Winsen
炜盛科技

MEMS type Temperature and Humidity Sensor

**(Model: WHT20)**

# Manual

Version: V1.4

Date: 2022.6.13

Zhengzhou Winsen Electronics Technology Co., Ltd

# Statement



Thanks for purchasing our product. In order to let customers use it better and reduce the faults caused by misuse, please read the manual carefully and operate it correctly in accordance with the instructions. If users disobey the terms or remove, disassemble, change the components inside of the sensor, we shall not be responsible for the loss.

The specific such as color, appearance, sizes &etc, please in kind prevail.

We are devoting ourselves to products development and technical innovation, so we reserve the right to improve the products without notice. Please confirm it is the valid version before using this manual. At the same time, users’ comments on optimized using way are welcome.

Please keep the manual properly, in order to get help if you have questions during the usage in the future.

Zhengzhou Winsen Electronics Technology CO., LTD

# WHT20 MEMS type Temperature and Humidity Sensor

**Overview**

WHT20 is embedded in a dual-row flat no-lead SMD package, which is suitable for reflow soldering, with 3.0x3.0mm bottom surface and 1.0mm height. The temperature and humidity signals can be read on different pins. The sensor outputs calibrated digital signals in standard IIC format.

WHT 20 is equipped with an ASIC chip, a MEMS capacitive humidity sensor and a temperature sensor. WHT 20 temperature and humidity sensors have been calibrated and tested on factory, and have excellent reliability and long-term stability.

**Features**

High accuracy ±3.0% RH and ±0.5℃

Wide power supply voltage range, from 2.0V to 5.5V

SMD package suitable for reflow soldering

Quick response and strong anti-interference ability

Excellent long-term stability under high humidity condition


**Application**

Home appliance fields: home appliance, humidity control, HVAC, dehumidifiers, smart thermostats, and room monitors etc ;

Industrial fields: automobiles, testing equipment, and automatic control devices;

Other fields: data loggers, weather stations, medical and other related temperature and humidity detection devices.

**Technical parameters of relative humidity** Stable1. humidity characteristic

| Parameter | Condition | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| Resolution | Typical | | 0.01 | | %RH |
| Accuracy error[1] | Typical | | ±3.0 | | %RH |
| | Max | See figure 2 | | | %RH |
| Repeatability | | | ±0.1 | | %RH |
| Hysteresis | | | ±1.0 | | %RH |
| Non-linear | | | <0.1 | | %RH |
| Response time[2] | $t_{63\%}$ | | <8 | | s |
| Scope of work | extended[3] | 0 | | 100 | %RH |
| Prolonged Drift[4] | Normal | | <0.5 | | %RH/yr |

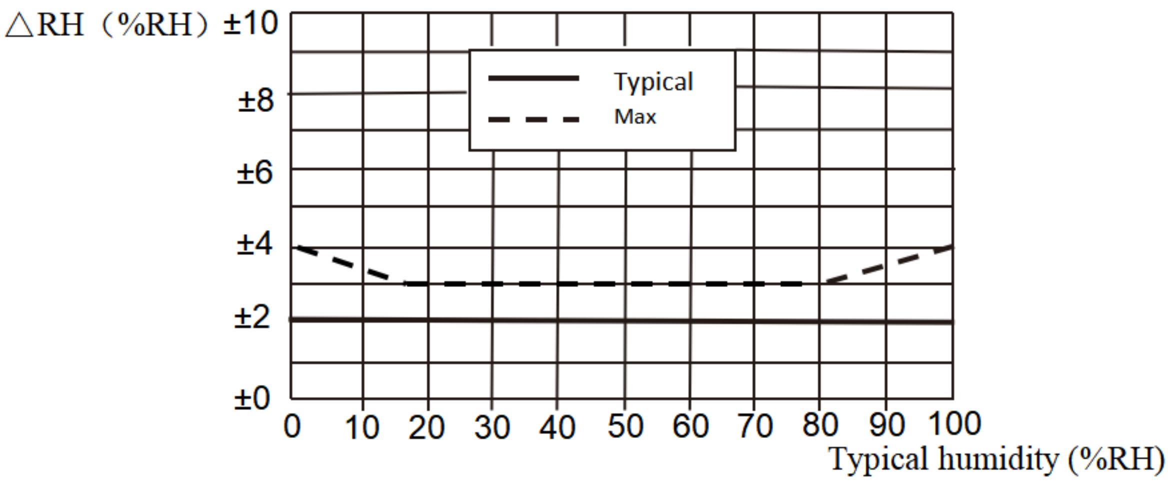



Figure 1 Maximum error of relative humidity at 25°C

**Technical parameters of temperature** stable2. temperature characteristic

| Parameter | Condition | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| Resolution | Typical | | 0.01 | | °C |
| Accuracy error | Typical | | ±0.5 | | °C |
| | Max | See figure 2 | | | °C |
| Repeatability | | | ±0.1 | | °C |
| Hysteresis | | | ±0.1 | | °C |
| Response time[5] | $t_{63\%}$ | 5 | | 30 | s |
| Scope of work | extended[3] | -40 | | 85 | °C |
| Prolonged Drift | | | <0.04 | | °C/yr |

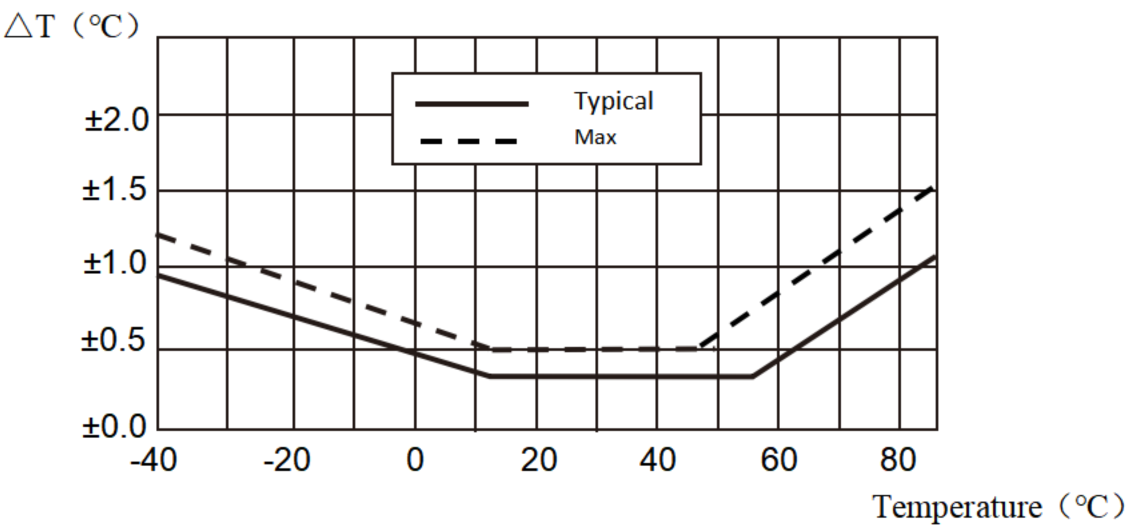



Figure 2 Temperature typical error and maximum error

**Suggested working environment**

The recommended temperature and humidity range of this sensor is 5~60℃ and 20~80% RH, as shown in Figure 3.

Long-term exposure in the non-recommended range, such as high humidity, may cause temporary signal drift (for example, >80%RH, drift +3% RH after 60 hours). After returning to the recommended range environment, the sensor will gradually return to the calibration state. Long-term exposure to the non-recommended range may accelerate the aging of the product.

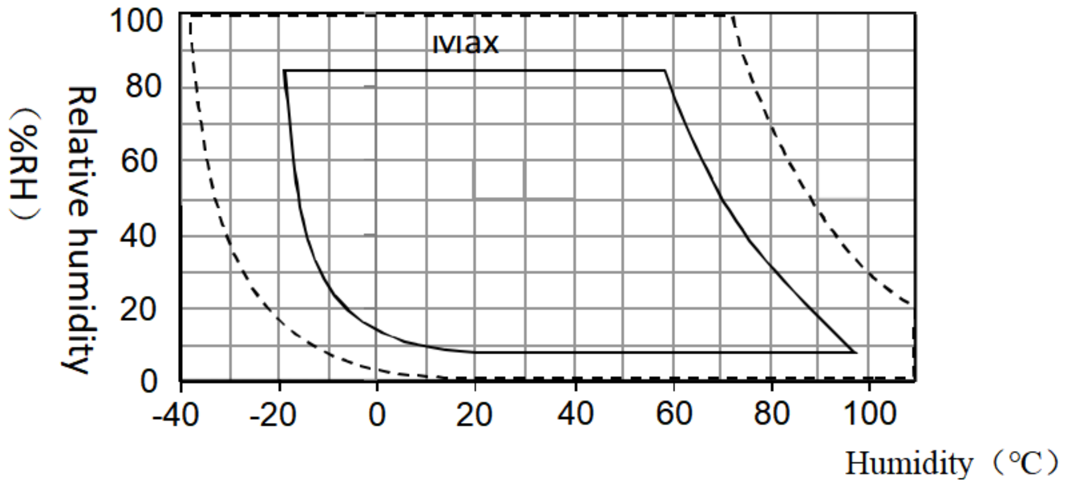



Figure 3 Working scope

**RH accuracy at different temperatures**

Figure 4 shows the maximum humidity error for other temperature ranges.

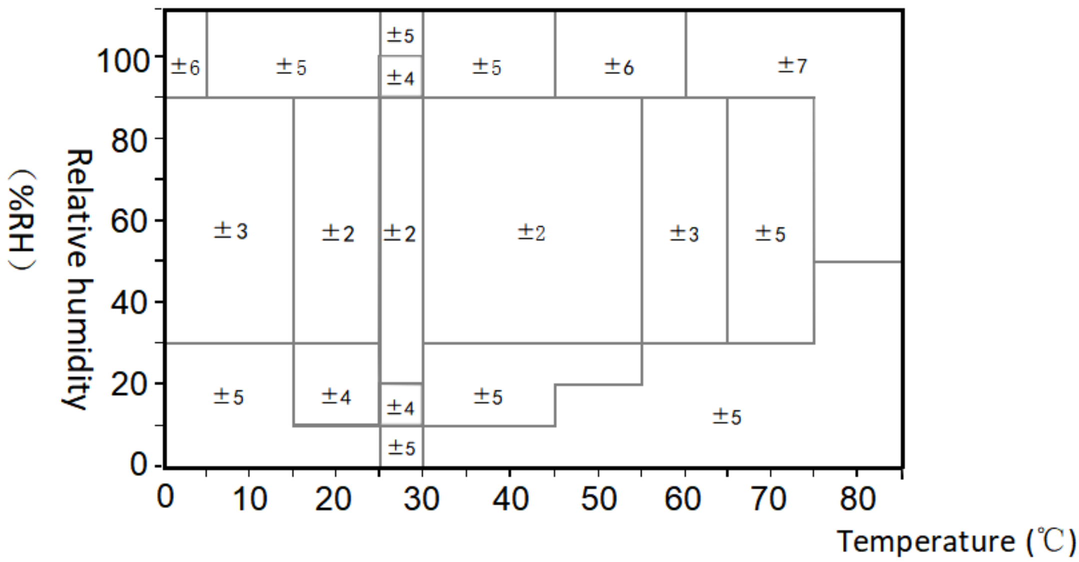



Figure 4 The maximum error of the corresponding humidity in the range of 0-80℃

**Electrical specifications (Table 3)**

| Parameter | Condition | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| Voltage | Typical | 2.0 | 3.3 | 5.5 | V |
| Current, IDD[6] | Dormant | - | | 240 | nA |
| | Measure | | 340 | | µA |
| Power consumption[6] | Dormant | - | | 0.8 | µW |
| | Measure | | 0.07 | | mW |
| | Average | - | 3.3 | - | µW |
| Communication | Dual-line digital interface, standard $I^2C$ protocol | | | | |

The power consumption given in Table 3 is related to temperature and supply voltage VDD. See Figures 5 and 6 for power consumption estimates. Please note that the curves in Figures 5 and 6 are typical natural characteristics, and there may be deviations.

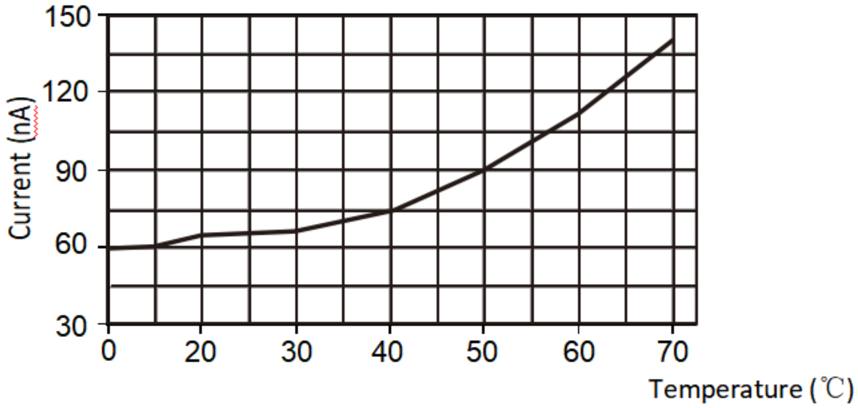



Fig. 5 Typical supply current vs. temperature curve (sleep mode) when VDD=3.3V. There is a deviation of approximately ±25% between these data and the displayed value.

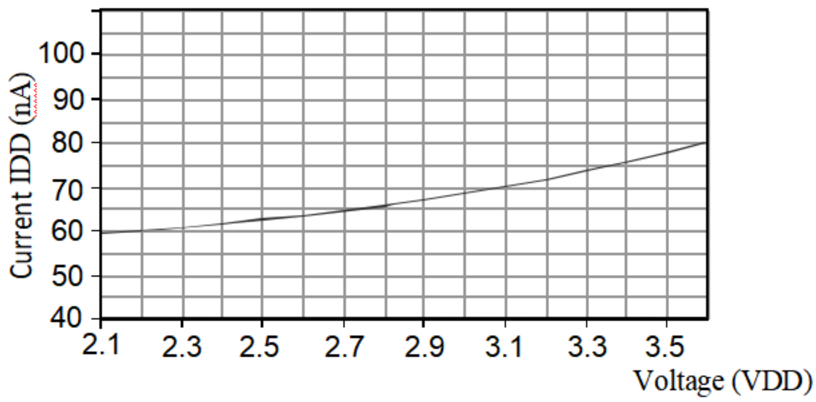



Figure 6 Typical supply current vs. supply voltage curve (sleep mode) at a temperature of 25 ℃. Note: The deviation between these data and the displayed value may reach ±50% of the displayed value. At 60 ℃, the coefficient is approximately 15 (compared to Table 3).

**Package information**

| Part no. | Package | Quantity |
|---|---|---|
| WHT 20 | Tape package | 5000PCS/Roll (MAX) |

Note: 1. This accuracy is the test accuracy of the sensor at 25℃ and the supply voltage is 3.3V during the factory inspection.

2. The time required to reach 63% response under the conditions of 25°C and 1m/s airflow.

3. Normal working range: 0-80%RH, beyond this range, the sensor reading will be biased (after 200 hours under 90%RH humidity, drift <3%RH). The working range is limited to -40-80℃.

4. If there are volatile solvents, tapes with pungent odors, adhesives and packaging materials around the sensor, the readings may get higher and speed up the drifting.

5. The response time depends on the thermal conductivity of the sensor substrate.

6. The minimum and maximum values of supply current and power consumption are based on the conditions of VDD = 3.3 V and T <60°C.

## Application Guide

### 1.1 Storage Conditions

The temperature and humidity sensor should not be exposed to volatile chemicals, such as organic solvents or other inorganic compounds, otherwise it will cause irreversible drift in humidity output readings. it is recommended to store the sensor in the original packaging including a sealed ESD bag, and meet the following conditions: temperature range 10℃-50℃ (within a limited time 0-85℃); humidity 20-60%RH (without ESD package sensor). For those sensors that have been removed from the original packaging, we recommend storing them in an anti-static bag made of PET/AL/CPE containing metal.

### 1.2 Recovery Processing

As mentioned above, the readings can drift if the sensor is exposed to extreme operating conditions or chemical vapors. It can be restored to the calibration state by the following processing. (1) Drying: Keep it at 80-85 ℃ and <5% RH humidity for 10 hours; (2) Re-hydration: Keep it at 20-30 ℃ and >75% RH humidity for 24 hours.

### 1.3 Temperature Effect

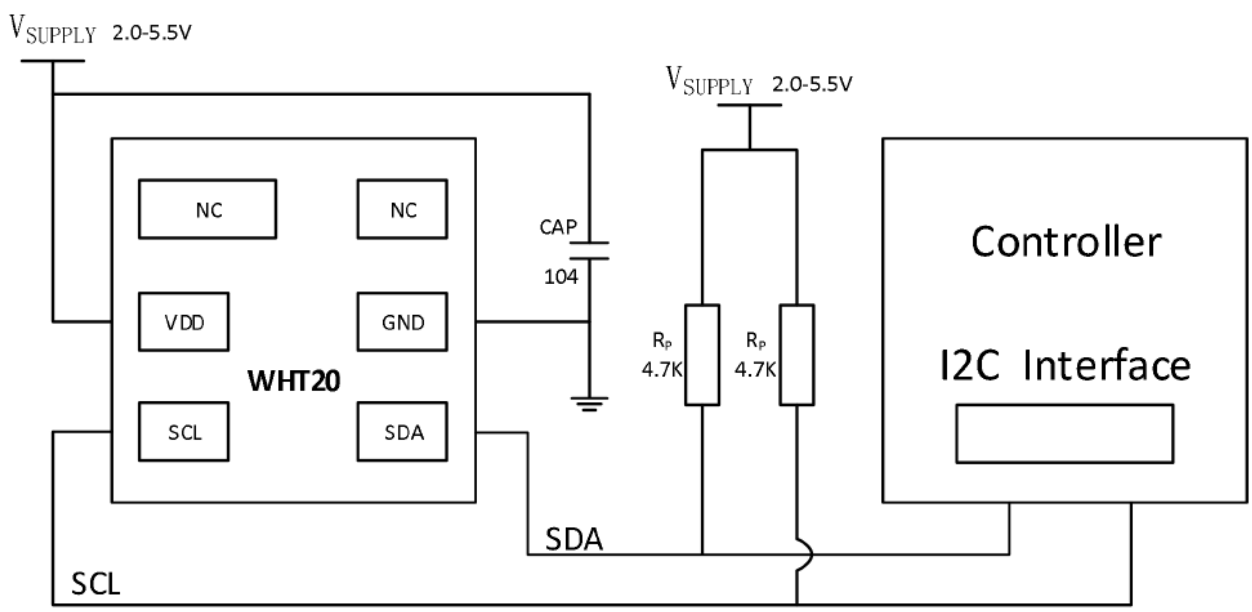
The relative humidity of gases depends largely on temperature. Therefore, when measuring humidity, all sensors measuring the same humidity should work at the same temperature as possible. When testing, it is necessary to ensure that the same temperature, and then compare the humidity readings.

On the same printed circuit board, to minimize the influence of heat transfer, the sensor should be isolated from electronic components that are prone to heat as much as possible.

High measurement frequency will also affect the measurement accuracy, because the temperature of the sensor itself will increase as the measurement frequency increases. To ensure that its own temperature rise is below 0.1°C, the activation time of WHT 20 should not exceed 10% of the measurement time. It is recommended to measure the data every 2 seconds.

### 1.4 Product application scenario design

In order to improve the stability of the system, the following power supply controllable scheme is provided:



**1.5 Materials for Sealing and Encapsulation**

To avoid the response time and hysteresis increase caused by the moisture absorption of the surrounding materials, the following materials are recommended: metal materials, LCP, POM (Delrin), PEEK, PVDF, PTFE (Teflon), PP, PB, PPS, PSU , PE, PVF.

It is recommended to use epoxy resin to encapsulate electronic components, or silicone resin. However, the gas released by the packaging material may also contaminate WHT20 sensor. Therefore, the final assembly of the sensor should be done in a well-ventilated place, and the contaminated gas can also be released before packaging.

**1.6 Wiring rules**

To avoid signal crosstalk and communication failure caused by wiring, do not place SCL and SDA signal lines in parallel or very close to each other. The solution is to place VDD and/or GND between the SCL and SDA signal lines, or use shielded cables.

**1.7 Signal integrity**

Reducing SCL frequency may also improve the integrity of signal transmission. A 100nF decoupling capacitor should be added between the power supply pins (VDD, GND) for filtering.

**1.8 Device function mode**

WHT20 has two operating modes: sleep mode and measurement mode. After power-on, WHT20 enters sleep mode. In this mode, WHT20 waits for the I2C input configuration conversion time, reads the battery status, triggers the measurement, and reads the measured value. After completing the measurement, WHT20 returns to sleep mode.

**1.9 Welding instructions**

SMD I/O pads are made of copper lead frame plane substrates, except these pads are exposed and are used for mechanical and circuit connections. For use, both I/O pads and bare pads need to be soldered to the PCB. To prevent oxidation and optimize welding, the solder joints at the bottom of the sensor are coated with Ni/Au.

On the PCB, the length of the I/O contact surface should be 0.2-0.3mm larger than the sensor's I/O sealing pad, and the width should be 0.1-0.2mm larger than the sealing pad. The part near the inner side should match the shape of the I/O pad, and the ratio of the pin width to the SMD sealing pad width should be 1:1, as shown in Figure 8.

For mesh and solder layer designs, it is recommended to use copper foil defined pads (SMD) with openings in the solder layer larger than the metal pads. For SMD pads, if the gap between the copper foil pads and the solder resistance layer is 60µm-75µm, the size of the solder resistance layer opening should be greater than the size of the pad 120µm-150µm. The square portion of the sealing pad shall match the corresponding square solder mask opening to ensure that there is sufficient solder mask area (especially at the corners) to prevent solder intersecting. Each pad shall have its own solder layer opening to form a network of solder layers around adjacent pads.

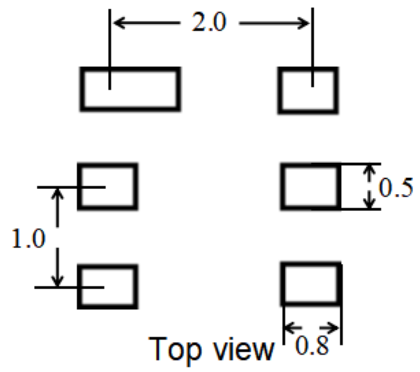



**Figure 8**: Recommend WHT 20 PCB design size (unit: mm)

For solder printing, laser cutting stainless steel mesh with electronic polishing trapezoidal wall is recommended, with recommended thickness of 0.125 mm. The steel mesh size of the pad should be 0.1 mm longer than PCB pad and placed 0.1 mm away from the packaging center. Steel mesh with bare pads must cover 70% - 90% of the pad area - that is, the central position of the heat dissipation area reaches 1.4 mm x 2.3 mm.

Due to the low SMD mounting, it is recommended to use no-cleaning type3 solders tin and to purify it with nitrogen during reflux.

Sensor can be welded through standard reflow furnace. The sensor fully meets the IPC/JEDEC J-STD-020D welding standard. The best temperature for reflow soldering is lower than 200 ℃,the ultimate welding temperature that the sensor can withstand is 260℃, and the contact time should be less than 30 seconds at the highest 260℃ (see Fig. 9). It is recommended to use low temperature 180℃ when reflow soldering.

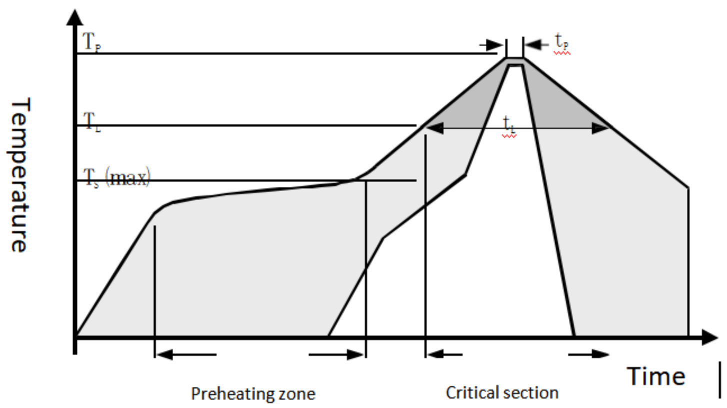



**Figure 9**: JEDEC standard welding process diagram, Tp<=260 ℃, tp<30 sec, lead-free soldering. TL<220 ℃, tl<150 sec, the temperature rise and fall speed during welding should be <5 ℃ /sec.

**Note:** After reflow soldering, the sensor should be stored in an environment of >75% RH for at least 24 hours to ensure the rehydration of the polymer. Otherwise, it will lead to sensor reading drift. The sensor can also be placed in a natural environment (>40% RH) for more than 5 days to rehydrate it. Using low temperature reflow soldering (for example: 180 ℃) can reduce the hydration time.

It is not allowed to rinse the circuit board after soldering. Therefore, it is recommended to use "no-clean" solder paste. If the sensor is used in corrosive gas or condensed water is generated (such as: high humidity environment), both the lead pad and PCB need to be sealed (such as: use conformal coating) to avoid poor contact or short circuit.

## Interface Definition

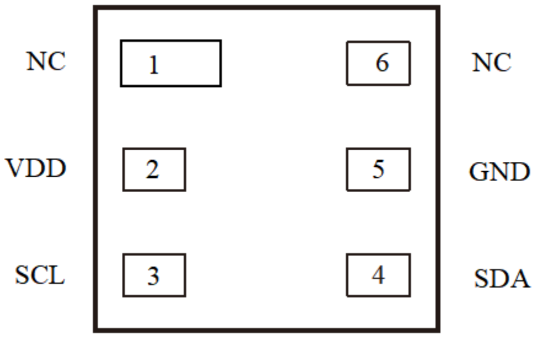



Table 4 WHT20 pin-out (top view)

| PIN | Name | Definition |
| --- | --- | --- |
| NC | 1 | Remain suspended |
| VDD | 2 | Power supply voltage, 2.0~5.5V power supply, recommended voltage of 3.3V |
| SCL | 3 | $I^2C$ serial clock, two-way, for Synchronous Communications between the microprocessor and sensor |
| SDA | 4 | $I^2C$ serial data, SDA, for data input and output of the sensor |
| GND | 5 | Power ground |
| NC | 6 | Remain suspended |

**Note:**

1. To prevent the current from being poured into the signal line (SCL/SDA) by the leakage current, which may lead the chip in a non-working state after power-on, VDD should be powered on prior to or synchronized with SDA and SCL.
2. To ensure communication safety, the effective time of SDA should be extended to TSU and THD before and after the rising edge of SCL (refer to Figure 10).

## Electrical Characteristics

### Absolute Maximum Ratings

The absolute maximum ratings of WHT20 are shown in Table 5. In addition, Table 5 also provides information such as pin input current. If the test condition exceeds the nominal limit index, the sensor needs to add an additional protection circuit.

Table 5 Electrical absolute maximum ratings

| Parameter | Min | Max | Unit |
| --- | --- | --- | --- |
| VDD to GND | -0.3 | 5.5 | V |
| Digital I/O Pins (SDA,SCL) to GND | -0.3 | VDD+0.3 | V |
| Input current per pin | -10 | 10 | mA |

Note: Long-term exposure to absolute maximum ratings may affect the reliability of the sensor.

**I2C interface voltage**

Electrical characteristics, such as power consumption, high and low voltages of input and output, etc., depend on the power supply voltage.

Table 6 DC characteristics of digital input and output pads, if there is no special statement, VDD=2.0 V to 5.5 V, T =-40 ℃ to 85℃

| Parameter | | Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Low output voltage | VOL | VDD = 3.3 V<br>Reverse current 3mA | 0 | - | 0.4 | V |
| High output voltage | VOH | | 0.7VDD | - | VDD | V |
| Output sink current | IOL | | - | - | -4 | mA |
| Low output voltage | VIL | | 0 | - | 0.3VDD | V |
| High output voltage | VIH | | 0.7VDD | - | VDD | V |
| Input current | | VDD = 5.5 V,VIN = 0 V to 5.5 V | - | - | ±1 | uA |

**I2C interface timing**

Table 7 Timing characteristics of $I^2C$ fast mode digital input/output terminals

| Parameter | | $I^{2}$$^{2}$C Standard | | $I^2C$ Fast | | Unit |
|---|---|---|---|---|---|---|
| | | MIN | MAX | MIN | MAX | |
| $I^2C$ clock frequency | $f_{SCL}$ | 0 | 100 | 0 | 400 | KHz |
| Start signal time | $t_{HDSTA}$ | 0.1 | | | | μs |
| SCL clock high level (width) | $t_{HIGH}$ | 4.7 | | 1.3 | | μs |
| SCL clock low level (width) | $t_{LOW}$ | 4.0 | | 0.6 | | μs |
| Data storage time (relative to SCL, SDA edge) | $t_{HDDAT}$ | 0.09 | 3.45 | 0.02 | 0.9 | μs |
| Data setting time (relative to SCL, SDA edge) | $t_{SUDAT}$ | 250 | | 100 | | μs |
| The idle time of the BUS bus before stopping and starting | $t_{BUS}$ | | | 1 | | μs |

**Note:**

(1) The two pins are measured from 0.2 VDD and 0.8 VDD.

(2) The above I2C timing is determined by the following internal delays: the internal SDI input pin is delayed relative to the SCK pin, typically The value is 100 ns; the internal SDI output pin is delayed relative to the falling edge of SCK, and the typical value is 200 ns.

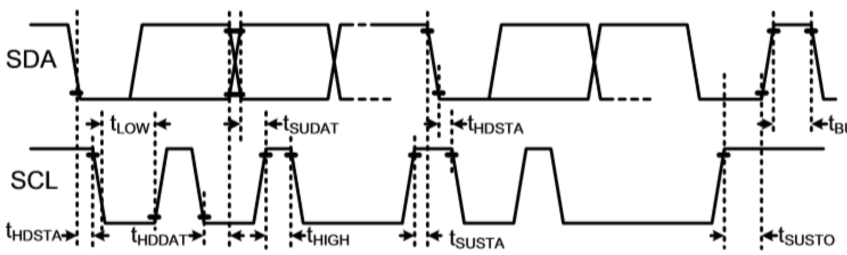



**Figure 10** The timing diagram and abbreviations of the digital input/output terminals are explained in Table 7. The thicker SDA line is controlled by the sensor, and the ordinary SDA line is controlled by

the microcontroller. Please note that the SDA valid read time is triggered by the falling edge of the previous conversion.

**Sensor Communication**

WHT 20 communicates as a slave of the I2C bus interface. After power on, the sensor can reach the sleep mode at most 20 ms (SCL is high at this time). When the host sends a command, it starts temperature and humidity measurement.

**Start/Stop Sequence**

Each transmission sequence starts with the Start state and ends with the Stop state, as shown in (1) and (2) of Figure 11.

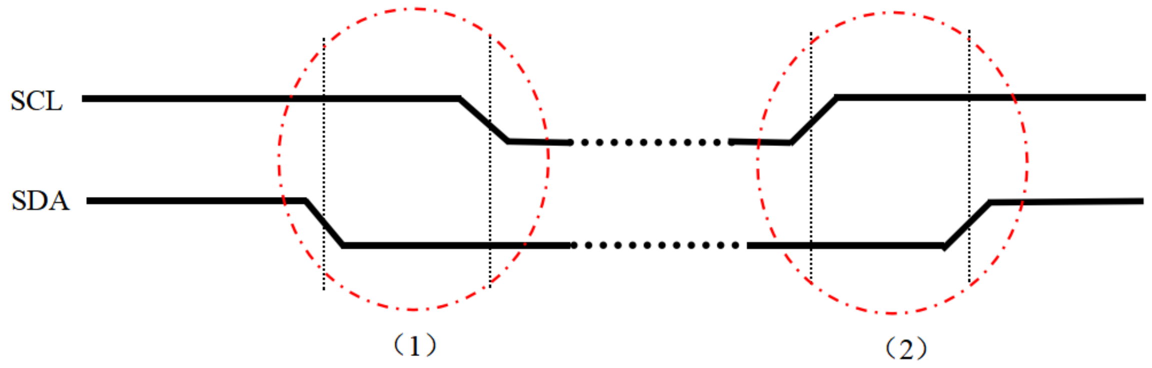



Figure 11 Start transmission state (S) and stop transmission state (P)

**Note**:

(1)When SCL is high, SDA is converted from high to low. The start state is a special bus state controlled by the master, indicating the start of the slave transfer (after Start, the BUS bus is generally considered to be in a busy state)

(2) When SCL is high, the SDA line changes from low to high. The stop state is a special bus state controlled by the master, indicating the end of the slave transmission (after Stop, the BUS bus is generally considered to be in an idle state).

**Transmission of command**

The first byte of $I^2C$ that is subsequently transmitted includes the 7-bit $I^2C$ device address 0x38 and a SDA direction bit x (read R: ‘1’, write W: ‘0’). After the 8th falling edge of the SCL clock, pull down the SDA pin (ACK bit) to indicate that the sensor data is received normally.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | Read and write bits |

0x38

As shown in Table 8, the sensor starts initialization, by sending '1011'1110' command. While the sensors starts temperature and humidity measurement by sending '1010'1100' command, and MCU should wait until the measurement is completed.

Table 8 Basic commands

| Code | Command | Meaning |
|---|---|---|
| 1011'1110 (0xBE) | Initialization command | Host hold |
| 1010'1100 (0xAC) | Measurement trigger | Host hold |

**Status byte description**

Table 9 shows the status bit description returned by the slave. Different bits represent different meanings, and their meanings are not the same.

Table 9 Status bit description

| Bit | Meaning | Description |
|---|---|---|
| Bit[7] | Busy indication | 1 -- busy, in measurement status<br>0 -- idle, sleep status |
| Bit[6:5] | Current working status | 00 means NOR mode<br>01 means CYC mode<br>1x means CMD mode |
| Bit[4] | Memory data integrity indicator | 1 - indicates that the integrity test failed<br>0 - indicates that the integrity test passed |
| Bit[3] | CAL Enable | 1 --calibrated<br>0 --uncalibrated |
| Bit[2:0] | Retain | Retain |

**Sensor reading process**

1. 40ms waiting time is required after power-on. Before reading the temperature and humidity value, check whether the calibration enable bit (Bit[3]) is 1 or not (you can get a status byte by sending 0x71). If it's not 1, send the 0xBE command (initialization), this command has two bytes, the first byte is 0x08, and the second byte is 0x00.
2. Send the 0xAC command (measurement trigger) directly. This command has two bytes, the first byte is 0x33, and the second byte is 0x00.
3. Wait for 75 ms for the measurement to be completed, and Bit[7] of the busy indicator is 0, and then six bytes can be read (read 0X71).
4. Calculate the temperature and humidity value.

**Note**: The calibration status check in the first step only needs to be checked when the power is turned on, which is not required during the normal reading process.

To trigger measurement

<table>
<tr><td>Start</td><td colspan="8">$I^2C$ address + write</td><td>ACK</td><td colspan="8">Measurement trigger<br>0xAC</td><td>ACK</td><td colspan="8">DATA0</td><td>ACK</td><td colspan="8">DATA1</td><td>ACK</td><td>Stop</td></tr>
<tr><td>S</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td></td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td>P</td></tr>
</table>

To read humidity and temperature data

<table>
<tr><td>Start</td><td colspan="8">$I^2C$ address + read</td><td>ACK</td><td colspan="8">Status</td><td>ACK</td><td colspan="8">Humidity data</td><td>ACK</td><td colspan="8">Humidity data</td><td>ACK</td></tr>
<tr><td>S</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr>
</table>

<table>
<tr><td colspan="8">Humidity data and temperature data</td><td>ACK</td><td colspan="8">Temperature data</td><td>ACK</td><td colspan="8">Humidity data</td><td>ACK</td><td colspan="8">CRC data</td><td>NAK</td><td>Stop</td></tr>
<tr><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td><td>P</td></tr>
</table>

| | Slave to master |
|---|---|
| ACK | Slave response ACK |
| ACK | Master response ACK |
| NAK | Master response NAK |
| S | Start |
| P | Stop |

Table 10 Description of sensor program commands

**Signal conversion**

Relative humidity conversion

The relative humidity RH can be calculated according to the relative humidity signal $S_{RH}$ output by SDA through the following formula (the result is expressed in% RH).

$$RH[\%]=(\frac{S_{RH}}{2^{20}})\times100\%$$

Temperature conversion

The temperature T can be calculated by substituting the temperature output signal ST into the following formula (the result is expressed in temperature ℃).

$$T[\square]=(\frac{S_{T}}{2^{20}})\times200-50$$

**Environmental stability**

When the sensor is used in equipment or machinery, it is necessary to place the sensor and the reference sensor under the same temperature and humidity conditions. In order to prevent errors caused by insufficient test time, when the sensor is placed in equipment or machinery, ensure that sufficient measurement time is reserved in the program design.

**Package**

WHT20 adopts double-sided no-lead flat package. The sensor chip is made of Ni/Au-plated copper lead frame. The weight of the sensor is about 19 mg, and the specific dimensions of the sensor are shown in Figure 12.

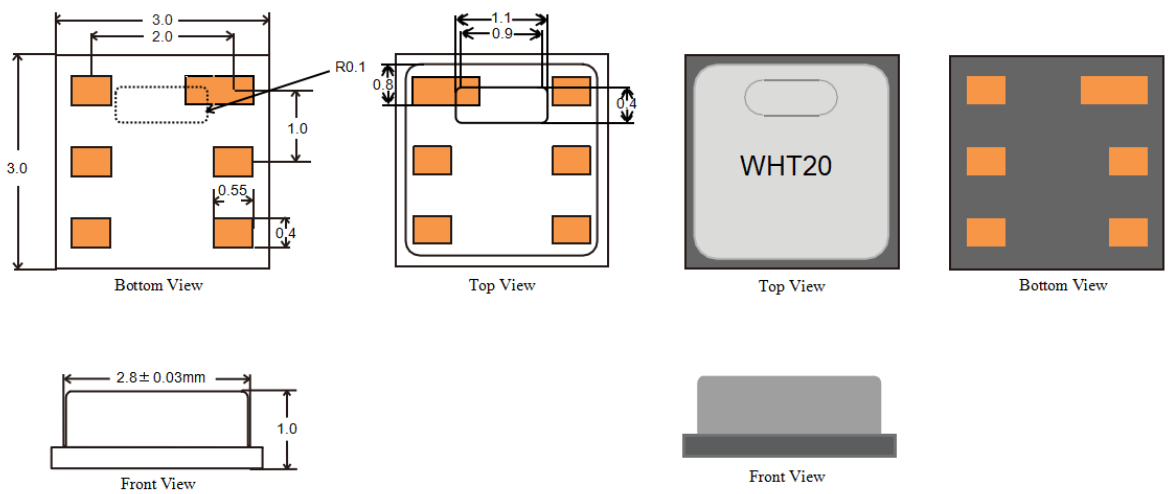



Figure 12 WHT20 sensor package diagram (unit: mm tolerance: ±0.1 mm)

WHT20 is packaged in tape and reel, sealed in an anti-static ESD bag. The standard packaging size is 5000 pieces per roll. For WHT20 packaging, the rear 400 mm (50 pcs sensors capacity) and front 200 mm (25 pcs sensors capacity) parts of each reel are empty.
The packaging diagram with sensor positioning is shown in Figure 13. The reel is placed in an anti-static bag.

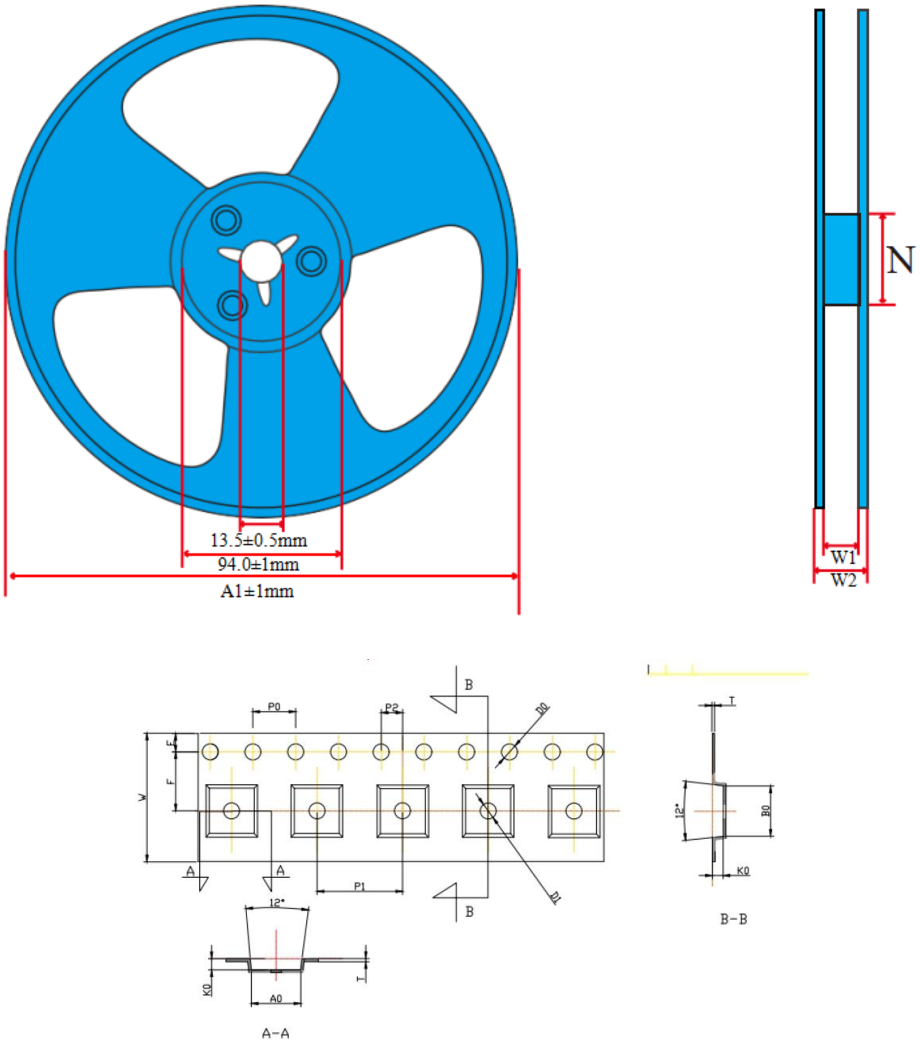



Fig13.Packaging tape and sensor location diagram

| Model | A1 | E | W1 | W2 | N |
|---|---|---|---|---|---|
| Scroll | 330 | 2 | 12.5 | 16.7 | 100 |

| Model | Unit | Tolerance | Quantity | Weight |
|---|---|---|---|---|
| Scroll | mm | ±0.5 | 5000(AMX) | 500/g |

| Model | A0 | B0 | K0 | P0 | P1 | P2 |
|---|---|---|---|---|---|---|
| tape | 3.23±0.1 | 3.23±0.1 | 1.05±0.1 | 4±0.1 | 8±0.1 | 2±0.1 |

| Model | W | T | F | E | D0 | D1 |
|---|---|---|---|---|---|---|
| tape | 12±0.3 | 0.2±0.05 | 5.5±0.1 | 1.75±0.1 | Φ15±0.05 | Φ15±0.05 |

**Tracking information**

All WHT20 sensors have laser markings on the surface. See Figure 14. There are labels on the reels, as shown in Figure 15, and other tracking information is provided.


Figure 154 Sensor laser marking

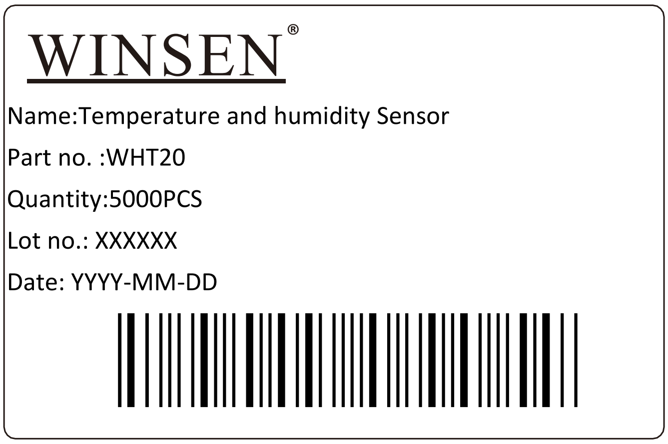



Figure 15 The label on the reel

**Important notice**

**Warning, Personal Injury**

Do not apply this product to safety protection devices or emergency stop equipment, and any other applications that may cause personal injury due to the product's failure. Do not use this product unless there is a special purpose or use authorization. Refer to the product data sheet and application guide before installing, handling, using or maintaining the product. Failure to follow this recommendation may result in death and serious personal injury.

**ESD Protection**

Due to the inherent design of the component, it is sensitive to static electricity. In order to prevent the damage caused by static electricity or reduce the performance of the product, please take necessary anti-static measures when using this product.

**Quality Assurance**

The company provides a 12-month (1 year) quality guarantee (calculated from the date of shipment) to direct purchasers of its products, based on the technical specifications in the product data manual published by Winsen. If the product is proved to be defective during the warranty period, the company will provide free repair or replacement. Users need to satisfy the following conditions:

1. Notify our company in writing within 14 days after the defect is found.
2. The defect of this product will help to find out the deficiency in design, material and technology of our product.
3. The product should be sent back to our company at the buyer's expense.
4. The product should be within the warranty period.

**Zhengzhou Winsen Electronics Technology Co., Ltd**
**Add:** No.299, Jinsuo Road, National Hi-Tech Zone, Zhengzhou 450001 China
**Tel:** +86-371-67169097/67169670
**Fax:** +86-371-60932988
**E-mail:** sales@winsensor.com
**Website:** www.winsen-sensor.com