

Handling Instructions

For SHTxx Humidity and Temperature Sensors

Preface

Sensirion SHTxx are relative humidity and temperature sensors of high quality. For taking advantage of their outstanding performance some precautions must be taken during storage, assembly and packaging. Therefore, please read the following instructions carefully - preferably during design-in phase and before production release of the respective device. Special attention is required regarding the exposure to volatile

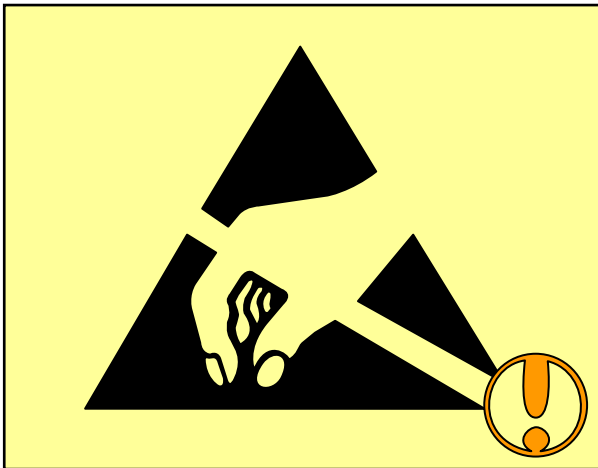
organic compounds, i.e. high concentration and long exposure time to respective gases shall be avoided. Such conditions are known to occur in manufacturing environment and/or during storage. Therefore proper handling and choice of materials are crucial. Applying sensors in the field in ambient environment is not critical.

Applicability

This document is applicable to all Sensirion SHTxx humidity and temperature sensors.

ESD protection

The sensor shall be protected from ESD (Electrostatic Discharge) and only be handled in ESD protected areas (EPA) under protected and controlled conditions (ground all personnel with wrist-straps, ground all non-insulating and conductive objects, exclude insulating materials from the EPA, operate only in grounded conductive floor, etc.). Protect sensor outside the EPA using ESD protective packaging.



Protection against ESD is mandatory.

Exposure to Chemicals

Humidity and Temperature sensors are highly accurate environmental sensors and as such they are not ordinary electronic components. The opening in the package exposes the sensor to the environment and makes it susceptible to pollutants. While applying sensors in the field in ambient environment is not

critical, pollutants are known to occur in manufacturing environments and during storage. Please carefully follow the guidelines in this application note to ensure that you can benefit of the sensor's outstanding performance.

The sensor shall not get in close contact with volatile chemicals such as solvents or other organic compounds. Especially high concentration and long exposure must be avoided. Ketenes, Acetone, Ethanol, Isopropyl Alcohol, Toluene, etc. are known to cause drift of the humidity reading – irreversibly in most of the cases. Please note that such chemicals are integral part of epoxies, glues, adhesives, etc. and outgas during baking and curing. These chemicals are also added as plasticisers into plastics, used for packaging materials, and do out-gas for some period.

Acids and bases may affect the sensor irreversibly and shall be avoided: HCl, H₂SO₄, HNO₃, NH₃ etc. Also Ozone in high concentration or H₂O₂ have the same effect and therefore shall be avoided. Please note, that above examples represent no complete list of harmful substances.

The sensor shall not get in contact with cleaning agents (e.g. PCB board wash after soldering) or strong air blasts from an air-pistol (not oil-free air). Applying cleaning agents to the sensor may lead to drift of the reading or complete breakdown of the sensor.

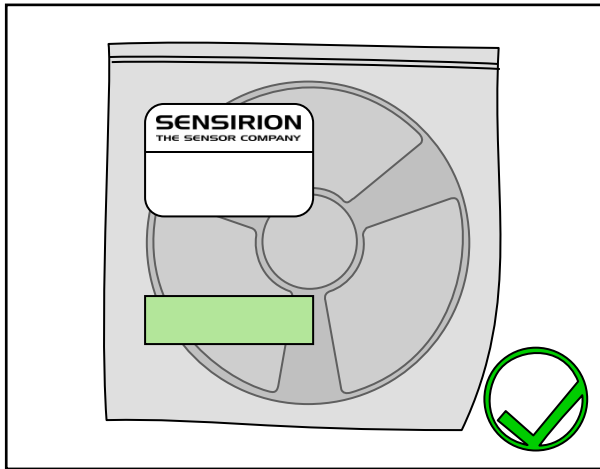
Ensure good ventilation (fresh air supply) to avoid high concentrations of volatile chemicals (solvents, e.g. ethanol, isopropanol, methanol, acetone, cleaning solutions, detergents...).

Packing and Storage

Prior to assembly or use of the sensors it is strongly recommended to store the sensors in the original sealed ESD bag at following conditions: Temperature shall be in the range of 10°C – 50°C (0 – 125°C for

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limited time) and humidity at 20 – 60%RH (sensors that are not stored in ESD bags).



Store sensors in original, unopened ESD bag. Place additional stickers only on the outside of the ESD bag.

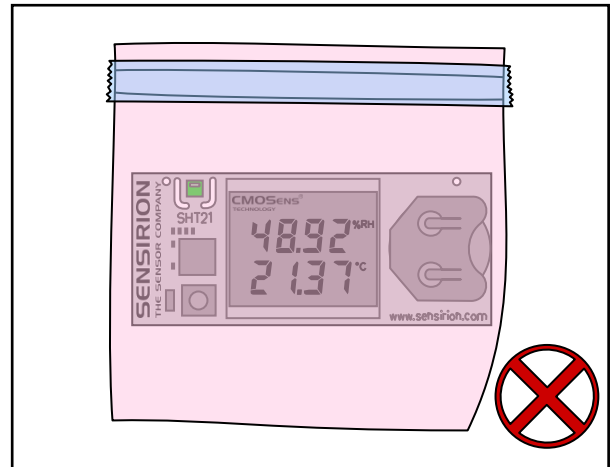
Once sensors have been removed from the original ESD bag we recommend to store the individual sensors as well as devices with assembled sensors in metal-in antistatic shielded ESD bags. In particular, it is recommended not to use any adhesive or adhesive tapes to reseal the sensor bag after opening. Therefore reclosable bags with zipper are preferred. For a recommendation on specific ESD bags please contact Sensirion.

Sensors as a component or mounted into the final product shall not be packaged in outgassing plastic materials which could cause sensor pollution. Besides metal-In antistatic shielded ESD bags, paper or cardboards based packaging, deep drawn plastic trays (PE, PET, PP) may be considered. Do not use antistatic polyethylene bags (light blue, pink or rose color); be very careful with bubble foils and foams.

Be careful about stickers present inside the packing (e.g. on the housing of the device). Sticker size should be kept to a minimum, and the sticky side shall fully adhere onto a surface.

Please note that many packaging materials may be provided with additives (plasticizers) which may have a polluting effect on the sensor. Generally speaking, if a material emits a strong odor you should not use it. Additives may also be added to materials which are listed for recommended use. For high safety, device housing and shipment packaging must be qualified. Such a qualification test may contain exposure of the final device with sensor in its shipment packaging to temperature $\geq 65^{\circ}\text{C}$ for at least 168 hours. (If shipping or storage conditions are expected to be harsh, the

qualification test conditions for the packing material have to be customized.) The sensor reading then shall show no changed deviation against a reference compared to same measurements before the exposure.



Do not use polyethylene antistatic bags (light blue, pink or rose color). Do not use adhesive tapes inside packaging.

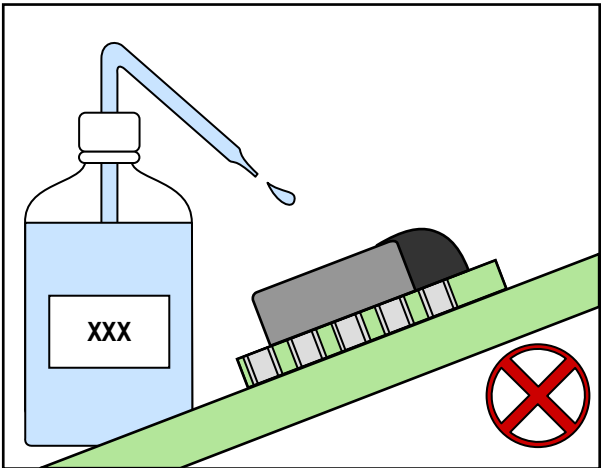
For guidance on simple and straight-forward testing of humidity sensors please consult the Testing Guide for humidity sensors.

Assembly

Sensors in SMT packages are classified as Moisture Sensitivity Level 1 (IPC/JEDEC J-STD-020). It is recommended to process the sensors within 1 year after date of delivery.

Before developing the assembly process please read the User's Guide of the Datasheets carefully. In the following, crucial items are underlined plus additional items are given:

For soldering please read carefully the corresponding Section in the User's Guide of respective Datasheet. Make sure that maximum temperatures and exposure times are respected. In case the PCB passes through multiple solder cycles (as is the case for e.g. PCB that are assembled on top and bottom side), it is recommended to assemble the SHTxx only in the last solder cycle. This is to reduce risks of sensor pollution. It is important that "no-clean" solder paste is used and no board wash is applied once the sensor is assembled to the PCB.

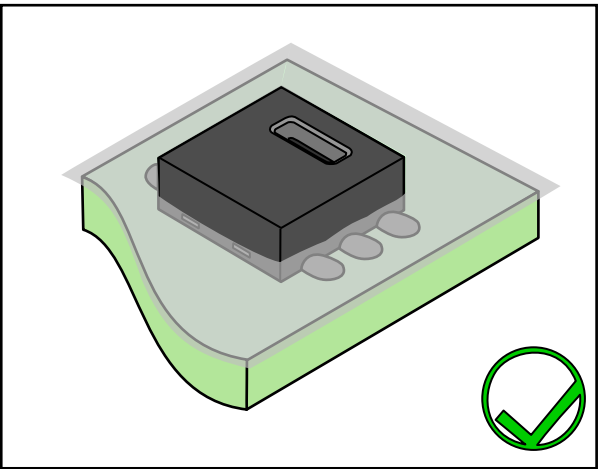


Do not apply board wash.

No mechanical force shall be applied to any part of the sensor during assembly or usage. Especially, after soldering no force shall be applied to the sensor cap (SHT1x) to prevent weakening of the adhesive joint between cap and PCB.

For application in corrosive environment – such as condensed water or corrosive gases – it may be necessary to protect the electronic assembly including the soldered contacts of the sensor with a passivation. Such passivation may be achieved by conformal coating or by applying adhesive.

Low viscose conformal coatings or potting materials may flow into the inside the sensor cap (SHT1x, SHT7x), cover the sensor element and thus make the humidity sensor inoperative. Use only high viscose conformal coatings or potting materials, or seal the interface between sensor cap (SHT1x, SHT7x) and sensor PCB before applying conformal coating. Make sure that used conformal coating is not outgassing.

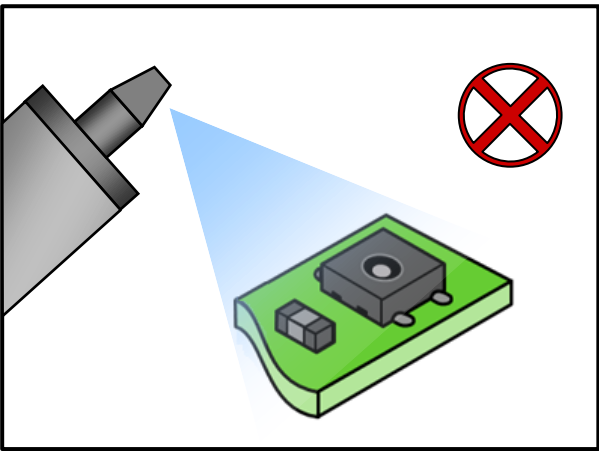


If conformal coating is applied, the top surface of the sensor must remain free of coating.

In any case, covering the humidity sensor opening with any kind of coating must be avoided. Therefore, the top surface of the sensor should remain free of coating.

The following table lists conformal coatings which have been tested regarding pollution of the humidity sensor and are known to be suitable if applied and fully cured under good ventilation (fresh air supply) and according to respective datasheet.

Conformal Coatings	
Manufacturer	Product
Peters	Elpeguard SL 1301 ECO-FLZ
Dow Corning	1-2577 Low Voc Conformal Coating

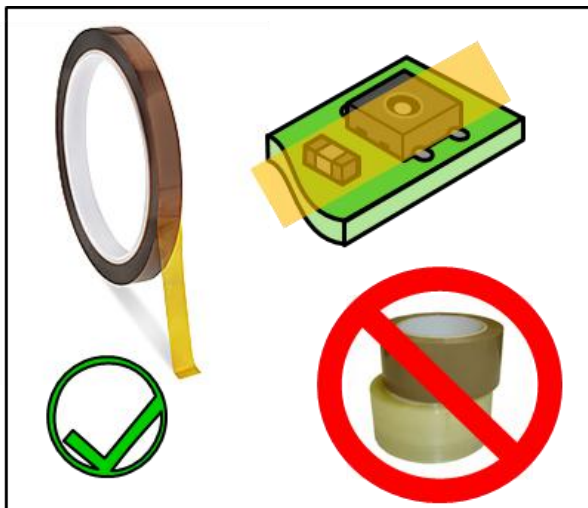


Do not apply spray to unprotected sensor.

Whenever using spray coating techniques (e.g. to apply varnish or conformal coating, etc.) the SHTxx sensor has to be covered by the adhesive tape to prevent coating of the humidity sensor opening. The following table lists adhesive tapes which have been tested regarding pollution of the humidity sensor and are known to be suitable.

Adhesive Tapes	
Manufacturer	Product
3M	Electrical Tape 92

Do not apply any other adhesive tapes such as Scotch Tape, Sello Tape, Tesa Film, etc.



In conjunction with the sensor, use only recommended Kapton® tape Electrical Tape 92 by 3M™.

Regarding adhesives and encapsulants the material in the following tables may be used – according to respective datasheets, applied and fully cured in well ventilated environment (fresh air supply). Materials and brands not listed in the following tables may be harmful and shall be tested carefully before applying.

Epoxy Adhesives	
Manufacturer	Product
EPO-TEK	H70E/S
EPO-TEK	T6067
EPO-TEK	93-86
Lord	MD-130
Eccobond	E3503-1
Ablebond	84-3

Epoxy Glob Top Encapsulants	
Manufacturer	Product
Stycast	50300 / 50400 series
Hysol	EO1061/EO1062

Silicone Adhesives	
Manufacturer	Product
RTV	6424 (Momentive)
Dow Corning	732

Silicone Glob Top Encapsulants	
Manufacturer	Product
Stycast	S 7503

Instant Adhesives	
Manufacturer	Product
Loctite	401

PUR (Polyurethane) Casting Compounds

Manufacturer	Product
Peters	VU 4457-61

Hot melts may absorb water and thus may have an impact on the response time of the sensor in the device. Therefore hot melt shall be applied sparingly.

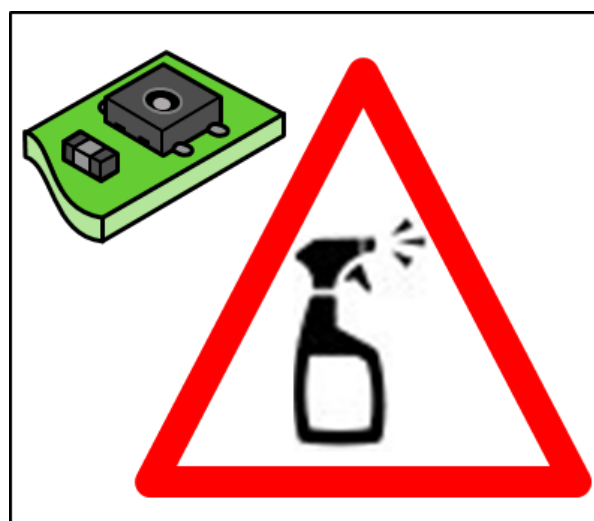
The sensor shall be mounted into the device, if possible, after all materials that are used in the assembly process have completely cured or dried out. Otherwise ensure good ventilation (fresh air supply) in curing ovens and assembly lines.

Prevent any dust or particles from entering the sensor opening (sensor performance may be affected).

Wear clean gloves or finger cots while handling the sensor and avoid touching the sensor opening.

Ensure recommendations in this application note are equally considered during repair and rework of assemblies containing sensors. During repair and rework it may be recommendable to cover Kapton tape (specific recommendation see above).

Be particularly careful when using strong cleaning agents (e.g. detergents, alcohols, brominated or fluorinated solvents). Cleaning any part of a product might lead to high concentration of cleaning agents on the sensor. Please remove any sensors or devices containing sensors before cleaning the production area and tools. Ensure good ventilation (fresh air supply) and that any solvents have evaporated before resuming production.



Prevent sensor from exposure to cleaning agents.

Application in extreme environment

Some applications require the exposure of humidity and temperature sensors to harsh environments. In many of the cases the sensor is uncritical to be used. However, some precautions must be taken.

For exposure to extreme conditions with regards to humidity and temperature please consult the User's Guide of respective product. Please make sure that exposure time of the sensor to maximum range of operating conditions is limited as given in the User's Guide. Exposure to volatile organic compounds at high concentration and long exposure time is critical not only in assembly but also in the field. Such application needs to be carefully tested and qualified.

Exposure to acids or bases may be critical, too. In order to be critical, the concentration must be such that polymers are attacked. For bases there is a rule of thumb that $\text{pH} < 9$ are uncritical. Etching substances such as H_2O_2 , NH_3 , etc. at high concentrations are critical to the sensor, too.

Corrosive substances at very low concentrations are not critical to the sensor itself. However, they may attack the solder contacts. Therefore, the contacts must be well protected (passivated) in case of an application to such environment – compare also Section “Assembly”.

Application of Sensirion humidity and temperature sensors to harsh environment must be carefully tested and qualified. Sensirion qualifies its humidity and temperature sensors to work properly within ambient clean air – qualification for use in harsh environment is duty of the user of the sensor.

Reconditioning Procedure

As stated above extreme conditions or exposure to solvent vapors may offset the sensor. The following reconditioning procedure may bring the sensor back to calibration state:

Baking: 100 – 105°C at < 5%RH for 10h
Re-Hydration: 20 – 30°C at ~ 75%RH for 12h ¹.

Disclaimer

The above given restrictions, recommendations, materials, etc. do not cover all possible cases and items.

The material recommendations are given with regard to pollution of SHTxx sensors and assume optimal processing for avoiding VOC in process – the materials were not tested regarding other properties like reliability, performance, usability or mechanical properties. The material recommendations have been compiled with our best knowledge at the time of writing. Manufacturers may change the compounds without notice, which can lead to reduced Sensor performance due to outgassing.

This document is not to be considered complete and is subject to change without prior notice.

¹ 75%RH can conveniently be generated with saturated NaCl solution.

Revision History

Date	Revision	Changes
29 June 2007	0.1 (Preliminary)	Initial revision
7 January 2009	1.0	Complete rework.
18 March 2010	1.1	New format, implementation of pictograms.
28 June 2012	2.0	Moisture Sensitivity Level adapted.
18 November 2013	3	Document partially restructured and clarifications added.
22. May 2014	4	ESD bag recommendation changed, reconditioning procedure added.