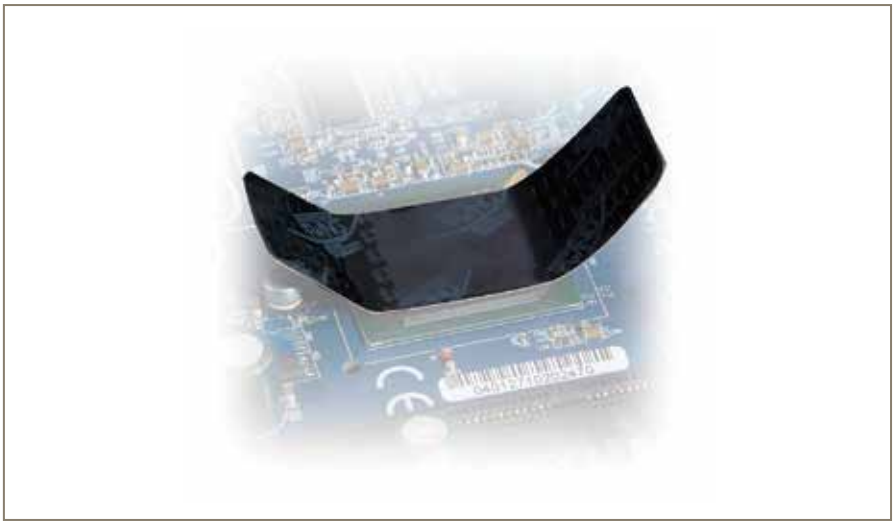
T-WING® HEAT SPREADERS

Thin Heat Spreaders

Parker Chomerics' family of thin heat spreaders provides a low-cost, effective means of cooling IC devices in restricted spaces where conventional heat sinks are inappropriate.



FEATURES/BENEFITS

- Component junction temperature reduction of 10 to 20°C is common
- Easily added to existing designs to lower component temperatures and improve reliability
- Custom shapes available for complex designs

TYPICAL APPLICATIONS

- Microprocessors
- Memory modules
- Laptop PCs and other high density, handheld portable electronics
- High speed disk drives

DESIGN DETAILS

- Low profile (0.33 mm/0.013 in) allows use in limited space environments
- Easy peel and stick adhesion to all surfaces, including packages with residual silicone mold release
- Offers low cost cooling for many package types
- Low application force (<5 psi/ 0.03 MPa) minimizes risk of damage to component
- Available in a range of standard sizes
- Pliable nature allows conformance to concave or otherwise non-flat surfaces for optimal thermal and mechanical performance
- Light weight (0.039 oz/in^2)
- Standard parts are scored for easy forming and alignment
- Easy removal for device replacement
- Available die-cut on continuous rolls

TESTING SUMMARY

Summaries of test procedures used for T-WING heat spreaders are described below. Thermal performance, adhesion strength and visual inspection were used as pass/fail criteria.

Apparatus

Anatek® Thermal Analyzer: The ATA was used to measure Rj-a before and after environmental stressing. PQFP: 196 lead, plastic PQFPs known to contain silicone mold release were evaluated. T-WING Heat Spreader: 1 in x 4 in T-WING parts were applied to the PQFP packages with a 5 psi (0.03 MPa) mounting pressure.

THERMAL PERFORMANCE

Various sizes of T-WING heat spreaders were applied to a 196 lead PQFP using less than 5 psi (0.03 MPa) bonding pressure. Within 30 minutes of application, the test boards were mounted in an Analysis Tech® thermal analyzer. The devices were heated to equilibrium (45 to 60 minutes) with approximately 3 watt load on 3 x 3 in (7.6 x 7.6 cm) test boards.

Two test environments were used: restricted convention, achieved with a 1 x 5 x 6 in (2.5 x 12.7 x 15.2 cm) plexiglass box; and 100 LFM (30 m/min) air flow. Results were obtained using thermocouples for Tc (centered on case) and Rj-a.

Environmental Stressing

Control: Specimens were maintained for 1000 hours at standard laboratory conditions, 23°C, 35-60% RH.

Heat Aging: Test specimens were placed in a forced convection hot air oven maintained at 150°C ±5°C for 1000 hours. Test specimens were then removed and tested.

Elevated Temperature/ High Humidity:
Specimens were placed in a humidity chamber maintained at 85°C ± 2°C and 90%-0 +10% RH for 1000 hours.

Temperature Cycling: Specimens were subjected to 500 cycles from -50°C to +150°C in a Tenney Temperature Cycling Oven.

Temperature Shock: Specimens were subjected to 100 temperature shocks by immersion into -50° and +150°C liquids. Temperatures were monitored with thermocouples.

Evaluation Procedure

Visual: All test specimens were examined for de-bonding, delamination or other signs that the tape was failing after environmental stress.

Thermal Performance: T-WING was applied to the PQFP with 5 psi mounting pressure. After a one hour dwell, the Rj-a of each specimen was measured at 100 LFM and under restricted convection conditions. The Rj-a was again measured after environmental stressing.

90° Peel Strength: A T-WING heat spreader was applied to each PQFP with 5 psi mounting pressure. The specimens were subjected to environmental stress and then tested for 90° peel strength at room temperature.

Results

Visual: There was no visual evidence of T-WING adhesion failure to the PQFP after the environmental stresses.

Thermal Performance: The before and after thermal resistances are given in Table 4. The data shows that the thermal resistances were essentially unchanged by the exposures.

90° Peel Strength: The results of the peel strength tests are given above. The data shows that the average peel strength actually increases with high temperature/humidity and temperature shock, while remaining unchanged with heat aging and decreasing slightly with temperature cycling.

APPLICATION INSTRUCTIONS

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

Step 1: For best results, clean the top surface of the component using a lint-free cotton cloth.

Step 2: Wipe the bonding surface of the component with an industrial solvent, such as MEK, acetone or isopropyl alcohol. In the case of a plastic package, select a cleaner that will not chemically attack the plastic substrate. Do not touch the cleaned surface during any part of the assembly process. If the surface has been contaminated, repeat Steps 1 and 2.

Step 3: Remove the clear release liner from the T-WING part, exposing the pressure-sensitive adhesive (PSA). Avoid touching exposed adhesive with fingers.

Step 4: For best bond strength and contact area, center the exposed PSA onto the component. Press and smooth the entire T-WING bonding area with firm finger pressure of about 5 psi, for 5 seconds.

Note: Bond strength will increase as a function of time as the adhesive continues to wet out the bonding surface. Increasing any of the application variables (pressure, temperature and time) can improve bonding results.

T-WING® Heat Spreaders

	Typical Properties		Test Method
Physical	Color	Black	Visual
	Total Thicknesses, in (mm)	0.013 (0.33)	ASTM D374
	PSA Type	Silicone based	--
	PSA Thickness, in (mm)	0.002 (0.05)	Visual
	Insulator Type	Black polyester	--
	Insulator Layer Thickness, in (mm)	0.001 (0.025)	--
	Weight, oz/in^2	0.039	--
	Thermal Conductor	Copper	--
	Maximum Operating Temperature, °F (°C)	257 (125)	--
	Thermal Conductor Thickness, in (mm)	0.007 (0.178)	--
Electrical	Dielectric Strength, Vac/mil (kVac/mm)	5,000 (200) for each dielectric layer	ASTM D149
	Volume Resistivity, ohm-cm	N/A	ASTM D149
	Dielectric Constant @ 1,000 MHz	N/A	ASTM D150
	Dissipation Factor @ 1,000 kHz	N/A	Chomerics
Regulatory	Flammability Rating (See UL File E140244)	V-0	UL 94
	RoHS Compliant	Yes	Chomerics Certification
	Shelf Life, months from date of manufacture	12	Chomerics

Typical Properties

Typical Thermal Properties (Performed on surface of 196 lead 3 Watt PQFP package)			Standard Part Size in (mm)					
Environment*	**Properties**	**Without T-WING**	**0.5 x 2 (12.7 x 50.8)**	**0.5 x 3 (12.7 x 76.2)**	**0.75 x 3 (19.1 x 76.2)**	**1 x 3 (25.4 x 76.2)**	**1 x 4 (25.4 x 101.6)**	**1.5 x 4 (38.1 x 101.6)**
Restricted Convection**	Thermal Resistance Rj-a, °C/W	26	25	23	23	22	20	19
	Case Temperature, °C	92	82	78	76	72	70	68
100 LFM***	Thermal Resistance Rj-a, °C/W	18	16	14	14	14	13	12
	Case Temperature, °C	68	57	52	49	46	44	44

* Measured values do not account for heat losses through bottom of case and leads. Ambient temperature range from 21°C to 24°C.

** Restricted convection in a simulated notebook computer environment - a 1 x 5 x 6 in (2.54 x 12.7 x 15.2 cm) plexiglass box.

*** T-WING long axis perpendicular to air flow direction in wind tunnel.

Notes

Rj-a = thermal resistance from junction to ambient

LFM = airflow rate (linear feet per minute)

Typical Adhesion Performance

Test	Procedure	Result	Test Method
Lap Shear - Room Temperature	apply/60 min. R.T. dwell/R.T. pull	960 oz/in^2 (414 kPa)	ASTM D1000
Lap Shear - Elevated Temperature	apply/60 min. R.T. dwell/100°C pull	53 oz/in^2 (23 kPa)	ASTM D1000
90° Peel - Room Temperature	apply/1 min. R.T. dwell/R.T. pull	40 oz/in (441 g/cm)	ASTM B571/D2861
90° Peel - Elevated Temperature	apply/60 min. R.T. dwell/100°C pull	20 oz/in (220 g/cm)	ASTM B571/D2861
Creep Adhesion, days	275°F (135°C), 7 oz/in^2 (3 kPa), on aluminum	>80 days, no failure	P.S.T.C. No. 7

Environmental Stress Thermal Performance

Environment	Before	After
Heat Aging		
Rj-a, °C/W Restricted Convection	20.3	20.6
Rj-a, °C/W 100 LFM	12.7	13.1
High Temperature/Humidity		
Rj-a, °C/W Restricted Convection	21.4	21.4
Rj-a, °C/W 100 LFM	14.1	14
Temperature Cycling		
Rj-a, °C/W Restricted Convection	21.4	21.7
Rj-a, °C/W 100 LFM	14.1	13.9

Note: Tested with a 1" x 4" (25.4 x 101.6 mm) T-WING.

Environmental Stress Adhesive Performance

Environment	90° Peel Strength	
	oz/in	gm/cm
Control	36	393
Heat Aging	36	393
High Temperature/Humidity	46	514
Temperature Shock	38	424
Temperature Cycling	30	335

Note: Average of three samples tested per ASTM B571/D2861.

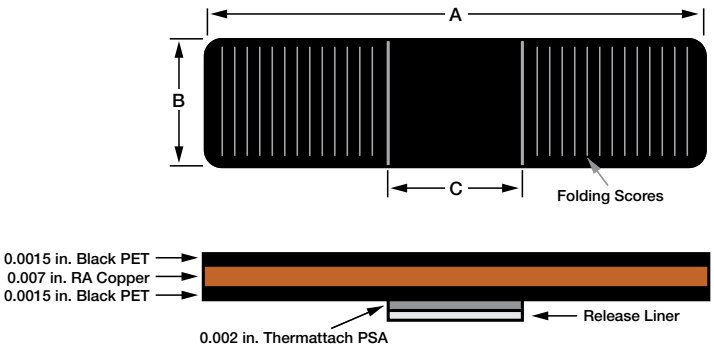
Ordering Information

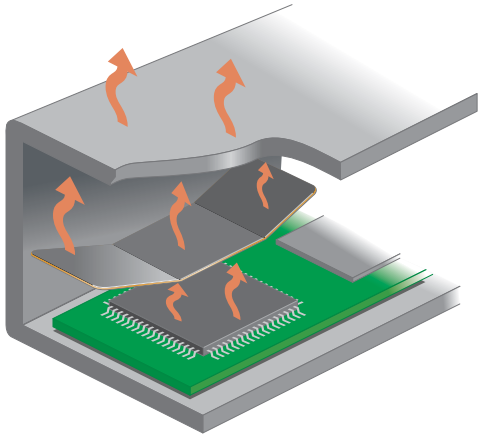
T-WING® Heat Spreaders

Standard Parts: Refer to table below for part numbers and sizes. T-WING heat spreaders are available in standard packages of 100 parts/pkg.

Custom Parts: Custom configured T-WING parts are also available. Contact Parker Chomerics' Applications Engineering Department for details.

Available in standard sizes 1,000 parts per plastic tray. Also available die-cut on continuous rolls.





Part Numbers	Size (inches/mm)		
	A: Length, inches (mm)	**B:** Width, inches (mm)	**C:** Adhesive Width, inches (mm)
60-12-20264-TW10	2.0 (50.8)	0.50 (12.7)	0.50 (12.7)
60-12-20265-TW10	3.0 (76.2)	0.50 (12.7)	0.50 (12.7)
60-12-20266-TW10	3.0 (76.2)	0.75 (19.1)	0.75 (19.1)
60-12-20267-TW10	3.0 (76.2)	1.00 (25.4)	1.00 (25.4)
60-12-20268-TW10	4.0 (101.6)	1.00 (25.4)	1.00 (25.4)
60-12-20269-TW10	4.0 (101.6)	1.50 (38.1)	1.50 (38.1)