3.8 THERM Threshold Register

The $\overline{\text{THERM}}$ threshold registers (39h, 42h, 4Ah, 52h, 5Ah, 62h, 6Ah, 72h, 7Ah) and $\overline{\text{THERM2}}$ threshold registers (3Ah, 43h, 4Bh, 53h, 5Bh, 63h、6Bh, 73h, 7Bh) of the two constant temperature modes of GD30TS308T are used to store the temperature comparison thresholds of different remote channels. The data format of the above registers is the same as that of the remote channel temperature register, with a temperature resolution of 0.0078125°C and a temperature range of −256°C to +255.9921875°C. Negative temperature is implemented using binary complement.

When some channels do not need to monitor the temperature output, it is recommended to set the THERM threshold register of the channel to 7FFF (+255.9921875°C). After this setting, the bit in the corresponding THERM status register and the THERM output pin will not be activated because of this channel.

6.3.9 Temperature Register Block

The register block for storing the local and remote channel temperature output in GD30TS308T consists of 9 registers with pointers from 80h to 88h. The values stored in the above registers are mirror images of the local and remote channel temperature registers (00h to 08h). The register block supports reading the values in the above registers separately through only one I2C communication, see *Block Register Reads* for details.

7 Application Information

The typical application diagram of GD30TS308T is shown in Figure 7. D1+ to D4+ pins are positive input pin of each remote channel, and the D- pin is the negative input pin of each remote channel. When some remote channels do not need to measure temperature, the D+ pin of the channel must be shorted to the D- pin. The SCL, SDA, $\overline{\text{THERM}}$ and $\overline{\text{THERM2}}$ pins are open-drain output and should be connected to 1.6V to 5.5V power supply through a pull-up resistor RPULLUP. GD30TS308T supports the high level (1.6V to 5.5V) of the two-wire bus to be lower than the chip power supply (2.7V to 5.5V). See *Low-Voltage Communication* for details.

GD30TS308T's D+ and D- pins are recommended to mount RS and filter capacitor CF. The resistance of the filter resistor should be less than 1kΩ, and the capacitance of the filter capacitor should be less than 1nF. For details, see *Filter and Series Resistance Elimination*.

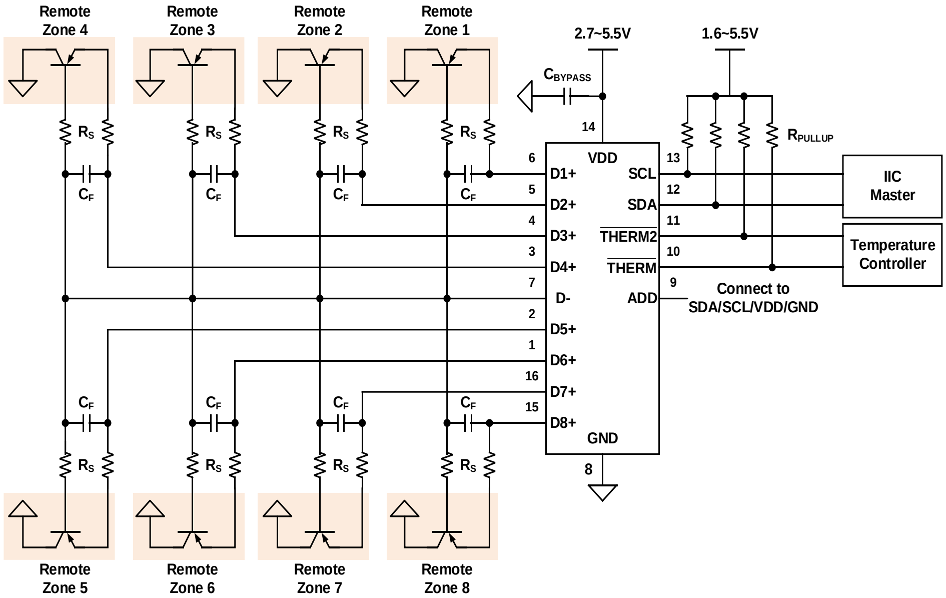


Figure 7. Diagram of GD30TS308T's Typical Connection

GD30TS308T's temperature measurement probe of each remote channel can select isolation components, or be integrated in the processor chip, FPGA, ASIC and other circuit modules. Remote temperature measurement probe can select PNP or NPN devices. Each remote channel of GD30TS308T can be selected as separate original devices or integrated in the circuit modules such as processor chip, FPGA, ASIC, etc. The remote temperature probe can be selected as PNP or NPN devices; NPN must be connected by diode, and PNP can be connected by diode or transistor, as shown in Figure 8. Some applications specify the range of bias current on the remote temperature probe. The maximum bias current provided by GD30TS308T for the remote temperature probe is 120μA and the minimum value is 7.5μA. For temperature probes with different η factor values, the η factor correction register can be configured to obtain more accurate remote temperature measurement results. See *η Factor Correction Register* for details. The default η factor value of GD30TS308T is 1.008. When the selected temperature probe $\eta_{eff} \neq 1.008$, the error value of the temperature measurement result T at this time can be calculated according to the following formula, where the unit of T must be °C.

$$T_{ERROR} = \left(\frac{\eta_{eff} - 1.008}{1.008}\right) \times (T + 273.15) \quad (2)$$

When using isolation components as the remote temperature measurement probe of GD30TS308T, the device selection can be carried out according to the following standards to obtain higher temperature measurement accuracy:

- At the highest measured temperature and bias current of 7.5μA, VBE >0.25V;
- At the lowest measured temperature and bias current of 120μA, VBE <0.95V;
- Base resistance < 100 Ω;
- h FE variation range is as small as possible (50 ~ 150);

Based on the above standards, the recommended remote temperature probe model is MMBT3904 (NPN) or MMBT3906 (PNP).

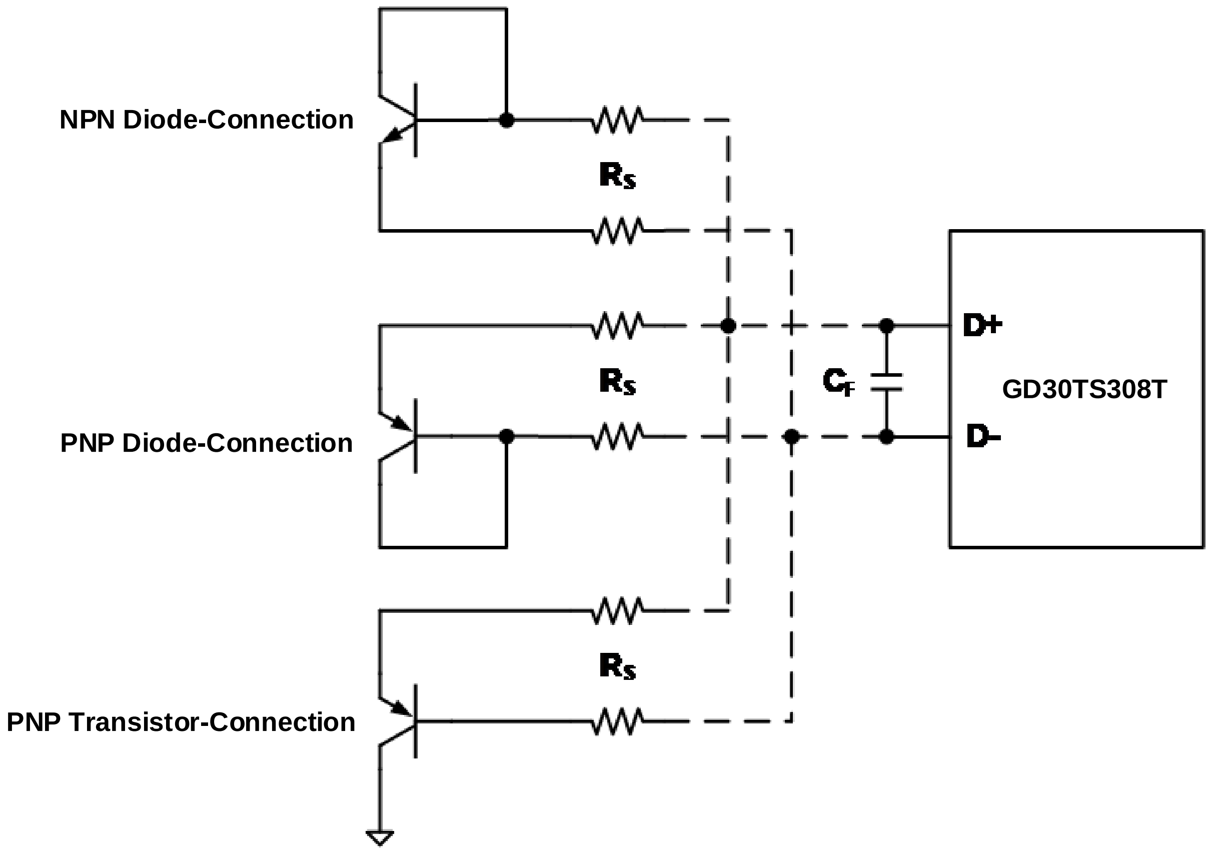
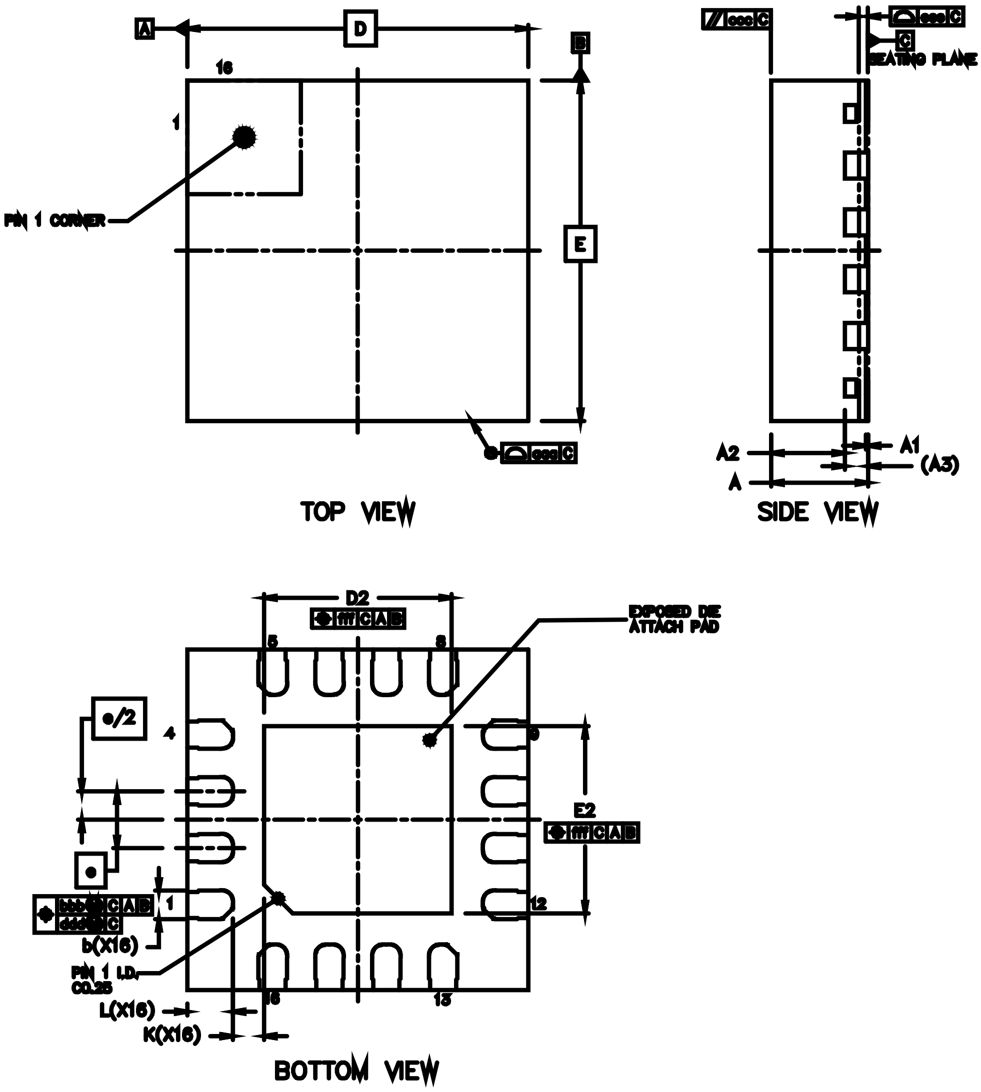


Figure 8. Diagram of Remote Temperature Probe with Different Connection Methods

8 Package Information

8.1 Outline Dimensions

QFN16 Package Outline



NOTES: (continued)

1. All dimensions are in millimeters.
2. Package dimensions does not include mold flash, protrusions, or gate burrs.
3. Refer to the Table 12 *QFN16 dimensions(mm)*.

Table 12. QFN16 dimensions(mm)

SYMBOL	MIN	NOM	MAX
A	0.8	0.85	0.9
A1	0	0.02	0.05
A2		0.65	
A3		0.23 REF	
b	0.2	0.25	0.3
D		3 BSC	
E		3 BSC	
e		0.5 BSC	
D2	1.55	1.65	1.75
E2	1.55	1.65	1.75
L	0.3	0.4	0.5
K		0.2 MIN	
aaa		0.1	
ccc		0.1	
eee		0.08	
bbb		0.1	
ddd		0.05	
fff		0.1	

9 Ordering Information

Ordering Code	Package Type	ECO Plan	Packing Type	MOQ	OP Temp(°C)
GD30TS308TLUTR-I	QFN16	Green	Tape & Reel	3000	−40°C to +125°C

10 Revision History

REVISION NUMBER	DESCRIPTION	DATE
1.0	Initial release and device details	2024

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