Thermal Compound Selection Guide
Silicone-Free Thermal Interface Material

Thermal Interface Material (TIM) is any material used to enhance thermal coupling between two parts. TIM may be known by any number of names including thermal compound, thermal grease, thermal gel, heat sink compound, CPU grease, gap filler, and thermal paste. Each is formulated to provide an advantage in specific use conditions. Depending on the materials used, unit price varies from inexpensive to quite high for premium performance.

When two surfaces are placed in contact, surface imperfections cause contact to occur at discrete points, with a relatively low percentage of the nominal area making contact. Thermal compounds are intended to conform to surfaces, filling in the space between discrete contact points. This creates an uninterrupted, thermally-conductive path between surfaces, delivering far better heat-carrying capacity than contact points alone.

**Mechanics of Heat Transfer**

Choosing the best thermal compound requires some understanding of the mechanics of heat transfer and how the thickness of the thermal compound layer, the bond line thickness, influences product choice.

Bond line can be divided into three categories:

- **Low**, at less than 75 μm
- **Medium**, from 75 to 250 μm
- **High**, at greater than 250 μm

There are two critical thermal performance characteristics: Thermal Conductivity (TC) and Thermal Resistance (TR). In low bond line applications, thermal resistance dominates performance. In high bond line applications, thermal conductivity dominates performance. In medium bond line there is a blended influence.

**Thermal Conductivity (TC)**

TC is a measurement of heat transfer between Material 1 and Material 2, expressed in units of W/mK (see Figure 1). The thicker the layer of thermal compound, the greater the influence of thermal conductivity. Examples: copper 385, steel 50.4, glass 0.80, TIM 0.6-8.0, and wood <0.12.

**Thermal Resistance (TR)**

TR is a measurement of temperature drop across an interface of materials, expressed as °C/W. Thermal compounds that have the best wetting and filler structure can have exceptionally low thermal resistance with moderate thermal conductivity. In low and medium thickness applications this lower thermal resistance can greatly enhance heat transfer because thermal coupling is more efficient.
Recommended Thermal Compound based on Bond Line

<table>
<thead>
<tr>
<th>Formula</th>
<th>Bond Line Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>52054</td>
<td>Low</td>
</tr>
<tr>
<td>52160</td>
<td>Medium</td>
</tr>
<tr>
<td>52055</td>
<td>High</td>
</tr>
<tr>
<td>52050</td>
<td>Low</td>
</tr>
<tr>
<td>52060</td>
<td>Medium</td>
</tr>
<tr>
<td>52022</td>
<td>High</td>
</tr>
<tr>
<td>52153</td>
<td>Low</td>
</tr>
<tr>
<td>52070</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Legend:
- **TC**: Thermal Conductivity
- **TR**: Thermal Resistance
- **BLT**: Bond Line Thickness
- **WC**: Water Cleanable

Non-Metal Filled Low TR Thermal Grease
- TC: 1.3 W/mK
- TR: 0.0310 °C/W

Metal Filled Low BLT Thermal Grease
- TC: 2.0 W/mK
- TR: 0.0416 °C/W

Non-Metal Filled WC Thermal Grease
- TC: 1.3 W/mK
- TR: 0.0334 °C/W

Non-Metal Filled High TC Thermal Grease
- TC: 3.8 W/mK
- TR: 0.0671 °C/W

Metal Filled High TC Thermal Grease
- TC: 6.0 W/mK
- TR: 0.0800 °C/W

Non-Metal Filled Original Thermal Grease
- TC: 0.92 W/mK
- TR: 0.0671 °C/W

Non-Metal Filled Low Cost Gap Filler
- TC: 3.5 W/mK
- TR: 0.100 °C/W

Metal filled Gap Filler
- TC: 7.4 W/mK
- TR: 0.085 °C/W

For Nordson EFD sales and service in over 40 countries, contact Nordson EFD or go to www.nordsonefd.com

Global
East Providence, RI USA
800-556-3484; +1-401-431-7000
info@nordsonefd.com

Europe
Dunstable, Bedfordshire, UK
0800 585733; +44 (0) 1582 666334
europe@nordsonefd.com

Asia
China: +86 (21) 3866 9006; china@nordsonefd.com
India: +91 80 4021 3600; india@nordsonefd.com
Japan: +81 03 5762 2760; japan@nordsonefd.com
Korea: +82-31-736-8321; korea@nordsonefd.com
SEAAsia: +65 6796 9522; sin-mal@nordsonefd.com

©2017 Nordson Corporation v032317