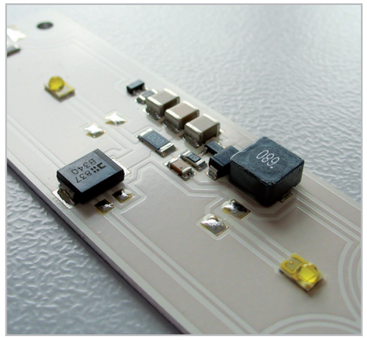
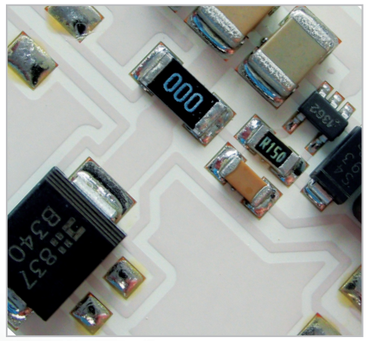
POLYTHERM™
Your heat manager





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*Your global source for PCB materials!*

POLYTHERM™
Your heat manager


# Thermal Management –

## Cooling Solution for LED Applications

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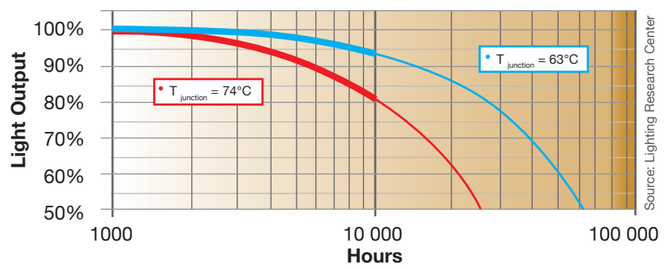
# Why is thermal management so important?

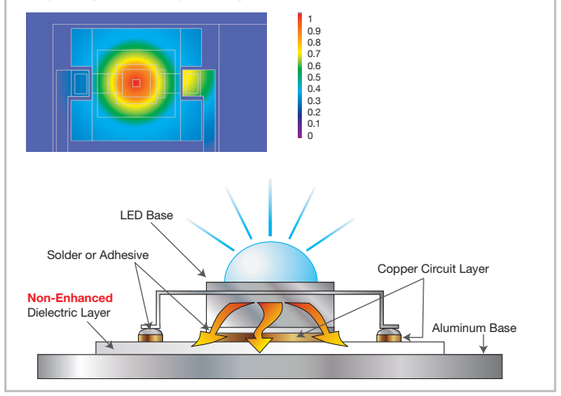
Excess heat directly affects short-term and long-term LED performance.
The short-term effects are color shift and reduced light output. The color or wavelength will change with temperature. With increasing temperature the wavelength of the color gets longer.

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 Tj. 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.

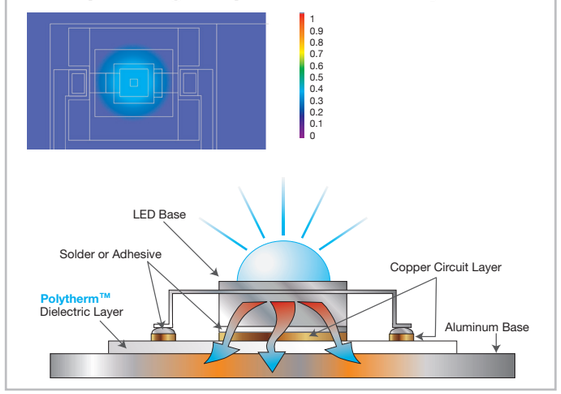
***Useful Life of High Brightness White LEDs at Different Operating Temperatures***




***High operating temperature***

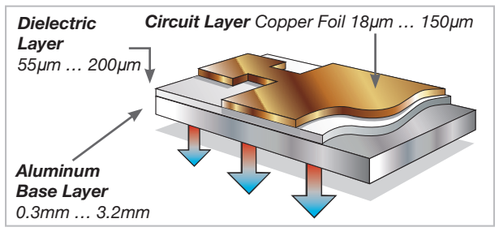



***Low operating temperature with Polytherm™***




# 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. Polytherm™ is also available as flexible base material, e.g. 0.3 mm Aluminium, 55 µm dielectric und 35 µm copper.



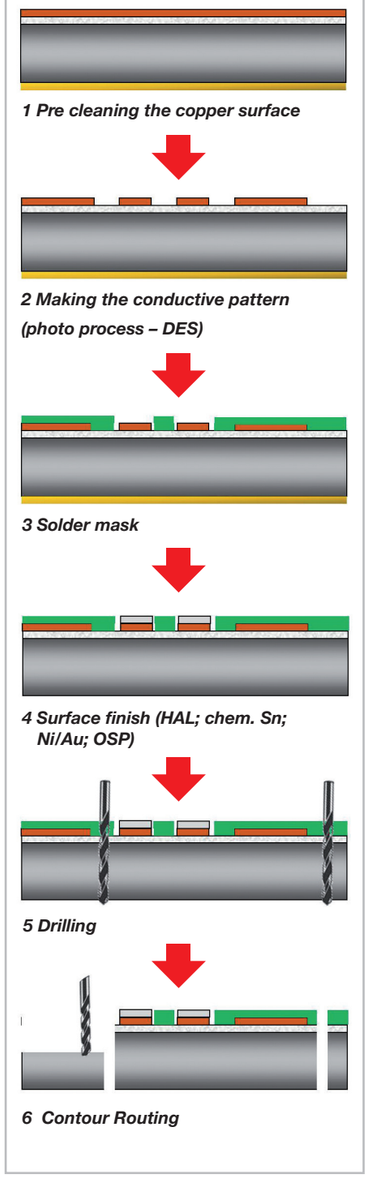

| a) Product b) Family | Thermal Conductivity W/mK | Thermal Resistance K/W | MOT °C | Dielectric Strength(3) KV | Tg °C | CTI PLC |
|---|---|---|---|---|---|---|
| TC-Lam 1.3 | 1.3 | 0.77 (1) | 130 | ≥ 5 | 100 | 600 |
| TC-Lam 2.0 | 2.0 | 0.50 (1) | 130 | ≥ 5 | 100 | 600 |
| TC-Lam 1.8 (hi Tg) | 1.8 | 0.56 (1) | 130 | ≥ 5 | 170 | 600 |
| TC-Lam 3.0 | 3.0 | 0.33 (1) | 130 | ≥ 5 | 100 | 600 |
| TC-Lam 4.0 | 4.0 | 0.28 (1) | 130 | ≥ 5 | 100 | 600 |
| TC-Lam 5.0 | 5.0 | 0.23 (1) | 130 | ≥ 5 | 100 | 600 |
| Flex-TC-Lam 1.0 | 1.0 | 0.30 (2) | 130 | ≥ 3 | 100 | 600 |

1) Dielectric thickness 100µm | 2) Dielectric thickness 55µm | 3) IPC TM 650-2.5.6.2

# Making Polytherm™ printed circuit boards for LED applications

Processing the Polytherm™ material is an easy task as it is very similar to the process for single side FR4 base material. Just some minor adjustments are necessary. For easier processing Polytherm™ is covered on the Aluminum side with a high temperature stabile (≤ 280°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.

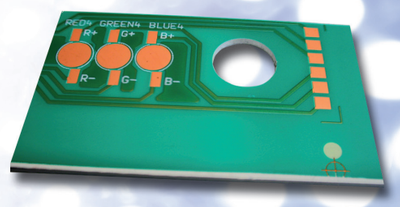
Polytherm is also available with massive copper or stainless steel as base layer.

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

| Aluminum Alloy | Temper Designation | Chem. Designation | Thermal Conductivity W/mK | 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 |
| **Other Metals** | | | | | | | |
| Copper | NA | CW004A >99% Cu | 394 | 75 | Good | Poor | Very high |
| Stainl. Steel | NA | X5CrNi 18-10 | 15 | 150-180 | Excellent | Special | 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.