Silicone thermal interface materials are compound materials which contain a high ratio of thermally conductive fillers. They exhibit outstanding thermal conductivity because they fit snugly in the gap between the heating element and the heatsink. Shin-Etsu Silicone offers an optimal heat dissipation solution tailored to the required usage and performance from a wide range of product lineups.

**Model of Improved Thermal Conductivity**

Silicone thermal interface materials fill a fine gap between a heat-generating unit and a heatsink, and efficiently transfer heat.

**Thermal conductivity**

Silicone thermal interface materials: approx. 0.8 to 8.0 W/m·K  
Air: approx. 0.03 W/m·K

---

**Product Lineup**

### Thermal Interface Insulating Silicone Rubber Sheets

**Main Products:** TC-TA Series

**P4**

- **Features**
  - Easy to use, excellent stability  
  - There are a variety of shapes, such as sheets, caps, tubes, etc.  
  - Excellent electrical insulation

### Thermal Interface Silicone Soft Pads

**Main Products:** TC-CA Series

**P5**

- **Features**
  - Easy to use  
  - Soft, excellent adhesion  
  - Excellent electrical insulation

### Double Sided Thermal Interface Silicone Tapes

**Main Products:** TC-SAS Series

**P6**

- **Features**
  - High tackiness  
  - Wide use temperature range (-40°C to +150°C)  
  - Excellent reworkability

### Thermal Softening Sheets Phase Change Materials

**Main Products:** PCS Series

**P6**

- **Features**
  - Thermal softening sheet with excellent workability  
  - Low contact thermal resistance  
  - Available for low BLT

---

**Liquid and Grease Products**

### Thermal Interface Oil Compounds

**Main Products:** G-XXX Series

**P7**

- **Features**
  - Thin film coating is possible (low BLT is possible)  
  - Lower contact thermal resistance  
  - Optimal for the application of uneven adherends

### Condensation Cure Type Liquid Silicone Rubbers

**P8**

- **Features**
  - Cure by reaction with moisture under room temperature  
  - Bonding and fixing of electronic components are possible.  
  - Optimal for the application of uneven adherends

### Addition Cure Type Liquid Silicone Rubbers Adhesives/ Potting Materials

**P8**

- **Features**
  - The product can be cured for a short time by heating  
  - 2 component room temperature cure type is also available.  
  - Bonding and fixing of electronic components are possible.  
  - Optimal for the application of uneven adherends

---

**Gap Filler SDP Series & CLG Series**

**P7 & P9**

- **Features**
  - Thick application is possible.  
  - Optimal for the application of uneven adherends  
  - Balancing resistance to misalignment and cracking and low stress

---

**Soft cured sample of G-1000**  
**Soft cured sheet of SDP series**
Thermal Interface Insulating Silicone Rubber Sheets

Suitable Applications
- Substitute for insulating paper
- Thermal dissipation in areas where insulation is to be ensured only by sandwiching a thin sheet

Features
- With thermal conductivity, heat dissipation from heating elements
- Insulation can be guaranteed by ensuring creepage distance.
- Excellent workability, stability, and electrical insulation
- There are a variety of shapes, such as sheets, caps and tubes, etc.

Structure
- Thin sheet that ensures insulation
- Compatible with the shape of tubes and caps as required

General Properties

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td></td>
<td>Black brown</td>
<td>Purple</td>
<td>Light purple</td>
<td>Dark Gray</td>
<td>Pink</td>
<td>Light gray</td>
<td>White</td>
</tr>
<tr>
<td>Reinforcement layer</td>
<td></td>
<td>None</td>
<td>Glass cloth</td>
<td>Polyimide film</td>
<td>Glass cloth</td>
<td>Glass cloth</td>
<td>Glass cloth</td>
<td>Glass cloth</td>
</tr>
<tr>
<td>Standard size</td>
<td>mm</td>
<td>300×1,000</td>
<td>300×1,000</td>
<td>320×1,000</td>
<td>300×1,000</td>
<td>420×500</td>
<td>420×500</td>
<td>210×270</td>
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<tr>
<td>Thickness</td>
<td>mm</td>
<td>0.20, 0.30, 0.45, 0.60</td>
<td>0.13, 0.30, 0.45, 0.80</td>
<td>0.11</td>
<td>0.20, 0.30, 0.45, 0.60</td>
<td>0.20, 0.30, 0.45, 0.60</td>
<td>0.20, 0.30, 0.45, 0.60</td>
<td>0.20, 0.30, 0.45</td>
</tr>
</tbody>
</table>

Representative product properties

- Thermal conductivity of rubber W/m·K: ISO 22007-2
- Thermal conductivity of products W/m·K: ISO 22007-2
- Thermal resistance 50°C/100 psi: ASTM D5470
- Density at 23°C: JIS K 6249
- Hardness Durometer A: JIS K 6249
- Dielectric breakdown voltage: JIS K 6249
- Dielectric strength: JIS C 2110
- Volume resistivity: TO-m
- Flame retardance UL94:
- Low-voltage weight loss count ID×D×W ppm: Shin-Etsu method

Application Examples
- transistor heat dissipation

Instructions for Use

- Transistor heat dissipation

Contact
- Sales and Marketing Department
- Phone: +81-(0)3-3246-5101
Thermal Interface Silicone Soft Pads

Suitable Applications
- Heat radiation from uneven heat sources*
- Attaching multiple heating elements together
- Ensuring the space as an insulator
- By absorbing gaps generated by tolerances on the heat source side and the heatsink side, voids between the heat generating elements, pads, and heat sink are eliminated, and the heat radiation effect is maximized.

Features
- Maximize heat dissipation effect by adhering well to heat generating parts and reducing thermal resistance
- Easy attachment/detachment to/from the heat generating part and temporary fixation, and excellent workability
- Dissipate heat from each heating element to the overall housing and heatsink
- High cost performance and thermal conductivity

Structure

- Single layer type
  - Protective film (polyethylene)
  - Silicone soft pad
  - Protective film (PET)

- Multi-layer type (TC-SP-1.7 Series)
  - Protective film (PET)
  - Adhesive side: Silicone soft pad
  - Non-stick side: Glass cloth containing thermal conductive silicone rubber

Application Examples
- Radiating heat from uneven heat sources
- Temporary fixation is possible at the time of mounting.
- Heat dissipation of electric vehicle batteries

General Properties

<table>
<thead>
<tr>
<th>Type</th>
<th>Ultra-soft Multi-layer</th>
<th>General-purpose</th>
<th>Low density</th>
<th>Ultra High Thermal Conductivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td>Series</td>
<td>TC-SP-1.7 Series</td>
<td>TC-CAS-10 Series</td>
<td>TC-CAB-10 Series</td>
</tr>
<tr>
<td>Color</td>
<td>Light blue/gray</td>
<td>Dark gray</td>
<td>Pale red/bronze</td>
<td>Pale red purple</td>
</tr>
<tr>
<td>Standard size</td>
<td>mm</td>
<td>300×400</td>
<td>300×400</td>
<td>300×400</td>
</tr>
<tr>
<td>Thickness*1</td>
<td>mm</td>
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<td>0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0</td>
<td>0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0</td>
</tr>
<tr>
<td>Representative product properties</td>
<td>Test method</td>
<td>TC-SP-1.7</td>
<td>TC-CAS-10</td>
<td>TC-CAB-10</td>
</tr>
<tr>
<td>Thermal conductivity of rubber</td>
<td>W/m·K</td>
<td>ISO 22007-2*2</td>
<td>1.5</td>
<td>1.8</td>
</tr>
<tr>
<td>Thermal resistance 50°C/40 ps</td>
<td>cm²·K/W</td>
<td>ASTM D4570</td>
<td>8.2</td>
<td>3.3</td>
</tr>
<tr>
<td>Density at 23°C</td>
<td>g/cm³</td>
<td>JIS K 6249</td>
<td>2.3</td>
<td>1.9</td>
</tr>
<tr>
<td>Hardness Aker C*3</td>
<td></td>
<td>JIS K 6249</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Dielectric breakdown voltage in oil</td>
<td>kV</td>
<td>JIS K 6249</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>Dielectric strength in oil</td>
<td>kV</td>
<td>JIS C 2110</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>Flame retardance UL94</td>
<td>—</td>
<td>V-0 (UL file No. E48923)</td>
<td>V-0 equivalent</td>
<td></td>
</tr>
<tr>
<td>Iodine value/weight % of 20°C/20μm</td>
<td>Shinketsu method*4</td>
<td>20</td>
<td>70</td>
<td>90</td>
</tr>
</tbody>
</table>

*1 Please contact our sales department for details on other thickness of the product line.
*2 Hardness Aker C: Measured by standing two thermal interface soft silicone pads with a thickness of 1 mm.
*3 Not in stock method
*4 American extraction method

Contact: Sales and Marketing Department III Phone: +81-(0)3-3246-5101
Suitable Applications
- Insulating heat dissipation of the part to be fixed by adhesive
- Insulation + Heat dissipation + Adhesive Fixing for Transistor

Structure
- Transparent protection film
- Double sided adhesive layer
- Protective film

Features
- Threadless with strong and stable adhesion
- Stable thermal resistance over a wide range of temperatures
- Good workability in large areas

Application Examples
- Insulation + Heat dissipation + Adhesive Fixing for Transistor
- Insulation between LED light source and heatsink + Heat dissipation + Adhesive fixation

Reliability test data
- Temperature dependence of adhesion
- Shear stress after aging

General Properties

- Parameter | Product name | Test method | TC-10SAS | TC-20SAS
- Thermal conductivity | W/m·K | ASTM E1461 | 1.0 | 1.0
- Thermal resistance | cm²·K/W | ASTM E1461 | 2.0 | 2.9
- Color | - | White | White
- Standard size | mm | 300×400 | 300×400
- Thickness** | μm | 100 | 200
- Delaunay breakdown voltage | kV | J5 K 6249 | 3 | 6
- Peeling strength**
  - Aluminum | - | 6.0 | 6.4
  - SUS | - | 7.0 | 7.6
  - Glass epoxy | - | 7.6 | 8.1
- Flame resistance UL94 | - | V-0 (UL file No. E48923)

Suitable Applications
- Heat dissipation at the site requiring the thinness (low BLT*)
  - BLT=Bond Line Thickness
- Heat dissipation in the vertical region

Features
- Handling of sheets and heat dissipation performance of grease are compatible.
- Adhesion and insertion are possible in determinate quantities with adhesion comparable to grease.
- Softened to grease at about 50°C
- When compression is applied in a heat softened state, the BLT becomes low.
- The wettableness is improved by the self-heating of the device even after mounting.
- Excellent pumpout resistance

Application Examples
- Heat dissipation between LED light sources and heatsinks
  - When the base plate is ceramic (insulating specification)
  - For aluminum (conductive type)
  - Insulated tapes

Model of heat softening

Before softening
- Improved adhesion reduces contact thermal resistance

General Properties

- Parameter | Product name | Test method | PCS-CR-10 | PCS-LT-30 | PCS-PL-30
- Thermal conductivity | W/m·K | ASTM E1461 | 2.0 | 3.0 | 1.7**
- Thermal resistance | cm²·K/W | ASTM E1461 | 0.08 | 0.11 | 0.73
- Type | - | Non-Insulated | Non-Insulated | Insulator
- Color | - | White | Gray | White
- Initial thickness | μm | 200 | 120 | 120
- Thickness after compression | μm | Micropage | 10 | 28 | 30
- Reinforcement layer | - | None | None | Polyimide film
- Density at 23°C | g/cm³ | J5 K 6249 | 2.9 | 2.4 | 2.7
- Delaunay breakdown voltage | kV | J5 K 6249 | - | - | 5.5**
- Softening point | °C | Melting method | About 50 | About 50 | About 50
- Standard size | mm | 300×400, Roll | 300×400, Roll | 320×400, Roll
- Flame resistance UL94 | - | V-0 equivalent | V-0 equivalent | V-0 equivalent

* Please contact our sales department for details on other thickness of the product line.
** Not specified values
* After baking on a tape on a heat plate, then pressed down until 50% thickness.
* * After bending of 180° and cut by 50% (at 180° and cut by 50%)
** Measure at the initial thickness

Contact Sales and Marketing Department Phone: +81-(0)3-3246-5101
**Suitable Applications**

- Thermal dissipation in areas where thin film application (low BLT*) is required (thermal resistance can be reduced by using thin film)
- Thermal dissipation in areas with fine irregularities
- Thermal dissipation in areas where reworkability is required

*BLT = Bond Line Thickness

**Unsuitable Applications**

- Use in parts that cannot be screwed (Thermal interface oil compound is not adhesive.)

**Features**

- Among thermal interface silicone products, it has high thermal conductivity and low contact thermal resistance.
- Since it is grease-like, it can be used for low BLT by wetting and crushing heat-generating parts well.
- A lineup of high performance products with resistance to pumping out and misalignment

**Consistency**

- Soft grease

**Application Examples**

**Application to the heating element**

- Model of an application site
  - TIM2
  - Heatsink
  - Heat spreader
  - TIM1
  - Die
  - Heating element

**Thermal dissipation of LED headlamps for automobiles**

- LED
- Reflector
- Lens
- Heatsink
- Thermal interface oil compound

**General Properties**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>G-747</th>
<th>G-775</th>
<th>G-777</th>
<th>G-779</th>
<th>Condensation Cure Type G-1000</th>
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</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>White grease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal conductivity (W/m·K)</td>
<td>0.9</td>
<td>3.6</td>
<td>3.3</td>
<td>3.0</td>
<td>2.4</td>
</tr>
<tr>
<td>Thermal resistance (mm²·K/W)</td>
<td>15</td>
<td>25</td>
<td>21</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>BLT (μm)</td>
<td>10</td>
<td>75</td>
<td>56</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>Specific gravity at 25°C</td>
<td>2.65</td>
<td>3.4</td>
<td>3.2</td>
<td>3.2</td>
<td>3.04</td>
</tr>
<tr>
<td>Viscosity at 25°C (Pa·s)</td>
<td>50</td>
<td>500</td>
<td>140</td>
<td>160</td>
<td>80</td>
</tr>
<tr>
<td>Penetration* 25°C/unworked</td>
<td>328*</td>
<td>250</td>
<td>190</td>
<td>190</td>
<td>-</td>
</tr>
<tr>
<td>Hardness after curing (Asker C)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>40</td>
</tr>
<tr>
<td>Dielectric breakdown strength 0.25 mm (kV)</td>
<td>3.7</td>
<td>2.5</td>
<td>3.2</td>
<td>3.2</td>
<td>3.6</td>
</tr>
<tr>
<td>Use temperature range (°C)</td>
<td>-50 to +150</td>
<td>-40 to +150</td>
<td>-40 to +200</td>
<td>-40 to +180</td>
<td>-</td>
</tr>
<tr>
<td>Low-molecular weight silicone content ≥D₉ (ppm)</td>
<td>&lt;100</td>
<td>&lt;300</td>
<td>&lt;100</td>
<td>&lt;100</td>
<td>&lt;100</td>
</tr>
</tbody>
</table>

* Values of BLT thickness
* *Values in accordance with JIS K 2226 *1 25°C/unworked

**Contact**

Sales and Marketing Department IV Phone:+81-(0)3-3246-5152
Suitable Applications
- Heat dissipation at heat-generating sites with complicated shapes to which no sheet can be attached
- Bonding and fixing of heating element
- Heat dissipation in uneven areas

Unsuitable Applications
- Heat dissipation in areas where reworkability is required
- Condensation cure type: heat dissipation and laminating of moisture-free confined area
- Addition cure type: heat dissipation of parts that cannot be heated due to low heat resistance of peripheral components

Features
- Pastes and liquids can be used in various heating element shapes.
- React with moisture or cure to rubber elastics by heating
- In addition to radiating heat from heat-generating elements, it is possible to bond and fix them, and to pot and seal them for insulation and moisture-proof purposes.
- UL certified products (UL94 V-0)

Consistency
- Paste, medium and low-viscosity liquids

Adhesive

Application Examples
- Thermal dissipation bonding of the notebook PC adapter

General Properties
- Parameter: Thermal conductivity, W/m·K
- KE-4918-WF: 0.65
- KE-4961-W: 1.6
- KE-4962-W: 2.4
- KE-1867: 2.2
- KE-1891: 4.0
- Curing method: One-component condensation

Before curing
- Appearance: White paste
- Byproduct gas: Alcohol
- Viscosity at 23°C: Pa·s
- Tack-free time: min
- Standard curing conditions: 23°C ± 2°C/50 ± 5% RH × 7 days

After curing
- Density at 23°C: g/cm³
- Hardness durometer A: 80
- Tensile strength MPa: 3.5
- % elongation at break: 50%
- Volume resistivity: Ω·m
- Dielectric breakdown strength: kV/mm
- Tensile lap-shear strength (Al/Al): MPa
- % low moisture weight loss at 125°C × 8h ppm
- Flame resistance: UL94

Potting Agent

Application Examples
- Heat-dissipation, insulation, and moisture-proof potting of terminal boxes

General Properties
- Parameter: Thermal conductivity, W/m·K
- KE-1292-A/B: 0.55
- KE-1285-A/B: 0.8
- KE-1897-A/B: 1.2
- KE-1898-A/B: 2.0
- KE-1899-A/B: 3.0
- Curing method: Two-component, addition

Before curing
- Appearance: White paste
- Viscosity at 23°C: Pa·s
- % elongation at break: 140
- Volume resistivity: Ω·m
- Dielectric breakdown strength: kV/mm
- Tensile lap-shear strength (Al/Al): MPa
- % low moisture weight loss at 125°C × 8h ppm
- Flame resistance: UL94

Contact: Sales and Marketing Department | Phone: +81-(0)3-3246-5152
Gap Filler
SDP Series & CLG Series

Suitable Applications
- Heat dissipation in areas where thick coating is required (When the clearance of the parts is large)
- Heat dissipation in areas where stress relaxation is required using cushioning properties of materials
- Heat dissipation in uneven areas (excellent compliance)
- Heat dissipation in areas where reworkability is required

Features
- Usable for a variety of heating element shapes
- SDP Series: Two-component - Cures into a soft sheet at room temperature to relieve stress room temperature addition cure type Curing time can be shortened by heating.
- CLG Series: One-component uncurled type - It can be applied thickly and is excellent in pumpout resistance and misalignment resistance.

SDP Series: Two-component Room Temperature Addition Cure Type

Consistency
Before curing: Grease-like and wet well to the substrate surface
After curing: Cures into a soft sheet

Application Examples
Heat dissipation of electric vehicle batteries

Cure data

General Properties

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Product name</th>
<th>SDP-3540-A/B</th>
<th>SDP-5040-A/B</th>
<th>SDP-6560-A/B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal conductivity W/m-K</td>
<td>3.5</td>
<td>5.1</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Curing method</td>
<td>Two-component, addition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard curing conditions</td>
<td>25°C/24h</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Before curing
- Appearance: A: White B: Gray
- Viscosity at 23°C: Pa s
- Mix viscosity at 25°C: Pa s
- Touch drying time: mm
- Pot life at 23°C: min
- Specific gravity at 25°C: 

After curing
- Density at 23°C: g/cm³
- Hardness: Shore O°
- Tensile strength: MPa
- Elongation at break: %
- Volume resistivity: Ω-m
- Dielectric breakdown strength: kV/mm
- Flame resistance: UL94 V-0 equivalent V-0 equivalent V-0 equivalent

CLG Series: One-component Non-cured Type Products with Improved Pumpout and Misalignment Resistance

Consistency
Soft grease

Application Examples
- ECU heat dissipation
- Heat dissipation of components subject to vibration, such as in-vehicle components

Pumpout test results

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Product name</th>
<th>CLG-2500</th>
<th>CLG-3500</th>
<th>CLG-4500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After 1,000 cycling</td>
<td></td>
<td></td>
<td></td>
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General Properties

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Product name</th>
<th>CLG-2500</th>
<th>CLG-3500</th>
<th>CLG-4500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal conductivity W/m-K</td>
<td>2.9</td>
<td>3.3</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td>White grease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific gravity at 25°C</td>
<td>2.9</td>
<td>3.1</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Viscosity at 25°C: Pa s</td>
<td>500</td>
<td>250</td>
<td>550</td>
<td></td>
</tr>
<tr>
<td>Dielectric breakdown strength: kV/mm</td>
<td>6.2</td>
<td>8.5</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td>Use temperature limit: °C</td>
<td>-40 to 180</td>
<td></td>
<td></td>
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<tr>
<td>flame retardant ratio</td>
<td>25D-0% ppm</td>
<td>&lt;300</td>
<td></td>
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</tr>
</tbody>
</table>

Contact: Sales and Marketing Department IV Phone:+81-(0)3-3246-5152
# Thermal Conductive Characteristics List

<table>
<thead>
<tr>
<th>Type</th>
<th>Series Product name</th>
<th>Thermal conductivity, Bulk elastomer W/m·K</th>
<th>Thermal conductivity of products W/m·K</th>
<th>Thermal resistance cm²·K/W</th>
<th>Test method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Interface Insulating Silicone Rubber Sheets</td>
<td>TC-TA-1 Series</td>
<td>1.0</td>
<td>1.1</td>
<td>3.8</td>
<td>Thermal conductivity of products: ISO 22007-2</td>
</tr>
<tr>
<td></td>
<td>TC-TAG-2 Series</td>
<td>1.8</td>
<td>1.4</td>
<td>2.5</td>
<td>Hot disk method</td>
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<tr>
<td></td>
<td>TC-TAP-2 Series</td>
<td>1.8</td>
<td>0.9</td>
<td>2.0</td>
<td></td>
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<tr>
<td></td>
<td>TC-TAG-3 Series</td>
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<td>TC-BG Series</td>
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<td><strong>Thermal Interface Insulating Silicone Soft Pads</strong></td>
<td>TC-PEN3-10 Series</td>
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<td>2.3</td>
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<td>TC-PEN5-20 Series</td>
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<td>TC-UP8 Series</td>
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<td>TC-CAT-20 Series</td>
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<td>TC-CAF-40 Series</td>
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<td><strong>Thermal Interface Oil Compounds</strong></td>
<td>TC-10SAS</td>
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<td>Thermal Conductivity &amp; Thermal Resistance: ASTM E 1461 Laser Flash Method</td>
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<td>TC-20SAS</td>
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<td>2.9</td>
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<td><strong>Thermal Softening Sheets Phase change materials</strong></td>
<td>PCS-CR-10</td>
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<td>0.08</td>
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<td>Thermal conductivity: ASTM E 1461 Laser Flash Method</td>
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<td>PCS-LT-30</td>
<td>3.0</td>
<td>0.11</td>
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<td>Thermal resistance: ASTM E 1461 Laser Flash Method After Heating and Compressing at 50 psi/100° C for 1 h</td>
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<td>PCS-PL-30</td>
<td>1.7*</td>
<td>0.73</td>
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*Thermal conductivity of the phase change material

<table>
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<th>Type</th>
<th>Product name</th>
<th>Thermal conductivity W/m·K</th>
<th>Thermal resistance mm²·K/W</th>
<th>Dielectric breakdown strength kV/mm</th>
<th>Test method</th>
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<tr>
<td>Thermal Interface Oil Compounds</td>
<td>G-747</td>
<td>0.9</td>
<td>15 (10μm)</td>
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<td>Thermal conductivity: ISO 22007-2</td>
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<td></td>
<td>G-775</td>
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<td>25 (75μm)</td>
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<td>Thermal resistance: Shin-Entu method</td>
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<td>G-777</td>
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<td>21 (55μm)</td>
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<td>Dielectric breakdown strength: JIS K 6249</td>
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<td>G-779</td>
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<td>10 (25μm)</td>
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<td></td>
<td>G-1000</td>
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<td>29 (50μm)</td>
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<td><strong>Thermal Interface Liquid Silicone Rubbers Adhesives</strong></td>
<td>KE-4918-WF</td>
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<td>Thermal conductivity: JIS R 2616</td>
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<td>KE-4961-W</td>
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<td>KE-4962-W</td>
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<td>KE-1867</td>
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<td>KE-1891</td>
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<td><strong>Thermal Interface Liquid Silicone Rubbers Potting Materials</strong></td>
<td>KE-1292-A/B</td>
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<td>KE-1897-A/B</td>
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<td>KE-1898-A/B</td>
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<td><strong>Gap Filler</strong></td>
<td>SDP-3540-A/B</td>
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<td>20</td>
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<td>SDP-5040-A/B</td>
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<td>21</td>
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<td>Dielectric breakdown strength: JIS K 6249</td>
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<td>SDP-6560-A/B</td>
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<td>CLG-2500</td>
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<td></td>
<td>CLG-4500</td>
<td>4.8</td>
<td>4.7</td>
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</table>
Measurement and Evaluation of Thermal Properties

Two values which represent the thermal properties of thermal interface materials are thermal conductivity (\( \lambda \)) and thermal resistance (R). Heat-dissipation performance is directly proportional to thermal conductivity and inversely proportional to thermal resistance. Heat-dissipation is affected not only by the thermal conductivity of the silicone itself, but is also largely dependent on the contact thermal resistance of the interface between the heat generator and the heat dissipator.

\[ Q = \lambda \frac{(T_1 - T_2)A}{L} \]

\[ \lambda = \frac{Q}{A} \times \frac{L}{(T_1 - T_2)} \]

Thermal resistance is the sum of contact resistance plus the resistance present as a quantity of heat (Q) flows between temperatures at T1 and T2.

\[ \text{Thermal Resistance} \]

\[ R = \frac{Q}{T_1 - T_2} = \frac{L}{\lambda A} \]

<table>
<thead>
<tr>
<th>Grade</th>
<th>( \Sigma \eta (\mu m) ) (n=3-10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC-TA-1</td>
<td>40</td>
</tr>
<tr>
<td>TC-TAG-2</td>
<td>30</td>
</tr>
<tr>
<td>TC-TAG-3</td>
<td>10 &gt;</td>
</tr>
<tr>
<td>TC-TAP-2</td>
<td>10 &gt;</td>
</tr>
<tr>
<td>TC-306G</td>
<td>10 &gt;</td>
</tr>
<tr>
<td>TC-30C-CP</td>
<td>10 &gt;</td>
</tr>
<tr>
<td>TC-30S2-CP</td>
<td>10 &gt;</td>
</tr>
</tbody>
</table>

Measurement of Thermal Conductivity

**Hot-wire method**

JIS R 2616

Measurement method used for liquid silicone rubbers. A probe (hot wire and thermocouple) is placed on top of a sample, and temperature change, voltage, amperage and thermal conductivity over time are measured.

**Hot disc method**

ISO 22007-2

Measurement method used for rubber finished products and oil compounds. A constant current is supplied to a sensor sandwiched between samples. The sensor is heated to a constant temperature, and the rise in temperature is measured by the change in impedance to the sensor, from which thermal conductivity is calculated.

**Laser flash method**

ASTM E-1461

Measurement method used for double sided thermal interface silicone tapes TC-SAS series and phase change materials. A sample is illuminated with a laser, and the thermal diffusivity of the sample is derived from the rise in temperature of the sample. This is used to calculate thermal conductivity.

Low-molecular-weight (LMW) Siloxane

**What is LMW siloxane?**

The figure shows the chemical formula of low-molecular-weight siloxane, a nonreactive cyclic dimethyl polysiloxane (generally \( D_3D_3n \)), which is volatile and therefore sublimates into the atmosphere both during and after curing. As shown below, LMW siloxane has been reported to cause electrical contact failure under certain conditions.

* Almost all of products in this catalog reduce low molecular siloxane content.

Electrical Contact Failure

It has already been noted that various substances may lead to contact failure. Contact failure may be caused by organic materials such as human body oils and organic gases, or inorganic materials such as hydrogen sulfide and ammonia gas. Electric and electronic manufacturers report that LMW siloxane can cause contact failure in the low-voltage, low-current range.

**Relationship of load conditions to contact reliability**

*Effects of load on contact reliability (micro-relay)*

<table>
<thead>
<tr>
<th>Load</th>
<th>Current (mA)</th>
<th>Resistance at point of contact (Y/N)</th>
<th>Contact resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DC1V</td>
<td>N</td>
<td>No increase measured</td>
</tr>
<tr>
<td>2</td>
<td>DC1V</td>
<td>36mA</td>
<td>N</td>
</tr>
<tr>
<td>3</td>
<td>DC3.5V</td>
<td>1mA</td>
<td>N</td>
</tr>
<tr>
<td>4</td>
<td>DC5.6V</td>
<td>1mA</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>DC12V</td>
<td>1mA</td>
<td>Y</td>
</tr>
<tr>
<td>6</td>
<td>DC24V</td>
<td>1mA</td>
<td>Y</td>
</tr>
<tr>
<td>7</td>
<td>DC24V</td>
<td>35mA</td>
<td>Y</td>
</tr>
<tr>
<td>8</td>
<td>DC24V</td>
<td>100mA</td>
<td>Y</td>
</tr>
<tr>
<td>9</td>
<td>DC24V</td>
<td>200mA</td>
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</tr>
<tr>
<td>10</td>
<td>DC24V</td>
<td>1mA</td>
<td>Y</td>
</tr>
<tr>
<td>11</td>
<td>DC24V</td>
<td>4mA</td>
<td>Y</td>
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</table>

[Test conditions] Switching frequency 1 Hz, temp. room temperature, contact force 13 g

Presented by The Institute of Electronics, Information and Communication Engineers (corporation), Yoshimura and Itoh EMC76-41 Feb. 18, 1977.
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