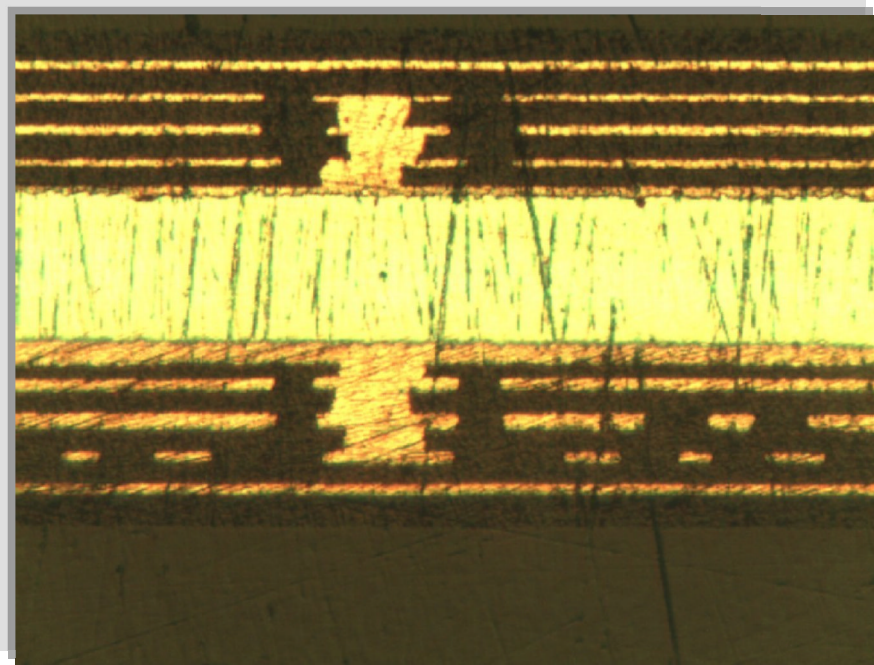


Version 1.01

METAL CORE PCB DESIGN



Written by
Robert Tarzwell

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The information in this book is current to January 2010. As material specifications and manufacturing practices change and evolve, please ensure you are using up to date information.

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Introduction for Robert Tarzwell

One of the most amazing things that I have seen Robert Tarzwell do, and there are many, is the day he told the owner of a \$20 million board shop that he could take a walk through his shop and come up with savings of at least half a million dollars. The owner took him up on his challenge. Bob walked through the shop and came up with a list of things the owner could do to save money; all in about an hour time frame. A few months later when I was again talking to that owner, I asked him if he had ever followed any Bob's suggestions from the walk that day. *"Oh yes!"* he answered with enthusiasm, *"We took all of them and the only thing he was wrong about was that we actually are realizing savings larger than he predicted."*

Bob Tarzwell is truly one of the Printed Circuit Board industry's technology gurus. With his grasp of today's technology and his insight into the technologies of tomorrow, he is the real "go-to" person for anyone who is looking for the right direction to take their company. Bob has that unique ability to take very complicated problems and come up with elegant and seemingly simple solutions. Whether you are talking about learning how to produce the absolutely best four layer board, in the most cost efficient way possible, or talking about fabricating a circuit board with one mils lines and spacing, Bob is literally the only person in the industry that I know of who can get it done.

Not being technical myself, Bob is the person I go to when I am working with a client who has a new technology and I need it explained to me. Bob will talk to the client for me and then come back and explain the technology in a way that makes it so clear to me that I not only understand it but then can proceed to do my job of helping the client sell it. There are not many people who can do that. As A Wang once said *The true sign of a genius is someone who can take something very complicated and make it simple enough for everyone to understand.* And this surely applies to Bob Tarzwell.

Dan Beaulieu

President

D.B.Management Group L.L.C.

Chapter 1

Introduction to Metal Core Printed Circuits

Today's advanced electronics require higher power levels and larger heat removal from the denser chip packaging. Typical printed circuit technology will not disperse enough heat to satisfy these newer designs nor does it have low enough CTE numbers to properly place higher count BGA without reliability problems. Advanced metal cores, as well as higher thermal conductivity laminates, combined with new ideas, can obtain the thermal conductivity that you desire with the CTE numbers needed.

New microelectronics is packing more density than ever into a smaller package, resulting in higher heat densities and creating new heat related problems. Metal core high thermal conductivity chip packaging advances allow higher output designs to run cooler.

Very high power LED chips used in digital camera flash and super lamination applications are a special engineering problem with very high temperature dispersions in a small footprint. Present laminates and metal core printed circuits struggle to spread and disperse the high temperatures of the LED die. New R&D advances may solve this problem in the near future. Stay tuned for new technologies in advanced thermal dynamic printed circuit boards. There exist many different types of metal core PCBs.

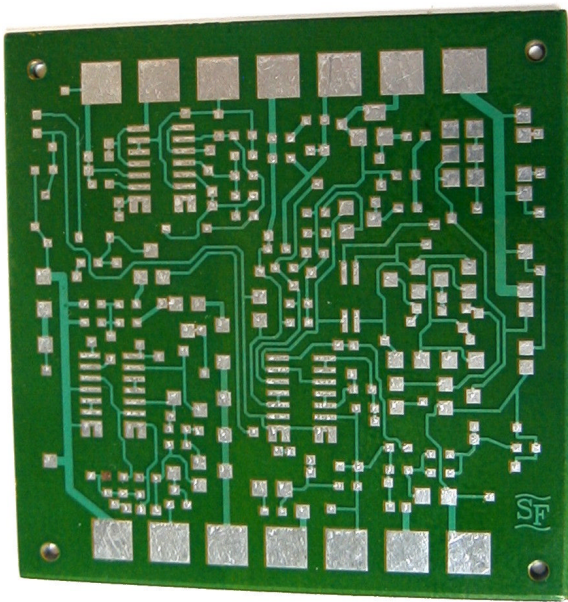
Single sided thermal prepreg on metal for power supplies and LED applications for heat removal only.

Double sided boards where the core is metal for either thermal conductance and or CTE requirements.

Multilayer boards with a metal core in the center for CTE and for thermal considerations.

Multiple metal cores in multilayer for tighter CTE control.

Thermal plane technology for higher density and higher thermal dissipation metal core boards.



Metal core ½ brick power circuit on aluminum.

Metals Used in Cores

Copper Invar Copper (CIC) is very popular and readily available. However, some shops find a tough time processing it. CIC has low CTE numbers and middle thermal conductivity.

Copper Molybdenum Copper (CMC) is a higher thermal conductive metal than invar. CMC is tough to drill but not impossible. It is tough on drill bits, can be bought from a few suppliers and has very low CTE numbers.

Aluminum: It is easily available, in many different types; 6061 t6 is the most used, also 3003. It has good thermal but high CTE numbers in x-y and z. Some anodized aluminum is used but can have delamination problems.

Copper has high thermal conductivity, high CTE and good adhesion to FR4. It is easy to get, can be oxide coated and easily drilled with low angle bits or router bits.

Aluminum/ceramic hard material cannot be drilled, has high thermal conductivity, must be precast to size and pre-machined in green mode and then cured. It is used in small metal modules with direct chip attach and has low CTE numbers.