

Hvilke prosesser hos en mønsterkort  
produsent er ikke kostnad drivene?

Etsing

Laser boring

Det er billigere å produsere en 50 mikron leder, sammenlignet med en 100 mikron leder.

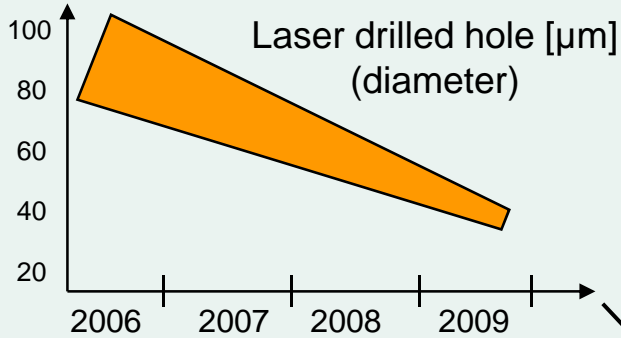
Du får en dobbel så lang ledning for samme prisen.

Hvor langt ned **kan** man gå?

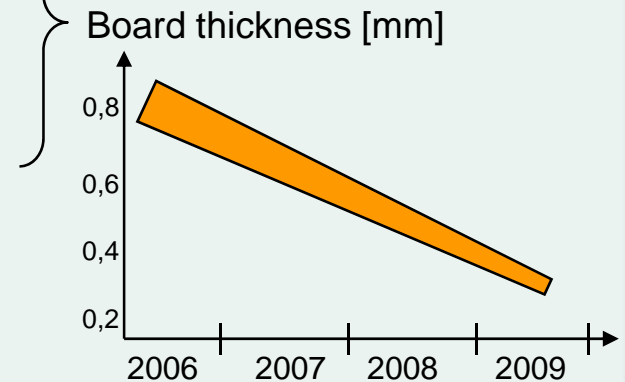
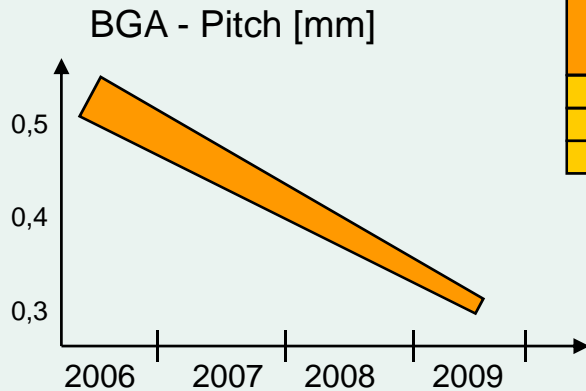
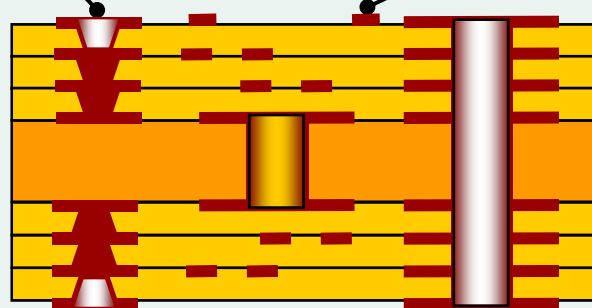
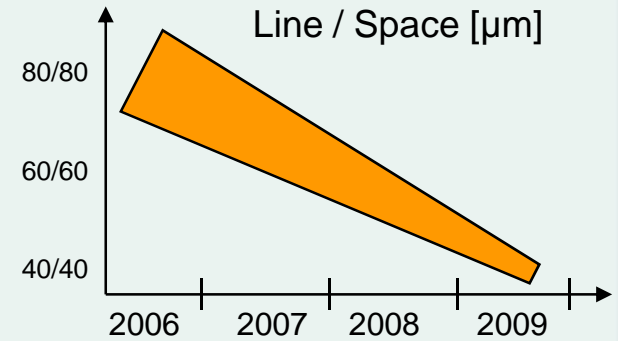
Hvor langt ned kan man gå før  
vraket går til himmels

Hvor langt ned **må** man gå?

# Overview – Technology Trends



- Decrease of nominal values
- Decrease of tolerances



## Standard Multilayer (HDI; SPP Operation)

### HDI Multilayer

Design (Volume Production)	2007	2008	2009	2010
Min. Line/space width ( $\mu\text{m}$ )	125	100	75	75
Min. Drilled Hole Size ( $\mu\text{m}$ )	200	200	200	200
Min. mech. Via-land (outer) ( $\mu\text{m}$ )	700	600	600	500
Min. mech. Via-land (inner) ( $\mu\text{m}$ )	700	600	600	500
Min. cooper thickness in hole ( $\mu\text{m}$ )	20/25	20/25	20/25	20/25
Thick copper inner/outer layer ( $\mu\text{m}$ )	70(105)	70(105)	70(105)	70(105)
Min. Laser Via-dia ( $\mu\text{m}$ )	130	100	100	100
Min. $\mu\text{via}$ -land (outer) ( $\mu\text{m}$ )	laser dia +250	laser dia +200	laser dia +200	laser dia +200
Min. $\mu\text{via}$ -land (inner) ( $\mu\text{m}$ )	laser dia +250	laser dia +200	laser dia +200	laser dia +200
Min. Solder mask registration ( $\mu\text{m}$ )	+/-38	+/-38	+/-38	+/-38
Aspect Ratio	1:8	1:8	1:8	1:8
Min. BGA-Pitch ( $\mu\text{m}$ )	600	600	500	500

## Standard Multilayer (Nanjangud Operation)

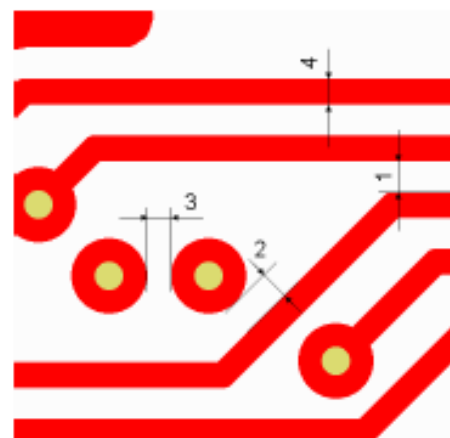
Design (Volume Production)	2007	2008	2009	2010
Min. Line/space width ( $\mu\text{m}$ )	125	125	100	75
Min. Drilled Hole Size ( $\mu\text{m}$ )	250	250	200	200
Min. mech. Via-land (outer) ( $\mu\text{m}$ )	700	600	600	500
Min. mech. Via-land (inner) ( $\mu\text{m}$ )	700	600	600	500
Min. copper thickness in hole ( $\mu\text{m}$ )	20/25	20/25	20/25	20/25
Thick copper inner/outer layer ( $\mu\text{m}$ )	70	70	70(105)	70(105)
max. board thickness	3,2	3,2	3,2	3,2
Aspect ratio	1:6	1:6	1:6	1:8
Solder mask registration	+/-75	+/-75	+/-50	+/-50
Min. BGA-Pitch ( $\mu\text{m}$ )	800	650	500	500

Design (Volume Production)	2007				2008				2009	2010
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q		
Min. Line/space width ( $\mu\text{m}$ )	60/60				60/60				50/50	35/35
Tolerance of Line width, Standard & Critical ( $\mu\text{m}$ )	+/-15 / +/-9				+/-15 / +/-9				+/-15 / +/-9	+/-15 / +/-9
Copper thickness surface max. ( $\mu\text{m}$ )	25				25				20	20
Min. $\mu\text{via-dia}$ ( $\mu\text{m}$ )	50				50				40	40
Min. $\mu\text{via-land}$ (outer) ( $\mu\text{m}$ )	250				230				180	150
Min. $\mu\text{via-land}$ (inner) ( $\mu\text{m}$ )	230				200				150	150
Min. mech. drill diameter ( $\mu\text{m}$ )	200				200				150	150
Min. mech. Via-land (outer) ( $\mu\text{m}$ )	450				400				350	350
Min. mech. Via-land (inner) ( $\mu\text{m}$ )	500				450				375	375
Min. Soldermask reg. ( $\mu\text{m}$ )	+/-38				+/-38				+/-25	+/-25
Min. BGA Pitch ( $\mu\text{m}$ )	400				400				400	300

## Etching capabilities

	Copper cladding		Track - Track <b>1</b>	Pad - Track <b>2</b>	Pad - Pad <b>3</b>	min. Track <b>4</b>
	[ $\mu\text{m}$ ]	[ $\mu\text{m}$ ]				
Copper cladding + galv. copper						
Innerlayers						
	18	18	78	78	78	78
	35	35	76	76	76	76
	70	70	170	150	150	150
	105	105	250	250	250	250
External layers						
	6-9	35	76	78	76	78
	18	45	100	100	100	100
	35	70	180	150	150	150
	70	105	250	250	250	250
	105	140	280	280	280	300

↔ Differential etching from 18 $\mu\text{m}$  copper cladding

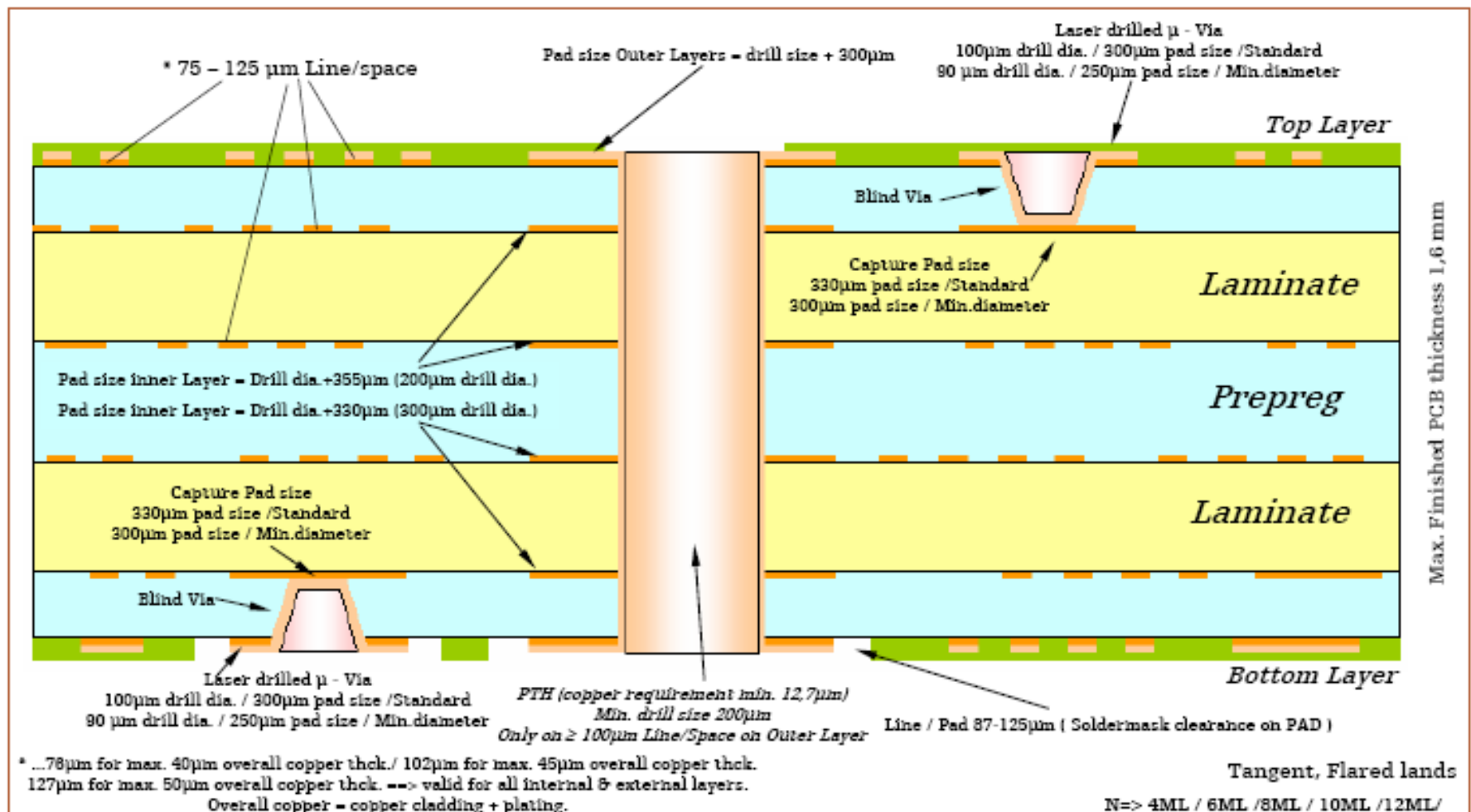


Please open the presentation for detailed information regarding design rules:

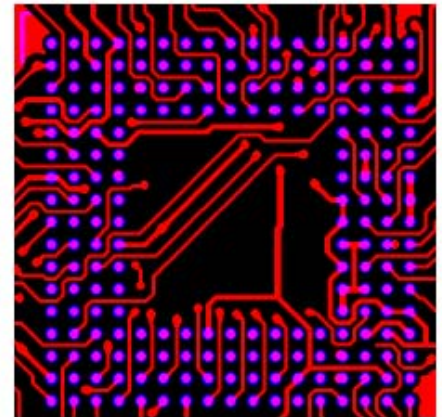
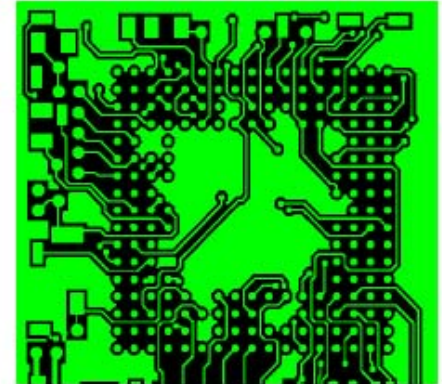


AT&S SPP - Design Rules

# Microvia fra begge sider

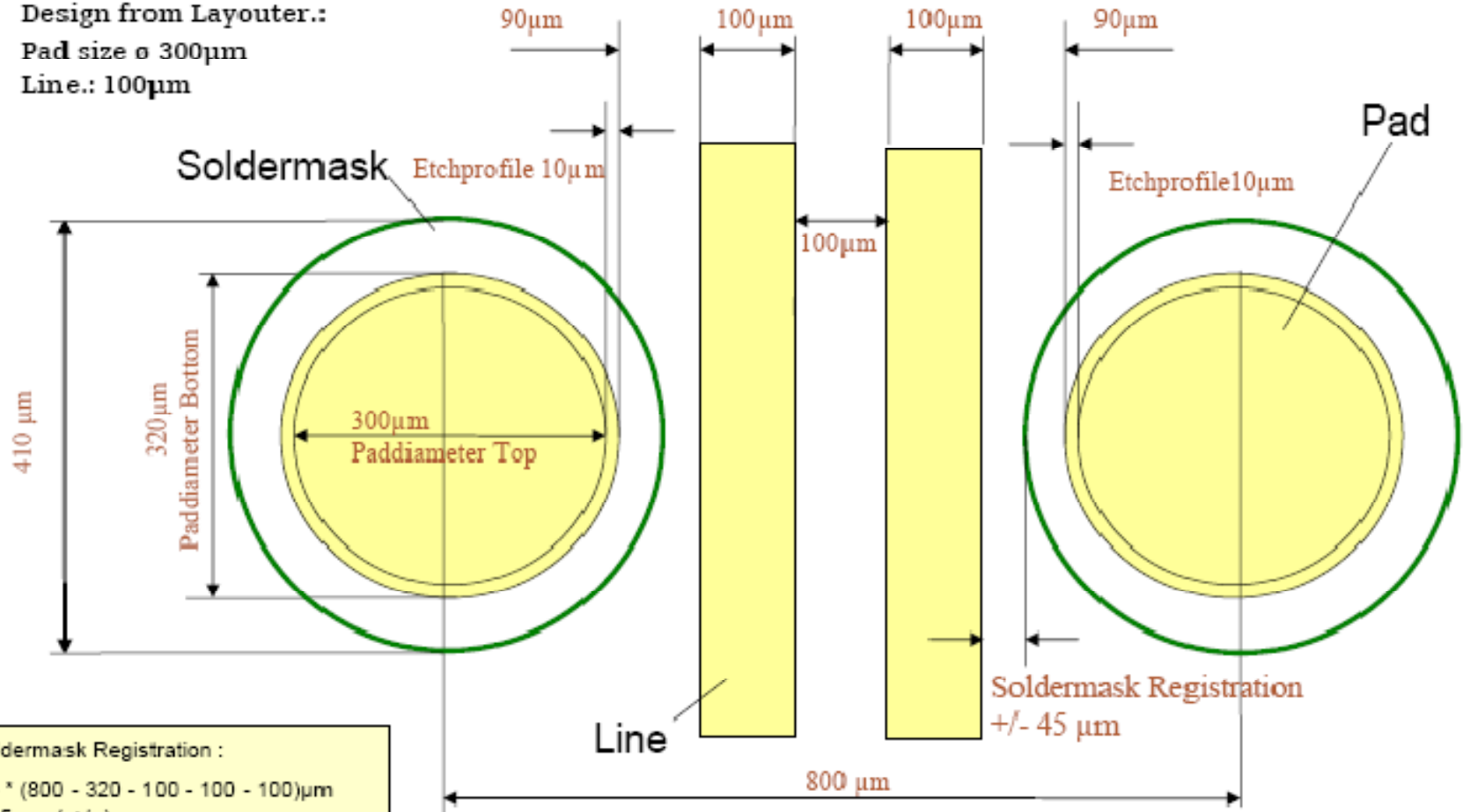


- 1.) 0,8 mm Ball Grid Array 300  $\mu\text{m}$  Pad size
- 2.) 0,65 mm Ball Grid Array 300  $\mu\text{m}$  Pad size
- 3.) 0,65 mm Ball Grid Array 250  $\mu\text{m}$  Pad size
- 4.) 0,5 mm Ball Grid Array 300  $\mu\text{m}$  Pad size
- 5.) 0,5 mm Ball Grid Array 250  $\mu\text{m}$  Pad size
- 6.) 0,4 mm Ball Grid Array 250  $\mu\text{m}$  Pad size



## 0,80 mm BGA

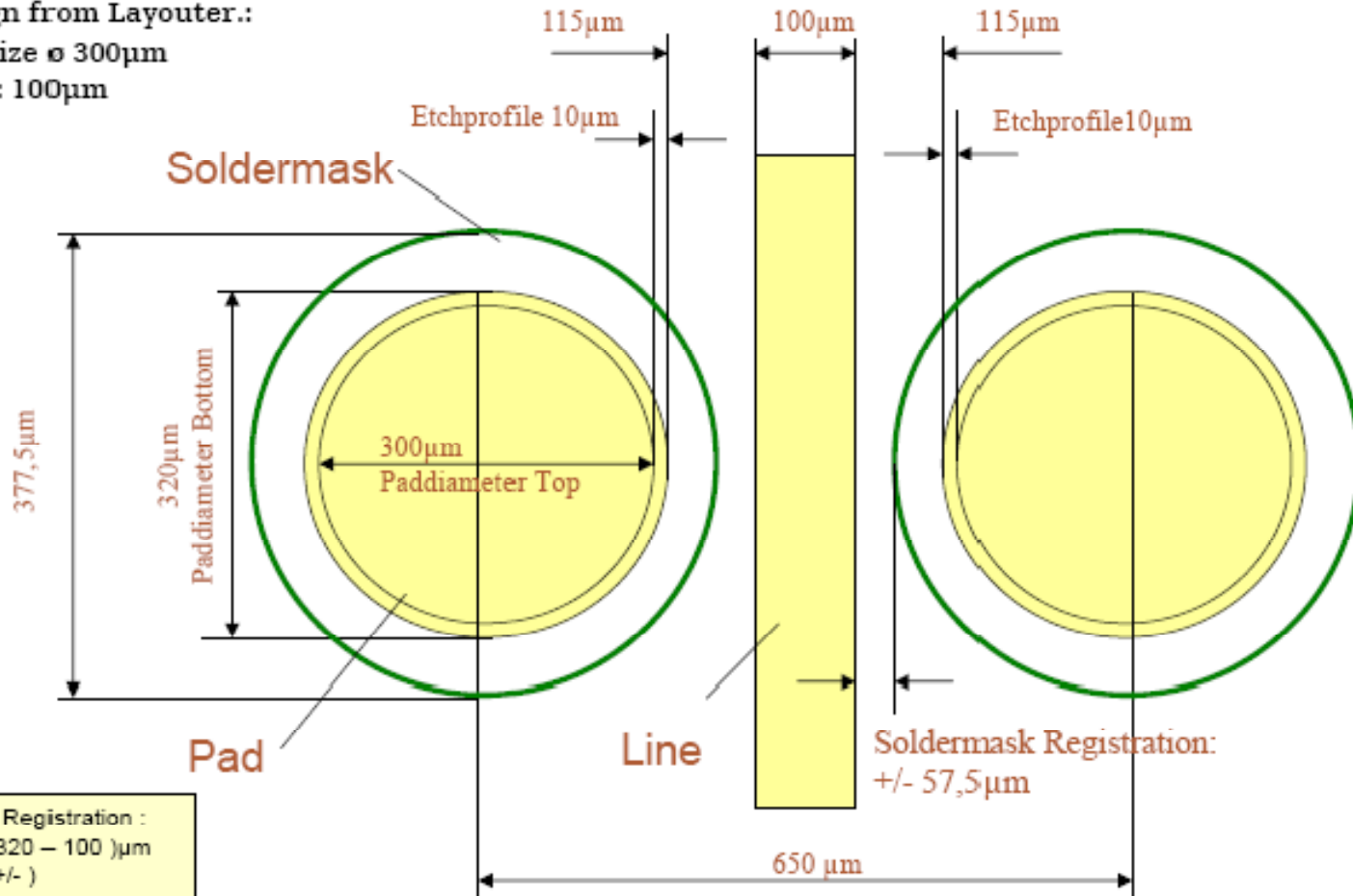
- Design from Layouter.:
- Pad size  $\phi$  300 $\mu$ m
- Line.: 100 $\mu$ m



Soldermask Registration :  
 $1/4 * (800 - 320 - 100 - 100 - 100) \mu\text{m}$   
 $= 45 \mu\text{m} ( +/- )$

# 0,65 mm BGA

- Design from Layouter.:
- Pad size  $\varnothing 300\mu\text{m}$
- Line.:  $100\mu\text{m}$

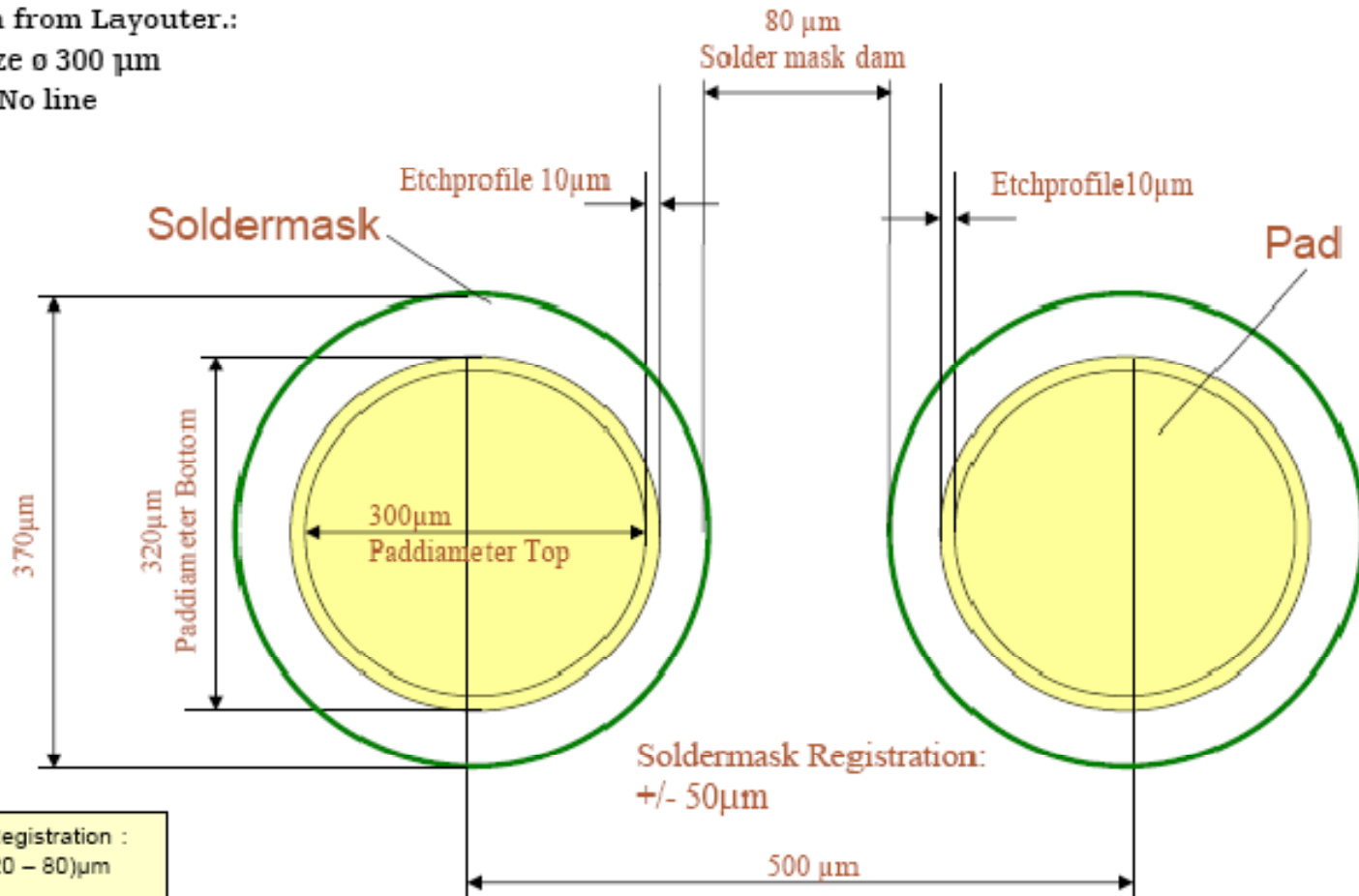


Soldermask Registration :  
 $\frac{1}{4} * (850 - 320 - 100) \mu\text{m}$   
 $= 57,5 \mu\text{m} ( \pm )$



# 0,50 mm BGA

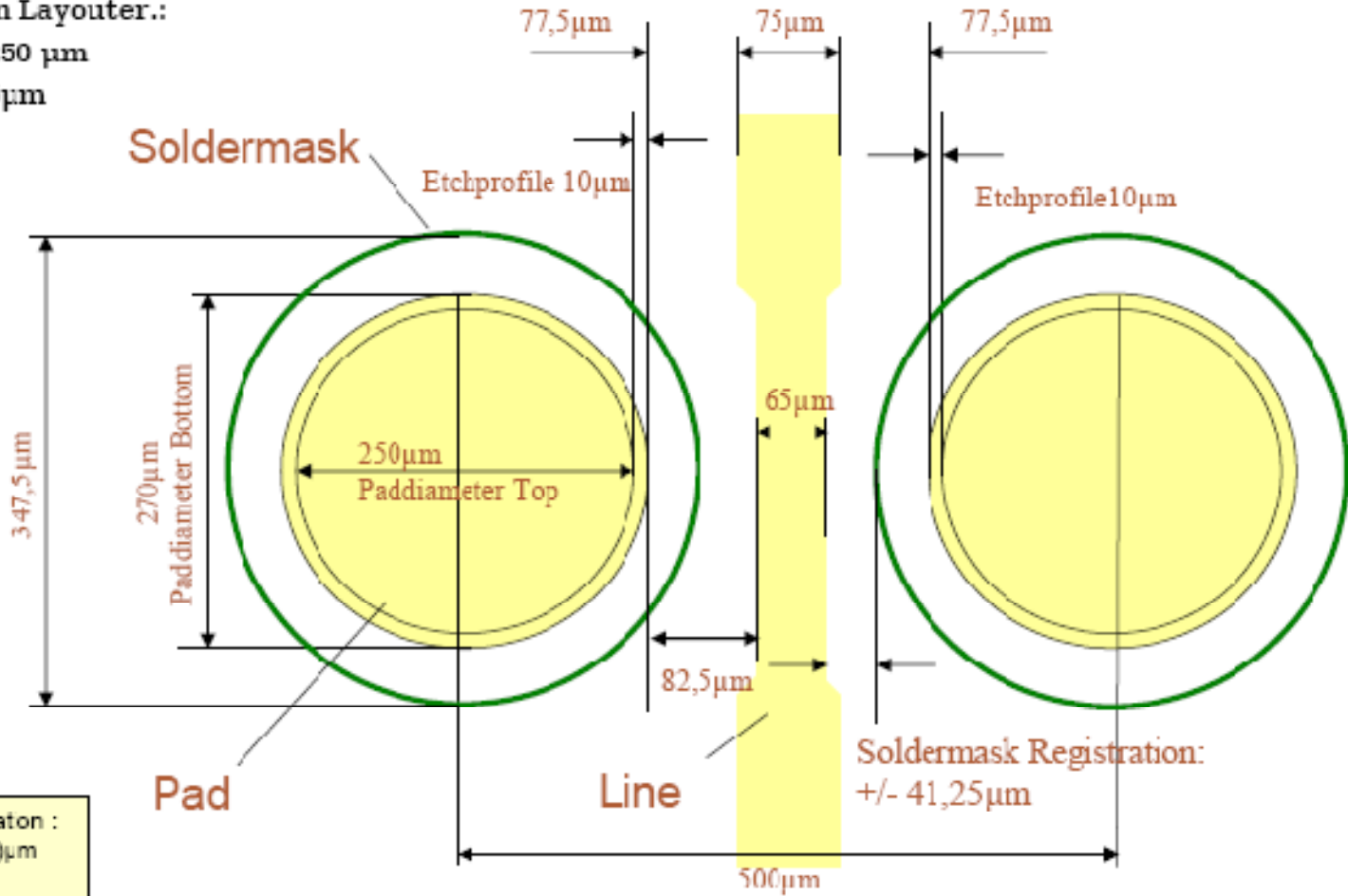
- Design from Layouter.:
- Pad size  $\varnothing$  300  $\mu\text{m}$
- Line.: No line



Soldermask Registration :  
 $1/4 * (500 - 320 - 80) \mu\text{m}$   
 $= 50 \mu\text{m} (+/-)$

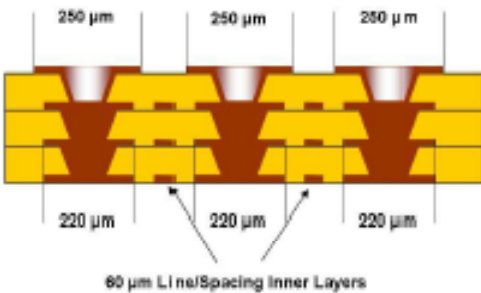
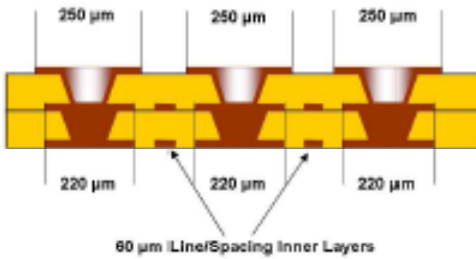
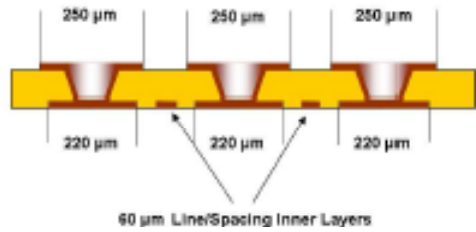
# 0,50 mm BGA

- Design from Layouter.:
- Pad size  $\varnothing$  250  $\mu\text{m}$
- Line.: 65-75  $\mu\text{m}$



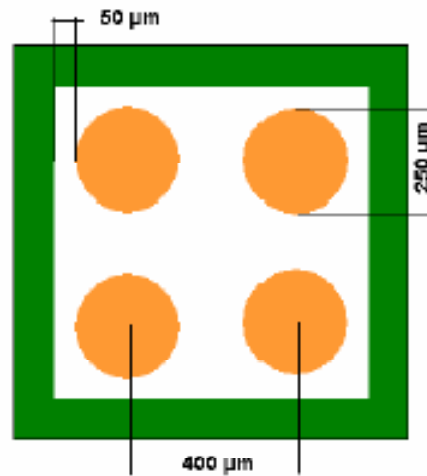
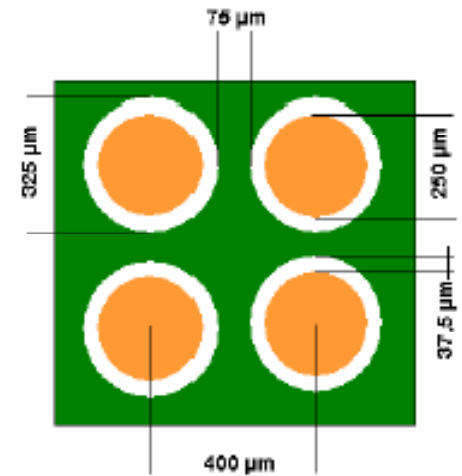
Soldermask Registraton :  
 $1/4 * (500 - 270 - 65) \mu\text{m}$   
 $= 41,25 \mu\text{m} (+/-)$

## 0,40 mm BGA



### *Solder Mask*

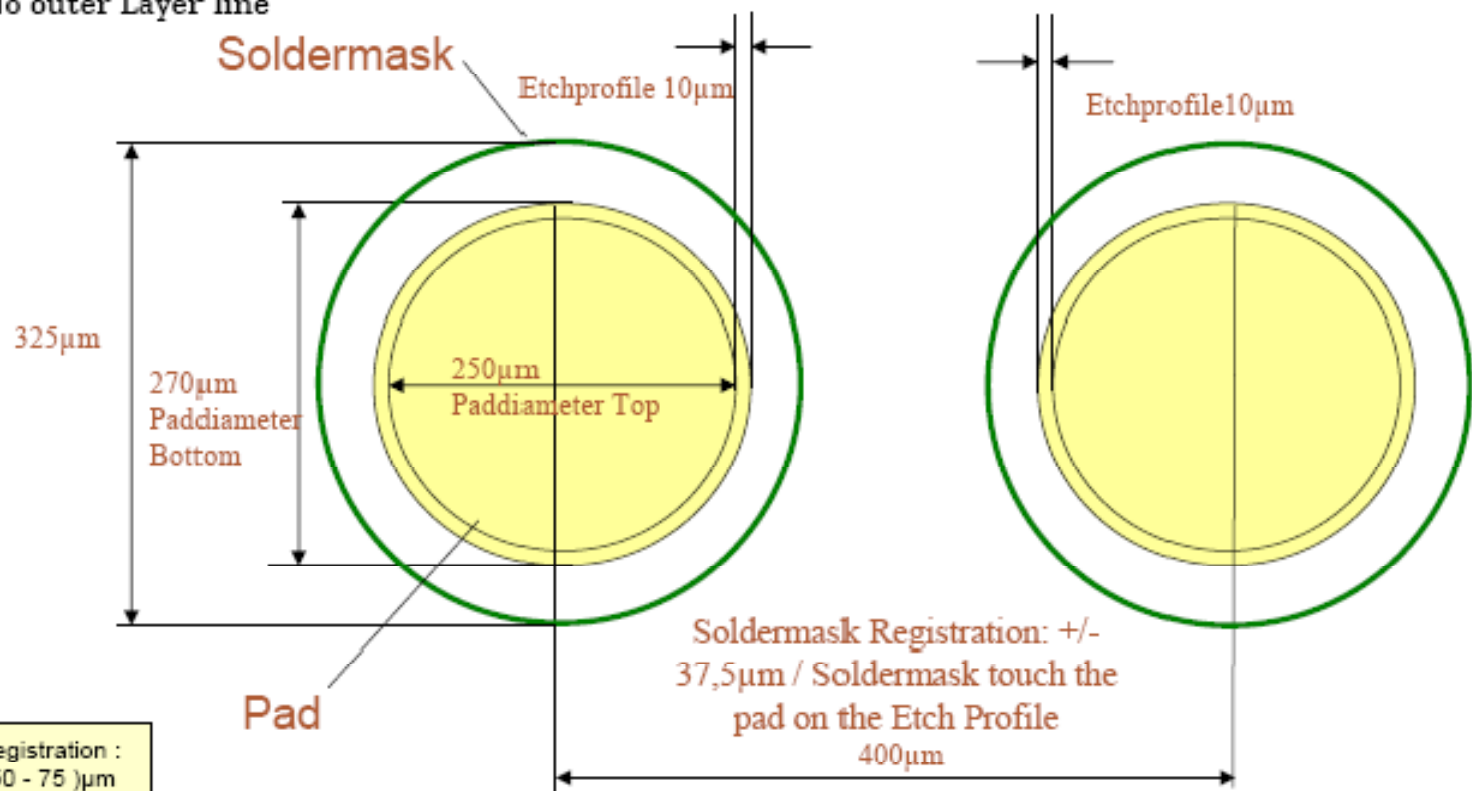
Positive Clearance  
37,5 μm and Registration  
of +/- 37,5 μm



Positive Clearance  
50 μm around the BGA  
of +/- 50 μm

## 0,40 mm BGA ytterlag

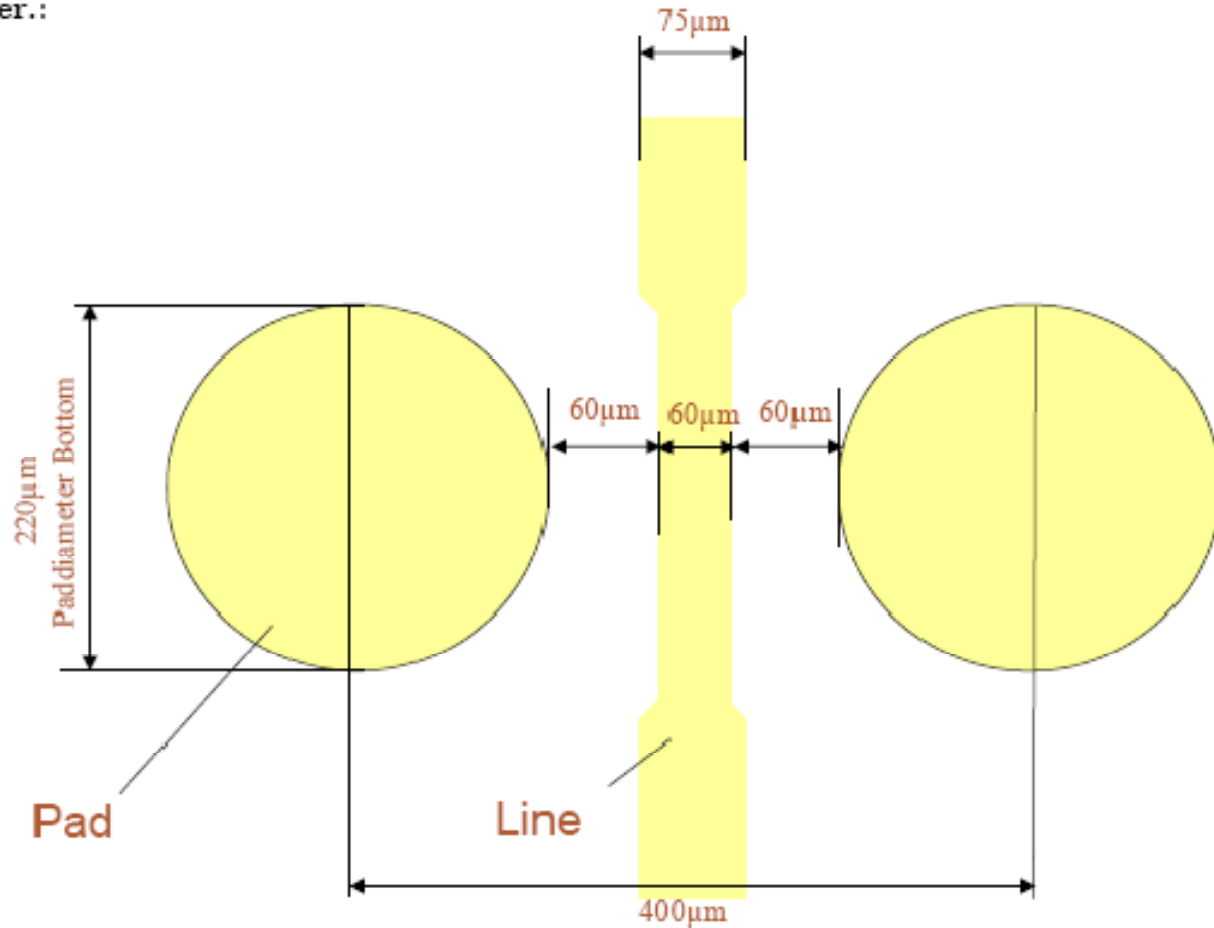
- Design from Layouter.:
- Pad size  $\varnothing$  250  $\mu\text{m}$
- Line.: No outer Layer line



Soldermask Registration :  
 $1/2 \times (400 - 250) \mu\text{m}$   
 $= 37.5 \mu\text{m} (\pm)$

## 0,40 mm BGA innerlag

- Design from Layouter.:
- Pad size  $\varnothing 220\ \mu\text{m}$
- Line.:  $60\cdot 75\ \mu\text{m}$



# Laserboring

## Er det lønnsomt?

**Borhastigheter/spindel**  
**Laserboring: 200-300 hull/sek**  
**Mekanisk boring: 4-8 hull/sek**

# Hva avgjør prisen på kort med microvia

Hvor mange ganger kortet går  
gjennom produksjonen

Valg av produsent

## HDI Buildups - 4 layer laser drilled




HDI PCB 4ML Laser drilled



HDI PCB 1-2-1

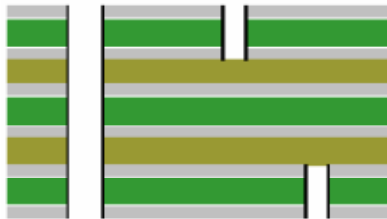


**Key:**

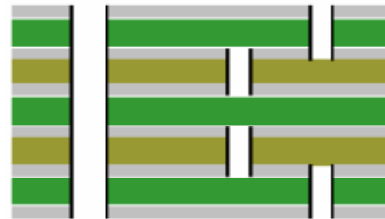
-  Core
-  Prepreg
-  Cu - foil

## HDI Buildups - 6 layer laser drilled

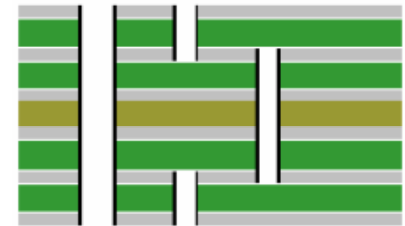
HDI PCB 6ML Laser drilled



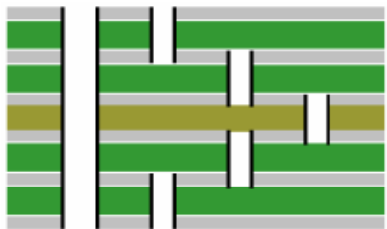
HDI PCB 1 - 2 + 2 - 1



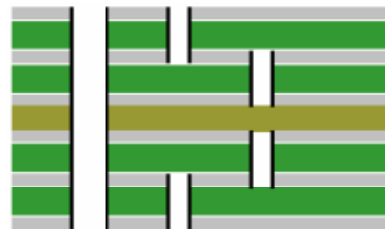
HDI PCB 1 - 4 - 1



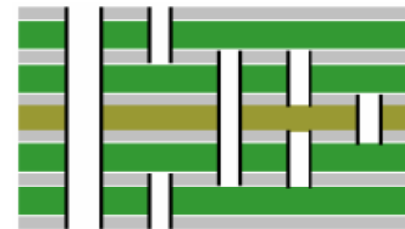
HDI PCB 1 1 2 1 1



HDI PCB 1 1 2 1 1

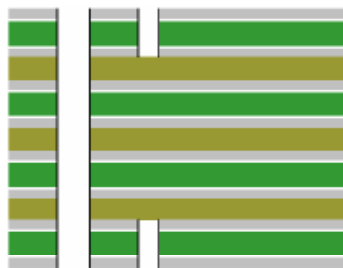


HDI PCB 1 1 + 2 + 1 1

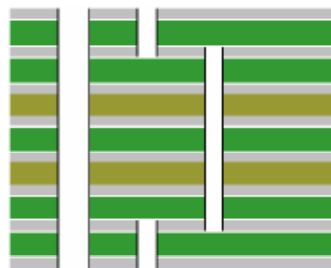


## HDI Buildups - 8 layer laser drilled

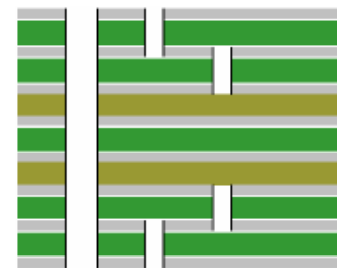
HDI PCB 8ML Laser drilled



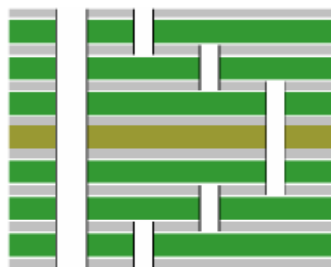
HDI PCB 1-6-1



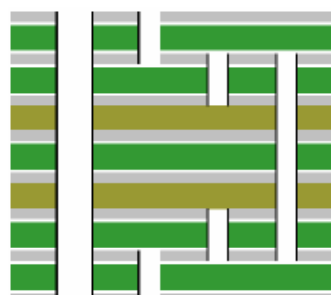
HDI PCB 1-1-2-2-1-1



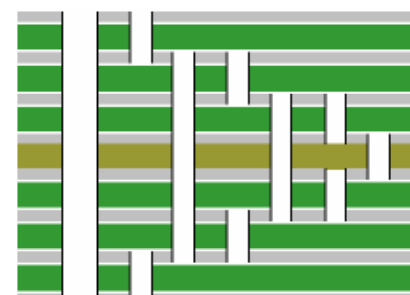
HDI PCB 1-1-4-1-1



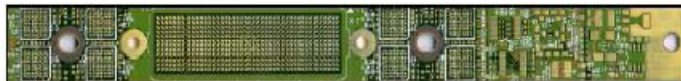
HDI PCB 1-1-2-2-1-1



HDI PCB 1-1-1-2-1-1-1



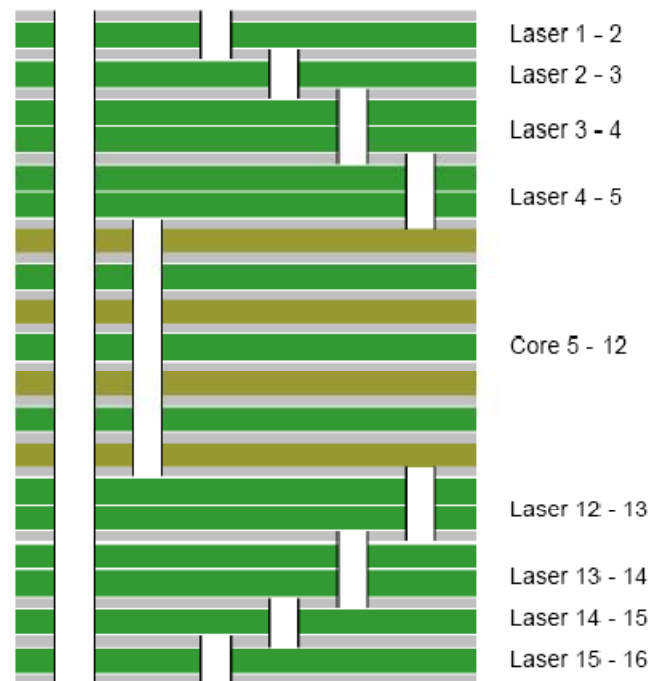
## Magnetic Resonance



<b>Market Segment:</b>	Medical
<b>Application:</b>	Magnetic Resonance
<b>Technology:</b>	HDI / High End ML

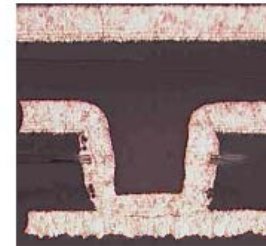
### 16 layer core – laser

structure: 1-1-1-1-2+2+2+2-1-1-1-1



## Laser drilling

Technologie	UV – CO2
Aspect ratio	1 : 1,4 (dielectric : laser $\varnothing$ )



Drilldiameter [ $\mu\text{m}$ ]	Laserpad [ $\mu\text{m}$ ]	Prepregtype	Prepregthickness [ $\mu\text{m}$ ]
90	300	RCF / 1 x 106	50
110	320	1 x 1080	70
140	340	2 x 0106	100
160	360	2 x 106 (L1 – L2 / L1- L3)	100
160	380	2 x RCF (L1 – L2 – L3) without connection	120

# Vrak er en funksjon av

Antall lag

Kortstørrelse

Antall prosesser kortet må igjennom

# Vrak som funksjon av antall lag

Hvis antall defekter/overflateenhet er lik får vi følgende utvikling av vrak.

2 % 2-lagskort

4 % 4-lagskort

10 % 10-lagskort

# Vrak som funksjon av kortstørrelse

Kort 50x50 mm gir 1% vrak

Kort 100x100mm gir 4% vrak

Kort 200x300mm gir 24% vrak

# Måter å regne vrak på

## Produsert

100 stk gjennomplettete kort 50x50mm

10 stk 8-lagskort 200x200mm

## Vrak

1 stk gjennomplettet kort

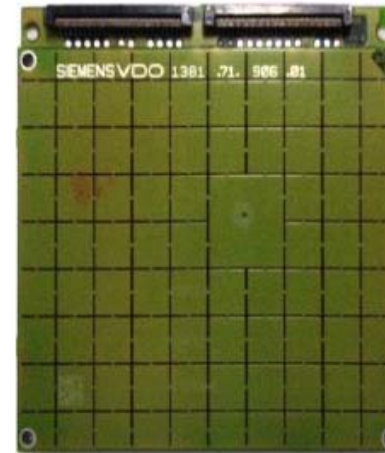
2 stk 8-lagskort

# Måter å regne vrak på

Resultat regnet som kort  
2,7 % vrak

Resultat regnet som areal  
18,6% vrak

## Digital Tachograph



**Market Segment:** Automotive

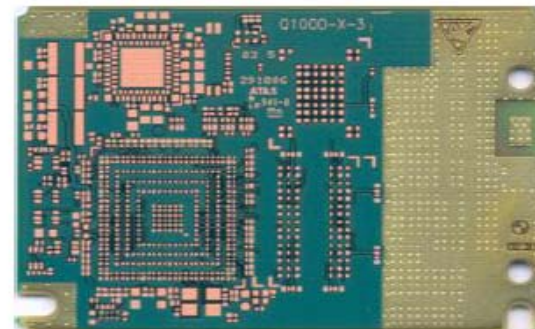
**Application:** Digital Tachograph for Daimler-Chrysler Trucks

**Technology:** ML 8 Standard, 1-1-2-1-1 HDI, 1-1-4-1-1 HDI Microvia

[www.ats.net](http://www.ats.net)

Austria Technologie & Systemtechnik  
Aktiengesellschaft

## Wireless module for mobile computing



**Market Segment:** Communication

**Application:** HSDPA / UMTS / GSM Wireless Module

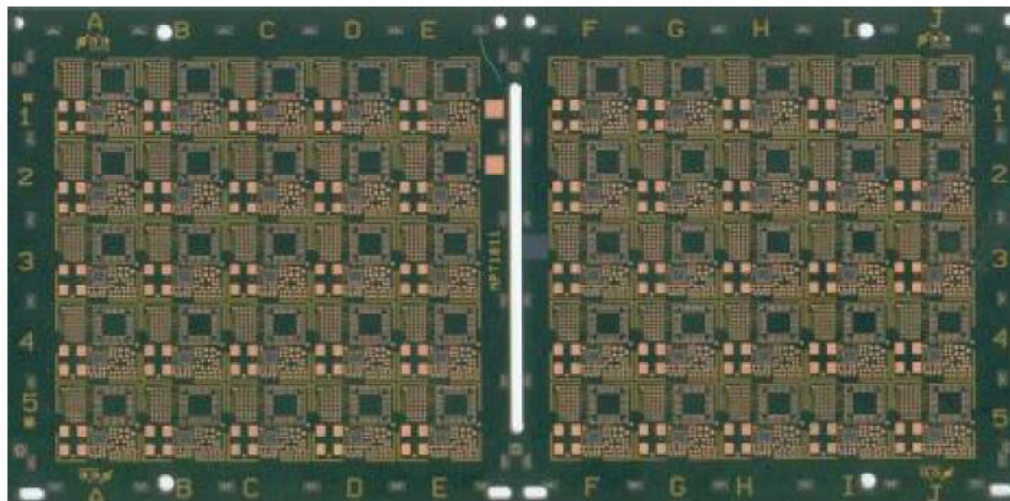
**Technology:** HDI Microvia – 2 n 2 technology

[www.ats.net](http://www.ats.net)

Austria Technologie & Systemtechnik  
Aktiengesellschaft

## Micro-BGA Designs: Worlds smallest GPS receiver module

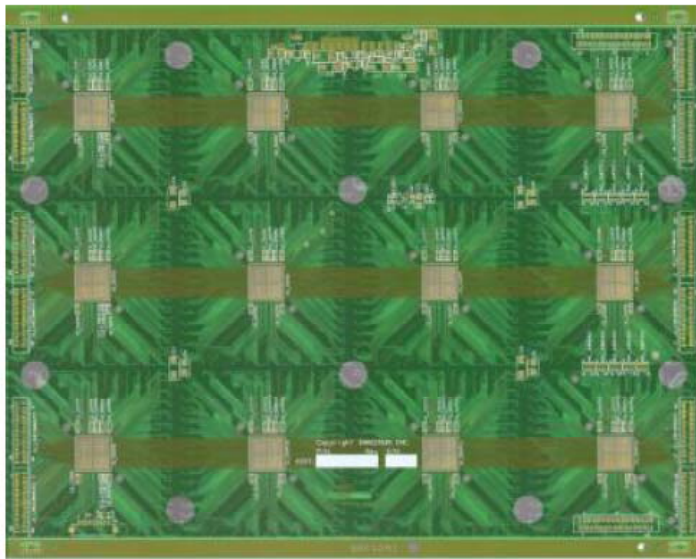
350 $\mu$  pitch FC, 50 $\mu$  line/space, 10mm x 10mm x 1,6mm



[www.ats.net](http://www.ats.net)

## Micro-BGA Designs: Scalable Display Board

256 x 192mm, 12pcs 370 $\mu$  pitch BGA, 50 $\mu$  line/space, 4-4-4, copperfilled  $\mu$ -vias



# Design anbefalinger

Lederbredde ned til 75 mikron på kort > 1dm<sup>2</sup>

Lederbredde ned til 60 mikron på kort < 1dm<sup>2</sup>

Velg microvia boret fra ytterlag.

Legg microvia i loddeputer

Bruk microvia i steden for mekanisk boret blinde via.