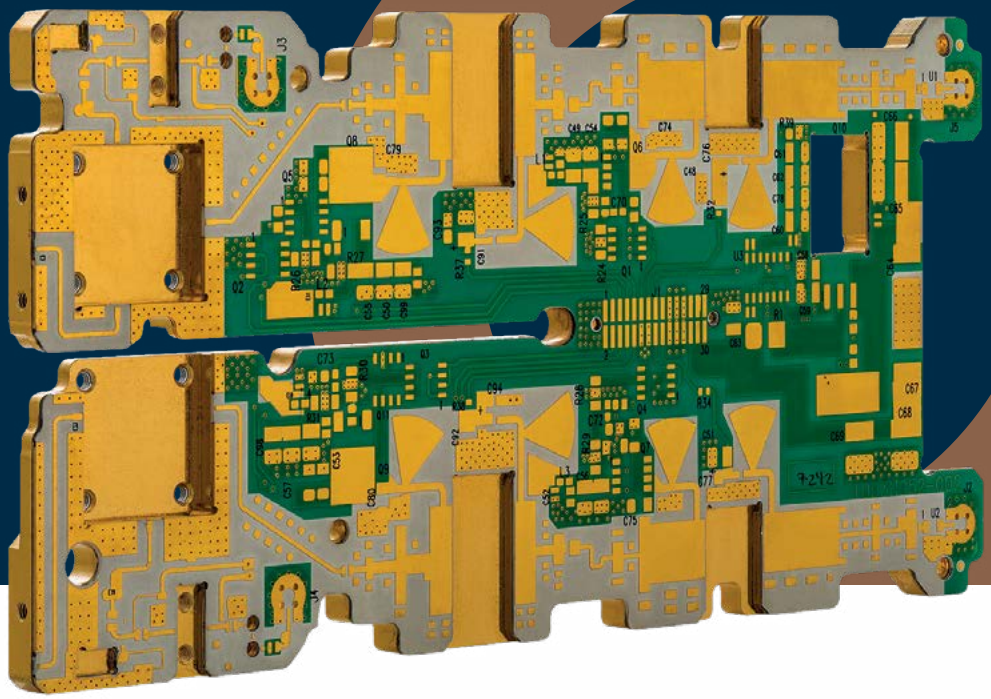
PCB TECHNOLOGIES
leading the way

Heat Management PCBs



Thermal, or heat management is an essential element of printed circuit board (PCBs) design.

Excess heat generated by components has to be removed to maximize the life of a product and reduce the risk of burnout. Thermal dissipation solutions absorb and conduct heat away from PCB components.

The need for thermal management has grown considerably in recent years because of miniaturization and greater component density. In addition, higher speeds, frequencies and currents in electronics have increased the amount of heat generated. As a global leader in PCB design, manufacturing and assembly, we are the preferred choice for thermal management solutions. We have many years of experience working with special materials and different operational environments. This means we can provide guidance on design and material choices to maximize PCB performance, as well as save you time and money.

Our thermal management solutions include:

- Via farm
- Heat sinks
- Embedded coins (T-coin, I-coin, U-coin)
- Post-bonded metal back
- Electrical and/or thermally conductive adhesives
- Specialist materials with high heat conductivity characters

Heat Management Case Study

The Challenge

One of our clients had an especially high-heat dissipation requirement for an electronic device. The client was looking for a PCB solution that could withstand high environmental temperatures, as well as the large amount of heat generated through the device's operation. Excess heat generated by components had to be removed to maximize the life of a product and reduce the risk of burnout.

The Solution

The solution needed to deliver extreme heat dissipation conductivity capacity in the shortest possible time.

Previous attempts to tackle the problem meant that we had to analyse the current stack-up structure and come up with a different solution.

We created an additional prepreg layer made out of a special material with high thermal conductivity. This was placed under the seventh layer so that all of the heat gathered along the via farm was discharged in one go.

Technical Specifications

Raw material	Teflon. Glass Epoxy
Customer required thickness	1.60mm
Inner layer number of layers (including ext.)	8
Subs number	1
Min Drill Diameter	0.450mm
Holes number	7021
Paste fill wrap requirement	IPC 6012 Class 3
Finish CS	chm_gold
QA Spec.	IPC 6012 class 3
QA Type	Rigid
QA FAI	Per AS9102
QA Status	Military

The PCB Technologies Way

We analysed the original 7-layer PCB to understand its structure and materials, as well as earlier attempts to tackle the problem such as repeated delamination between its layers.

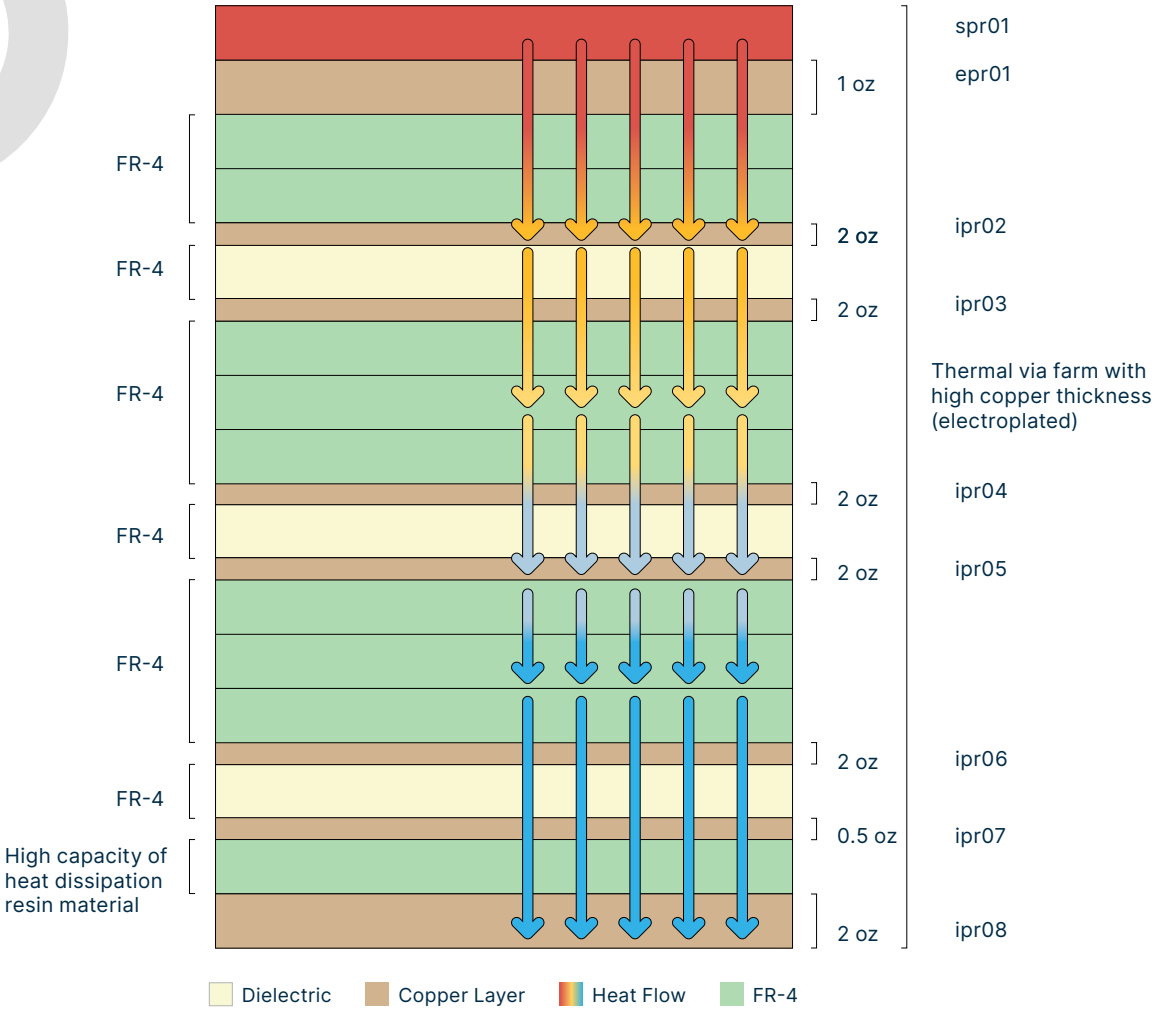
The existing PCB design had a heat sink attached on the bottom side and copper-electro-plated via farm holes connecting all the layers. We initially explored ways to improve this design by pressing the stack-up with the heat sink to the PCB. While this did deliver some improvements, it also generated partial capping of the via farm holes.

Our final solution was to create an additional prepreg layer out of specialist material with characteristics such as high thermal conductivity including -2.0 W/mK Z-Axis, and -3.5 W/mK X/Y plane (10 times higher than the original & typical FR-4 material used). We placed this prepreg under the seventh layer to discharge all the heat captured along the via farm at the same time.

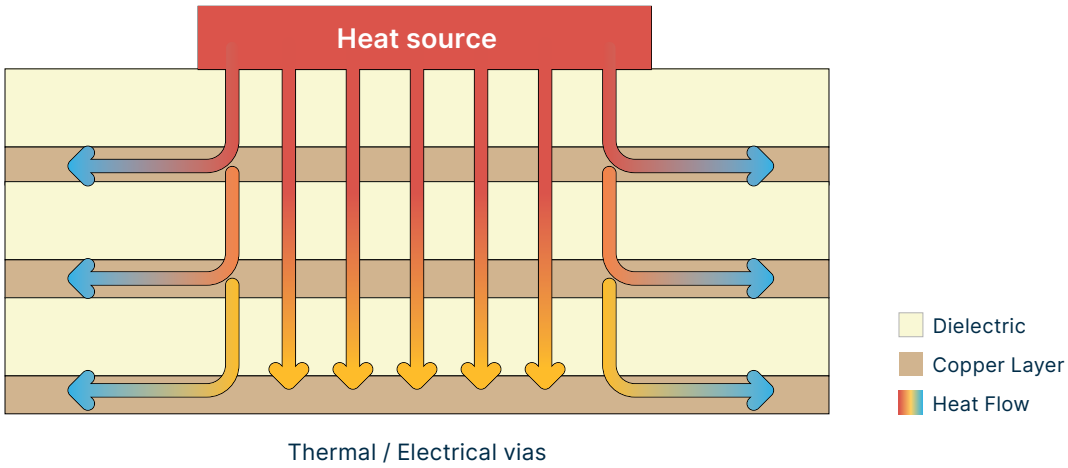
The characteristics of our new prepreg layer reduces the operating temperature and has a high Tg of 160°C. This enables the PCB to survive lead-free assembly conditions, enhancing reliability. It also has minimal impact on the size of the PCB stack-up.

As a result, the device can now withstand up to 90°C in environmental temperatures, significantly higher than the 65°C-71°C required by the military standard. Testing proved beyond doubt the positive effect this had on the durability of the critical components in the PCB.

Our unique addition to the stack-up



Heat dissipation in the works



Thermal / Electrical vias