**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

<table>
<thead>
<tr>
<th>Thickness Aluminium in µm</th>
<th>Copper foil (ED) thickness in µm</th>
<th>Thickness dielectric in µm</th>
<th>Aluminium alloy</th>
<th>Protective Film N (normal)</th>
<th>Protective Film HT (high temperature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 - 1000 - 1500 - 2000 - 3000</td>
<td>18 - 35 - 70 - 100 - 137 - 206</td>
<td>50, 75, 100, 125, 150</td>
<td>5052 - 1100</td>
<td>≤ 160 °C</td>
<td>≤ 280 °C</td>
</tr>
</tbody>
</table>

### Material properties

**Material properties (1500 µm Al / 100 µm Dielectric / 35 µm Cu)**

<table>
<thead>
<tr>
<th>Test method / Treating condition</th>
<th>Unit</th>
<th>Specification</th>
<th>Typical values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal stress 288 °C, dipping, no delamination</td>
<td>sec</td>
<td>≥ 10</td>
<td>90</td>
</tr>
<tr>
<td>Copper peel strength</td>
<td></td>
<td>N/mm</td>
<td>≥ 1.05</td>
</tr>
<tr>
<td>Dielectric breakdown</td>
<td></td>
<td>kV/mm</td>
<td>≥ 2.5</td>
</tr>
<tr>
<td>Electrical strength</td>
<td></td>
<td>W/m°K</td>
<td>30</td>
</tr>
<tr>
<td>Thermal conductivity dielectric</td>
<td></td>
<td>kW</td>
<td>≤ 1.50</td>
</tr>
<tr>
<td>Dielectric breakdown</td>
<td></td>
<td>MΩ</td>
<td>10^7</td>
</tr>
<tr>
<td>Volume resistivity</td>
<td></td>
<td>MΩ·cm</td>
<td>6*10^7</td>
</tr>
<tr>
<td>Surface resistivity</td>
<td></td>
<td>MΩ·cm</td>
<td>6*10^7</td>
</tr>
<tr>
<td>Flammability</td>
<td></td>
<td>UL-94</td>
<td>V-0</td>
</tr>
<tr>
<td>Comparative tracking index CTI</td>
<td></td>
<td>UL746A</td>
<td>PLC 0</td>
</tr>
<tr>
<td>Glass transition temperature Tg</td>
<td></td>
<td>%</td>
<td>≤ 0.5</td>
</tr>
</tbody>
</table>

### Availability and Tolerances

- **Standard size in mm**: 480 x 580, 480 x 600, 460 x 610, 530 x 630
- **Dimensions tolerance in mm**: ± 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.
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Thermal Management —
Cooling Solution for LED Applications
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.

*Excess heat directly affects short-term and long-term LED performance.*

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 (≤ 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.

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

<table>
<thead>
<tr>
<th>Aluminum Alloy</th>
<th>Temper Designation</th>
<th>Chem. Designation</th>
<th>Thermal Conductivity W/m*K</th>
<th>Brinnell Hardness HB</th>
<th>Corrosion resistance</th>
<th>Processability</th>
<th>Price Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1100</td>
<td>H24</td>
<td>Al 99.0Cu</td>
<td>222</td>
<td>32</td>
<td>Excellent</td>
<td>Poor</td>
<td>Low</td>
</tr>
<tr>
<td>5052</td>
<td>H34</td>
<td>AlMg2.5</td>
<td>138</td>
<td>68</td>
<td>Good</td>
<td>Good</td>
<td>Medium</td>
</tr>
<tr>
<td>6061</td>
<td>T6</td>
<td>AlMg1.5Cu</td>
<td>167</td>
<td>95</td>
<td>Good</td>
<td>Good</td>
<td>High</td>
</tr>
</tbody>
</table>

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.

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.

High operating temperature | Low operating temperature with Polytherm™

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

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Thermal Conductivity W/m*K</th>
<th>Thermal Resistance K/W</th>
<th>MOC °C</th>
<th>Dielectric Strength (KV)</th>
<th>Tg °C</th>
<th>CRI PLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC-Lam 1.3 (PP)</td>
<td>1.3</td>
<td>0.77</td>
<td>130</td>
<td>≥ 5</td>
<td>130</td>
<td>2</td>
</tr>
<tr>
<td>TC-Lam 1.3</td>
<td>1.3</td>
<td>0.77</td>
<td>130</td>
<td>≥ 5</td>
<td>130</td>
<td>2</td>
</tr>
<tr>
<td>TC-Lam 2.0</td>
<td>2.0</td>
<td>0.50</td>
<td>130</td>
<td>≥ 5</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>TC-Lam 1.8</td>
<td>1.8</td>
<td>0.56</td>
<td>130</td>
<td>≥ 5</td>
<td>170</td>
<td>0</td>
</tr>
<tr>
<td>High Tg</td>
<td>3.0</td>
<td>0.33</td>
<td>130</td>
<td>≥ 5</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

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