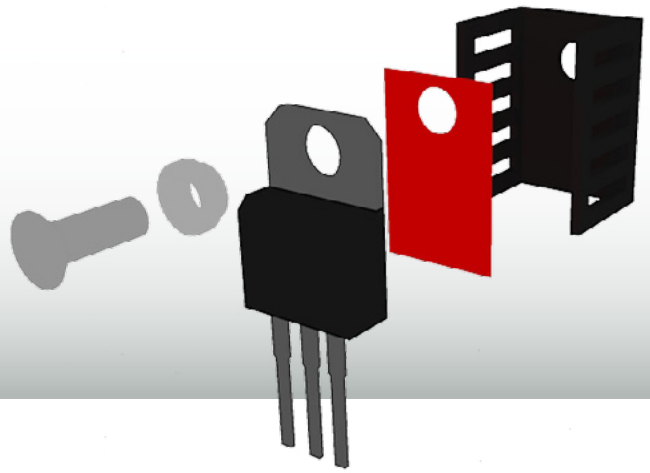
WÜRTH ELEKTRONIK

WE-TINS Design Guideline

Thermally Conductive Insulator



Content:

Thermally Conductive Insulator

Thermal Management is the term used to describe the methods used take care of the excess heat that electronic devices and components generate. It is a field of upmost importance in order to guarantee reliability of electronic devices and components as well as to prevent premature failure.

1. What is the WE-TINS used for?

The WE-TINS is a silicone elastomer gap filler pad, designed to electrically isolate electronic components and cooling assemblies, such as a heatsinks, metal housings or radiators.

The pad itself is composed by two main components, as shown in Figure 1:

- **Thermally conductive silicone rubber:** This is the main part of the component. Silicone allows the product to be soft and to conform with ease. It also provides electrical insulation between contact surfaces.
- **Fiberglass mesh:** this component brings mechanical strength to the product as well as shear and puncture resistance.

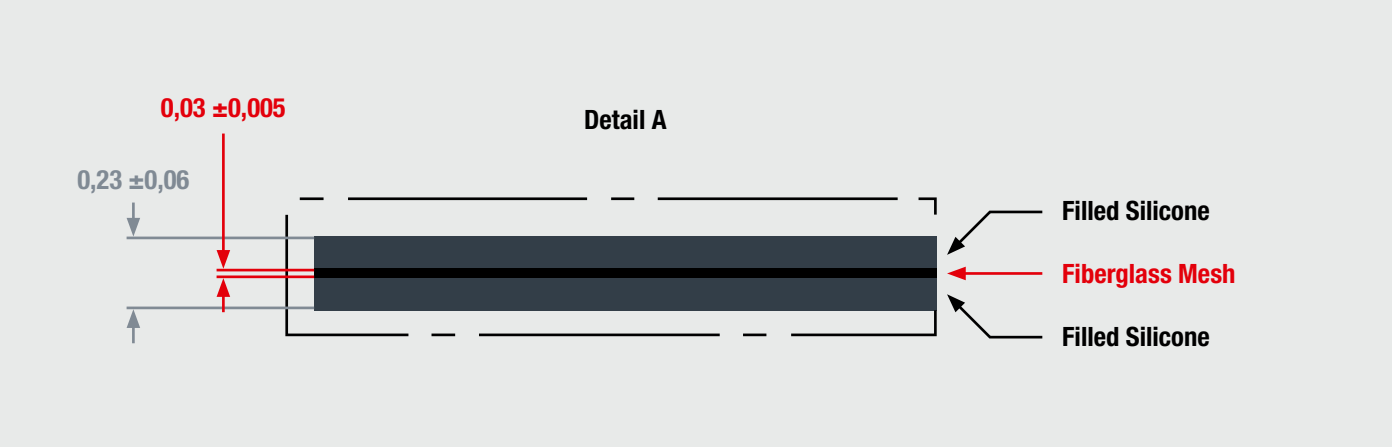


Fig. 1: *WE-TINS cross-section*

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2. Where can the WE-TINS be used?

The WE-TINS is designed for applications where electrical insulation between component and cooling assembly is needed as well as the conduction of heat energy. The most common use of this product is in combination with the Transistor Outline (TO) package family and heat sink assemblies (**Figure 2**).

- **Thermal Conductivity:** From a common use 1.6 W/mK version up to 3.5 W/mK for the most demanding applications.
- **Thickness:** Standard thickness of 0.23 and 0.25 mm depending on the thermal conductivity.
- **Electric Insulation:** since the product is based on a silicone matrix, there is complete electric insulation between the component's contact surfaces of > 5.5 kV/mm.
- **High-pressure applications:** The WE-TINS is able to withstand a tensile strength of 30 MPa. Also it is designed to be mechanically compressed as in the picture above. Hardness (Shore A) of 70 – 92.

The standard product comes as a dry pad. If for a particular application one or two side adhesive is needed, it can also be added as an optional component with our customization service.

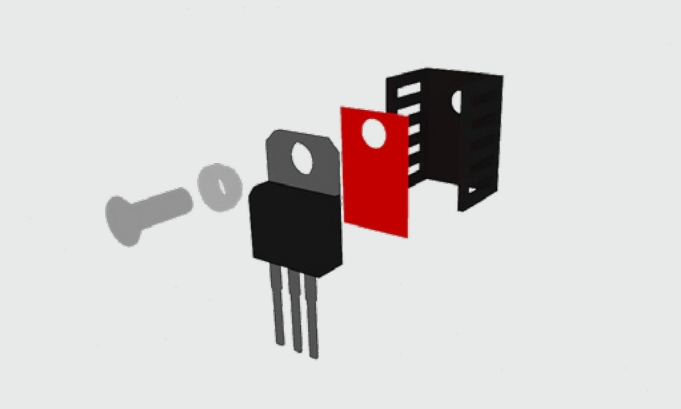

Fig. 2: *Transistor mounted on a heat sink with an Insulator pad*

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3. Solutions specially tailored for you

Another benefit of the WE-TINS that adds value to its versatility is the ease of shape customization. Würth Elektronik brings this value to you by providing a customization service with no **MOQ** and no **tooling costs**.

Reach out to your Würth Elektronik representative with the following information and they will get back to you with a personized quotation:

- Thermal Conductivity needed for the application
- Number of parts needed
- Technical drawing of the tailored solution
- Any other requirement you may have

4. General use of the WE-TINS recommendations

- For optimal laying, the surfaces of the component and the cooling assembly must be clean and dry. It is recommended to use Isopropyl alcohol applied with a lint-free wipe or swab for removing any particles on the surfaces.
- Gaps and/or air bubbles between the gap filler and the contact surfaces must be avoided. Otherwise, the performance of the product may be affected.
- The temperature rise of the component which needs thermal management must be taken into consideration. The operating temperature is comprised of ambient temperature and temperature rise of the component.
- It is highly recommended to cut the WE- TINS as straight as possible to improve the contact between the surfaces.
- Due to the mechanical properties of the material, it can be compressed as desired. Tensile strength of up to 30 MPa.

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5. Frequently Asked Questions

Q: Can I modify standard parts? What if I need an adhesive pad or something outside of the catalogue?

A: There are many ways to tailor the part to fulfil your requirements, please contact your Würth Elektronik representative for your specific solution:

- Dimensions
- Shapes
- Adhesive surfaces

Q: What test method has been used for the thermal performance measurements provided by the datasheet?

A: All thermal related measurements have been performed following ASTM D5470.

Q: Will the material change its mechanical properties under high temperatures?

A: If the material is used under the parameters specified in the datasheet there will be no significant change in its hardness or any other mechanical property.

Q: Can the WE-TINS be reworked / re-attached?

A: If the part in use does not have optional adhesives in it's contact surfaces, then it can be reworked.

Q: Does the WE-TINS also help in vibration dampening?

A: Due to the soft nature of the product it will certainly help with vibration dampening without the need of any other mechanical help.

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6. Thermal Properties & Glossary

Thermal interface materials (TIMs) are materials that are inserted between two surfaces to improve the thermal coupling between them. The usual application is between a heat source and a cooling assembly.

TIMs can be categorized in two main groups:

- **Vertical Thermal Interfaces:** The commonly used gap filling solution such as silicone elastomers, thermal transfer tapes or greases.
- **Heat spreaders:** : These materials work great distributing heat from one spot to a whole surface.

Besides providing a path for heat energy to flow through, these materials provide a seamless interface between all contact surfaces, conforming to any microscopic irregularities in either the heat source or the cooling assembly. This is an important characteristic, since air is a thermal insulator and it can become a barrier that affects the overall performance of the solution.

As represented in **Figure 3,** we can combine two different TIMs to take advantage of a combination between vertical and horizontal interfaces. In the example TIM 2 could be a WE-TGF silicone gap filler and TIM 1 a WE-TGS graphite heat spreader. This combination would allow the use of a larger heatsink than the footprint of the heat source would allow, thus enhancing the cooling capabilities of the whole assembly.

There are many factors that should be taken into consideration when selecting the optimal Thermal Management Solution of your application. The most common ones are:

- **Thermal conductivity:** Determines the overall performance of the heat transfer between contact surfaces.
- **Thermal resistance:** Opposition of the material to transfer heat, the lower the resistance the more efficient the TIM is. This property is the reciprocal of the thermal conductivity.
- **Electrical conductivity:** Depending on the TIM electrical insulation can be an intrinsic property of the material. But for those that are not other layers can be added to the material in order to insulate it.
- **Operating temperature range:** TIMs work at different temperature ranges so it must be taken into consideration when selecting a solution.
- **Thickness/Height:** The distance between the mating surfaces is a key factor in order to select a TIM. Depending on the solutions, it must be taken into consideration that the material should be compressed (as recommended in the datasheet) to achieve optimal thermal performance.
- **Pressure:** Depending on the final application, some materials are designed to withstand higher pressure such as the WE-TINS.

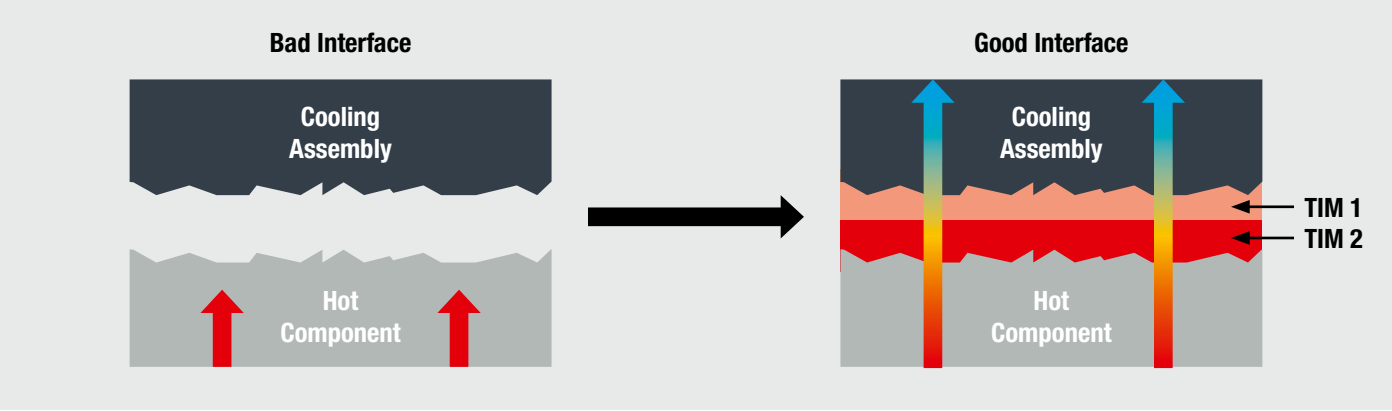

Fig. 3: *Detail of contact surfaces*

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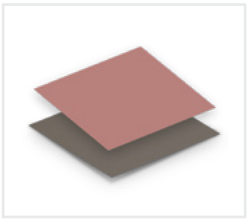
7. Würth Elektronik's Thermal Management Solutions

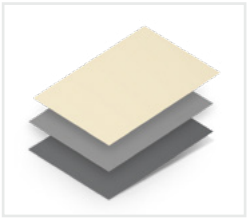
Gap filling solutions vary in shape and form; there are different criteria to be considered when looking for a solution: dimensions of the gap that needs filling, evaluation of the heat energy that needs to be managed and if electrical insulation is required between the hot component and the cooling assembly.

Würth Elektronik brings to you a broad portfolio with solutions for any gap, interface type and thermal conductivity.

WE-TGF
Silicone Gap Filler Pad
K: 1 – 10 W/mK
Thickness: 0.5 – 18 mm



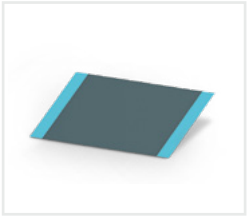
WE-TINS
Thermally Conductive Insulator
K: 1.6 – 3.5 W/mK
Thickness: 0.23 mm



WE-PCM
Phase Changing Material
K: 1.6 – 5 W/mK
Thickness: 0.2 mm

WE-TTT
Thermal Transfer Tape
K: 1 W/mK
Thickness: 0.2 mm

WE-TGFG
Graphite Foam Gasket
K: 400 W/mK
Thickness: 1.5 – 25 mm



WE-TGS
Graphite Sheet
K: 1800 W/mK
Thickness: 0.03 mm