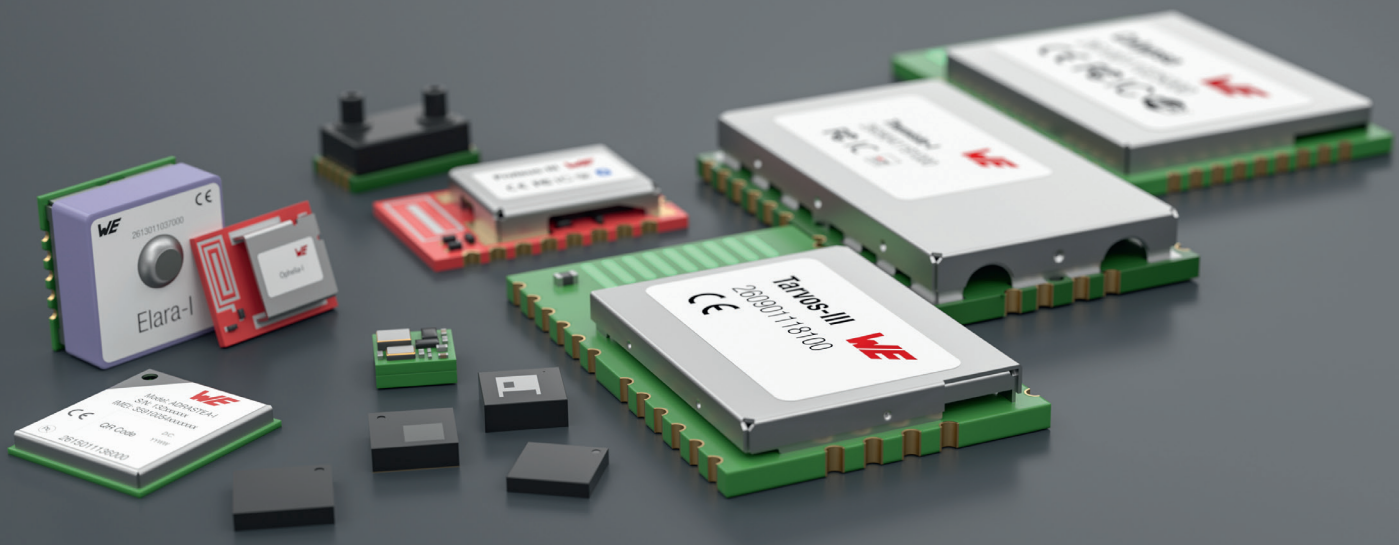

USER MANUAL

WSEN-HIDS FILTER CAP

2500060600000

VERSION 1.0

MARCH 13, 2025

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

Revision history

Manual version	Notes	Date
1.0	• Initial release of the user manual	March 2025

Abbreviations

Abbreviation	Description
PBT	Polybutylene Terephthalate
PCB	Printed Circuit Board
PTFE	Polytetrafluoroethylene

Contents

1 Product description

1.1 Introduction

The filter cap is made to provide protection for humidity sensors, ensuring consistent performance in harsh environments. By shielding sensors from contaminants such as dust, and water, it prolongs sensor life and preserves measurement accuracy.

Constructed from high-quality polybutylene terephthalate (PBT) with an integrated PTFE filter membrane, the WSEN-HIDS filter Cap minimizes internal cavity volume to reduce response time impact. Its snap-fit design enables seamless post-soldering installation, simplifying assembly workflows while ensuring robust attachment to the PCB. Compact and versatile, the filter cap integrates effortlessly into various device housings. For applications requiring enhanced environmental protection, additional sealing options like adhesives and o-rings can create a watertight assembly, further safeguarding the sensor in challenging conditions.

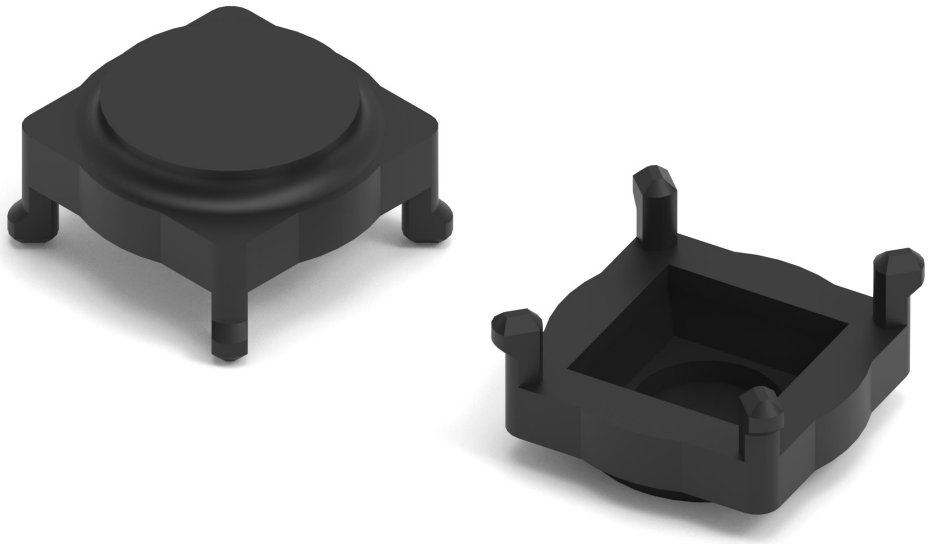

Figure 1: Filter cap

1.2 Main Functions

- **Protection against contaminants**: The filter cap provides a robust barrier against dust, water, and particle contamination, ensuring the sensor's longevity and accuracy in various environments.
- **Impact on response time**: The filter cap affects the sensor's response time and air exchange by acting as a barrier between the sensor and the environment. While it provides protection, it may slow down humidity exchange and slightly delay the sensor's response time compared to an exposed sensor.
- **Mechanical stability**: The filter cap is designed for secure attachment to the PCB, ensuring that the sensor remains firmly in place even in challenging conditions, thereby enhancing the overall durability of the sensor assembly.

- **Compact integration**: The filter cap forms a compact and unified assembly with the sensor, simplifying integration into the device housing. This design also allows for a streamlined waterproofing solution when used with an adhesive and an o-ring.
- **Ease of installation** : The filter cap features a straight forward installation process, where it can be clipped into the PCB after the soldering process, providing convenience and flexibility in the manufacturing workflow.

2 Material and Performance Data

Operating Conditions	
Operating Range	-40 °C to 125 °C
Ingress Protection (IP)[1]	IP67
RoHS Compliance	Yes

Material Properties	
Body Material	Polybutylene Terephthalate (PBT)
Body Color	Black
Flame Rating (UL94)	UL94 V-0

Filter Specifications	
Filter Material	PTFE with polyester scrim
Filter Color	Black
Filter Thickness	0.13 mm
Filter Pore Size	1.5 µm
Filtration Efficiency [2]	99.99%
Oleophobic Rating [3]	8

Performance	
Hydrostatic Resistance (Mullen Test)	>100 mbar (>1 m water)

Table 1: Material and performance data of the filter cap

[1] *Achieving IP rating at the connections between the housing, PCB, and filter cap is the customer's responsibility.*
[2] *0.1 µm particles at 0.05 m/s air flow.*
[3] *Resistance to oil and hydrocarbons is evaluated based on the AATCC 118-1992 standard, which assigns a rating from 0 to 8. A rating of 8 indicates the highest level of repellence.*

3 Handling Instruction

The sensor, protected by a filter cap, measures humidity that diffuses through the PTFE filter membrane. The membrane acts as a shield, preventing particles and liquids from reaching the sensor surface. However, any clogging of the membrane pores may restrict the diffusion of humidity, potentially compromising the sensor's performance. Furthermore, damage to the filter membrane can reduce the protective effect of the filter cap, leading to sensor degradation.

3.1 Preventing Membrane Clogging

To mitigate the risk of clogging or damaging the filter membrane due to improper handling of the filter cap, it is crucial to observe the following precautions:

- **Use appropriate handling tools:** It is recommended to use tools such as vacuum tweezers with rubber tips, pick-and-place tools with rubber tips, or tweezers with rounded tips. These tools minimize the risks of damaging the membrane during handling.
- **Avoid direct contact with the membrane:** Whenever possible, avoid direct contact between handling tools and the filter membrane. This precaution helps to maintain the integrity of the membrane's pores and prevents clogging.
- **Ensure cleanliness of tools:** If contact with the filter membrane is unavoidable, ensure that the handling tools are clean and free from contaminants such as oils or adhesives. Any contamination can compromise the membrane's performance.

3.2 Proper Insertion of the Filter Cap

When inserting the filter cap into dedicated holes on the PCB, a certain amount of force may be required. Apply force only to the membrane-free parts of the plastic housing or the outer ring of the circular membrane surface. Applying force directly to the center of the top surface may result in damage to the filter membrane, compromising its protective function.

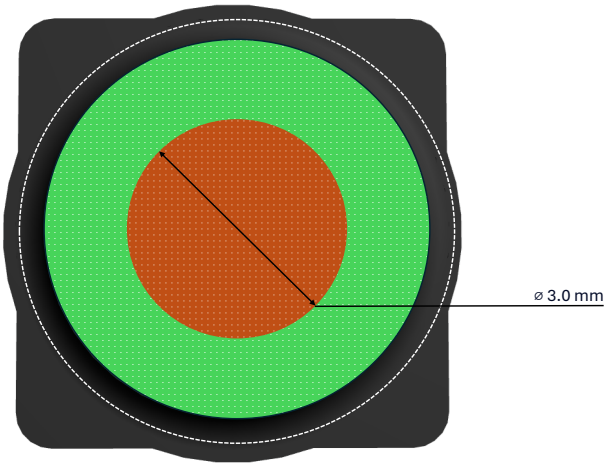

Figure 2: Top view of the filter cap.The green and black frame areas are safe for applying pressure, while the red area should be avoided to prevent damage.

If a conformal coating is applied to seal the solder pads before assembling the filter cap, ensure that the conformal coating does not cover the holes in the PCB designated for mounting the filter cap. Obstruction of these holes will prevent proper assembly of the filter cap.

4 Mounting Instruction

To ensure the optimal protection and positioning of the sensor, attach the protective cap to the PCB after soldering the sensor in place. The cap has four pins that align with openings on the PCB, allowing for secure attachment. Depending on the distance between these openings, the cap can either clip firmly onto the board using natural mechanical force or act as an adjustment or alignment guide when the cap is fixed to the PCB using glue or adhesive.

For a secure clipping fit, we recommend spacing the PCB openings at $5.1\,\text{mm} \pm 0.05\,\text{mm}$. If the PCB openings are intended primarily for alignment or adjustments, a spacing of $5.28\,\text{mm}$ is suitable. Adjusting the PCB opening distance by $\pm 0.05\,\text{mm}$ the level of clipping force can be fine-tuned to achieve the desired balance between secure attachment and ease of assembly. A smaller distance increases the force, while a larger distance reduces it.

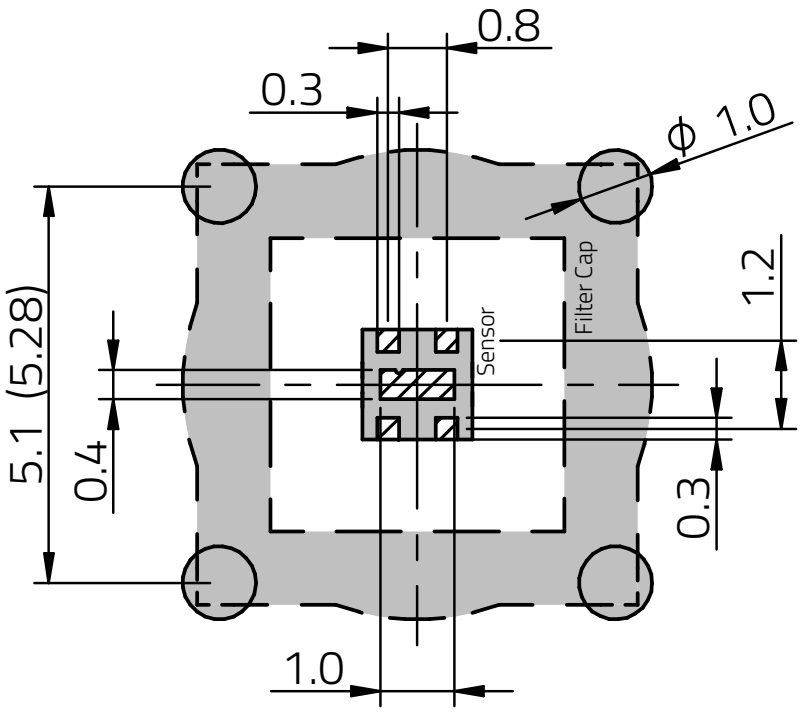

Figure 3: PCB layout example of WSEN-HIDS and filter cap. Dimensions are given in mm.

For applications where a hermetic seal is not required, the cap can be securely mounted on the PCB using the integrated clips, with no adhesive needed. However, it is important to note that when using clips alone, a small gap may remain between the cap and the PCB due to possible

unevenness of the surfaces. This gap might allow air to flow between the interior of the cap and the external environment, which could compromise the cap's ability to isolate the sensor's environment from external atmosphere.

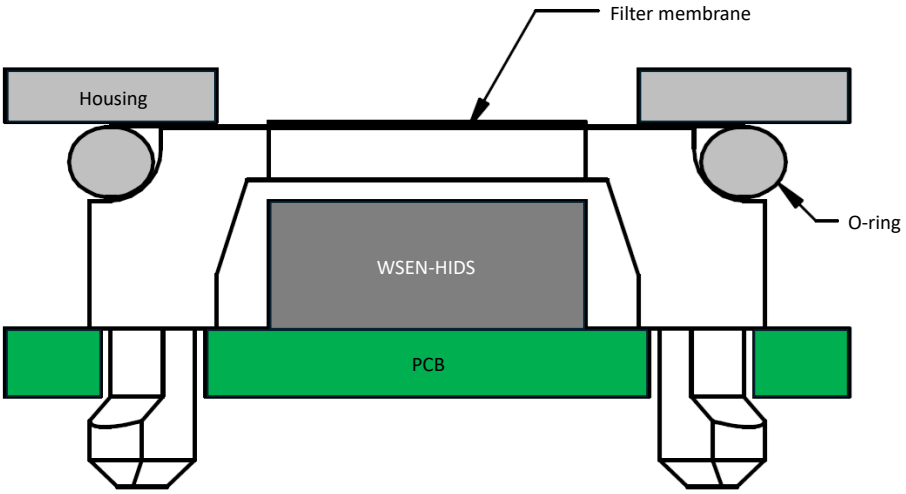

Figure 4: Interface of filter cap on PCB

In scenarios where a hermetic seal is essential, particularly to prevent air exchange or to ensure water (pressure) proofing, it is recommended to use adhesive in addition to the clips. This ensures a sealed interface between the cap and the PCB. For optimal clip mounting, a PCB thickness of at least 0.8 mm is recommended, and the mounting hole pattern should be designed according to the cap's specifications.

Additionally, care should be taken to protect the membrane and all parts of the cap from external forces or contact, as mechanical stress could cause the cap to shift or break. Designing the housing to fully enclose the cap, as suggested in Figure 4, can help shield the membrane and ensure the cap remains securely in place.

4.1 Enhanced Protection Measures

To achieve a secure and airtight seal between the filter cap and the PCB, it is necessary to use adhesive during the assembly process. This seal provides enhanced protection against water ingress, internal condensation and corrosion of the sensor's solder pads. Follow these steps for optimal adhesive application:

1. **Preparation and Adhesive Application:**
   - Select a mounting hole pattern that positions the filter cap's pins for alignment only.
   - In the PCB design, draw a line connecting the selected mounting hole pattern. This line will serve as a guide for adhesive application.
   - Apply the adhesive along this line, ensuring that the top surface of the WSEN-HIDS remains free of adhesive. Use adhesive dispensing equipment with a fine tip (e.g., gauge 22) to control the application.

- Conduct a test run to determine the correct amount of adhesive. The goal is to apply enough to form a closed line around the filter cap without allowing adhesive to enter the filter cap opening.

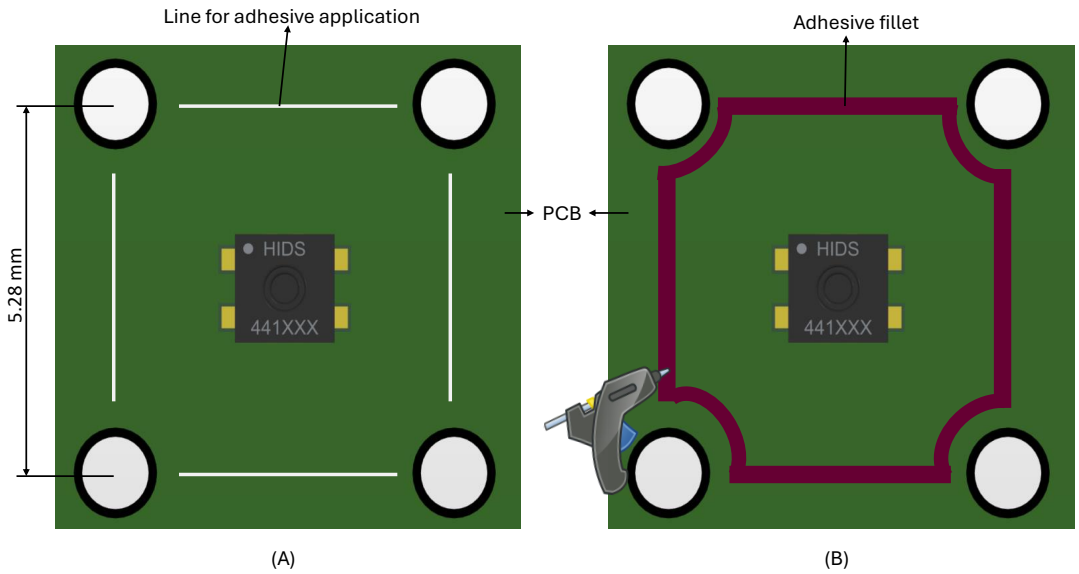

Figure 5: Application of adhesive

2. **Filter Cap Assembly:**
   - After placing the filter cap onto the PCB, a slight fillet of adhesive should be visible around the edges of the cap. During the test run, verify that no adhesive is visible in the filter cap opening after removing the membrane. If adhesive is present in the opening, reduce the amount used.

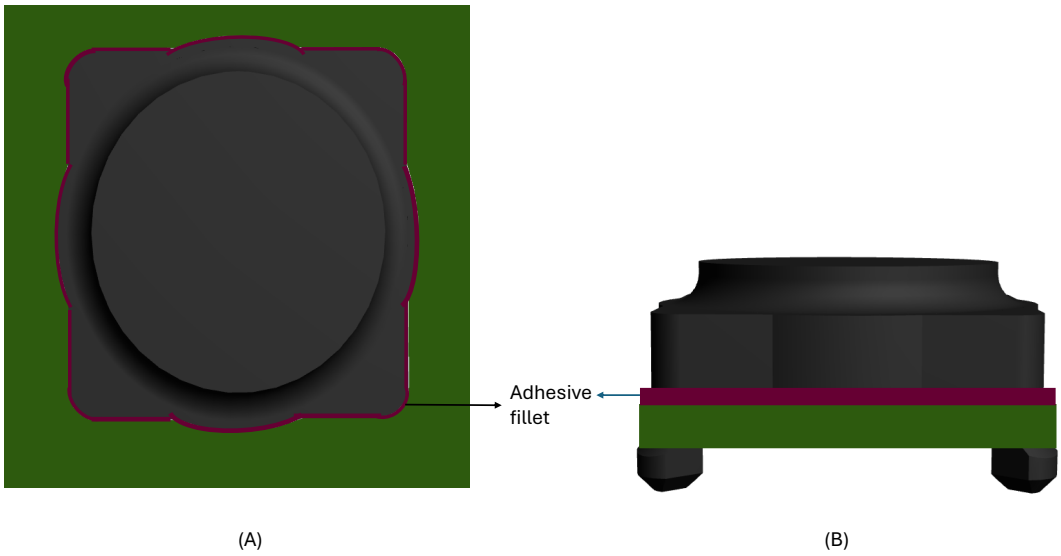

Figure 6: Application of adhesive

3. **Curing the Adhesive:**
    - Cure the adhesive according to the manufacturer's data sheet. Ensure that this process is carried out in a well-ventilated area to ensure proper curing and safety.

For applications where solder joint corrosion is a concern, coating the solder points with adhesive is advisable.

4.2 Mounting to the Housing Wall

In addition to providing defense against dust and water ingress, the protective cap facilitates the secure mounting of the sensor to the housing wall. When attached to an external housing wall, the sensor is optimally positioned to measure the humidity and temperature of the surrounding environment.

To safeguard the interior of the device housing from water ingress, it is recommended to place an o-ring between the protective cap and the housing wall. Refer to Figure 4 for reference. For such o-rings, the following specifications are recommended.

- Inner Diameter: 5 mm
- Cross Section: 1 mm
- Material: NBR (Nitrile Butadiene Rubber)

Important: Ensure that the airflow path to the measured environment is unobstructed by any additional membranes, as this could significantly delay the sensor's response time.

5 Product drawing

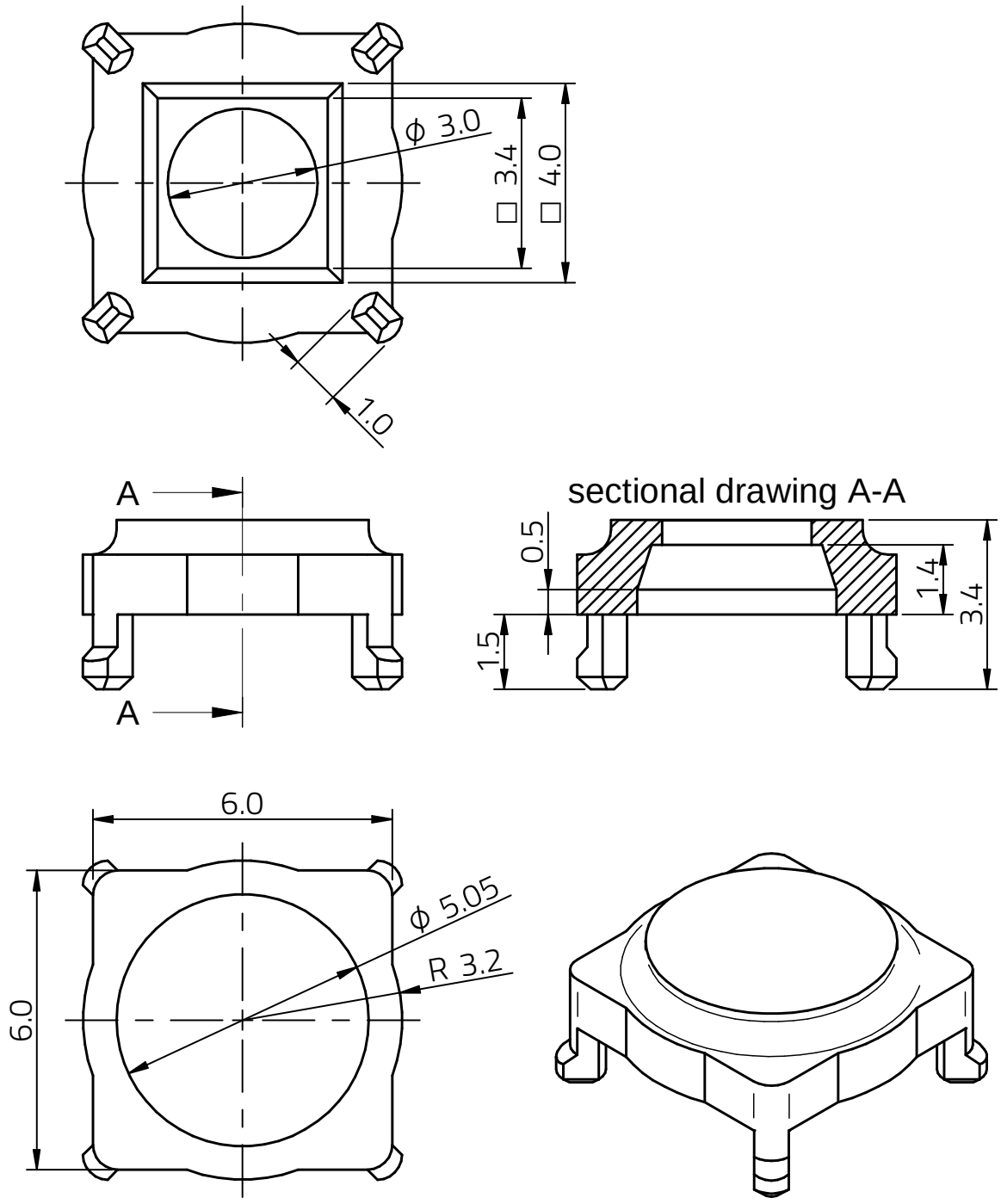

Figure 7: Product drawing. Dimensions are given in mm.

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