参考資料

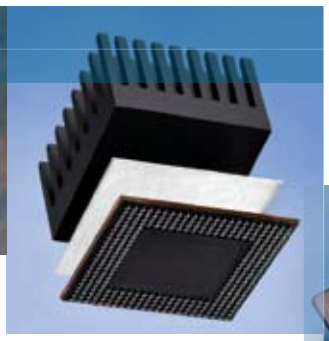
3M™ Thermal Management Solutions for Electronics

3M™ Thermally Conductive Adhesive Transfer Tapes

This range of high adhesion thin tapes offers efficient thermal transfer for a wide range of applications requiring a thermal management solution: bonding heat sinks, heat spreaders and other cooling devices to IC packages, power transistors, and other heat generating components.

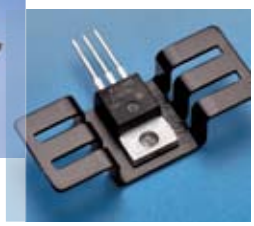
Each tape combines 3M high performance acrylic adhesive with highly conductive ceramic particles for an extremely reliable and user-friendly thermal interface. Highly conformable construction provides excellent wet-out on surfaces.

Select 5, 10, 15 and 20 mil thicknesses to meet application requirements. The unique 40 mil 9889FR is a highly conformable pressure-sensitive film that offers a combination of high thermal conductivity, good dielectric properties, high bond strength, and ease of use.



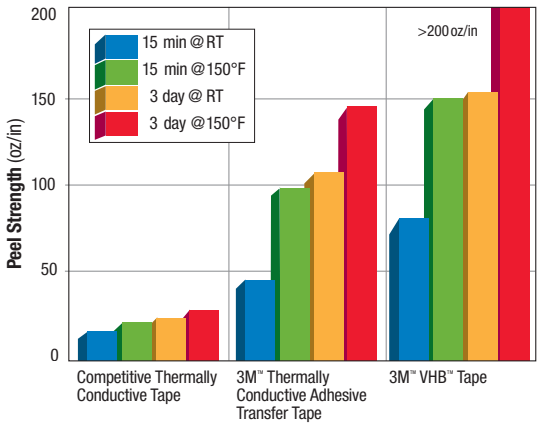
3M™ Thermally Conductive Adhesive Transfer Tapes 8805, 8810, 8815, 8820. High temperature adhesion with good dielectric strength. Applies quickly and easily using die-cut shapes.

Heat Sink. Thermally Conductive Adhesive Transfer Tape bonds a heat sink to a component and provides a thermal path for component cooling.



Power Transistor Attachment. 3M™ Thermally Conductive Adhesive Transfer Tape 8810 replaces silicone grease and screws for attaching transistors to heat sink.

90º Peel Adhesion to Bare Untreated Aluminum



3M™ Thermally Conductive Interface Materials Selection Guide

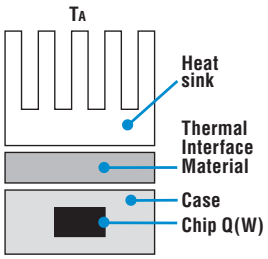
Product	Description				Adhesion	Thermal Performance		Dielectric Properties			
	Base Material Type	Product Thick-ness mil (mm)	Filler Type	Liner Type	Peel Strength @ 72 hr. Dwell at RT (N/cm)	Conductivity (W/m-K 3M ASTM D5470 TM)	Impedance °C-in²/W (°C-cm²/W)	Dielectric Strength (KV/mm)	Volume Resistivity (ohm/cm)	UL Flammability Rating	Potential Operating Temperature Range** (°C)
3M™ High Adhesion Thermally Conductive Adhesive Transfer Tape (TCATT): Softer-Improved Surface Conformability Acrylic Thermal Tape											
8805	Filled Acrylic Polymer	5 (0.13)	Ceramic	Silicone-Release Polyester: Dual Liners	5.8	0.6	0.48 (3.1)	26 8815 tested	5.2 X 10^{11}	UL Testing Note: Adhesive tapes are not intended to be used independently as a single component. Tapes are recognized for use with specific substrates and the tape/substrate is tested for a UL rating.	Short Term (Hours-Days): 125-150°C Long Term (Weeks-Months): 90-100°C
8810		10 (0.25)			8.3		0.88 (5.7)		3.9 X 10^{11}		
8815		15 (0.38)			9.8		1.17 (7.6)		3.8 X 10^{11}		
8820		20 (0.51)			11.9		1.50 (9.7)		3.8 X 10^{11}		
3M™ Thermally Conductive Adhesive Transfer Tape (TCATT): Standard Acrylic Thermal Tape											
9882	Filled Acrylic Polymer	2 (0.05)	Ceramic	Silicone Release Polyester	2.1 - 3.4	0.6	0.32 (2.1)	29 9890 tested	2 X 10^{14}	UL Testing Note: Adhesive tapes are not intended to be used independently as a single component. Tapes are recognized for use with specific substrates and the tape/substrate is tested for a UL rating.	Short Term (Hours-Days): 125-150°C Long Term (Weeks-Months): 90-100°C
9885		5 (0.13)					0.49 (3.2)				
9890		10 (0.25)					0.89 (5.7)				
3M™ Thermally Conductive Acrylic Soft Tape (TCAST): Thick Acrylic Thermal Tape											
9889FR*	Filled Acrylic Polymer	40 (1.0)	Ceramic	Silicone Release Paper	3.7 on Al Substrate	0.5	—	—	—	UL 94 V-2	Short Term (Hours-Days): 90-125°C Long Term (Weeks-Months): 70-80°C

Note: *1) 3M Tape 9889FR is a specialty tape used for very large panels or surfaces where a very conformable thermal tape is needed to achieve good wet-out/adhesion. The 3M Tape 8820 is the suggested standard TCATT Thermal tape for most typical, somewhat larger surface areas as the thermal impedance is lower vs the 3M Tape 9889FR.

** End use application testing will determine final temperature range based on final design and other environmental conditions. Suggested Temperature range is based on a UL-746 Test Method or a 3M Test Method.

Calculate Chip Temperature for use with Tapes, Pads, and Epoxies

Input Values
A (in^2), size of thermal interface material
%WO, % wet-out of interface material (estimate of actual contact area)
Q(W)), power rating of chip
$R_{chip\text{-}case}$ (°C/W) (0.55 ref.), thermal resistance of chip to case
$R_{sink\text{-}air}$ (0.80 ref.), thermal resistance of heat sink to ambient
TA (°C) (35°C ref.), ambient temperature
Z (°C-in^2/W), thermal impedance of 3M interface material



Calculations
Thermal Resistance of 3M Interface Material $R\ (°C/W) = \frac{Z/A}{\%WO/100}$
Total resistance, R_{total} (°C/W) = $R_{chip\text{-}case}$ + R + $R_{sink\text{-}air}$, For temperature of Chip, TChip = **TA + (Q x R_{total})**

Obtain Maximum Operating Temperature of Chip from vendor.
Calculated TChip should not exceed temperature specified.

3M™ Thermally Conductive Interface Materials Typical Applications

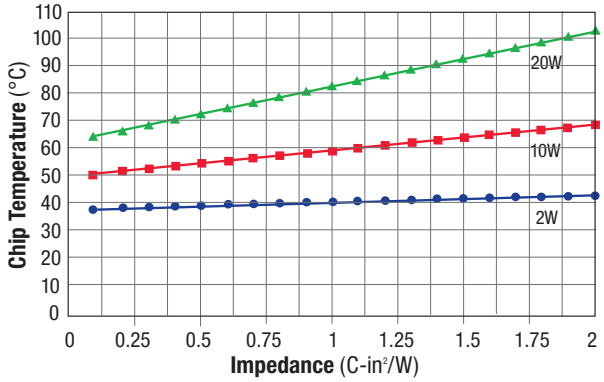
Product	Typical Applications
8805 8810 8815 8820	Thermally conductive adhesive transfer tapes with high mechanical strength, improved surface wet-out, and excellent shock performance. Applications include: heat sink attachment, flex circuit bonding, power device attachment and general thermal attachment solutions.
9882, 9885, 9890	3M's original thermally conductive adhesive transfer tape for applications requiring thin bonding with good thermal transfer.
9889FR	One millimeter thick, flame retardant acrylic soft tape for applications requiring gap filling and bonding with good thermal transfer, generally used for large surface area bonding.
5516/5516S[2] 5519, 5519S[2] 5591S[2], 5592[1] 5595[1]	Thermally conductive interface pads (silicone) for applications requiring gap filling and superior thermal performance without bonding. Provides IC package and PCB thermal interfacing with heat sinks or other cooling device, and metal cases.
TC-2707 TC-2810 DP 190 Gray	Thermally conductive epoxies for applications requiring high adhesive strength, good surface wet-out, gap filling or thin bond lines with good thermal transfer.
5589H[2] 5590H[2]	Thermally conductive interface pads use an acrylic elastomer for applications that require a non-silicone thermal pad.
TCG-2035/ TCG-2031* TCG-2037/ TCG-2033*	Thermally conductive greases provide a thin thermal interface to optimize thermal heat transfer between hot running devices and heat sinking surfaces. Excellent flow properties for improved interface wet-out.

* Note 1) 3M Greases TCG-2031 and TCG-2033 are supplied with a small wt% of a solvent added to lower viscosity. Lower viscosity can allow for reduced thickness during application and may benefit screen printing options. Effective thermal measurements are not significantly different from non-solvent added versions.
Shear Rate viscosity reduced by 5-10x.

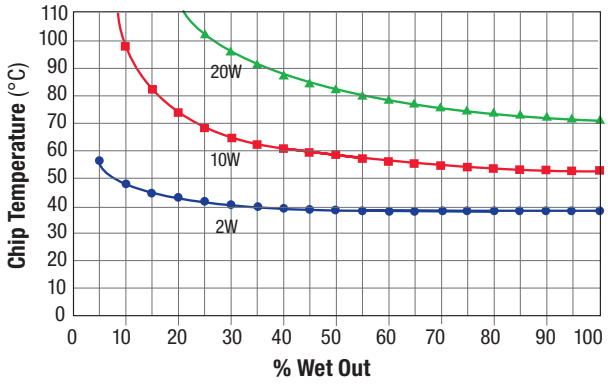
[1] 3M Pads 5592 and 5595 are also available with a polyester film on one side to provide a non-tacky surface.

[2] "S" designation signifies a polyester film on one side to provide a non-tacky surface. "H" designation signifies a product with one non-tacky surface without the use of a PET film.

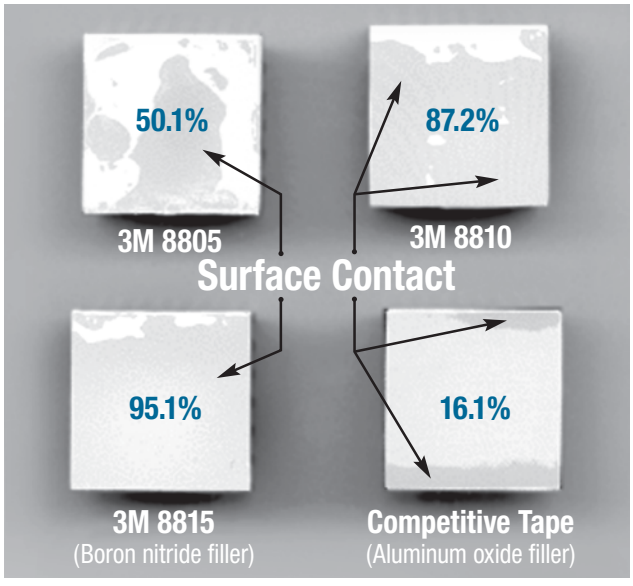
Effect of Thermal Interface Impedance and Device Power on Chip Temperature



Effect of Wet-Out (Interface Contact) and Device Power on Chip Temperature



% Wet-out of Heat Sink to Glass Slide



Dark areas show adhesive wet-out.

Increased wet-out improves both mechanical and thermal performance.

Relative darker color indicates surface contact has occurred. Boron nitride filler appears lighter in color versus aluminum oxide filler

Note: The technical information and data on these pages should be considered representative or typical only and should not be used for specification purposes.