

承 认 书

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[illegible]

SENSYLINK Microelectronics

(CHT8305C)

Digital Humidity & Temperature Sensor

CHT8305C is a Digital Humidity and Temperature Sensor with $\pm 3.0\%RH$ Accuracy for humidity and $\pm 0.5^{\circ}C$ Accuracy for temperature. It is compatible with I²C and 2-wire Interface. It is ideally used in HVAC, environment monitor etc.

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Description

CHT8305C is a digital humidity and temperature sensor with $\pm 3.0\%RH$ (Max.) accuracy for humidity and $\pm 0.5^{\circ}C$ (Max.) accuracy for temperature. Humidity and Temperature data can be read out directly via I²C digital interface by MCU, Bluetooth Chip or SoC chip.

CHT8305C supports I²C communication with speed up to 400kHz.

Each chip is specially calibrated for temperature and humidity accuracy in factory before shipment to customers. There is no need for re-calibration anymore.

It includes a high precision band-gap circuit, a 14-bit analog to digital converter, a calibration unit with non-volatile memory, and a digital interface block.

It has ALERT logic output pin with open drain structure, which is active low.

The chip supports up to 4 devices in one I²C bus by setting different slave address via AD0 pin.

Available Package: DFN3x3-6 package

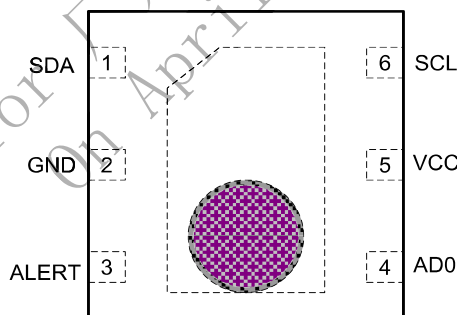
Features

- Operation Voltage: 2.5V to 5.5V
- Average Operating Current: 1.5uA (Typ.), 3.0uA(Max.)
- Standby Current: 0.05uA(Typ.), 0.3uA (Max.)
- Temperature Accuracy without calibration: Maximum: $\pm 0.5^{\circ}C$ from $0^{\circ}C$ to $50^{\circ}C$
- Humidity Accuracy without calibration: Maximum: $\pm 3.0\%RH$ at 50%RH
- 14 bit ADC for Temperature and Humidity
- Compatible with 2-wire and I²C interface
- Programmable Alert response of Over Temperature and/or Humidity
- Generate 4 different slave address by setting AD0 pin
- Temperature Range: $-40^{\circ}C$ to $125^{\circ}C$
- Humidity Range: 0%RH to 100%RH
- Protection Cover is available

Applications

- Smart HVAC System
- Environment Monitor
- Portable/Wearable Weather Monitor

PIN Configurations (Top View)



DFN3x3-6(Package Code DN)

Typical Application

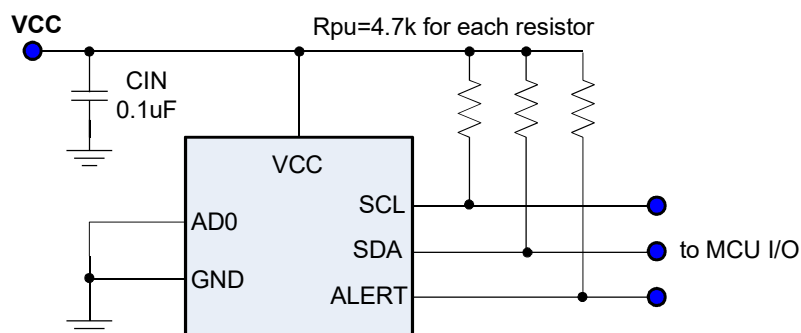


Figure 1. Typical Application of CHT8305C

Pin Description

PIN No.	PIN Name	Description
1	SDA	Digital interface data input or output pin, need a pull-up resistor to VCC.
2	GND	Ground pin.
3	ALERT	To Indicate alert status of over Humidity and/or Temperature limitation programmed by setting H _{LIMIT} /T _{LIMIT} register. Need a pull-up resistor to VCC in application. active low with open drain output.
4	AD0	Slave Address selection pins, the chip can be defined total 4 different slave addresses by connecting this pin to GND, VCC, SCL or SDA pin respectively. If leave this pin open, address is 0x80. See Slave Address for detail.
5	VCC	Power supply input pin, using 0.1uF low ESR ceramic capacitor to ground
6	SCL	Digital interface clock input pin, need a pull-up resistor to VCC.

Function Block

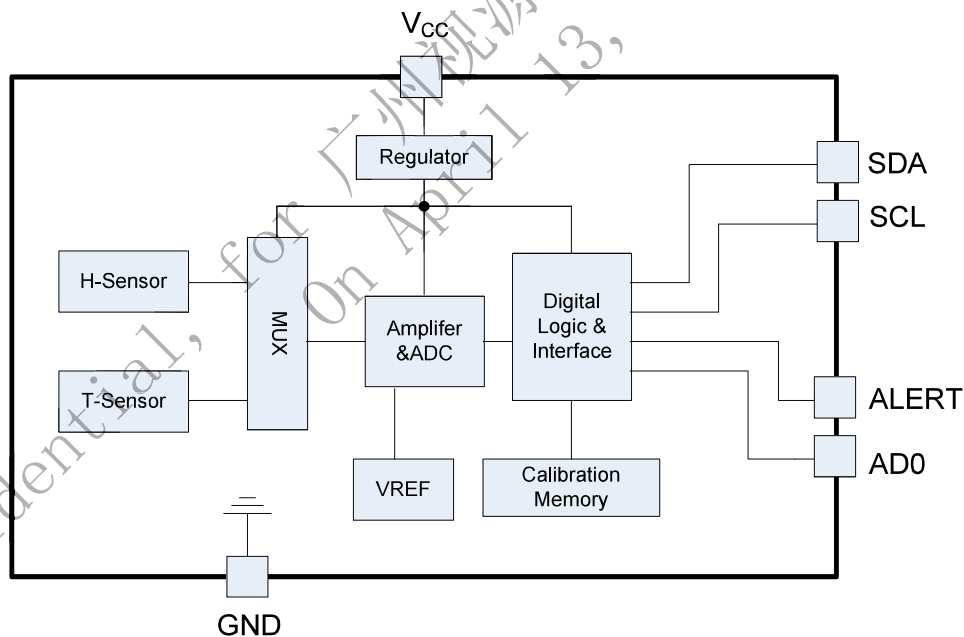


Figure 2. CHT8305C function block

Ordering Information
CHT8305C X X - X
Package Type

DN : DFN3x3-6

Packing

R: Tape & Reel

Protection

C : with Cover

Blank : without Cover

Order PN	Accuracy	Green ¹	Package	Marking ID ²	Packing	MPQ	Operation Temperature	Protection Cover
CHT8305CDNR	±0.5℃ ±3%RH	Halogen free	DFN3x3-6	8305 YWWAXX	Tape & Reel	3,000	-40℃~+125℃	No
CHT8305CDNR-C	±0.5℃ ±3%RH	Halogen free	DFN3x3-6	8305 YWWAXX	Tape & Reel	3,000	-40℃~+125℃	Yes

Notes

1. Based on ROHS Y2012 spec, Halogen free covers lead free. 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 1st row of characters are part number, and the 2nd row of characters are date code plus production information.

- Generally, date code is represented by 3 numbers. The number stands for year and work week information. e.g. 501 stands for the first work week of year 2015; 621 stands for the 21st work week of year 2016.
- Right after the date code information, the next 2-3 numbers or letters are specified to stand for supplier or production location information.
- For very small outline package, there's 4 digits to stand for product information and date code, first 2 digits represent product code, and the other 2 digits stand for work week.

Absolute Maximum Ratings (Note3)

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC} to GND	-0.3 to 5.5	V
SDA, SCL, AD0 Voltage	$V_{SDA}/V_{SCL}/V_{AD0}$ to GND	-0.3 to 5.5	V
ALERT Voltage	V_{ALERT} to GND	-0.3 to 5.5	V
Operation junction temperature	T_J	-50 to 150	°C
Storage temperature Range	T_{STG}	-65 to 150	°C
Lead Temperature (Soldering, 10 Seconds)	T_{LEAD}	260	°C
ESD MM	ESD_{MM}	400	V
ESD HBM	ESD_{HBM}	4000	V
ESD CDM	ESD_{CDM}	1000	V

Note3

- Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at the "Absolute Maximum Ratings" conditions or any other conditions beyond those indicated under "Recommended Operating Conditions" is not recommended. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.
- Using 2oz dual layer (Top, Bottom) FR4 PCB with 2.5x1.4 mm² cooper as thermal PAD

Recommended Operating Conditions

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	2.5 ~ 5.5	V
Ambient Operation Temperature Range	T_{AT}	-40~+125	°C
Ambient Operation Temperature Range for Humidity	T_{ATH}	0~ +85	°C
Ambient Operation Humidity Range	T_{AH}	0~100	%RH

Electrical Characteristics (Note4)

Test Conditions: $C_{IN} = 0.1\mu F$, $V_{CC} = 3.3V$, $T_A = 25^\circ C$ unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{CC}		2.5		5.5	V
Shutdown Current	$I_{SHUTDOWN}$	Idle, no iteration on SDA/SCL		0.05	0.3	μA
Open Drain Output Voltage	V_{OL}	ALERT pin, sink 5mA	0		0.4	V
Open Drain Leakage	I_{ODL}	ALERT pin	-1.0		1.0	μA
Heater Current	I_{HEATER}	Peak Current during Heater Enable		7.0		mA
Temperature Sensor						
Temperature Accuracy	T_{AC}	$T_A = 0$ to $50^\circ C$	-0.5	± 0.3	0.5	$^\circ C$
		$T_A = -20$ to $85^\circ C$	-1.0	± 0.5	1.0	$^\circ C$
		$T_A = -40$ to $125^\circ C$	-2.0	± 1.0	2.0	$^\circ C$
Temperature Resolution		14-bit		0.02		$^\circ C$
Conversion time	t_{CON}	14-bit for Temperature		5.0		ms
Conversion Current	I_{CON}	14-bit		150		μA
Humidity Sensor						
Humidity Accuracy	H_{AC}	$H_A = 50\%RH$		± 2	± 3	%RH
		$H_A = 20\%RH$ to $80\%RH$		± 3	± 5	%RH
		$H_A = 5\%RH$ to $95\%RH$		± 5		%RH
Humidity Resolution		14-bit		0.02		%RH
Humidity Hysteresis	H_{HYS}			± 1.0		%RH
Humidity Response time	$t_{63\%}$			8		s
Conversion time	t_{CON}	14-bit for Temperature		5.0		ms
Conversion Current	I_{CON}	14-bit		175		μA
Digital Interface						
Logic Input Capacitance	C_{IL}	SDA, SCL pin		3.0		pF
Logic Input High Voltage	V_{IH}	SDA, SCL pin	$0.7 \cdot V_{CC}$		$V_{CC} + 0.3$	V
Logic Input Low Voltage	V_{IL}	SDA, SCL pin	-0.3		$0.3 \cdot V_{CC}$	V
Logic Input Current	I_{INL}	SDA, SCL pin	-1.0		1.0	μA
Logic Output Sink Current	I_{OLS}	SDA, SCL pin, forced 0.2V		4.0		mA
SCL frequency	f_{CLK}	Fast Speed Mode	1		400	kHz
Clock low period time	t_{LOW}	Fast Speed Mode	1300			ns
Clock high period time	t_{HIGH}	Fast Speed Mode	600			ns
Bus free time	t_{BUF}	Between Stop and Start condition	1200			ns
Hold time after Start condition	$t_{HD:STA}$		600			ns
Repeated Start condition setup time	$t_{SU:STA}$		600			ns
Stop condition setup time	$t_{SU:STO}$		600			ns
Data Hold time	$t_{HD:DAT}$		100			ns
Data Setup time	$t_{SU:DAT}$		100			ns
Clock/Data fall time	t_F				300	ns
Clock/Data rise time	t_{SR}				1000	ns

Note 4:

- All devices are 100% production tested at $T_A = +25^\circ C$; All specifications over the automotive temperature range is guaranteed by design, not production tested.
- Time for the RH output to change by 63% of the total RH change after a step change in environmental humidity.
- For humidity accuracy, it excludes hysteresis, high temperature baker, hydration drift, long-term drift.

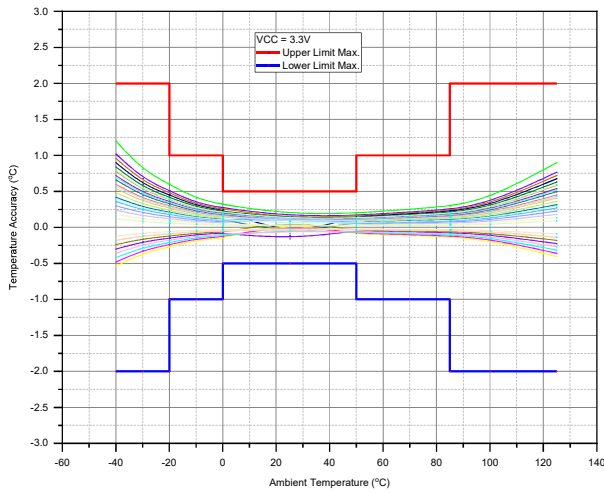


Figure 3. Temperature Accuracy

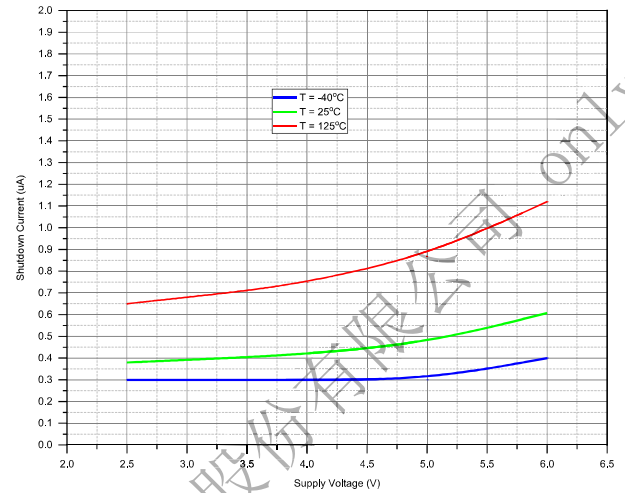


Figure 5. Shutdown Current

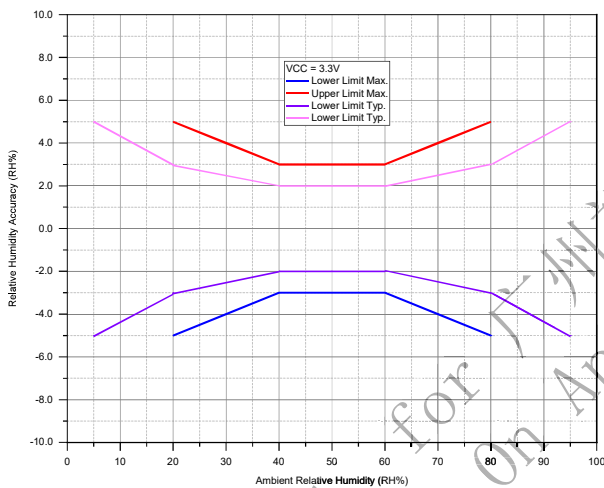


Figure 4. Relative Humidity Accuracy

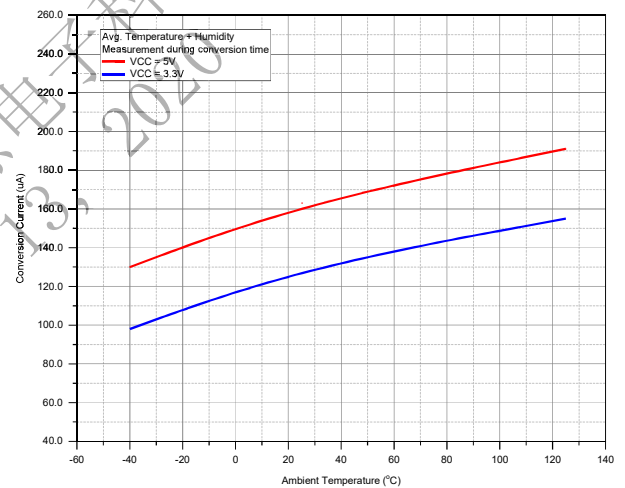


Figure 6. Conversion Current

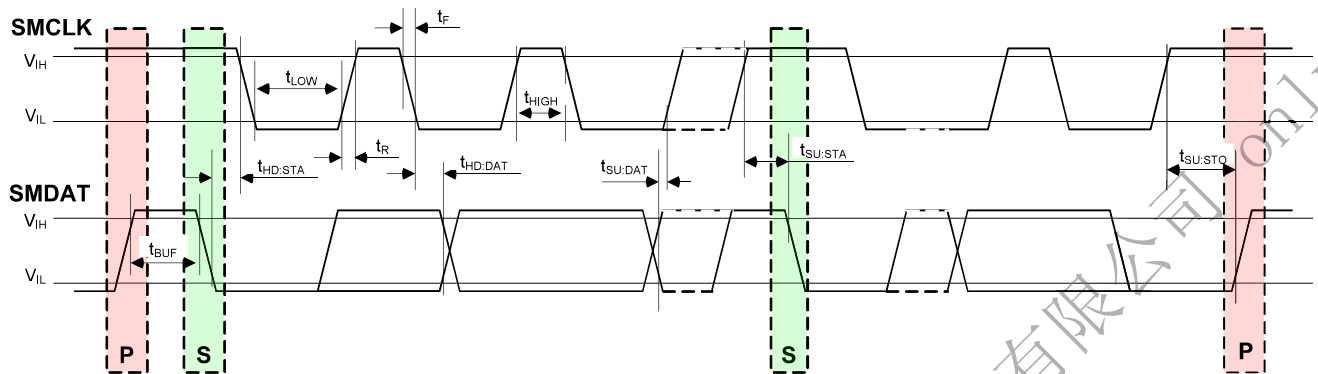


Figure 7. I²C Timing Diagram

1 Function Descriptions

The chip can sense both temperature and humidity that integrates temperature and humidity sensor transducers, an analog-to-digital converter, signal processing, calibration, polynomial fit correction, and an I²C interface in a single chip. The chip is individually calibrated for both temperature and humidity before shipment using on-chip non-volatile memory. It is permitted to connect 4 devices at the same I²C bus by setting AD0 PIN. The SDA and SCL pins integrate spike-suppression filters and Schmitt triggers to minimize the effects of input spikes and bus noise. After power-up, the sensor enters standby mode until a communication or humidity and/or temperature measurement is performed. All output data bytes are transmitted MSB first. Also the chip supports programmable high-limit of temperature and humidity settings. If the measured temperature and/or humidity exceeds the high-limit threshold (T_{TH}, H_{TH}), ALERT pin will be asserted low. Once the measured temperature goes below the high-limit threshold, ALERT pin will be released.

1.1 Register Map

The sensor has 6 registers that user can access. The detail information is shown as below.

Table 1. Register Maps Definition

Register Address	Name	Default	Attribution*	Description
0x00	Temperature	0x0000	R/O	Temperature measurement data.
0x01	Humidity	0x0000	R/O	Relative humidity measurement data.
0x02	Config	0x1000	R/W	Sensor for configuration and status.
0x03	Alert Setup	0xCD36	R/W	High-limit setup for Temperature and Humidity
0xFE	Manufacture ID	0x5959	R/O	Manufacture ID
0xFF	Version ID	0x8305	R/O	Sensor Version ID

*Note: R/O, means ready only; R/W means readable/writable.

1.1.1 Temperature Measurement Data [Add:0x00]

The temperature measurement data is stored in Read Only temperature register. The temperature register is in 16-bit binary format with 2-Bytes. Actually only 14 bits (bit15 to bit2) are valid, bit1 and bit 0 are always '0'. This 2-Bytes Temperature data must be read at the same time in each reading cycle, 1st-Byte is MSB followed by 2nd-Byte, the LSB. The relationship between temperature data in Celsius degree and binary data is shown as below formula (1).

Table 2. 16-bit Temperature Data

Bit	Attribution	Temperature Data
Bit15 to bit2	Read only	Valid data, 0 or 1
Bit1 to bit0	Read only	Always 0

$$\text{Temperature}(^{\circ}\text{C}) = 165 * \frac{\text{Temperature}[\text{bit15:0}]}{2^{16}-1} - 40 \dots (1)$$

1.1.2 Relative Humidity Measurement Data [Add:0x01]

The relative humidity measurement data is stored in Read Only humidity register. The humidity register is in 16-bit binary format with 2-Bytes. Actually only 14 bits (bit15 to bit2) are valid, bit1 and bit 0 are always '0'. This 2-Bytes data must be read at the same time in each reading cycle, 1st-Byte is MSB followed by 2nd-Byte, the LSB. The relationship between humidity data in %RH and binary data is shown as below formula.

Table 3. 16-bit humidity Data

Humidity Data	Attribution	Humidity Data
Bit15 to bit2	Read only	Valid data, 0 or 1
Bit1 to bit0	Read only	Always 0

$$\text{Relative Humidity}(\%RH) = 100\% * \frac{\text{Humidity}[\text{bit15:0}]}{2^{16}-1} \dots (2)$$

1.1.3 Config Register [Add: 0x02]

The chip has a 16-bit (2-Bytes) configuration register, which is readable/writable attribution for user. User can change related bit to setup features, like Alert trigger, clock stretching, heater ON/OFF etc. Also user can read out register data to check the chip working status. And the register will reset to default data after power-up. 16 bits definition is shown as below table.

Table 4. Status Register Definition

BIT	15	14	13	12	11	10	9	8
definition	SRST	CLKSTR	Heater	MODE	VCCS	T_RES	H_RES	
default	0	0	0	1	0	0	00	
BIT	7	6	5	4	3	2	1	0
definition	ALTM		APS	HALT	TALT	Reserved	Reserved	
default	00		0	0	0	0	00	

bit2 is reserved for internal test with R/W attribution, DO NOT write '1'b into this bit during application.

SRST, Software Reset bit

'1' -- means soft reset.

'0' -- means normal operation.

default: 0

Heater

'1' -- means Heater ON.

'0' -- means Heater OFF.

default: 0

VCCS, Supply Voltage Status bit

'1' -- means >2.8V.

'0' -- means <2.8V.

default: 0

H_RES, Humidity resolution bit

'10' -- means 8-bit.

'01' -- means 11-bit.

'00' -- means 14-bit.

default: 00

CLKSTR, clock stretching

'1' -- means clock stretching enable.

'0' -- means clock stretching disable.

default: 0

MODE, measurement mode selection

'1' -- means both T and RH are measured in sequence, T in first.

'0' -- means only T or RH or voltage is measured

default: 1

T_RES, Temperature resolution bit

'1' -- means 11-bit.

'0' -- means 14-bit.

default: 0

ALTM, Alert trigger mode selection bit

'00' -- either T or RH happens, ALT pin is active.

'01' -- only T happens, ALT pin is active.

'10' -- only RH happens, ALT pin is active.

'11' -- Both T&RH happen, ALT pin is active.

default: 00

APS, Alert Pending Status bit

'1' -- means at least one pending alert.
 '0' -- means no pending alert.
 default: 0

HALT, Humidity Alert Status bit

'1' -- means alter.
 '0' -- means no alter.
 default: 0

TALT, Temperature Alert Status bit

'1' -- means alter.
 '0' -- means no alter.
 default: 0

1.1.4 Alert High Limit Setup [Add: 0x03]

The chip features high-limit of temperature and humidity at ALERT pin. When temperature and/or humidity of measured achieves or exceeds threshold temperature and humidity setup by user, ALERT pin will be active. Once both temperature and humidity measured falls below threshold value, ALERT pin will be released from active status. ALERT pin is open drain output with active low. It is necessary to use external pull-up resistor of 4.7k to 10k in application. The default status of ALERT pin is NOT active after power on or soft reset the chip. ALERT pin trigger happens after each measurement cycle. In each measurement cycle, the chip will compare data of temperature and humidity register to that of threshold register. Compare result will be performed at both ALERT pin and related bit of configuration register (bit4, bit3).

For threshold temperature and humidity data, the format is shown as below.

Table 5. Threshold Bit definition

BIT	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Default:0xCD36 RH=80%,T=60°C	1	1	0	0	1	1	0	1	0	0	1	1	0	1	1	0
	Humidity							Temperature								

The 1st 7bits are used for humidity threshold and the last 9bits are used for temperature threshold data.

The relationship between binary data and threshold data is shown as below sample.

Step 1, using zero '0' as LSB to complete 16 bits format data.

for Humidity, **1100 1100 0000 0000**

for Temperature, **1001101100000000**

Step 2, using above formula to calculate temperature and humidity respectively.

$$\text{Relative Humidity}(\%RH) = 100\% * \frac{\text{humidity}[\text{bit15:0}]}{2^{16} - 1} = 100\% * \frac{52224}{65535} = 79.7\%RH \approx 80\%RH$$

$$\text{Temperature}(^{\circ}C) = 165 * \frac{\text{Temperature}[\text{bit15:0}]}{2^{16} - 1} - 40 = 165 * \frac{39680}{65535} - 40 = 59.9^{\circ}C \approx 60^{\circ}C$$

Conversely, it is easy to convert threshold data into binary format for 7-bits humidity and 9-bits temperature.

For example, set threshold for humidity as 90%RH, 80oC for temperature.

Step 1, convert threshold data into binary according to above formula.

Humidity, **1110 0110 0110 0101**, only keep the fist 7-bits[1110 011], remove all rest bits.

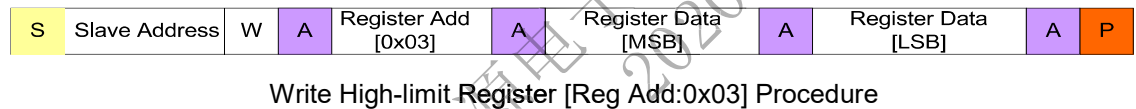
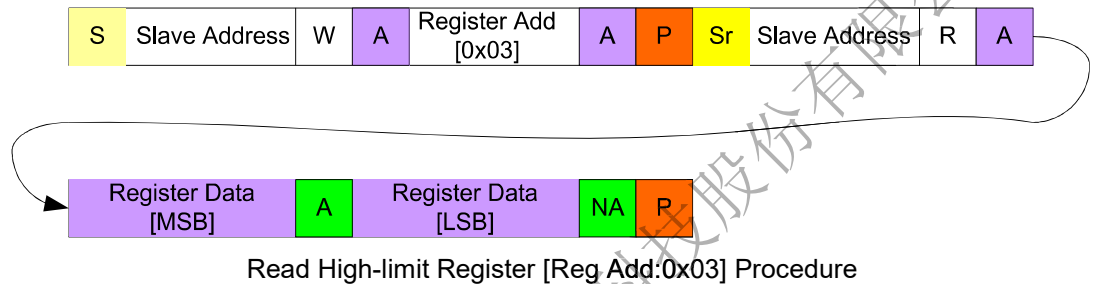
Temperature, **1011 1010 0101 1101**, only keep the fist 9-bits[1011 1010 0], remove all rest bits.

Step 2, then combine Humidity and Temperature binary data to compose full 16 bit format

Table 6. Combination for humidity and temperature high-limit

BIT	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	1	1	1	0	0	1	1	1	0	1	1	1	0	1	0	0
	Humidity							Temperature								

Based on above example, the threshold resolution for humidity is $512/65535 = 0.78\%RH$, for temperature is $128/65535 * 165 = 0.32^{\circ}C$. The binary threshold data can be read & write by reading and writing command shown as below.



1.1.5 Manufacture ID [Add: 0xFE]

Manufacture ID is the ready only register, for this sensor, the data is 0x5959.

1.1.6 Version ID [0xFF]

Version ID is another ready only register, which stands for released version or part no.

1.2 Soft Reset

Generally the chip will reset itself internally during power up every time. Also the chip supports to perform reset without removing the power supply, using soft reset command. When bit15 of config register is set to '1', the sensor will perform reset. After finishing reset, all registers will become the default data and the chip will reload calibration data from the memory. And bit15 will be read as '0'.

1.3 Heater

The chip integrated a resistive heater device that could be used to raise the temperature of the sensor. The heater can be switched on and off by setting bit13 as '1' or '0' of config register. After a reset the heater is disabled (as default). This can be used to drive off condensation, or to implement dew-point measurement. Turning on the heater will reduce the tendency of the humidity sensor to accumulate an offset especially at high humidity conditions. The heater current is slightly changed by VCC voltage.

1.4 Do Measurement Procedure

The sensor can be easily used to read out temperature and humidity data just follow below steps.

1.4.1 Step 1, Setup The Sensor

It is necessary to setup the sensor by writing proper data into config register [Reg Add:0x02], .like acquisition mode (bit12, MODE), temperature resolution (bit10, T_RES) and humidity resolution (bit9, bit8, RH_RES). Of course it is ok to use the default setup, just ignore this step.

1.4.2 Step 2, Trigger Temperature and/or Humidity Measurement

Trigger temperature measurement by writing register address, 0x00 into the sensor via I²C bus.

Trigger humidity measurement by writing register address, 0x01 into the sensor via I²C bus.

1.4.3 Step 3, Waiting for Conversion Time

The typical conversion time of temperature/humidity is 5.50ms with 14-bit, during the conversion, the sensor will NOT ACK reading action at I²C bus until one-time conversion is finished. Also the clock will be stretching if user set CLKSTR '1' (bit12 of config).

1.4.4 Step 4, Read Out Temperature and/or Humidity Measurement Data

Once conversion is finished, temperature and humidity raw data can be obtained by reading register 0x00, 0x01 respectively via I²C bus.

1.4.5 Example C++ Code for Reading Out Temperature and Humidity Data

Here is the C++ code as example, to show 2 methods of reading out temperature and humidity register data.

Method 1, reading 2-bytes from Reg 0x00 and Reg 0x01 to get temperature and humidity data respectively.

```
DWORD wLength;
BYTE* pReadBuf_CHT8305_Temp_Reg = new BYTE[wLength];
BYTE com_CHT8305_T_Reg[4]; com_CHT8305_T_Reg[0]=0x00;
BYTE com_CHT8305_H_Reg[4]; com_CHT8305_H_Reg[0]=0x01;
//get Temperature Data
DoWrite(0x80,com_CHT8305_T_Reg,1); //writeReg add, 0x00, 0x80 is I2C slave add.
Sleep(20); //waiting 20ms for temperature conversion.
DoRead(0x80,pReadBuf_CHT8305_Temp_Reg,2,0,com_CHT8305_T_Reg); //reading 2-bytes, and put them into
pReadBuf_CHT8305_Temp_Regvariable.
```

Digital Humidity and Temperature Sensor

//get Relative Humidity Data

DoWrite(0x80,com_CHT8305_H_Reg,1); //writeReg add, 0x01, 0x80 is I2C slave add.

Sleep(20); //waiting 20ms for humidity conversion.

DoRead(0x80,pReadBuf_CHT8305_Temp_Reg,2,0,com_CHT8305_H_Reg); //reading 2-bytes, and put them into pReadBuf_CHT8305_Temp_Reg variable.

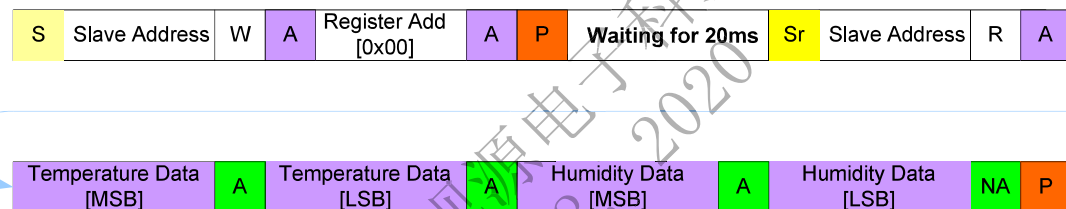
Method 2, reading 4-bytes from Reg 0x00 to get temperature and humidity data at once reading operation.

//get both Temperature & Humidity Data at once reading cycle

DoWrite(0x80,com_CHT8305_T_Reg,1); //writeReg add, 0x01, 0x80 is I2C slave add.

Sleep(20); //waiting 20ms for both temperature and humidity conversion.

DoRead(0x80,pReadBuf_CHT8305_Temp_Reg,4,0,com_CHT8305_T_Reg); //reading 4-bytes, and put them into pReadBuf_CHT8305_Temp_Reg variable.



1.5 Digital Interface

1.5.1 Slave Address

The chip is compatible with industry standard I²C protocol as slave device communication with host via SDA and SCL pin. Both SDA and SCL pin are open drain structure, so it is necessary to use 2 pull-up resistors of 4.7k to 10k. The communication speed supports up to 400 kHz. The I²C slave address of this device can be configured 4 different addresses by setting AD0 pin. See below table for detail. This permits connecting total 4 devices in one same bus. If keeping AD0 pin float is the same as connecting AD0 pin to GND.

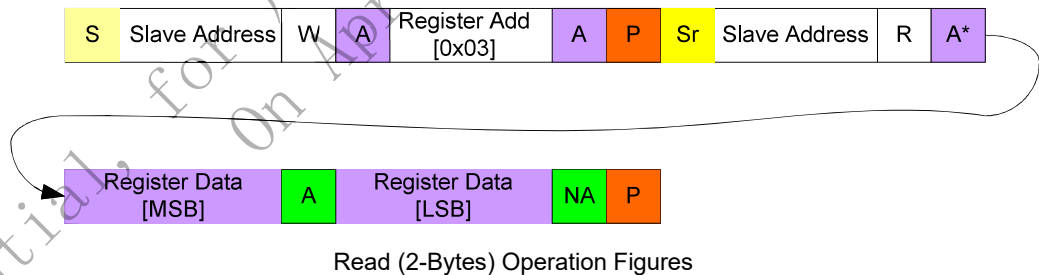
Table 7. Slave address vs. AD0 pin connection

No.	AD0	R/W bit	Slave Address in Hex [R/W]
1	GND	1/0	0x81/0x80
2	VCC	1/0	0x89/0x88
3	SDA	1/0	0x91/0x90
4	SCL	1/0	0x99/0x98

1.5.2 Read/Write Operation

The chip supports basic standard protocols of Read, Write operation, shown as below figures. For CHT8305C, all register data is 16bit, 2-Bytes format.

Read Operation, host generates start 'S' signal in first, then sends slave address (R/W bit=0) of the chip set by user, the chip will ACK the slave address by pull SDA low, then host sends register address, the chip will acknowledge, end with stop 'P'. Host will generate re-start 'Sr', then send slave address again (R/W bit=1), the chip will ACK again, the output 16-bit (2-Bytes) data with MSB first, then LSB, host have to ACK the MSB byte. Then host send ACK or NACK with stop 'P' at last.



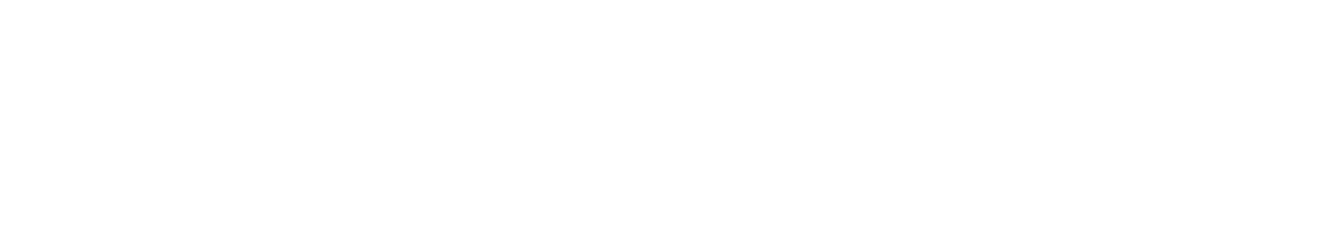
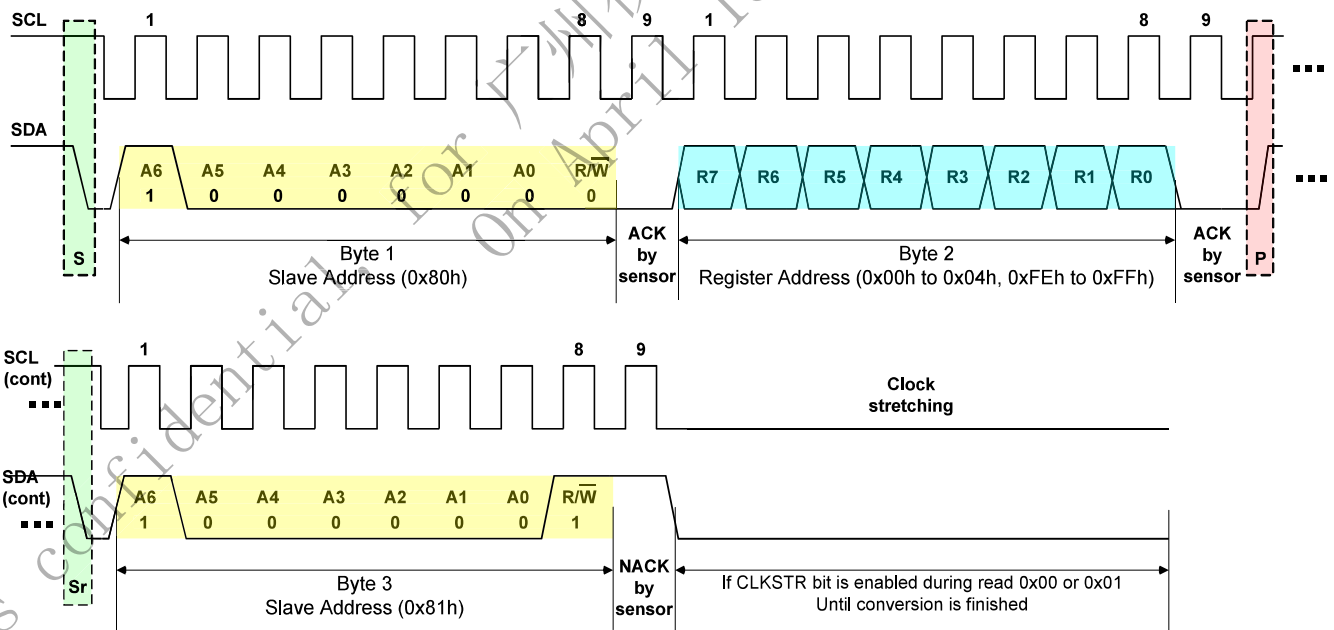
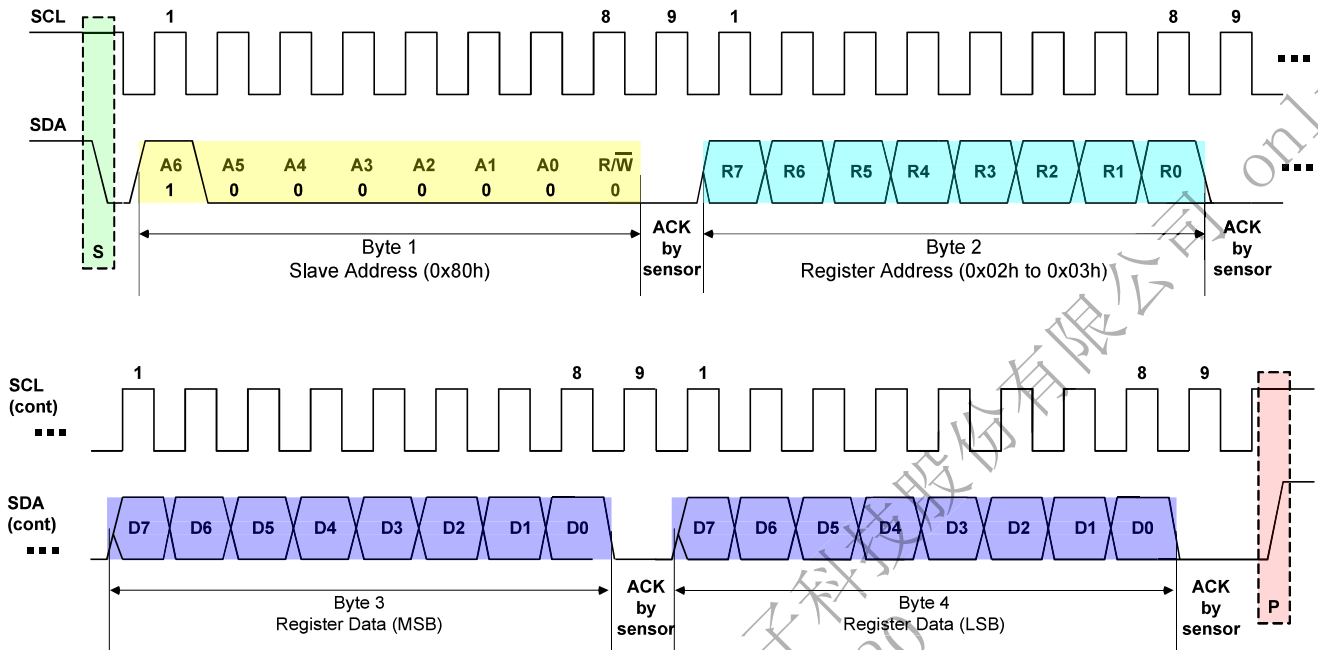
Read (2-Bytes) Operation Figures

Write Operation, host generates start 'S' signal in first, then sends slave address (R/W bit=0) of the chip set by user, the chip will acknowledge the slave address by pull SDA low, then host sends register address. The chip will acknowledge. Host will send 16-bit (2-Bytes) data to be write with MSB first, then LSB, the sensor will ACK byte by byte. Then host send stop 'P' at last.



Write (2-Bytes) Operation Figures

*Note: the chip will NOT ACK the slave address byte until conversion is finished if read 0x00 or 0x01 register.



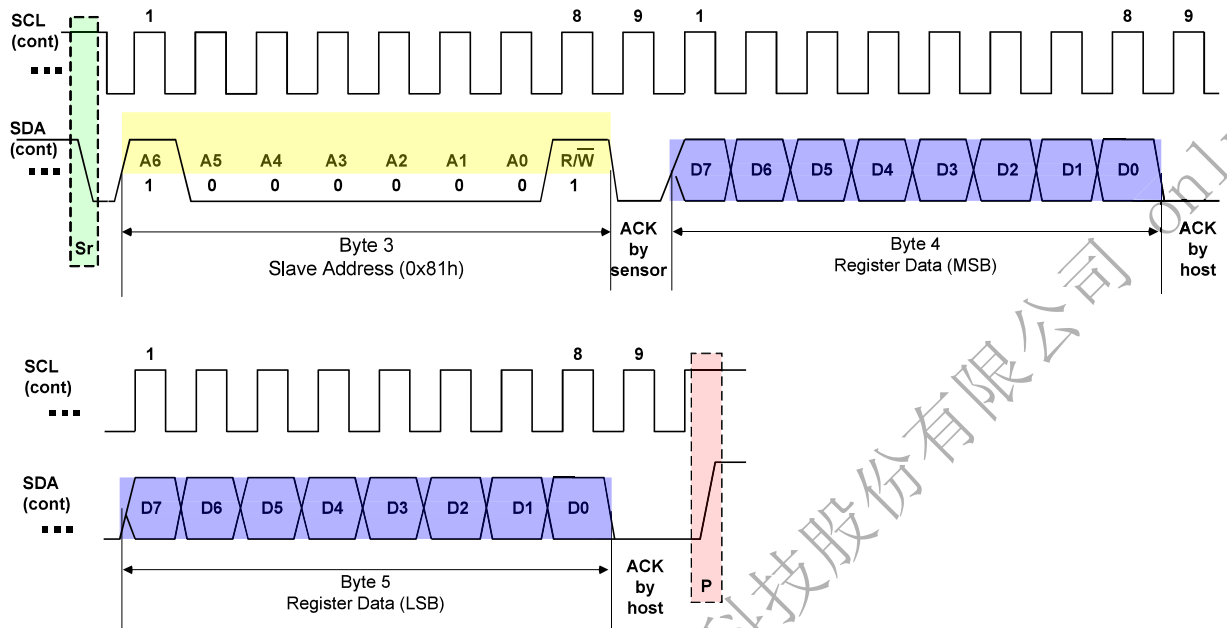


Figure 9. I²C Read Word (2-Bytes, for temperature or humidity) Timing Diagram

1.6 ALERT Output

ALERT pin is open drain output with active low. And it is triggered when the measured temperature and/or humidity equals or exceeds the high-limit threshold temperature and humidity setup by user. The ALERT pin can be used to connect to the interrupt pin of a microcontroller. It should be connect a pull-up resistor in application shown in Figure 1. The logic status of ALERT pin is shown as in Figure 6.

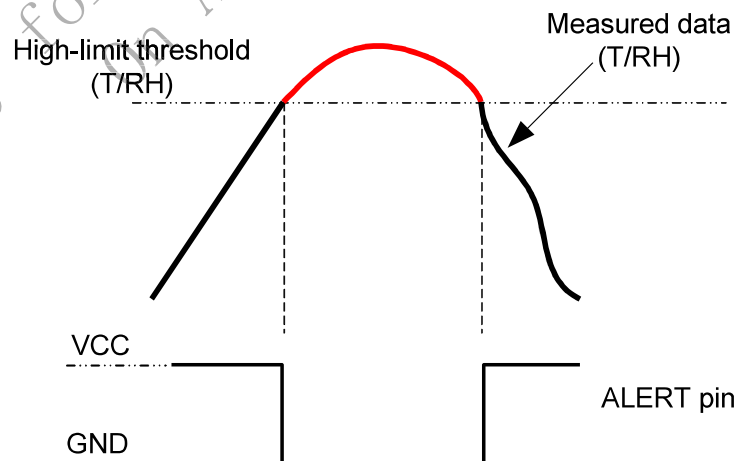


Figure 10. ALERT pin logic status

2 Application Information

In order to correctly and accurately sense the ambient temperature and humidity, the chip should be kept away from heat sources, RF module and big size components on the PCB. Also to minimize the error caused by self heating it is recommended to measure at a maximum sample rate of 1mps (1 time measurement per second) (H + T). In general application, 0.5mps or even lower monitoring frequency of humidity and temperature is still enough.

2.1 Typical Application in Hardware

For the sensor, voltage range (VCC) can be applied by 2.5V to 5.5V. The formula is shown as below. It is necessary to use 4.7k pull-up resistors for I²C Bus (SDA, SCL pin). If I²C bus is available in system, which means pull-up resistors have been placed, just connect SDA, SCL pin of the sensor to the bus respectively. It need another pull-up resistor (4.7k) for ALERT pin, due to open drain structure. for AD0 pin, it is ok to connect to GND, or VCC or SDA, or SCL pin directly.

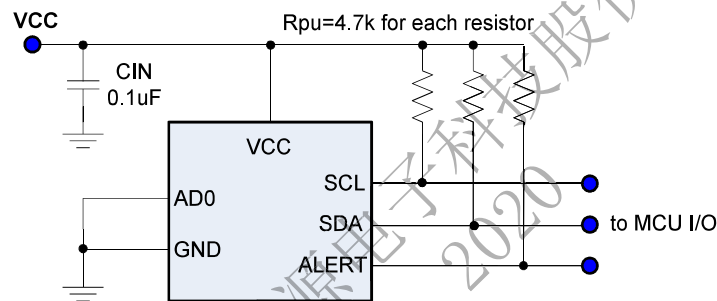


Figure 11. Sensor typical application

2.2 PCB Layout

Cautions below are important to improve temperature and humidity measurement accuracy in PCB layout design.

2.2.1 Device Placement

The sensor has to be located on the top side of the PCB. It is recommended to isolate the sensor from the rest components of the PCB by eliminating copper layers below the device (GND, VDD) and creating a slot into the PCB around the sensor to enhance thermal isolation. It is better to place the sensor away from any thermal source (e.g. power device in board), high speed digital bus (e.g. memory bus), coil device (e.g. inductors or transformers) and wireless antenna (e.g. Bluetooth, WiFi or RF). It is better to keep the sensor be perpendicular to the ground to prevent dust drop into the cavity. Another important thing is to keep the sensor be good air circulation with environment to be measured.



Figure 12. sensor placement example at PCB

2.2.2 Cin, Pull-up Resistor

It is better to place C_{in} as close as possible to VCC and GND pins of the chip. The recommended C_{in} value is 0.1uF with low ESR ceramic cap although using multi caps, such as 1.0uF plus 0.1uF or 0.01uF, is ok, which can suppress digital noise with different frequency range. User has to put a pull-up resistor with 4.7k to 10k for SDA, SC and ALERT pins respectively. For AD0 pin, it can be connected to GND, VCC, SDA or SCL pin directly to assign different slave address, see above table.

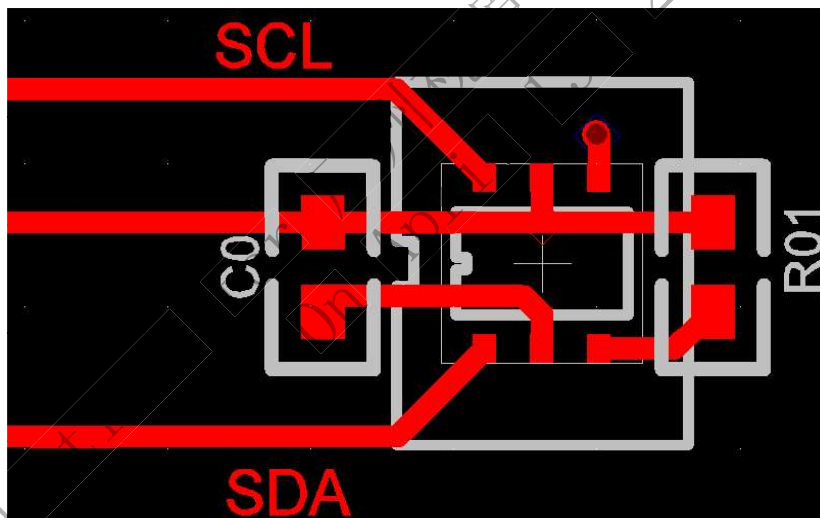


Figure 13. Sensor PCB layout example

2.3 Humidity Hysteresis

The measured humidity data of the sensor when environment changes from low to high, like from 10% to 80% could be slightly different from that when environment changes from 80% to 10%. Which are called humidity sensor hysteresis. The root cause is the difference of moisture absorption and moisture desorption of sensor transducer material. the below figures show the hysteresis.

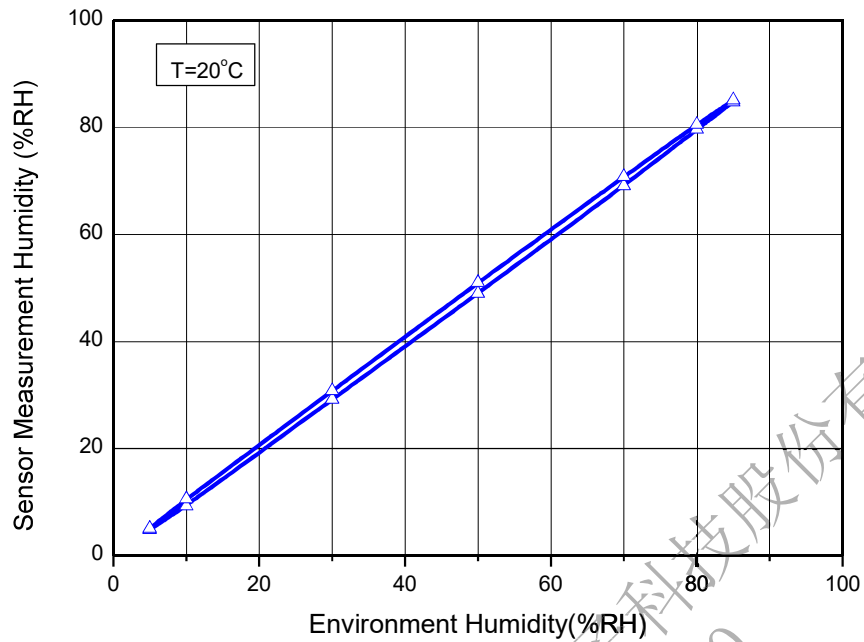


Figure 14. Humidity sensor data vs. environment humidity

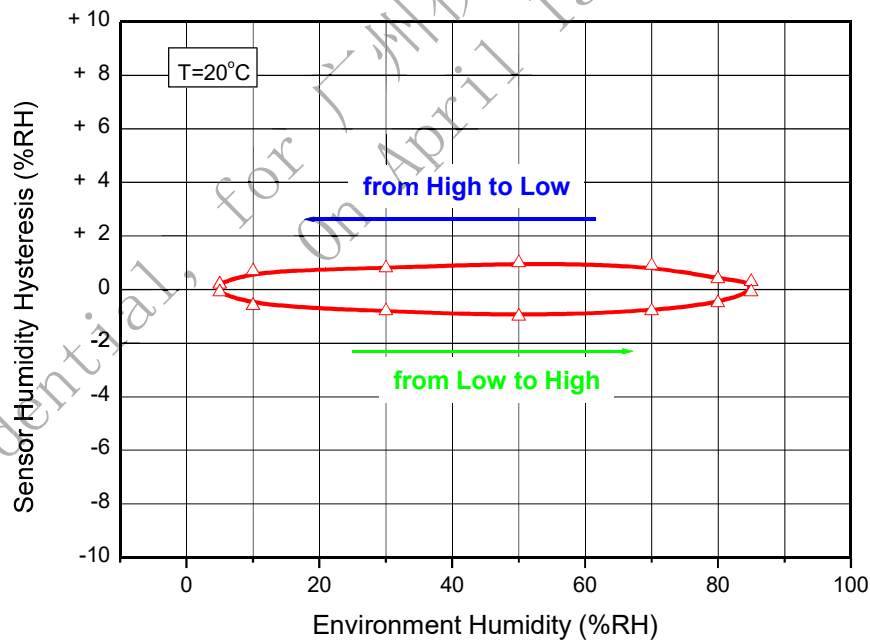


Figure 15. Sensor Humidity Hysteresis vs. environment humidity

2.4 Important Notices

It is important to avoid the probability of contaminants coming into contact with the sensor through the open cavity. Dust and other particles as well as liquids could affect the humidity reading data. Also it is recommended to be far away from VOC, which could cause data drift of humidity reading. However the sensor could recovery after couple minutes once keep away of environment. **DO NOT touch the surface of sensor area by inserting hard solid needle into cavity, like tweezers, which could permanently damage the sensor.**

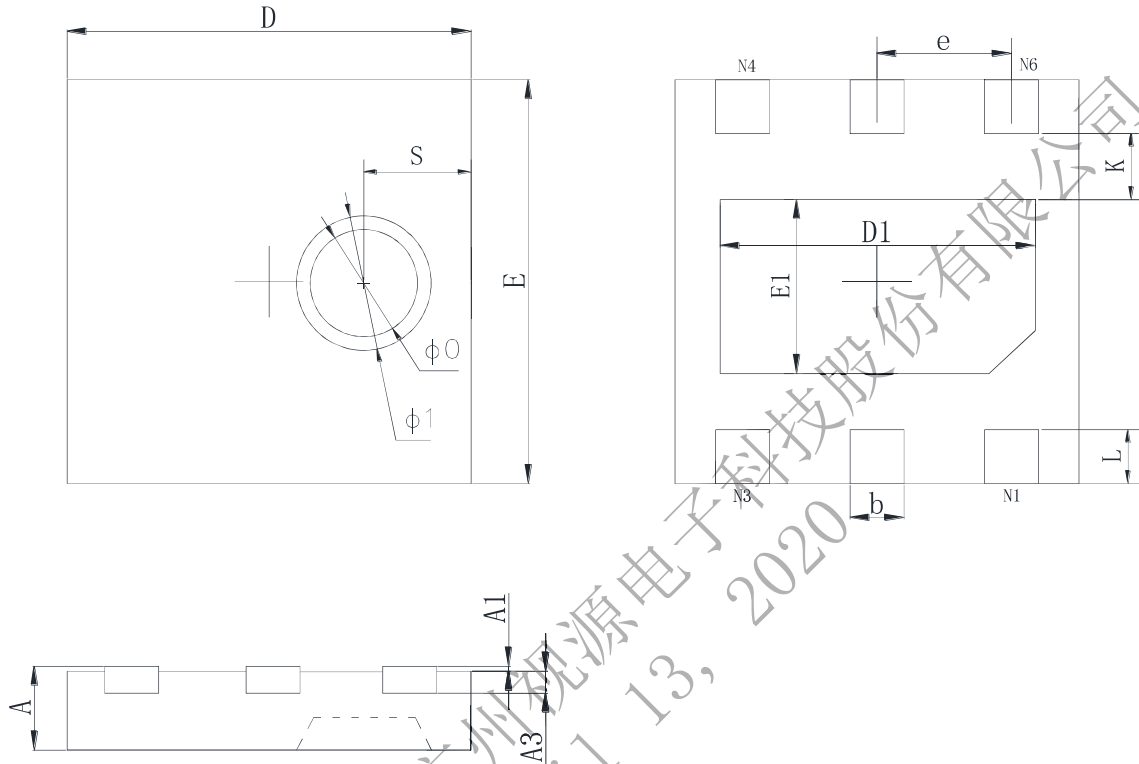
2.4.1 Soldering

The CHT8305C chips shipped from the factory is vacuum-packed with an enclosed desiccant to avoid humidity accuracy offset during storage and to prevent moisture issues during solder reflow. The following procedure is recommended during PCB assembly: This sensor chip is compatible with standard board reflow assembly process. It is recommended to use 'No Clean' solder reflow process to reduce water or solvent rinsing impact. If cleaning is have to do after reflow, it is better to order the chip with cavity protection cover, see ordering information for detail. The humidity data of the sensor could be lower if reading immediately after reflow. However it will come back to normal after hydration. Do not exceed 300°C over 10s during reflow or manual handling, which could damage the sensor permanently. For detail about baker conditions, please contact Sensylink sales.

2.4.2 Cavity Protection Cover

The cavity protection cover for CHT8305C is available for order with postfix 'C'. it stick the chip surface and cover the cavity totally. It is NOT necessary to remove this cover after reflow process. It is very effective to block dust and liquid down to 0.40 microns in size. Below is cavity sample with 3 rows by 4 columns.



Package Outline Dimensions
DFN3x3-6
Unit (mm)


Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.100	0.035	0.043
A1	0.010	0.050	0.000	0.002
A3	0.203REF.		0.008REF	
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
D1	2.300	2.500	0.091	0.098
E1	1.400	1.600	0.055	0.063
k	0.350MIN.		0.014MIN	
b	0.350	0.450	0.014	0.018
e	1.000TYP.		0.040TYP	
L	0.350	0.450	0.014	0.018
S	0.740	0.840	0.029	0.033
φ0	0.800TYP		0.036TYP	
φ1	1.000TYP		0.040TYP	



SENSYLINK Microelectronics Co., Ltd

www.sensylink.com

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1. 目的

规定Sensylink open cavity产品的包装操作要求。

2. 范围

- 2.1 适用于 Sensylink所有用 S 商标产品。
- 2.2 当特殊情况时（如新供应商引入、订单量小情况），经 Sensylink 书面同意后，可采用供应商之中性包装规范。

3. 职责

- 3.1 产品工程部门负责文件定义与更新
- 3.2 Sensylink的生产部门以及供应商应遵从以上所列的包装要求执行。

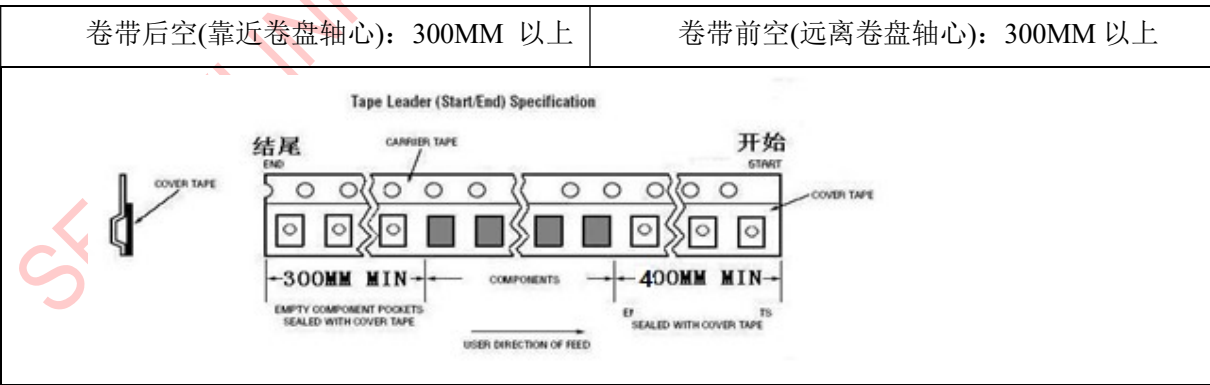
4 程序

4.1 卷盘出货的包装要求，包装数量见相应附表。

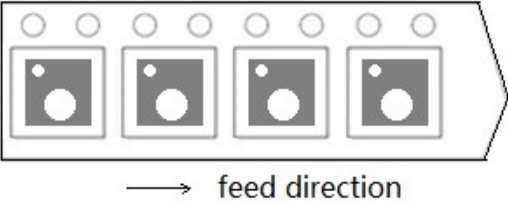
封装形式	卷盘尺寸	只/卷盘	卷盘/内包装盒	只/内包装盒	内包装盒/外包装盒	只/外包装盒
QFN(DFN)-3*3	13”	3000	2	6000	6	36000

内盒尺寸（mm）：360x360x60， 外箱尺寸（mm）：425x380x390

4.1.1 卷带前空及后空要求



4.1.2 产品在编带中的位置与方向

DFN/QFN with cavity	 <p>Diagram illustrating the feed direction for DFN/QFN with cavity. The diagram shows a row of four square components, each with a central circular cavity. Above each component is a small circle. An arrow points to the right, labeled "feed direction".</p>
---------------------	--

4.1.3 产品包装及标签位置示意图

编带方向要求:	 <p>Image showing a carrier tape with a blue arrow indicating the feed direction.</p>
卷盘标签粘贴要求: 产品标签粘贴在无定位孔面	 <p>Image showing a blue carrier tape with a label attached to the bottom edge.</p>
铝箔袋标签粘贴要求: 产品标签贴于正面，同时粘贴ESD标签与MSL标签 或使用表面已印有ESD和MSL标签内容的铝箔袋 注意：包装内不可以放干燥剂/湿度卡 MSL等级为MSL1	 <p>Image showing a silver foil bag with a label attached to the front.</p>
内盒标签粘贴要求: 标签贴于内盒开口面右侧	 <p>Image showing a cardboard box with a label attached to the right side of the opening.</p>

文件名称：DFN open cavity产品包装规范

批准日期：2019-3-30

文件编号：

第3页共4页

<p>内盒摆放要求：</p> <p>内盒包装完毕按照统一方向入外箱，如图与外箱标签同侧，不满箱须以空盒填充，空盒上需有空盒标记</p>	
<p>外箱标签粘贴要求：</p> <p>上下封口处粘贴 QA seal 标签</p> <p>外箱标签贴于右侧面右上角</p> <p>封箱带封口</p>	

4.2 标签说明

4.2.1 产品标签格式（70*50mm）用于卷盘、托盘、内盒、外箱。标签上加盖 QA 章，标签不能手写，半成品也需要盖 QA 章。二维码内容包含Part No， package， lot no， date code QTY， 每个数据项之间使用|作为分隔。

4.2.2 标签示例



Part No	产品型号
Package:	封装形式

文件名称: DFN open cavity产品包装规范

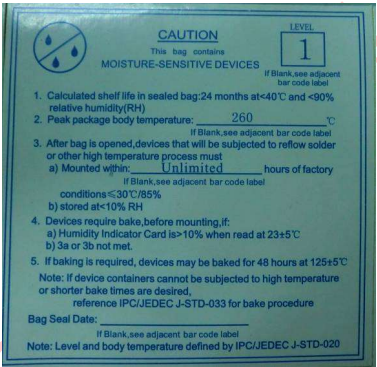
批准日期: 2019-3-30

文件编号:

第 4 页 共 4 页

Lot No:	回货批号, 用来追溯产品生产信息
D/C:	周号代码, 格式为YWWAXX Y为生产年代码, WW为生产周代码 , A为生产厂家代码, XX为批次代码
QTY:	实际包装的产品数量
二维码	条码内容: 由 “Part no Package LotNo D/C QTY” 组成
注意事项	标签打印字体为Arial 条码代码: QR Code

4.2.3 MSL 标签:需在铝箔袋上贴MSL1 标签



物质成分或部件展开表						
供应商名称	产品名称	厂商产品型号	物料组成部位	原材料厂商名称	部件型号	原材料原产地
上海申矽凌微电子科技有限公司	温湿度传感器芯片	CHT8305CDNR	Chip	Asic: TSMC Sensor: BCD	Si	上海
			Lead Frame	ASM	A194	新加坡/深圳
			Wire	宁波康强	Au	宁波
			Soft Solder	HNKEL	ATB-120U	韩国
			Mold Compound	苏州住友	G631BQ	苏州
			Plating	/	/	
晶圆和工厂信息						
晶圆厂名称1：		TSMC	晶圆厂详细地址：	上海市松江科技园区文翔路4000		
晶圆厂名称2：		BCD	晶圆厂详细地址：	上海闵行紫星路1600号		
封装厂名称1：		西安华天	封装厂详细地址：	西安经济技术开发区凤城五路105号		
封装厂名称2：		/	封装厂详细地址：			
晶圆测试厂名称：		/	晶圆测试厂详细地			
外发工序（包括不限于晶元测试，封装测试，包装，电镀等如有不在晶元厂和封装厂生产的工序均需填写，并报备）						
外发工序1		测试/包装				
外发厂名称1：		申矽凌微电子	外发厂详细地址：	上海虹梅南路2588号		
外发工序2						
外发厂名称2：			外发厂详细地址：			
湿度敏感等级						
MSL			1			