Thermally Conductive Base Material

The continuously increasing demand for "High Brightness-LEDs" (> 1 W) requires the thermal conductivity of PCBs at an increasing rate. Although LEDs feature higher levels of efficiency than conventional spotlights do the loss of heat here is still at 75 % of the feed-in capacity. Because of the temperature-sensitive and light-emitting chip faces a heat dissipation is indispensable.

But even in the fields like engine management systems, converters, or rectifiers higher demands are made on the heat management.

Thus, Isola has developed a thermally conductive base material for temperature-sensitive applications with a drastically increased thermal conductivity compared to standard FR-4 base material by the use of special fillers. The thermal conductivity of the dielectric is at 1 W/m·K. This guarantees an efficient thermal conductivity and , thus, offers an economic and failure-resistant alternative to active cooling methods.

Various kinds of thermally conductivity at a glance:

- FR-4 ≈ 0,24 W/m·K
- Isola IS450 = 1 W/m·K
- Aluminium ≈ 220 W/m·K
- Copper ≈ 400 W/m·K
- Air ≈ 0,02 W/m·K

IS450 is available as prepreg or as aluminium clad IMS laminate (Lambda-IS450) and can be made into multilayer with conventional technologies. An economic mixed lay-up with other multilayer materials is also possible. In the process, our laminate with IS450 reaches a glass transition temperature of up to 180 °C.

In combination with aluminium as carrier the heat can be put out of the system quickly and enables so to produce assemblies that are not feasible or only with lavish cooling realisable with standard base material.

Owing to the optimally correlated build-up and the therewith reached efficient thermal conductivity it is possible to further shorten the distances of the components and hence to increase the power density. This allows to realise micro-modules which is only hard to achieve with conventional base materials. Another advantage is that no additional actions for the heat management are necessary.

Advantages of Isola's IMS technology

- Very good thermal conductivity up to 14 W/m·K having the same design possibilities as with standard materials
- Longer life span of the components due to an efficient heat dissipation
- Sequential layer construction possible
- High mechanical stability
- Size reduction of the boards possible

Typical applications

- LED-Technology
- Power Converter
- Heat Sink Circuits
- Industrial Electronics
- Automobile Electronics

Special characteristics of IS450 prepregs/laminates

- High thermal conductivity of up to 14 W/m·K with laminates
- High thermal conductivity of up to 1 W/m·K with prepregs
- High thermally permanent stress resistance
- T_{260} up to >60 min
- T_{288} up to > 25 min
- Low coefficient of expansion in z-axis direction α_z = 35 – 40 ppm/K @ RT –120 °C
- High mechanical stability

Advantages

- Lower operating temperature due to better heat distribution
- Small board surface
- Higher power density
- Improved mechanic performance
- Combination of power module and control module
- CAF-resistant

Thermal conductivity prepreg

Name	Fabric	Thermal Conductivity λ (W/k x m)
DE104	106	0,24
IS450	106	1,0

Thermal conductivity IMS laminate

Name	Build-Up	Thermal Conductivity λ (W/k x m)
Lambda-DE104-106	35 µ Cu 106 AT01 1,5 mm Aluminium	6,35
Lambda-DE104-1080	35 µ Cu 1080 AT01 1,5 mm Aluminium	5,0
Lambda-IS450-106	35 µ Cu 106 IS450 1,5 mm Aluminium	**14,73**
Lambda-IS450-1080	35 µ Cu 1080 IS450 1,5 mm Aluminium	11,98

Because of the better availability Isola uses type1050 H24 aluminium. Extensive tests at HPTec have shown that there are no differences in the mechanical processing, correct processing parameters given.

For more information please call your Isola-contact person.