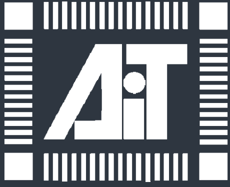
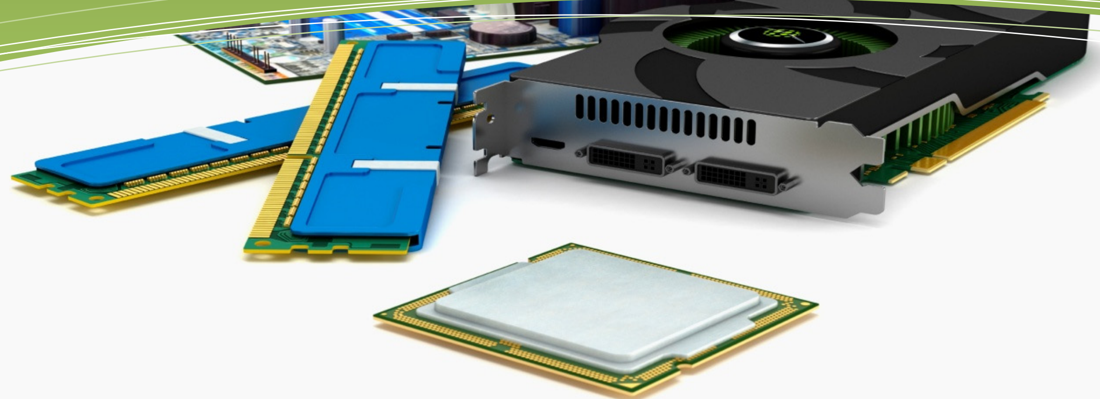


DIE ATTACH & THERMAL INTERFACE MATERIALS FOR CPU, GPU, MEMORY MODULE IN LAPTOP & TABLET

HIGH PERFORMANCE ELECTRO-THERMAL DIE-ATTACH FOR HIGH POWER CPU & GPU
INSTANT BONDING PRESSURE SENSITIVE THERMAL TAPE ADHESIVE FOR GPU MODULE
COMPRESSIBLE, CONFORMAL PHASE-CHANGE THERMAL INTERFACE MATERIAL (TIM) PAD



DIE ATTACH ADHESIVES & THERMAL INTERFACE MATERIALS FOR COMPUTERS

Paradigm Shifting Challenges for Computer Electronic Adhesives & Thermal Interface Materials

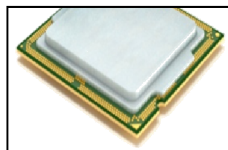
While the functional aspects of the typical die-attach, component attach, substrate attach and thermal management are the same for all electronics, managing the ever evolving CPU and GPU die-attaches for power thermal management and stacking of large area chips for memory modules requires ever enhanced performance. With over 30 years of experience in inventing and formulating specialty adhesives for electronic applications, AIT provides some of the most comprehensive die-attach film and paste adhesives and thermal interface solutions that are engineered to facilitate manufacturability and throughput.

- High thermal and electrical conductivity die-attach pastes and film adhesives
- 450mm and all size wafer DDAF
- Compressible pressure sensitive thermal film that is industry best to provide instant bonding and lowest thermal resistance for GPU and memory modules
- Conformal compressible phase change or pressure sensitive thermal interfaces for modules to heat-sink or board to casing

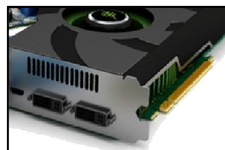
AIT CPU, GPU and Memory Modules Electronic Adhesives

What distinguishes AIT's CPU, GPU and memory modules electronic adhesives and thermal management material solutions besides their unparalleled and proven low thermal resistance is their proven long-term reliability. In die-attach, module mounting and heat-sink thermal interfaces, AIT's patented compressible phase-change interface pads feature molecular flexible structures and provide long-term reliability and consistent performance after years of thermal shock and cycling. Outstanding reliability and high performance has been a cornerstone of all AIT products since the company's founding. Other key AIT features include:

- Ultra-low electrical and thermal resistance between dies and substrates. Flexibility to produce camber-free, stress-free die mounting.
- For module mounting, molecular flexibility is specifically engineered in the thermal adhesive to provide stress absorption even in the most mis-matched CTE substrates and surfaces that extend to below -55°C.
- In the heat-sink interface layer, AIT provides a patented and proven compressible and conformable phase-change interface pad to eliminate trapped air and accommodate irregularity in gaps.
- Ultra-low thermal resistance gels and greases that are silicone free and free from drying and "pumped out."
- Compressible and pressure sensitive thermal interface adhesive and/or pad for large area heat-spreading and heat-sinking for laptops and tablets.
- RoHS, REACH and WEEE compliant to meet UL94V-0 rating.



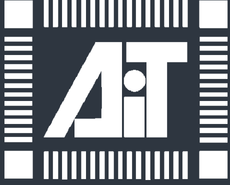
Ultra Low Thermal Resistance Die Attach is Critical for Performance & Reliability



Compressible Phase-Change or Pressure Sensitive Thermal Interface Materials

Failure in Thermal Management in Module Mounting is Not an Option

Proven Reliability over Years of Thermal Cycling and Shock is Critical



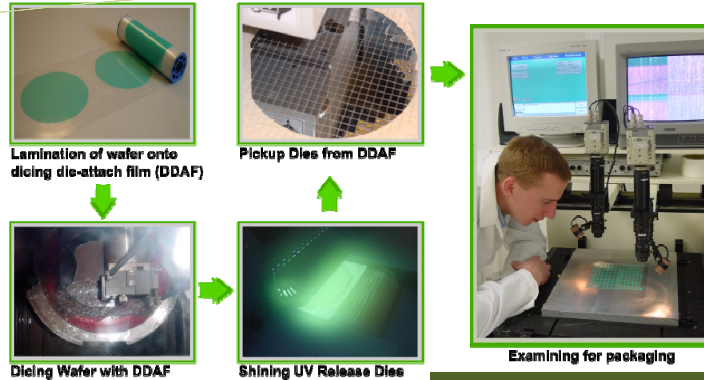
ELECTRO-THERMAL & DIELECTRIC-THERMAL DIE-ATTACH

ULTRA LOW THERMAL RESISTANCE FOR HIGHER POWER CPU & GPU CHIPS INSTANT BONDING
MAINTAIN STABLE BOND STRENGTH FOR EXTREME THERMAL SHOCK & CYCLING
MODIFIED EPOXY FOR CAMBER-FREE BONDING

Proven Lowest Possible Die-Attach Thermal Resistance Die-Attach Adhesives for Over 20 Years

Die-Attach thermal management is the first and most critical layer of the thermal stacks in CPU and GPU modules. High thermal conductivity with a thin and void-free bond-line of the die-attach adhesive is critical in dissipating the heat quickly to the broader module substrate. AIT has more than 20 years experience in supporting super-computers and high performance CPU and GPU modules with its high molecular flexibility and lowest thermal resistance die attach adhesives.

- ME8512 is a popular choice of void-free die attach with low electrical and thermal resistance.
- ME7519-LB is a thermally conductive and electrically insulating die-attach adhesive.
- ME7159-CD and ME8456-DA are popular workhorses for the most demanding CPU and GPU bonding of large dies.
- MC7885 and MC8880 are ideal for high power applications with a temperature operation of 250°C and beyond.



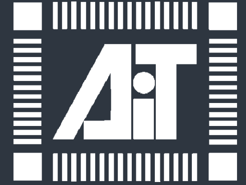
THERMAL CONDUCTIVE DIE-ATTACH

Properties of COOL-BOND™ Die-Attach for Power Electronics

PROPERTY	ME8512	ME8456-DA	MC8880	ME7519-LB
Electrical Resistivity	<0.0003 Ω-cm	<0.0003 Ω-cm	<0.003 Ω-cm	>10^{14} Ω-cm
Viscosity @5.0 rpm /Thixotropic Index	10,000 cps/4.0	20,000 cps/4.0	10,000 cps/4.0	20,000cps/>3
Glass Transition Tg (°C)	52	-20	220	52
Device Push-off Strength (psi)	>3000	>2000	>3000	>3000
Hardness (Type)	~ 80D	~ 80A	~ 99D	~ 85D
Cured Density of Conductive Adhesive Portion (gm/cc)	4.0	4.8	4.0	2.5
Thermal Conductivity	> 12.0 W/m-°K	> 12 W/m-°K	> 8 W/m-°K	> 12 W/m-°K
Linear Tab-Composite Thermal Expansion Coefficient (ppm/°C)	40 (X-Y=Z, Isotropic)	90 (X-Y=Z, Isotropic)	26 (X-Y=Z, Isotropic)	45 (X-Y=Z, Isotropic)
Maximum Continuous Operation Temperature (°C)	> 180	> 180	> 250	> 180
Decomposition Temperature @5% weight loss (°C)	>450	>450	>500	>450
Recommended Curing Temperature/Time (°C/min.)	>175/10	>175/10	>150/10	>175/10

Thermal Interface for the Ever More Powerful Graphic Processor Unit (GPU) Module

Instant Bonding Compressible Pressure Sensitive Adhesive Tape and Pad
Compressible Phase-Change Interface Pad Proven for Performance



Materials Proven for Performance

GPU and other Module Mounting Thermal

PROPERTY/PARAMETER	RTC8550	RTK7559-LB	ME7159-LB
Dielectric Strength (Volts/mil)	Not Applicable	>750	>750
Device Push-off Strength (psi)	>1000	>1000	>1000
Cured Density (gm/cc)	4.5	2.5	2.5
Thermal Conductivity	> 8.0 W/m-°C	> 8.0 W/m-°C	> 12 W/m-°C
Maximum Continuous Operation Temp. (°C)	> 150	> 150	> 150
Electrical Resistivity	$<3x10^{-4}$ ohm-cm	$>10^{14}$ ohm-cm	$>10^{14}$ ohm-cm

Thermal Interface Materials for Extreme Power GPU

FUNCTION	AIT PART#	THERMAL, ELECTRICAL, & other RELEVANT PROPERTIES
Compressible Phase-Change	COOL-SILVER™ PAD CPR8850-LB	• Lowest thermal resistance, electrically non-conductive interface pad • Compressible, phase-change interface pad (US patented)
Compressible Phase-Change	COOL-SILVER™ G3 PAD	• Lower cost version of the lowest thermal resistance pad • Compressible, phase-change interface pad (US patented)
Compressible Phase-Change	COOL-PAD™ CPR7159-LB	• Modified diamond filled with one of the lowest thermal resistances • Compressible, electrically insulating phase-change pad (US patented)
Compressible Phase-Change	COOL-PAD™ CPR7155-LB	• Modified aluminum oxide filled with one of the lowest thermal resistances • Compressible, electrically insulating phase-change pad (US patented)
Gap-Filling Thermal Pad	COOL-GAPFILL™ DT	• Gap filling compressible thermal pad with the lowest thermal resistances • One-side tacky (DT) with tacky side bonding to heat-sink surface
Gap-Filling Thermal Pad	COOL-GAPFILL™ TT	• Gap filling compressible thermal pad with the lowest thermal resistance • Both side tacky (TT) for elimination of clips and/or fasteners
Thermal Gel	COOL-SILVER™G3 Gel	• Non-curing, electrically non-conductive interface gel forming paste • Non-silicone grease, proven thermal stability similar to thermal pad

Compressible Phase-Change Thermal Interface Pads

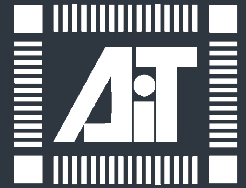
- Compressible and conformal coupled with phase change to allow elimination of voids
- Proven for the most stringent civilian and military applications
- Non-silicone and non-contaminating
- US patented innovation

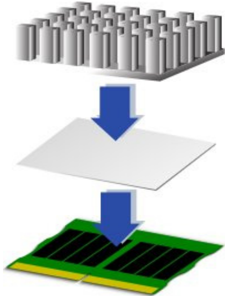
Compressible Thermal Gap Pad Thermal Interface

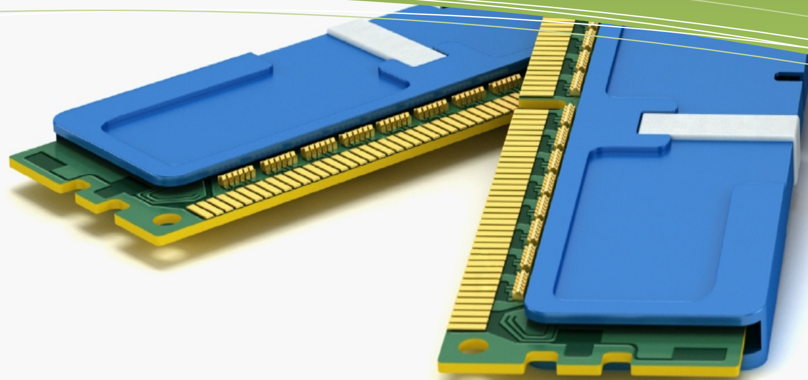
- Compressible and conformal
- Proven for large areas requiring thermal filling into height gaps of different components
- Ideal for large area module to device enclosure
- Proven and used for the most critical thermal challenges with military grade reliability
- Non-silicone and non-contaminating
- Available in different thicknesses with one-side or both-sides pressure sensitive

THERMAL PSA ADHESIVE FILM & GELFILM DESIGNED FOR OPTIMUM THERMAL TRANSFER TO HEAT-SPREADING & SINKING METAL SURFACES

METAL PROVEN AND PRAISED BY THE GAMING AND DO-IT-YOURSELF ENTHUSIASTS







ADVANCED FLEXIBLE & INSULATED METAL SUBSTRATES

Other AIT Thermal Interface Materials for Power Electronics

FUNCTION	AIT PART#	THERMAL, ELECTRICAL, & other RELEVANT PROPERTIES
Compressible Gel–Film Pad	COOL-GELFILM™ SZ	• Thin compressible gel like film • Non-curing, thin bond-line thermal interface
Compressible Gel–Film Pad	COOL-GELFILM™ G3	• Lower cost version of the lowest thermal resistance pad • Compressible, phase-change interface pad (US patented)
Gap-Filling Pressure Sensitive Thermal Pad	COOL-GAPFILL™ DT	• Gap filling compressible thermal pad with the lowest thermal resistance • One-side tacky (DT): tacky side bonded onto heat-sink surface
Gap-Filling Pressure Sensitive Thermal Pad	COOL-GAPFILL™ TT	• Gap filling compressible thermal pad with the lowest thermal resistance • Both sides tacky (TT) to enable application without clips or fasteners
Thermal Gel	COOL-GEL™ CGL7015	• Non-curing, electrically non-conductive interface gel forming paste • Non-silicone grease, proven thermal stability similar to thermal pad

About AI Technology, Inc.

Since pioneering the use of flexible epoxy technology for electronic packaging in 1985, AI Technology has been one of the leading forces in developing advanced materials and adhesive solutions for electronic interconnection and packaging.

Besides pioneering the use of "phase-change" materials (PCM) as thermal interface materials (TIM), AIT has provided the electronic packaging industry with its flexible epoxy thermal adhesives. By managing interfacial stress induced by differential coefficient of thermal expansion between bonding adherents, these thermal management materials have found extensive use and success in critical military and aerospace applications.

The same stress-free dielectric adhesives are now adapted for use with copper- and aluminum-clad insulated metal substrates. The key advantage of these thermal management materials is unparalleled long-term reliability attributed to their ability to withstand repeated thermal cycling and stress-free bonding between the heat-spreader plate and the circuit layer.

AI Technology has a full line of products including:

- Die and substrate attach films and pastes
- Thermal interface materials
- (EMI/RFI) mitigation material solutions
- Conductive caulks and adhesives
- Advanced flexible and Insulated Metal Circuit Substrates for camber-free modules

AIT has an ISO9001:2000 certified manufacturing and R&D facility on a 16-acre campus in Princeton Junction, NJ.

AIT also offers the same flexible epoxy pre-preg with high thermal conductivity for more advanced multilayer insulated metal substrate circuits and modules. This novel class of thermal management materials provides a platform and infrastructure for large area thermal management of power modules such as solar cells, LED panels, etc.