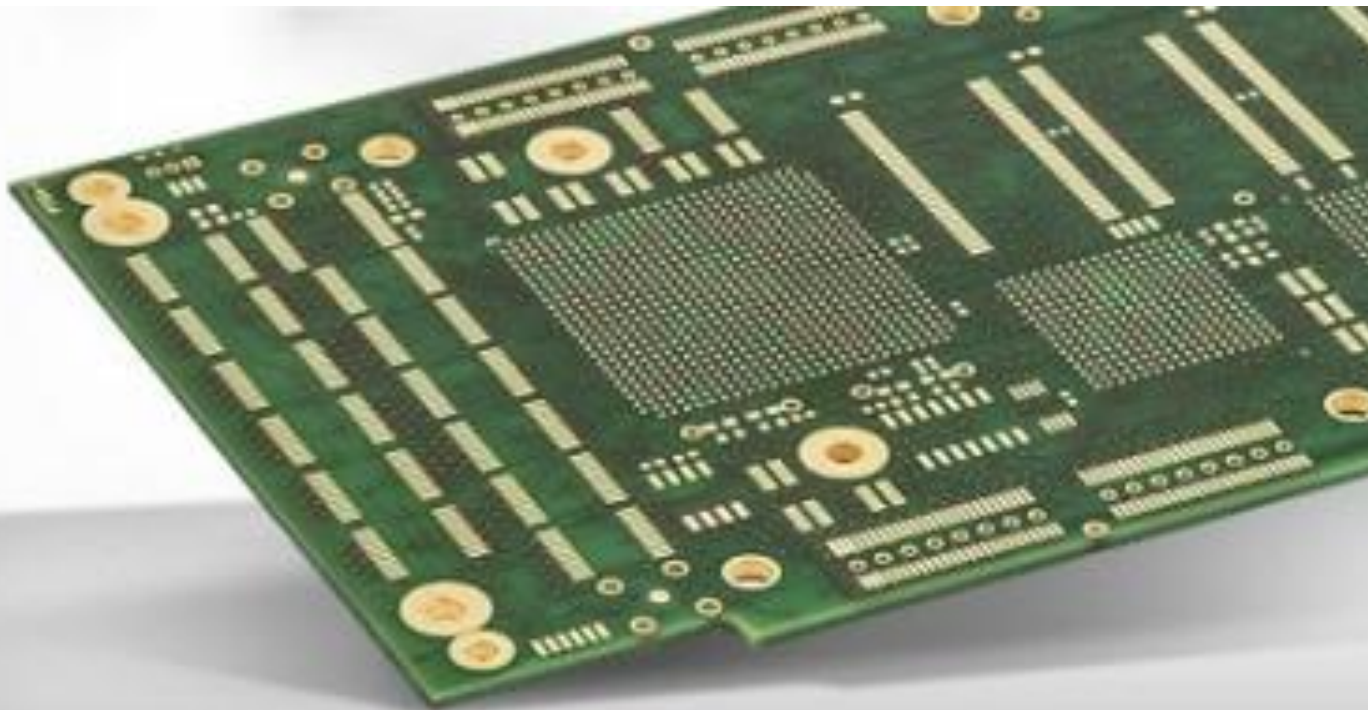


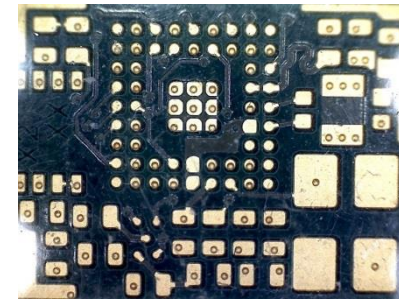
PCB Cost Drivers



Agenda

- **Cost Drivers**
 - Panel utilization
 - Choice of material
 - Copper price
 - Mechanical processing
 - Advanced Technologies
 - Ideology
 - Clarifications

- **Summary**
- **Q & A**

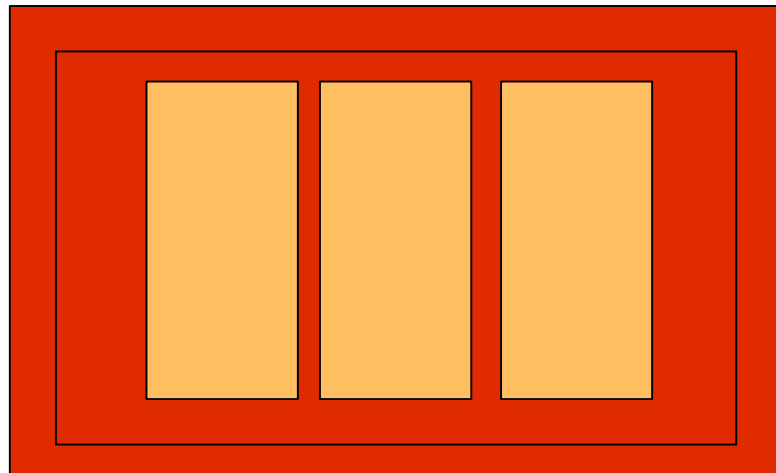


Panel utilization

Key factor:

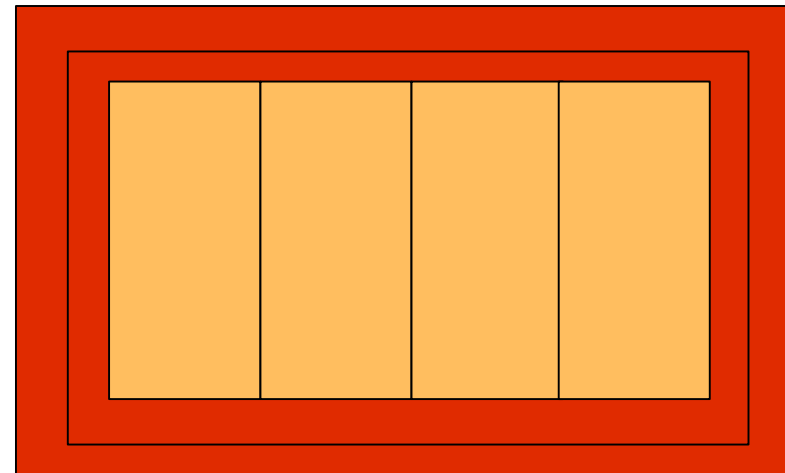
How efficiently is the production panel used?

milling -25 %



or

v-scoring +33%



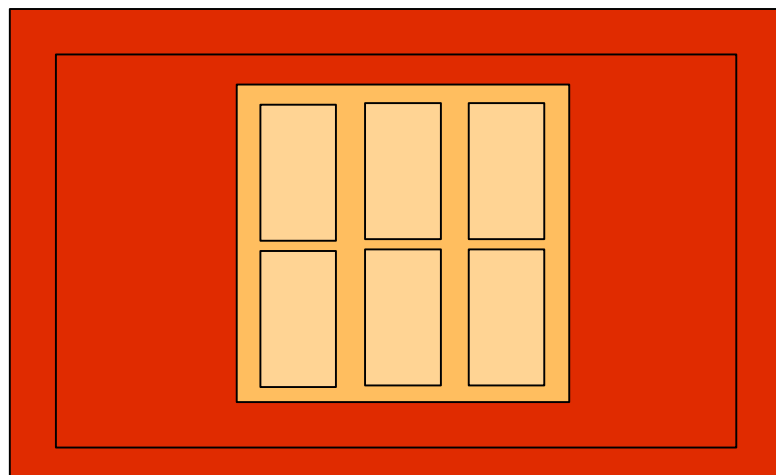
A question of philosophy or necessity?

Panel utilization

Key factor:

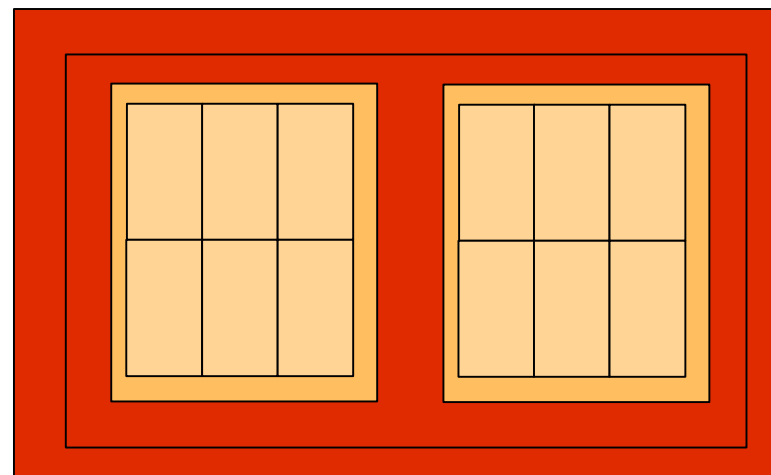
How efficiently is the production panel used?

milling -50 %



or

v-scoring +100 %



A question of philosophy or necessity?

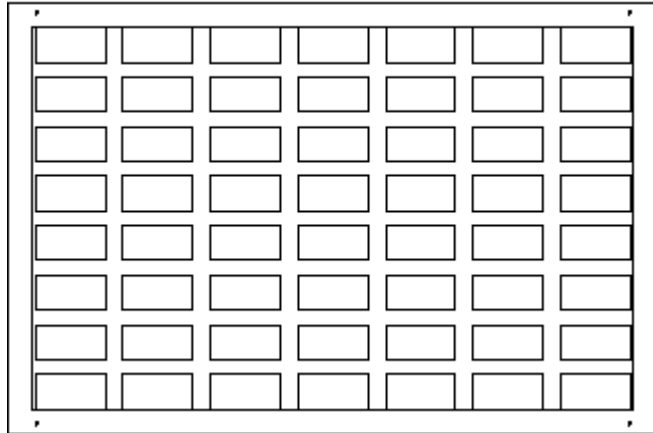
Panel utilization

Key factor:

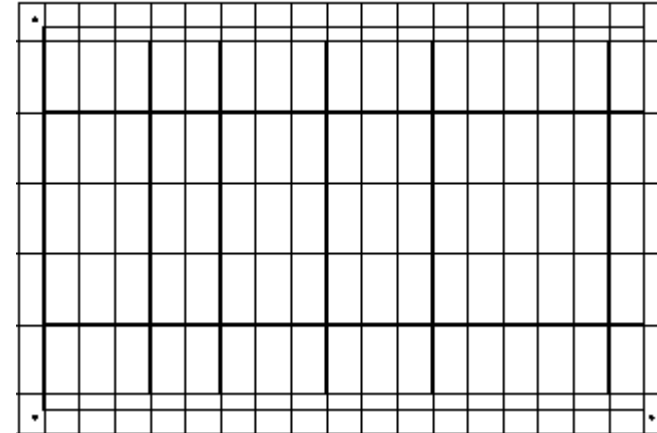
How efficiently is the production panel used?

The smaller the PCB, the bigger the effect!

Fertigungsformat RAS 460,00 * 305,00 Fertigungsnutzen RT [RT]



Fertigungsformat RAS 460,00 * 305,00 Fertigungsnutzen RT [RT]



A question of philosophy or necessity?

Choice of material

What is required **or** what is possible?

TG- Value	Thickness	CU foil	Costs in %															
150	0,51	35/35	100%															
150	0,51	70/70	152%															
150	0,51	105/105	301%															
150	1,55	35/35	100%															
150	1,55	70/70	125%															
150	1,55	105/105	185%															
150	2,40	35/35	100%															
150	2,40	70/70	141%															
150	2,40	105/105	206%															

Choice of material

Using the example of heat development

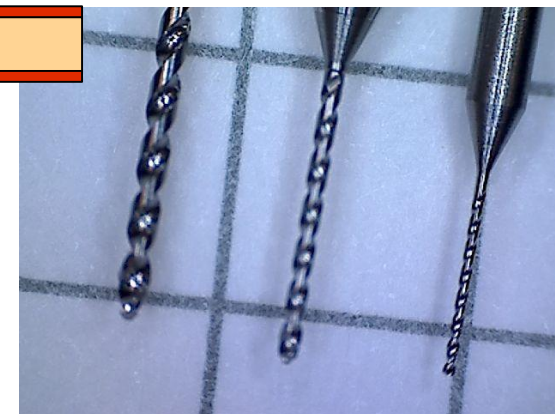
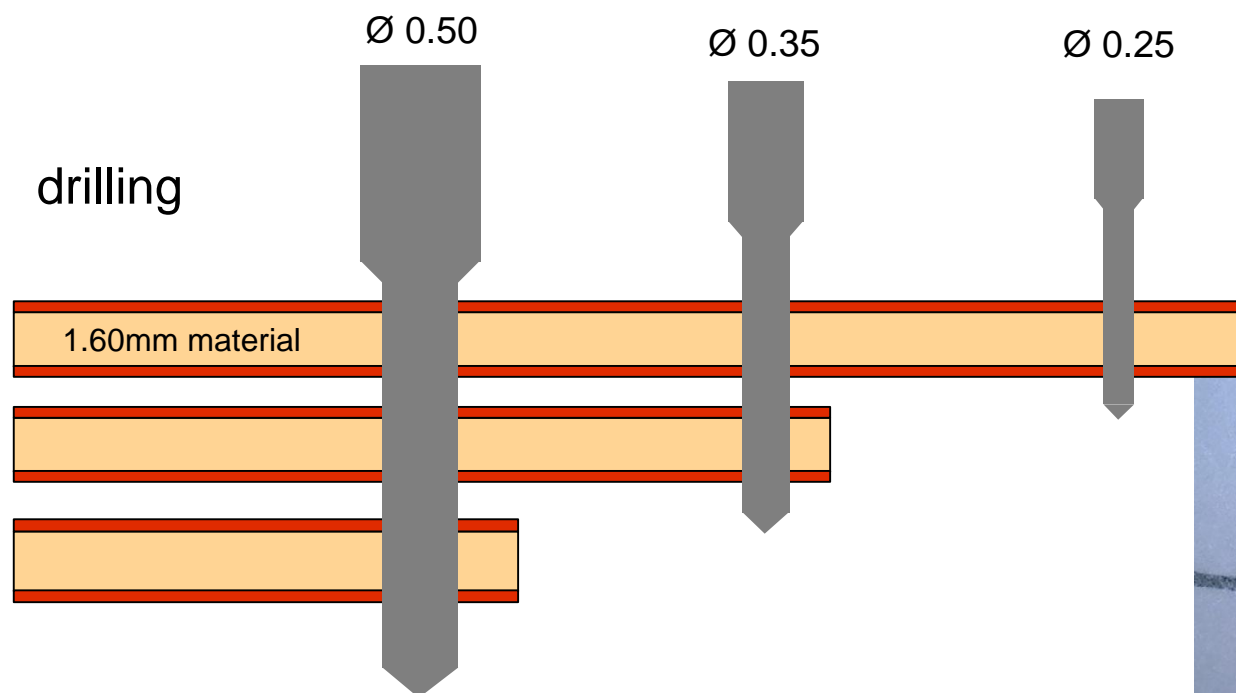
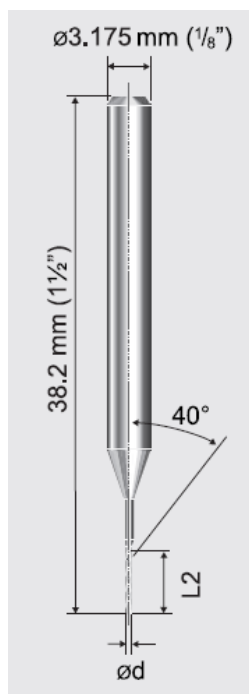
Current	Cu thickness	Trace	Heat Increase	Trace	Heat Increase
5A	35 μ m	0,80mm	~ 50 Grad	0,90mm	~ 44 Grad
5A	55 μ m	0,80mm	~ 33 Grad	0,90mm	~ 28 Grad
5A	70 μ m	0,80mm	~ 27 grad	0,90mm	~ 22 Grad
10A	35 μ m	1,50mm	~ 82 Grad	1,65mm	~ 72 Grad
10A	55 μ m	1,50mm	~ 53 Grad	1,65mm	~ 47 Grad
10A	70 μ m	1,50mm	~ 43 grad	1,65mm	~ 37 Grad
30A	105 μ m	5,00mm	~ 44 Grad	5,50mm	~ 38 Grad
30A	140 μ m	5,00mm	~ 33 Grad	5,50mm	~ 28 Grad

Copper price



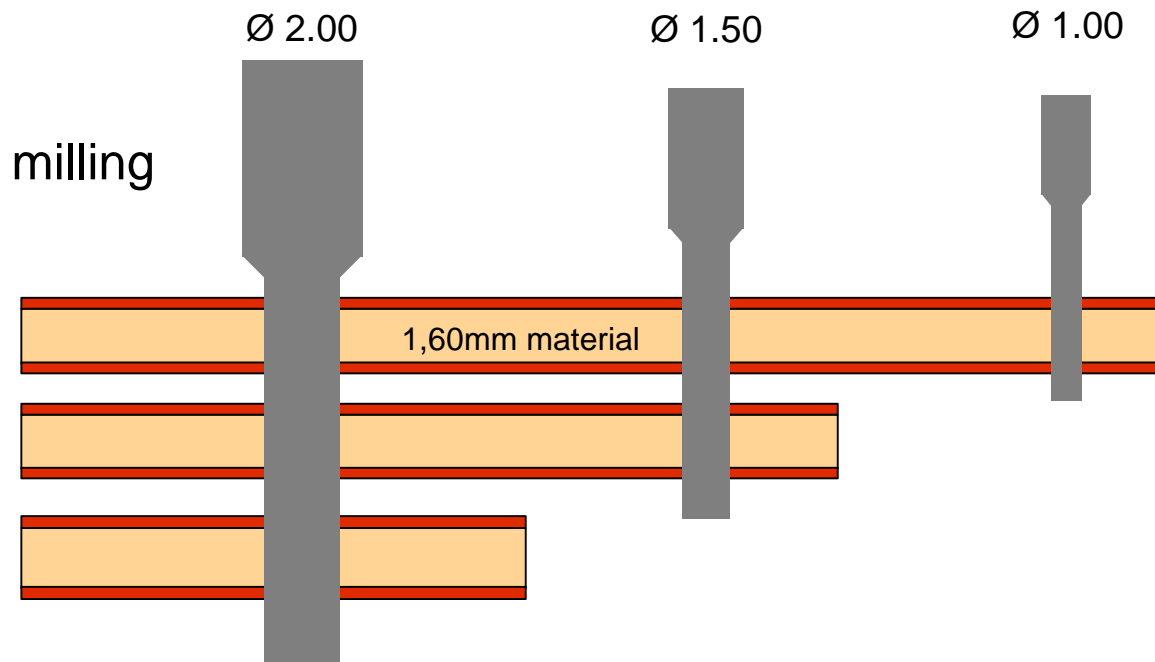
Source: Finanzen.net

Mechanical processing

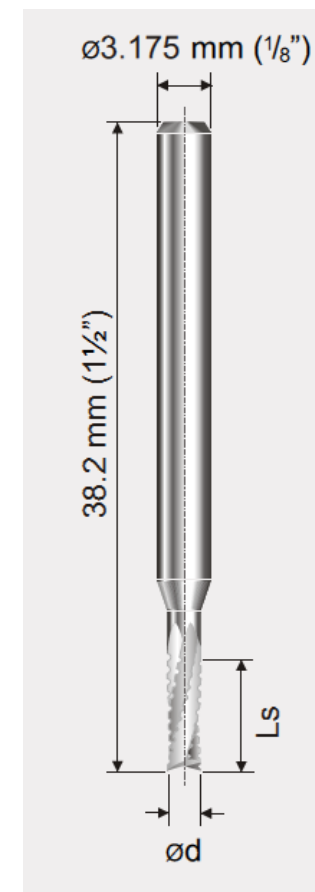


	Ø 0.50	Ø 0.35	Ø 0.25
• Run Time	1500 drill hits	1000 drill hits	500 drill hits
• Stack height	3	2	1
• Drill bits per PCB at 1000 drillings/PCB	0.22	0.50	2.00
• Drill time ~ 15,000 drill hits	~ 1h	~ 1.5h	~ 3,5 Std
• Drill bit attrition	3,33	7,5	30

Mechanical processing



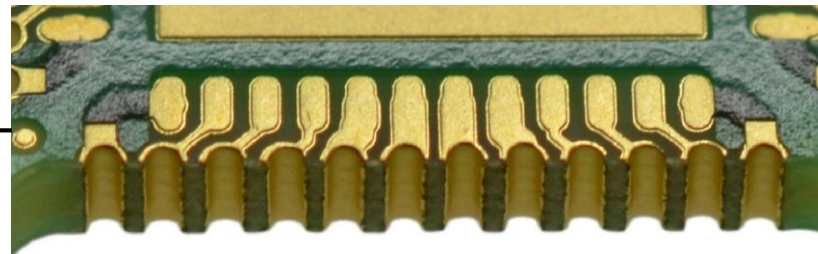
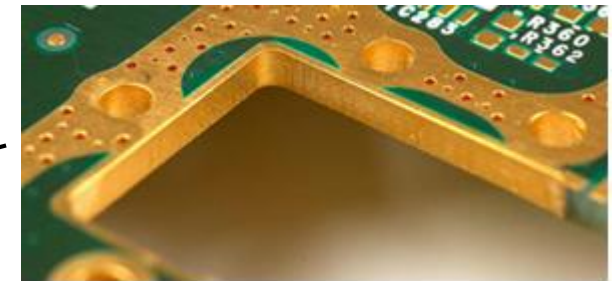
• Run time	~ 80-100m	~ 8-12m	~ 1-2m
• Stack height	3-up stack	2-up stack	1-up stack
• Milling speed m/min.	1,2 -1,5	0,5 – 0,8	0,1 – 0,2
• Mill heads per 100 PCBs at 0.5m diameter/PCB	0,170	2,50	25 - 50



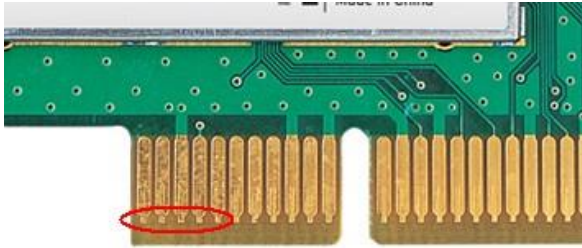
Advanced Technologies

Further cost drivers

- Thickness of the PCB → relevance in drilling, pressing, milling....
- Number of layers → material
- Number of laminations
- Edge plating
- Open PTHs?



Advanced Technologies



Special characteristics:

Thickness:

Hardness:

Purity „gold“:

Abrasion resistance:

Cost:

imm. gold

imm. gold

contacts for electrolytic plating process

~ 1 – 4µm possible

140 – 170 HV
„HV = Vickers hardness“

99,80 % (Cobalt)

good

high (layer thickness/plane)

possible charges up to 500%

ENIG

ENIG

none

ca. 0,05 – 0,12µm

80 – 110 HV

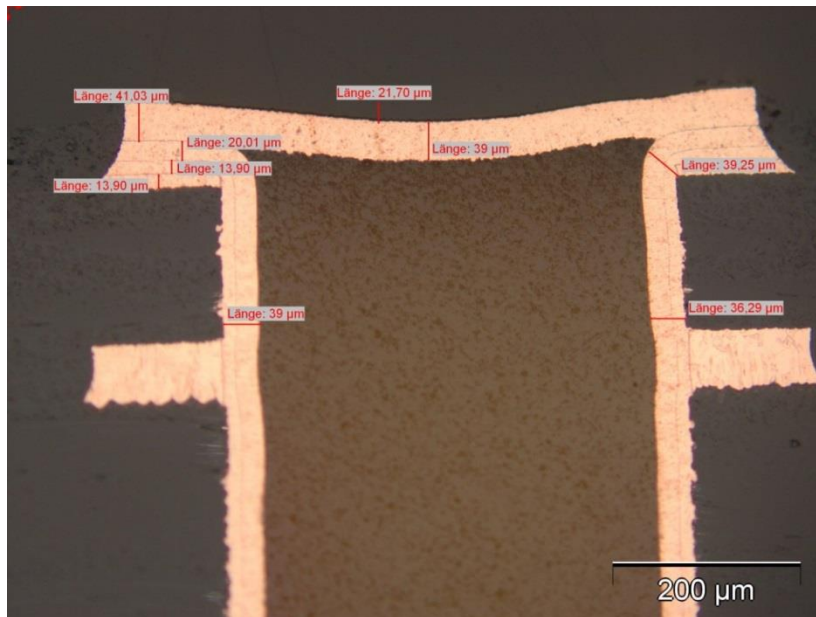
99,99 %

low

fairly low

Advanced Technologies

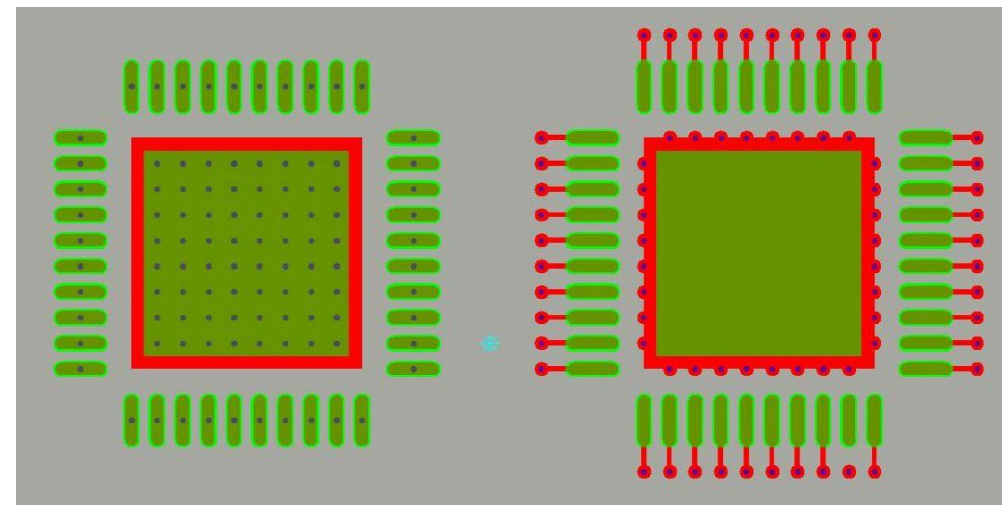
IPC 4761 Type VII „Filling capped“ → Via resin filled and copper capped



Field of application:

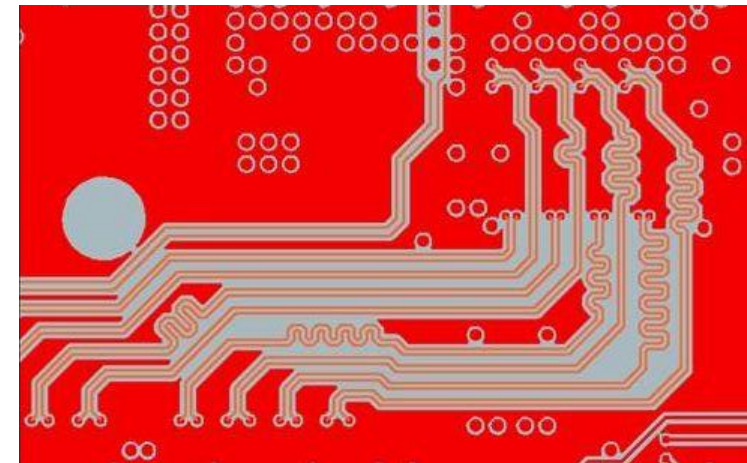
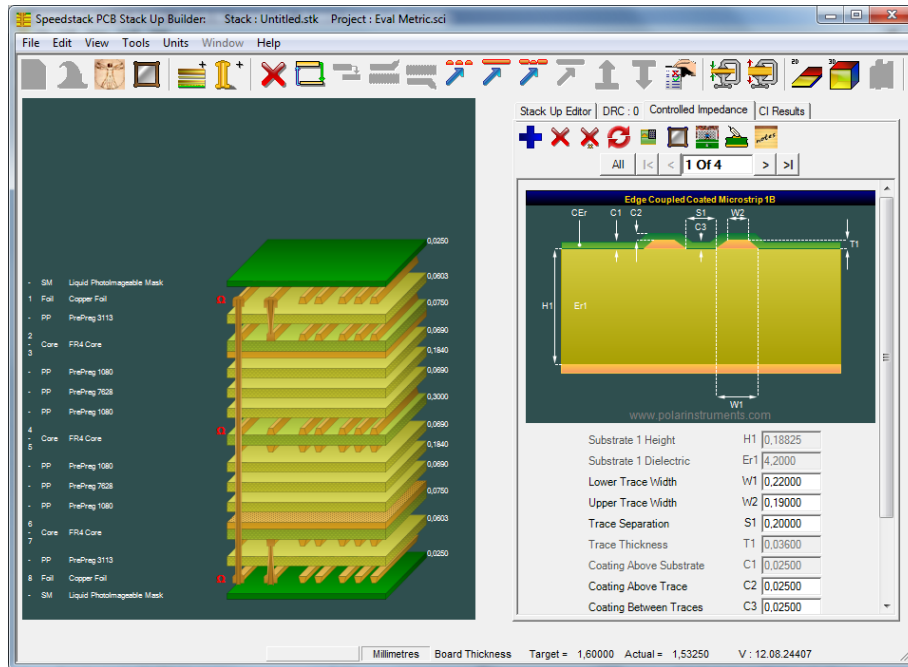
- Heat dissipation vias
- Via in pad
- Vakuum effect

**Necessary or avoidable
by an intelligent design?**



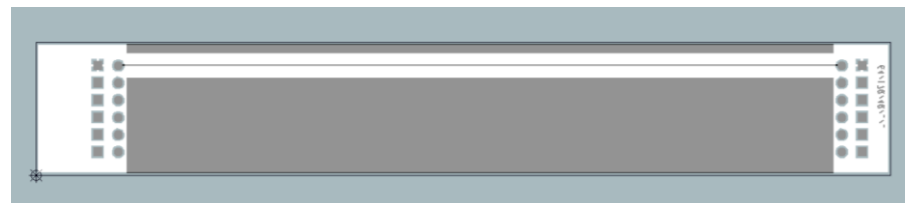
Advanced Technologies

Impedances



Impedance produced
Impedance tested

→ only calculated stack-up and circuit paths
→ with test coupon → reduced amount of PCBs each panel



Ideology

...past and today...:

...we have always done it this way...!

**...IPC class 3 = 25 μ m copper in PTH!
Yes it is, and much more!**



In the past it was right, but today and tomorrow...?

Clarifications

What is often forgotten:

Clarifications cost a lot of time and efforts on the supplier and customer side!



**But...
The day only
has 8 hours!**

Could the time be used more productive?

Summary

The design and the specifications determine the price.
Investments for the layout are **“non-recurring costs“!**

Costs for material and technological efforts must be paid
with every order!

An accurate preparation saves time, costs and efforts.



Summary

So the question is... What do I need?

As much as possible?

or

As much as necessary?



Q & A



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Thank you for your attention!

