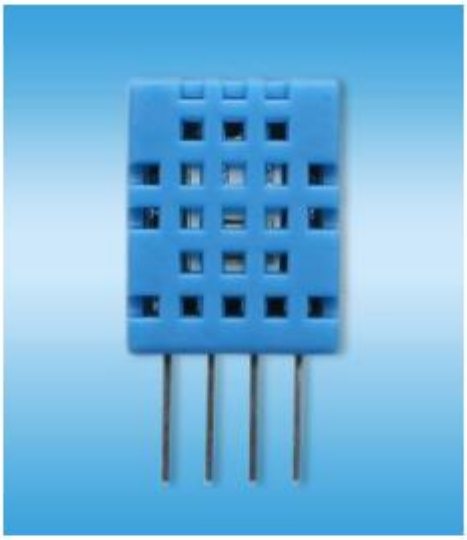
AOSONG

Temperature and Humidity Module
DHT11 Product Manual



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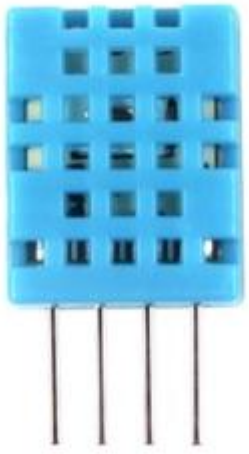
Document modification record

The date of	version	Modify the content
The 2017-03-31	V1.3	1. The "resistance type moisture component" in product description is changed to "capacitive moisture component". 2. Updated the product dimension diagram. 3. Updated 5.1 relative humidity parameter list to form form, measuring range of 20-90%RH 5-95% RH. 4. 5.2 temperature parameter list to update the tabular form, measuring range is 0 to 50 ℃ to - 20 to 60 ℃. 5. Updated the 5.3 temperature parameter list to form form. 6. The first step of the typical circuit is 5.1k, which is 4.7k, and the 3 th is changed to 2 seconds, increasing the 4th pointThe content. 7. Add table 10 single bus signal characteristics.

product overview

The DHT11 digital temperature and humidity sensor is a temperature and humidity composite sensor with the output of calibrated digital signals. It applies dedicated digital module acquisition technology and temperature and humidity sensing technology to ensure high reliability and long-term stability of products. The sensor includes a capacitive sensing element and an NTC temperature measuring element, which is connected to a high-performance 8-bit single-chip microcomputer.



Application scope

Hvac, dehumidifier, agriculture, cold chain, warehousing, testing and detection equipment, consumer goods, automotive, automatic control, data recorder, weather stations, household appliances, humidity regulator, medical and other relative humidity control.

Product highlights

Low cost, long-term stability, relative humidity and temperature measurement, high quality, super fast response, strong anti-interference ability, long signal transmission distance, digital signal output, precise calibration.

4. External dimension (unit: mm)

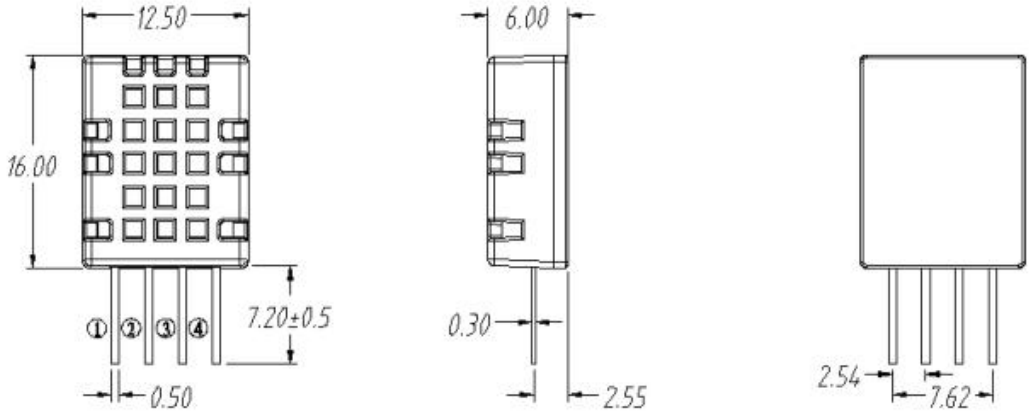


FIG. 1 product dimension diagram

Pin description

1. VDD power supply 3.3 ~ 5.5V DC
2. DATA serial DATA, single bus
3. NC empty feet
4. GND grounding, power supply negative

product parameters

5.1 relative humidity

Table 1 relative humidity performance table

parameter	conditions	min	type	max	unit
Scale range		5		95	%RH
Precision [1]	25℃		±5		%RH
repetitive			±1		%RH
interchangeability		Completely interchangeable			
The response time	1 / e(63%)		<6		S
hysteresis			±0.3		%RH
drift	Typical values		<±0.5		%RH / A year

5.2 the temperature

Table 2 temperature performance table

parameter	conditions	min	type	max	unit
Scale range		-20			℃
Precision [1]	25℃		±2		℃
repetitive			±1		
interchangeability		Completely interchangeable			
The response time	1 / e(63%)		<10		℃
hysteresis			±0.3		s
drift	Typical values		<±0.5		℃ A year

5.3 electrical characteristics

Table 2 electrical characteristics

parameter	conditions	min	type	max	unit
The power supply voltage		**3.3**	**5.0**	**5.5**	**V**
The power supply current		**0.06 (standby)**	**-**	**1.0 (measurement)**	**mA**
Sampling period	**measurement**		**>2**		**S/time**

[1] the precision of factory inspection, sensors in 25 ℃ and 5 v, under the condition of test precision index, it does not include the hysteresis and nonlinear, and is only suitable for the condensation environment.
[2] at 25 ℃ and 1 m/s air conditions, 63% of first order response time.
[3] the number may be higher in volatile organic compounds. See instructions for storing information.

Typical circuits

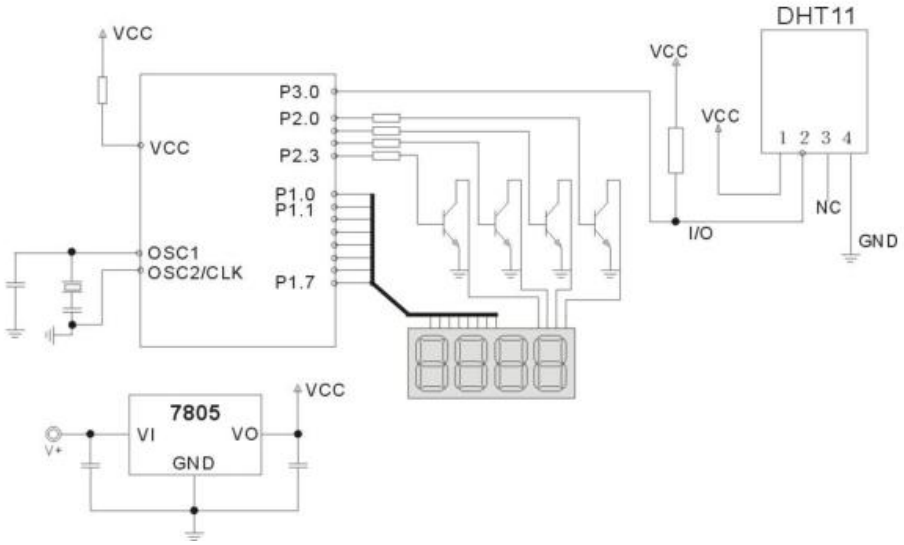


FIG. 1 2 DHT11

The typical application circuit of the microprocessor and DHT11 is shown in the figure above, which is connected to the I/O port of the microprocessor.

1. In typical application circuit, it is recommended that the length of cable length is shorter than 5m, with a pull resistance of 4.7k, which is lower than 5m according to the actual situation Resistance.

2. When using 3.3V voltage power supply, the cable shall be as short as possible, and the connection too long will cause the sensor to supply insufficient power, resulting in measurement deviation.

3. The value of the temperature and humidity reading is the result of the last measurement. To obtain real-time data, it is required to read two consecutive times, but it is not recommended to be repeated several times

Reading the sensor, each time the sensor is read more than 2 seconds, can obtain accurate data.

5. If there is any fluctuation in the power supply, it will affect the temperature. If the switch power ripple is too large, the temperature will jump.

7. Serial communication (one-way two-way)

A single bus specification

DHT11 devices use a simplified single bus communication. Single bus is the only data line, the data exchange and control in the system are completed by single bus. The device (host or slave) connects to the data line through an open port or a three-state port to allow the device to release the bus without sending the data, while other devices use the bus; Single bus usually require an external one is about 4.7 k Ω pull-up resistors, so that when the bus is idle, its status as a high level. Because they are the master-slave knot, only the host the call from the machine, the machine can respond, so the host access device must be strictly follow the sequence of single bus, if there is a sequence of chaos, the device will not respond to the host.

The single bus transmits data bit definitions

DATA is used for communication and synchronization between microprocessor and DHT11, and a single bus DATA format is used to transmit 40 DATA at a time.

Data format:

8bit humidity integer data + 8bit humidity decimal data + 8bit temperature integer data + 8bit temperature decimal data + 8bit check bit.

Note: the humidity fraction is 0.

The checkbit data definition

"8bit humidity integer data + 8bit humidity decimal data + 8bit temperature integer data + 8bit temperature decimal data" 8bit check bit is equal to

The end of the result is 8.

The name says	Definition of single bus format
Start signal	The microprocessor pulls the data bus (SDA) down for a period of time at least 18ms (maximum no more than 30ms), notifying the sensor to prepare the data.
The response signal	The sensor lowers the data bus (SDA) to 83 (s) and then high 87 (s) to respond to the host's initial signal.
The data format	After receiving the host initial signal, the sensor is sent out of the data bus (SDA) at one time with 40 data
humidity	Humidity position is the data of humidity integral part, humidity low is partial data of humidity
The temperature	The temperature is high as part of the data of the temperature. The temperature is low as part of the data of the temperature, and the temperature low bit 8 is the negative temperature, otherwise the

	temperature is positive
Check digit	Check position = humidity high + humidity low + temperature high + temperature low

Example One：40 receives the data to:

0011 0101	0000 0000	0001 1000	0000 0000	0100 1101
High humidity 8	Low humidity 8	High temperature 8	Low temperature 8	Parity bit

Calculated as follows:

0011 0101+0000 0000+0001 1000+0000 0000= 0100 1101

Receive data is correct:

Humidity: 0011 0101=35H=53%RH

Temperature:0001 1000=18H=24℃

Example Two: The received data is 40:

0011 0101	0000 0000	0001 1000	0000 0000	0100 1001
High humidity 8	High humidity 8	High temperature 8	High temperature 8	Parity bit

Calculated as follows:

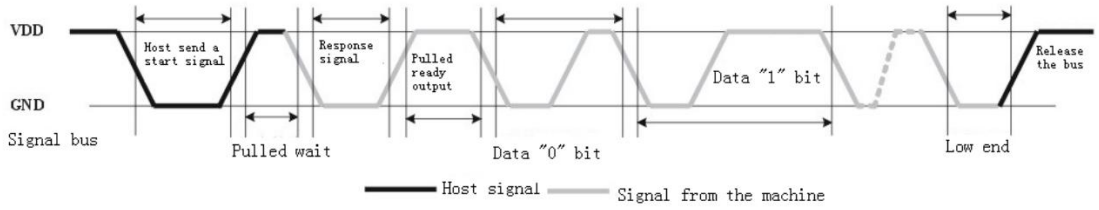
0011 0101+0000 0000+0001 1000+0000 0000 = 0100 1101

01001001 is not equal to 01001101

The received data is not correct, give up, again receiving data.

◎Data Timing Diagram

Hosts (MCU) after sending a start signal, DHT11 transition from a low-power mode to high-speed mode, the host until after the end of the start signal, DHT11 send a response signal, send 40bit data acquisition and trigger a letter. Signal transmission shown in fig.



Data Timing Diagram

Note: the temperature and humidity data that the host reads from DHT11 is always the previous measurement value, such as the long interval between the two measurements, please read twice

The second obtained value is the real-time temperature and humidity value.

◎ Peripheral reading step

Communication between master and slave can be completed by the following steps (peripherals (such as a microprocessor) to read step DHT11 data).

Step one:

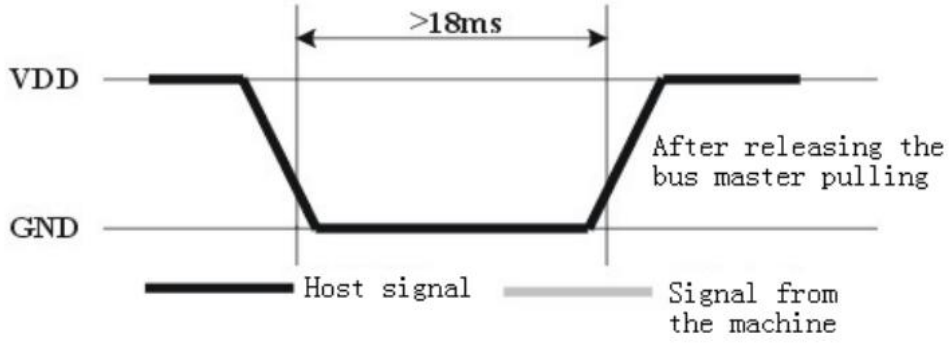
DHT11 after power (power after DHT11 1S to wait to cross the unstable state during this period can’ t send any commands), test environment temperature and humidity data, and record data while

the data lines DATA DHT11 pulled by a pull-up resistor remains high; DHT11 this time the DATA

pin is the input state, always detect external signals.

Step two:

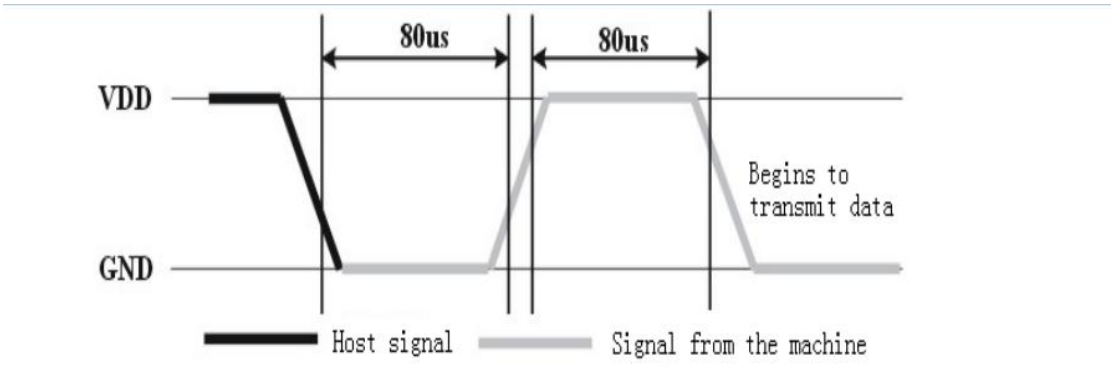
Microprocessor I / O output while the output is set to low, and low retention time can’ t be less than 18ms, then the microprocessor I / O is set to enter the state, due to the pull-up resistor, the microprocessor I / O that the data lines DHT11 also will go high, waiting to answer DHT11 signals transmitted signal as shown:



The host sends a start signal

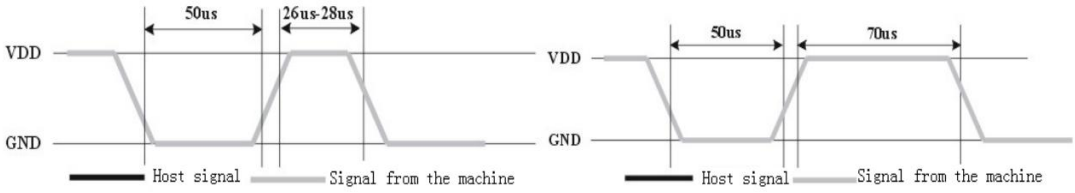
Step 3:

DHT11 external signal detected DATA pin has a low electricity at ordinary times, waiting for an external signal end of low level, delay of DHT11 DATA pins in the output state, output low level as the response signal of 83 microseconds, followed by the output high level notice peripherals is ready to receive the DATA of 87 microseconds, the I/O at this time of the microprocessor in the input state, detect the I/O has a low level (DHT11 response signal), after waiting for 87 microseconds after the high level of DATA reception, sending signals as shown:



Step four:

By DHT11 DATA output pin 40 DATA, microprocessor according to the change of the I/O level received 40 DATA, a DATA format for: "0" 54 microseconds, low level and high level of 23-27 microseconds, a DATA format for: "1" 54 microseconds, low level and high level of 68-74 microseconds. The data "0" and "1" format signal as shown in fig:



Bit data "0" format　　Bit data "1" format

End signal:

After the DATA pins of DHT11 output 40 bits of DATA, the output of the low level 54 microsecond will be changed to the input state, since the upper pull resistance then becomes high level. But DHT11 internally retests the environmental temperature and humidity data, and records the data, waiting for the external signal to arrive.

Table 10 single bus signal characteristics

symbol	parameter	min	type	max	单位
T be	Host start signal pull down time	10	20	50	ms
T go	Host release bus time	10	13	35	μS
T rel	The response time is low	78	83	88	μS
T reh	Response high level time	80	87	92	μS
T LOW	Signal "0", "1" low level time	50	54	58	μS
T H0	Signal "0" high level time	23	24	27	μS
T H1	Signal "1" high level time	68	71	74	μS
T en	The sensor releases the bus time	52	54	56	μS

Note: in order to ensure the accurate communication of the sensor, the user should design the parameters and timing sequence of table 10 and figure 21 in strict accordance with table 10 and figure 21.

Application information

1. Work and storage conditions

A temporary drift signal of up to 3%RH can be caused by the above recommended work range.
After returning to the normal working bar, the sensor will slowly move to the school
Quasi - state law. To speed up the recovery process can "participate in recovery processing".
Prolonged use of non-normal working conditions will accelerate the aging process.
Avoid placing components in a dry and exposed environment for long periods of time.
A, salt fog;
B, acidic or oxidized gases, such as sulfur dioxide or hydrochloric acid;
Recommended storage environment
Temperature: 10 ~ 40 ℃, humidity below 60% RH.

2. Exposure to chemicals

The induction layer of the capacitive humidity sensor is disturbed by chemical vapor. The diffusion of the chemical in the induction layer can lead to the drift of measured value and the decrease of sensitivity. In a pure environment, the pollutants will release slowly. The recovery process described below will speed up the implementation of this process. A high

concentration of chemical pollution can lead to complete damage to the sensor layer.

3. Temperature influence

The relative humidity of the gas depends largely on temperature. Therefore, when measuring humidity, it is necessary to ensure that humidity sensors work at the same temperature. If Shared with electronic components heat released a printed circuit board, should as far as possible when installing sensors into electronic components, and installed at the bottom of the heat source, and at the same time to keep the good ventilation of the enclosure. In order to reduce heat conduction, the copper plating of the other parts of the sensor and the printed circuit board should be as minimal as possible and allow a gap between the two.

4. Influence of light

Prolonged exposure to sunlight or intense ultraviolet radiation can degrade performance.

5. Recovery processing

The sensor, placed under extreme working conditions or chemical vapor, can be restored to the on-time status of the school by the following processing procedure. In 45 ℃ and 10% RH of humidity for 2 hours (drying); Then in about 20 to 30 ℃, and > 70% RH humidity to keep more than 5 hours.

6. Matters needing attention

The quality of DATA signal wire can affect communication distance and communication quality, and it is recommended to use high quality shielding wire.

7. Welding information

1, manual welding, the highest temperature of 300 ℃ under the condition of contact time must be less than 3 seconds.

2. No wave soldering.

3. Do not use alcohol, washboard water or other liquid cleaning.

8. Product upgrading

Please refer to our technical department.

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