PRELIMINARY PRODUCT DATA SHEET

CHOMERICS

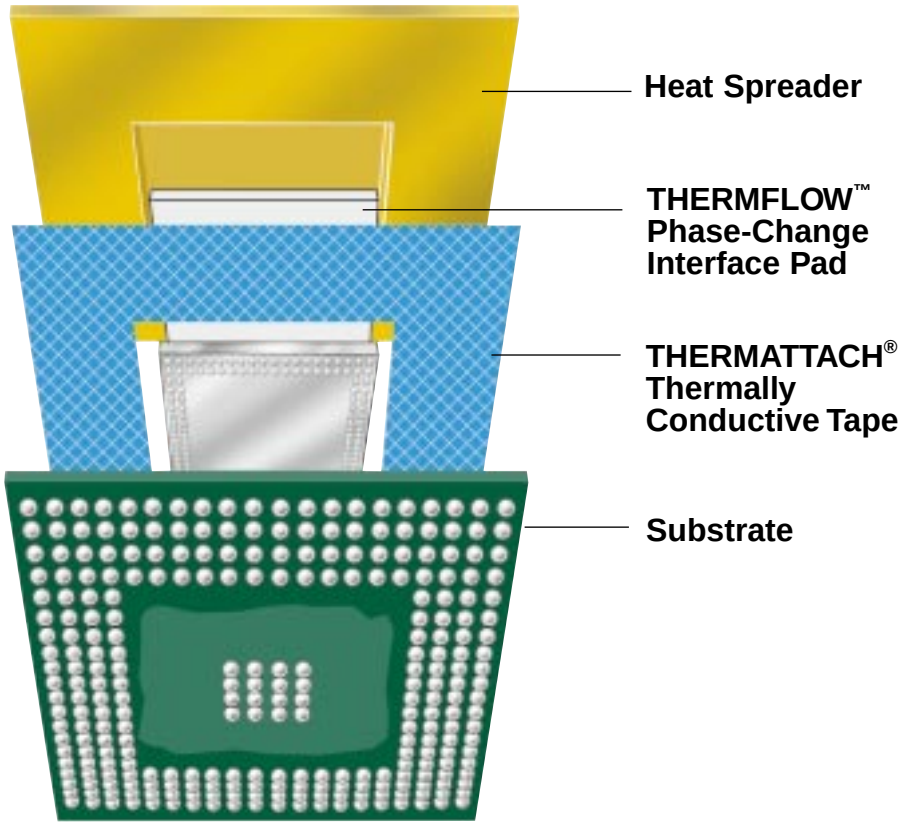
LEADER IN THERMAL MANAGEMENT: DESIGN, INNOVATION AND MATERIALS

Parker Seals

THERMAL MANAGEMENT FOR BGAs

A new generation of advanced materials offers performance and manufacturing advantages for Ball Grid Array assembly.

The explosive growth of array packaging presents new challenges to the users and suppliers of high performance materials for semiconductor assembly. Traditional materials are no longer capable of handling the requirements of these high density packages. Chomerics' family of thermal products has been designed to meet the needs of this burgeoning market.



SUPERIOR PERFORMANCE — *phase-change material replaces thermal grease with a stress-free interface on backside of flip chip die*

- Eliminates thermal cycling "pump-out" concerns
- Absorbs mismatch in CTE between the silicon die and the lid

LOWER INSTALLED COSTS — *one-step process for mounting stiffeners or lids to the substrate*

- Eliminate time-consuming, wasteful dispensing steps and curing cycles
- Reduce concerns of solder ball fatigue caused by rigid adhesive systems
- Pre-apply THERMFLOW pads and THERMATTACH tape to heat spreaders, stiffeners and lids

THERMATTACH®
Thermally Conductive BGA Assembly Tapes

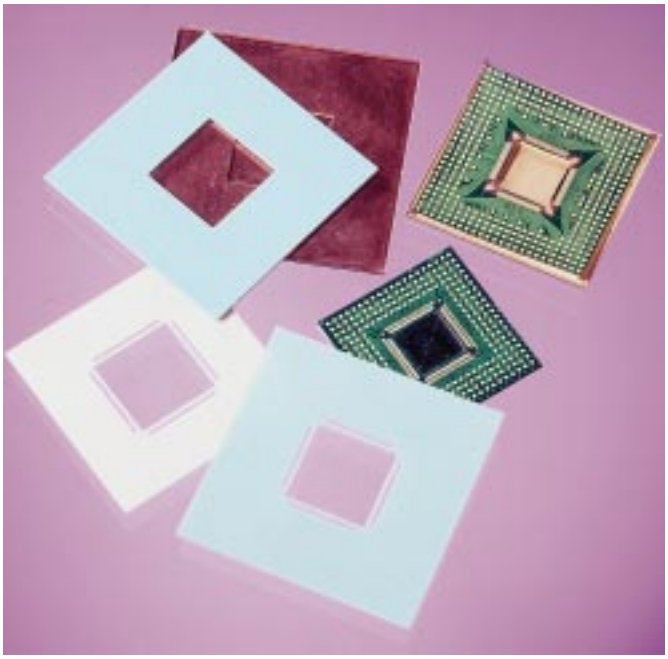
DESCRIPTION

THERMATTACH tapes have been designed to provide a high performance bond in the assembly of EBGA (Enhanced Ball Grid Array) and TBGA (Tape Ball Grid Array) semiconductor packages. Their thermally conductive filler ensures superior package performance when used to bond the flex or laminate substrate to stiffeners and heat spreaders.

In addition to offering excellent adhesive and thermal characteristics, these compliant materials absorb mismatches in CTE (coefficient of thermal expansion) of various package materials. They have been formulated to be ionically clean in order to eliminate concern over corrosion on the substrate or on plated stiffeners and heat spreaders.

THERMATTACH BGA assembly tapes are designed and tested to meet the rigorous performance demands of the semiconductor packaging industry, including HAST (Highly Accelerated Stress Test) and PCT (Pressure Cooker Testing).

Supplied in rolls or on reels, THERMATTACH Tapes can be die-cut to component dimensions.



THERMATTACH T421 and T422 Tapes

Ideally suited for roller lamination techniques, these transfer adhesives help ensure void-free assemblies while reducing processing times. The T421 and T422 materials have no carrier, allowing clean cutting and routing. There is no particle contamination of the bond pad or lamination area.

THERMATTACH T424 and T427 Tapes

These configurations offer a choice of carrier. The T424 tape consists of a thermally conductive pressure-sensitive acrylic adhesive coated on fiberglass. The system is embossed with a unique pattern to provide void-free laminations. In the T427 tape, the thermally conductive, pressure-sensitive acrylic adhesive is coated on a Kapton† MT carrier. This system provides excellent electrical isolation properties.

	TYPICAL PROPERTIES	T421	T422	T424	T427	TEST METHOD
CONSTRUCTION	Binder	Acrylic	Acrylic	Acrylic	Acrylic	—
	Filler	Aluminum Oxide	Aluminum Oxide	Aluminum Oxide	Aluminum Oxide	—
	Carrier	—	—	Fiberglass	Kapton MT	—
	Thickness, inch (mm)	0.002 (0.05)	0.003 (0.08)	0.007 (0.18)	0.007 (0.18)	ASTM D374
THERMAL	Thermal Impedance, °C-in²/W (°C-cm²/W)	0.35 (2.26)	0.38 (2.45)	0.65 (4.19)	0.60 (3.87)	ASTM D5470
	Thermal Conductivity, W/m-K	0.46	0.43	0.40	0.43	ASTM D5470
ELEC.	Voltage Breakdown, Vac	—	—	4000	6000	ASTM D149
	Volume Resistivity, ohm-cm	$>1.0 \times 10^{14}$	$>1.0 \times 10^{14}$	$>1.0 \times 10^{15}$	$>1.0 \times 10^{15}$	ASTM D257
MECHANICAL	Specific Gravity	1.5	1.6	1.5	1.75	ASTM D792
	Peel Adhesion, lb/in (kN/m)	3.4 (0.6)	3.4 (0.6)	3.4 (0.6)	2.75 (0.5)	ASTM D1000
	Die Shear Adhesion, psi (MPa)	150 (1.04)	150 (1.04)	180 (1.24)	150 (1.04)	CTP No.54**
	Tack Adhesion, gm	500	500	700	500	Polyken PSTC*

*Pressure Sensitive Tape Council **Chomerics Test Procedure

† Trademark of Du Pont

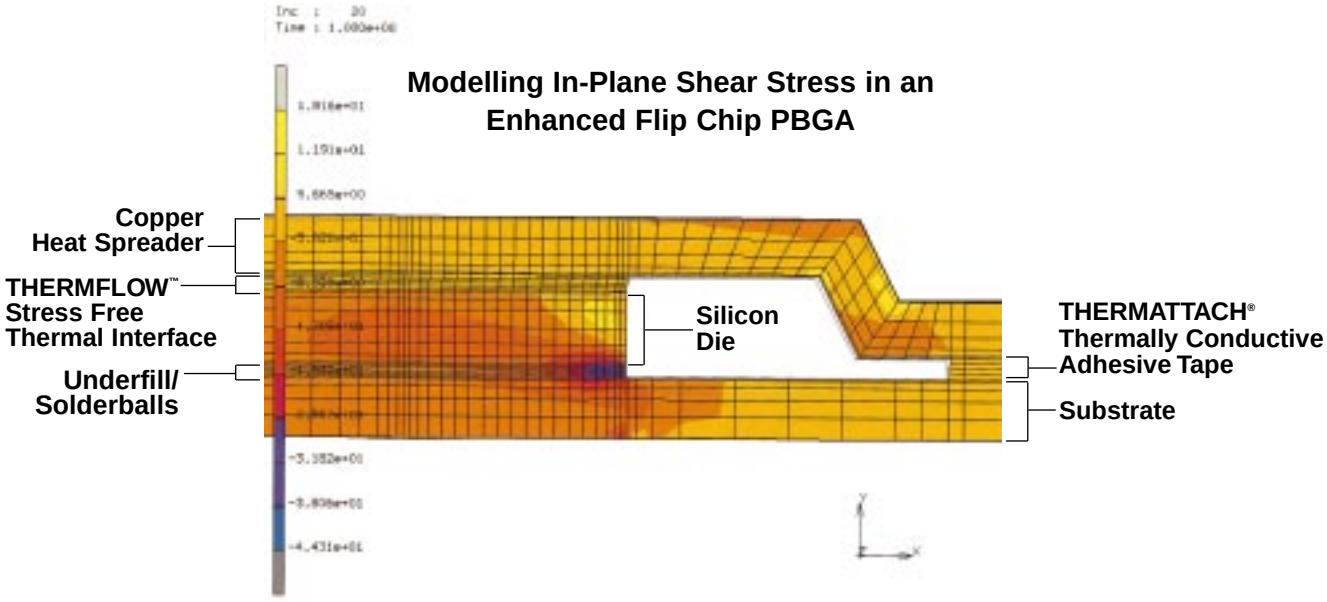
FINITE ELEMENT ANALYSIS shrinks lead times

Chomerics' in-house FEA capability uses sophisticated computer simulation to predict the mechanical behavior of materials in proposed designs. This powerful tool bypasses trial and error testing of successive prototypes, while allowing designs to be optimized. The result is a *technically superior solution—achieved more rapidly and cost-effectively than ever before.*

In this example, FEA was used to predict the shear stress relieving behavior of THERMATTACH adhesive tape when used between a copper heat spreader and an organic substrate subjected to a 125°C temperature rise.

Chomerics routinely uses FEA to evaluate deformation, load-deflection, void ratios, stress, friction, seal life and other critical design factors. For more information, contact Chomerics' Applications Engineering Department.

Modelling In-Plane Shear Stress in an Enhanced Flip Chip PBGA



THERMFLOW™ Phase-Change Interface Pads for BGA

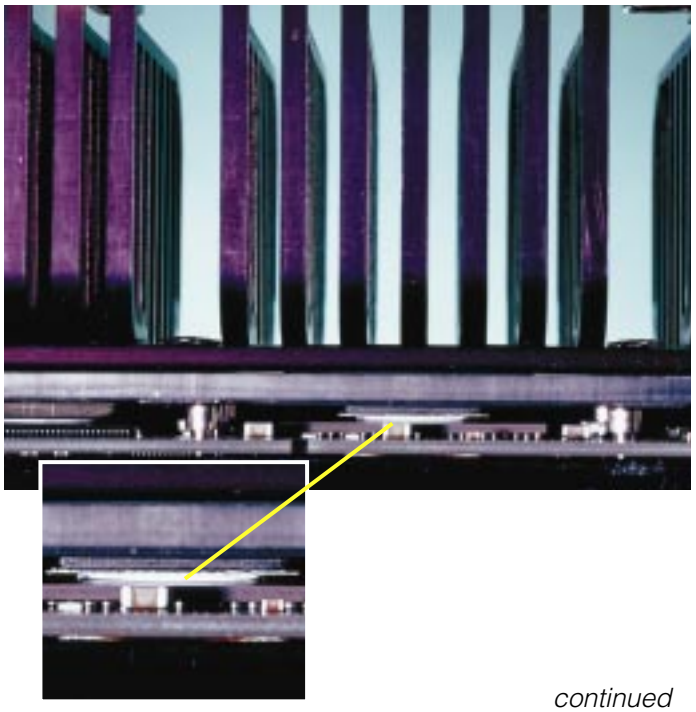
DESCRIPTION

THERMFLOW phase-change materials are specially formulated for use in high performance devices requiring minimum thermal resistance for maximum component reliability. For over 30 years grease has been employed as the interface between a flip chip die and the heat spreader or lid. With the advent of THERMFLOW products, phase-change materials are finding their way into "inside the package" applications to replace thermal grease.

A major advantage of using THERMFLOW materials is their ability to be pre-applied. Moreover, they eliminate the concerns of thermal cycling "pump-out" which can accompany the use of thermal grease.

At room temperature, THERMFLOW materials are solid and easy to handle, for clean application equivalent to installing conventional dry thermal interface pads. At device operating temperatures, however, THERMFLOW materials soften and flow, conforming readily to both surfaces and filling microscopic air pockets and surface imperfections.

THERMFLOW materials are supplied die-cut on rolls.



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THERMFLOW T443 material
This fiberglass-reinforced configuration is 0.005 inch (0.13 mm) thick, and designed for best flow at application pressures of 20 to 60 psi (0.138 to 0.414 MPa), even after thousands of temperature cycles. It was originally developed as an "inside the package" phase-change material for second generation Pentium†II type microprocessors, meeting thermal, mechanical, quality and manufacturing requirements for high volume semiconductor assembly.

THERMFLOW T725 material
This inherently tacky, elastomeric phase-change material is 0.005 inch (0.13 mm) thick. The T725 material is designed to perform best under application pressures from 5 to 100 psi (0.035 to 0.690 MPa). It functions as an interface for the backside of a flip chip die in applications where superior thermal performance is required.

	TYPICAL PROPERTIES	T443	T725	TEST METHOD
CONSTRUCTION	Carrier	Fiberglass	None	—
	Color	Light Gray	Pink	Visual
	Thickness, inch (mm)	0.005 (0.13)	0.005 (0.13)	ASTM D374
THERMAL	Thermal Impedance, @ 50 psi, °C-in²/W (°C-cm²/W)	0.10 (0.65) (no PSA)	0.03 (0.19) (no PSA)	Modified ASTM D5470
	Thermal Conductivity, @ 50 psi, W/m-K	1.0	0.7	Modified ASTM D5470
	Phase-Change Temperature, °C	43	58	ASTM D3418
ELEC.	Volume Resistivity, ohm-cm	5×10^{15}	1×10^{15}	ASTM D257
MECH.	Specific Gravity	1.27	1.11	ASTM D792

†Trademark of Intel Corp.

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