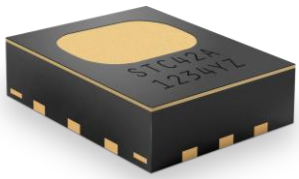
SENSIRION

Handling and Assembly Instruction

For Sensirion STC3x and STC4x Thermal Conductivity Sensors



Key Topics

- ESD protection
- Dust protection membrane
- Pick and place instructions
- Soldering instructions
- Conformal coating
- Storage and handing instructions

The Sensirion STC thermal conductivity sensor is designed for high volume applications. It is therefore compatible with standard assembly and soldering processes. Nevertheless, these sensors are non-standard electronic components. Some care must be taken to ensure proper and reliable operation of the sensors after assembly. This document contains information on the handling and assembly of Sensirion STC3x and STC4x thermal conductivity sensors in a production environment.

Contents

1 Applicability

This document is applicable to Sensirion STC3x and STC4x thermal conductivity sensors. For other thermal conductivity sensors, like STCC4, consult their product specific documentation.

2 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 sensors outside the EPA using ESD protective packaging.

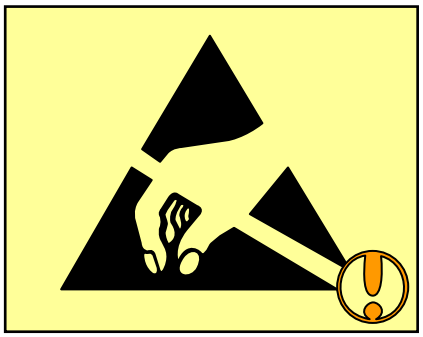


Figure 1 Protection against ESD is mandatory.

3 Dust protection membrane

The STC sensor is equipped with a dust protection membrane that is directly attached to the sensor. The membrane completely covers the sensor opening (see **Figure 2**) and thus acts as a shield against pollution by dust. The membrane is completely permeable to all target gases the STC is intended to measure. Therefore, *dust protection membrane must not be removed, damaged or altered in any way* to ensure reliable operation of the STC sensor.

Picking at or close to the membrane can damage the sensor package and influence performance and reliability.

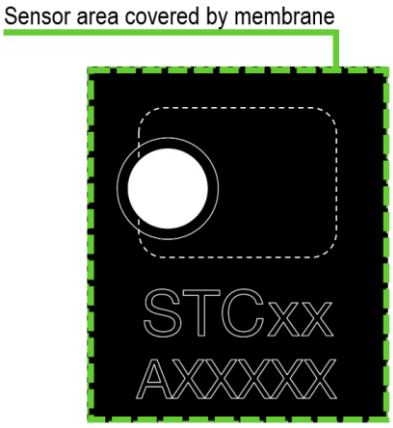


Figure 2 The dust protection membrane completely covers the STC sensor surface.

4 Pick & place process

Standard pick & place equipment for QFN packages may be used for handling. The upper part of the sensor, where the membrane-covered cavity resides, is very sensitive to mechanical impact and any contact must be prevented. Direct contact between the nozzle and sensor membrane must be avoided. The lower 1.6 mm for STC3x and 1.35mm for STC4x of the sensor surface is intended for pick & place (see **Figure 3** and **Figure 4**). The tool surface touching the module in the pick area should be flat and smooth. Pick & place forces should not exceed 4N.

WARNING

Picking at or near the membrane may damage the sensor package and affect its performance and reliability.

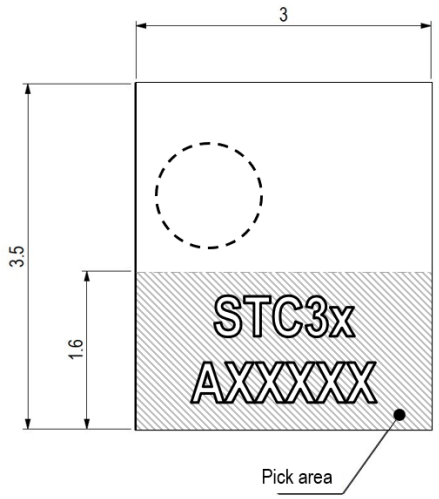


Figure 3 The area of STC3x suitable for applying force during the mounting process is indicated by hatched lines. All dimensions are in millimeters.

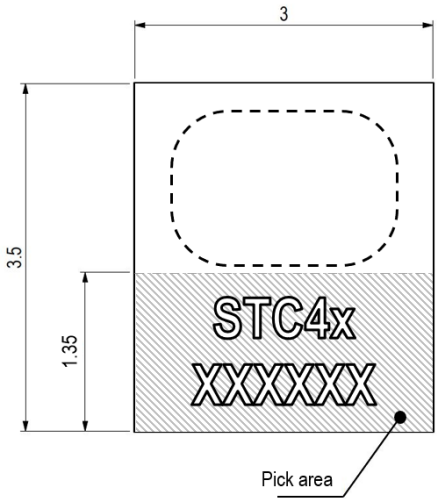


Figure 4 The area of STC4x suitable for applying force during the mounting process is indicated by hatched lines. All dimensions are in millimeters.

5 Soldering instructions

Standard reflow soldering ovens may be used for soldering. The sensors are designed to withstand a soldering profile according to IPC/JEDEC J-STD-020 with a recommended peak temperatures of 260 °C up to 30 seconds for Pb-free assembly in IR/Convection reflow ovens (see **Figure 5**). In addition, we also recommend a maximum ramp-down rate of <4 °C/s.

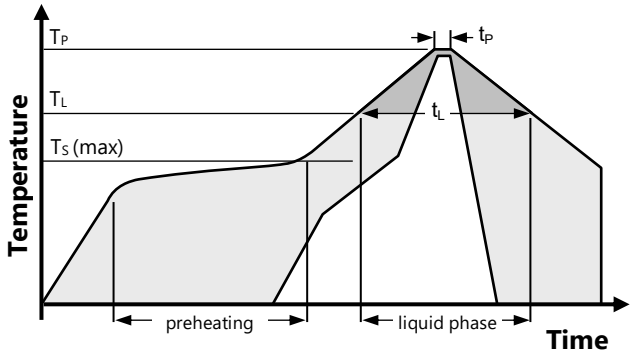


Figure 5 Soldering profile according to JEDEC standard. Recommended T_P =260 °C and $t_P \leq 30$ sec for Pb-free assembly. T_L < 220 °C and t_L < 150 sec. Ramp-up rate < 3 °C and ramp-down rate < 4 °C/sec.

It is recommended not to use vapor phase soldering to avoid potential contamination of the sensor.

The use of "no clean" type 3 solder paste is recommended. An appropriate amount of solder paste shall be used to achieve a stand-off height (clearance between the package body and any part of the substrate) of 50 – 75 µm. Please consult the appropriate sensor datasheet for device specific information on metal land patterns.

Board wash is to be avoided for Sensirion STC sensors, and it is therefore recommended to use a "no-clean" solder paste. In addition, we recommend *not to use ultrasonic cleaning* since it could result in damage of the sensor. If a board wash is a requirement for the final product or application, the corresponding wash process needs to be properly qualified to be proven compatible with the STC sensor.

We recommend *not to manually solder* the Sensirion STC sensor since corresponding process parameters may not be controlled well and it could result in damage of the sensor. In particular, hot air with an air temperature above 260°C on the device surface should be avoided. Since the sensing element has a very low thermal mass, it heats up to the air temperature very quickly.

It is important to note that the side faces of the I/O pads may oxidise over time. Therefore, a solder fillet may or may not form.

6 Conformal coating

Low viscose conformal coatings or potting materials can flow onto the sensor, cover the sensor element, and thus make the gas sensor inoperative. Ensure that nothing is (even partly) covering the sensor's dust protection membrane. Do not protect/cover the top surface with tape as this may harm the sensor's dust protection membrane.

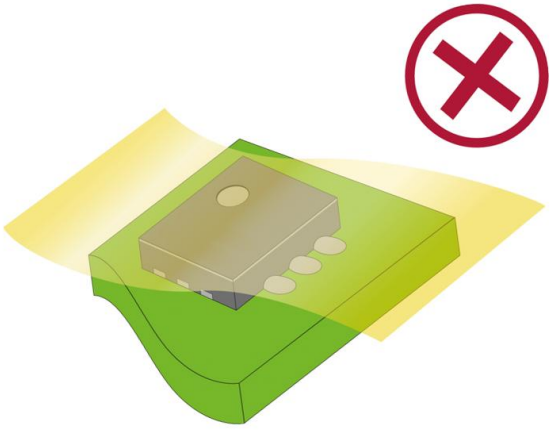


Figure 6 Do not put tape on sensor.

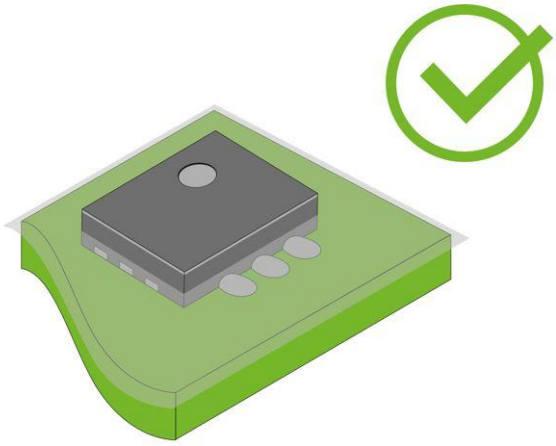


Figure 7 If conformal coating is applied, the top surface of the sensor must remain free of coating.

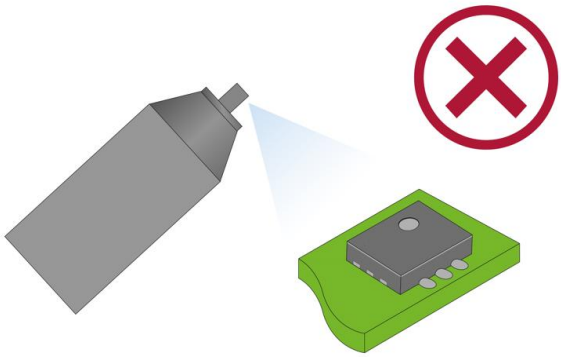


Figure 8 Do not spray onto sensor.

Specifically, in applications where a form of coating is necessary the following approach can be used.

Use a PCB with plugged vias. Cover traces and vias with solder mask. For most applications the solder mask will already protect the PCB traces and the vias from corrosion. The solder joints can be protected with an underfill material. The underfill must precisely coat the solder joints of the STC sensor without coating the top surface. This can be achieved with a jetting procedure. This procedure is easier to control with a low viscosity coating.

As an example, we can recommend the 2-component epoxy Epotec Epoxy 301-2fl. Due to the low viscosity of the coating, it can be jetted at an appropriate distance to the STC sensor while still covering all soldering joints.

Do not cure the coating at high temperatures and ensure that temperature ramps are slow, since deformation due to stress in the material could damage the Sensor.

In case an SHT4x sensor is used in conjunction with an STC sensor, please follow the guidelines for handling and soldering the SHT4x sensor in the Handling Instructions for SHT Sensors documentation.

7 Storage conditions and handling instructions

Sensirion STC thermal conductivity sensors are non-standard electronic components and need to be handled with care.

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

Wear clean gloves or finger coats while handling the sensor and avoid touching the sensor's dust protection membrane.

Ensure recommendations in this application note are equally considered during repair and rework of assemblies containing the STC sensor.

Sensor storage is recommended to be under ambient humidity conditions.

For more detailed information please contact Sensirion.

8 Revision history

Date	Version	Section	Changes
June 2024	1.2	all	Completely new revision and compilation of relevant design guidance for STC31-C
January 2025	2.0	all	New Document Template New Figures for STC3x and STC4x added

Important Notices

Warning, Personal Injury

Do not use this product as safety or emergency stop devices or in any other application where failure of the product could result in personal injury (including death). Do not use this product for applications other than its intended and authorized use. Before installing, handling, using or servicing this product, please consult the data sheet and application notes. Failure to comply with these instructions could result in death or serious injury.

If the Buyer purchases or uses SENSIRION products for any unintended or unauthorized application, Buyer shall defend, indemnify and hold harmless SENSIRION and its officers, employees, subsidiaries, affiliates and distributors against all claims, costs, damages and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if SENSIRION is allegedly negligent with respect to the design or the manufacture of the product.

ESD Precautions

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take customary and statutory ESD precautions when handling this product. See application note "ESD, Latchup and EMC" for more information.

Warranty

SENSIRION solely warrants to the original purchaser of this product for a period of 12 months (one year) from the date of delivery that this product is of the quality, material and workmanship defined in SENSIRION's published specifications of the product. Within such period, if proven to be defective, SENSIRION shall as sole and exclusive remedy, in SENSIRION's discretion, repair this product or send a replacement product, free of charge to the Buyer, provided that:

- notice in writing describing the defects shall be given to SENSIRION within fourteen (14) days after their appearance;
- such defects shall be found, to SENSIRION's reasonable satisfaction, to have arisen from SENSIRION's faulty material or workmanship;
- the defective product shall be returned to SENSIRION's factory at the Buyer's expense; and
- the warranty period for any repaired or replaced product shall be limited to the unexpired portion of the original period.

The Buyer shall at its own expense arrange for any dismantling and reassembly that is necessary to repair or replace the defective product. This warranty does not apply to any product which has not been installed or used within the specifications recommended by SENSIRION. EXCEPT FOR THE WARRANTIES EXPRESSLY SET FORTH HEREIN, SENSIRION MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT. ANY AND ALL WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY EXCLUDED AND DECLINED.

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SENSIRION reserves the right, without further notice, (i) to change the product specifications and/or the information in this document and (ii) to improve reliability, functions and design of this product.

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