

Functional safety base failure rate

For SHT4xA Sensors

This report lists the base failure rates (FITs) of the Sensirion Humidity and Temperature SHT4xA sensors. The overall component FIT is made up of the die and the package failure rate $\lambda_{SHT4xA} = \lambda_{die} + \lambda_{package}$ and is calculated using industry recommended standards:

Die failure rate	Siemens SN29500-2 : 2010-09 standard for integrated circuits
Package failure rate	Reliability data handbook IEC TR 62380 : 2004

The failure rate is directly dependent on the reference conditions and the mission profile of the application. A list of failure rates for two different mission profiles is shown in the table below¹. The sensor configuration used for this calculation is as follows:

- Wettable flanks/non-wettable flanks (no significant influence)
- Heater off/on (no significant influence)
- Die pad unsoldered
- I²C communication

Reference conditions

- Operating time > 3000hrs
- Operating voltage $U_{op} = 5V$
- Current under operating voltage $I_{op} = 25\mu A$
- Operating Mode: continuous duty cycle under steady stress

Mission profile phases

1. 2 night starts
2. 4 daylight starts
3. 30 days/year non-used vehicle

Base FITs for passenger compartment

Mean ambient temperature: 35°C

T [°C]	distribution
27	10%
30	80%
85	10%

Base Failure Rates:

$$\lambda_{Sensor} = 17.045$$

$$\lambda_{die} = 15.75$$

$$\lambda_{package} = 1.295$$

Base FITs for motor control

Mean ambient temperature: 60°C

T [°C]	distribution
32	34%
60	26%
85	40%

Base Failure Rates:

$$\lambda_{Sensor} = 45.890$$

$$\lambda_{die} = 43.8$$

$$\lambda_{package} = 2.089$$

¹ For possible calculation for other mission profiles, please contact Sensirion directly.

Revision History

Date	Revision	Pages	Changes
February 2024	1.0	All	Initial release

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. 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 shall purchase or use 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 shall be 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 warrants solely to the original purchaser of this product for a period of 12 months (one year) from the date of delivery that this product shall be 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 repair and/or replace this product, in SENSIRION's discretion, 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 design, 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.

This warranty does not apply to any equipment which has not been installed and used within the specifications recommended by SENSIRION for the intended and proper use of the equipment. 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.

SENSIRION is only liable for defects of this product arising under the conditions of operation provided for in the data sheet and proper use of the goods. SENSIRION explicitly disclaims all warranties, express or implied, for any period during which the goods are operated or stored not in accordance with the technical specifications.

SENSIRION does not assume any liability arising out of any application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. All operating parameters, including without limitation recommended parameters, must be validated for each customer's applications by customer's technical experts. Recommended parameters can and do vary in different applications.

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.

Headquarters and Subsidiaries

Sensirion AG

Laubisruetistr. 50
CH-8712 Staefa ZH
Switzerland

phone: +41 44 306 40 00
fax: +41 44 306 40 30
info@sensirion.com
www.sensirion.com

Sensirion Taiwan Co. Ltd

phone: +886 2 2218-6779
info@sensirion.com
www.sensirion.com

Sensirion Inc., USA

phone: +1 312 690 5858
info-us@sensirion.com
www.sensirion.com

Sensirion Japan Co. Ltd.

phone: +81 45 270 4506
info-jp@sensirion.com
www.sensirion.com/jp

Sensirion Korea Co. Ltd.

phone: +82 31 337 7700~3
info-kr@sensirion.com
www.sensirion.com/kr

Sensirion China Co. Ltd.

phone: +86 755 8252 1501
info-cn@sensirion.com
www.sensirion.com/cn

To find your local representative, please visit
www.sensirion.com/distributors