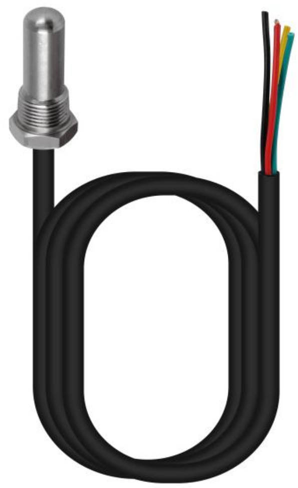
HCTD01 Digital Temperature Transmitter

Features



· High precision ±0. 1°C @ -5°C—+5 0°C

· 12C interface / anti-interference / simplified circuit design

· Small size, stainless steel thread seal structure, strong environmental adaptability

· Operating temperature range: - 4 0°C—+ 1 2 5°C

· Thread shape can be customized, flexible and convenient

Applications

· Industrial precision control field
· Heating / Cooling System
· Home Appliances / Security
· Replace traditional thermistors P T C and N T C
· HVAC
· Transportation

Product description

The HCTD01 is a new universal universal digital temperature sensor. It incorporates a temperature sensing chip and a high precision 24-bit ΔΣ-A D C, which gives it highly accurate temperature information and high-resolution measurement performance. At the same time, the I 2 C interface is provided, which improves the anti-interference ability and simplifies the design of subsequent circuits.

Product features

parameter	symbol	surroundings	Minimum	typical	maximum	unit
Temperature measurement range	T_{RANG}		-40		125	℃
Precision 1	T_{ACC1}	-5°C < T < +50°C Vdd = 3.2V – 3.4V	-0.1		+0.1	℃
Precision 2	T_{ACC2}	-40°C < T < +125°C Vdd = 3.2V – 3.4V	-0.5		+0.5	℃
Temperature resolution	T_{RES}				0.01	℃
Time constant	T	t10-90 T1=25°C T2=75°C PCB 900mm2 x 1.5mm FR4		9		s
Self-heating	SH1	10 samples/s, 60s, still air			0.02	℃

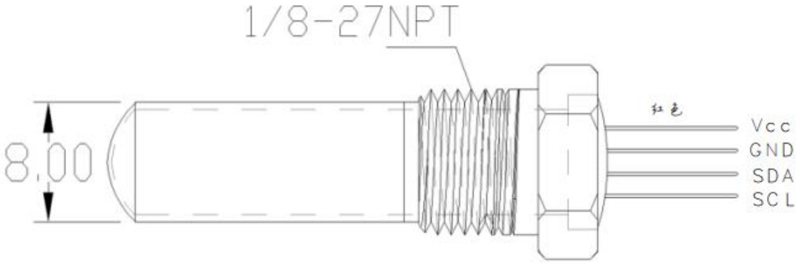
Digital input (SCLK, SDI, CSB, PS)

parameter	symbol	surroundings	Minimum	typical	maximum	unit
High voltage input	V_{IH}	V_{DD} =2.2···3.6V	$0.7V_{DD}$		V_{DD}	V
Low voltage input	V_{IL}	V_{DD} =2.2···3.6V	$0.0V_{DD}$		$0.3V_{DD}$	V
CS low to the first SCLK rise	t_{CSL}		21			ns
CS high level to the first SCLK rise	t_{CSH}		21			ns
SDI is set to the first SCLK rise	T_{DSO}		6			ns
SDI keeps rising to the first SCLK	T_{DO}		6			ns

Digital output (SDA, ADO)

parameter	symbol	surroundings	Minimum	typical	maximum	unit
High voltage output	V_{OH}	Isource=1mA	$0.8V_{DD}$		V_{DD}	V
Low voltage output	V_{OL}	Isink=1mA	$0.0V_{DD}$		$0.22V_{DD}$	V
SDO is set to the first SCLK rise	t_{QS}		10			ns
SDO keeps rising to the first SCLK	t_{QH}		0			ns

Pin definition



I2C communication protocol

I2C interface

The I2C communication mode starts with a start condition and ends with a stop condition. Each command consists of two bytes: an address byte and a command byte.

command:

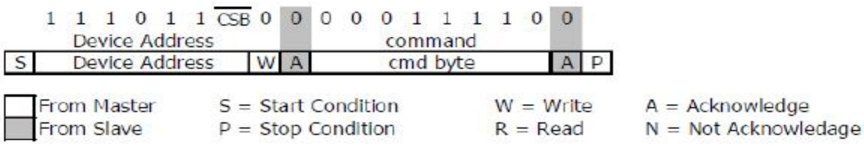
1. Reset
2. Read the PROM (calibration parameters)
3. Start ADC temperature conversion
4. Read ADC temperature results

command	Hexadecimal value
Restart	0x1E
Start ADC temperature conversion	0x48
Read ADC temperature results	0x00
PROM read address 0	0xA0
PROM read address 1	0xA2
PROM read address 2	0xA4
PROM read address 3	0xA6
PROM read address 4	0xA8
PROM read address 5	0xAA
PROM read address 6	0xAC
PROM read address 7	0xAE

Reset mode

A reset command must be sent after power-on. It can also be used to reset the device ROM.

I²C

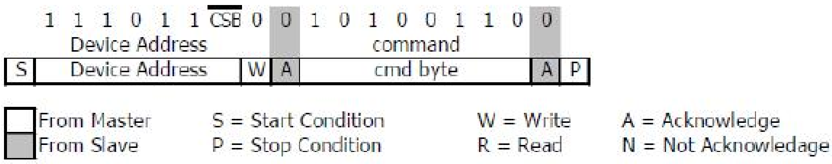


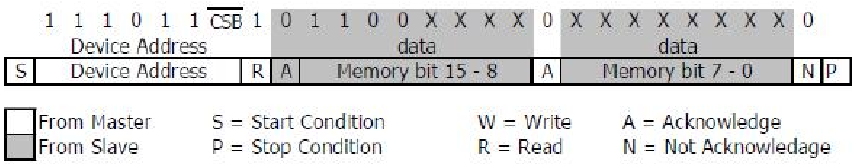
PROM reading order

The PROM Read command consists of two parts. The first command sets the system to PROM read mode. The second part gets the data from the system.

The following example is a sequence of reading address 3 (command 0xA6).

I²C



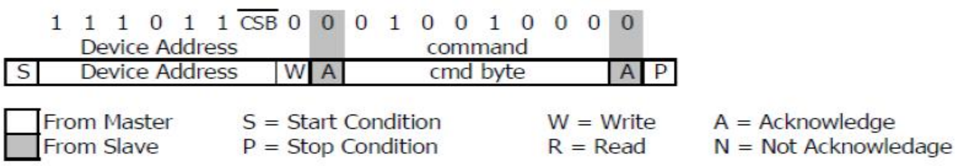


Conversion order

The conversion must be initiated by sending this command. The sensor remains busy until the conversion is complete. After the conversion is complete, you can access the data using the ADC read command.

I2C

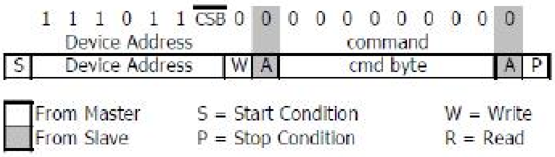
When the command is sent, the sensor remains busy until the conversion is complete. All other commands except this will not be executed during this time. After the conversion is complete, when the sensor is confirmed, the data can be accessed by sending an ADC read command.

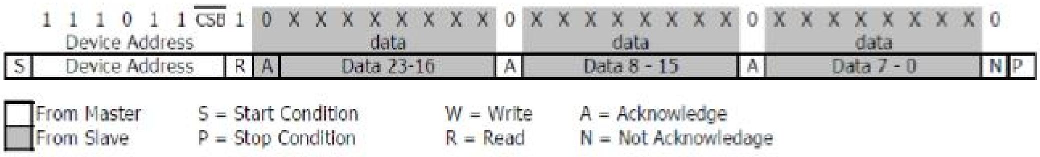


Read ADC results

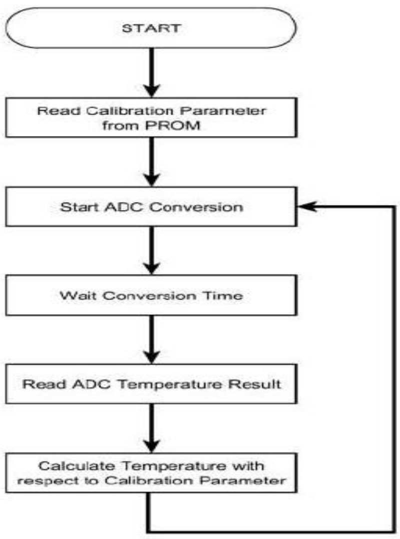
After the conversion command, the ADC result is read using the ADC read command. Repeated reads of the ADC command or execution of the command without prior conversion will return all zeros as a result.

I²C





Temperature calculation



Temperature calculation

variable	description	command	Size/bit	Min	Max	example
K4	Polynomial coefficient k4	0xA2	16	0	65535	28446
K3	Polynomial coefficient k3	0xA4	16	0	65535	24926
K2	Polynomial coefficient k2	0xA6	16	0	65535	36016
K1	Polynomial coefficient k1	0xA8	16	0	65535	32791
K0	Polynomial coefficient k0	0xAA	16	0	65535	40781

Temperature polynomial

ADC24: ADC value
ADC16: ADC24 / 256

$$T / °C = (-2) * k4 * 10^{-21} * ADC16^{4} + 4 * k3 * 10^{-16} * ADC16^{3} + (-2) * k2 * 10^{-11} * ADC16^{2} + 1 * k1 * 10^{-6} * ADC16 + (-1.5) * k0 * 10^{-2}$$

例:

ADC24: 9378708
ADC16: 9378708 / 256 = 36636

$$T / °C = (-2) * 28446 * 10^{-21} * 36636^{4} + 4 * 24926 * 10^{-16} * 36636^{3} + (-2 * 36016 * 10^{-11} * 36636^{2} + 1 * 32791 * 10^{-6} * 36636 + (-1.5) * 40781 * 10^{-2}$$

T / °C = 10.59

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