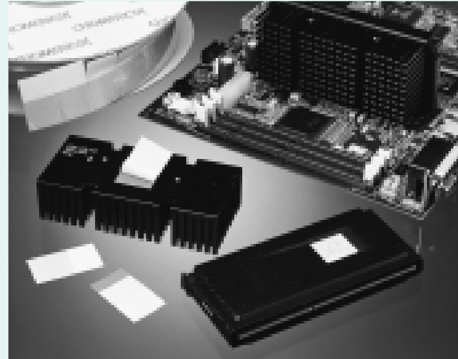
THERMFLOW™ Phase-Change Materials

The THERMFLOW family of phase-change thermal interface materials combines the consistency and ease of use of elastomeric pads with the low thermal impedance of thermal grease. This winning combination makes Chomerics' THERMFLOW materials an excellent choice for many of today's most demanding thermal interface applications.

Typical Applications

- microprocessors, memory modules & cache chips
- DC/DC converters
- IGBTs and other power modules
- power semiconductors
- solid state relays
- bridge rectifiers



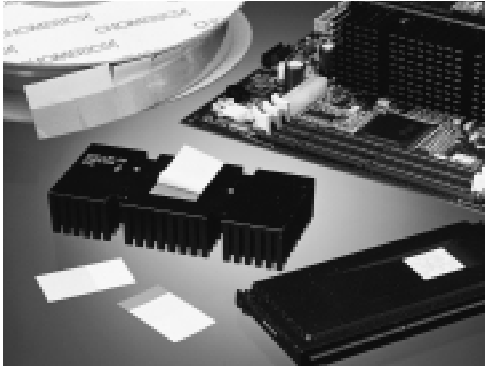
Features/Benefits

- low thermal impedance, 0.03°C-in²/watt
- automated installation equipment available
- proven solution – over 2 years of production use in Personal Computer OEM applications
- demonstrated reliability – no separation or dry-out after 3000 temperature cycles
- can be pre-applied to heat sinks
- PSA (pressure-sensitive adhesive) versions allow "peel and stick" installation
- available in custom die-cut shapes, kiss-cut on rolls
- thixotropic, paste-like consistency at flow temperatures ensures material will not run or drip, even in vertically-oriented applications

Typical Properties

THERMFLOW™ Material	Thickness inches (mm)	Reinforcing Carrier	Thermal Impedance	Features/Typical Applications
T725	0.005 (0.13)	None	0.03°C-in²/W (@ 50 psi)	• Increase melt point • For High Power Microprocessors (> 50 watt dissipation), DC/DC Converters, IGBTs and other Power Modules • Recommended for pressure range of 5 to 100 psi • Inherently tacky
T443	0.005 (0.13)	Fiberglass	0.10°C-in²/W (@ 50 psi no PSA)	• For Microprocessors and Heat Spreaders which are typically attached to heat sinks with spring clips • Recommended for pressure range of 5 to 50 psi • Available with PSA for "peel and stick" application (at a slightly reduced thermal performance level)
T310	0.007 (0.18)	Fiberglass	0.17°C-in²/W (@ 300 psi no PSA)	• For DC/DC converters and power modules which are typically attached to heat sinks with higher compression force mechanical fasteners • Inherently tacky surface eliminates need for mounting PSA and allows pad to be repositioned prior to final heat sink assembly • Recommended for pressure range of 50 to 300 psi
T710	0.005 (0.13)	Fiberglass	0.18°C-in²/W (@ 5 psi with PSA)	• For Microprocessors and Power ICs which are typically attached to heat sinks with spring clips • Recommended for pressure range of 5 to 50 psi • Standard version includes PSA for "peel and stick" application. Also available with optional Release Liner Tab to ease removal of protective blue liner

THERMFLOW™ Low Thermal Resistance Phase-Change Interface Pads



Chomerics' THERMFLOW phase-change materials are formulated for use with high performance components requiring minimal thermal resistance for maximum heat transfer efficiency. They combine the easy handling advantages of elastomeric pads with the low thermal impedance of thermal grease, making THERMFLOW materials an ideal choice for today's most demanding thermal management applications:

Microprocessors	***Memory Modules***	***Cache Chips***
DC/DC Converters	***IGBTs***	***Power Modules***
Power Semiconductors	***Solid State Relays***	***Bridge Rectifiers***

DESCRIPTION

THERMFLOW™ materials are thermally enhanced polymers designed to minimize the thermal resistance between power dissipating electronic components and their associated heat sinks. This low thermal resistance path maximizes heat sink performance and improves the reliability of microprocessors, memory modules, DC/DC converters and power modules.

The key feature of THERMFLOW materials is their phase-change characteristic. At room temperature, THERMFLOW materials are solid and easy to handle. This allows them to be consistently and cleanly applied as dry pads to a heat sink or component surface. THERMFLOW material softens as it reaches component operating temperatures. With light clamping pressure it will readily conform to both mating surfaces, similar to thermal grease. This ability to completely fill interfacial air gaps and voids typical of component packages and heat sinks allows THERMFLOW pads to outperform non-flowing elastomeric or graphite-based thermal pads and achieve performance comparable to thermal grease (see Figure 1).

THERMFLOW materials are electrically non-conductive. However, since metal-to-metal contact is possible after the material undergoes phase-change in a typical heat sink assembly, THERMFLOW pads should not be used as electrical insulators.

KEY FEATURES AND BENEFITS

- **Low thermal impedance**, 0.03°C-in^2/watt
- Automated **installation equipment** available
- **Proven solution** – years of production use in Personal Computer OEM applications
- **Demonstrated reliability** – no separation or dry-out after 3000 temperature cycles
- Can be **pre-applied** to heat sinks
- **PSA (pressure-sensitive adhesive)** versions allow "peel and stick" installation
- **Non-PSA versions** available for improved thermal performance
- **Protective release liner** prevents contamination of material prior to final component assembly
- **Tabs available** to ease removal of release liner
- Available in **custom die-cut shapes**, kiss-cut on rolls
- **45°C or 58°C** phase-change temperature
- **Thixotropic**, paste-like consistency at application temperatures ensures that material will not run or drip, even in vertically-oriented applications
- **Electrically non-conductive**

APPLICATION AND PERFORMANCE

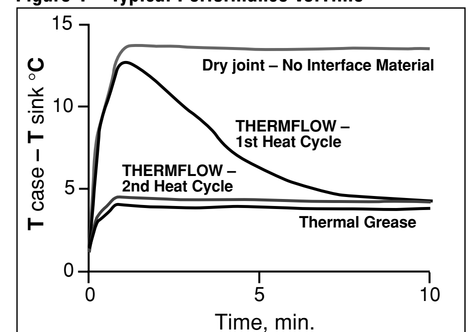
THERMFLOW pads can be supplied with pressure-sensitive adhesive (PSA) for easy pre-application to heat sinks. Contact your heat sink supplier or Chomerics for further information. Since PSAs tend to increase thermal impedance, non-PSA versions are also available for improved thermal performance. Most heat sink suppliers have the capability to "heat flux" non-PSA THERMFLOW pads in place onto their heat sinks.

Each THERMFLOW material has been designed to perform best within a specified clamping pressure range. See next page for the recommended material for some common applications.

THERMFLOW materials are not structural adhesives and should not be used to mechanically attach heat sinks to processors. Clips or other mechanical fasteners must be used to maintain heat sink to component clamping pressure.

Due to the "grease-like" behavior of the material, actual thermal impedance in a specific application cannot be determined using only the material's bulk thermal conductivity unless the actual operating pressure, temperature, thickness, etc. are known. Therefore, to account for the unique situations associated with specific applications, Chomerics recommends customer testing to validate performance. Contact Chomerics Applications Engineering at 603-579-5764 for assistance or further information.

Figure 1 – Typical Performance vs.Time



Note: The THERMFLOW pad will exhibit high thermal impedance until it flows during the first heat cycle. This is a one time effect and will not be seen during subsequent heat cycles. These curves illustrate typical performance seen in a microprocessor heat sink application in a desktop PC.

THERMFLOW™ Low Thermal Resistance Phase-Change Interface Pads *continued*

	TYPICAL PROPERTIES	T725	T443	T310	T710	TEST METHOD
CONSTRUCTION	Carrier	None	Fiberglass	Fiberglass	Fiberglass	—
	Color	Pink	Light Gray	Light Gray	Light Gray	Visual
	Thickness, inch (mm)	0.005 (0.13)	0.005 (0.13)	0.007 (0.18)	0.005 (0.13)	ASTM D374
	PSA Options Dry Pad PSA One Side	Std Available	Std Available	Std Available	Available Std	—
THERMAL	Thermal Impedance, °C-in^2/W	0.03 @ 50 psi (no PSA)	0.10 @ 50 psi (no PSA)	0.17 @ 300 psi (no PSA)	0.10 @ 5 psi (no PSA) 0.18 @ 5 psi (PSA)	Modified ASTM D5470
	Apparent Thermal Conductivity, W/m-K	0.7	1.0	0.6	0.7	Modified ASTM D5470
	Phase-Change Temperature, °C	58	43	46	45	ASTM D3418
	Operating Temperature Range, °C	-60 to +125	-60 to +125	-60 to +125	-60 to +125	—
ELEC.	Volume Resistivity, ohm-cm	1×10^{15}	5×10^{15}	5×10^{14}	5×10^{16}	ASTM D257
MECH.	Specific Gravity	1.11	1.27	1.63	1.15	ASTM D792
	Suggested Heat Sink/ Component Clamping Pressure, psi (MPa)	5 to 100 (0.035 to 0.690)	20 to 60 (0.138 to 0.414)	50 to 300 (0.345 to 2.070)	5 to 20 (0.035 to 0.138)	—

TYPICAL APPLICATIONS

THERMFLOW T725
High End Microprocessors (P-III, Workstation Network Server, CPUs, etc.), Power Modules

THERMFLOW T443
Microprocessors (P-II, P-III, K-7, etc.), Exposed Die BGAs

THERMFLOW T310
DC/DC Converters, IGBTs and Other Power Modules

THERMFLOW T710
Microprocessors (P-II, K-6, M-II, etc.), Memory Modules, Power Semi's

Note: P-II, P-III (Intel®), K-6, K-7 (AMD®), M-II (Cyrix National)

ORDERING INFORMATION

THERMFLOW materials are supplied in several standard formats (see part number guide blow). Custom die-cut shapes can also be provided on kiss-cut rolls by Chomerics' extensive network of Distributor/ Fabricators. To ease release liner removal an optional tab can be added. Standard tolerances for slitting widths and individually cut pieces are ±0.020 inch (±0.51 mm). T443 rolls include a loose 3-mil polyester interfeaf to prevent pad material from sticking to the back side of the liner.

THERMFLOW Material – Part Numbers

WW — XX — YYYY — T725, T443, T310 or T710

WW:
- 64 = Roll Stock
- 66 = Roll Stock with PSA
- 68 = Roll Stock with removal tab and PSA
- 69 = Custom Shapes

XX:
- 10 = 100 ft. (30.5m) Roll Stock
- 30 = 300 ft. (91.4m) Roll Stock
- 11 = Custom Die-Cut Shape, No PSA
- 12 = Custom Die-Cut Shape, PSA One Side

YYYY — **Roll Stock, Width.**
- 0075 = 0.75 in. (1.91 cm)
- 0100 = 1.00 in. (2.54 cm)
- 0150 = 1.50 in. (3.81 cm)
- 0200 = 2.00 in. (5.08 cm)
- 0500 = 5.00 in. (12.7 cm)
- 1000 = 10.00 in. (25.4 cm)
- 2000 = 20.00 in. (50.8 cm)

For custom roll stock and die-cut parts, this 4 or 5 digit number will be assigned by Chomerics

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PRELIMINARY PRODUCT DATA SHEET

LEADER IN THERMAL MANAGEMENT DESIGN, INNOVATION AND MATERIALS

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THERMFLOW™ T766

High Performance, Reworkable Phase Change Material

DESCRIPTION

Chomerics' patent pending THERMFLOW T766 phase change thermal interface material is recommended for applications where rework and ease of disassembly are important. The material provides the high performance properties of typical phase change materials with the added benefit of easy removal. It consists of a tacky, electrically non-conductive phase change film on one side of a conformable metal foil carrier. T766 can be assembled onto a heat sink or heat spreader, leaving the metal foil exposed. The natural tack of the phase change polymer will hold the T766 to the heat sink, while the foil layer acts as a clean interface between the component and heat sink, allowing a clean break during disassembly or rework. The foil also eliminates the need for a protective liner, which simplifies the final assembly process and minimizes shipping concerns and contamination issues.

APPLICATION

THERMFLOW T766 material is inherently tacky on the light gray polymer film side for easy attachment to the heat sink or thermal spreader. The metal foil side of the material is left exposed for contact with the electronic component to be cooled. The dry nature of the foil side enables easy removal of the heat sink for rework on the assembly. T766 pads are supplied kiss-cut on rolls for easy installation.

If rework is needed, the T766 pads can be removed from the heat sink at the light gray polymer interface using a single-edged razor, and then cleaning the heat sink surface with isopropanol (IPA) solvent.

	Typical Properties	T766		Test Method
CONSTRUCTION	Carrier	Conformable Metal		- - -
	Color (Polymer/Metal)	Light Gray/Silver		Visual
	Carrier Thickness, inch (mm)	0.001 (0.025)		ASTM D374
	Polymer Thickness, inch (mm)	0.0025 (0.064)		ASTM D374
	Overall Thickness, inch (mm)	0.0035 (0.089)		ASTM D374
THERMAL	Thermal Impedance, °C-in^2/W @ 70ºC, 50 psi	0.04		ASTM D5470 modified
	Apparent Thermal Conductivity, W/m-K	Polymer 0.7	Carrier 75	ASTM D5470 modified
	Phase Change Temperature Range, °C	51-58		ASTM D3418
	Operating Temperature Range, °C	-60 to +125		- - -
MECH	Specific Gravity	3.0		ASTM D792

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