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Nyfea product specification

PRODUCT SPECIFICATION

Customer: ______________________

Product Name : Temperature and Humidity Sensor

Part NO: FHT31

Issue Date : ______________________

Prepared	Checked	Customer Check
ChenTT	Zelig	

1 Features

- Fully calibrated, linearized, and temperature compensated digital output
- Wide supply voltage range, from 2.0 V to 5.5 V
- I2C interface with communication speed of 1 MHz
- Two user-selectable addresses
- Typical accuracy of FHT31 is ±2%RH / ±0.2°C
- Single chip integrated temperature and humidity sensor
- High reliability and long-term stability
- Relative humidity range: 0 ~ 100%
- Temperature range: -45°C ~ 130°C
- Integrated 16-bit high precision ADC
- Measurement time as low as 2.5ms

2 Applications

- Communication equipment
- Photovoltaic energy storage
- Consumer electronics
- Cold chain transportation
- Smart home
- Smart agriculture

Figure 1. Chip Rendering

3 Description

FHT31 is the next generation of single-chip integr ated temperature and humidity sensor developed by NYF EA. It was developed based on the extremely weak signa l detection design platform and MEMS process design pla tform of NYFEA . Integrating high-sensitivity MEMS moi sture-sensitive components on silicon-based CMOS wafer s can reduce the interference of multi-chip signal transmi ssion, reduce chip area, and improve packaging reliab ility. It has two user-selectable I²C addresses, the I²C communication speed is up to 1MHz, and the chip is pack aged in a miniaturized DFN package with an outline size o f 2.5 x 2.5 mm_2 and a height of 0.9 mm. This enables th e FHT31 to be integrated in various applications. In ad dition, the wide power supply voltage range of 2.0~5.5V m akes it adaptable to various power supply environments.

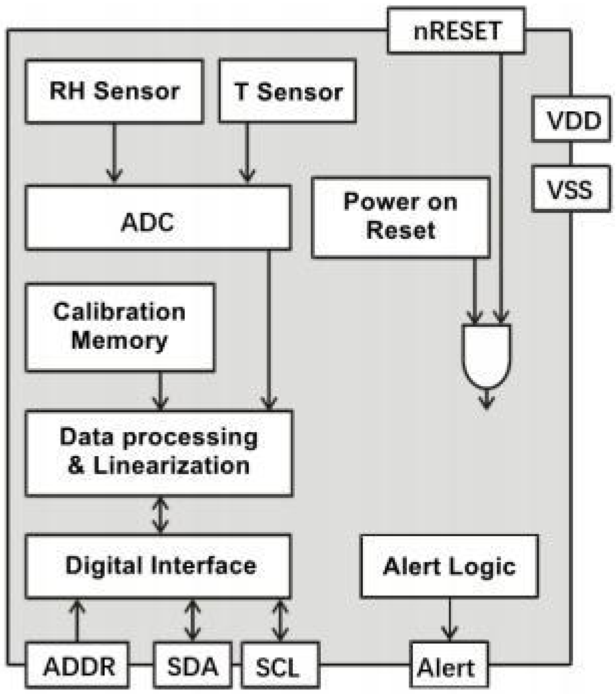

Figure 2. Functional block diagram of FHT31

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Table of Contents

4 Sensor Performance

Table 1. Humidity Sensor Specification

PARAMETER	CONDITION	VALUE	UNITS
FHT31 accuracy	Typical	±2	% Relative humidity
	Maximum	Figure 3	-
Repeatability	Low	0.25	% Relative humidity
	Medium	0.15	% Relative humidity
	High	0.10	% Relative humidity
Resolution	Typical	0.01	% Relative humidity
Hysteresis	At 25°C	±1.0	% Relative humidity
Specified range	Measurement range	0-100	% Relative humidity
Response time	τ63%	8	Second
Long-term stability	Typical	<0.25	% Relative humidity / year

Table 2. Temperature Sensor Specification

PARAMETER	CONDITION	VALUE	UNITS
FHT31 accuracy	Typical, -40℃ to 90℃	±0.2	℃
Repeatability	Low	0.2	℃
	Medium	0.1	℃
	High	0.06	℃
Resolution	Typical	0.015	℃
Operating range	Measurement range	-45 to +130	℃
Response time	τ63%	>2	Second
Long-term stability	Maximum	<0.03	℃ / year

Temperature and humidity sensor performance diagram

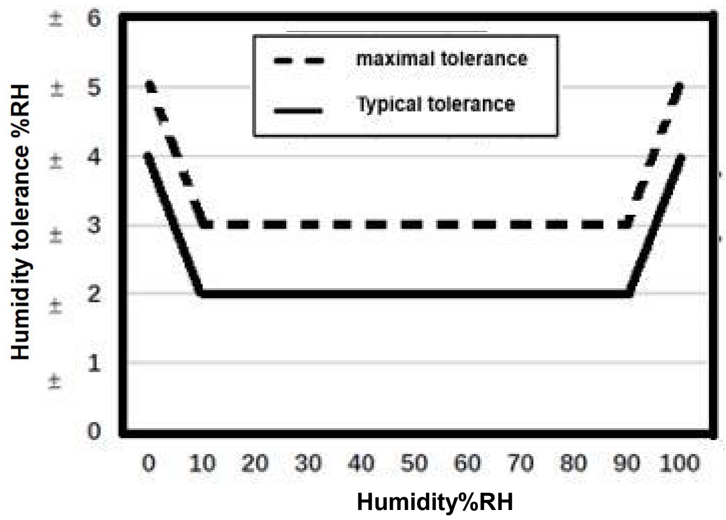

Figure 3. Tolerance of RH at 25°C for FHT31

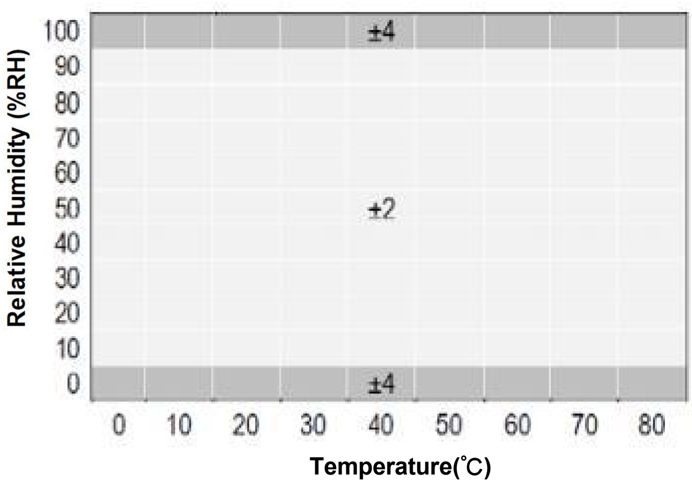

Figure 4 Tolerance of FHT31 under total sstemperature conditions

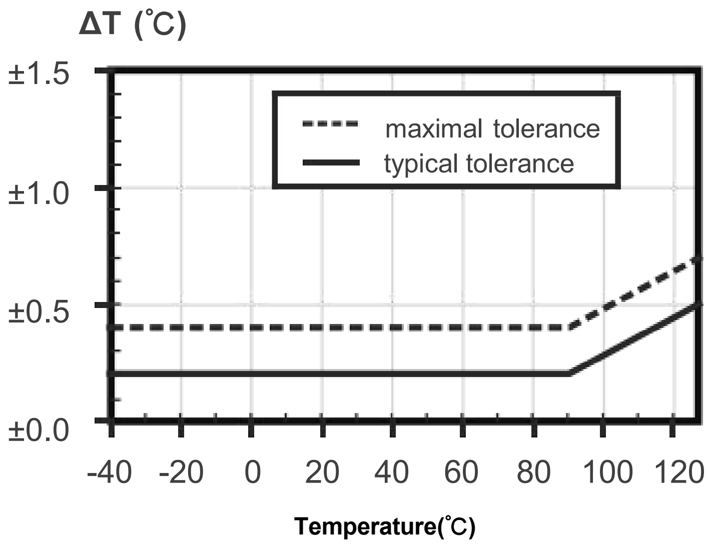

Figure 5. Temperature accuracy of FHT31

Recommended Operating Condition

The sensor shows optimum performance when operating within the recommended normal temperature and humidity ranges (5°C ~ 60°C and 20%RH ~ 80%RH, respectively). Long-term exposure to conditions outside the normal range, especially at high humidity, may temporarily shift the relative humidity signal. After returning to normal temperature and humidity ranges, the sensor will slowly return to calibration state by itself.

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5 Specifications

5.1 Electrical Specifications

Table 3. Temperature Sensor Specification

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	COMMENTS
Supply voltage	V_{DD}		2.0	3.3	5.5	V	
Power-up/down	V_{POR}		1.8	1.9	2.0	V	
Slew rate change of the supply voltage	$V_{DD,\ slew}$				20	V/ms	Changes in supply voltage should be less than the maximum slew rate, changing too fast may lead to reset.
Supply current	I_{DD}	Idle state (single shot mode) T=25°C	-	0.2	2.0	μA	Current when sensor is not performing a measurement during single shot mode.
		Idle state (single shot mode) T=125°C	-	-	6.0	μA	Current when sensor is not performing a measurement during periodic data acquisition mode.
		Idle state (periodic data acquisition mode) T=125°C	-	45	-	μA	Current when temperature and humidity conversion is not turned on in periodic data acquisition mode.
		Measuring	-	600	1500	μA	Current consumption while sensor is measuring.
		Average	-	1.7	-	μA	Average consumption (operation with one measurement per second at lowest repeatability, single shot mode)
Alert output driving strength	I_{OH}			1.5x V_{DD}		mA	
Heater power	P_{Heater}	Heater running	3.6	-	33	mW	Depending on the supply voltage.

Note: Typical values correspond to temperatures of 25 ° C, while maximum and minimum values correspond to temperatures of -45 ° C and 130 ° C, respectively.

5.2 Timing Specification for the Sensor

Table 4. Timing Specification（@ -40℃~+125℃ ， 2.4V~5.5V）

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNITS	COMMENTS
Power-up time	t_{PU}	$V_{DD} \geqslant V_{POR}$	-	0.5	1	ms	Time between V_{DD} reaching V_{POR} and sensor entering idle state.
Soft reset time	t_{SR}	Start from the soft reset signal	-	0.5	1.5	ms	Time between ACK of soft reset command and sensor entering idle state.
Duration of reset pulse	t_{RESETN}		1	-	-	μs	
Measurement duration	$t_{MEAS,\ l}$	Low repeatability	-	2.5	4	ms	Three repeatability modes differ with respect to duration, noise level and consumption.
	$t_{MEAS,m}$	Medium repeatability	-	4.5	6	ms	
	$t_{MEAS,h}$	High repeatability	-	12.5	15.5	ms	

Table 5. Timing Specification（@ -40℃~+125℃ ， 2.2V~2.4V）

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNITS	COMMENTS
Duration of reset pulse	t_{PU}	$V_{DD} \geqslant V_{POR}$	-	0.5	1.5	ms	Time between V_{DD} reaching V_{POR} and sensor entering idle state.
Measurement duration	$t_{MEAS,\ l}$	Low repeatability	-	2.5	4.5	ms	Three repeatability modes differ with respect to duration, noise level and consumption.
	$t_{MEAS,m}$	Medium repeatability	-	4.5	6.5	ms	
	$t_{MEAS,h}$	High repeatability	-	12.5	15.5	ms	

5.3 Absolute Minimum and Maximum Ratings

Table 6. Minimum and Maximum Ratings (volage values is only applied for short time periods)

PARAMETER	RATING	UNITS
Supply voltage V_{DD}	-0.3 to 6	V
Max voltage on pins (1 (SDA) ; 2 (ADDR); 3 (ALERT); 4 (SCL); 6 (nRESET))	-0.3 to V_{DD}+0.3	V
Max input current on any pin	±100	mA
Operating temperature range	-45 to 130	℃
Storage temperature range	-45 to 150	℃
ESD HBM (human body model)	8	kV
ESD CDM (charge device model)	850	V

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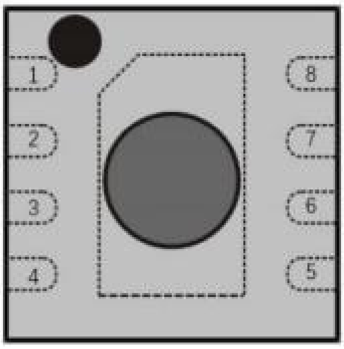
6 Pin Assignment

DFN-8 TOP VIEW



Note： Dashed lines are only visible viewed from below.

The middle pad is internally connected to V_{SS}.

Table 7. Pin Assignment

PIN	NAME	COMMENTS
1	SDA	Data pin; input/output.
2	ADDR	Address pin, input; connect to either logic high or low, do not leave floating.
3	AIFRT	Indicates alarm condition; will be set high if the set threshold is exceeded; output; must be left floating if unused
4	SCL	Serial clock; input/output
5	V_{DD}	Supply voltage; input
6	nRESET	Reset pin active low; input; if not used, it is recommended to be left floating.
7	R	No electrical function; to be connected to VSS.
8	Vss	Ground.

6.1 Power Pins（V_{DD}、V_{SS}）

The electrical specifications of the FHT31 are described in Table 3. A 100nF decoupling capacitor should be connected between the power supply pins and ground, and the capacitor should be as close as possible to the sensor chip. A schematic diagram of a typical application circuit is shown in Figure 6.

6.2 Serial Clock and Serial Data（SCL、SDA)

SCL is used to synchronize the communication between the microcontroller and the sensor. The clock frequency range is 0~1 MHz. Supports clock stretching commands conforming to I²C standard

The SDA pin is used to transfer I2C data. Communication with frequencies up to 400KHz must meet the I2C Fast Mode1 standard. Communication with frequencies up to 1MHz must meet the specification conditions in Table 21.

Both SCL and SDA are open-drain output pins with reverse-biased diodes connected to V_{DD} and GND. SCL and SDA must be pulled up to V_{DD} by an external resistor. Devices on the I²C bus can only pull the bus down to ground. The pull-up resistors are required to pull the signal high. The recommended pull-up resistor is 4.7K, and resistors with different resistance values need to be selected according to different communication rates. It should be noted that pull-up resistors may be included in some microcontrollers. The typical application circuit of the temperature and humidity sensor chip is shown in Figure 6.

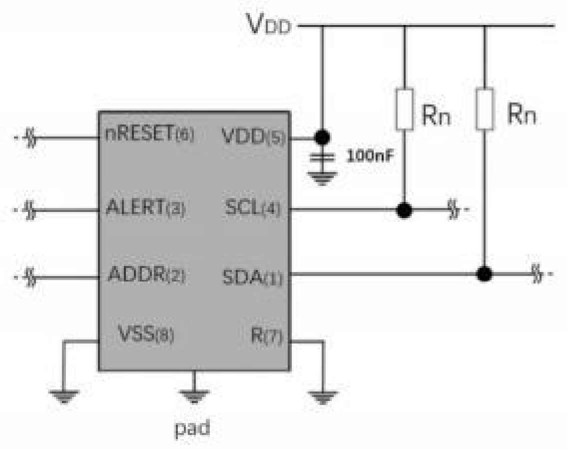


Figure 6. Typical Application Circuit.

It should be noted that the positioning of the pins does not reflect the position on the real sensor. This is shown in Table 7.

6.3 Die Pad

The center pad (die pad) is in the middle of the backside of the chip. It is connected to VSS inside the sensor chip so there is no need to consider the electrical connection of the center pad. However, based on mechanical stress considerations, the center pad should still be soldered on the PCB. See the FHT31 Design Guide for more design information.

6.4 ADDR Pin

The I²C address of the sensor can be changed by changing the connection method of ADDR. When ADDR is connected to a low level, the address of the sensor chip is 0x44, and when ADDR is connected to a high level, the address of the sensor chip is 0x45. It should be noted that the level of ADDR cannot be changed during the communication process. This address selection method can connect two FHT31s to the same I²C bus.

It should be noted that the I²C address is represented through the 7 MSBs of the I²C read or write header. The

LSB of the read-write command header is the read-write indicator bit, 0 for writing and 1 for reading. The pins of ADDR cannot be left floating. The specific address description is shown in Table 8.

Table 8 I2C Device Addresses

FHT31	I²C ADDRESS IN HEX	COMMENTS
I2C address A	0x44 (default)	ADDR pin connected to V_{SS}
I2C address B	0x45	ADDR pin connected to V_{DD}

6.5 Alert Pin

The Alert pin can be connected to the interrupt pin of the microcontroller. The output value of the Alert pin depends on the comparison result between the temperature and humidity value converted by the sensor and the set threshold. Its specific functions are described in the dedicated alarm documentation. This pin needs to be left floating when the alarm function is not used. When the output temperature and humidity value exceed the set threshold range, this pin outputs a high level. The maximum drive loads are shown in Table 3. It should be noted that this pin can only be connected to the gate of the transistor to switch the transistor.

6.6 nRESET pin

Areset signal can be given to the sensor through the nRESET pin. The reset signal is active low with a minimum pulse width of 1 μs. Its function will be explained in detail in the fourth section. If not used, it is recommended to leave this pin floating or use a resistor greater than 2 kΩ to pull this pin up to V_{DD}. In fact, this pin has been pulled up to V_{DD} by a 50kΩ resistor inside the chip.

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7 Functional Description

FHT31 supports I2Cfast mode（up to 1MHz）, Clock stretching can be turned on and off by specific commands. For more I²C protocol descriptions, please refer to NXP's I²C bus specification 2.

After each command is sent to the sensor, wait at least 1ms before sending the next command to the sensor.

All FHT31 commands and data are mapped into a 16-bit address space. In addition, all data and commands are protected with a CRC checksum, which is used to enhance the reliability of data transmission. The 16-bit command already contains the CRC check result in the lower three bits. The data sent and received by the sensor needs to be followed by an 8-bit CRC.

When the microcontroller writes data to the sensor, it must be accompanied by a CRC check byte, because FHT31 only receives data with correct CRC checksum. When reading the data of the sensor, the microcontroller is required to process the CRC check.

7.1 Power-Up and Communication

When the power supply voltage exceeds V_{POR}, the sensor starts powering-up. After reaching this threshold voltage the sensor needs the time t_{PU} to enter idle state. Once in the idle state, the chip is ready to receive commands and data from the microcontroller.

According to the I²C communication protocol, each communication of the sensor chip must start with a START signal and end with a STOP signal. When the sensor is powered up, but not receiving communication or temperature and humidity conversion commands, it automatically enters the idle state, which is convenient for reducing the power consumption. The idle state is determined internally by the chip and is not controlled by the user.

7.2 Starting a Measurement

To measure temperature and humidity, you need to send a start signal first, then send an I²C write header, and then follow a 16-bit temperature and humidity conversion command. After the sensor receives each byte of data sent by the microcontroller, it will give an ACK signal by pulling the SDA bus to a low level. The complete temperature and humidity measurement and data reading process are shown in Table 9.

With the acknowledgement of the measurement command, the FHT31 starts the conversion measurement of temperature and humidity.

7.3 Measurement Commands for Single Shot Data Acquisition Mode

After receiving these commands, the device will enter the single shot data acquisition mode. After completing temperature and humidity conversion, it will store the temperature and humidity data in the interface register and wait for the microcontroller to read the measurement data. Each data pair consists of one 16-bit temperature with 8-bit CRC, followed by one 16-bit humidity data with 8-bit CRC, see section 7.4 for details.

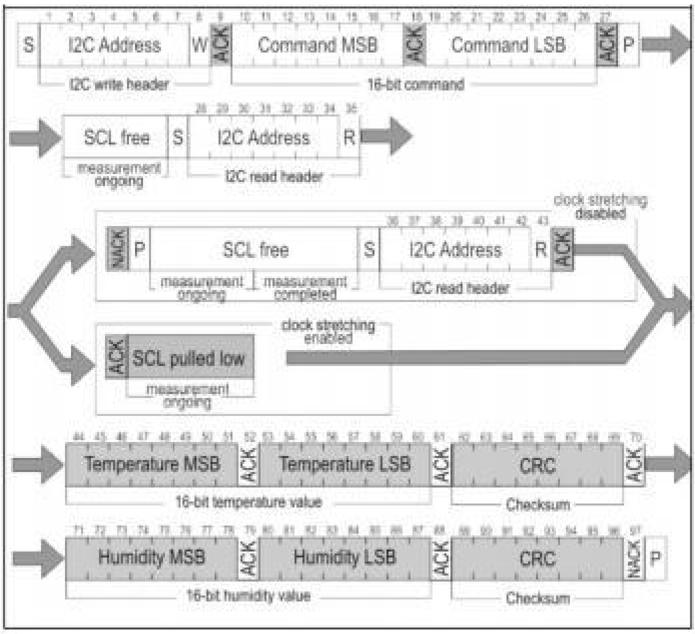
In single shot mode different 16-bit measurement commands can be selected, see Table 9 for details. The difference between them is the repeatability and clock stretching (enabled and disabled).

A higher repeatability corresponds to a longer conversion duration, a higher energy consumption, and a higher conversion accuracy.

Table 9. Measurement Command in Single Shot Mode

CONDITION		HEX	
Repeatability	**Clock stretching**	**MSB**	**LSB**
High	Enabled	0x2C	06
Medium			0D
Low			10
High	Disabled	0x24	00
Medium			0B
Low			16

E.g., 0x2C06: high repeatability, clock stretching enabled.



Note: The first SCL idle period means to wait at least 1ms.

(Clear blocks are controlled by the microcontroller, grey blocks by the sensor)

7.4 Readout of Measurement Results for Single Shot Mode

After the sensor completes the temperature and humidity measurement, the master can read the measurement result by sending the START condition followed by an I²C read header. If the temperature and humidity data is ready, the device will send an ACK condition to the master, and then send two bytes of temperature data followed by one byte CRC checksum and two bytes of humidity data followed by one byte CRC checksum.

The master must send ACK condition to each byte of data received, otherwise the device will stop sending data.

The microcontroller should send a NACK and a STOP condition to end this data transmission after receiving the CRC byte of the humidity data, as shown in Table 9.

The I²C master can abort the data transmission with a NACK condition at any time. For example, I²C does not care about the CRC result of the temperature data or does not care about the subsequent humidity data. It can terminate the data transmission after receiving the desired data for saving time.

No Clock Stretching

If the clock stretching function is disabled, after sending the temperature and humidity conversion command, if the temperature and humidity conversion has not been completed, the temperature and humidity data will be read, and the device will give NACK at this time. Only when the waiting time is long enough to ensure that the temperature and humidity conversion has been completed and then read the data will the device respond. The temperature and humidity conversion time are shown in Table 5.

Clock Stretching On

When clock stretching is on, regardless of whether the temperature and humidity measurement is completed, as long as the master sends the read data header, the device will give ACK and then pull SCL low. Once the measurement is completed, the SCL bus will be released immediately, and then the device will start sending the measured temperature and humidity data.

7.5 Measurement Commands for Periodic Data Acquisition Mode

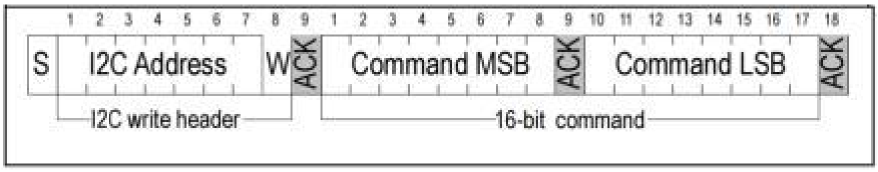
After receiving the command to convert the temperature and humidity periodically, the device will periodically convert the temperature and humidity. Different periodic conversion modes can be selected, as shown in Table 10. The main difference between these commands is the repeatability (high, medium, low) and data acquisition frequency (e.g., 0.5, 1, 2, 4 & 10 measurements per second, mps). Clock stretching cannot be selected in this mode.

The data acquisition frequency and the repeatability setting influence the measurement duration and the power consumption, see Section 5 for details

Table 10. Measurement Commands for Periodic Data Acquisition Mode

Condition		Hex code	
Repeatability	mps	MSB	LSB
High	0.5	0x20	32
Medium			24
Low			2F
High	1	0x21	30
Medium			26
Low			2D
High	2	0x22	36
Medium			20
Low			2B
High	4	0x23	34
Medium			22
Low			29
High	10	0x27	37
Medium			21
Low			2A

E.g., 0x2130: high repeatability mps -measurement per second.



Note: Clear blocks are controlled by the microcontroller, grey blocks by the sensor.

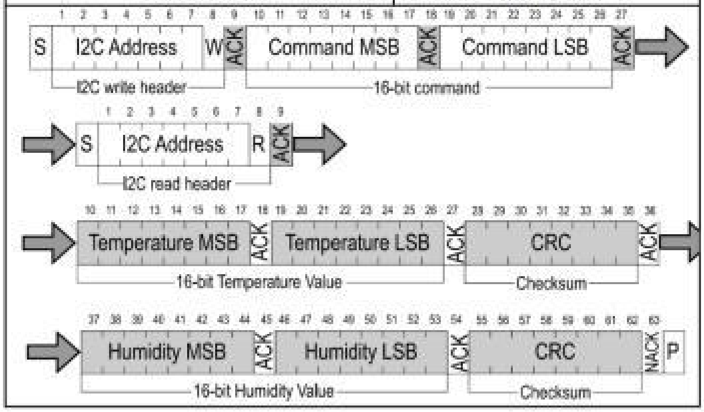
Self-heating of the sensor might occur at the highest mps setting.

7.6 Readout of Measurement Results for Periodic Mode

Transmission of the measurement data can be initiated through the fetch data command shown in Table 11. If no measurement data is present, the I²C read header is responded with a NACK (Bit 9 in Table 10) and the communication stops. If the master reads the temperature and humidity data, the buffer storing the temperature and humidity data will be cleared to zero until the temperature and humidity data obtained by the next measurement is loaded.

Table 11. Readout of Measurement Results for Periodic Mode

Command	Hex code
Fetch Data	0x E0 00



Note: Clear blocks are controlled by the microcontroller, grey blocks by the sensor.

7.7 Break / Stop Periodic Data Acquisition Mode

The periodic data acquisition mode can be stopped using the break command shown in Table 12. In addition to the command to read the periodic measurement temperature and humidity data, it is recommended to send the command to stop the periodic measurement mode before sending any other commands. After the device receives this command, it will exit the periodic measurement mode and enter the single shot mode after the current measurement is completed. This mode switching time takes 1ms.

Table 12. Break Periodic Data Acquisition Mode

Command	Hex Code
Break	0x3093

Note: Clear blocks are controlled by the microcontroller, grey blocks by the sensor.

7.8 Reset

The system reset of FHT31 can be realized by sending a reset command (soft reset) or sending a low-level signal to the nRESET port. In addition, a system reset is generated internally during power-up. It should be noted that the device will not process any commands from the microcontroller during the reset procedure.

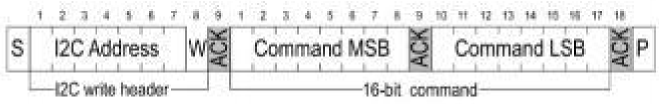
In order to achieve a full reset of the device without removing the power supply, it is recommended to use the nRESET reset pin of the FHT31.

Soft Reset

The FHT31 provides a soft reset mechanism to reset the system to a predefined state without removing the power supply. When the device is in an idle state, a soft reset command can be sent.0 After the device receives the soft reset command, it will reset the internal control module and reload the data in the non-volatile memory. The commands for soft reset are shown in Table 13.

Table 13. Soft Reset Command

Command	Hex Code
Soft Reset	0x30A2



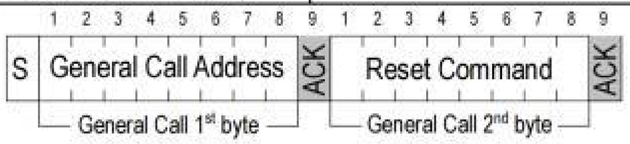
Note: Clear blocks are controlled by microcontroller, grey blocks by the sensor.

Reset through General Call

In addition, the device can be reset through the “general call” according to I²C-bus specification. This generates a reset which is functionally identical to using the nRESET pin. It should be noted that a reset generated in this way is not device specific. See Table 14 for General Call commands.

Table 14. General Call Reset

Command	Code
Address byte	0x00
Second byte	0x06
Reset command using the general call address	0x0006



Note: Clear blocks are controlled by microcontroller, grey blocks by the sensor.

Reset through the nReset Pin

Pulling thenReset pin low generates a similar reset to a power-on reset (see Table 7). The nReset pin is internally connected to VDD through a pull-up resistor, so it is active low. The nReset pin has to be pulled low for at least 1 μs.

Hard reset

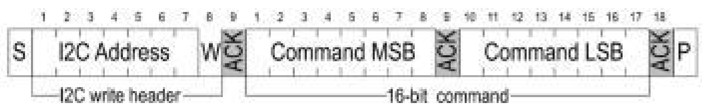
A hard reset is achieved by powering down the chip and then powering it back on. In order to prevent powering the sensor over the ESD diodes, the voltages on SDA and SCL should also be removed.

7.9 Heater

The FHT31 is equipped with a heater inside. When the heater is turned on, the temperature of the device will increase, but the temperature range is fixed. This heater can be switched on and off with the corresponding commands (as shown in Table 15). The on/off status of the heater is also reflected in the internal status register.

Table 15. Heater Command

Command	Hex Code	
	MSB	LSB
Heater Enable	0x30	6D
Heater Disabled		66



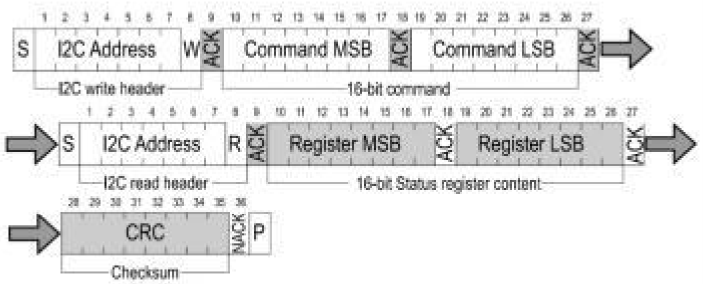
Note: Clear blocks are controlled by microcontroller, grey blocks by the sensor.

7.10 Status Register

The status register contains heater status, alarm information, reset information, CRC check information, and command execution status. The command to read out the status register is shown in Table 16 whereas a description of the content can be seen in Table 17.

Table 16. Command to Read the Status Register

Command	Hex code
Read Out of status register	0xF32D



Note: Clear blocks are controlled by microcontroller, grey blocks by the sensor.

Table 17. Description of the Status Register

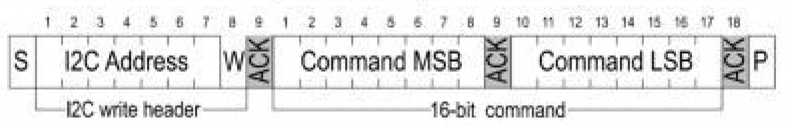
Bit	FIELD DESCRIPTION	DEFAULT
15	Alert status: '0': no pending alerts; '1': at least one pending alert	‘0’
14	Reserved	‘0’
13	Heater status: '0': heater off; '1': heater on	‘0’
12	Reserved	‘0’
11	Humidity tracking alert: ‘0’: no alert; ‘1’: alert	‘0
10	Temperature tracking alert: ‘0’: no alert; ‘1’: alert	‘0’
9:5	Reserved	‘xxxxx’
4	System reset detected '0': no reset detected since last ‘clear status register’ command '1': reset detected (soft reset, hard reset, nReset reset)	‘1’
3:2	Reserved	‘00’
1	Command execution status '0': last command executed successfully '1': last command not processed (An incorrect command was sent)	‘0’
0	Write data CRC checksum status '0': checksum of last write transfer was correct '1': checksum of last write transfer failed	‘0’

Clear status register

All flag bits (Bit 15, 11, 10, 4) of the internal register can be cleared by sending commands shown in Table 18.

Table 18. Command to Clear the Status Register

Command	Hex Code
Clear status register	0x 30 41



Note: Clear blocks are controlled by microcontroller, grey blocks by the sensor.

7.11 CRC Checksum

The CRC check algorithm for data transmission is shown in Table 20. The CRC check object is the 2 bytes of data transmitted before it.

Table 19 I2C CRC8 Properties

Property	Value
Name	CRC-8
Width	8 bit
Protected data	Read and/or write data
Polynomial	0x31 ($x^8 + x^5 + x^4 + 1$)
Initialization	0xFF
Reflect input	False
Reflect output	False
Final XOR	0x00
Examples	CRC (0xBEEF) = 0x92

7.12 Conversion of Signal Output

The output temperature and humidity data are 16-bit unsigned data. These data have been linearized and compensated for temperature. Converting these raw values into real temperature and humidity data can be achieved using the following formulas:

Relative humidity conversion formula (result in %RH):

$$RH = 100 \cdot \frac{S_{RH}}{2^{16}-1}$$

Temperature conversion formula (result in °C & °F):

$$T[°C] = -45 + 175 \cdot \frac{S_T}{2^{16}-1}$$

$$T[°F] = -49 + 315 \cdot \frac{S_T}{2^{16}-1}$$

S_{RH} and S_T represent the raw sensor output for humidity and temperature, respectively. Note that S_{RH} and S_T must be converted to decimal representation in formula calculations.

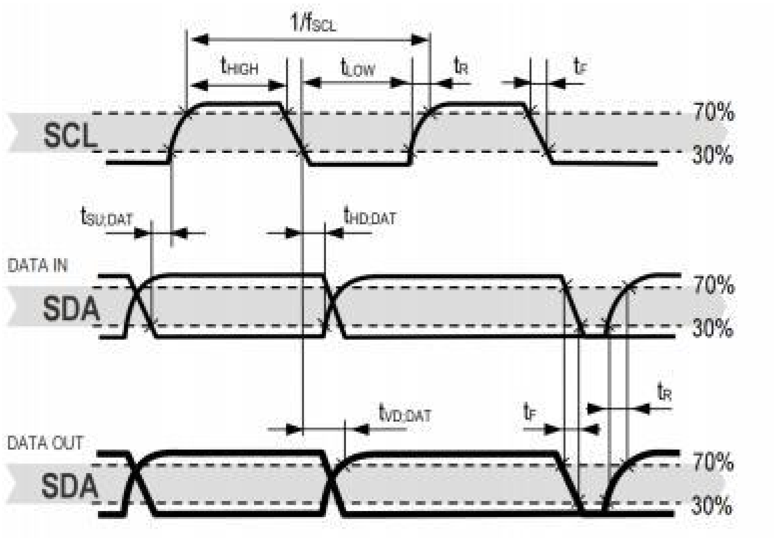
7.13 Communication Timing

Table 20. Communication Timing Specifications for I²C

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNITS	COMMENTS
SCL clock frequency	f_{SCL}		0	-	1000	kHz	
Hold time START condition	$t_{HD;STA}$	After the retention time, the first SCL clock starts to generate	0.24	-	-	μs	
LOW period of the SCL clock	t_{LOW}		0.53	-	-	μs	
HIGH period of the SCL clock	t_{HIGH}		0.26	-	-	μs	
SDA hold time	$t_{HD;DAT}$		0	-	250	ns	send data
			0	-	-	ns	receive data
SDA set-up time	$t_{SU;DAT}$		100	-	-	ns	
SCL/SDA rise time	t_R		-	-	300	ns	
SCL/SDA fall time	t_F		-	-	300	ns	
SDA valid time	$t_{VD;DAT}$		-	-	0.9	μs	
Set-up time for START condition	$t_{SU;STA}$		0.26	-	-	μs	
Set-up time for STOP condition	$t_{SU;STO}$		0.26	-	-	μs	
Capacitive load on the bus	C_B		-	-	400	pF	
Low level input voltage	V_{IL}		0	-	$0.3xV_{DD}$	V	
High level input voltage	V_{IH}		$0.7xV_{DD}$	-	$1xV_{DD}$	V	
Low level output voltage	V_{OL}	3 mA current sink	-	-	0.4	V	

Note： Temperature range T=-40℃~125℃, Voltage range V_{DD} = V_{DDmin}~V_{DDmax}.。

Table 21. Timing Diagram for Digital Input/Output Pads



Note：Bold SDA lines are controlled by the sensor, plain SDA lines are controlled by the micro-controller.

8 Package Information

The FHT31 are provided in an open-cavity DFN package. The opening for the humidity sensor is centered on top side of the DFN package.

The temperature and humidity sensor are integrated on a single CMOS die and then mounted to a lead frame. The lead frame is made of Cu plated with Ni/Pd/Au. The die and lead frame are over-molded by an epoxy-based mold compound, exposing the central die pad and I/O pins. It should be noted that the chips are packaged in batches and then cut into individual chips, so there are still gold cutting residues on the sides of the chips.

The chip is packaged in accordance with the Small-Scale Plastic Quad and Dual Inline, Square and Rectangular, No-LEAD packages as described in 4.20 of JEDEC 95 and also in Small Scale (QFN/SON) Specification D.01, 2009.

The FHT31 is compliant with IPC/JEDEC J-STD-020 Moisture sensitivity Level of 1.

8.1 Traceability

All FHT31 sensors are laser marked for easy product identification and traceability. The top mark represents the chip model number. The bottom mark contains 5 characters, the first four YYWW represent the production date, YY represent year, WW present month. The latter D represents product ID code. There is an ID code inside the chip, which enables tracing on batch level through production, calibration and testing. If there is a reasonable request, you can apply to NYFEA for the decoding of batch marks for product traceability.

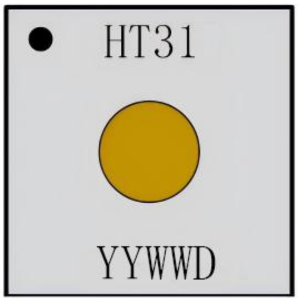


Figure 7. Top view of the FHT31 illustrating the laser marking

8.2 Package Outline

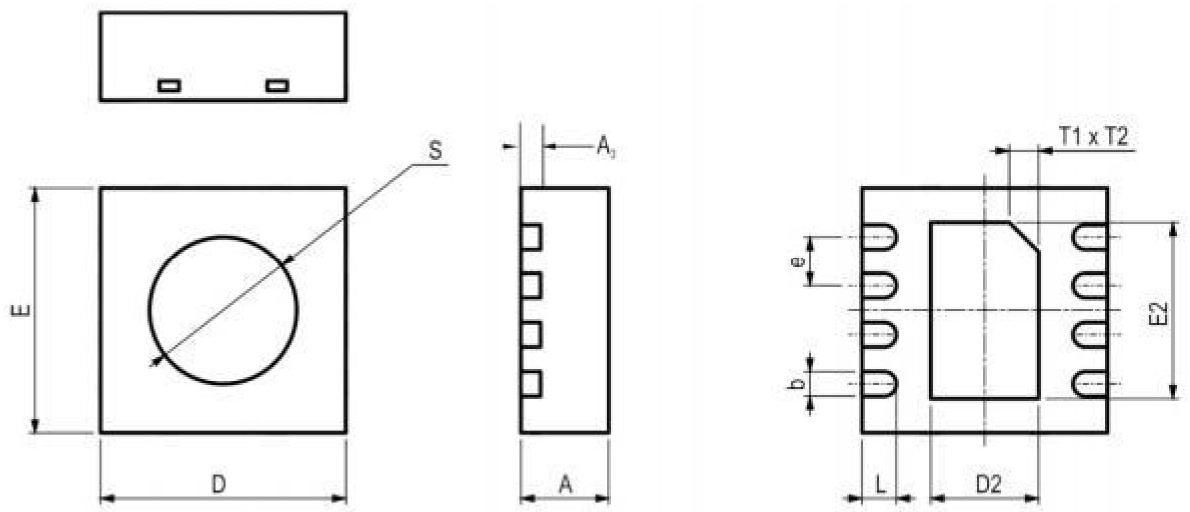


Figure 8. Dimensional drawing of FHT31 sensor package.

Table 22. Package Outline

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS	COMMENTS
Package height	A	1.14	1.2	1.26	mm	Applies to FHT31
Lead frame height	A3	-	0.2	-	mm	
Pad width	b	0.2	0.25	0.3	mm	
Package width	D	2.4	2.5	2.6	mm	
Center pad length	D2	1	1.1	1.2	mm	
Package length	E	2.4	2.5	2.6	mm	
Center pad width	E2	1.7	1.8	1.9	mm	
Pad pitch	e	-	0.5		mm	
Pad length	L	0.25	0.35	0.45	mm	
Max cavity	S		1	1.5	mm	
Center pad marking	T1xT2	-	0.3x0.45	-	mm	Indicates the position of pin 1

8.3 Land Pattern

Figure 8 shows the land pattern of the sensor chip. The land pattern is understood to be the open metal areas on the PCB, onto which DFN pads are soldered.

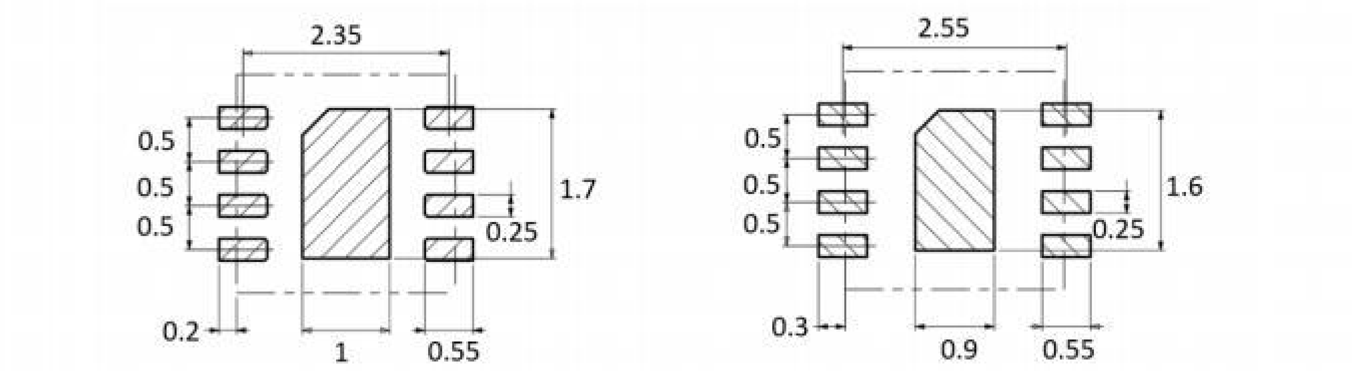


Figure 9. Recommended metal land pattern and stencil apertures for the FHT31.

(The dashed lines represent the outer dimension of the DFN package)

9 Package Size

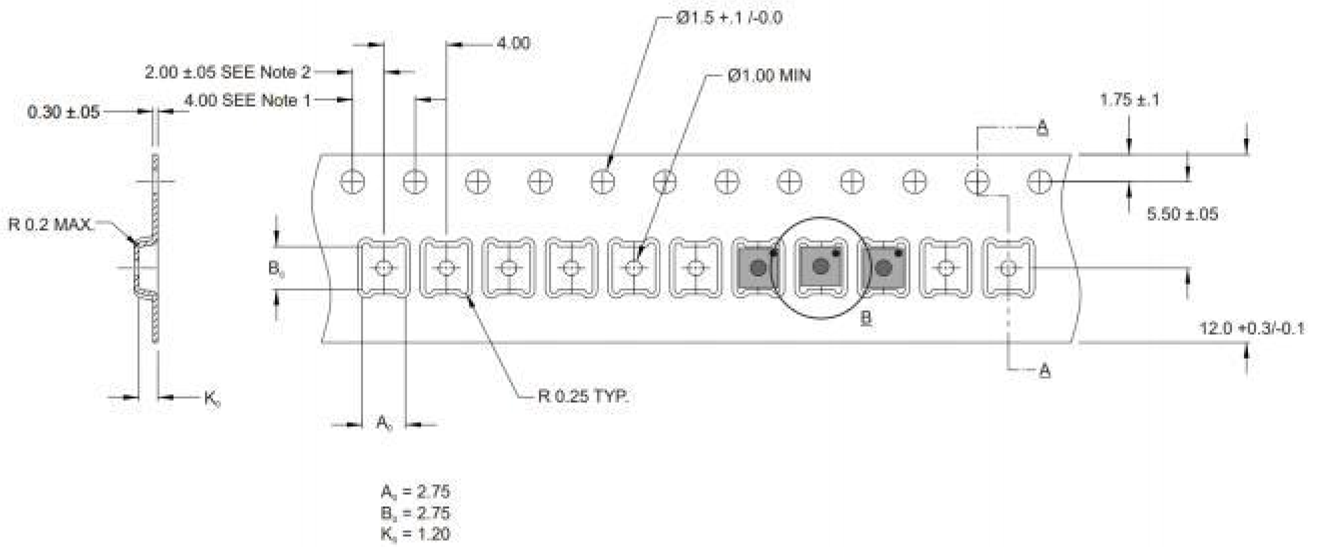


Figure 10. Dimensions of tape for chip transport.

10 Quality Description

The quality inspection of FHT31 complies with the JEDEC JESD47 quality inspection standard. The product is fully RoHS compliant and does not contain harmful metals such as Pb, Cd and Hg.

NYFEA

11 Chip description and ordering information

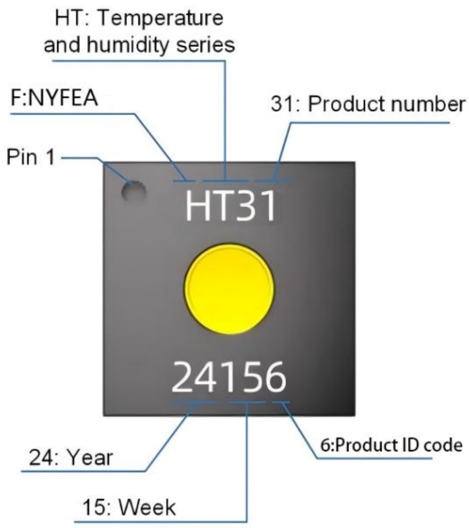
Order number description:

FHT31-TR：FHT31 represents the product.number, TR represents packaged form is tape and reel.

Model Coding：

（1）FHT31：F represents the trademark of the company NYFEA；HT represents temperature and humidity series products; 31: represents the chip number

FHT31 LOGO description：



Ordering Information：

Purchase Number	Device	Package	SPQ	Note
FHT31-TR	FHT31	DFN8 2.5mm*2.5mm	2000	Tape and reel, covered with a dustproof breathable film

12 Important Notices

（1） ESD Precautions

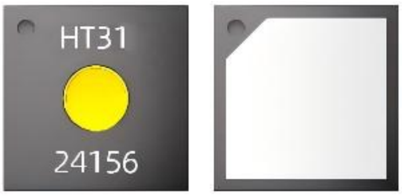
The inherent design of this part makes it very sensitive to electrostatic discharge (ESD). To prevent damage or degradation caused by electrostatic discharge, operate the sensor in an Electrostatic Protected Area (EPA) and take proper measures (operator should be grounded by wrist strap, and all non-insulated or conductive objects should be grounded).

（2） Exposure to Chemicals

The temperature and humidity sensors of NYFEA are high-sensitivity environmental sensor, not ordinary electronic components. The sensors should not be in close contact with volatile chemicals, such as chemical solvents or organic compounds, especially high concentrations and prolonged exposure are more dangerous. (Ethyl)ketene, acetone, isopropanol, ethanol, toluene, etc., have been shown to cause a shift in humidity readings that is irreversible in most cases.

（3） Dustproof Breathable Film

The temperature and humidity sensors are different from the general sensor chips. The sensors are very sensitive, so their opening part are easily polluted by dust and impurities. For customers in outdoor applications, it is recommended to order our products with a dust-proof and breathable film, which can prevent dust. It can protect the sensor, resist pollution, improve the life and reliability of the sensor, and must not be torn off.



（4） Applications in Extreme Environments

Some applications require the temperature and humidity sensor to be exposed to harsh environments. In many cases, the suitability of the sensor is not considered. There are some situations that require special attention.

a) The sensor needs to return to the normal environment to recover for a period of time after working under abnormal temperature and humidity conditions (> 90).

b) In some application environments, the sensor may be exposed to a high concentration of volatile organic solvents for a long time, which may occur in both the assembly process and the application process. Such applications require attention.

c) In some application environments, the sensor may be exposed to an acidic or alkaline environment, but only a certain concentration will cause harm to the sensor. For bases, pH > 9 will cause damage to the sensor. Etching materials, such as H_2O_2, NH_3, etc., can also harm the sensor in high concentrations.

d) There may be corrosive gases in some application environments. If the concentration is relatively low, it will not affect the sensor, but it will affect the connection of the solder joints. Higher concentrations can also cause damage to the sensor.

（5）Spraying of Conformal Coating

The paint itself is contaminating to the temperature and humidity sensor. For customers who must spray the paint on the board, they need to order our products with a conformal coating film, after spraying the conformal coating, tear off the conformal coating film before normal testing of temperature and humidity. When spraying the conformal coating, keep at least thirty centimeters away from the sensor and move the can slowly to ensure an even coating, the surface will dry in about thirty minutes and the second spraying can be carried out. Allow the paint to dry fully, approximately 24 hours, then gently remove the film.

（6）Packaging and Storage

Before use, it is strongly recommended to store the sensor in its original packaging in the following environment: temperature 10 °C ~ 50 °C (0 °C - 125 °C for a limited time), 20% ~ 65% RH.

（7）Assemblage

The sensor can be stored for 1 year in normal storage environment, and the sensor has a moisture resistance level of 1.