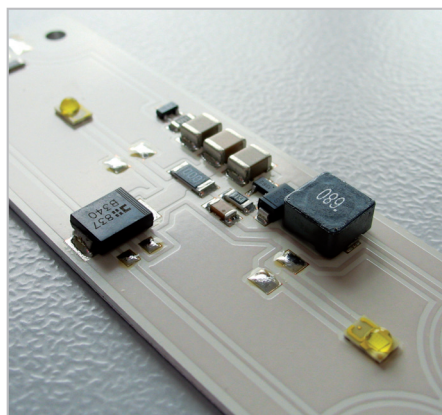
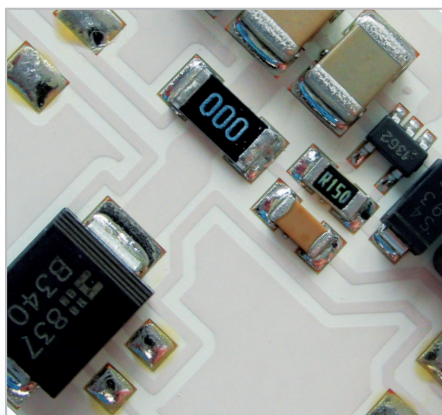


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## Thermal Management – Cooling Solution for LED Applications



POLYMER

*Your global source for PCB materials!*



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## Why is thermal management so important?

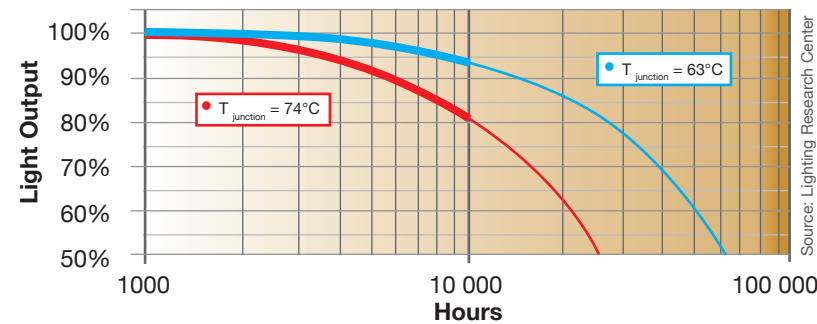
Excess heat directly affects short-term and long-term LED performance. The short-term effects are color shift and reduced light output. The color or wavelength will change with temperature. With increasing temperature the wavelength of the color gets longer.

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

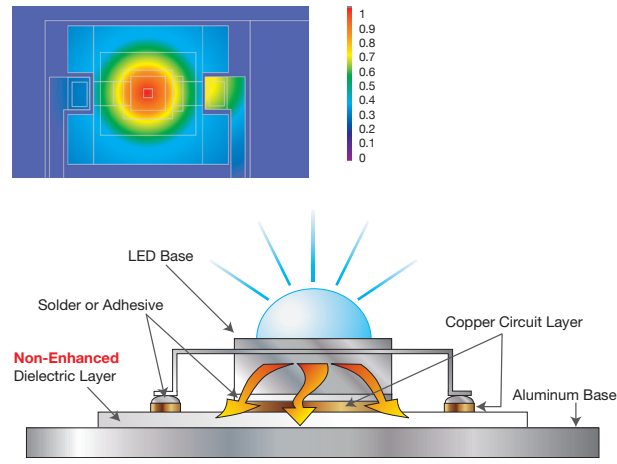
Two identical LEDs driven at the same current but with an 11 °C difference in junction temperature  $T_j$ . The result is a reduced lifetime of about 60% (estimated at 70% light output).

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

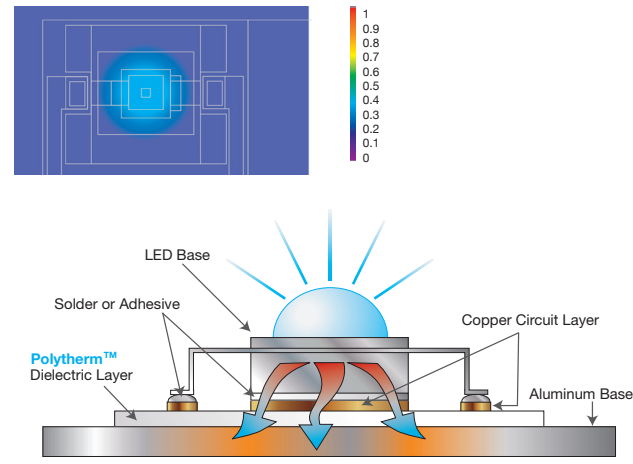
**Useful Life of High Brightness White LEDs at Different Operating Temperatures**



**High operating temperature**



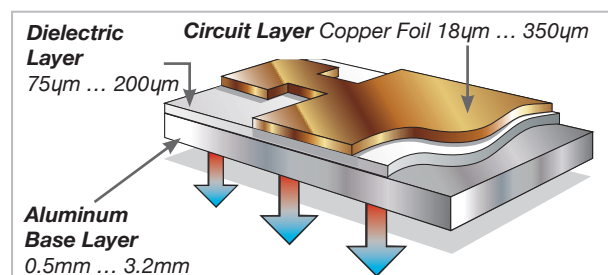
**Low operating temperature with Polytherm™**



## 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.



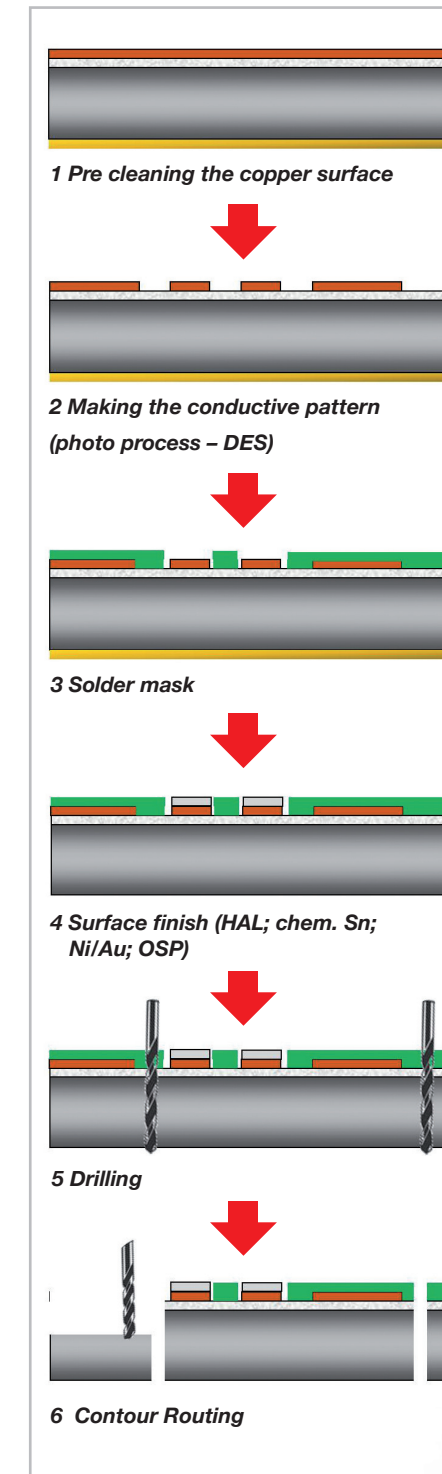
Product Family	Thermal Conductivity W/m²K	Thermal Resistance <sup>(1)</sup> K/W	MOT °C	Dielectric Strength <sup>(2)</sup> KV	Tg °C	CTI PLC
TC-Lam 1.3 (PP)	1.3	0.77	130	≥ 5	130	2
TC-Lam 1.3	1.3	0.77	130	≥ 5	100	0
TC-Lam 2.0	2.0	0.50	130	≥ 5	100	0
TC-Lam 1.8 high Tg	1.8	0.56	130	≥ 5	170	0
TC-Lam 3.0	3.0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

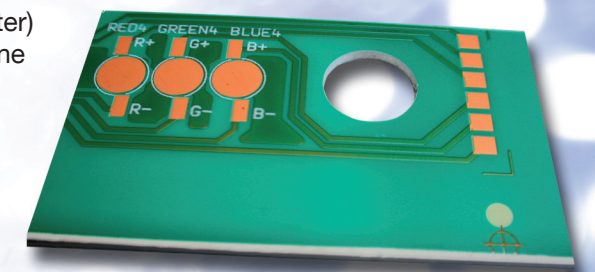
Aluminum Alloy	Temper Designation	Chem. Designation	Thermal Conductivity W/m²K	Brinell Hardness HB	Corrosion resistance	Process ability	Price Indication
1100	H24	Al 99.0Cu	222	32	Excellent	Poor	Low
5052	H34	AlMg2.5	138	68	Good	Good	Medium
6061	T6	AlMg1SiCu	167	95	Good	Good-very good	High

**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.