PCB design-rules om een goed produceerbaar design voor HDI en VHDI printen te maken

Door: Boy van Veghel

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Onderwerpen

- Component pitch
- Verschillende Stack-ups
- Mogelijkheden drill-pairs
- Design rules HDI & VHDI
- Soldeermasker uitdaging bij fine pitch
- QPI R&D

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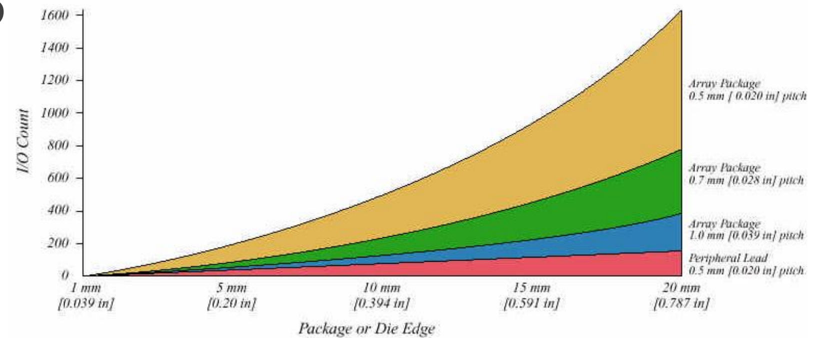
Component pitch

- Pitches van BGA,LGA,CSP
  - worden als maar kleiner
  - Packages worden kleiner
  - Meer functionaliteit
  - Meer i/o per mm2



- 0.5 & 0.4 mm pitch BGA’s zijn veel voorkomende packages
- 0.35 mm komt eraan, trend zet door
- Keuze stack-up & design rules is essentieel

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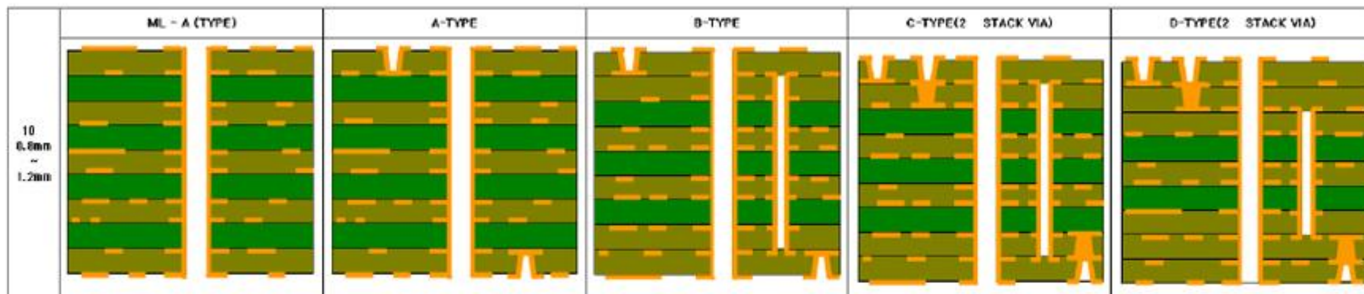
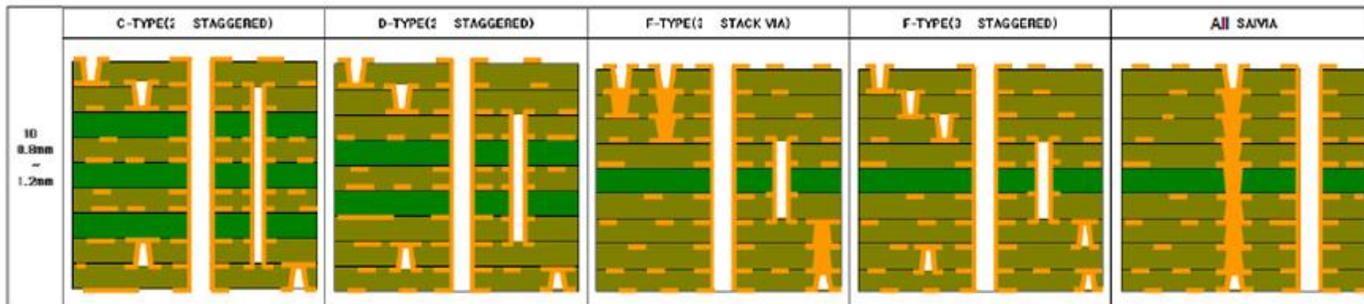
Stack-ups

- Veel verschillende keuzes in stack-up
- Juiste keuze is erg belangrijk bij start layout





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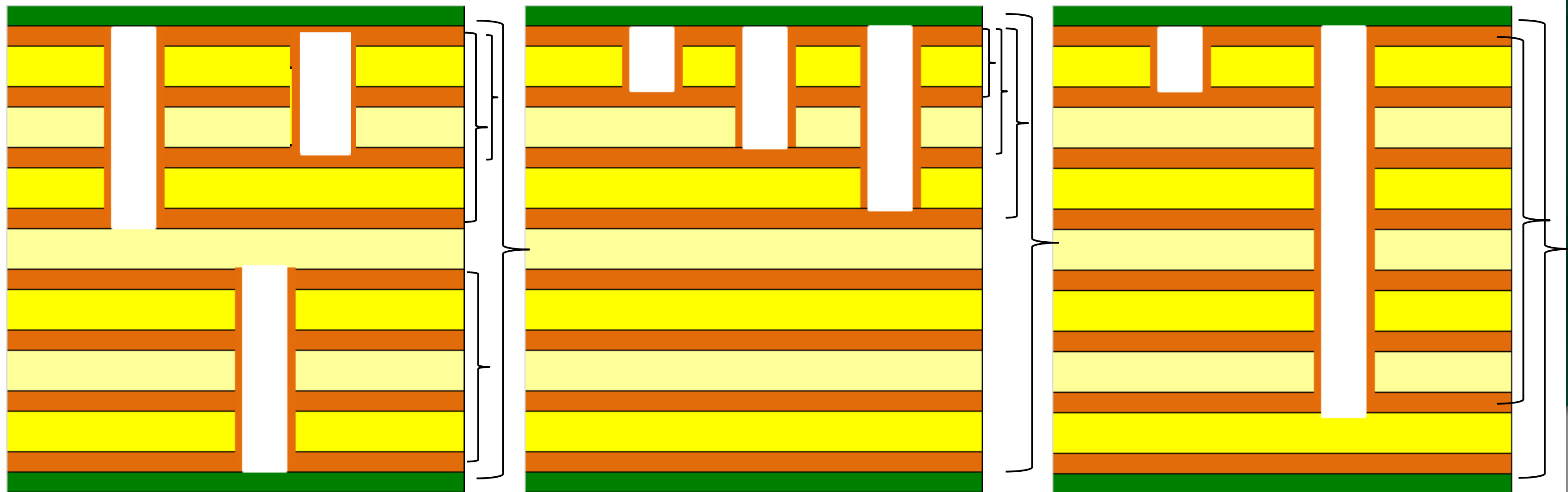
Stack-ups

- Verkeerde keuzes
  - Multi bond, multi plating, a-symmetrisch
  - Erg lastig te produceren
  - Lage yield, hoge kosten



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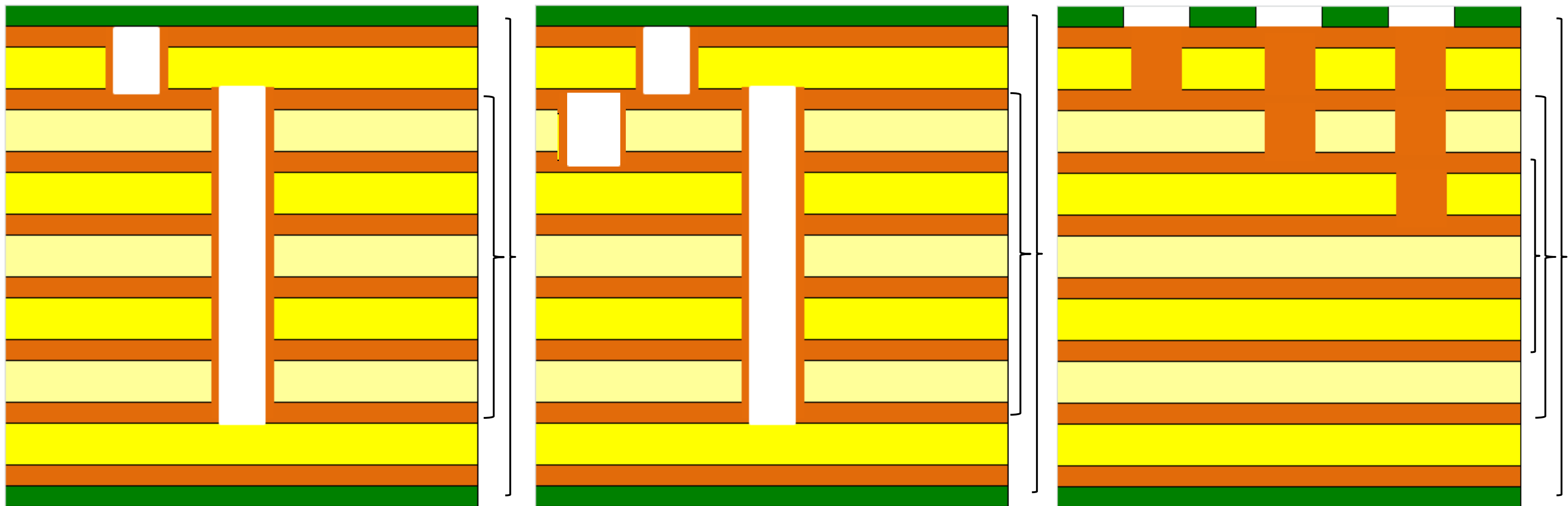
Stack-ups

- Goede keuzes
  - Multi bond, single plating, symmetrisch
  - Goede yield



Stack-up

- Stack-up & design rules worden bepaald door
  - i/o per component
  - Pitch van component
  - Component densiteit
  - Impedantie vereiste
    - Aantal impedantie en aantal p/g lagen
- Juiste keuze bepaald yield en dus prijs
- IPC 2226 bied een aantal standaard opties

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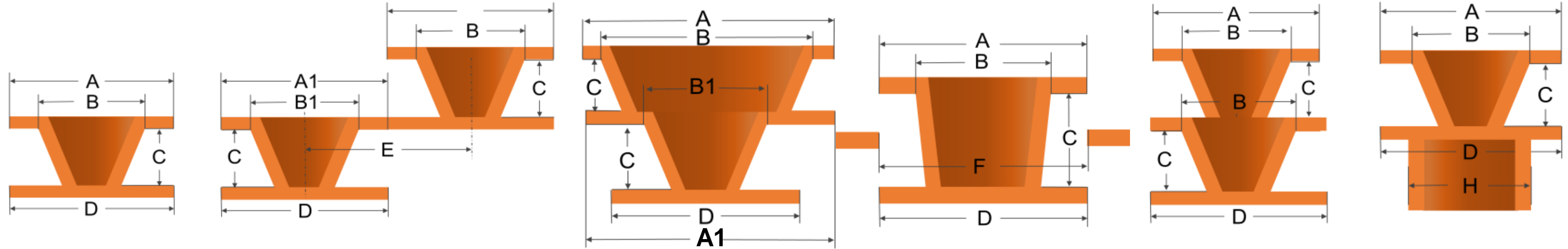
Drill pairs(HDI)



Type 1)	Type 2)	Type 3)	Type 4)	Type 5)	Type 6)
Standard	Staggered	Stepped	Skipped	Stacked	On pad

Index	Description	Unit	Type 1)		Type 2)		Type 3)		Type 4)		Type 5)		Type 6)	
	S=standard A=advanced		S:	A:	S:	A:	S:	A:	S:	A:	S:	A:	S:	A:
A	Microvia entry pad	[µm]	300	250	300	250	400	350	400	350	300	250	300	250
A1	Microvia entry pad	[µm]					200	200						
B	Laser drill	[µm]	100	100	100	100	400	350	200	200	100	100	100	100
B1	Laser drill	[µm]					100	100						
C	Dielectric thickness	[µm]	60-80	60-80	60-80	60-80	60-80	60-80	140	140	60-80	60-80	60-80	60-80
D	Capture pad	[µm]	300	250	300	250	300	250	400	350	300	250	500	450
E	Microvia pitch	[µm]			400	350								
F	Anti pad	[µm]							400	350				
G	Buried hole	[µm]											250	200

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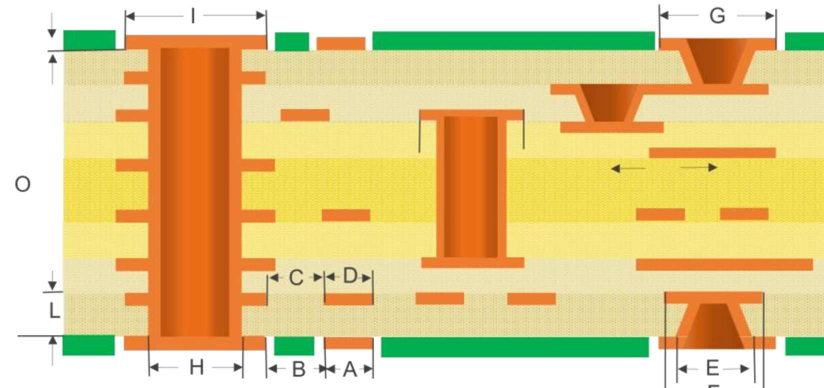
Design rules(HDI)



Design-Rules for laser drilled HDI-PCBs

Symbol	Feature	Unit	IPC 2226 Level B	Advanced
A	Line width Cu thickness > 35µm	[µm / mil]	100 / 4	75 / 3
B	Spacing at Cu thickness > 35µm	[µm / mil]	125 / 5	100 / 4
C	Spacing pad to line inner layer	[µm / mil]	100 / 4	75 / 3
D	Line width innerlayer Cu > 35µm	[µm / mil]	100 / 4	75 / 3
E	Laser drill size, outer Layer	[µm / mil]	125 / 5	100 / 4
F	Landing pad size, inner layer	[µm / mil]	330 / 13	250 / 10
G	Diameter capture pad, outer layer	[µm / mil]	330 / 13	250 / 10
H	Diameter through hole	[µm / mil]	230 / 9	125 / 5
I	Diameter pad through hole	[µm / mil]	330 / 13	230 / 9
J	Diameter burried hole pad	[µm / mil]	330 / 13	230 / 9
K	Base copper outer layer	[µm / mil]	18 / 0.7	12 / 0.03
L	Dielectric thickness	[µm / mil]	60-80 / 2.4-3	60-80 / 2.4-3
M	Microvia pitch	[µm / mil]	500 / 20	350 / 14

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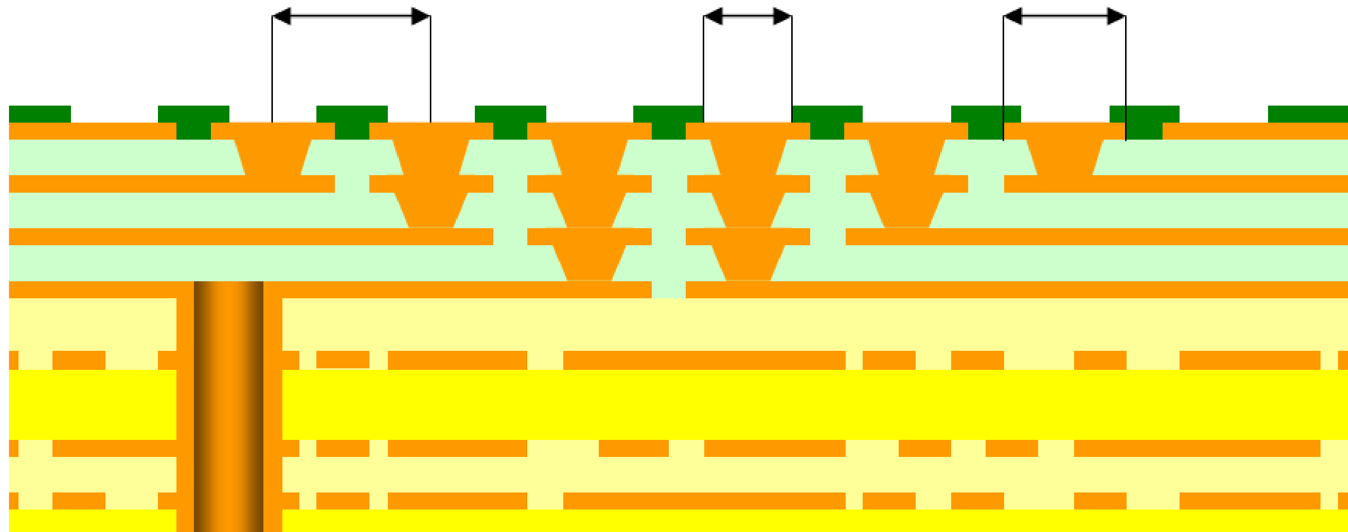
Design rules(HDI)

- Pitches <0.5
- Stacked via's 75-100µ Cu filled
- Geen "hightech" design rules nodig



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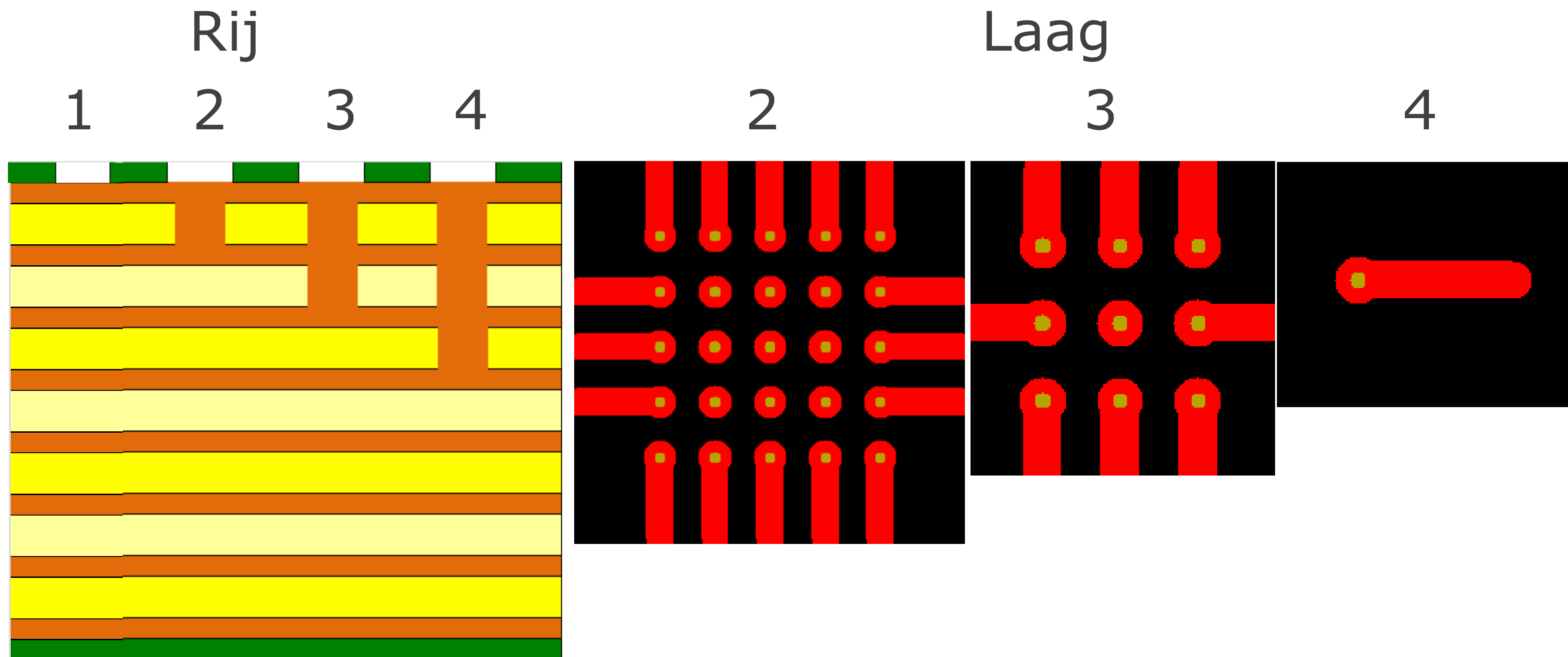
Design rules(HDI)

- Elke rij wordt op een afzonderlijk laag ge-rout
  - Rij 1 op laag 1, rij 2 op laag 2 etc.



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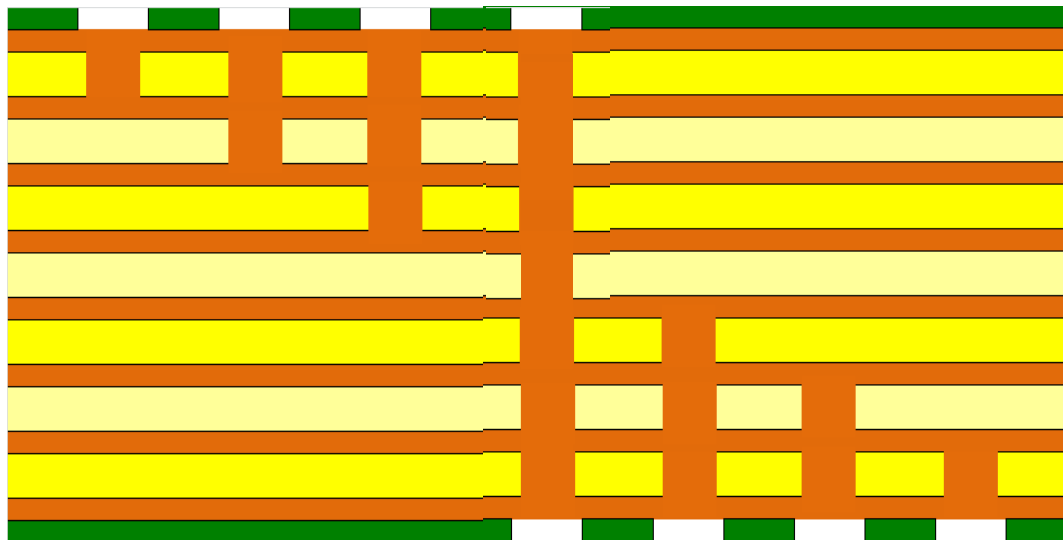
Design rules(HDI)

- Bij full array BGA(10x10) gebruikt men "Any layer" technologie



8 lagen
3 pers cycli
7 boorgangen

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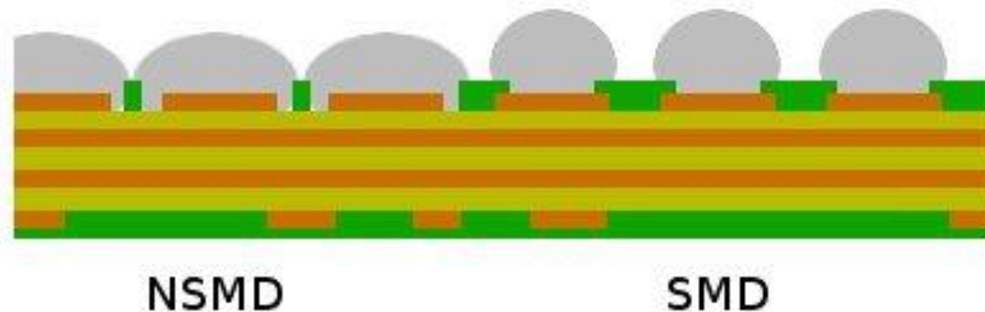
Soldeermasker(HDI) NSMD, SMD

- Pitches <0.3 mm
  - SM registratie erg kritisch(10-15µ)
  - SM opening erg kritisch(80-90µ) met SMD
  - SM dam (min. 75µ) met NSMD
- LDI soldeermasker, dunne laag ~10-15µ



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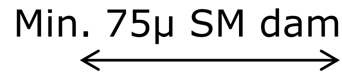
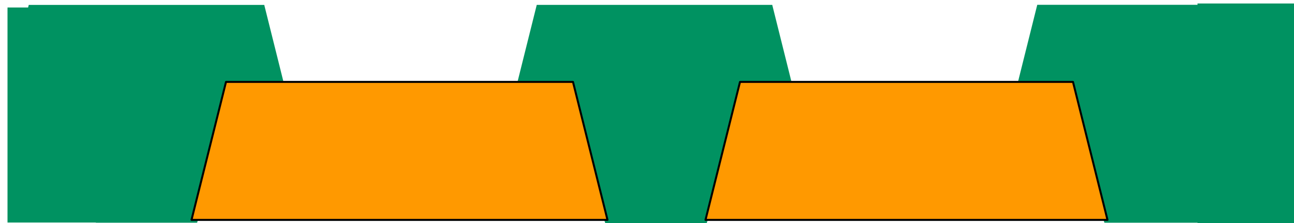
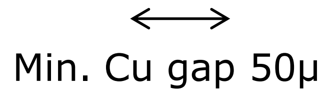
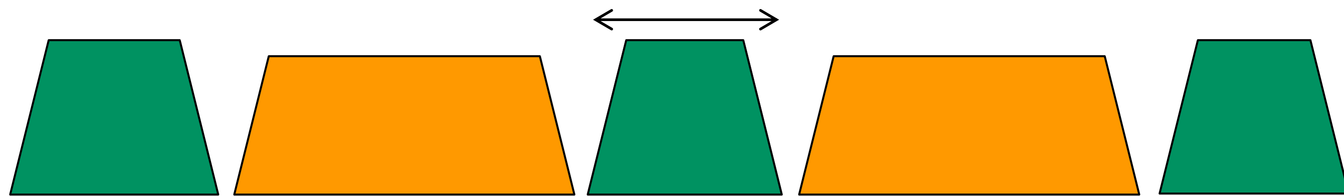
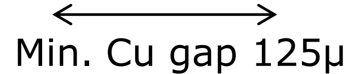
Soldeermasker(HDI) NSMD, SMD

- SM “undercut”







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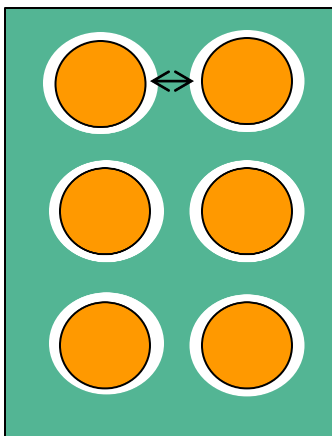
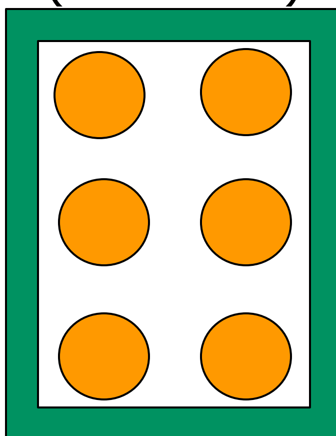
Soldeermasker(HDI) NSMD, SMD

NSMD



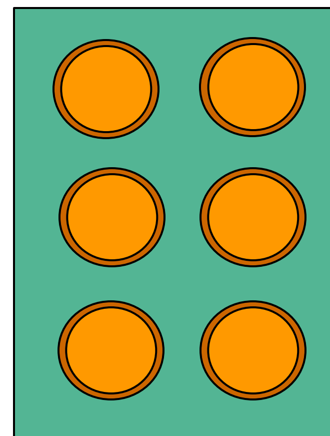
- Cu pad 80-100µ
- SM registratie en SM opening kritisch
- Dam min. 75µ

NSMD (Voorkeur)



- Cu pad 80-100µ
- SM registratie kritisch

SMD



- Cu pad 100-120µ
- SM registratie en SM opening kritisch 80-90µ
- Dam min. 75µ

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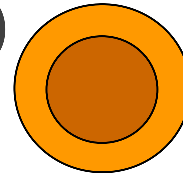
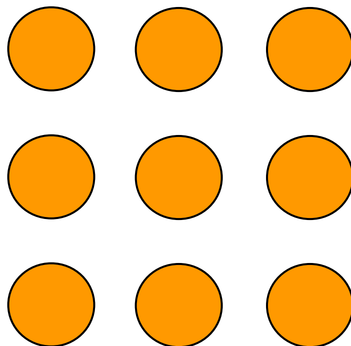
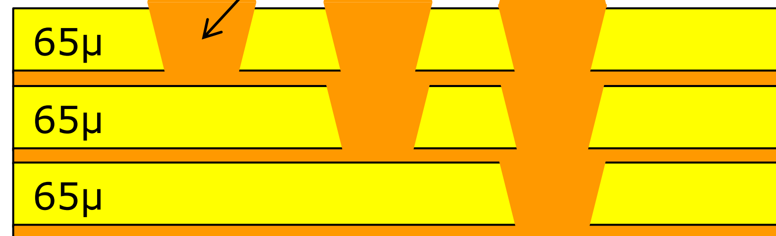
QPI R&D (VHDI)

- 0.15-0.2 mm pitch(Ultra-fine)
- “Landless hole” technologie
  - Cu gevulde laser via’s
  - Geen sporen aan de buitenzijdes
  - Geen SM rondom BGA



No Annular ring





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QPI R&D (VHDI)

- 0.15-0.2 mm pitch eerste resultaten

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QPI R&D (VHDI)

- 0.15-0.2 mm pitch design rules(voorlopig)

BGA Pitch	200µ	190µ	180µ	170µ	160µ	150µ
Cu Pad size	140µ	130µ	120µ	110µ	105µ	95µ
Cu Pad2Pad	60µ	60µ	60µ	60µ	55µ	55µ
SM clearanc e	100µ	95µ	90µ	85µ	80µ	75µ
Stacked via	Yes	Yes	Yes	Yes	Yes	Yes
Landless Laser via	140µ	130µ	120µ	110µ	105µ	95µ

QPI R&D (VHDI)

- Pitches <0.15 mm
- PCB technologie gelimiteerd
  - Subtractieve technologie
    - Etsen Cu
  - Laser boren
  - LDI belichting
- Lithography technologie in PCB fabriek
  - Dunne film technologie
  - Additieve technologie
    - Sputteren

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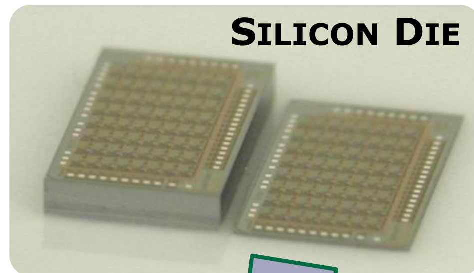
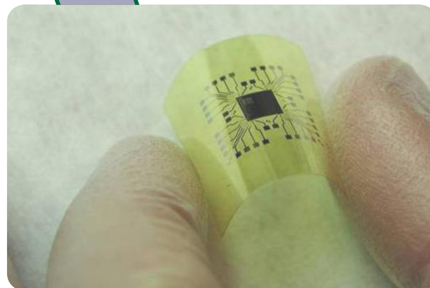
QPI R&D (VHDI)

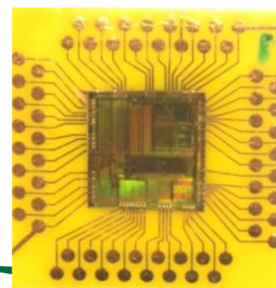
- Ultra-Thin-Chip-Package (UTCP) IMEC/Ugent
  - Next generation

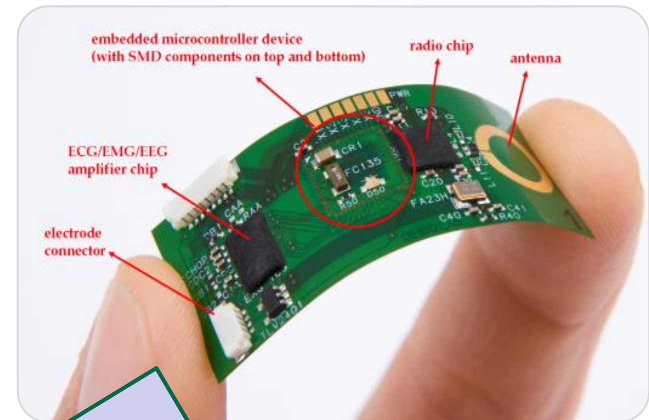


1. ULTRA THIN DIE 30µ

2. UTCP







3. EMBEDDED UTCP

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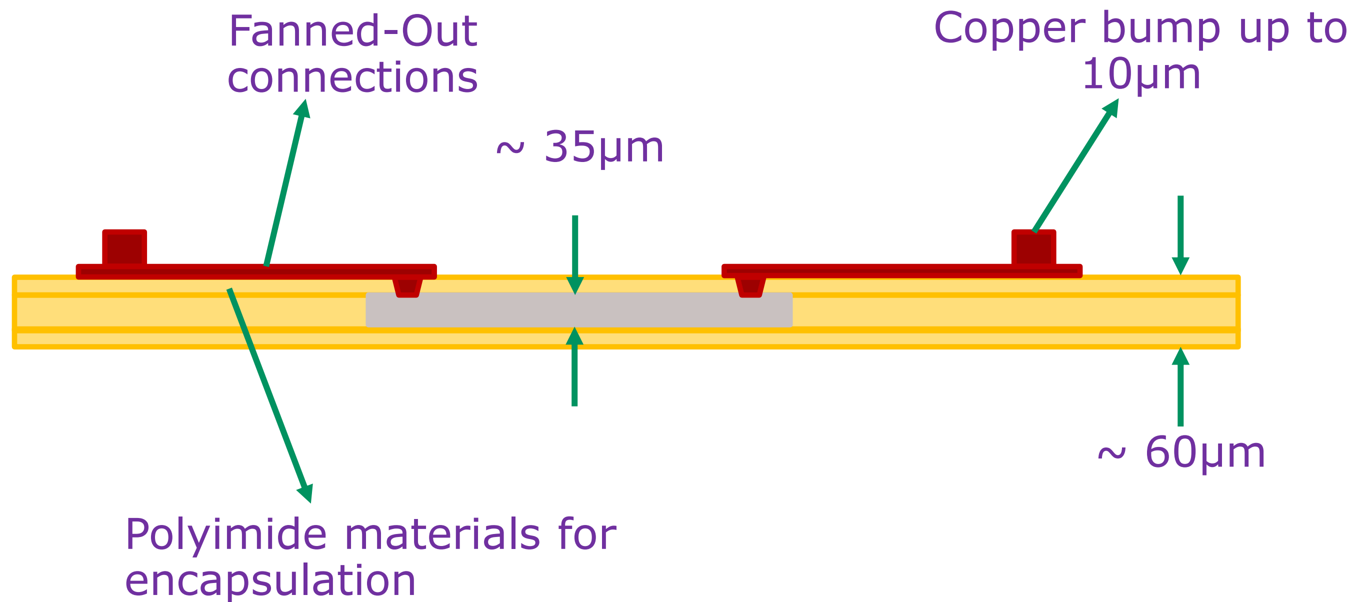
QPI R&D (VHDI)

- UTCP wordt aangeleverd
- Verwerken van UTCP in een PCB dmv standaard PCB processen en machines



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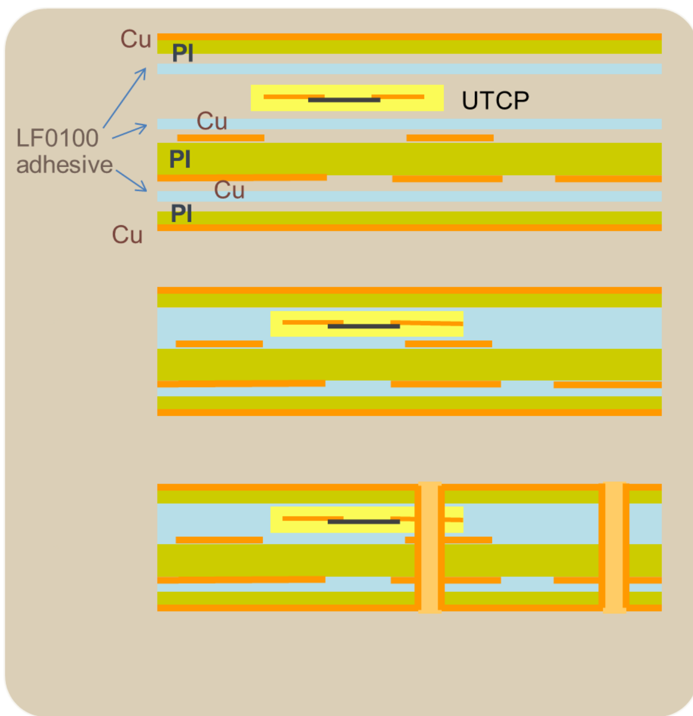
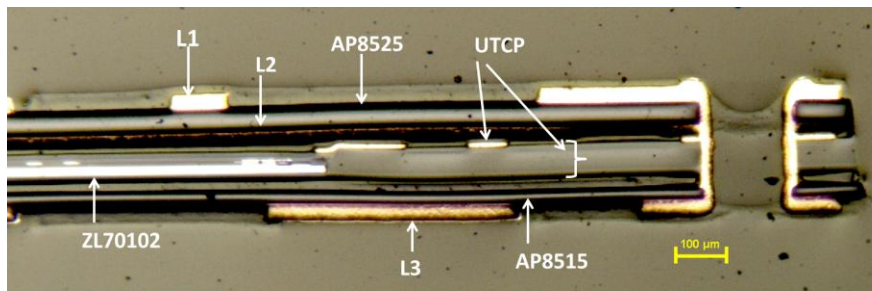
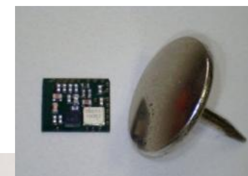
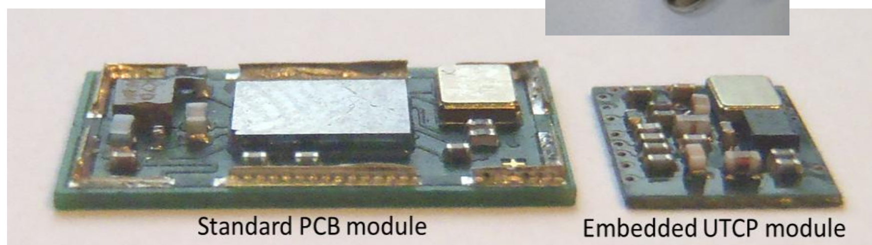
QPI R&D (VHDI)

- UTCP verperst in flex of rigid PCB









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