

Actaphase is cost effective non-isolated high performance phase-change material which utilizes an aluminum substrate to act as a thermally conductive carrier in order to deliver a uniform thickness coating of Actaphase 60 phase-change thermal compound on both sides. Through the development of this unique formulation, Actaphase 60 offers efficient thermal transfer by phase-changing during normal device operating temperatures while maintaining a uniform bond line thus driving out the air and adjusting for any surface imperfections or flatness conditions that may exist across the interface.

Being able to manufacture Actaphase 60 in multiple compound thicknesses as well as aluminum substrate thicknesses allows us to meet a wide range of electronic cooling applications ranging from Power Electronics, Transistors, Diodes, Microprocessors or any type of heat generating *isolated* power device requiring efficient and reliable thermal transfer into a heat sink/case sink.



- High Performance Thermal Transfer
- Low Thermal Impedance
- Solutions for many types of surfaces
- Excellent replacement for thermal greases
- Rolls, Sheets, Die Cuts
- Thixotropic / Prevents Compound Run-Out
- Multiple Standard Material Constructions
- Cost Effective "Drop in Place" Solution / Reworkable
- *Fully Customizable—centered around specific requirements*

Typical Device Applications	• Power Modules (IGBT)	• LED	• Diodes / Relays	• Power Semiconductor	• Heat Sink/Case Sink
	• Power Electronics	• Transistors	• Microprocessor	• RF Components	• Large Surface Area Transfer

Actaphase 60 Thermal Compound Properties

- * Phase Change Temp.....60°C / 140°F
See Actaphase 80 for higher phase-change temp
- * Volumetric Expansion.....15%
- * Thermal Impedance...see page 4 for details on specific material construction performance (ASTM D5470)

Standard Actaphase 60 Coating Thickness

- * L05.....0.0005" (0.013mm) per side
 - * L10.....0.001" (0.025mm) per side
 - * L20.....0.002" (0.051mm) per side
- Contact us for custom Actaphase 60 coating thickness options

Standard Aluminum Substrate Thickness

- * AL1.....0.001" (0.025mm)
 - * AL2.....0.002" (0.051mm)
 - * AL3.....0.003" (0.076mm)
 - * AL5.....0.005" (0.127mm)
 - * AL10.....0.010" (0.254mm)
- Standard aluminum type is 1145 (O) soft temper
Custom aluminum types as well as copper substrate options available.

Actaphase Delivery Formats / Typical Lead Times

- * Log rolls.....3 to 10 business days
 - * Sheets.....3 to 10 business days
 - * Die cut individuals.....10 to 15 business days
 - * Multiple die cuts per card.....10 to 15 business days
 - * Die cut continuous reels.....15 to 20 business days
- Laser cutting available for tight dimensional tolerance requirements

Stocking and blanket order program options available for qualified customers. For more information, please contact us at 1-888-201-5546 or e-mail info@timtelthermal.com

Actaphase 60 Pre-Apply Attachment Options

- * LT05 = low tack pressure sensitive (repositionable)
 - * HT1 / HT2 = high tack pressure sensitive (permanent)
 - * ZE2 = high tack silver filled pressure sensitive
 - * Discrete PSA placement or 100% backed options
- See page 2 for detailed pre-apply attachment options and configurations

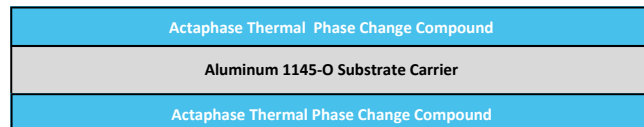
Other Information

- * Manufactured to ISO 9001:2008 Standards
- * RoHs Compliant / Halogen Free Compliant

What is Actaphase 60?

Actaphase 60 is a solvent free thermal interface material that is designed to provide efficient thermal transfer by providing precision phase-change and a uniform bond line thickness across a device/component mounting interface. The ability to manufacture Actaphase 60 in a variety of phase-change thicknesses, aluminum substrate thicknesses as well as within rolls, sheets and pre-form die-cuts allows us to meet a wide range of requirements within multiple industries. Actaphase's inherent flexibility from manufacturing to installation makes it an ideal solution for applications ranging from low volume (even prototypes) and/or high volume environments. Actaphase is manufactured to superior quality guidelines set forth by our ISO 9001:2008 Quality Standards and offers a quick turnkey solution from design to production.

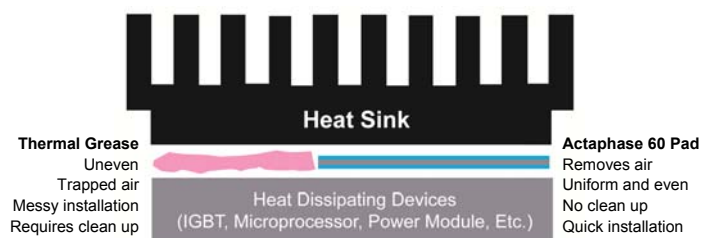
Standard Actaphase Pad Construction



See page 2 for detailed material construction options and material codes

Superior Alternative to Thermal Grease

Actaphase 60 is designed as a pre-formed thermally conductive "drop in place" pad that offers excellent thermal transfer characteristics not only through design of the compound formulation itself, however, through its uniform pad thickness in X, Y, Z dimensions as well. From an installation perspective, thermal greases are difficult to dispense as well as provide inadequate coverage and a uniform thickness across the interface most often leaving trapped air leading to poor thermal transfer. Not to mention the thermal grease clean up required in unwanted areas afterwards.



Since Actaphase 60 is manufactured with a specific thickness and die cut pattern, it can be placed instantly and immediately ready for component mounting. Due to its thixotropic formulation design, compound is held within the interface with no worries of run-out into unwanted areas during installation or device/component operation. Upon initial phase-change of the Actaphase 60 compound, Actaphase begins its wetting out process allowing it to fill in any microscopic surface imperfections or uneven surface conditions across the interface as well as drive out any trapped air leading to increased thermal transfer performance keeping the device/component cool and reliable.

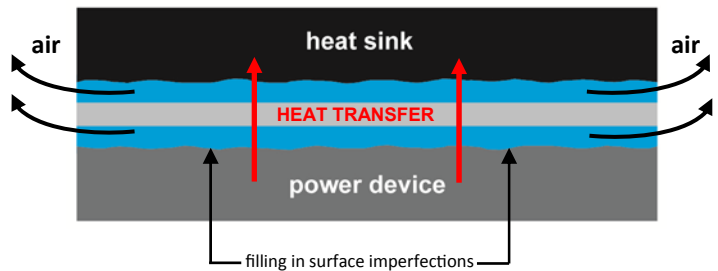
Actaphase 60 pre-formed pads are shipped in clean sizable packs or continuous die cut reels instantly ready for cost effective installation and reliable thermal performance.

Thinner vs. Thicker

Actaphase 60 is manufactured in a range of compound coating thicknesses as well as aluminum substrate thicknesses in order to meet various surface flatness conditions, overall interface size and/or nominal gap filling requirements. It is typically recommended that for larger surface area conditions with surface finishes exceeding 64 microns and/or flatness conditions exceeding 0.002" or more, thicker compound coating thicknesses should be considered to allow the Actaphase 60 compound to adjust for these features during initial phase change. Filling a nominal gap requirement with smooth interface surfaces can typically be accomplished with thicker substrate options.

Driving Out the Air

A primary advantage of utilizing the Actaphase 60 phase-change system is the ability to drive out air from within the interface during initial device cycling causing phase change and surface wetting of the thermal compound coating.



Note: during initial phase-change, it is recommended to re-check your torque settings if device utilizes a screw mounting system. Applying additional torque during initial phase change will thin the material bond line slightly leading to improved thermal performance.

Standard Actaphase 60 Material Constructions

Actaphase 60 is manufactured standard within a range of phase-change coating thicknesses as well as aluminum 1145-O (soft) aluminum substrate thicknesses allowing us to target standard and custom device / mounting application requirements. Below is a table of standard Actaphase 60 material constructions to choose from.

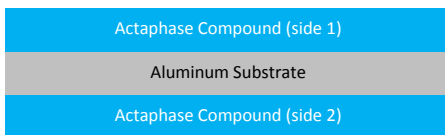
Standard Actaphase Material Constructions	0.001" / 0.025mm Aluminum 1145-O	0.002" / 0.051mm Aluminum 1145-O	0.003" / 0.076mm Aluminum 1145-O	0.005" / 0.127mm AL 1145 Aluminum 1145-O	0.010" / 0.254mm Aluminum 1145-O
L05 (0.0005" / 0.013mm) compound per side	AL1-L05 0.002" / 0.051mm	AL2-L05 * 0.003" / 0.076mm	AL3-L05 0.004" / 0.100mm	AL5-L05 0.006" / 0.152mm	AL10-L05 0.011" / 0.279mm
L10 (0.001" / 0.025mm) compound per side	AL1-L10 0.003" / 0.076mm	AL2-L10 * 0.004" / 0.100mm	AL3-L10 0.005" / 0.127mm	AL5-L10 0.007" / 0.177mm	AL10-L10 0.012" / 0.304mm
L20 (0.002" / 0.051mm) compound per side		AL2-L20 * 0.006" / 0.152mm	AL3-L20 0.007" / 0.177mm	Custom substrate types and thicknesses available Double laminated Actaphase constructions available	

* Popular Actaphase Material Constructions

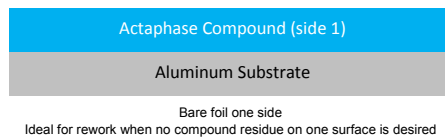
Actaphase 60 Standard and Custom Material Constructions

See Actafil for free standing film versions (no substrate)

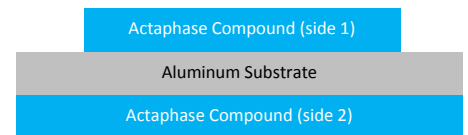
Standard Double Coated Construction



Single Side Coated



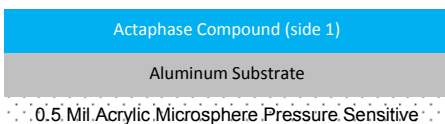
Discrete Coating Placement



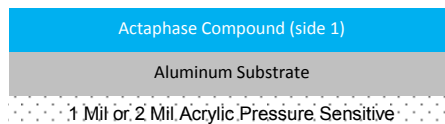
Actaphase 60 Pre-Apply Attachment Options (100% surface backed)

Note: the introduction of an additional tacking layer to 100% one side of Actaphase will impact the overall thermal performance of the material.

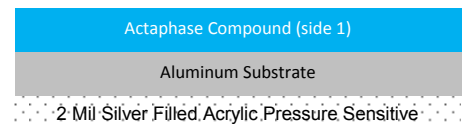
Low Tack Repositionable (LT05)



High Tack Permanent (HT1 or HT2)



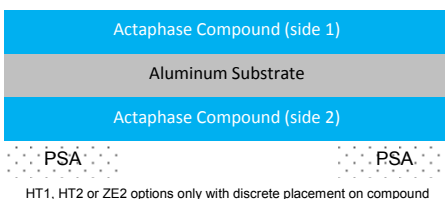
High Tack Permanent Silver Filled (ZE2)



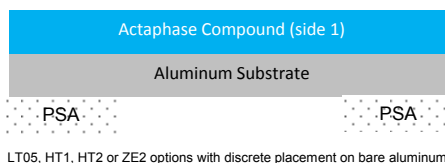
Actaphase 60 Pre-Apply Attachment Options (Discrete PSA Placement)

Note: Discrete placement designed for applying PSA outside of primary thermal via so thermal performance will not be impacted.

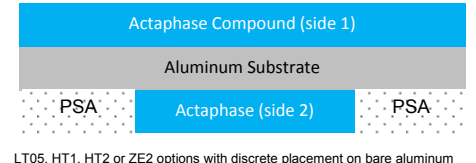
Discrete PSA Placement on Compound



Discrete PSA Placement on Uncoated Side



Discrete PSA with Discrete Coating Placement



Actaphase 60 Physical Properties / Form Characteristics

Characteristic	Actaphase 60
Base Formulation (Compound)	Proprietary
Phase Change Temperature	60°C / 140°F
Viscosity @ Phase Change	Thixotropic
Overall Thickness Tolerance	Target Thickness +/- 10% (typical)
Actaphase 60 Color	White
Separator Liner / Color	Paper / Pink
Available Formats	Master Rolls / Slit Rolls / Die Cuts (piece or reels)
Maximum Master Roll Width	11.500" (29.2cm) or 17.500" (44.5cm)
Standard Master Roll Lengths	25ft / 50ft / 100ft / 250ft / 500ft
Custom Roll Lengths and Widths Available	Yes (customer defined)
Standard Sheet Sizes	12.0" x 24.0" (30.5cm x 61.0cm) or 18" x 24" (45.7cm x 61.0cm)
Custom Sheet Lengths and Widths Available	Yes (customer defined)
TIMTEL Die Cutting Capabilities	Steel Rule Die / Flexible Die / Rotary Die / Laser Cutting
Typical TIMEL Die Cut Delivery Formats	Individuals, Multiples on a card, or Continuous Reel
Typical TIMTEL Die Cut Dimensional Tolerance	0.005" (0.13mm) to 0.010" (0.25mm) (determined at design review)

Thermal Outgassing (Actaphase Compound Only)	Result
Total Mass Loss, % TML	0.138
Collectible Volatile, Condensable Matter, % CVC	0.130
Water Vapor Gain, % WVR	0.021

Note: Thermal outgassing test performed per ASTM E595-93 using thermal compound formulation only. Due to no outgassing, Actaphase 60 is suitable for aerospace application.

Actaphase 60 Storage & Shelf Life	Result
Storage Condition and Temperature	Cool Dry Location at or below 95°F / 35°C
Shelf Life	Indefinite if stored per storage conditions above
Transit Methods / Conditions	Due to the temperature sensitive design of our thermal materials, it is recommended to ship air freight during warmer months to prevent phase-change of thermal compound during long ground transit conditions within elevated temperature environments (May through September)

Formulation Revisions (post testing of Actaphase 60 by customer)

Due to the flexibility of technology and capability, not always does our **standard** Actaphase 60 formulation or form factors 100% optimize a unique application requirement. This is why at TIMTEL, we can provide our customers with minor to major formulation adjustments to fit better within the scope a specific customer defined requirement/characteristic. This is accomplished through base compound modification and/or filler particle type, size or structure. These options are available to customers that have tested the standard formulations and can offer feedback from this testing so it can be used as a baseline for further modification/development.

Application Re-Work / Clean Up

Reworking your application with Actaphase 60 is simple. Simply detach your device from its heat sink or case sink and remove the pad. Depending on the amount of Actaphase compound left on your application surface, introduction of new Actaphase 60 material may be required when re-assembling. Actaphase compound residue on the application surface can be cleaned up using mineral spirits solvent or isopropyl alcohol and a cloth towel. Other clean up methods include slightly heating the compound and gently wiping away softened unwanted adhesive. **For best results, make sure all application surfaces are clean and free of debris before applying the Actaphase Pad.**

Flexibility Across Markets and Application Requirements

Due to Actaphase 60's unique formulation and form factor capability allows it to be a viable candidate within various market and application types where a high performing thermally conductive material is required. Actaphase 60 is available in a variety of delivery formats including master rolls, slit rolls, die cut individuals or die cuts on a continuous reel

Thermal Performance Testing and Characteristics

Below is thermal impedance data based upon ASTM D5470, *Standard Test Method for Thermal Transmission Properties of Thermally Conductive Electrical Insulation Materials*.

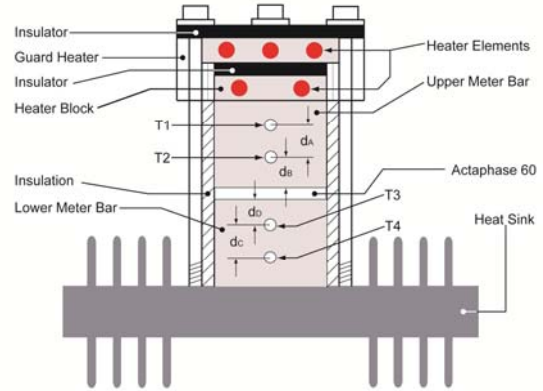
What is thermal impedance and why do we measure it?

Thermal impedance allows us to consistently measure the thermal transfer ability of a thermally conductive interface material taking into account a device's power density, interface area as well as bond line thickness (thermal material thickness). By measuring the temperature at 2 points (shown right) in both the upper and lower metering bars, the temperature of the interface surfaces can be determined and thus the thermal impedance can be calculated due to the temperature differential of these 2 surfaces measured in °C-in²/watt (°C-cm²/watt)

For more information on the full test procedure, please contact us at 1-888-201-5546 or send an e-mail to info@timtelthermal.com

Below are thermal impedance values for common versions of Actaphase 60 materials. For thermal impedance values for a standard material construction listed on this data sheet but not presented below, please contact us toll free at 1-888-201-5546 or e-mail info@timtelthermal.com

General Test Setup / Overview for Measuring Thermal Impedance



$T_A = T_2 - d_b / d_A (T_1 - T_2)$ = Temperature of upper meter bar surface in contact with Actaphase 60 Pad

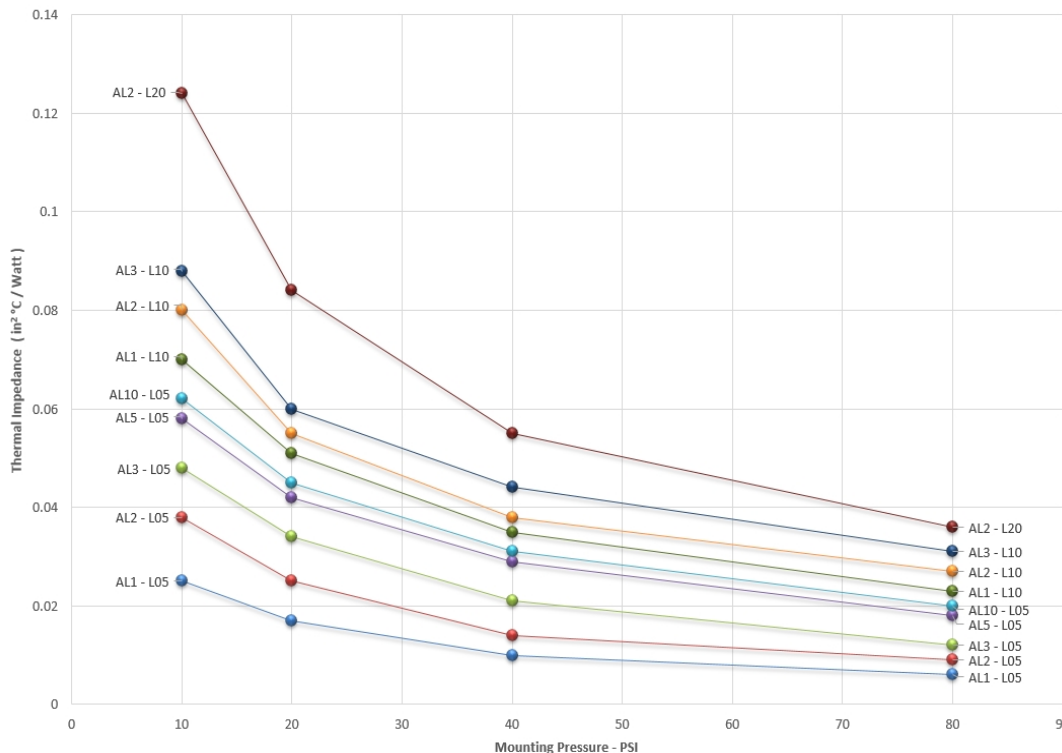
$T_B = T_3 + d_o / d_c (T_3 - T_4)$ = Temperature of lower meter bar surface in contact with Actaphase 60 Pad

Thermal Impedance is calculated as follows: $(T_A - T_B) \times \text{Area} / \text{Power Applied} = \text{°C-in}^2/\text{watt}$

Type	@ 10 PSI	@ 20 PSI	@ 40 PSI	@ 80 PSI
AL1-L05	0.025 °C-in ² / Watt	0.017 °C-in ² / Watt	0.010 °C-in ² / Watt	0.006 °C-in ² / Watt
AL2-L05	0.038 °C-in ² / Watt	0.025 °C-in ² / Watt	0.014 °C-in ² / Watt	0.009 °C-in ² / Watt
AL2-L10	0.080 °C-in ² / Watt	0.055 °C-in ² / Watt	0.038 °C-in ² / Watt	0.027 °C-in ² / Watt
AL3-L05	0.048 °C-in ² / Watt	0.034 °C-in ² / Watt	0.021 °C-in ² / Watt	0.012 °C-in ² / Watt
AL3-L10	0.088 °C-in ² / Watt	0.060 °C-in ² / Watt	0.044 °C-in ² / Watt	0.031 °C-in ² / Watt
AL5-L05	0.058 °C-in ² / Watt	0.042 °C-in ² / Watt	0.029 °C-in ² / Watt	0.018 °C-in ² / Watt
AL10-L05	0.062 °C-in ² / Watt	0.045 °C-in ² / Watt	0.031 °C-in ² / Watt	0.020 °C-in ² / Watt

Note: Thermal Impedance Testing is available upon request for customers who require a non-standard Actaphase 60 material thickness, custom constructions, revised substrates or PSA pre-tacking options within pressure ranges of 10 PSI to 80 PSI

Thermal Impedance vs. Mounting Pressure



Actaphase 60 Samples

Thermal material evaluation is always critical when designing in a new material or developing a new product. Sheet samples of Actaphase 60 are available for preliminary testing to determine the optimal Actaphase 60 thickness as well as overall material construction best suited within the scope of your application requirements.

Want to test samples per your required die cut part? Our razor plotter sampling machine allows us to provide customers Actaphase 60 material already cut to their required outline for testing. Plotter formed samples provide our customers the ability to test not only the Actaphase material itself, but their required outline as well without incurring the expense of production tooling.

Contact TIMTEL to request sample sheets or plotter formed samples for testing.