ES-13507

High-Accuracy, Ultra-Low-Power, 16-bit Relative Humidity and Temperature One Wire Sensor.

Features

- Relative humidity accuracy: up to ±1.8 %RH
- Temperature accuracy: ±0.18 °C
- Supply voltage: 2.97 V … 3.6 V
- Average current: 400 µA (at meas. rate 1 Hz)
- Fully calibrated
- 1-wire interface
- Pore size range: 5 to 120 microns
- Dustproof and interception effect, high filtration efficiency.
- Operating range: 0…100 %RH, -40…125 °C
- Fully functional in condensing environment
- Variable power heater
- Sensor is JEDEC JESD47 qualification
- Breathable shell
- Corrosion resistance
- 150 bar anti-pressure capability

1. General Description

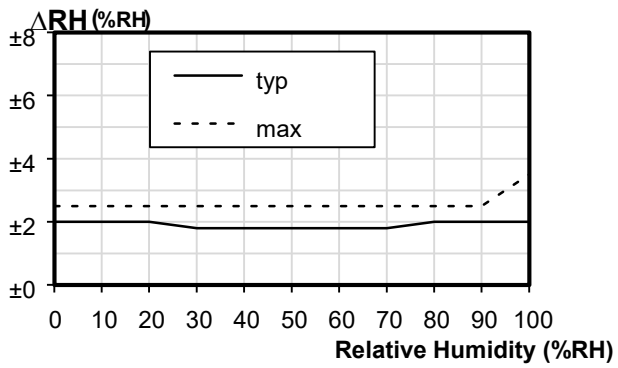
ES-13507 is a digital sensor probe for measuring relative humidity and temperature. Its 1 Wire interface provides several preconfigured commands and maintains an ultra-low power budget. The one-wire digital humidity and temperature sensor probe build on a completely new and optimized CMOSens chip that offers reduced power consumption and improved accuracy specifications encapsulated within a breathable metal shell probe.
The probe connector is Mini Round Shell type and wire length is 1 meter. It could be a great choice for measuring Humidity and Temperature in harsh environment.

2. Humidity and Temperature Sensor Specifications

Every Sensor is individually tested and calibrated in factory and is identifiable by its unique serial Number. The calibration of the reference, used for the calibration of the transfer standards, is NIST traceable through an ISO/IEC 17025 accredited laboratory.

2.1 Relative Humidity

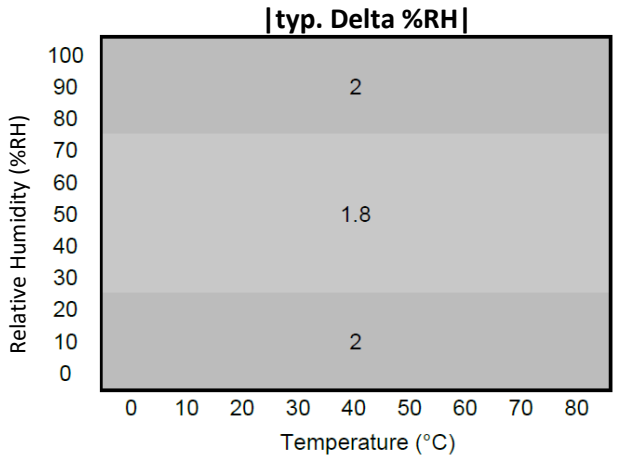
Parameter	Conditions	Value	Units
RH accuracy	typ.	1.8	%RH
	max.	see Figure	-
Repeatability	high	0.08	%RH
	medium	0.15	%RH
	low	0.25	%RH
Resolution	-	0.01	%RH
Hysteresis	At 25°C	0.8	%RH
Specified range	extended	0 to 100	%RH
Response time	$t_{63\%}$	4	s
Long-term drift	typ.	<0.2	%RH/y



Typical and maximal relative humidity accuracy at 25 °C.

Relative Humidity Accuracy at the Extended Temperature Range

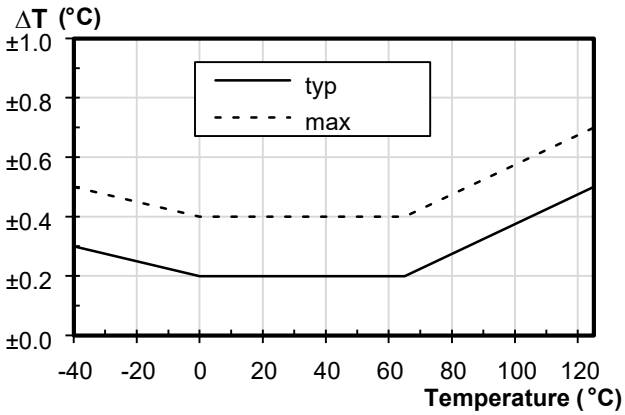
The typical RH accuracy tolerances in the range of T = 0°C … 80 °C is given below



Typical RH accuracy tolerance over humidity and temperature

2.2 Temperature

Parameter	Conditions	Value	Units
SHT41 T Accuracy	typ.	0.2	°C
	max.	see Figure	-
Repeatability	high	0.04	°C
	medium	0.07	°C
	low	0.1	°C
Resolution	-	0.01	°C
Specified range	-	–40 to +125	°C
Response time	$t_{63\%}$	2	s
Long-term drift	typ.	<0.03	°C/y



2.3 Recommended Operating Conditions

The sensor shows best performance when operated within the recommended normal temperature and humidity range of 5 °C … 60 °C and 20 %RH … 80 %RH, respectively. Long term exposure to conditions outside recommended normal range, especially at high relative humidity, may temporarily offset the RH signal (e.g. +3 %RH after 60 h at > 80 %RH). After returning into the recommended normal temperature and humidity range the sensor will recover to within specifications by itself. Prolonged exposure to extreme conditions may accelerate ageing.

3 Electrical Specifications

Valid for all electrical specifications: Typical values correspond to VDD = 3.3 V and T = 25 °C. Min. and max. values are valid in the full temperature range -40 °C … 125 °C and at declared VDD levels and are based on characterization.

3.1 Absolute Maximum Ratings

Parameter	Rating
Max. voltage on any pin	V_{SS} - 0.3 V … V_{DD} + 0.3 V
Operating temperature range	-40 °C … 125 °C
Storage temperature range	-40 °C …150 °C
ESD HBM	2 kV
ESD CDM	500 V
Latch up, JESD78 Class II, 125°C	+-100 mA

4 Sensor Operation

ES-13507 communication is based on Maxim's 1-Wire protocol that combines power and signal on a single wire, and which is driven by the programmable I/O pins on the host's Microcontroller. The 1-Wire network supports connection lengths up to 100m and 10 sensor nodes or more.

ES-13507 is controlled by 9 sequential One wire command. Command response is received against each command.

One Wire Write/Read	Command and Response	Command Hex Values
Write	Command 1	{0xCC,0x66,0x05,0x83,0x0B,0x03,0xA5,0x0F,0x75,0x02,0xAA}
wait for 900 msec		
Read	Ignore response	
Write	Command 2	{0x55,**0x56,0xBC,0xE8,0x00,0x00,0x00,0x00,0x2C**,0x66,0x05,0x83,0x0B,0x03,0xA5,0x0F,0x75,0x02,0xAA}
wait for 80 msec		
Read	read response of 5 bytes	
wait for 200 msec		
Write	Command 3	{0x55,**0x56,0xBC,0xE8,0x00,0x00,0x00,0x00,0x2C**,0x66,0x01,0x7A,0x9F,0x93,0xAA}
	wait for 80 msec	
Read	read response of 9 bytes	
wait for 200 msec		
Write	Command 4	{0x55,**0x56,0xBC,0xE8,0x00,0x00,0x00,0x00,0x2C**,0x66,0x01,0x6A,0x9E,0x5F,0xAA}
	wait for 80 msec	
Read	read response of 6 bytes	
wait for 200 msec		
Write	Command 5	{0x55,**0x56,0xBC,0xE8,0x00,0x00,0x00,0x00,0x2C**,0x66,0x02,0x55,0x01,0xFE,0x26,0xAA}
	wait for 80 msec	
Read	read response of 5 bytes	
wait for 200 msec		

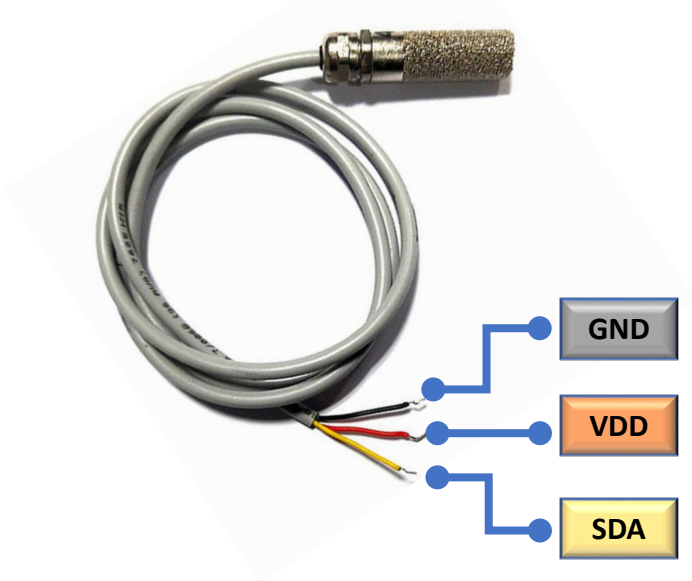
Write	**Command** 6	{0x55,**0x56,0xBC,0xE8,0x00,0x00,0x00,0x00,0x2C**, 0x66, 0x18, 0x11, 0x00, 0x00,0x02, 0xE3, 0x02, 0x88, 0xFD,0x03,0xDD, 0x08,0x02, 0xE3, 0x01, 0x89, 0xD4, 0x06, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x03,0xC8, 0x30, 0xAA}
	wait for 80 msec	
Read	read response of 5 bytes	
wait for 200 msec		
Write	Command 7	{0x55,**0x56,0xBC,0xE8,0x00,0x00,0x00,0x00,0x2C**, 0x66, 0x03, 0x22, 0x00, 0x2A, 0xD6, 0x69, 0xAA}
	wait for 80 msec	
Read	read response of 24 bytes	
wait for 200 msec		
Write	Command 8	{0x55,**0x56,0xBC,0xE8,0x00,0x00,0x00,0x00,0x2C**, 0x66, 0x04, 0x33, 0x00, 0x2A, 0x00, 0x18, 0xDD, 0xAA}
	wait for 80 msec	
Read	read response of 7 bytes	
wait for 200 msec		
Write	Command 9	{0x55,**0x56,0xBC,0xE8,0x00,0x00,0x00,0x00,0x2C**,0x66, 0x03, 0x22, 0x0E, 0x0C, 0x5D, 0xBC, 0xAA}
wait for 80 msec		

Read	read response of 10 bytes	result = (response_arr[3]<< 8);
		result |=response_arr[4] ;
		result1 = (response_arr[6]<< 8);
		result1 |=response_arr[7] ;
		
		temperature= (float)(-45 + 175 / 65535.0 * (float)result);
		temperature_f= (float)(-49 + 315 / 65535.0 * (float)result);
		humidity= (float)(-6 + 125 / 65535.0 * (float)result1);

wait for 200 msec		

5 Pin Defamation

Pin	Name	Comments
1	SDA	Serial data, bidirectional
2	VDD	Supply voltage
3	VSS	Ground



5.1 Power Pin(VDD)

Supply voltage is from 3.3V to 5.5V.

5.2 Serial Data Pin(SDA)

1-Wire Bus Interface. The SDA pin is a three state structure that is used to read and write sensor data. Further information about timing and communication between the sensor and micro controller is explained in the detailed description of the communication protocol.

6 Arduino Sample Code

```
#include <OneWire.h>
#include "string.h"
#include "temp_humidity.h"

int ret=0;
//OneWire  ds(4);  // on pin 10

void setup(void)
{
  Serial.begin(9600);

 ret = sensors_Init();
 if(ret)
 {
 Serial.print("\nNUMBER OF TEMPERATURE HUMIDITY SENSORS DETECTED :
");
 Serial.println(SensorCount);
 for(int sr = 1;sr <= SensorCount; sr++)
  {
    Serial.print("sensor no : ");
    Serial.print(sr);
    Serial.print(" ");
    init_th_sensor(sr);
    Serial.println(" Initialized");
  }
 }
 else
 {
  Serial.print("\nSENSOR NOT DETECTED");
 }
}
```

```
void loop(void)
{
  if(SensorCount > 0)
  {
     Serial.println(" ");
     for(int sr = 1;sr <= SensorCount; sr++)
     {
       Serial.print("sensor no : ");
       Serial.print(sr);
       Serial.print(" ");
       Serial.print("  Temp : ");
       Serial.print(get_temperature_deg(sr));
       Serial.print(", Tempf : ");
       Serial.print(get_temperature_far(sr));
       Serial.print(", hum : ");
       Serial.println(get_humidity(sr));
     }
  }
  else
  {
    Serial.println("SENSOR NOT DETECTED");
    delay(1000);
  }
}
```