

## THERMATTACH® Adhesive Tapes

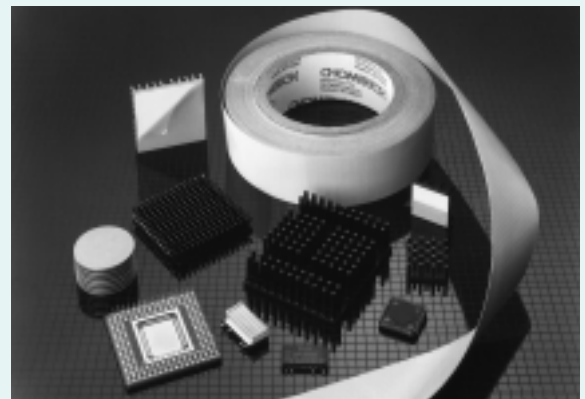
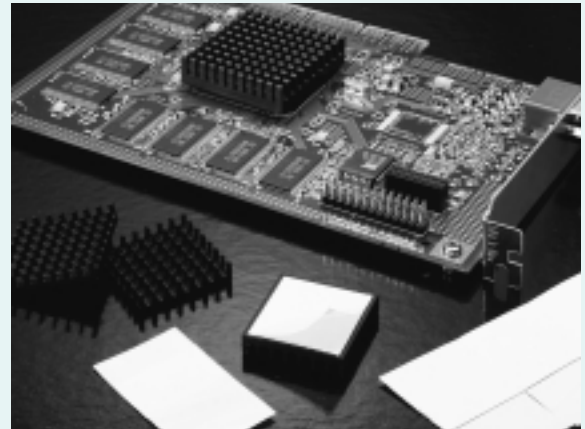
The THERMATTACH family of thermally conductive adhesive tapes is used extensively to bond heat sinks to microprocessors and other power-dissipating semiconductors. Offered with a choice of aluminum oxide or titanium diboride fillers coated on Kapton<sup>†</sup> film, aluminum foil, fiberglass or expanded aluminum, these tapes combine exceptional bonding strength with low thermal impedance to effectively replace thermal grease and mechanical fasteners.

### Typical Applications

- bonding heat sinks to plastic packages (T410 and T411)
- bonding heat sinks to metal or ceramic packages (T404, T405 and T412)
- heat spreader to circuit board attachment (T413 and T414)

### Features/Benefits

- double-sided adhesive system replaces mechanical fasteners
- acrylic or silicone adhesives
- loaded with ceramic fillers for low impedance connections
- electrically isolating and non-isolating versions available



### Typical Properties

THERMATTACH® Material	Dielectric Strength (Vac)	Carrier	Color	Thickness inches (mm)	Thermal Impedance	Features/Typical Applications
T410	NA	Aluminum	Clear/White	0.007 (0.18)	1.1°C-in <sup>2</sup> /W	• Attach heat sinks to plastic packages
T411	NA	Expanded Aluminum	Clear/Silver	0.011 (0.28)	1.0°C-in <sup>2</sup> /W	• Accommodates non-flat plastic surfaces
T404	5000	Kapton MT	Beige	0.005 (0.13)	0.6°C-in <sup>2</sup> /W	• Electrically insulating
T405	NA	Aluminum	White	0.006 (0.15)	0.5°C-in <sup>2</sup> /W	• Electrically non-insulating
T412	NA	Expanded Aluminum	Gray	0.009 (0.23)	0.25°C-in <sup>2</sup> /W	• Best thermal performance
T413	3700	Fiberglass	White	0.007 (0.18)	0.65°C-in <sup>2</sup> /W	• Ionically clean
T414	5000	Kapton MT	Beige	0.005 (0.13)	0.6°C-in <sup>2</sup> /W	• Ionically clean • Electrically insulating

NA= Not Applicable

<sup>†</sup> Trademark of DuPont

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**Parker** Seals

October 1999

- Phase-change thermal interface materials
- Thermally conductive adhesive tapes
- Thermally conductive insulator pads
- Thermally conductive gap fillers
- Thermally conductive silicone compounds
- Flexible heat spreaders • Thermal management for BGAs

# THERMATTACH® T410 and T411

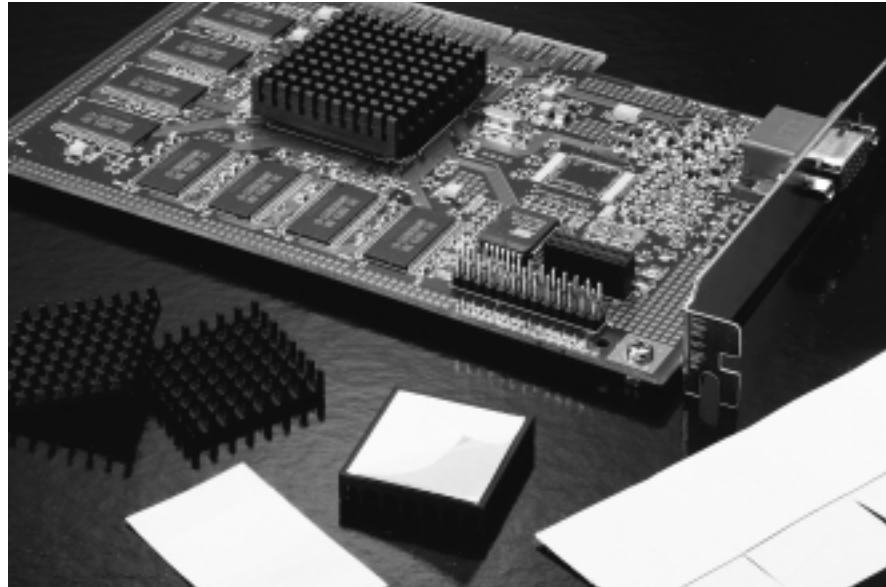
## Thermally Conductive Tapes for Heat Sink Attachment to BGAs and other Plastic Encapsulated Components

**DESCRIPTION**

Chomerics' patented THERMATTACH T410 and T411 double-sided adhesive tapes provide an effective thermal interface and heat sink attachment method for plastic component packages. The tapes are thermally conductive and have exceptional bonding properties. They can also be used to adhere components to vertical heat sinks or to metal chassis walls in place of clips, screws or other mechanical fasteners, without the need for additional thermal compounds.

THERMATTACH T410 tape consists of a high bond strength, pressure sensitive acrylic adhesive loaded with aluminum oxide and coated onto a 0.002 inch (0.05 mm) aluminum foil carrier. The other side of the foil carrier has a silicone pressure sensitive adhesive which provides excellent adhesion to silicone-contaminated plastics and other low energy surfaces.

THERMATTACH T411 tape consists of a high bond strength pressure-sensitive adhesive with an expanded aluminum mesh carrier layer. The mesh carrier allows the tape to conform to curved surfaces of plastic molded IC packages,



providing a high adhesive strength attachment for heat sinks. The high performance silicone PSA allows adhesion to silicone-contaminated plastics and other low energy surfaces.

*NOTE: THERMATTACH T410 and T411 tapes do not feel sticky to the touch although their adhesion is excellent when applied to plastic components.*

*continued*

TYPICAL PROPERTIES		T410	T411	TEST METHOD
CONSTRUCTION	Adhesive (to heat sink side)	Acrylic	Silicone	—
	Color (to heat sink side)	White	Clear (Silver)	Visual
	Carrier	Aluminum Foil	Aluminum Mesh	—
	Adhesive (onto component side)	Silicone	Silicone	—
	Color (to component side)	Clear (Silver)	Clear (Silver)	—
	Thickness, inch (mm)	0.007 (0.18)	0.011 (0.28)	ASTM D374
THERMAL	Thermal impedance @ <1 psi °C-in <sup>2</sup> /W (°C-cm <sup>2</sup> /W)	1.1 (7.1)	1.0 (6.5)	ASTM D5470
	Operating Temperature Range, °C	-50 to +150	-50 to +150	—
ELEC	Voltage Breakdown, Vac	N/A	N/A	ASTM D149
	Volume Resistivity, ohm-cm	N/A	N/A	ASTM D257
MECH	Lap Shear Adhesion, psi (MPa)	60 (0.414)	14 (0.094)	ASTM D1002
	Die Shear Adhesion, psi (MPa) Steel/FR4 25°C 125°C	170 (1.172) 40 (0.276)	80 (0.552) 20 (0.138)	Chomerics Test Procedure No.54

\* Pressure Sensitive Tape Council

**APPLICATION INSTRUCTIONS**

**Step 1:** Ensure that bonding surfaces are free from oil, dust, etc.

**Step 2:** Cut tape to size and remove clear liner or remove pre-cut tape from roll. For optimal surface contact with typical plastic packages, tape should be cut smaller than component size, leaving a 0.05 to 0.10 inch (1.27 to 2.54 mm) border.

**Step 3:** For T410 tape, apply the white adhesive side to the center of the heat sink bonding area. For T411 tape, apply either side to heat sink. Smooth over the entire surface using moderate pressure.

**Step 4:** Remove paper liner from tape. Center heat sink over plastic component and press into place using finger pressure or 5-10 psi.

Effective contact surface area and adhesive performance can be slightly improved by applying pressure and/or heat during heat sink placement. The table below provides some temperature/pressure options.

Pressure	Temperature	Time
10 psi (0.069 MPa)	22°C	15 sec.
10 psi (0.069 MPa)	50-65°C	5 sec.

Please contact Chomerics Applications Engineering Department for additional information.

Approximately 70% of the ultimate adhesive bond strength is achieved with initial application and 80-90% is reached within 15 minutes. Ultimate adhesive strength is achieved within 36 hours. However, the next manufacturing step can occur immediately following the initial application.

**REMOVAL INSTRUCTIONS**

Materials needed: Single-edge razor blade or a small, thin-bladed pocket knife and a soft, thin metal spatula.

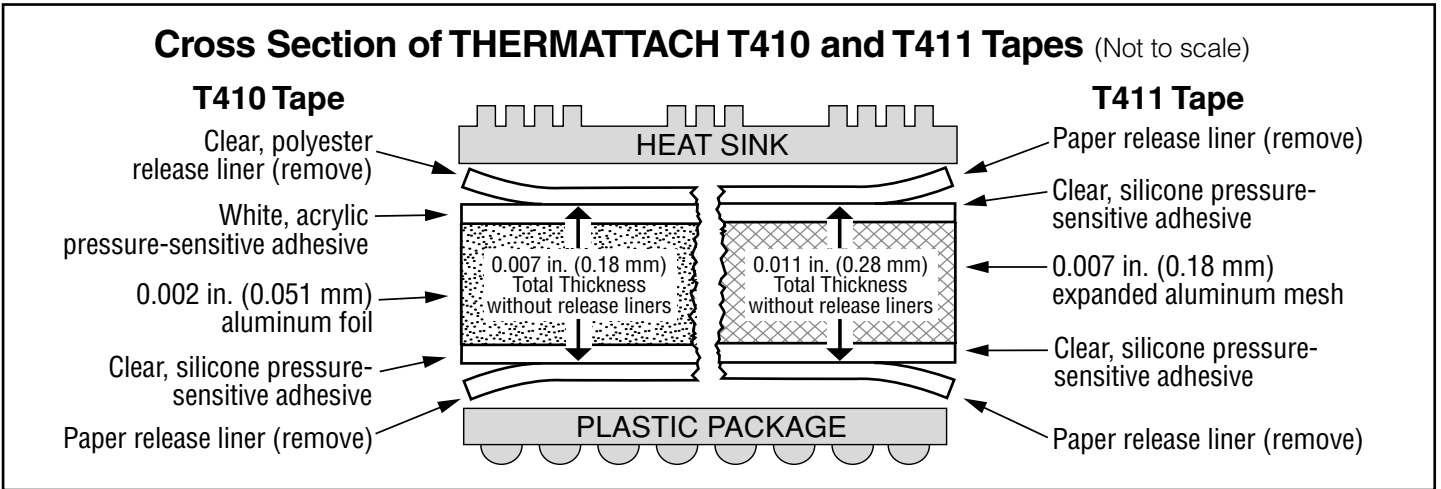
**Step 1:** Carefully insert the blade edge into the bond line at a corner between the heat sink and the component. The penetration need not be very deep.

**Step 2:** Remove the blade and insert the spatula into the wedge. Slowly twist the spatula blade so that it exerts a slight upward pressure.

**Step 3:** Continue the twisting motion and upward force until the two surfaces are completely separated.

**Step 4:** After the two components are separated, the tape can be removed and discarded. Any remaining adhesive on the component surface must be removed. Use solvent (isopropyl alcohol, MEK or acetone) to remove all adhesive residue.

**Step 5:** Let solvent-cleaned components air dry 15 minutes before applying new tape.



**ORDERING INFORMATION**

*Standard Rolls*

THERMATTACH T410 thermal tapes are available in standard roll sizes of 6 inch (15.2 cm) width x 100 ft. (30.5 m) or 400 ft. (122 m). Custom pre-cut parts are available in kiss-cut, rectangular shapes on rolls.

THERMATTACH T411 tape is available as pre-cut parts supplied kiss-cut on rolls in the following standard sizes.

For availability of THERMATTACH parts for other components or package sizes, please contact Chomerics' Inside Sales Department.

**67 - XX - 0600 - T410**

Roll Length
10 = 100 ft. (30.5 m)
40 = 400 ft. (122 m)

**60 - 13 - XX - T411**

Pad Size
18 = 18 mm x 18 mm (0.71 in. x 0.71 in.)
20 = 20 mm x 20 mm (0.79 in. x 0.79 in.)
25 = 25 mm x 25 mm (0.98 in. x 0.98 in.)
30 = 30 mm x 30 mm (1.18 in. x 1.18 in.)
35 = 35 mm x 35 mm (1.38 in. x 1.38 in.)

- Phase-change thermal interface materials
- Thermally conductive adhesive tapes
- Thermally conductive insulator pads
- Thermally conductive gap fillers
- Thermally conductive silicone compounds
- Flexible heat spreaders • Thermal management for BGAs

LEADER IN THERMAL MANAGEMENT: DESIGN, INNOVATION AND MATERIALS

## THERMATTACH® T404, T405 and T412

### Thermally Conductive Adhesive Tapes for Heat Sink Attachment to Ceramic or Metal Components

#### DESCRIPTION

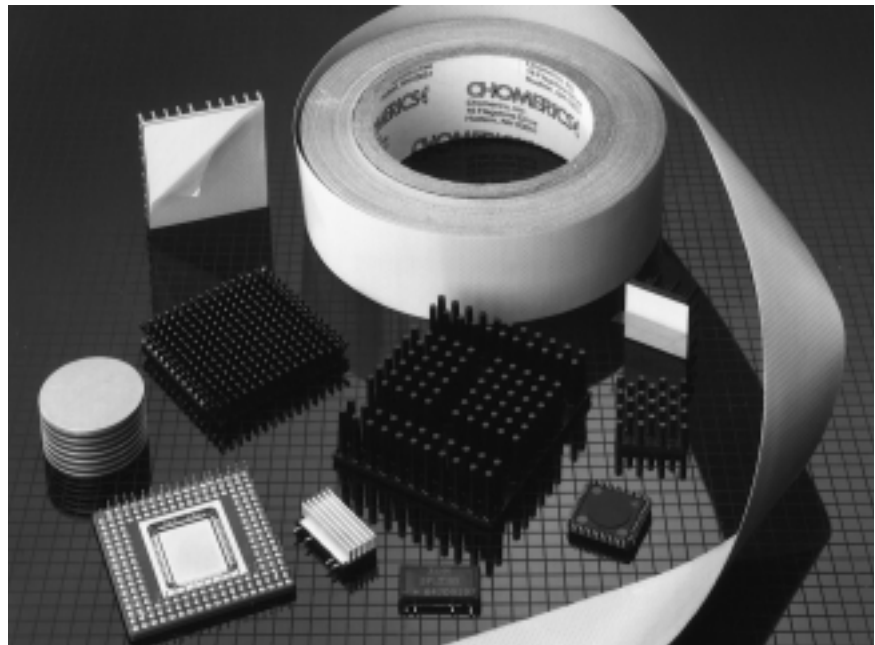
Chomerics' patented† THERMATTACH double-sided adhesive tapes provide an effective thermal interface between electronic components and heat sinks. These tapes have high thermal conductivity and exceptional bonding properties – eliminating the need for thermal grease and mechanical fasteners.

THERMATTACH T404 thermal tape consists of a high bond strength, pressure-sensitive acrylic adhesive, loaded with aluminum oxide particles and coated on 0.001 in (0.025 mm) Kapton® MT thermally conductive polyimide film. The tape provides good thermal performance and excellent electrical isolation.

THERMATTACH T405 thermal tape consists of a high bond strength, pressure-sensitive acrylic adhesive, loaded with aluminum oxide and coated onto a 0.002 in (0.050 mm) aluminum foil carrier. The aluminum foil provides added thermal conductivity for applications where electrical isolation is not required.

THERMATTACH T412 thermal tape consists of a high bond strength, pressure-sensitive acrylic adhesive, loaded with titanium diboride and applied to an expanded aluminum carrier. The combination of filler, expanded metal and embossed surface enhances both tape conformability and thermal performance. For additional application information concerning BGAs, PGAs, ceramic packages, packages with heat spreaders and/or PQFPs, contact Chomerics' Applications Department.

THERMATTACH tapes are embossed with a unique pattern for maximum conformability and minimal air pockets.



Extensive testing has shown that Chomerics' embossing system provides thermal and mechanical results superior to those of flat thermal tapes.

All THERMATTACH tapes offer excellent thermal, mechanical, environmental and chemical properties. Vibration testing at 10 G shows no adverse effects. Unlike traditional acrylic pressure-sensitive tapes, after extended temperature/humidity aging and harsh conditions, THERMATTACH tapes meet or exceed initial properties for shear strength and thermal conductivity.

#### APPLICATIONS

**For heat sink attachment to plastic encapsulated components, such as BGAs, THERMATTACH T410 and 411 tapes are recommended. Please see Chomerics Technical Bulletin No.79 for more information.**

THERMATTACH thermal tapes bond heat sinks to hot components. They attach components to vertical heat sinks or to metal chassis walls in place of clips, screws or other mechanical fasteners, and require no additional thermal compound.

THERMATTACH tapes have many advantages over traditional adhesives such as hot melts or thermal epoxies. They can be consistently applied to meet design-level thermal and adhesive requirements. The tapes can be removed after application, reducing repair and rework costs in both the manufacturing plant and the field.

† U.S. Patent #5,298,791

*continued*

TYPICAL PROPERTIES		T404	T405	T412	TEST METHOD	
CONSTR.	Carrier	Kapton* MT	Aluminum	Expanded Al	—	
	Color	Beige	White	Grey	—	
	Thickness, inch (mm)	0.005 (0.127)	0.006 (0.152)	0.009 (0.229)	—	
	Thickness, Tolerance, inch (mm)	±0.001 (0.03)	±0.001 (0.03)	±0.001 (0.03)	—	
THERMAL	Thermal Impedance @<1 psi, °C-in <sup>2</sup> /W (°C-cm <sup>2</sup> /W)	0.6 (3.7)	0.5 (3.4)	0.25 (1.7)	ASTM D5470	
	Thermal Conductivity, W/m-K	0.37	0.50	1.40	ASTM D5470	
ELEC.	Voltage Breakdown, Vac	5000	NA	NA	ASTM D149	
	Volume Resistivity, ohm-cm	3 x 10 <sup>14</sup>	NA	1.3 x 10 <sup>-2</sup>	ASTM D257	
MECHANICAL	Flammability Rating (E140244)	V-0	V-0	Not Rated	UL94	
	Lap Shear Adhesion, psi (MPa)	125 (0.862)	135 (0.931)	70 (0.483)	ASTM D1002	
	Die Shear Adhesion, psi (MPa)	Aluminum 25°C 150°C	130 (0.897) 50 (0.345)	125 (0.862) 55 (0.379)	135 (0.931) 25 (0.172)	Chomeric Test Procedure No. 54
			Copper 25°C 150°C	120 (0.828) 45 (0.310)	160 (1.10) 70 (0.488)	
		Aluminum Oxide Substrate 25°C 150°C		170 (1.17) 50 (0.345)	145 (1.00) 60 (0.414)	
			Creep Adhesion, days 25°C, 12 psi (0.083MPa) 150°C, 12 psi (0.083MPa)	>50 >50	>50 >50	
	Adhesive CTE, ppm/°C, -40 to +150°C	400		400	400	Chomeric Test Procedure No.163

\*Tradename of DuPont \*\*Pressure Sensitive Tape Council

Unlike rigid adhesives, Chomerics thermal tapes are pliable and conformable, reducing concerns over CTE mismatch and the cracking or splitting of components or epoxy bond lines. At very comparable installed cost, THERMATTACH tapes offer advantages over mechanical fasteners or liquid adhesives which may require a large capital investment.

**TEST METHODS**

*Summaries of test procedures used for THERMATTACH thermal tapes are described below. Thermal performance, die shear strength and visual inspection were used as pass/fail criteria.*

**Thermal Performance.** Thermal tape 0.6 x 1 inch (15.2 x 25.4 mm) was applied to a transistor. The second layer of release liner was removed and the transistor was attached to the heat sink. Four transistors were applied one after the other. After a one hour dwell, the Rj-s† and Rj-a‡ of each transistor was determined using an Analysis Tech® Thermal Analyzer. The test fixture was subjected to 1000 hours

at 150°C. The individual Rj-s and Rj-a values were again measured and recorded.

**Die Shear Strength.** 0.5 x 0.5 inch (12.7 x 12.7 mm) thermal tape was applied to 0.06 x 1 x 4 inch (15.2 x 25.4 x 101.6 mm) cleaned aluminum panels using light pressure. Six dies were applied to each aluminum panel. The samples were subjected to 1000 hours at 150°C and tested for die shear strength at room temperature.

**Visual Inspection.** All test specimens were examined for tape lifting, delamination or any other sign that the tape was failing.

**Test Method Descriptions and Results**

**1000 Hrs., 66°C, 85% Relative Humidity.** Samples of each product passed this test based on thermal performance, die shear strength and visual performance criteria.

**1000 Hrs., 25°C, 95% Relative Humidity.** Samples were subjected to high humidity at ambient laboratory

temperature for 1000 hours. Each product passed this test as evidenced by no decrease in adhesion or thermal performance.

**Heat Aging.** Samples were subjected to 1000 hour heat aging at 150°C. All products passed this test based on thermal performance, die shear strength and visual performance criteria.

**Mechanical Shock.** Samples were tested for mechanical shock resistance. All products passed the test as evidenced by no loss of adhesion or deterioration of thermal performance.

**Thermal Shock Resistance.** Samples were subjected to ten thermal shock cycles following ASTM D-1674 guidelines. All products passed this test based on thermal performance, die shear strength and visual performance criteria.

**Vibration Resistance.** Samples were subjected to random vibration testing. All products passed the test with no loss of adhesion or thermal performance.

†Rj-s = Thermal resistance from junction to heat sink.  
‡Rj-a = Thermal resistance from junction to ambient.

## THERMATTACH® Heat Sink Attachment Tapes *continued*

**Vibration Resistance at Elevated Temperature.** Samples of THERMATTACH tapes were subjected to random vibration at elevated temperature. None of the tested products were negatively affected.

### APPLICATION PERFORMANCE – SUMMARY

Test	Results*
High Temperature/Humidity Resistance, 1000 Hours, 66°C, 85% RH .....	Pass
High Humidity @ Ambient 1000 Hours, 25°C, 95% RH .....	Pass
Heat Aging 1000 Hours, 150°C .....	Pass
Mechanical Shock .....	Pass
Thermal Shock, -60 to +150°C	
10 Cycles .....	Pass
100 Cycles .....	Pass
Heat Aging .....	Pass
Vibration .....	Pass
Vibration @ 150°C .....	Pass
Temperature Cycling, -50 to +150°C, 1000 Cycles .....	Pass
Long-Term Storage .....	Pass

**Note:** Formal Test Reports are available from Chomerics' Applications Engineering Department.

\*See details on previous page or contact Chomerics for more information.

The base acrylic adhesive used in these THERMATTACH tapes has been evaluated for resistance to salt spray and typical solvents, and compatibility with common conformal coating compounds. Details can be obtained from Chomerics' Applications Engineering Department.

### APPLICATION INSTRUCTIONS

**Materials needed:** Clean cotton cloth or rag, industrial solvent, rubber gloves.

For optimal performance, Chomerics recommends interface flatness of 0.002 in/in (0.05 mm/mm) max. for T412 and 0.001 in/in (0.025 mm/mm) max. for T404 and T405.

**Step 1:** Ensure that bonding surfaces are free from oil, dust, etc. Using rubber gloves, wipe surfaces with a cloth dampened with industrial solvents such

as MEK, toluene, acetone or isopropyl alcohol are recommended.

**Step 2:** Cut tape to size and remove clear liner or remove pre-cut tape from roll. (Due to variations in heat sink surfaces, Chomerics' data indicates that the tape should be cut slightly smaller than the area of the heat sink. See back page for size recommendations.)

**Step 3:** Apply to center of heat sink bonding area and smooth over entire surface using moderate pressure.

**Step 4:** Remove blue embossed liner from the tape. Center heat sink component and apply using any one of the recommended temperature/pressure options shown below:

Pressure	Temperature	Time
10 psi (0.069 MPa)	22°C	15 sec
30 psi (0.207 MPa)	22°C	5 sec
10 psi (0.069 MPa)	50°C-65°C	5 sec
30 psi (0.207 MPa)	50°C-65°C	3 sec.

Contact Chomerics' Applications Department for additional information.

**Note:** Increasing any of the application variables (pressure, temperature and time) can improve results due to the relationship of the variables. Elevated temperature can be achieved by exposing heat sinks to a conventional hot air/heat gun prior to application.

Approximately 70% of the ultimate adhesive bond strength is achieved with initial application, and 80-90% is reached within 15 minutes. Ultimate adhesive strength is achieved within 36 hours; however, the next manufacturing step can occur immediately following the initial application.

### REMOVAL INSTRUCTIONS

**Materials needed:** Single-edged razor blade or a small, thin-bladed pocket knife; soft, thin metal spatula

Use safety precautions when handling sharp instruments and organic solvents.

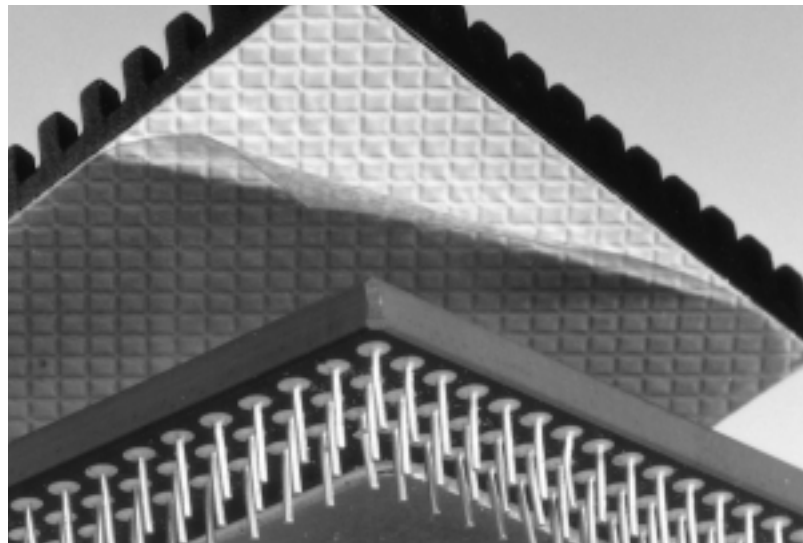
**Step 1:** Carefully insert the blade edge into the bond line at a corner between the heat sink and the component. The penetration need not be very deep.

**Step 2:** Remove the blade and insert the spatula into the wedge. Slowly twist the spatula blade so that it exerts a slight upward pressure.

**Step 3:** As the two surfaces start to separate, move the spatula blade deeper into the bond line and continue the twisting motion and upward force.

**Step 4:** After the two components are separated, the tape can be removed and discarded. If adhesive remains on the component surfaces, it must be removed. Adhesive is best removed by wiping with a rag dabbed with isopropyl alcohol, MEK or toluene. Use sufficient solvent to remove all adhesive.

**Step 5:** Let solvent cleaned components air dry for 15 minutes before reapplying THERMATTACH tape.



**ORDERING INFORMATION**

*Standard Rolls*

THERMATTACH T404, T405 and T412 thermal tapes are available in standard 100 ft. (30.5 m) rolls of various widths. Use this part number system when ordering rolls of THERMATTACH tapes. Pre-cut parts are available in kiss-cut, rectangular shapes on rolls (see table below).

**67 - 10 - YYYY - ZZZZ**

Roll Width
0050 = 0.50 inch (1.27 cm)
0075 = 0.75 inch (1.91 cm)
0100 = 1.00 inch (2.54 cm)
0125 = 1.25 inch (3.18 cm)
0150 = 1.50 inch (3.81 cm)
0175 = 1.75 inch (4.45 cm)
0200 = 2.00 inch (5.08 cm)
0800 = 8.00 inch (20.32 cm)

Material
T404 = THERMATTACH 404
T405 = THERMATTACH 405
T412 = THERMATTACH 412

**Size Recommendations and Part Numbers for Most Popular Microprocessor Packages**

Package Type	Heat Sink Base Size Range	THERMATTACH Part Number	Pre-cut Tape Size
<b>PGA</b>			
15 x 15	1.50 to 1.75 in. sq. (3.81 to 4.45 cm sq.)	69-13-Y110-T_ _ _	1.375 in. x 1.375 in. (3.49 cm x 3.49 cm)
17 x 17	1.75 to 1.90 in. sq. (4.45 to 4.83 cm sq.)	69-13-S799-T_ _ _	1.6 in. x 1.6 in. (4.06 cm x 4.06 cm)
19 x 19	1.90 to 2.10 in. sq. (4.83 to 5.33 cm sq.)	69-13-S438-T_ _ _	1.75 in. x 1.75 in. (4.45 cm x 4.45 cm)
21 x 21	2.10 to 2.30 in. sq. (5.33 to 5.84 cm sq.)	69-13-Y788-T_ _ _	2.0 in. x 2.0 in. (5.08 cm x 5.08 cm)
<b>CQFP</b>			
164 Pin	1.00 to 1.25 in. sq. (2.54 to 3.18 cm sq.)	69-13-Y790-T_ _ _	0.90 in. x 0.90 in. (2.29 cm x 2.29 cm)
196 Pin	1.25 to 1.50 in. sq. (3.18 to 3.81 cm sq.)	69-13-Y789-T_ _ _	1.125 in. x 1.125 in. (2.86 cm x 2.86 cm)

When using THERMATTACH tape for bonding heat sinks to microprocessors, Chomerics recommends that the THERMATTACH tape size be recessed a minimum of 0.05 in. (0.127 cm) from the edge of the heat sink base.

Pre-cut parts are supplied kiss-cut on rolls of 1000 parts per roll.

For availability of THERMATTACH parts for other components or package sizes, please contact Chomerics' Inside Sales Department.

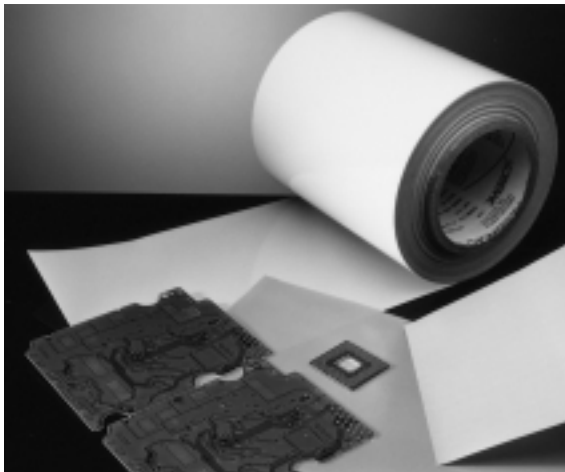
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LEADER IN THERMAL MANAGEMENT: DESIGN, INNOVATION AND MATERIALS

# THERMATTACH® T413 and T414

## Thermally Conductive Adhesive Tapes

### for Heat Spreader to Circuit Board Attachment



conformability and minimal air pockets. Extensive testing has shown that Chomerics' embossing system provides thermal and mechanical results superior to those of flat thermal tapes.

All THERMATTACH tapes meet stringent thermal, mechanical, environmental and chemical requirements. Vibration testing at 10 G shows no adverse effects. Unlike traditional acrylic pressure-sensitive tapes, after extended temperature/humidity aging and harsh conditions, THERMATTACH tapes meet or exceed initial properties for shear strength and thermal conductivity.

#### DESCRIPTION

Chomerics' patented\* THERMATTACH® T413 and T414 double-sided adhesive tapes provide an effective thermal interface between components, ceramic hybrid circuits, printed circuit boards, flexible circuits and heat spreaders and sinks. Both are ionically clean tapes with good thermal conductivity and exceptional bonding properties – eliminating the need for thermal grease and mechanical fasteners.

THERMATTACH T413 thermal tape consists of a high bond strength, pressure-sensitive acrylic adhesive filled with aluminum oxide applied to a fiberglass carrier. The adhesive thickness and fiberglass allow for good conformability to irregular surfaces and good electrical isolation.

THERMATTACH T414 thermal tape consists of a high bond strength, pressure-sensitive acrylic adhesive, loaded with aluminum oxide particles and coated on 0.001 in. (0.025 mm) Kapton MT\*\* thermally conductive polyimide film. The tape provides good thermal performance and excellent electrical isolation.

THERMATTACH tapes are embossed with a unique pattern for maximum

#### APPLICATIONS

**For heat sink attachment to plastic encapsulated components, such as BGAs, THERMATTACH T410 and 411 tapes are recommended. Please see Chomerics Technical Bulletin No.79 for more information.**

THERMATTACH T413 thermal tape bonds copper heat spreaders to the bottom of printed circuit boards to allow heat dissipation through the thermal vias under components. The tape also bonds heat spreaders/stiffeners to flex circuits in microprocessor TAB package constructions as well as ceramic hybrid circuits to metal chassis walls in place of clips, screws or other mechanical fasteners without thermal compounds.

THERMATTACH T413 tape has many advantages over traditional adhesives and mechanical fasteners. It can be consistently applied to meet design level thermal and mechanical requirements. Unlike rigid adhesives, THERMATTACH T413 is pliable and conformable, reducing concerns over CTE mismatch and the cracking or splitting of components or epoxy bond lines. At very comparable installed costs, THERMATTACH T413 offers advantages over mechanical fasteners or liquid adhesives which may require a large capital investment.

#### APPLICATION INSTRUCTIONS

**Materials needed:** Clean cotton cloth or rag, industrial solvent, rubber gloves. For optimal performance, Chomerics recommends interface flatness of 0.002 in/in (0.05 mm/mm) max. for T413 and 0.001 in/in (0.025 mm/mm) max. for T414.

**Step 1:** Ensure that bonding surfaces are free from oil, dust, etc. Using rubber gloves, wipe surfaces with a cloth dampened with industrial solvents such as MEK, toluene, acetone or isopropyl alcohol.

**Step 2:** Cut tape to size and remove clear liner or remove pre-cut tape from roll.

**Step 3:** Apply device and smooth over entire surface using moderate pressure.

**Step 4:** Remove blue embossed liner from the tape. Center device using any one of the recommended temperature/pressure options shown below:

Pressure	Temperature	Time
10 psi (0.069 MPa)	22°C	15 sec.
30 psi (0.207 MPa)	22°C	5 sec.
10 psi (0.069 MPa)	50-65°C	5 sec.
30 psi (0.207 MPa)	50-65°C	3 sec.

Contact Chomerics' Applications Department for additional information.

**Note:** Increasing any of the application variables (pressure, temperature and time) can improve results due to the relationship of the variables. Elevated temperature can be achieved by exposing heat sinks to a conventional hot air/heat gun prior to application. Approximately 70% of the ultimate adhesive bond strength is achieved with initial application, and 80-90% is reached within 15 minutes. Ultimate adhesive strength is achieved within 36 hours; however, the next manufacturing step can occur immediately following the initial application.

continued

\* U.S. Patent #5,298,791

\*\* Trademark of DuPont

**REMOVAL INSTRUCTIONS**

**Materials needed:** Single-edged razor blade or a small, thin-bladed pocket knife; soft, thin metal spatula. Use safety precautions when handling sharp instruments and organic solvents.

**Step 1:** Carefully insert the blade edge into the bond line at a corner between the device and the bonding surface. The penetration need not be very deep.

**Step 2:** Remove the blade and insert the spatula into the wedge. Slowly twist the spatula blade so that it exerts a slight upward pressure.

**Step 3:** As the two surfaces start to separate, move the spatula blade deeper into the bond line and continue the twisting motion and upward force.

**Step 4:** After the device is separated, the tape can be removed and discarded. If adhesive remains on the surfaces, it must be removed. Adhesive is best removed by wiping with a rag dabbed with isopropyl alcohol, MEK or toluene. Use sufficient solvent to remove all adhesive.

**Step 5:** Let solvent cleaned components air dry for 15 minutes before reapplying THERMATTACH tape.

TYPICAL PROPERTIES		T413	T414	TEST METHOD
CONSTR.	Carrier	Fiberglass	Kapton MT**	—
	Color	White	Beige	Visual
	Thickness, inch	0.007 (0.178)	0.005 (0.127)	ASTM D374
THERMAL	Thermal Impedance @ <1 psi, °C-in <sup>2</sup> /W (°C-cm <sup>2</sup> /W)	0.65 (4.0)	0.6 (3.7)	ASTM D5470
	Thermal Conductivity, W/m-K	0.35	0.37	ASTM D5470
ELEC.	Voltage Breakdown, Vac	3700	5000	ASTM D149
	Volume Resistivity, ohm-cm	1.3 x 10 <sup>16</sup>	5 x 10 <sup>15</sup>	ASTM D257
MECHANICAL	Lap Shear Adhesion, psi (MPa)	100 (0.69)	100 (0.69)	ASTM D1002
	Die Shear Adhesion, psi (MPa) Aluminum 25°C 150°C	180 (1.24) 20 (0.138)	150 (1.04) 15 (0.104)	Chomerics Test Procedure No. 54
	Creep Adhesion, days 25°C, 12 psi (0.083 MPa) 150°C, 12 psi (0.083 MPa)	>50 >10	>50 >10	PSTC-7***
	Adhesive CTE, ppm/°C, -40 to +150°C	147	147	ASTM D3386

\*\* Trademark of DuPont \*\*\* Pressure Sensitive Tape Council

**ORDERING INFORMATION**

**Standard Rolls**

THERMATTACH T413 and T414 thermal tapes are available in standard 100 ft. (30.5m) rolls of various widths. Use the part number system below when ordering rolls of THERMATTACH tapes.

Pre-cut parts are available in kiss-cut, rectangular shapes on rolls of 1000 parts per roll. For availability of THERMATTACH parts for other components or package sizes, please contact Chomerics' Inside Sales Department.

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