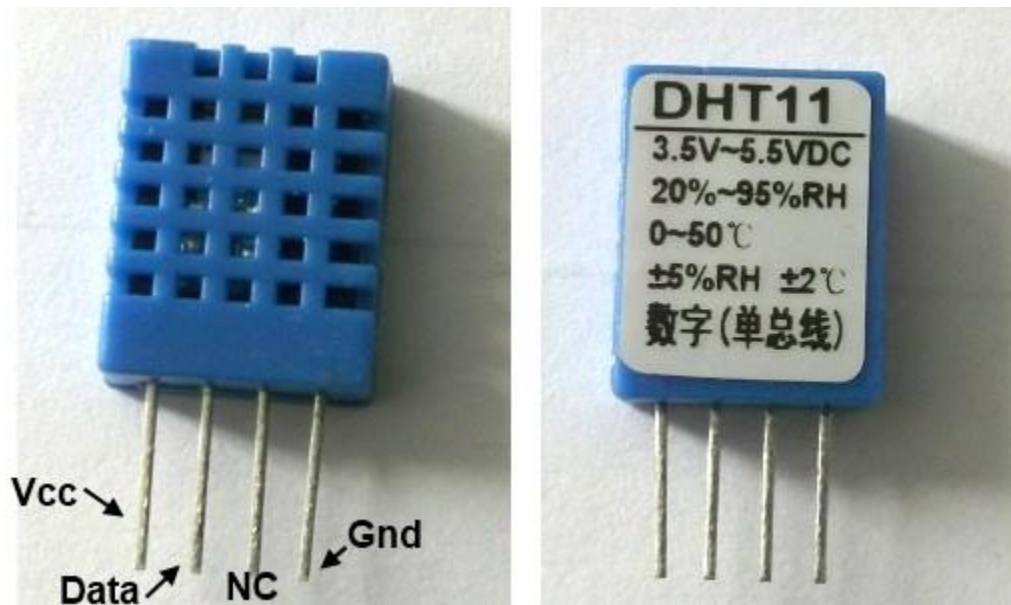The DHT11 sensor comes in a single row 4-pin package and operates from 3.5 to 5.5V power supply. It can measure temperature from 0-50 °C with an accuracy of ±2°C and relative humidity ranging from 20-95% with an accuracy of ±5%. The sensor provides fully calibrated digital outputs for the two measurements. It has got its own proprietary 1-wire protocol, and therefore, the communication between the sensor and a microcontroller is not possible through a direct interface with any of its peripherals. The protocol must be implemented in the firmware of the MCU with precise timing required by the sensor.

DHT11 sensor comes in a single row 4-pin package

The following timing diagrams describe the data transfer protocol between a MCU and the DHT11 sensor. The MCU initiates data transmission by issuing a "*Start*" signal. The MCU pin must be configured as output for this purpose. The MCU first pulls the data line low for at least 18 ms and then pulls it high for next 20-40 ?s before it releases it. Next, the sensor responds to the MCU "*Start*" signal by pulling the line low for 80 ?s followed by a logic high signal that also lasts for 80 ?s. Remember that the MCU pin must be configured to input after finishing the "*Start*" signal. Once detecting the response signal from the sensor, the MCU should be ready to receive data from the sensor. The sensor then sends 40 bits (5 bytes) of data continuously in the data line. Note that while transmitting bytes, the sensor sends the most significant bit first.
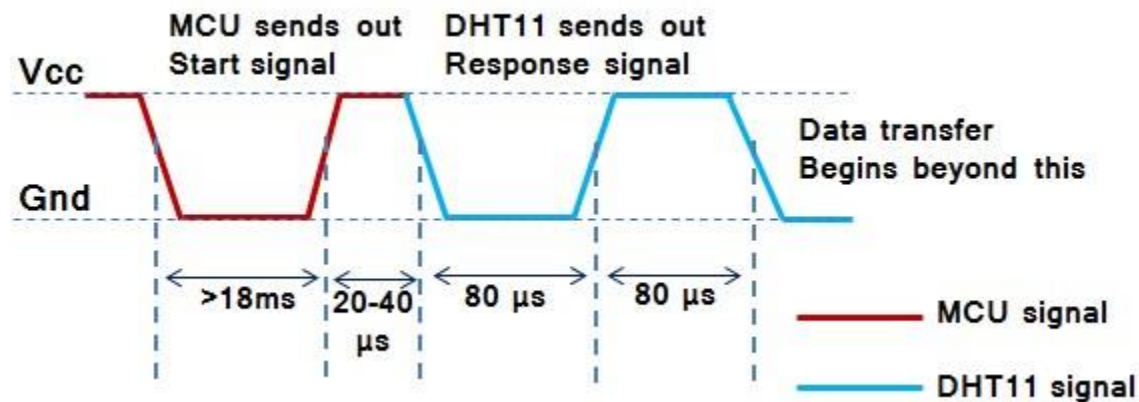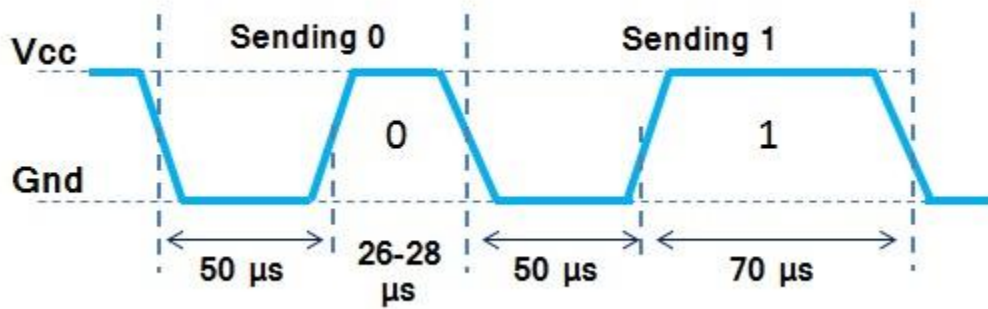
"Start" and "Response" signals

The 40-bit data from the sensor has the following structure.

Data (40-bit) = Integer Byte of RH + Decimal Byte of RH + Integer Byte of Temp. + Decimal Byte of Temp. + Checksum Byte

For DHT11 sensor, the decimal bytes of temperature and humidity measurements are always zero. Therefore, the first and third bytes of received data actually give the numeric values of the measured relative humidity (%) and temperature (°C). The last byte is the checksum byte which is used to make sure that the data transfer has happened without any error. If all the five bytes are transferred successfully then the checksum byte must be equal to the last 8 bits of the sum of the first four bytes, i.e.,

Checksum = Last 8 bits of (Integer Byte of RH + Decimal Byte of RH + Integer Byte of Temp. + Decimal Byte of Temp.)

Now lets talk about the most important thing, which is signalling for transmitting "0" and "1". In order to send a bit of data, the sensor first pulls the line low for 50 ?s. Then it raises the line to high for 26-28 ?s if it has to send "0", or for 70 ?s if the bit to be transmitted is "1". So it is the width of the positive pulse that carries information about 1 and 0.

Timing difference for transmitting "1s" and "0s"
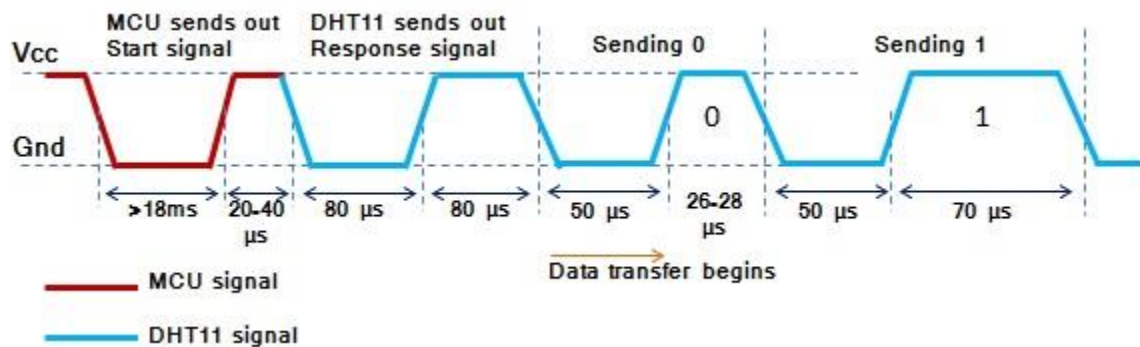
Start, Response and Data signals in sequence

At the end of the last transmitted bit, the sensor pulls the data line low for 50 ?s and then releases it. The DHT11 sensor requires an external pull-up resistor to be connected between its Vcc and the data line so that under idle condition, the data line is always pulled high. After finishing the data transmission and releasing the data line, the DHT11 sensor goes to the low-power consumption mode until a new "*Start*" signal arrives from the MCU.

Note:

- DHT11
- 0-50° C
- 20-90%RH
- asong
- (and there's a serial number)

From the Aosong website, I picked up the following for similar sensors...

Data on the AM2302. The data sheet says that "DHT22" is another name for the AM2302

- AM2302 / DHT22
- Vcc: 3.3-6v DC
- Sensing element polymer capacitor
- Sensing range: -40 to +80° C
- Sensing range: 0-100%RH
- Accuracy: humidity +/- 2%RH (max +/- 5%RH)
- Accuracy: temperature <+/- 0.5° Celsius
- Resolution: humidity 0.1%RH
- Resolution: temperature 0.1° Celsius
- Repeatability: humidity +/- 1%RH
- Repeatability: temperature +/- 0.2° Celsius
- Current used: Operating: 1 1.5 mA (that may be a typo)
- Current used: Standby: 50 uA

Data on the AM2303.

- AM2303 / DHT??
- Vcc: 3.3-5.5v DC (Says 6 in one place, 5.5 max in another)
- Sensing element polymer capacitor
- Temperature sensor: Dallas DS18B20
- Sensing range: 0-100%RH
- Sensing range: -40 to +125° C
- Accuracy: humidity +/- 2%RH (max +/- 5%RH)
- Accuracy: temperature +/- 0.2° Celsius
- Resolution: humidity 0.1%RH
- Resolution: temperature 0.1° Celsius
- Repeatability: humidity +/- 1%RH

- Repeatability: temperature +/- 0.2° Celsius
- Current used: Operating: 1.5 mA
- Current used: "Average": 0.8 mA

References:

http://embedded-lab.com/blog/wp-content/uploads/2012/01/DHT11Sensor1.jpg

https://akizukidenshi.com/download/ds/aosong/DHT11.pdf