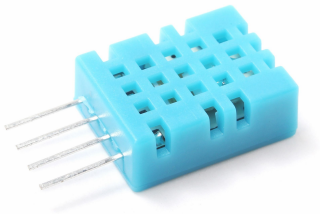

Digital relative humidity & temperature sensor DHT11

1. Feature & Application:

*Good precision
*Resistive type
*Full range temperature compensated
*Relative humidity and temperature measurement
*Calibrated digital signal
*Outstanding long-term stability
*Extra components not needed
*Long transmission distance, up to 100 meters
*Low power consumption
*4 pins packaged and fully interchangeable

2. Description:

DHT11 output calibrated digital signal. It applys 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(100m) enable DHT11 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	DHT11	
Power supply	3.3-5.5V DC	
Output signal	digital signal via Aosong 1-wire bus	
Sensing element	Polymer humidity resistor	
Operating range	humidity 20-90%RH;	temperature 0~50Celsius
Accuracy	**humidity +-5%RH**;	temperature +-2Celsius
Resolution or sensitivity	humidity 1%RH;	temperature 1Celsius
Repeatability	humidity +-2%RH;	temperature +-1Celsius
Humidity hysteresis	+-1%RH	
Long-term Stability	+-1%RH/year	
Interchangeability	fully interchangeable	

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

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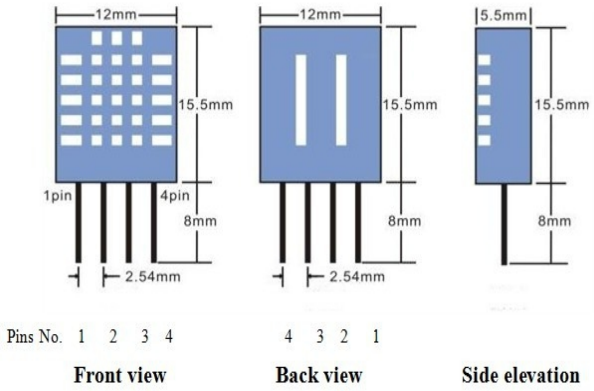
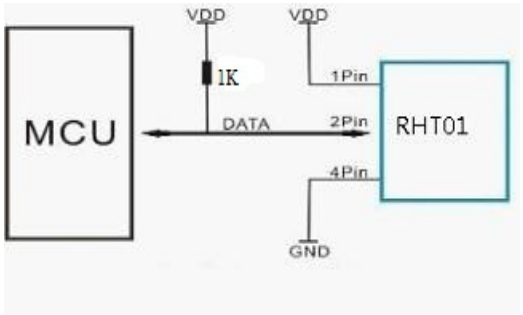


5. Electrical connection diagram:



6. Operating specifications:

(1) Power and Pins

Power's voltage should be 3.3-5.5V 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

Aosong 1-wire bus is used for communication between MCU and DHT11. (Aosong 1-wire bus is specially designed by Aosong Electronics Co., Ltd. , it's different from Maxim/Dallas 1-wire bus, so it's incompatible with Dallas 1-wire bus.)

Illustration of Aosong 1-wire bus:

DATA=16 bits RH data+16 bits Temperature data+8 bits check-sum

Example: MCU has received 40 bits data from DHT11 as

0010 0001	**0000 0000**	**0001 1010**	**0000 0000**	**0011 1011**
Integral part of RH	Decimal part of RH	Integral part of T	Decimal part of T	check sum

Remarks: The decimal part of RH and T is always 0000 0000.

Here we convert integral part of RH from binary system to decimal system,

0010 0001 → 33

Binary system Decimal system, **RH=33%RH**

Here we convert integral part of T from binary system to decimal system,

0001 1010 → 26

Binary system Decimal system, **T=26 Celsius**

Sum=0010 0001+0000 0000+0001 1010+0000 0000=0011 1011

Check-sum=the last 8 bits of Sum=0011 1011

When MCU send start signal, DHT11 change from standby-status to running-status. When MCU finishs sending the start signal, DHT11 will send response signal of 40-bit data that reflect the relative humidity and temperature to MCU. Without start signal from MCU, DHT11 will not give response signal to MCU. One start signal for one response data from DHT11 that reflect the relative humidity and temperature. DHT11 will change to standby status

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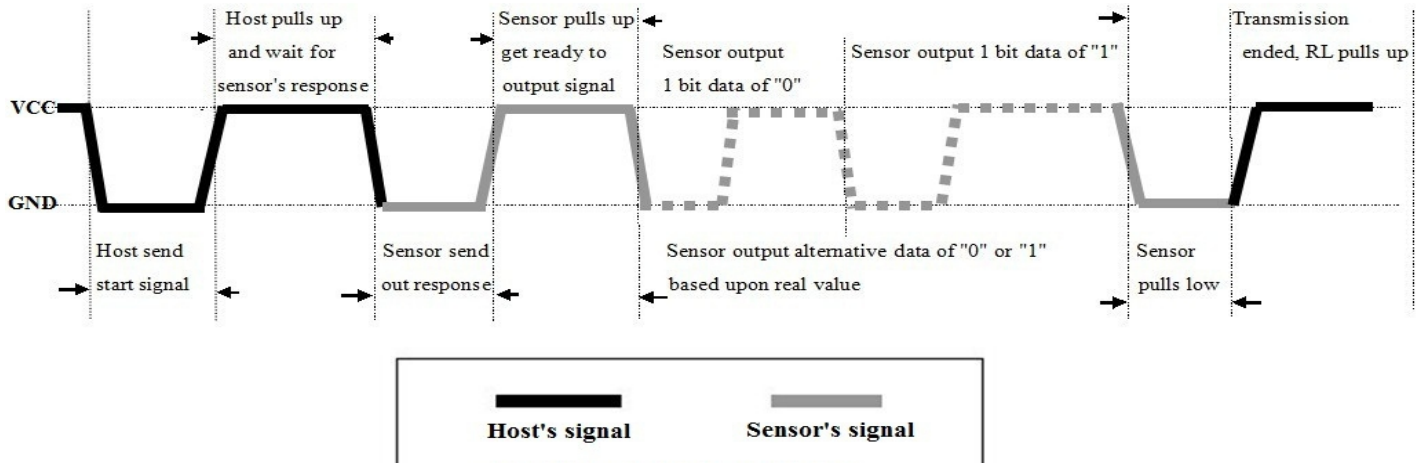
when data collecting finished if it don't receive start signal from MCU again.

See below figure for overall communication process, **the interval of whole process must beyond 2 seconds.**



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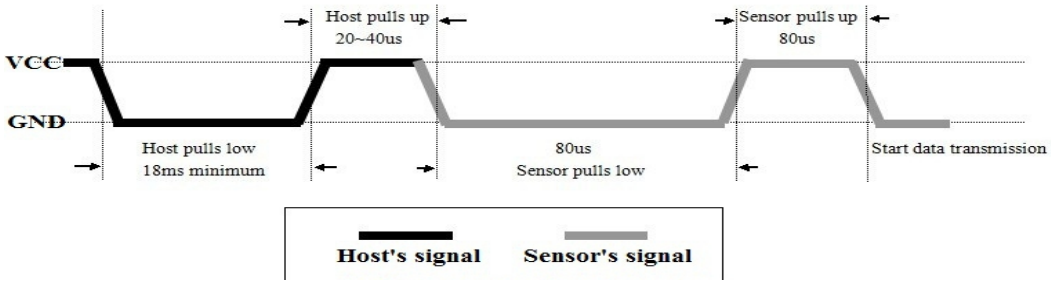
1) Step 1: MCU send out start signal to DHT11 and DHT11 send response signal to MCU

Data-bus's free status is high voltage level. When communication between MCU and DHT11 begins, MCU will pull low data-bus and this process must beyond at least 1~10ms to ensure DHT11 could detect MCU's signal, then MCU will pulls up and wait 20-40us for DHT11's response.

When DHT11 detect the start signal, DHT11 will pull low the bus 80us as response signal, then DHT11 pulls up 80us for preparation to send data. See below figure:



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2). Step 2: DHT11 send data to MCU

When DHT11 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". See below figures:

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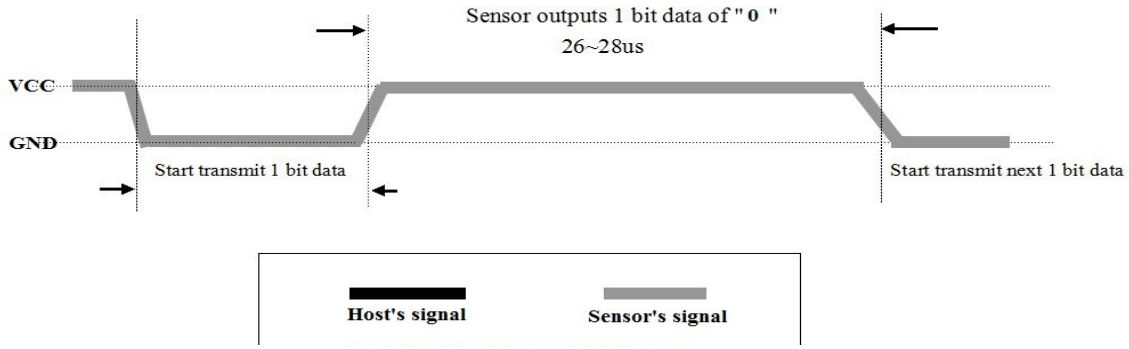

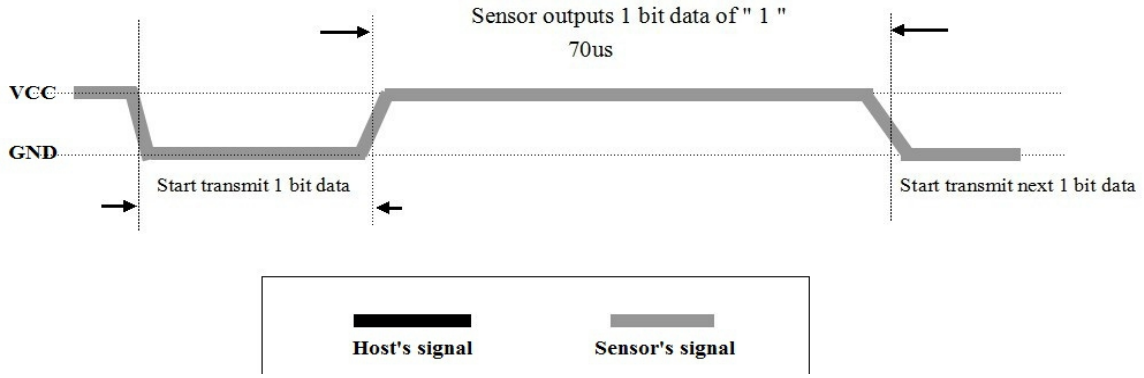

Attention:

If signal from DHT11 is always high-voltage-level, it means DHT11 is not working properly, please check the electrical connection status.

7. Electrical Characteristics:

Items	Condition	Min	Typical	Max	Unit
Power supply	DC	3.3	5	6	V
Current supply	Measuring	1		1.5	mA
	Stand-by	40	Null	50	uA
Collecting period	Second		2		Second

8. Error and sources of error:

Measure values maybe influenced by follow factors:

Humidity errors

Equilibration time too short, steam, water sprays, dripping water or condensation at the sensor, etc.

Temperature errors

Equilibration time too short, cold or hot outside wall, sunlights, heating elements, etc.

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9. 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 abnormal operating condition to calibrated status, but will accelerate sensors' aging.

(2) Attentions to chemical materials

Vapor from chemical materials may interfere DHT11's sensitive-elements and debase DHT11's sensitivity.

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

Step one: Keep the DHT11 sensor at condition of Temperature 50~60Celsius, humidity <10%RH for 2 hours;

Step two: After step one, keep the DHT11 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.

DHT11 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 DHT11'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 DHT11 may cause personal injury.

10. Warnings:

Don’t use this item on safety or emergency stop devices and any other application which may cause injury due to the failure of this item.

11. Quality Warranty:

Aosong warrants that this product will be free from defects in materials and workmanship for a period of 365 days from the date of shipment. If any such product proves defective during this warranty period, Aosong, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement for the defective product.

In order to obtain service under this warranty, customer must notify Aosong of the defect before the expiration of the warranty period and make proper prove for the defect. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Aosong, with shipping charges prepaid. Aosong

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shall pay for the return of the product to customer if the shipment is to a location within the country in which the Aosong service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Aosong shall not be obligated to furnish service under this warranty

a) to repair damage resulting from attempts by personnel other than Aosong representatives to repair the product;

b) to repair damage resulting from improper use or connection to incompatible equipment;

c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

Special notes: quality problem caused by following reasons is not warranted:

(1): Damaged by human factor

(2): Application beyond the using range as stated in product's technical specification

(3): Damaged by corrosive or acid or alkaline air

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