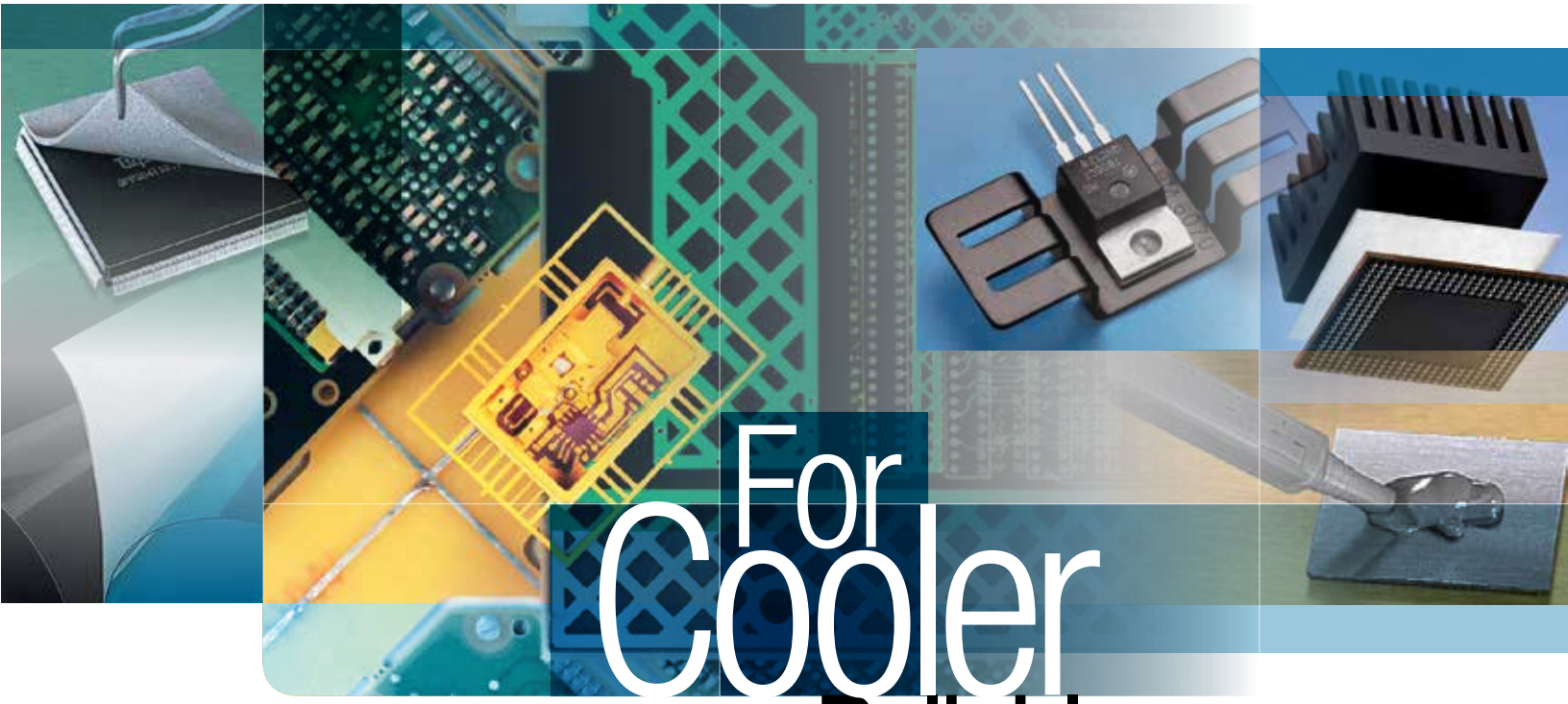
Thermal Management Solutions
For Electronics



For Cooler More Reliable Devices

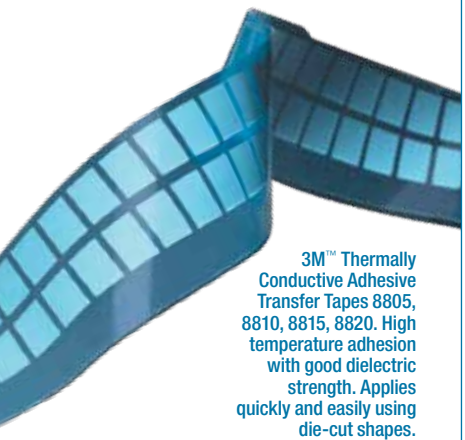
3M

3M™ Thermally Conductive Adhesive Transfer Tapes

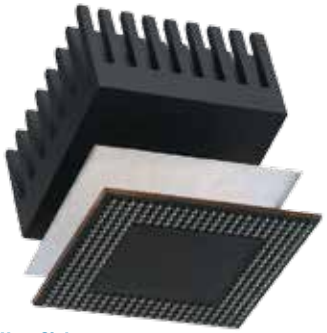
This range of high adhesion thin tapes offers efficient thermal transfer for a wide range of applications requiring a thermal management solution: bonding heat sinks, heat spreaders and other cooling devices to IC packages, power transistors, and other heat generating components.

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.

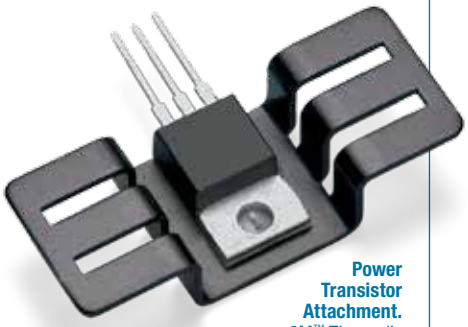
Select 5, 10, 15 and 20 mil thicknesses to meet application requirements.



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.

3M™ Thermally Conductive Interface Materials Selection Guide

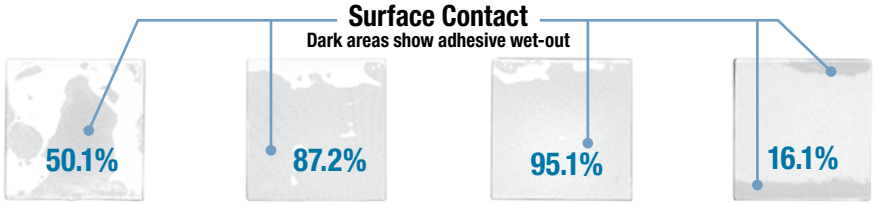
Product	Description				Adhesion	Thermal Performance		Dielectric Properties	
	Base Material Type	Product Thickness mil(mm)	Filler Type	Liner Type	Peel Strength @ 72 hr Dwell at RT (N/cm)	Conductivity (W/m-K)**	Impedance °C-in²/W (°C-cm²/W)	Dielectric Strength (kV/mm)	Volume Resistivity (ohm/cm)
3M™ Thermally Conductive Interface Tapes Softer - Improved Surface Conformability Acrylic Thermal Tape									
8805	Filled Acrylic Polymer	5 (0.13)	Ceramic	Silicone Release Polyester Dual Liners	7.5	0.6	0.48 (3.1)	26 8815 tested	5.2×10^{11}
8810		10 (0.25)			13.0		0.88 (5.7)		3.9×10^{11}
8815		15 (0.38)			19.0		1.17 (7.6)		3.8×10^{11}
8820		20 (0.51)			26.0		1.50 (9.7)		3.8×10^{11}
3M™ Thermally Conductive Interface Tapes Standard Acrylic Thermal Tape									
9882	Filled Acrylic Polymer	2 (0.05)	Ceramic	Silicone Release Polyester	5	0.6	0.32 (2.1)	29 9890 tested	2×10^{14}
9885		5 (0.13)			6.5		0.49 (3.2)		
9890		10 (0.25)			9.5		0.89 (5.7)		
3M™ Thermally Conductive Interface Tapes* ** High Adhesion									
TM-670SA*	Filled Acrylic Polymer	10 (0.25)	Ceramic	Silicone Release Polyester	25.0 /5.5	0.6	1.1 (7.1)	24 TM-670SA tested	–
TM-671SA*		15 (0.375)			30.0/9.3		1.2 (7.8)		
TM-672SA*		20 (0.5)			42.0/11.6		1.4 (9.1)		
8943		6.7 (0.17)		Film Liner	6.7	0.9	0.73 (4.7)	33 8940 tested	
3M™ Thermally Conductive Interface Tapes Flame Retardant Acrylic Thermal Tape									
8940	Filled Acrylic Polymer	7.5 (0.19)	Ceramic	Film Liner	6.7	0.9	0.78 (5.1)	33 8940 tested	–
8910-03		11.8 (0.3)		Paper	20.5	0.6	1.1 (7.2)	23	–
3M™ Thermally Conductive Heat Spreading Tapes Thermally Conductive / Heat Spreading Tape									
9876-10	Acrylic Polymer on Cu Layer	3.9 (0.1)	N/A	3M Logo Printed Silicone Release Paper	9	250 (X-Y) 0.8 (Z-axis)	0.21 (1.4)	20 9876-15 tested	–
9876-15		5.9 (0.15)		3M Logo Printed Film Liner	10		0.28 (1.8)		

* TM-67X tapes are designed with a high/low adhesion construction. Face side or non-liner side when product roll is unwound is the lower adhesion side.

** 3M-ASTM 05470TM

*** Products are special order in the USA. Please contact your 3M sales support for details.

% Wet-out of Heat Sink to Glass Slide



3M 8805 | **3M 8810** | **3M 8815** (Boron nitride filler) | **Competitive Tape** (Aluminum oxide filler)

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.

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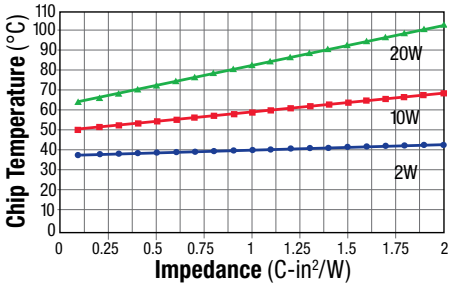
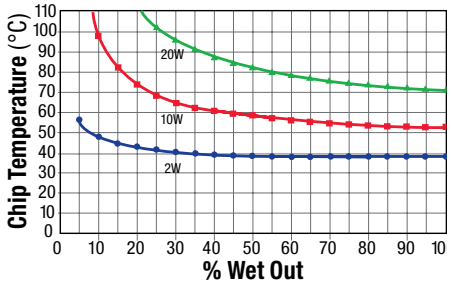
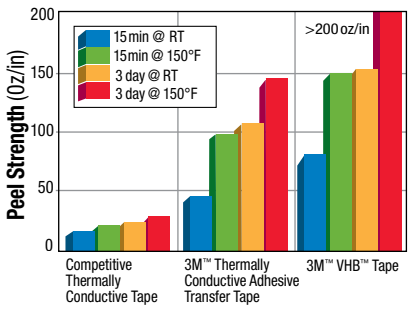
Effect of Thermal Interface Impedance and Device Power on Chip Temperature



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



90° Peel Adhesion to Bare Untreated Aluminum/3M 88xx TCATT



3M™ Thermally Conductive Interface Materials Selection Guide (Continued)

Product	UL Flammability Rating	Potential Operating Temperature Range* (°C)	Typical Applications	Notes
3M™ Thermally Conductive Interface Tape – Softer - Improved Surface Conformability Acrylic Thermal Tape				
8805 8810 8815 8820	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 Long Term (Weeks-Months) 90-100	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.	
3M™ Thermally Conductive Interface Tape – Standard Acrylic Thermal Tape				
9882 9885 9890	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 Long Term (Weeks-Months) 90-100	3M's original thermally conductive adhesive transfer tape for applications requiring thin bonding with good thermal transfer.	
3M™ Thermally Conductive Interface Tape – High Adhesion**				
TM-670SA* TM-671SA* TM-672SA*	Not Applicable - Non-Compliant	Short Term (Hours-Days) 110-130 Long Term (Weeks-Months) 80-90	3M TCAT TM-67X tapes are designed with a high/low adhesion construction. Face side or non-liner side when product is unwound is the lower adhesion side for good reworkability.	
8943	Not Applicable	Short Term (Hours-Days) 125-150 Long Term (Weeks-Months) 90-100	Thermally conductive tape with good bonding strength. 3M tape 8943 is a single coated tape version of 3M tape 8940.	
3M™ Thermally Conductive Adhesive Tapes (TCAT) – Flame Retardant Acrylic Thermal Tape**				
8940	UL 94 V-0 See UL listing for specifics of UL test criteria. Product tested with a substrate.	Short Term (Hours-Days) 125-150 Long Term (Weeks-Months) 90-100	Thermally conductive tape with good bonding strength and flame retardant performance.	
8910-03	UL 94 V-2	Short Term (Hours-Days) 110 - 130 Long Term (Weeks-Months) 80 - 90	For the advanced thermally conductive tape with super adhesion and good flame retardant, 3M TCAT 8910-03 can be considered and recommended as one of high performance thermal attachment solutions.	ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.
3M™ Thermally Conductive Heat Spreading Tapes				
9876-10 9876-15		Short Term (Hours-Days) 110 - 130 Long Term (Weeks-Months) 80 - 90	Excellent heat spreading on plane direction and low heat conduction on depth direction with good electrical insulation on surface. It is designed for thermal management by heat spreading.	TCoHST has adhesive on one side only. Product is not used to hold an assembly together. TCoHST use is primarily heat spreading in low profile applications when attached to or on a surface opposite a hot device.

* 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.

** Products are special order in the USA. Please contact your 3M sales support for details.

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)

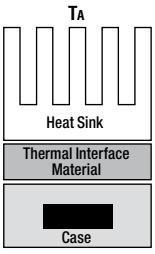
Q(W), power rating of chip

$R_{chip\text{-}case}$ (°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 = **$TA + (Q \times R_{total})$**

Obtain maximum operating temperature of chip from vendor. Calculated TChip should not exceed temperature specified.

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3M™ Thermally Conductive Interface Pads

Through innovative 3M technology, these soft and conformable pads provide high levels of conductivity for the more demanding applications in the electronics industry.

In addition, the pads provide excellent handling and can be die cut to fit most applications. Available in silicone and non-silicone elastomers.

- Thermal conductivity: 1.0-4.9 W/m-k
- Available in silicone and acrylic elastomers

3M™ Thermally Conductive Interface Pads Selection Guide

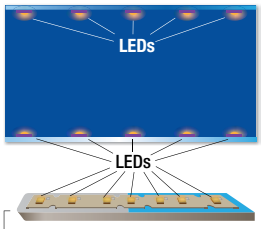
Product	Description				Adhesion/Shore 00 Softness	Thermal Performance		Dielectric Properties	
	Base Material Type	Product Thickness mil (mm)	Filler Type	Liner Type	Adhesion Characterization/// Shore 00 Testing based on TM 6 mm thickness	Conductivity (W/m-K 3M-ASTM 0547O TM)	Impedance** °C-in²/W (°C-cm²/W)	Dielectric Strength kV/mm	Volume Resistivity (ohm/cm)
3M™ Thermally Conductive Interface Silicone Pads									
5514	Filled Silicone Polymer	7.9 (0.2) 9.8 (0.25)	Ceramic	PET	No added adhesive layer. Pad is tacky and conformable/// Shore 00=58	1.6	0.44 (2.8) 0.47 (3.0)	14.0	8.6×10^{13}
5515					No added adhesive layer. Pad is tacky and conformable/// Shore 00=80	3.0	0.29 (1.8) 0.40 (2.6)	14.5	3.6×10^{14}
5515S*						2.7	0.62 (3.9) 0.70 (4.5)	17.7	8.6×10^{14}
5516		20 (0.5) 40 (1.0) 60 (1.5) 80 (2.0)			No added adhesive layer. Pad is tacky and conformable/// Shore 00=50	3.1	0.31 (2.0) 0.53 (3.4) 0.75 (4.9) 0.98 (6.3)	13.1	6.9×10^{14}
5516S*								16.0	
5519		20 (0.5) 40 (1.0) 60 (1.5) 80 (2.0)			No added adhesive layer. Pad is tacky and conformable/// Shore 00=70	4.9	0.29 (1.9) 0.48 (3.1) 0.65 (4.2) 0.82 (5.3)	11.1	1.7×10^{14}
5519S*								13.5	
5591		20 (0.5) 40 (1.0) 60 (1.5) 80 (2.0)			No added adhesive layer. Pad is tacky and conformable/// Shore 00=10-15	1.0	1.14 (7.3) 1.92 (12.4) 2.71 (17.5) 3.49 (22.5)	5.5	2.0×10^{12}
5591S*								7.9	
5592		20 (0.5) 40 (1.0) 60 (1.5) 80 (2.0)			No added adhesive layer. Pad is tacky and conformable/// Shore 00=43	1.1	0.64 (4.1) 1.15 (7.4) 1.66 (10.7) 2.43 (15.7)	12.2	3.0×10^{12}
5592S*								14.7	
5595		20 (0.5) 40 (1.0) 60 (1.5) 80 (2.0)			No added adhesive layer. Pad is tacky and conformable/// Shore 00=50	1.6	0.70 (4,5) 1.21 (7.8) 1.71 (11.0) 2.22 (14.3)	13.1	5.0×10^{12}
5595S*								15.7	
3M™ Thermally Conductive Interface Acrylic Pads									
5570	Filled Acrylic Polymer	20 (0.5) 40 (1.0) 60 (1.5) 80 (2.0)	Ceramic	PET	No added adhesive layer. Pad is tacky and conformable/// Shore 00=50	1.3	0.67 (4.3) 1.18 (7.6) 1.69 (10.9) 2.30 (14.9)	20	2.9×10^{12}
5589H		40 (1.0) 60 (1.5)			No added adhesive layer. Pad is tacky and conformable/// Shore 00=48	2.0	1.33 (8.6) 1.67 (10.8)	21	3.4×10^{12}
5590H		20 (0.5) 40 (1.0) 60 (1.5)			No added adhesive layer. Pad is tacky and conformable/// Shore 00=61	3.0	0.46 (3.0) 0.70 (4.5) 0.95 (6.1)	16	2.7×10^{12}
5567H		20 (0.5) 40 (1.0) 60 (1.5)			No added adhesive layer. Pad is tacky and conformable/// Shore 00=63	3.0	0.46 (3.0) 0.70 (4.5) 0.95 (6.1)	16	2.7×10^{12}

*Pads ending with S have a polymeric film on one side to be used as a non-tacky surface for ease of reworking an assembly.

**Thermal impedance is measured with the test sample under a nominal 10 psi pressure to reflect a typical end use application.

LED BLU Application

LED Assembly

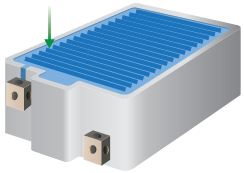


3M™ Thermally Conductive Interface Pads or 3M™ Thermally Conductive Interface Tapes

Heat Sink or Heat Spreader Plate

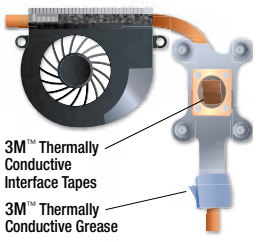
Automotive Battery Application

Battery Assembly



3M™ Thermally Conductive Interface Acrylic Pads

Notebook Thermal Module Application



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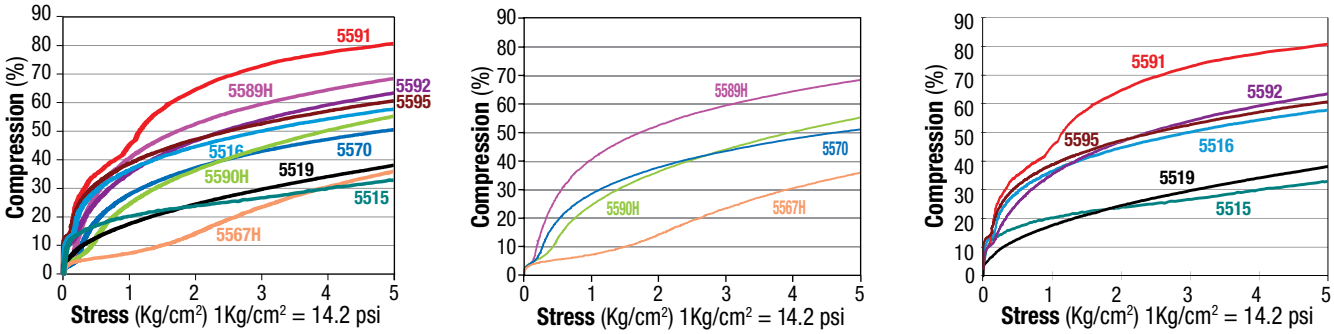
Compression vs. Stress

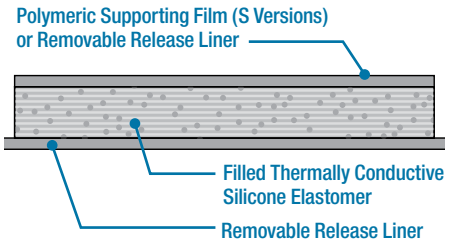


3M™ Thermally Conductive Interface Pads Selection Guide (Continued)

Product	UL Flammability Rating	Potential Operating Temperature Range***(°C)	Typical Applications	Notes
3M™ Thermally Conductive Interface Silicone Pads				
5514	UL 94 V-1	Short Term (Hours-Days) 180-200°C Long Term (Weeks-Months) 150-160°C	3M Pad 5514 is designed for applications requiring complicated shape, thin thickness (<0.25 mm) and good flexibility with over-bending.	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. "S" designation signifies a polyester (PET) or a PEN 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. ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.
5515	UL 94 V-0		3M TIM Pad 5515 is designed for applications requiring higher K(3 w/m-k) and thin thickness (<0.25 mm).	
5515S	Not Applicable		3M Pad 5515S is Thermal Pad 5515 with a permanent polyimide film on one side to be used as a non-tacky surface for anti-abrsion and ease of reworking on assembly. Thermal conductivity and thermal impedance are slightly changed with addition of thin polyimide film.	
5516	UL 94 V-0		**1)** 3M Pad 5516S is Thermal Pad 5516 with a polymeric permanent film on one side to be used as a non-tacky surface for ease of reworking an assembly. Thermal conductivity and thermal impedance are slightly changed with addition of the film, while Dielectric strength is improved. **2)** Optional thickness > 2.0 mm are available.	
5516S	UL 94 V-1 or V-0			
5519	UL 94 V-0		**1)** 3M Pad 5519S is Thermal Pad 5519 with a polymeric permanent film on one side to be used as a non-tacky surface for ease of reworking an assembly. Thermal conductivity and thermal impedance are slightly changed with addition of the film, while Dielectric strength is improved. **2)** Optional thickness > 2.0 mm are available.	
5519S				
5591	Not Applicable	Short Term (Hours-Days) 160-180°C Long Term (Weeks-Months) 130-140°C	**1)** 3M Pad 5591S has a polymeric permanent film on one side to be used as a non-tacky surface for ease of reworking an assembly. **2)** 3M Pad 5591S is available in 0.5 mm -2.0 mm thickness . **3)** Optional thickness > 2.0 mm are available.	
5591S	UL 94 V-1 or V-0			
5592	UL 94 V-1 or V-0		**1)** 3M Pad 5592S is Thermal Pad 5592 with a polymeric film on one side to be used as a non-tacky surface for ease of reworking and assembly. Thermal conductivity and thermal impedance are slightly changed with addition of the film, while dielectric strength is improved. **2)** 3M Pad 5592S is available in the 0.5 mm-2.0mm thickness. 3M Pad 5592 1.0-2.0 mm thickness **3)** Optional thicknesses > 2.0 mm are available.	
5592S				
5595	UL 94 V-0	Short Term (Hours-Days) 180-200°C Long Term (Weeks-Months) 150-160°C	**1)** 3M Pad 5595S is Thermal Pad 5595 with a polymeric film on one side to be used as a non-tacky surface for ease of reworking and assembly. Thermal conductivity and thermal impedance are slightly changed with addition of the film, while dielectric strength is improved. **2)** 3M Pad 5595S is available in the 0.5 mm-2.0 mm thickness. 3M Pad 5595 1.0-2.0 mm thickness **3)** Optional thicknesses > 2.0 mm are available.	
5595S				
3M™ Thermally Conductive Interface Acrylic Pads				
5570	UL 94 V-0	Short Term (Hours-Days) 110-130°C Long Term (Weeks-Months) 90-100°C	3M Pad 5570 has good recovery and a medium tack surface for both sides and uses an acrylic elastomer for applications that require a non-silicone thermal pad.	ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.
5589H			3M Pad 5589H has a very low tack surface and a medium tack surface and uses an acrylic elastomer for applications that require a non-silicone thermal pad.	
5590H			3M Pad 5590H has a very low tack surface and a medium tack surface and uses an acrylic elastomer for applications that require a non-silicone thermal pad.	
5567H			3M Pad 5567H has low odor, a very low tack surface and a medium tack surface on soft layer and uses an acrylic elastomer for applications that require a non-silicone thermal pad.	

Products are special order in the USA. Please contact your 3M sales support for details.

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.



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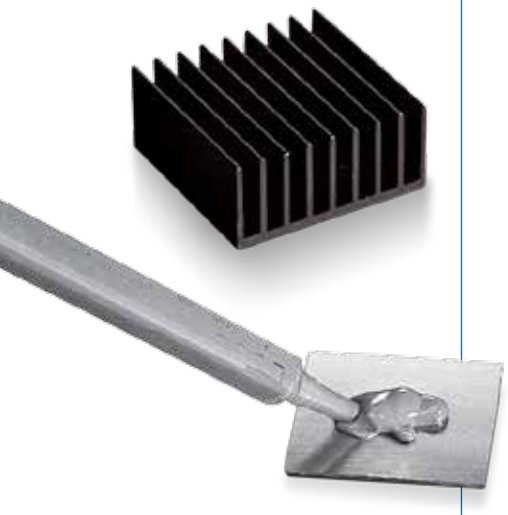
3M™ Thermally Conductive Epoxies

This range of liquid adhesives has less odor and good structural strength adhesion. Dispensing is easy for high output, in-line automated manufacturing and manual application.

Adhesive flows and fills micro-spaces on surfaces. Ultra-thin bond line helps achieve low thermal impedance.



3M™ Thermally Conductive Epoxies Selection Guide

Product	Description				Thermal Performance		Dielectric Properties		Potential Operating Temperature Range* (°C)	Typical Applications	Notes
	Base Material Type	Product Thickness mil(mm)	Filler Type	Packaging	Conductivity (W/m-K 3M-ASTM 05470TM)	Impedance °C-in²/W(°C-cm²/W) 2.0 mil (50µm) bondline thickness	Dielectric Strength (kV/mm)	Volume Resistivity (ohm/cm)			
3M™ Thermally Conductive Epoxies											
TC-2707	Filled Epoxy	Various	Aluminum Metal	2-part Epoxy/3M Duo-Pak	0.72	0.105 (0.67)	2.1	2.4×10^{11}			As the 3M™ Thermally Conductive Adhesive TC-2707 uses aluminum metal fillers, under certain end use application conditions the effective resistivity and/or effective dielectric strength could be significantly lower than noted. If the metal fillers are "trapped" or "pinched" between two surfaces, an electrical bridge path via the aluminum fillers could occur between these surfaces. Epoxy Adhesive TC-2707 is not suggested for applications where a powered electrical circuit is used or where a reliable volume resistivity and/or dielectric strength is desired. 3M Thermally Conductive Epoxy Adhesive TC-2810 uses ceramic filler and is suggested product to test for these types of application performance needs.
TC-2810			Ceramic		1.0-1.4	0.05 (0.32)	3	76×10^{12}			Thermal Conductivity (TC) can vary in an application as the filler is a boron nitride (BN) platelette shape and alignment can change effective TC.

* 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.

3M™ EPX Applicator and Nozzle simultaneously and accurately mixes, meters, and applies adhesive with a squeeze of the trigger

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

3M™ Thermally Conductive Grease

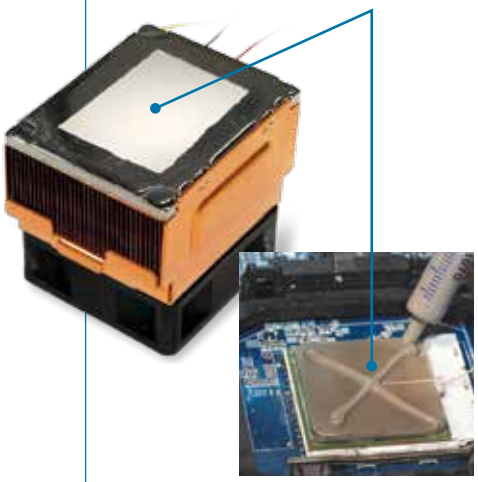
The 3M™ Thermally Conductive Greases are high performance thermal interface materials for transferring thermal energy from a heat source (e.g. processor chip, graphics chip, High Power LED) to a heat sink. The proprietary blend of inorganic fillers contained in an organic matrix (non-silicone) ensures high thermal conductivity and low thermal resistance. Grease products are available in two versions: Standard viscosity and a lower viscosity version that can be useful in screen printing application methods.

3M™ Thermally Conductive Grease Selection Guide

Product	Description				Thermal Performance		Dielectric Properties		Potential Operating Temperature Range* (°C)	Typical Applications	Notes
	Base Material Type	Product Thickness mil(mm)	Filler Type	Steady State Shear Viscosity @ 1.0 Shear/Rate	Conductivity (W/m-K3M-ASTM 05470 TM)	Impedance °C-in²/W (°C-cm²/W)	Dielectric Strength kV/mm (Film version tested)	Volume Resistivity (ohm/cm)			
3M™ Thermally Conductive Grease											
TCG-2035/ TCG-2031	Non-Silicone Polymeric Binder	Various	Ceramic	2100/150	4.1	0.0127 (0.81)	4.7	1.36 x 109	Short Term (Hours-Days) 125-150°C Long Term (Weeks-Months) 100-125°C	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.	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.

* 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.

3M™ Thermal Grease



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

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Contact 3M for the experience of 100 years of solutions for your design and production challenges.

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Electronics Materials Solutions Division
3M Center, Building 225-3S-06
St. Paul, MN 55144-1000
www.3M.com/electronics
1-800-251-8634

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Issued: 8/14 10061HB
78-9236-7060-4