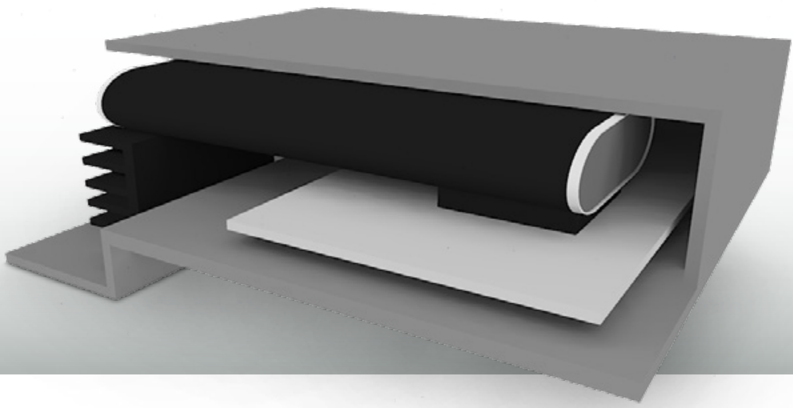
WE-TGFG Design Guideline

Thermally conductive Synthetic Graphite Foam gasket



Content:

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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-TGFG used for?

The WE-TGFG is a synthetic graphite layer wrapped around a core of foam. By placing the graphite around a foam core we provide vertical conductivity to a horizontal heat spreader.

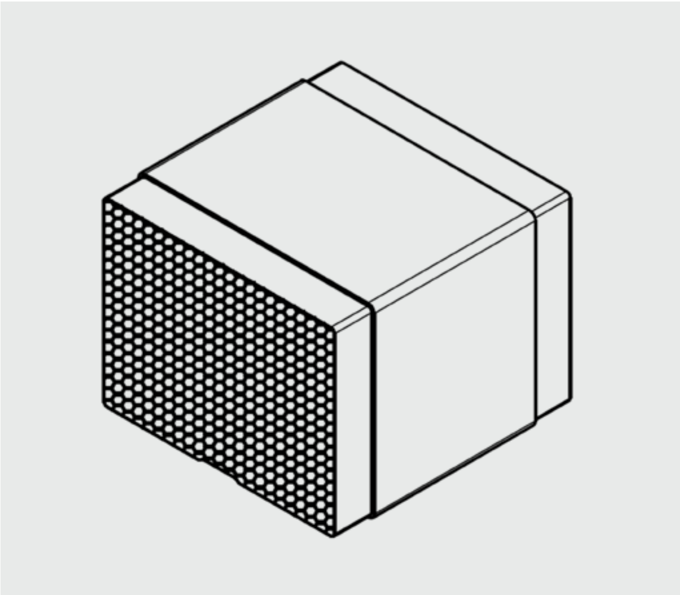

Fig. 1: *WE-TGFG components*

The Graphite foam gasket itself is composed by four main components as shown in Figure 1:

- **Acrylic Film:** The WE-TGFG is protected by two films, that provide electrical insulation between the contact surfaces.
- **Graphite layer:** Is the component which has the thermal conductivity properties.
- **Adhesive layer:** A thermally conductive adhesive layer is applied to the base of the product for mechanical fixing until final compression & assembly.
- **Heat Resistant Foam:** Provides mechanical stability and the elasticity to the gasket, allowing it to be compressed by reducing the height of the graphite and at the same time to ensure the best thermal interface.

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2. Where can the WE-TGFG be used?

The WE-TGFG is designed to be used in applications where the traditional thermal interface materials (TIM) cannot reach. Because it combines heat spreading as well as gap filling properties, it can be used to transport heat in all the axes (X, Y and Z).

Since it is a general purpose solution it covers a wide range of application requirements:

- **Thermal Conductivity:** 400 W/m*K.
- **Thickness:** From 2 to 25 mm of thickness available.

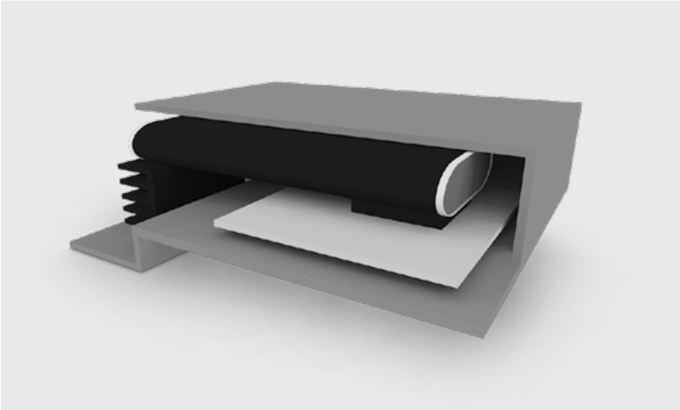

Fig. 2: *Heat sink assembly away from component*

Graphite gaskets are often presented as the alternative to traditional silicone gap fillers in applications where silicone is not allowed to be used.

The WE-TGFG can also be used as an alternative to traditional silicone gap fillers when a large gap needs to be filled with a high performance pad. The higher required thermal conductivity of the silicone pad the thinner it needs to be due to a manufacturing constrains. The WE-TGFG can fill gaps of up to 25mm with a much higher thermal conductivity than the one provided by the silicone elastomer.

By taking advantage of the heat spreading capabilities of the graphite, long gaskets can be manufactured in order to give designers solutions to problems where a heatsink cannot be mounted directly on top of the component. An example is illustrated in **Figure 2**.

Another benefit provided by the foam core is the possibility to manufacture gaskets with different profiles in order to give designers the liberty of not having the need of flat contact surfaces on cooling assemblies (**Figure 3**).

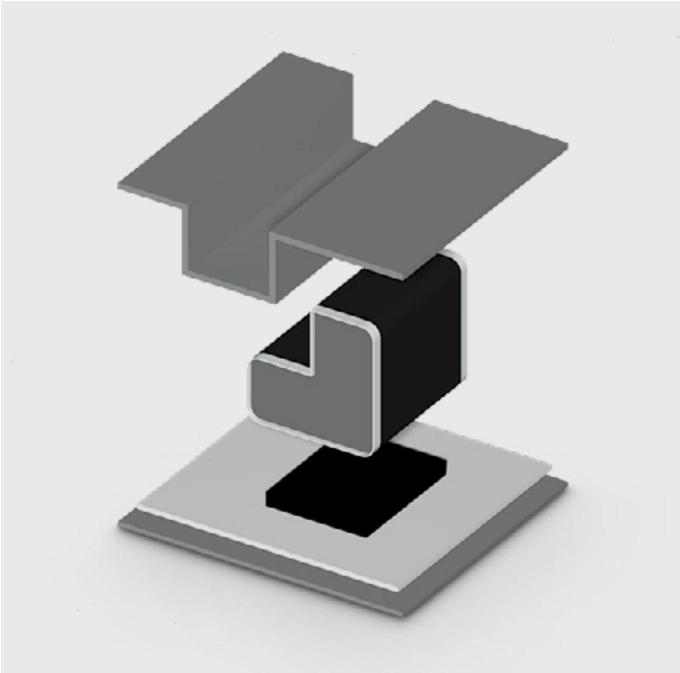

Fig. 3: *The use of a traditional TIM would be impossible here*

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3. Solutions specially tailored for you

Another benefit of the WE-TGFG that adds value to its versatility is the ease of shape customization. Würth Elektronik brings this value to you by providing a customization service of simple modifications **without tooling costs**.

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

- Desired thickness, shape and profile
- Volume or number of parts needed
- Technical drawing of the tailored solution
- Any other requirement you may have

4. General recommendations, how to use the WE-TGFG

- For optimal adhesion properties, the surface must be clean and dry. It is recommended use Isopropyl alcohol applied with a lint-free wipe or swab for removing surface contamination.
- Gaps and/or air bubbles between the gap filler and the contact surface must be avoided. Otherwise, the performance of the product may be affected.
- The temperature rise of the component must be taken into consideration. The operating temperature is comprised of ambient temperature and temperature rise of the component.
- For a proper operation, it is recommended to compress it between 20 % and 30 % from its original height.
- Exceeding the recommended compression can lead to mechanical failure.
- It is recommended to compress the material with equal pressure on the whole surface.

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5. Frequently Asked Questions

Q: Can I modify standard parts? What if I need a non-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.

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 C518.

Q: Is the WE-TGFG electrically insulating?

A: Graphite gaskets have an acrylic layer which provides electrical insulation.

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: Is it possible to request the WE-TGFG without any adhesive tape?

A: Yes, the WE-TGFG can be manufactured without an adhesive layer.

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

A: If a part with adhesive is used, rework is not recommended due to contamination of the contact surface by foreign particles. This can lead to thermal performance and adhesive issues.

Q: Can I do a special profile for my application?

A: Yes, profiles can be specially tailored for you.

Q: One of the standard parts suits my needs, could you supply it a little wider, thicker or longer?

A: Yes, all dimensions are modifiable.

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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 4**, 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.
- **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.

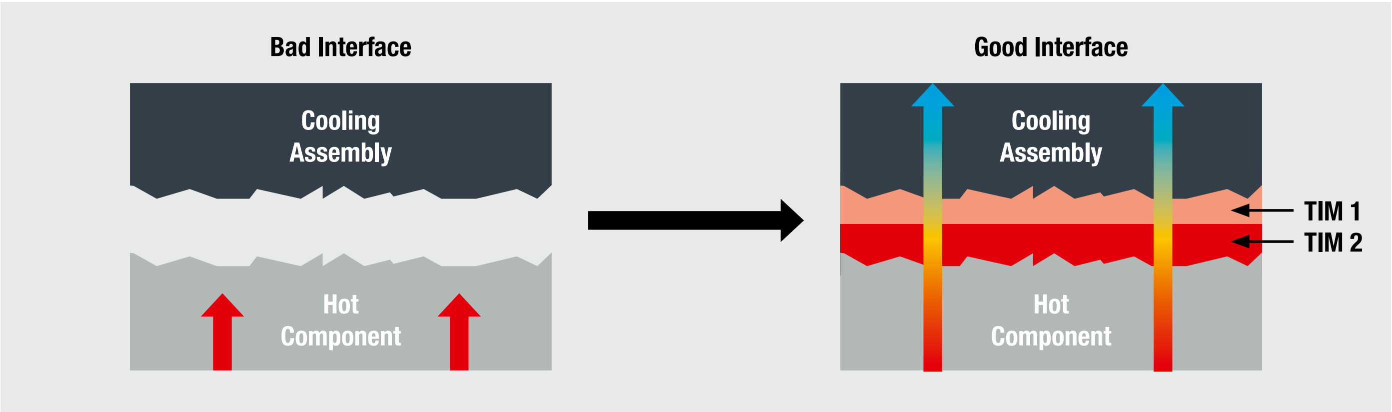

***Fig. 4:** Detail of contact surfaces*

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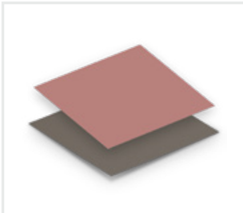
7. Würth Elektronik's Thermal Management Solutions

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

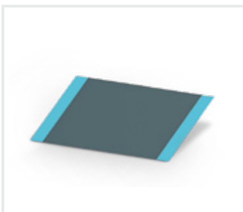


WE-TINS
Thermally Conductive Insulator
K: 1.6–3.5 W/mK
Thickness: 0.23 mm

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