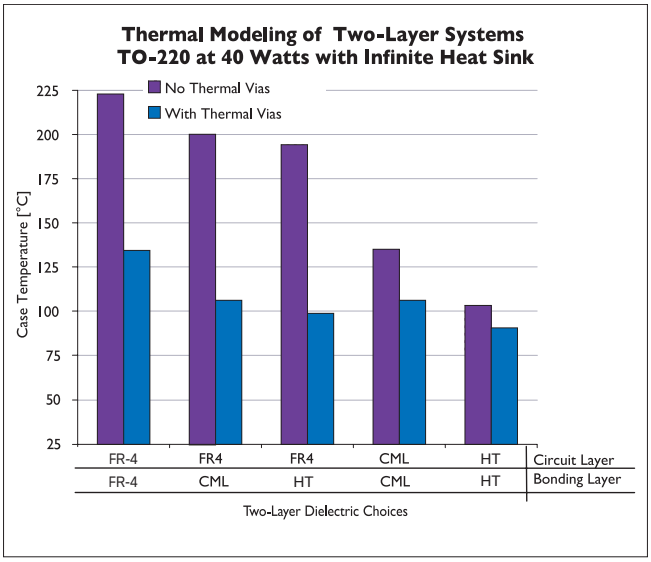
Using Thermal Clad Dielectric Material...

Two-Layer Systems Using FR-4 Circuits Or Thermal Clad Circuits

Bergquist dielectrics are ideal for applications requiring a two-layer solution. Two-layer constructions can provide shielding protection and additional electrical interconnects for higher component density. Bergquist dielectrics will provide superior thermal performance over traditional FR-4 constructions. In addition, thermal vias can maximize thermal capabilities for applications utilizing power components. When vias can not be used, selecting higher performance dielectrics can solve thermal issues independently (see graph, below).

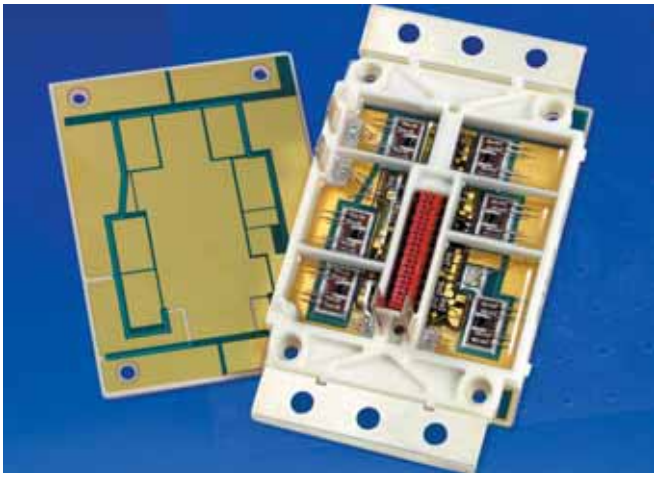


The graph depicts the modeled thermal result of various two-layer constructions as a function of device case temperature. The emphasis is the thermal effect of proper vias utilization.

DBC Replacement

Replace Ceramic Substrates

Thermal Clad can replace large-area ceramic substrates. It can also be used as a mechanically durable support for ceramic circuits or direct-bond copper subassemblies. The copper circuit layer of Thermal Clad has more current carrying capability than thick-film ceramic technology.

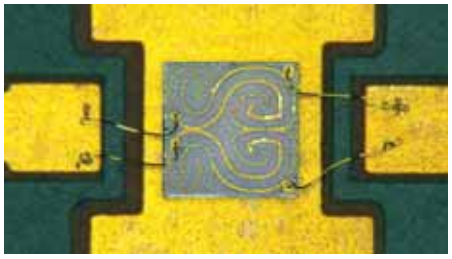


Thermal Clad has replaced ceramics and DBC in applications due to mechanical robustness and its ability to be fabricated in a wide variety of form-factors.

Direct Die Application

Direct die attach and wirebond are increasingly popular methods of component mounting to Thermal Clad substrates. A key benefit to this structure is lower thermal resistance as compared to conventional surface mount component packages soldered to an IMS substrate.

When designing circuits using Chip-On-Board (COB) technology it is important to use the appropriate surface finish to achieve excellent die mounting and wire bond connections. The die attachment is accomplished using SnPb, Pb-free solders, eutectic gold/in solder or an electrical/thermal conductive adhesive, depending on the application requirements to adhere the die to the substrate. The wirebonding performed to make circuit connections is usually either gold or aluminum. ENEPIG (Electroless Nickel/Electroless Palladium/Immersion Gold) is recommended for gold wire and ENIG (Electroless Nickel/ Immersion Gold) for aluminum wire applications. HT dielectrics are U.L. solder rated at 325°C/60 seconds, enabling Eutectic Gold/Tin solders.



Close-up view of direct die attachment in an LED application. The Thermal Clad substrate is used to mount the die or module.

Heavy Copper

Applications requiring heavy copper for high current or heat spreading are not limited to single-layer needs. The ability to have internal layers of heavy copper can provide greater application flexibility. Direct access to the internal copper layer to directly attach or mount components provides unique applications capability.

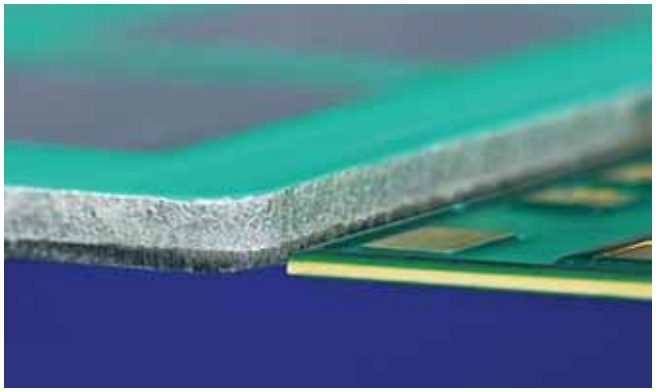
Look for opportunities to reduce the copper thickness. In many applications, Bergquist T-Clad thermal performance reduces the need for heavy copper.

Bergquist has the ability to laminate heavy copper up to 5 oz. (175µm) on the internal layer utilizing a thicker deposit of HT dielectric.

...In Specialty Applications

Ultra Thin Circuits

Ultra Thin Circuits (UTC) utilize T-Clad® dielectrics without the typical thick base layer. These circuits are often used for component level packaging where the thick aluminum or copper base is not required for mechanical or thermal mass. The circuit layer is a "stand-alone" ceramic submount replacement where the heat spreading and heat sinking is done in a different location. In addition, UTC can often be used for standard component package mounting. In some cases, the thermal performance and heat dissipation of the UTC is adequate to eliminate the need for heat sinking altogether. The total profile of a UTC can be as thin as 0.009" (0.23mm) and can be built up into multilayer structures. This type of structure is also available with Bond-Ply 450 thermally conductive PSA tape pre-applied to the back. See page 15 for examples of this format.



Photographic example of UTC versus a standard 0.062" (1.57mm) aluminum substrate.

Active Baseplates

Electrical Vias To Baseplate

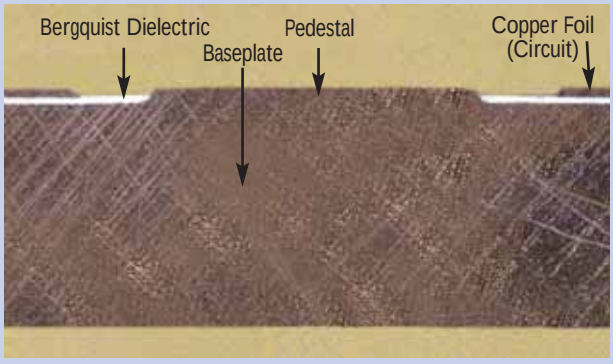
A copper IMS baseplate can be used as an active circuit with the use of blind plated electrical via's that connects the top circuit layer to the base metal.

Selective Dielectric Removal

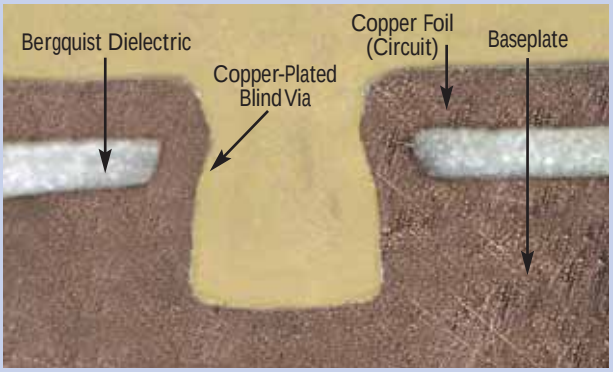
Bergquist has developed a process for selectively removing dielectric to expose the baseplate. This surface can be surface finished like the other circuit pads. We are not limited to geometry or size of the dielectric removal area. Selective removal features can be placed very accurately with respect to the circuits.

Pedestal

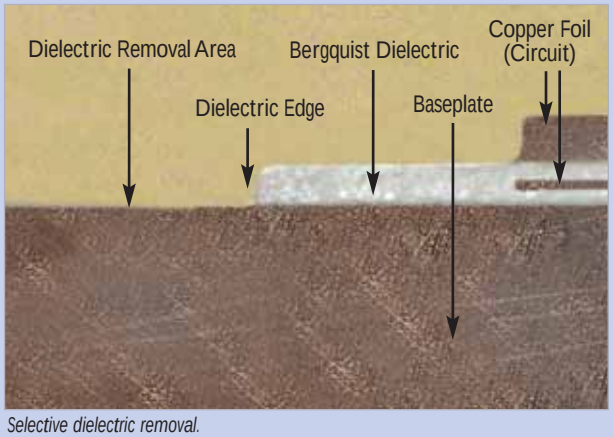
Using a copper base and by selectively removing the dielectric a pedestal can be formed moving the base metal up to be co-planar with adjacent circuits.



Pedestal formation through selective dielectric removal.



Electrical vias to baseplate.



Selective dielectric removal.

For more detail regarding design and tolerance recommendations for active baseplates, please contact your Bergquist representative for a White Paper.