Preliminary Data Sheet SHT3X

Humidity and TemperatureSensor

- ✍ Fully calibrated, linearized, and temperature compensated digital output
- ✍ Wide supply voltage range, from 2.4 to 5.5 V
- ✍ I2C Interface with communication speeds up to 1 MHz and two user selectable addresses
- ✍ Typical accuracy of ± 2%RH and ± 0.3°C
- ✍ Very fast start-up and measurement time
- ✍ Tiny 8-Pin DFN package

湿度传感器探头　　SHT3X系列
- ✓ 数字化
- ✓ 分辨率高达14比特
- ✓ 内部自校准

厂家直销 品质保障　精湛工艺

Product Summary

SHT3X is the next generation of Sensirion's temperature and humidity sensors. It builds on a new CMOSens® sensor chip that is at the heart of Sensirion's new humidity and temperature platform. The SHT3X has increased intelligence, reliability and improved accuracy specifications compared to its predecessor. Its functionality includes enhanced signal processing, two distinctive and user selectable I2C addresses and communication speeds of up to 1 MHz. The DFN package has a footprint of 2.5 x 2.5 mm while keeping a height of 0.9 mm. This allows for integration of the SHT3X into a great variety of applications. Additionally, the wide supply voltage range of 2.4 to 5.5 V guarantees compatibility with diverse assembly situations. All in all, the SHT3X incorporates 15 years of knowledge of Sensirion, the leader in the humidity sensor industry.

Benefits of Sensirion's CMOSens® Technology

- ✍ High reliability and long-term stability
- ✍ Industry-proven technology with a track record of more than 15 years
- ✍ Designed for mass production
- ✍ High process capability
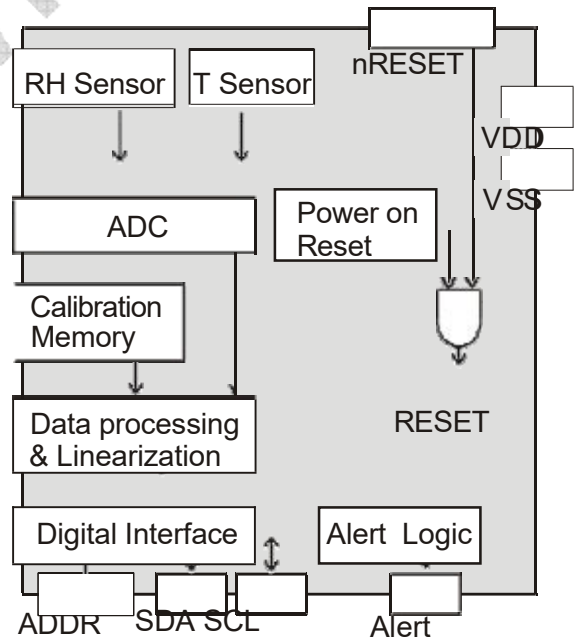- ✍ Low signal noise

Content

Figure 1 Functional block diagram of the SHT3X. The sensor signals for humidity and temperature are factory calibrated, linearized and compensated for temperature and supply voltage dependencies.

1 Sensor Performance

1.1 Humidity Sensor Performance

Parameter	Conditions	Value	Units
SHT30 Accuracy tolerance[1]	Typ.	±3	%RH
	Max.	Figure 2	%RH
SHT31 Accuracy tolerance[1]	Typ.	±2	%RH
	Max.	Figure 4	%RH
Repeatability[2]		0.13	%RH
Resolution	Typ.	0.05	%RH
Hysteresis	at 25°C	±0.8	%RH
Specified range[3]	extended[4]	0 to 100	%RH
Response time[5]	T63%	8[6]	s
Long-term drift	Typ.[7]	<0.25	%RH/yr

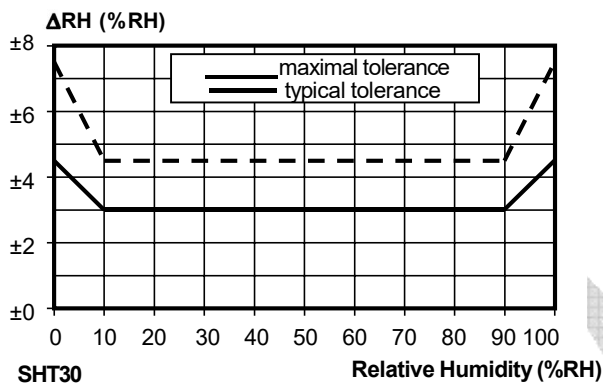**Table 1** Humidity sensor specification

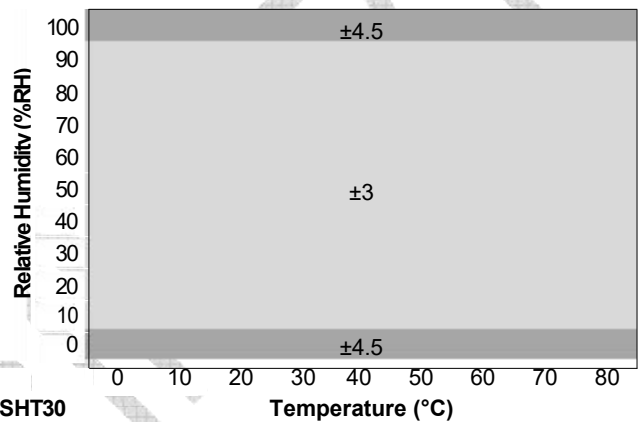**Figure 2** Tolerance of RH at 25°C for SHT30

Figure 3 Typical tolerance of RH over T for SHT30
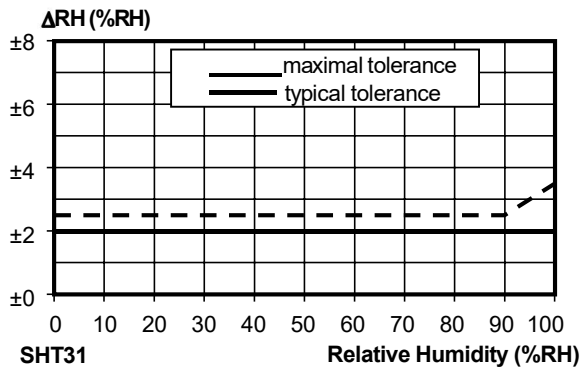

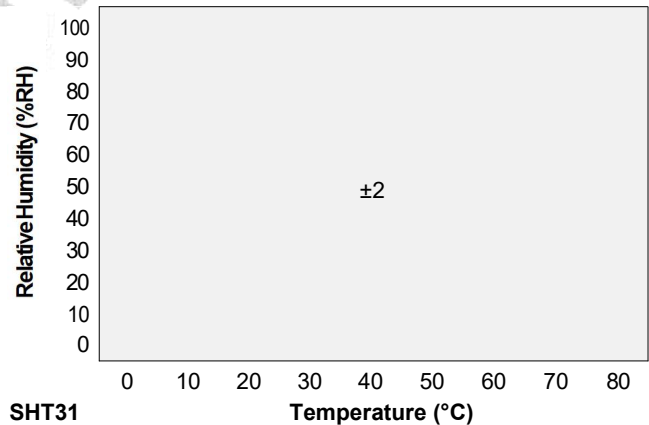**Figure 4** Tolerance of RH at 25°C for SHT31

Figure 5 Typical tolerance of RH over T for SHT31

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[1] For definition of typical and maximum accuracy tolerance, please refer to the document "Sensirion Humidity Sensor Specification Statement".

[2] The stated repeatability is 3 times the standard deviation (3σ) of multiple consecutive measurements at highest repeatability and at constant ambient conditions. It is a measure for the noise on the physical sensor output.

[3] Specified range refers to the range for which the humidity or temperature sensor specification is guaranteed.

[4] For details about recommended humidity and temperature operating range, please refer to section 1.3.

[5] Time for achieving 63% of a humidity step function, valid at 25°C and 1m/s airflow. Humidity response time in the application depends on the design-in of the sensor.

[6] With activated ART function (see section 4.7) the response time can be improved by a factor of 2.

[7] Typical value for operation in normal RH/T operating range, see section 1.2. Maximum value is < 0.5 %RH/yr. Value may be higher in environments with vaporized solvents, out-gassing tapes, adhesives, packaging materials, etc. For more details please refer to Handling Instructions.

1.2   Temperature Sensor Performance

Parameter	Condition	Value	Units
Accuracy tolerance[1]	Typ. 10 to +55	±0.3	°C
Repeatability[2]		0.06	°C
Resolution	Typ.	0.05	°C
Specified Range	-	-40 to 125	°C
Response time [8]	T63%	>2	s
Long Term Drift	-	<0.03	°C/yr

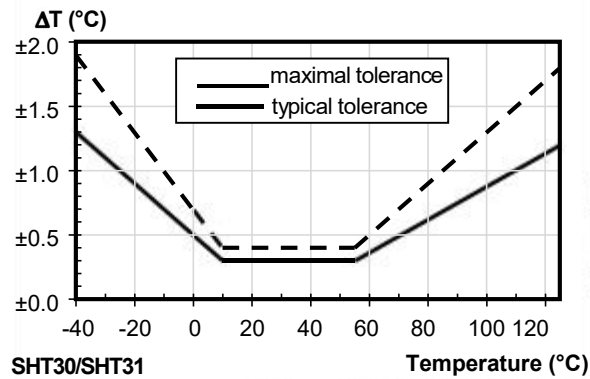**Table 2** Temperature sensor specification

Figure 6 Tolerance of the temperature sensor in °C for SHT30 and SHT31

1.3   Recommended Operating Condition

The sensor shows best performance when operated within recommended normal temperature and humidity range of 5 – 60 °C and 20 – 80 %RH, respectively. Long term exposure to conditions outside normal range, especially at high humidity, may temporarily offset the RH signal (e.g.+3%RH after 60h at >80%RH). After returning into the normal temperature and humidity range the sensor will slowly come back to calibration state by itself. Prolonged exposure to extreme conditions may accelerate ageing. To ensure stable operation of the humidity sensor, the conditions described in the document "SHTxx Assembly of SMD Packages", section "Storage and Handling Instructions" regarding exposure to volatile organic compounds have to be met. Please note as well that this does apply not only to transportation and manufacturing, but also to operation of the SHT3X.

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[8] Temperature response times strongly depends on the design-in of the sensor in the final application. Minimal response time can be achieved when the thermalized sensor at T1 is placed on a well conducting surface with temperature T2.

2 Specifications

2.1 Electrical Specifications

Parameter	Symbol	Condition	Min.	Typ.	Max.	Units	Comments
Supply voltage	V_{DD}		2.4	3.3	5.5	V	
Power-up/down level	V_{POR}		2.22	2.35	2.4	V	
Supply current	I_{DD}	Not measuring		0.2		∝A	Average current when sensor is not performing a measurement.
		Measuring		800		∝A	Average current consumption while sensor is measuring at lowest repeatability,
		Average		2		∝A	Average current consumption (operation with one measurement per second at lowest repeatability)
Heater power	P_{Heater}	Heater running	5		25	mW	Depending on the supply voltage

Table 3 Electrical specifications, Specification are at 25°C and typical VDD

2.2 Timing Specification for the Sensor System

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Comments
Power-up time	t_{PU}	After hard reset, $V_{DD} \geq V_{POR}$		0.3	0.5	ms	Time between V_{DD} reaching V_{POR} and sensor entering idle state
Soft reset time	t_{SR}	After soft reset.		0.3	0.5	ms	Time between ACK of soft reset command and sensor entering idle state
Duration of reset pulse			350			ns	See section 3.6
Measurement duration	$t_{MEAS,l}$			2.5	3	ms	Duration for a humidity and temperature measurement when the repeatability is set to low
	$t_{MEAS,m}$			4.5	5	ms	Duration for a humidity and temperature measurement when the repeatability is set to medium
	$t_{MEAS,h}$			12.5	13.5	ms	Duration for a humidity and temperature measurement when the repeatability is set to high

Table 4 System Timing Specification, Specification are at 25°C and typical VDD

2.3   Absolut Minimum and Maximum Ratings

Stress levels beyond those listed in Table 5 may cause permanent damage to the device or affect the reliability of the sensor.   These are stress ratings only and functional operation of the device at these conditions cannot be guaranteed.

Parameter	Rating	Units
Supply voltage V_{DD}	-0.5 to 6	V
MaxVoltage on pins (pin1 (SDA);pin2 (ADDR); pin 3 (ALERT); pin 4(SCL); pin 6(nRESET))	-0.5 to VDD+0.5	V
Input current on any pin	±100	mA
Operating temperature range	-40 to 125	°C
Storage temperature range	-40 to 150	°C
ESD HBM (human body model)	4	kV
ESD MM (machine model)	200	V
ESD CDM (charge device model)	750	V

Table 5 Absolut minimum and maximum ratings; values are target specs and not confirmed by measurements yet