THERMFLOW® Thermal Interface Material APPLICATION GUIDE

Introduction

THERMFLOW T777 material is a new addition to Chomerics' THERMFLOW family of phase change materials. This polymer solder hybrid material can be used wherever high heat transfer and low thermal impedance are required. Typical applications are thermal interface pads for microprocessors, graphics processors, ASICs, DSPs, power modules and anywhere else thermal grease or metallic solder is used. Unlike thermal grease, T777 is solid at room temperature and is easy to handle during manufacturing. However, at typical application operating temperatures, T777 softens and flows to produce high thermal performance by achieving minimum bond-line and maximum surface wetting. Also, unlike metallic solder, T777 does not require backside metallization on the die for soldering. Upon end-user application, T777 is re-workable and does not have a joint stress associated with metallic solder.

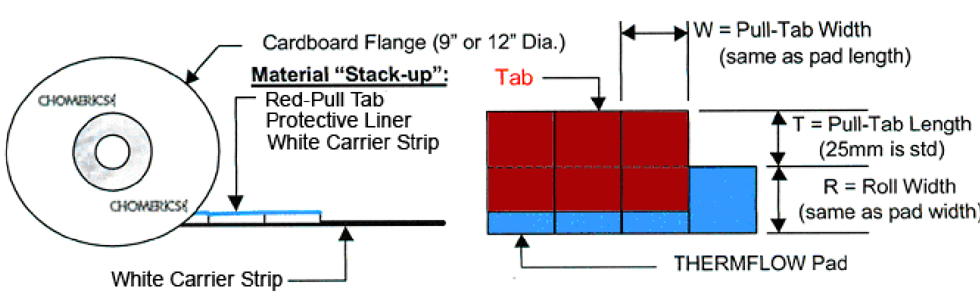
This Application Note contains recommendations on how to specify, handle and install T777 thermal interface pads. If a specific application raises questions not addressed here, please call Chomerics' Applications Engineering Department at 781-939-4620.

T777 Material Form

T777 is a free standing, unsupported film, gray in color, which is supplied between two poly release liners, (see Figure 1 below). As a free film, T777 can achieve a thin bond line (the average distance between the hot component and its cooling component), resulting in a very low thermal impedance connection. The surface texture of T777 is inherently tacky and will stick to most surfaces with light to moderate pressure; therefore, it does not require a pressure sensitive adhesive (PSA). The peak phase change temperature of T777 is 64°C.

T777 material is supplied on rolls, either in continuous format or as individually kiss-cut pads. Rolls contain two cardboard protective flanges that are 9 or 12 inches (229 or 305 mm) in outside diameter. The inside diameter of the metal "end bells" in the cardboard flanges is 1.5 inches (38mm). When T777 pads are supplied as rolls of kiss-cut parts, a 25mm pull-tab is included as a standard item. The pull-tab makes it easier to remove the protective liner prior to installation of the heat spreader onto the hot component.

Figure 1 – T777 Material Structure



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Mounting Surface Preparation

The mounting surface, usually the heat sink, spreader, pipe or its integrated form, should be clean and free from machining oils and aluminum dust, and may be cleaned with any common solvent, such as isopropyl alcohol (IPA) if necessary. The surface of the heat cooling component may be anodized, chromate coated or unfinished aluminum.

Cutting of T777 Pads

T777 material is supplied in one of the forms noted above. Chomerics can slit roll stock T777 material to the width required by the customer. However, the minimum slitting width for T777 material is 0.5 inches (12.5mm) wide with a tolerance of +/-0.02 inches (+/-0.5mm). Individually kiss-cut pieces are limited to pads no smaller than 0.4 inches (10mm) in width or length. Standard length and width tolerances for individual cut pieces are also +/-0.02 inches (+/-0.5mm). For custom widths, please contact your Chomerics Representative, or call Chomerics' Applications Engineering at 781-939-4620 to discuss size and tooling options.

T777 Pad Size Selection

A T777 pad softens and flows under the temperature and pressure conditions encountered in a typical application between a hot component and its cooling component. During the initial power cycle, as the T777 pad softens and flows to displace air in the interface gap, the average thickness of the pad will decrease and the total area covered by the pad will increase. Typical increase will be on the order of 30% in length and width, or about 60% in area. This 30% length/width increase was determined using a "generic" heat sink, its associated metal spring clip, and a microprocessor device with integrated heat spreader. The goal is to fully cover the footprint of the heat generating device. Each application will vary in terms of flatness, co-planarity, applied clamping pressure, operating temperature, pad-to-spreader placement tolerance, spreader-to-component placement tolerance, etc., so it is recommended that the pad size is verified through actual testing to be sure that thermal requirements are met.

Installation of T777 Pads

T777 material does not require pre-heating of the (integrated) heat spreader prior to installing the T777 pad onto the heat spreader substrate. The inherent "sticky or tacky" nature of T777 is sufficient for the pad to adhere to the substrate surface. However, due to the phase change nature of the T777 material, please follow the process temperature/pressure guidelines below to ensure the best results for a specific assembly process:

Installation of T777 Pads (Continued)

Table 1 – Recommended Installation Temperatures and Pressures

Process Step	Recommended Range
Removing pad from white carrier liner	Temp of Roll: less than 100°F (38°C)
Installing pad onto “cold” heat sink	Heat Spreader Temp: 60°F to 100°F (16°C to 38°C) Roll Temp: 70°F to 100°F (21°C to 38°C) *installation Pressure: 25 to 50 psi
Installing pad onto “warm” heat sink	Heat Spreader Temp: 75°F to 100°F (24°C to 38°C) Roll Temp: 70°F to 100°F (21°C to 38°C) *installation Pressure: 5 to 10 psi
Removing protective release liner	Temp of Heat Spreader /Pad Assembly: Less than 100°F (38°C)

**Apply pressure to the pad with a soft “press-pad” for 2 to 3 seconds*

Typical T777 Pad Installation Steps

1. If necessary, clean the (integrated) heat spreader or heat sink base of any machine oils, greases, hand oils, or other contaminants. Wipe with a solvent such as isopropyl alcohol, MEK, or toluene.
2. Peel the T777 pad (with release liner and pull-tab still in place) from the white carrier strip.
3. Place the T777 pad on the heat spreader/heat sink with the tacky side down and apply pressure on the protective release liner side to ensure intimate “wetting” of the T777 pad to the surface. This pressure, approximately 3,000 grams (6 pounds) on a 1-inch by 1-inch (25.4 x 25.4 mm) pad can typically be achieved manually by rolling a soft rubber wheel (e.g. a small wallpaper roller) back and forth over the pad. Table 1 above gives some recommended temperature/pressure conditions for best installation performance.
4. The protective release liner serves to prevent the T777 pad from being contaminated with dirt and dust during shipping/handling of the heat spreader component to the final system assembly location. The protective liner should be removed just prior to mounting the heat spreader onto the microprocessor component.
5. When removing the pull-tab, use a quick, lifting motion. This is preferable to peeling the pull-tab from the T777 pad and heat spreader. To ensure optimal “wetting” of the T777 pad to the heat spreader, it is recommended that the parts be allowed to dwell one hour prior to attempting protective liner removal.
6. With heat spreader and gray unprotected T777 pad in place on the component, install clip, screws or mechanical fasteners.

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Automated Installation of T777 Pads

Chomerics has developed several versions of automated pad installation equipment. Contact Chomerics' Applications Engineering at 781-939-4620 to determine the best approach for a specific component/heat spreader/sink configuration and assembly process.

Material Storage and Shipping

T777 is a temperature sensitive material, and should be stored below 35°C (95°F). Short term exposure to higher temperatures, up to 45°C (113°F) during product shipment will not affect product performance.

It is recommended that rolls of THERMFLOW material be stored with release liner pull-tabs such that the roll is resting on the THERMFLOW material not on the pull-tabs. In this orientation there is no weight pressing down onto the pull-tab material, thus preventing wrinkling of the pull-tabs and possible "telescoping" of the wound roll.

Initial Re-Flow of T777

As with any (PCM) phase change material, T777 material requires an initial phase change to achieve optimum thermal performance. Initial thermal performance will behave as a dry joint thermal interface, because the material has not yet driven out the air gaps between the heat spreader and the component. Re-flow and wetting of the surfaces typically takes only a few minutes once the 65°C phase change temperature is achieved. Also, allowing the monitored electronic component to reach 75°C, the T777 pad would fully change phase for maximum wetting. Pressure enhances and accelerates the effect. After this initial re-flow, the interface resistance will behave as high performance thermal grease, even after powering down of the microprocessor. Unless the heat spreader is removed from the component (for upgrades, re-work, etc.) the initial high interface resistance will not be seen during subsequent power cycles.

Rework Information

Typically, the heat spreader can be separated from the component with the help of a mini screwdriver, without elevating the temperature. If heating is possible, it will facilitate the separation of the heat spreader from the component. If heating is used, then first allow the heat spreader and component to cool down. A razor blade can then be used to scrape the residual T777 material away. Chemically, the residual T777 can be softened with either MEK (methyl ethyl ketone), or IPA (isopropanol), or toluene. The residual material can be removed by wiping with a cloth.

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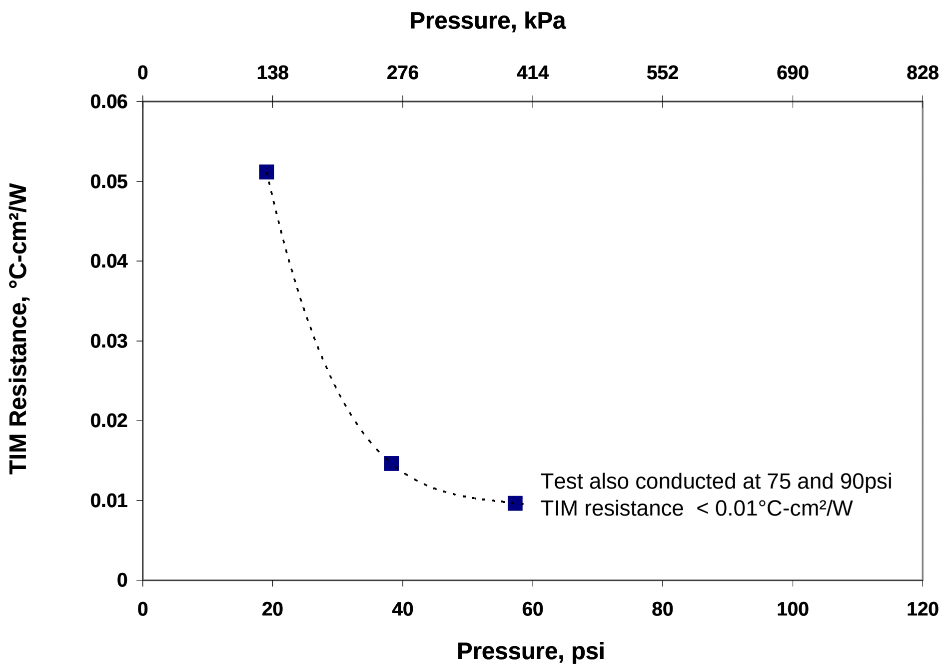
Thermal Performance vs. Contact Pressure

The ASTM D5470 test procedure was utilized to determine the thermal performance of T777 vs. the amount of contact pressure. The pressure was set initially at the desired pressure, and then the test was started. The data and graph follow in Figure 2.

Figure 2 – Thermal Impedance vs. Pressure



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