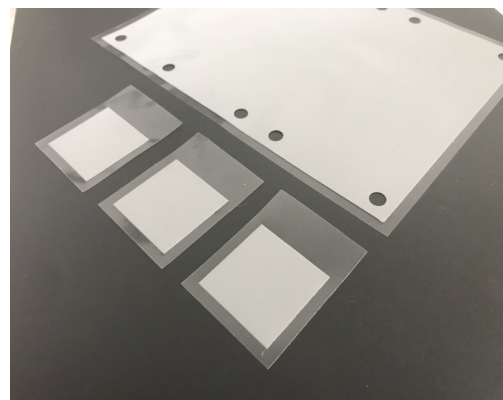


XoPhase 45 is a free standing 45C phase change thermal film designed to provide high performance heat transfer for a variety of electronic device applications including LED and microprocessor/sink assembly. Available standard as either a 5 mil, 8 mil or 12 mil thick free standing phase change film, XoPhase 45 is ideal for ultra-flat surfaces with a flatness condition of ~ 0.002" (0.051mm) or less within lower pressure applications.

Upon initial phase change, XoPhase 45 begins its controlled flow from its original pre-formed die cut size adjusting for surface irregularities and flatness conditions leading to improved thermal performance. This also includes a reduction of the bond line thickness as mounting pressures are increased.

- High performance thermal transfer
- Low thermal impedance
- Easy to apply—release liner tab system
- Die cut design prevents direct handling of film
- Designed for Ultra-Flat Surfaces
- Excellent replacement for thermal greases
- Re-workable after phase change
- Metal foil substrate coating options



Typical Device Applications	LED Assembly	Memory Modules	Thermoelectric Modules	Ultra-Flat Surfaces
	Clip Mount Sink	Microprocessor (CPU)	Microelectronics	Thermal Grease Replacement

### XoPhase 45 Phase Change Film

Phase Change Temp.....	45°C / 113°F
Compound Flow Design.....	Thixotropic
Volumetric Expansion.....	15%
Max Operating Temp.....	120C
Thermal Conductivity.....	3.0 W/m-K

XoPhase 45 is a solvent free / silicon free compound design

### Standard XoPhase 45 Film Thicknesses

X45-5.....	0.005" (0.13mm) film thickness
X45-8.....	0.008" (0.020mm) film thickness
X45-12.....	0.012" (0.30mm) film thickness

Contact us for custom XoPhase 45 Film thickness options

### XoPhase 45 Thermal Impedance

Thermal impedance testing performed per ASTM D5470

#### 5 mil (0.13mm) XoPhase 45 Film

10 PSI.....	0.0173 °C-in <sup>2</sup> / W		0.111 °C-cm <sup>2</sup> / W
20 PSI.....	0.0143 °C-in <sup>2</sup> / W		0.092 °C-cm <sup>2</sup> / W
40 PSI.....	0.0109 °C-in <sup>2</sup> / W		0.070 °C-cm <sup>2</sup> / W
80 PSI.....	0.0088 °C-in <sup>2</sup> / W		0.056 °C-cm <sup>2</sup> / W
100 PSI.....	0.0080 °C-in <sup>2</sup> / W		0.052 °C-cm <sup>2</sup> / W

#### 8 mil (0.20mm) XoPhase 45 Film

10 PSI.....	0.0200 °C-in <sup>2</sup> / W		0.129 °C-cm <sup>2</sup> / W
20 PSI.....	0.0159 °C-in <sup>2</sup> / W		0.103 °C-cm <sup>2</sup> / W
40 PSI.....	0.0126 °C-in <sup>2</sup> / W		0.081 °C-cm <sup>2</sup> / W
80 PSI.....	0.0103 °C-in <sup>2</sup> / W		0.066 °C-cm <sup>2</sup> / W
100 PSI.....	0.0093 °C-in <sup>2</sup> / W		0.060 °C-cm <sup>2</sup> / W

#### 12 mil (0.30mm) XoPhase 45 Film

10 PSI.....	0.0220 °C-in <sup>2</sup> / W		0.141 °C-cm <sup>2</sup> / W
20 PSI.....	0.0174 °C-in <sup>2</sup> / W		0.112 °C-cm <sup>2</sup> / W
40 PSI.....	0.0140 °C-in <sup>2</sup> / W		0.090 °C-cm <sup>2</sup> / W
80 PSI.....	0.0115 °C-in <sup>2</sup> / W		0.074 °C-cm <sup>2</sup> / W
100 PSI.....	0.0106 °C-in <sup>2</sup> / W		0.069 °C-cm <sup>2</sup> / W

### Other Information

RoHs Compliant / REACH Compliant / Halogen Free

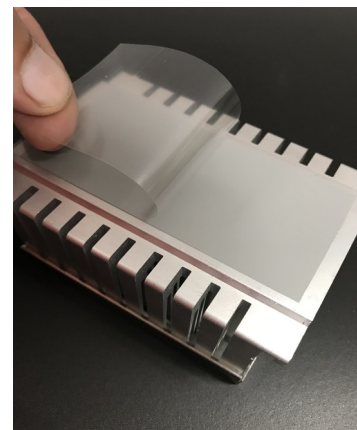


### Release Liner / Thermal Pad Transfer System

When designing XoPhase 45 to achieve excellent thermal transfer results, the thermal performance was not the only target. An additional key advantage in using XoPhase 45 is the offering of the TIMTEL Die Cut Thermal Pad Transfer System. The purpose of this die cut design was to avoid common issues typically experienced by similar phase change thermal pad application systems available in market place today.

#### These common issues typically include:

- ⇒ Having to directly handle the phase change thermal film.
- ⇒ Thermal film breaking when releasing from protective liners.
- ⇒ Inconsistent placement of thermal pad on module or heat sink surface.
- ⇒ Inconsistent transfer of thermal pad from release liner onto module or heat sink surface. Thermal film gets re-released back up with liner leading to a partially placed torn pad causing re-work or re-application of new pad.



The XoPhase 45 Die Cut Frame Thermal Pad Transfer System was designed to eliminate issues with handling, storage as well as placement of the thermal pad on either a power module or heat sink surface. Through design of special release liners as well as new die cutting process techniques, the XoPhase 45 Die Cut can be handled without direct handling contact with the soft phase change thermal film and fluently transferred down to a range of metal or anodized surfaces using a few different techniques within nominal pressure methods.

#### XoPhase 45 Thermal Pad Application Methods

The following methods of applying the XoPhase 45 have been developed to fit a range of low, mid and high volume thermal pad application requirements as well as allowable times permitted from the time the thermal pad is placed to the time when device mounting occurs.

- **Pad Mating:** place pad, transfer the thermal film under its own weight before removal of final liner. Transfer Time: *3 to 10 minutes depending on surface area (testing required)*
- **Nominal Finger Pressure:** place pad, apply nominal finger pressure to perimeter and interior of pad before removal of final liner. Transfer Time: *10 to 60 seconds (testing required)*
- **Roll and Release:** place pad, use a hand held roller with nominal pressure going back and forth a minimum of 2 times before removing final liner. Transfer Time: *Immediate*
- **Pneumatic Press:** place pad, use a press with a medium to soft durometer pad as an interface (2 to 5 PSI) (1 to 5 seconds) before removal of final liner. Transfer Time: *Immediate*

## XoPhase 45 General and Custom Configurations / TIMTEL Die Cut Capability

The XoPhase Die Cut Frame Thermal Pad is a fully adaptable installation system for a wide range of pre-formed pad requirements. All pre-formed pad designs utilize the same overall cross section relationship of XoPhase Pad to release liners and require the same steps needed for thermal pad transfer down to the application surface. Below is a general overview of some common die cut pad geometries, interior cut features and discrete pad placement capabilities.

### Rectangles and Squares



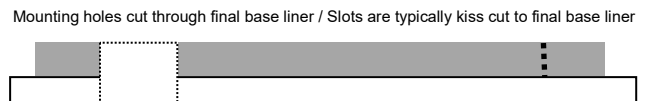
Cross section shown has top frame already removed. Pad is at a stage to be placed down on application surface with final liner to complete thermal pad transfer



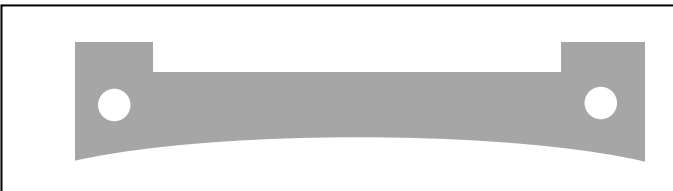
### Interior Mounting Holes or Slots



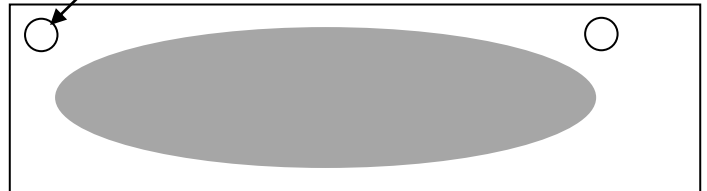
Cross section shown has top frame already removed. Pad is at a stage to be placed down on application surface with final liner to complete thermal pad transfer



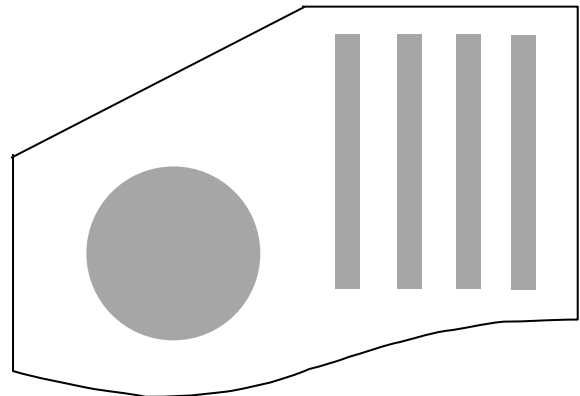
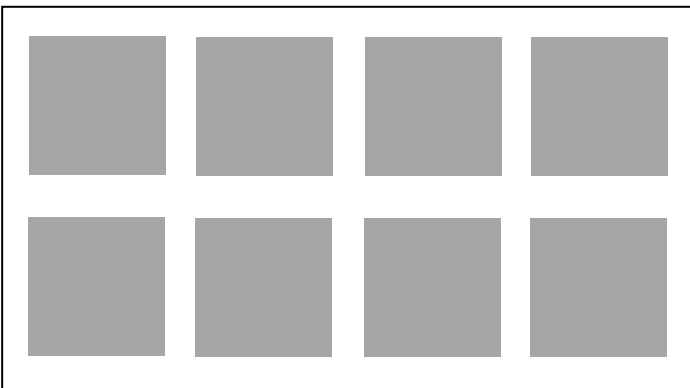
### Customer Defined Outlines



Final base liner can contain holes or other cut out features to assist with pad alignment during installation



### Discrete Pad Placement on Single Liner (for multiple discrete pad placements on same application surface or pad placements on multiple components within a fixtured setup)



**XoPhase 45 Cut Prototypes For Testing:** Thermal material evaluation is always critical when designing in a new material or developing a new product. Bulk sheet samples of XoPhase 45 as well as razor plotter cut prototypes are available for preliminary testing in order to optimize the best XoPhase Die Cut Pre-Form within the scope of your application. Contact us for details on how to receive bulk sample sheets as well as razor cut prototypes for testing.

# XoPHASE 45

## XoPhase 45 Substrate Coating Options

The flexibility and compound design of the XoPhase 45 phase change material provides TIMTEL the capability to coat the XoPhase on one side of thin metal foil substrate for customers who require one side of an interface to be compound free for re-work or component design purposes.

Below is a list of typical metal foil substrates within either a **100% surface coating** or **discrete XoPhase 45 placement** on a metal foil substrate. One side coating only.

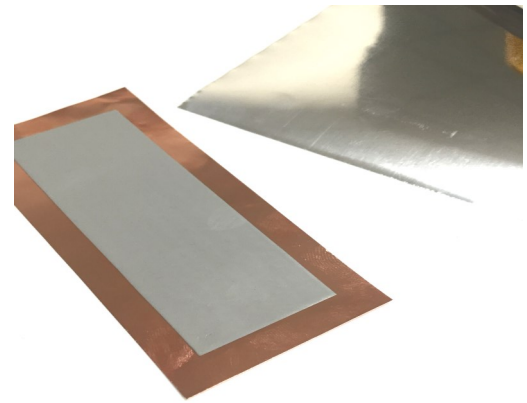
### Aluminum Foil (1100 Series)

0.001" (0.025mm), 0.002" (0.051mm), 0.003" (0.08mm), 0.005" (0.127mm)

### Copper Foil (110 series)

0.001" (0.025mm), 0.002" (0.051mm), 0.003" (0.076mm), 0.004" (0.102mm), 0.005" (0.127mm)

Contact us for more information about XoPhase Substrate Coating Options. Pressure sensitive adhesive foil backing options available.



## XoPhase 45 Physical Properties / Form Characteristics (free standing thermal film)

Characteristic	XoPhase 45
Base Formulation (Compound)	Proprietary
Phase Change Temperature	45°C (+/- 6C)
Viscosity @ Phase Change	Thixotropic
Overall Film Thickness Tolerance Contact us for custom XoPhase 45 Film Thicknesses	5 mil (0.13mm) +/- 20% 8 Mil (0.20mm) +/- 15% 12 Mil (0.30mm) +/- 10%
XoPhase 45 Color	Gray
Available Formats	Master Rolls / Sheets / TIMTEL Die Cuts
Master Roll Width Master Rolls Delivered with Clear Liner (Top and Bottom of X45 Film)	XoPhase 45 Material Width = 7.00" (17.7cm) T300-12 (Top Liner) - 0.003" (0.076mm) Clear (REMOVE FIRST) T200C (Bottom Liner) - 0.002" (0.051mm) Clear
Standard Master Roll Lengths	100ft or custom lengths
Standard Sheet Sizes Sheets Delivered with Clear Liner (Top and Bottom of X45 Film)	Sheet Size = 14.00" x 6.00" (35.6cm x 15.24cm) T300-12 (Top Liner) - 0.003" (0.076mm) Clear (REMOVE FIRST) T200C (Bottom Liner) - 0.002" (0.051mm) Clear
Custom Sheet Sizes Available	Yes (customer defined)
XoPhase Die Cut Dimensional Tolerance	+/- 0.020" (0.51mm) XoPhase 45 Final Pad Only

XoPhase 45 Storage & Shelf Life	Guidelines
Storage Condition and Storage Temperature	Cool Dry Location at or below 80°F / 27°C
Shelf Life	2 years from the date of manufacture if stored per storage conditions listed above. Recommended to leave in original package until use.
Transit Methods / Conditions	Due to low phase-change temperature, die cut parts are shipped in a cooler with ice pack(s). Cold storage is not required when receiving this material and should be stored at or below 80F/27C. It is recommended to ship product via air freight (not ground) due to low phase-change temperature.

## Disassembly / Re-Work / Clean Up

Reworking your application with XoPhase 45 is simple. Simply detach your device from its heat sink or case sink. Remove any excess Xophase compound off the surfaces using a solvent (ex: mineral spirits) or bio-solvent. Gently wipe away excess compound with a soft cloth. Allow solvent to fully flash off surfaces before applying a new Xo-Phase Pad. **For best results, make sure all application surfaces are clean and free of debris before applying the XoPhase 45 Pad.**