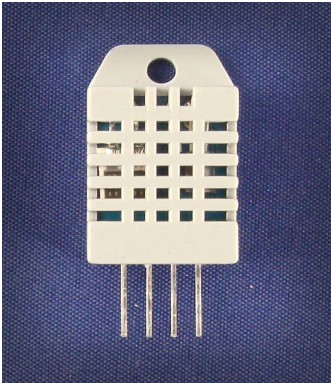# Digital-output relative humidity & temperature sensor/module AM2303



Capacitive-type humidity and temperature module/sensor

## 1. Feature & Application:

* Full range temperature compensated     * Relative humidity and temperature measurement
* Calibrated digital signal     *Outstanding long-term stability     *Extra components not needed
* Long transmission distance     * Low power consumption     *4 pins packaged and fully interchangeable

## 2. Description:

AM2303 output calibrated digital signal. It utilizes exclusive digital-signal-collecting-technique and humidity sensing technology, assuring its reliability and stability.Its sensing elements is connected with 8-bit single-chip computer.

Every sensor of this model is temperature compensated and calibrated in accurate calibration chamber and the calibration-coefficient is saved in type of programme in OTP memory, when the sensor is detecting, it will cite coefficient from memory.
Small size & low consumption & long transmission distance(20m) enable AM2303 to be suited in all kinds of harsh application occasions.

Single-row packaged with four pins, making the connection very convenient.

## 3. Technical Specification:

| Model | AM2303 |
|---|---|
| Power supply | 3.3-6V DC |
| Output signal | digital signal via single-bus |
| Sensing element | Polymer humidity capacitor & DS18B20 for detecting temperature |
| Measuring range | humidity 0-100%RH;          temperature -40~125Celsius |

| Accuracy | humidity +-2%RH(Max +-5%RH);     temperature +-0.2Celsius |
|---|---|
| Resolution or sensitivity | humidity 0.1%RH;     temperature 0.1Celsius |
| Repeatability | humidity +-1%RH;     temperature +-0.2Celsius |
| Humidity hysteresis | +-0.3%RH |
| Long-term Stability | +-0.5%RH/year |
| Sensing period | Average: 2s |
| Interchangeability | fully interchangeable |

# 4. Dimensions: (unit----mm)
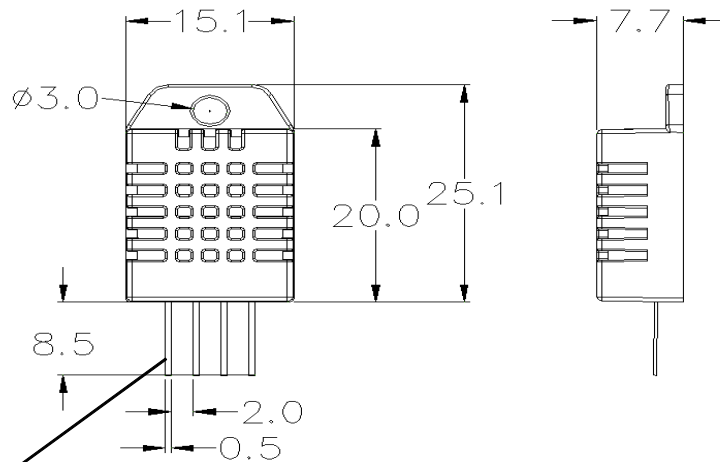


**Pin sequence number:  1 2 3 4 (from left to right direction).**

| Pin | Function |
|---|---|
| 1 | VDD----power supply |
| 2 | DATA--signal |
| 3 | NULL |
| 4 | GND |

# 5. Operating specifications:

**(1) Power and Pins**

Power's voltage should be 3.3-6V DC. When power is supplied to sensor, don't send any instruction to the sensor within one second to pass unstable status. One capacitor valued 100nF can be added between VDD and GND for wave filtering.

**(2) Communication and signal**

Single-bus data is used for communication between MCU and AM2303, it costs 5mS for single time communication.

Data is comprised of integral and decimal part, the following is the formula for data.
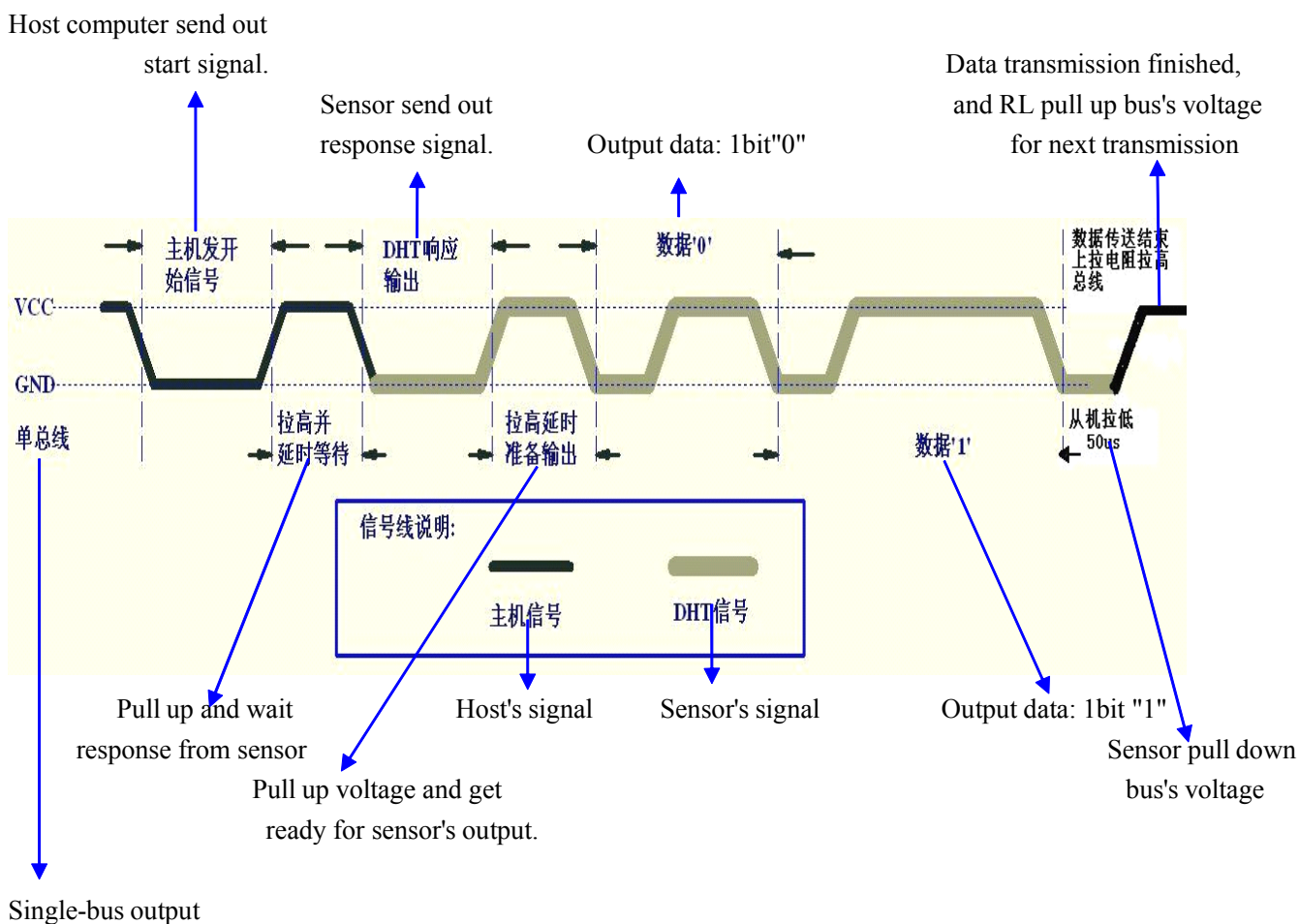
AM2303 send out higher data bit firstly!

  DATA=8 bit integral RH data+8 bit decimal RH data+8 bit integral T data+8 bit decimal T data+8 bit check-sum

If the data transmission is right, check-sum should be the last 8 bit of "8 bit integral RH data+8 bit decimal RH data+8 bit integral T data+8 bit decimal T data".

When MCU send start signal, AM2303 change from low-power-consumption-mode to running-mode. When MCU finishs sending the start signal, AM2303 will send response signal of 40-bit data that reflect the relative humidity and temperature information to MCU. Without start signal from MCU, AM2303 will not give response signal to MCU. One start signal for one time's response data that reflect the relative humidity and temperature information from AM2303. AM2303 will change to low-power-consumption-mode when data collecting finish if it don't receive start signal from MCU again.

1) Check bellow picture for overall communication process:

-------------------------------------------------------------------------------------------------------------

Host computer send out start signal.

Sensor send out response signal.

Output data: 1bit"0"

Data transmission finished, and RL pull up bus's voltage for next transmission

主机发开始信号

DHT响应输出

数据'0'

数据传送结束上拉电阻拉高总线

VCC

GND

单总线

拉高并延时等待

拉高延时准备输出

数据'1'

从机拉低 50us

信号线说明:

主机信号

DHT信号

Pull up and wait response from sensor

Host's signal

Sensor's signal

Output data: 1bit "1"

Sensor pull down bus's voltage

Pull up voltage and get ready for sensor's output.

Single-bus output

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2) Step 1: MCU send out start signal to AM2303

Data-bus's free status is high voltage level. When communication between MCU and AM2303 begin, program of MCU will transform data-bus's voltage level from high to low level and this process must beyond at least 18ms to ensure AM2303 could detect MCU's signal, then MCU will wait 20-40us for AM2303's response.
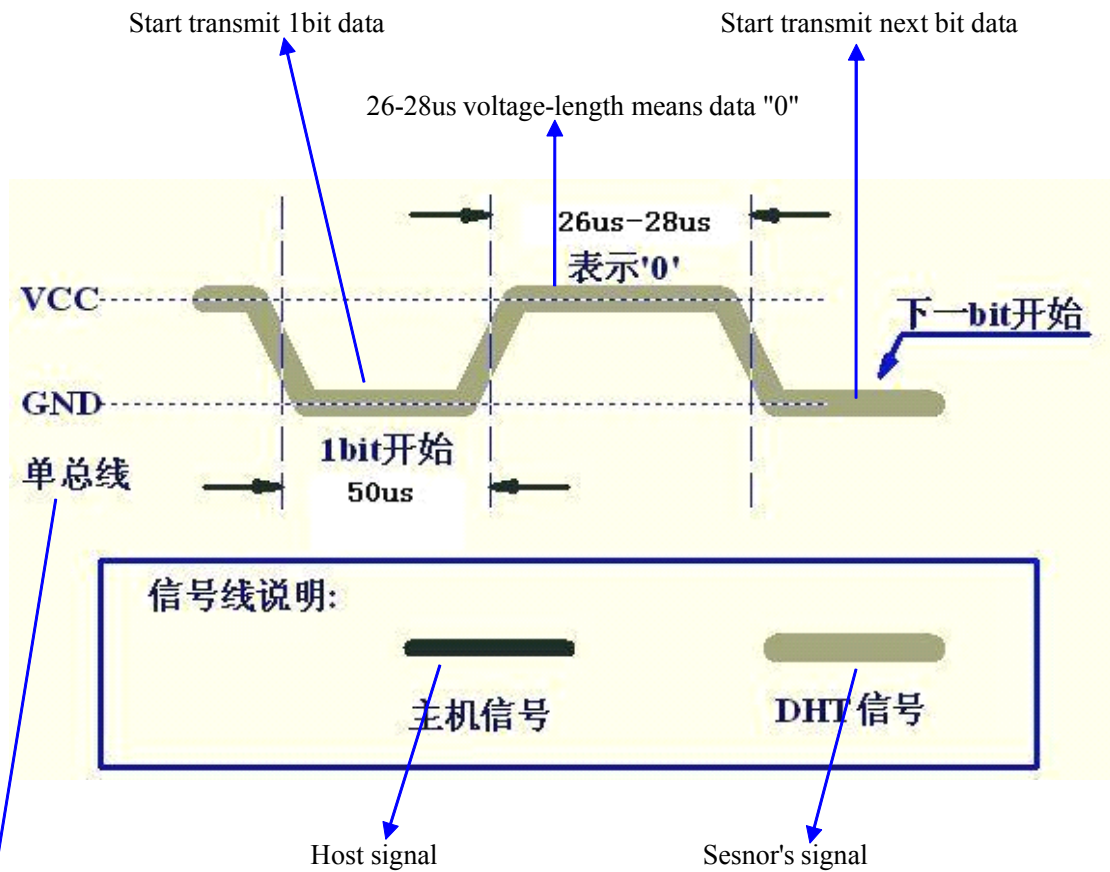
Check bellow picture for step 1:

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Host computer send start signal
- and keep this signal at least **500us**

Sensor send out response signal
- and keep this signal 80us

Host pull up voltage
-and wait sensor's response

Sesnor pull up bus's voltage

主机拉高
20-40us

DHT拉高
80us

VCC

开始传送数据

GND

单总线

主机至少拉低 18ms

DHT响应信号
80us

信号线说明：

主机信号

DHT信号

Signal from host

Start data transmission

Signal from sensor

Single-bus signal

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Step 2: AM2303 send response signal to MCU

When AM2303 detect the start signal, AM2303 will send out low-voltage-level signal and this signal last 80us as response signal, then program of AM2303 transform data-bus's voltage level from low to high level and last 80us for AM2303's preparation to send data.
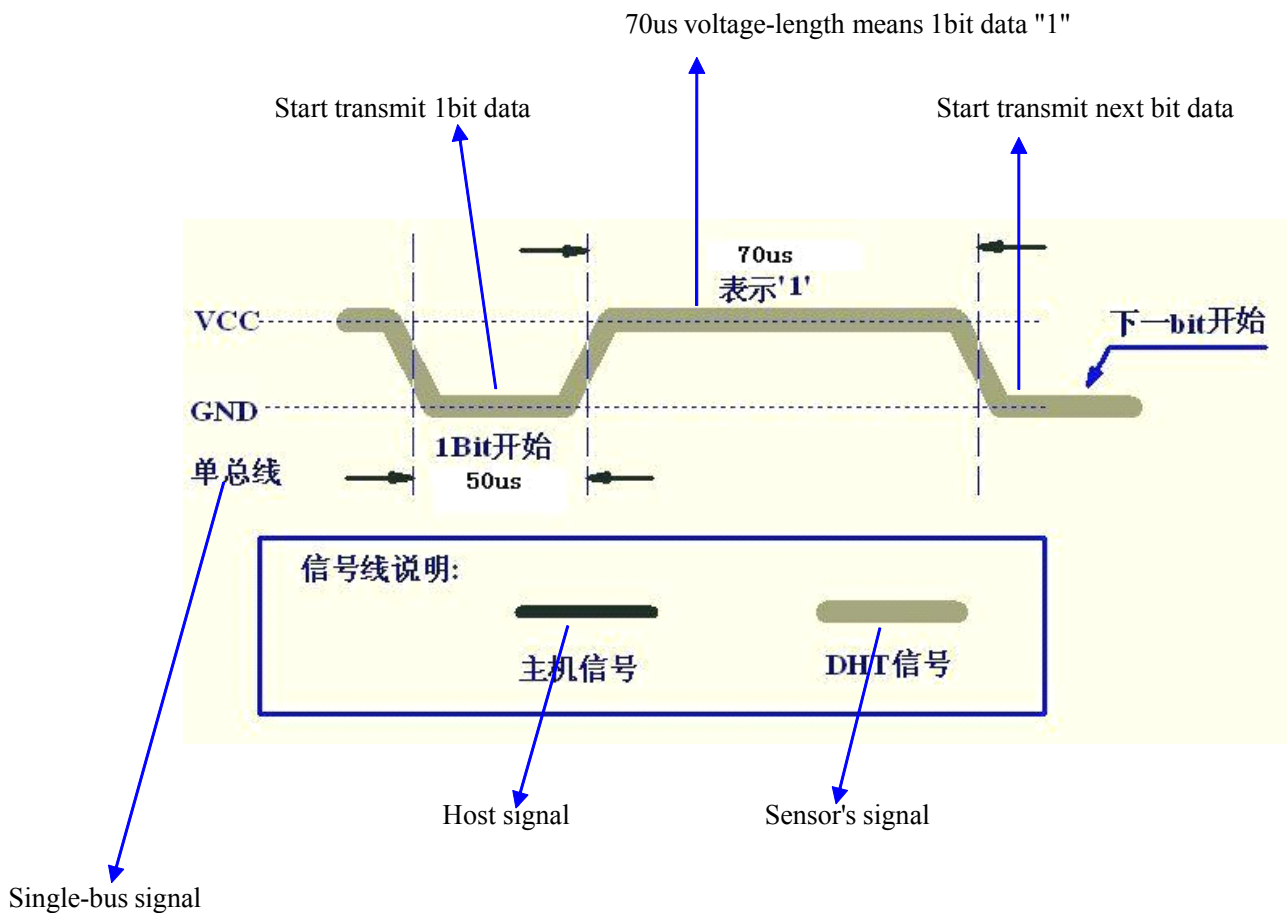
Check bellow picture for step 2:

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Start transmit 1bit data                                     Start transmit next bit data

26-28us voltage-length means data "0"



Host signal                                                  Sesnor's signal

Single-bus signal

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Step 3: AM2303 send data to MCU

When AM2303 is sending data to MCU, every bit's transmission begin with low-voltage-level that last 50us, the following high-voltage-level signal's length decide the bit is "1" or "0".

Check bellow picture for step 3:

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70us voltage-length means 1bit data "1"

Start transmit 1bit data

Start transmit next bit data

Host signal

Sensor's signal

Single-bus signal

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If signal from AM2303 is always high-voltage-level, it means AM2303 is not working properly, please check the electrical connection status.

# 6. Electrical Characteristics:

| Item | Condition | Min | Typical | Max | Unit |
|------|-----------|-----|---------|-----|------|
| Power supply | DC | 3.3 | 5 | 5.5 | V |
| Current supply | Measuring | 1.3 | 1.5 | 2.1 | mA |
| | Average | 0.5 | 0.8 | 1.1 | mA |
| Collecting period | Second | 1.7 | | 2 | Second |

*Collecting period should be : >1.7 second.

# 7. Attentions of application:

(1) Operating and storage conditions

We don't recommend the applying RH-range beyond the range stated in this specification. The DHT11 sensor

can recover after working in non-normal operating condition to calibrated status, but will accelerate sensors' aging.

(2) Attentions to chemical materials

Vapor from chemical materials may interfere AM2303's sensitive-elements and debase AM2303's sensitivity.

(3) Disposal when (1) & (2) happens

Step one: Keep the AM2303 sensor at condition of Temperature 50~60Celsius, humidity <10%RH for 2 hours;

Step two: After step one, keep the AM2303 sensor at condition of Temperature 20~30Celsius, humidity >70%RH for 5 hours.

(4) Attention to temperature's affection

Relative humidity strongly depend on temperature, that is why we use temperature compensation technology to ensure accurate measurement of RH. But it's still be much better to keep the sensor at same temperature when sensing.

AM2303 should be mounted at the place as far as possible from parts that may cause change to temperature.

(5) Attentions to light

Long time exposure to strong light and ultraviolet may debase AM2303's performance.

(6) Attentions to connection wires

The connection wires' quality will effect communication's quality and distance, high quality shielding-wire is recommended.

(7) Other attentions

* Welding temperature should be bellow 260Celsius.

* Avoid using the sensor under dew condition.

* Don't use this product in safety or emergency stop devices or any other occasion that failure of AM2303 may cause personal injury.