

## TC-Lam 1.3

### Product description

The POLYTHERM product is an isolated metal substrate (IMS) from MSC Polymer AG. An Aluminium base plate and electrodeposited copper foil is bonded together with a special dielectric. This guarantees as well enhanced thermal conductivity as electrical isolation. It is the ideal product for all applications which require higher thermal conductivity like LED substrates or power converters. The dielectric is specially formulated and guarantees excellent thermal conductivity, high dielectric breakdown and high thermal stability. Processing and assembly can be done with well known processes. The Aluminium base plate is covered with a protective film. The film usually protects the Aluminium side in wet processes. Protective film HT (high temperature) is even usable during solder mask cure and HAL process. POLYTHERM products fulfill the ROHS Directive 2002/95/EC and are UL qualified.

### STANDARD BUILD UP

Thickness Aluminium in $\mu\text{m}$	500 - 1000 - 1500 - 2000 - 3000	Aluminium alloy	5052 - 1100
Copper foil (ED) thickness in $\mu\text{m}$	18 - 35 - 70 - 100 - 137 - 206	Protective Film N (normal)	$\leq 160\text{ }^{\circ}\text{C}$
Thickness dielectric in $\mu\text{m}$	50, 75, 100, 125, 150	Protective Film HT (high temperature)	$\leq 280\text{ }^{\circ}\text{C}$

Material properties (1500 $\mu\text{m}$ Al / 100 $\mu\text{m}$ Dielectric / 35 $\mu\text{m}$ Cu )	Test method / Treating condition	Unit	Specification	Typical values
Thermal stress 288 $^{\circ}\text{C}$ , dipping, no delamination	TM 650-2.4.13.1	sec	$\geq 10$	90
Copper peel strength	TM 650-2.4.8 / A 288 $^{\circ}\text{C}$ , 10 s	N/mm N/mm	$\geq 1.05$ $\geq 1.05$	1.85 1.87
Dielectric breakdown	TM 650-2.5.6.2 / A	kV	$\geq 2.5$	$\geq 3$
Electrical strength	TM-650 / A	kV/mm	30	$\geq 30$
Thermal conductivity dielectric	A	W/m $^{\circ}\text{K}$	1.3	1.3
Thermal resistance dielectric	SJ20780 / A	K/W	$\leq 1.50$	1.20
Surface resistivity	TM-650-2.5.17.1 / E24/125 C96/35/90	M $\Omega$ M $\Omega$	$10^3$ $10^4$	$10^7$ $10^7$
Volume resistivity	TM-650-2.5.17.1 / E24/125 C96/35/90	M $\Omega$ -cm M $\Omega$ -cm	$6 \cdot 10^4$ $6 \cdot 10^4$	$10^5$ $10^7$
Flammability	UL-94	class	V-0	V-0
Comparative tracking index CTI	UL746A	V	PLC 0	PLC 0
Water absorption	TM 650-2.6.2.1 / D-24/23	%	$\leq 0.5$	0.1
Glass transition temperature Tg	A	$^{\circ}\text{C}$	---	100

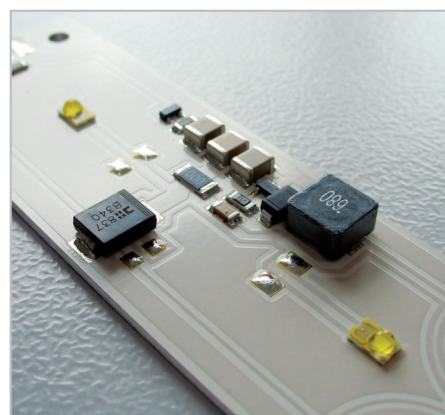
### Availability and Tolerances

Standard size in mm	480 x 580, 480 x 600, 460 x 610, 530 x 630
Dimensions tolerance in mm	$\pm 5$
Dielectric thickness tolerance	IPC-4101B grade B/L
Max. bow and twist in %	0.5



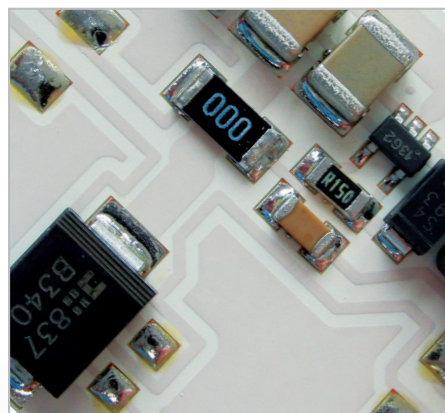
The data is based on typical values of standard production and should be considered as general information. It is the responsibility of the user to ensure that the product complies with his requirements.

## Contact



**MSC Polymer AG** Germany  
Am Boden 25-28  
D-35460 Staufenberg  
Hessen  
Germany  
E-Mail: [info@msc-polymer.de](mailto:info@msc-polymer.de)  
Phone: +49 (0) 6406-9149-0  
Fax: +49 (0) 6406-6782

**MSC Polymer Pte Ltd.** Singapore  
No. 8 Yung Ho Road  
SG - 618590 Singapore  
E-Mail: [info@msc-polymer.sg](mailto:info@msc-polymer.sg)  
Phone: +65-6268-2070  
Fax: +65-6268-0771



**MSC Polymer India**  
Mr. Kushal Sen  
4, Shefali Apt. Plot A-84,  
Kasturba Society,  
Vishrantwadi,  
Pune - 411 015 Maharashtra  
India  
E-Mail: [senkushal@gmail.com](mailto:senkushal@gmail.com)  
Phone: +91-98 60 43 63 58

**MSC Polymer sp.z.o.o.** Poland  
ul. 3-go Maja 9A  
08-440 Pilawa  
Poland  
E-Mail: [info@msc-polymer.pl](mailto:info@msc-polymer.pl)  
Phone: +48 502 64 09 60  
Fax: +48 22 730 98 11

[www.msc-polymer.com](http://www.msc-polymer.com)



## Thermal Management – Cooling Solution for LED Applications



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## Why is thermal management so important?

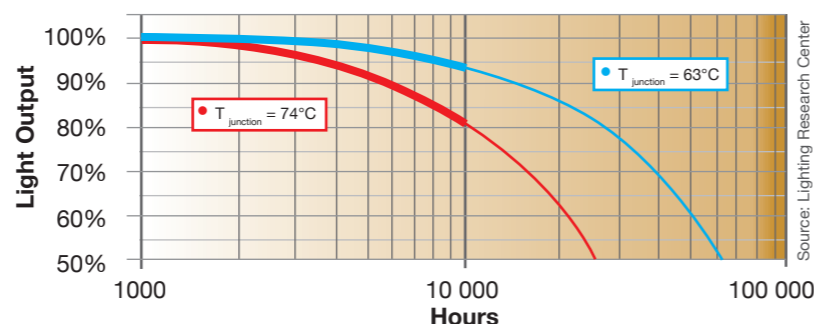
Excess heat directly affects short-term and long-term LED performance. The short-term effects are color shift and reduced light output. The color or wavelength will change with temperature. With increasing temperature the wavelength of the color gets longer.

The long-term effect results in a significantly reduced lifetime.

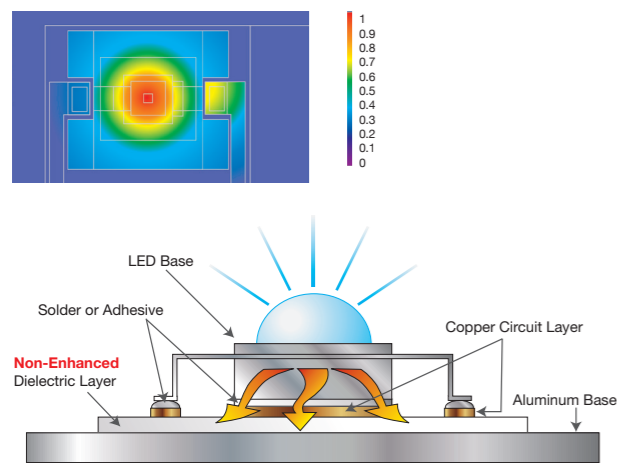
Two identical LEDs driven at the same current but with an 11 °C difference in junction temperature  $T_j$ . The result is a reduced lifetime of about 60% (estimated at 70% light output).

Polytherm™ is the ideal solution to keep the LED operating temperature low and to minimize short-term and long-term effects.

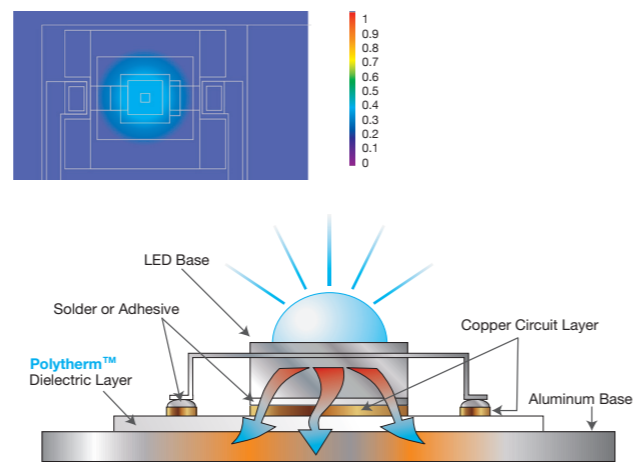
**Useful Life of High Brightness White LEDs at Different Operating Temperatures**



**High operating temperature**



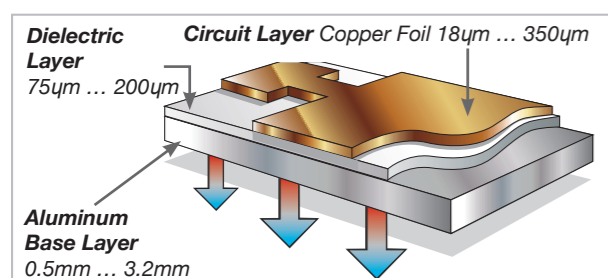
**Low operating temperature with Polytherm™**



## Polytherm™ – the Solution

Polytherm™ Insulated Metal Substrate is an optimized circuit board material for LED applications. A thin, thermally conductive layer is bonded to a thick Aluminum base layer for heat dissipation. On the opposite side there is a layer of copper foil for forming the circuitry.

Polytherm™ substrates are available in various combinations in respect of thermal conductivity, copper-, dielectric-, and Aluminum thickness.



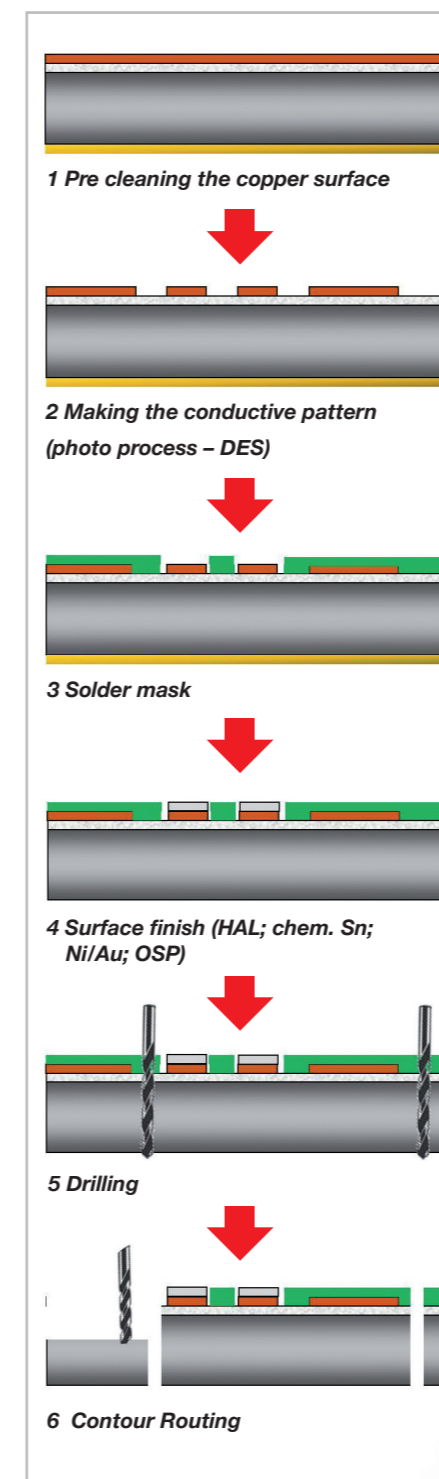
Product Family	Thermal Conductivity W/m²K	Thermal Resistance <sup>(1)</sup> K/W	MOT °C	Dielectric Strength <sup>(2)</sup> KV	Tg °C	CTI PLC
TC-Lam 1.3 (PP)	1.3	0.77	130	≥ 5	130	2
TC-Lam 1.3	1.3	0.77	130	≥ 5	100	0
TC-Lam 2.0	2.0	0.50	130	≥ 5	100	0
TC-Lam 1.8 high Tg	1.8	0.56	130	≥ 5	170	0
TC-Lam 3.0	3.0	0.33	130	≥ 5	100	0

1) Dielectric 100µm | 2) IPC TM 650-2.5.6.2 | PP) with glass fabric

## Making Polytherm™ printed circuit boards for LED applications

Processing the Polytherm™ material is an easy task as it is very similar to processing FR4 base material. Just some minor adjustments are necessary. For easier processing Polytherm™ is covered on the Aluminum side with a high temperature stable ( $\leq 280^\circ\text{C}$ ) protective film. It protects the Aluminum in all chemical wet processes and in addition in the solder mask curing process.

## Six easy steps for making Polytherm™ printed circuit boards



The most challenging part is mechanical processing (drilling, routing) of the thick Aluminum base layer. There are different Aluminum alloys available, which differ in cost, process ability and physical properties.

The following table gives you an overview and a side by side comparison.

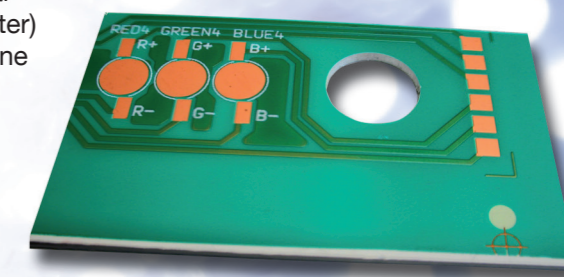
Aluminum Alloy	Temper Designation	Chem. Designation	Thermal Conductivity W/m²K	Brinell Hardness HB	Corrosion resistance	Process ability	Price Indication
1100	H24	Al 99.0Cu	222	32	Excellent	Poor	Low
5052	H34	AlMg2.5	138	68	Good	Good	Medium
6061	T6	AlMg1SiCu	167	95	Good	Good-very good	High

**Explanation:** H24 = half hard and partially annealed  
H34 = half hard, strain hardened and stabilized  
T6 = solution heat treated and artificially aged

Most commonly used is alloy 5052 H34, which offers good process ability for a reasonable price.

The following factors are important to achieve good results in the drilling and routing process.

- Back up and entry material
- Tool selection (drill bit, cutter)
- Routing and drilling machine parameters (speed, feed, backstroke, hit count)
- Lubrication



High hardness of the Aluminum guarantees good chipping and chip removal. Detailed information concerning mechanical processing is available to support our customers.

For more detailed information about Polytherm™ technology and processing, please contact us. We are looking forward to hearing from you and will provide you with the necessary support.