A Deep Dive Into Your Load Board

Tom Bresnan
R&D Altanova

TestConX™
Virtual Event • May 11-13, 2020

R&D Altanova®

Some Things to Think About

- Aspect ratio's
- Flute length
- Flip drilling
- Drill wander
- Layer alignment
- Via plating
- "Sweet spot"
- Board thickness limitations

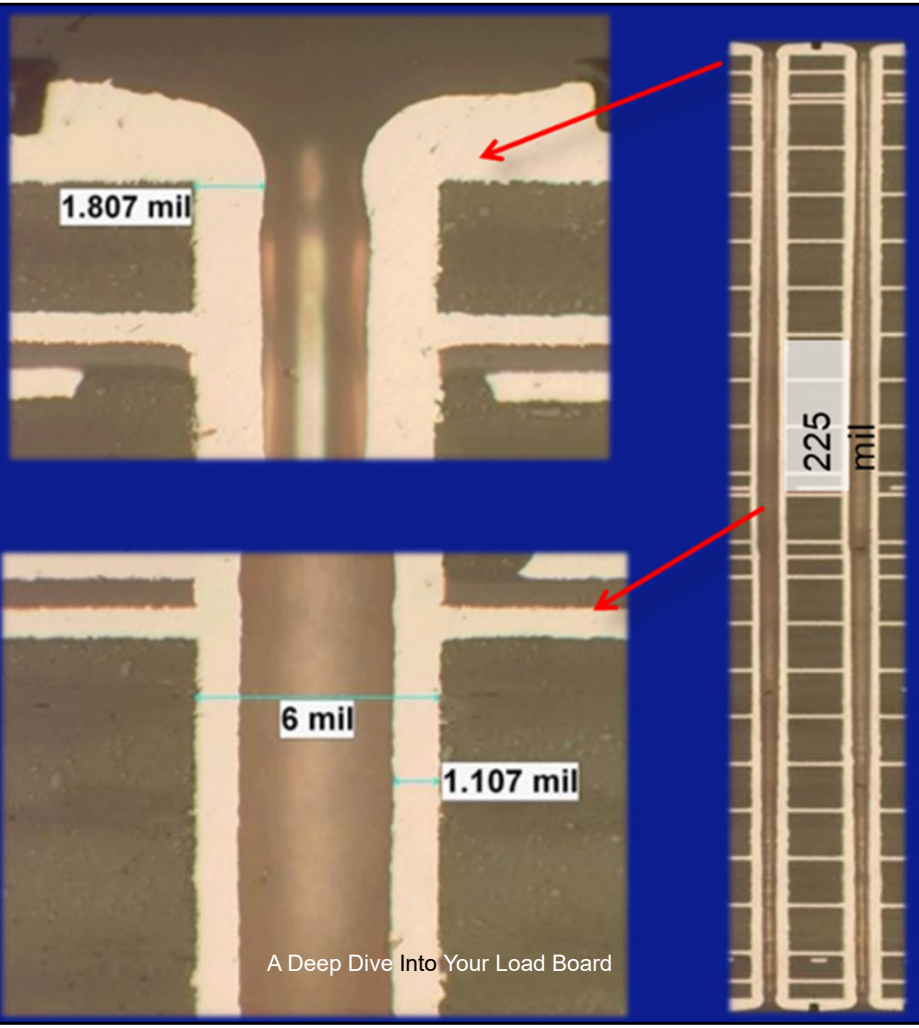
Unless otherwise noted, pictures and videos are provided by R&D Altanova

Aspect Ratio – what is it and why do I care?

- It's the ratio of board thickness / drill diameter
- In device test, some typical aspect ratio's:
  - 1.0mm, 13:1
  - 0.8mm, 16:1
  - 0.5mm, 31:1
  - 0.4mm, 38:1
  - 0.35mm, 40:1

Calculations based on a 5.0mm thick load board

Aspect Ratio – its affect on plating



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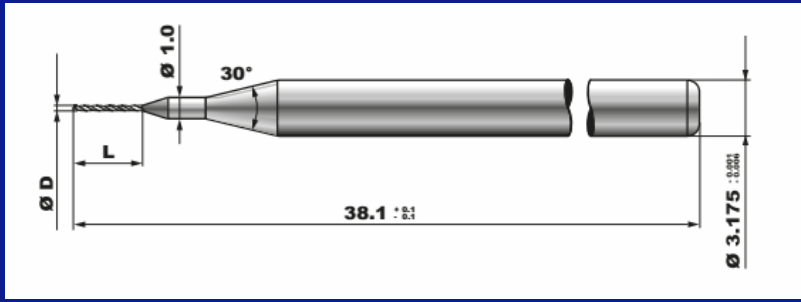
Flute Length

- Working part of a drill
  - 35mm to 50mm overall length
  - Shank diameter = 3.175mm
  - Shoulder diameter = 1.0mm
  - Flute length = < 2mm to 10mm



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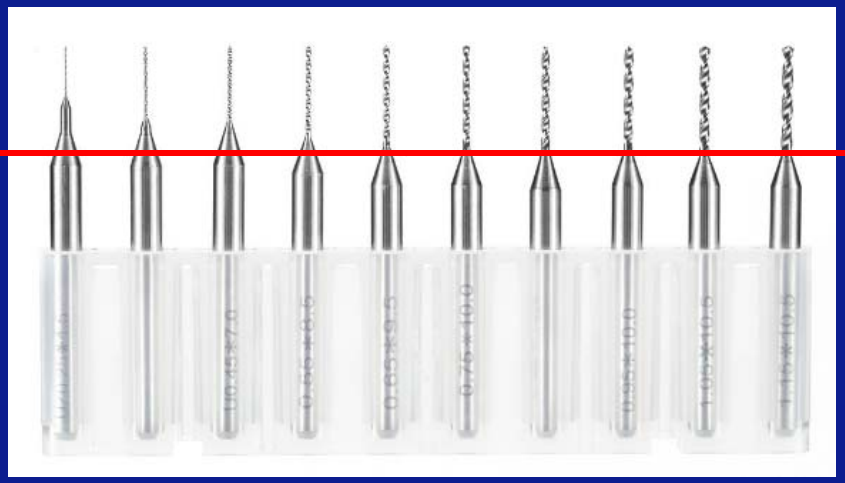
Various flute lengths depending on diameter

0.25mm



1.15mm

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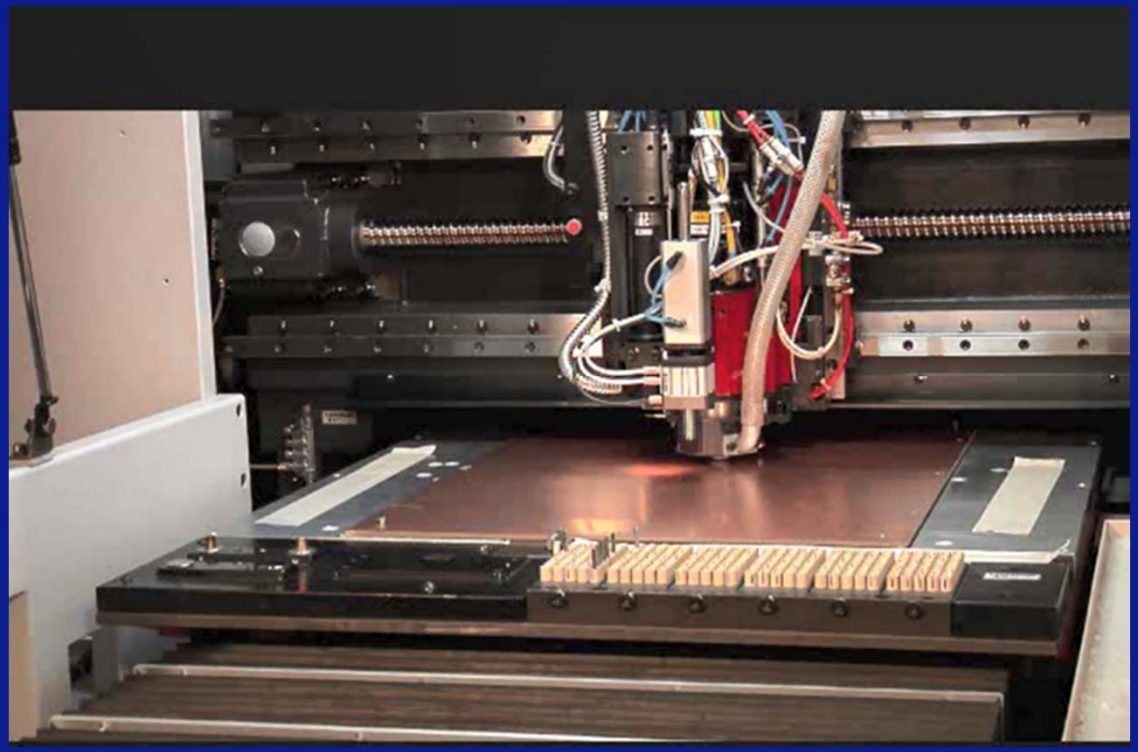
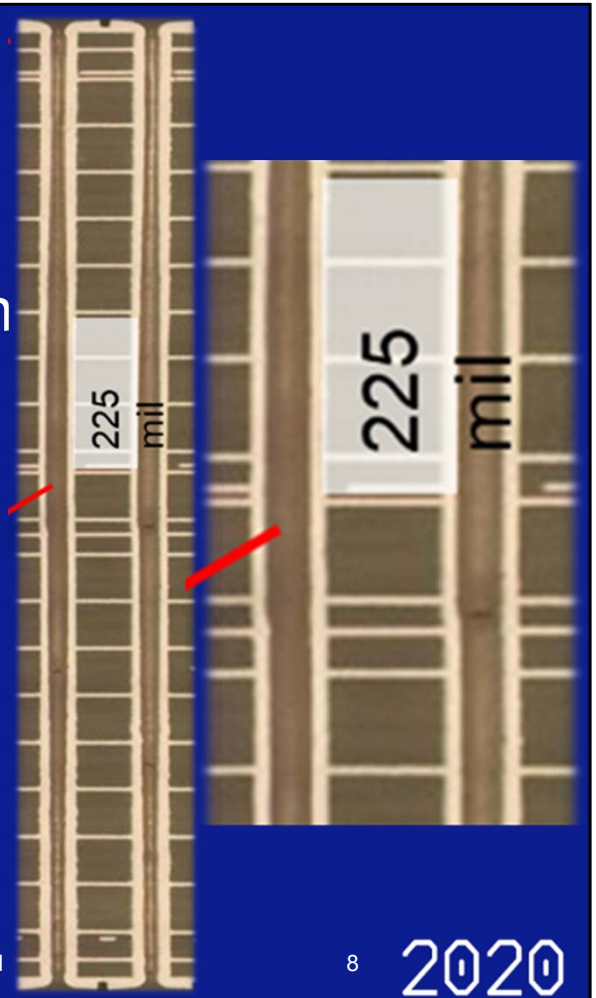
Drill Machines

- Drill side one
- Flip
- Drill side two

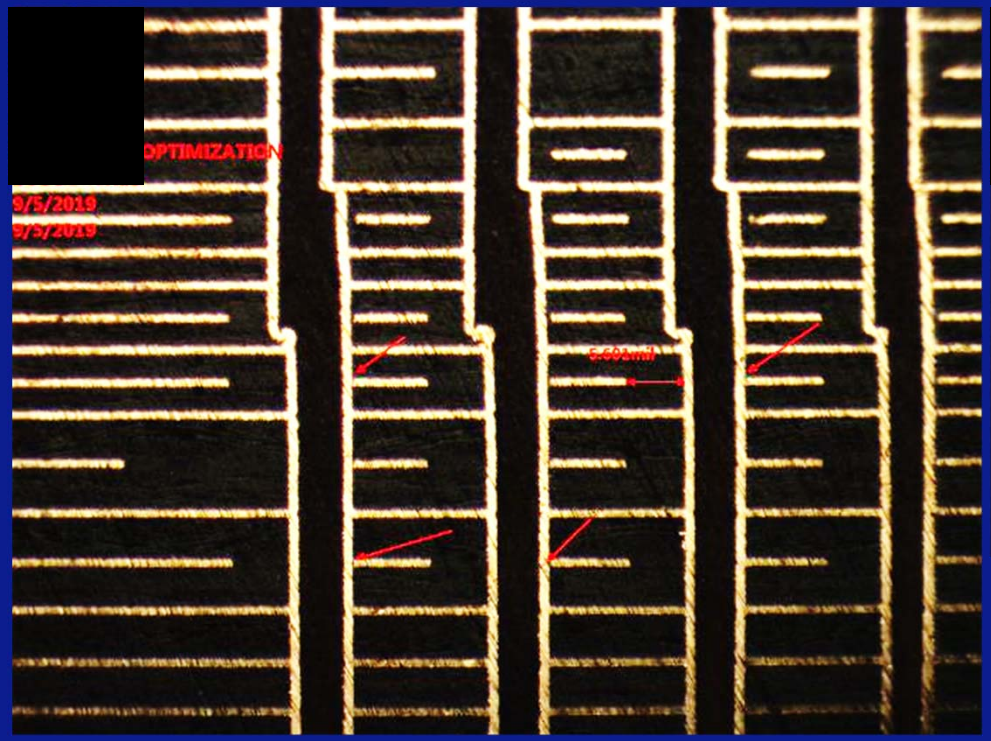


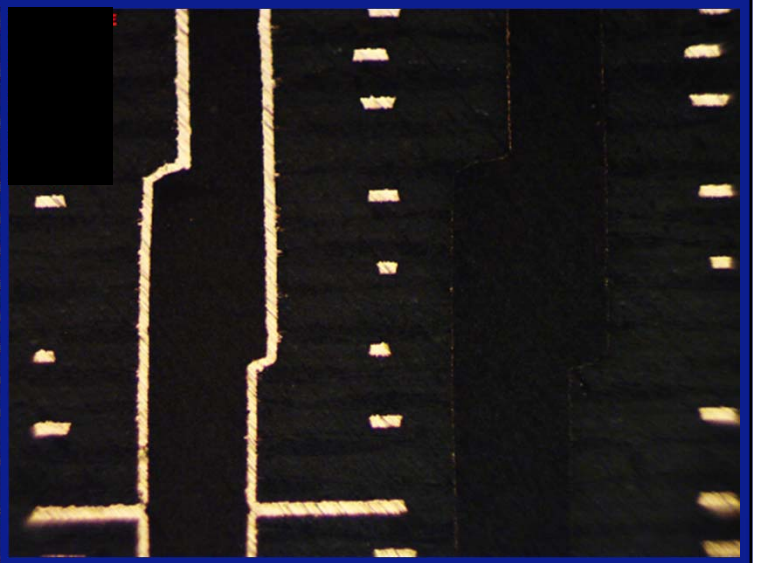
That leads us to Flip-Drilling

- A 5.72mm thick load board
- 3.0mm (or less) drill doesn't go through
- Flip drill
  - Drill one hole location from both sides

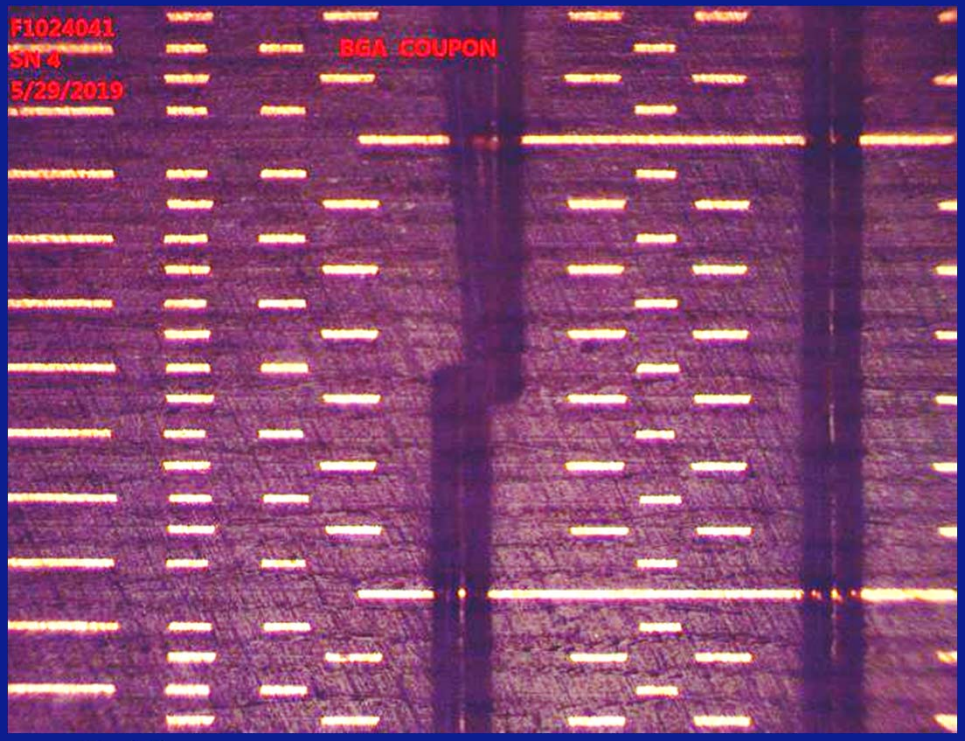


How NOT to Flip Drill

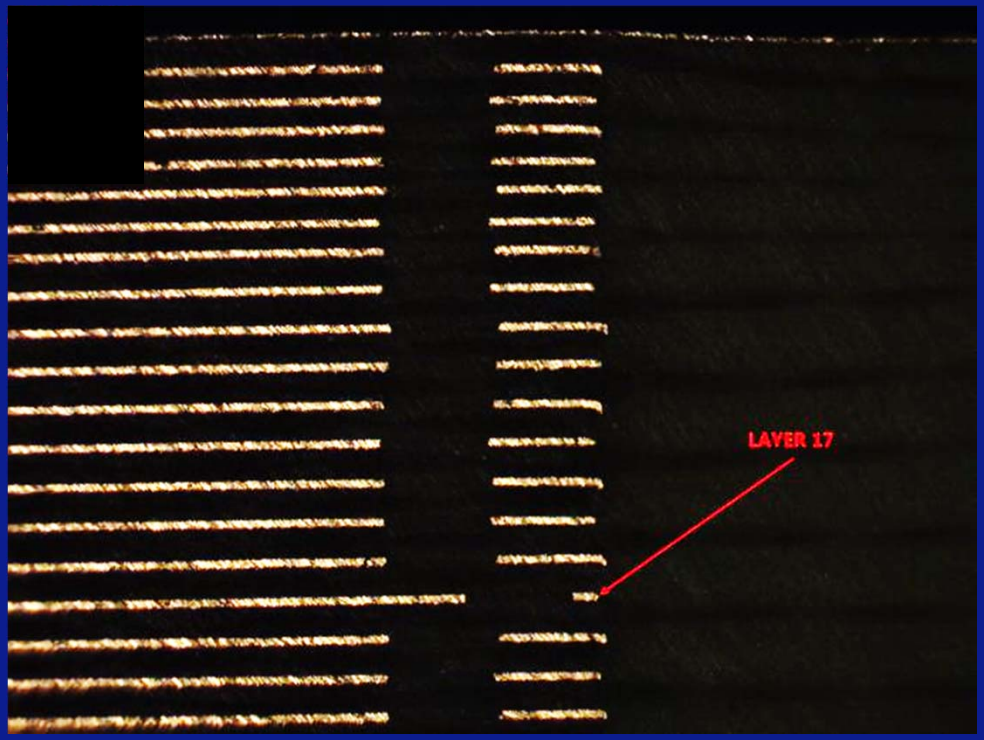




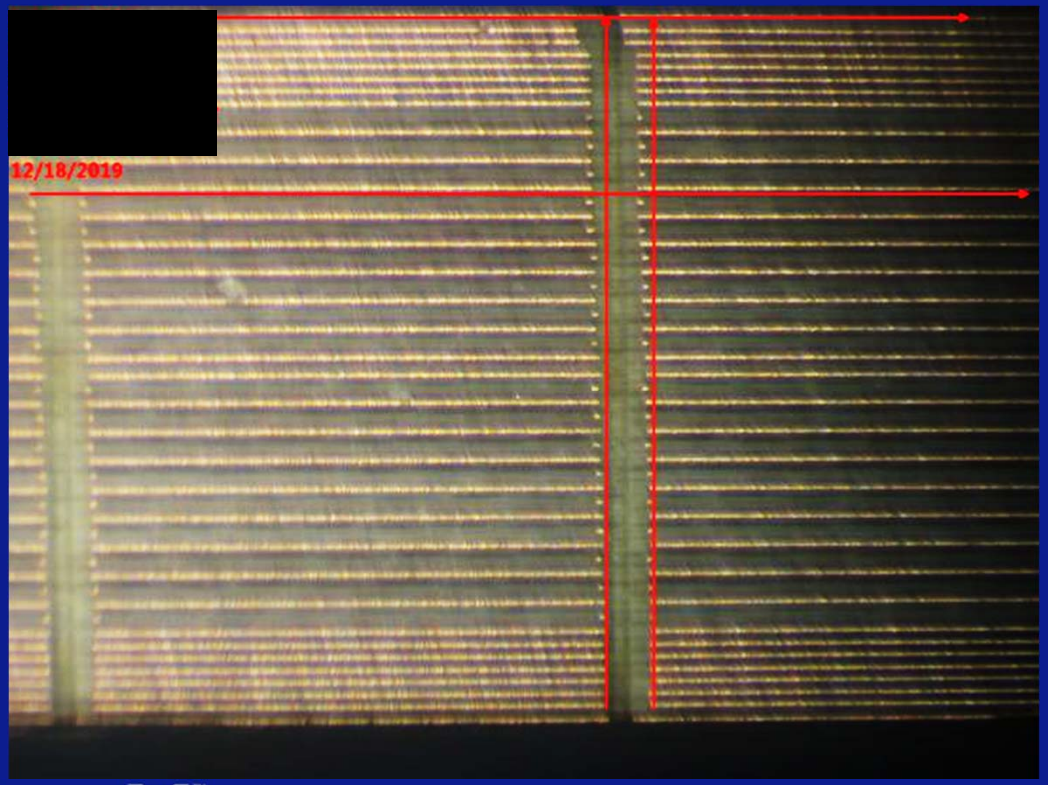
How Also NOT to Flip Drill



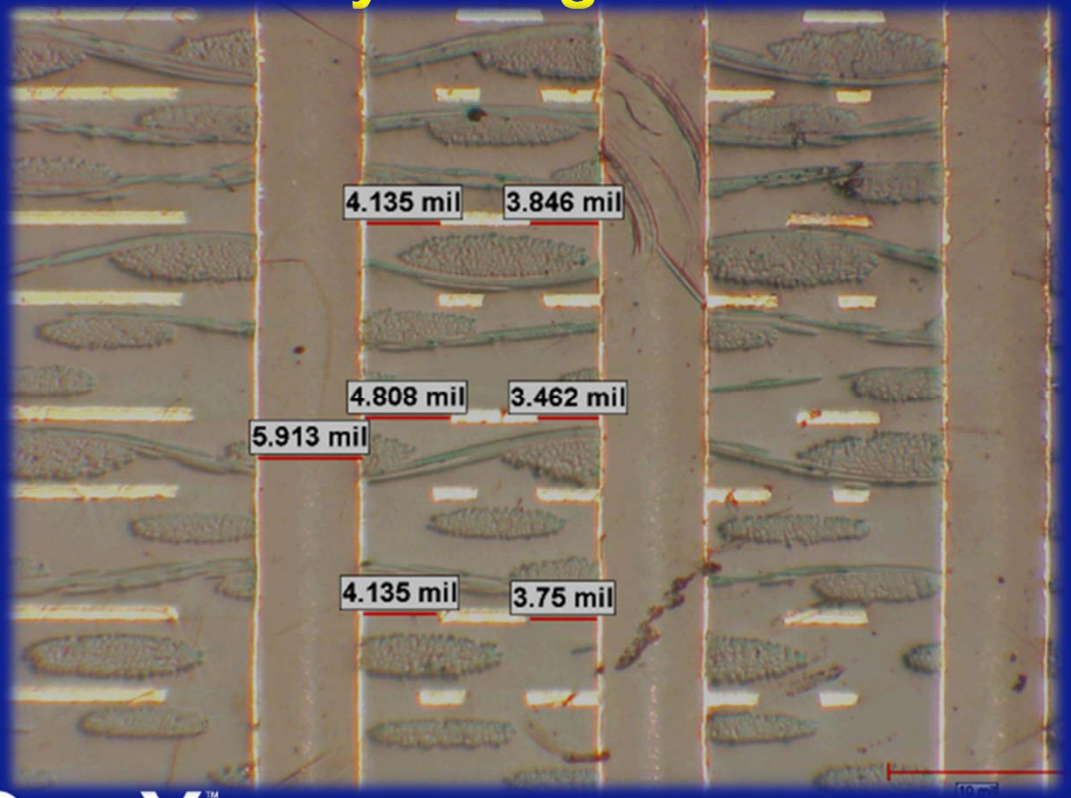
Layer Shift



Drill Wander



Layer Alignment



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2020

Why All this Worry About Alignment?

	1.0mm (0.0394)	0.8mm (0.0315)	0.5mm (0.0197)	0.4mm (0.0157)
Pad	0.76mm (0.0299)	0.66mm (0.026)	0.35mm (0.0138)	0.3mm (0.0118)
Hole	0.37mm (0.0146)	0.3mm (0.0118)	0.15mm (0.0059)	0.1mm (0.0039)
Line	200µ (0.008)	200µ/125µ (0.008/0.005)	200µ/75µ (0.008/0.003)	200µ/50µ (0.008/0.002)
Hole 2 Copper	0.25mm (0.010)	0.18mm (0.007)	0.12mm (0.005)	0.1mm (0.004)
Aspect Ratio	Low	Medium	High	Extreme

Via Plating

- Cathode bar
  - For the board
- Anode bar(s)
  - Facing each side
- Plating solution
  - Copper sulfate
    - Think rock salt
  - Water
  - Other ingredients

Via Plating

- High Aspect Ratio Challenges
- Fluid dynamics inhibit flow of chemistry through holes
  - Air bubbles or pockets form
- Electroplating wasn't designed for holes
  - Think chrome bumper on your first car

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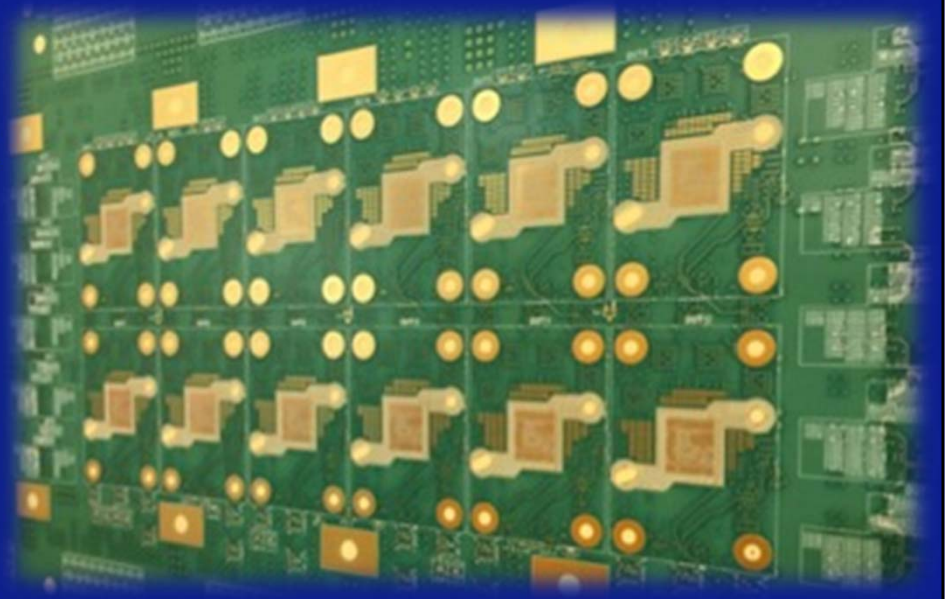
- Reverse Pulse Plating or Dutch Reverse Pulse Plating
  - Enhances the throwing power into high aspect ratio holes
  - Minimizes copper buildup on the surface

The Sweet Spot

- There is an area of the process panel in printed circuit manufacturing we like to call “The Sweet Spot”
- In the early days of test, it occupied the center of the panel and was maybe 40mm^2

The Sweet Spot

- Now we would say it consumes 300mm x 100mm or more
- It's important to know that the tolerances have not changed, only the area required for them has.



The Tolerance Budget

	1.0mm (0.0394)	0.8mm (0.0315)	0.5mm (0.0197)	0.4mm (0.0157)
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Board Thickness Limitations – A Summary

- Aspect ratio's
- Flute length
- Flip drilling
- Drill wander
- Layer alignment
- Via plating
- "Sweet spot"

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