Webinar

HDI Microvia Technology – Cost Aspects
HDI Microvia Technology – Cost Aspects

- Reasons for the use of HDI technology
- Printed circuit board (PCB) size
- Number of layers
- Stack-up and complexity
- Other important cost influences
  - Design rules
  - Drilling costs
  - Microvia filling

Stefan Keller
Product Manager
HDI Microvia Technology – why?

1. Complexity of the components
   in particular BGA pitches 0.65 mm and less require HDI

Pitch 0.8 mm / PTH Via Pad Ø 0.50 mm

Microvia

Design Rules:
> HDI Design Guide and HDI webinars
www.we-online.com/online-design-conference

HDI – no question !!
2. Reliability / Aspect Ratio

ASR 6:1 – 8:1 (PCB thickness / Ø)
Minimum drill tool diameter 0.30 mm / 0.25 mm

Final customer reliability requirements?
IPC class 2 or IPC class 3

>> Often the better solution: HDI microvia instead of PTH
Microvia ≈ 0.30 mm pad size / 0.10 mm Ø
HDI Microvia Technology – why?

3. Miniaturisation

Market requirements
size of the device
+ PCB size

Other examples:
- embedded computer
- medical technology
- industrial cameras

Other approaches / cost pressure:
• double sided assembly on the whole surface
• functional separation of top and bottom side
• Smaller or one PCB instead of two

Miniaturisation really possible only with HDI!
HDI Microvia Technology – why?

Survey:

Why do you use HDI Technology?

- Routing Fine Pitch BGAs
- Higher reliability
- Miniaturisation in general
- Other reasons
HDI Microvia Technology – but:

HDI = expensive

This is a thing of the past!
HDI – Cost Aspect PCB Size

PCB size ≈ size of the device

> could be essential for a successful product!

- Number of layers / stack-up

Avoidance of PTH vias!
HDI Technology
Microvias + Buried Vias
HDI – Cost Aspect PCB Size

QFP 0.40 mm pitch

solder pad 200 µm
max. 230 µm

Pad-Ø 300 µm

0,400 mm pitch
HDI – Cost Aspect Number of Layers

BGA – pitch 0.80 mm  20 x 20 = 400 pins  Design Study

How many signal layers are needed?

- With PTH – vias
  (only plated through hole vias)
- With Microvias (HDI)
HDI – Cost Aspect Number of Layers

BGA – Pitch 0.80 mm  20 x 20 = 400 Pins

Design Study

Microvia

Layer 2
Layer 3
Layer 4
Layer 5
Layer 6
Layer 7

How many signal layers are needed?

www.we-online.com    HDI - Cost Aspects    Seite 11
If the PCB size is fixed:

Recommendation: stack-up only as complex as necessary

- Number of layers
- Number of laminations / pressing processes / manufacturing processes
HDI – Cost Aspect Complexity HDI08

- Single pressing
- Laser drilling layer 1 to 3
- Inner layer microvias (staggered)
- Buried vias mech. drilled
- Additional inner layer microvias
- 3 sequential pressings

Costs: 100 %

1 + 6 + 1

115%

2 + 4 + 2

120%

1 + 6b + 1

142%

2 + 4(6b) + 2

150%

2 + 4b + 2

175%
What are the costs for a 8-layer multilayer without microvias?

1. Laser drilling layer 1 to 3 (115%)
2. Inner layer microvias (staggered) (120%)
3. Buried vias mech. drilled (142%)
4. Additional inner layer microvias (150%)
5. 2 sequential pressings (200%)

ML08

100 %

90 - 95 %
HDI – Cost Aspects Stack-up and Complexity

ML08 + eurocard 100 x 160 mm / 200 boards

1000 boards: $\approx 0.50 \text{ €}$

HDI08_1 + 6 + 1
HDI – Cost Aspect Technology

Microvias stacked
0,40 mm BGA pitch

Smaller pitch & higher connection density
Fine line structures & complex multilayer stack-up

Filling ?
HDI – Cost Aspect Design Rules

HDI Microvia Standard Design Rules
download:// www.we-online.de/microvia - Design Rules

microvia (for impedance controlled PCBs)
- pad Ø 325 μm
- final Ø 100 μm
- dielectric thickness 85 – 110 μm

stacked microvia
- Cu – filled up to max. 4 layer

standard – microvia
- Pad Ø 300 μm
- final Ø 100 μm
- dielectric thickness 58 – 70 μm

outer layer layout
- distance pad / track ≥ 100 μm
- track width ≥ 100 μm
- distance track / track ≥ 100 μm

microvia aspect ratio = 1 : 0.8
(diameter / depth)

microvias layer 1 to 3
- max. 55 μm
- max. 18 μm
- max. 50 μm
- pitch ≥ 300 μm
- pitch ≥ 400 μm
- inner layer clearance Ø 550 μm

staggered microvias
- pad Ø 360 μm
- pad Ø 660 μm inner layer
- inner layer track width ≥ 100 μm

inner layer layout (up to 35 μm Cu thickness)
- distance track / track ≥ 100 μm inner layer
- distance pad / track ≥ 100 μm inner layer

core material
- prepreg ≥ 100 μm
- core material ≥ 100 μm

dielectric thickness 58 – 70 μm (layer 1-2)
dielectric thickness 55 – 68 μm (layer 2-3)
HDI – Cost Aspect Design Rules

- BGA pitch \( \leq 0.80 \) mm
- 90 \( \mu \)m track width often uncritical
- Fine line structures 75 \( \mu \)m usually only for 0.50 mm pitch BGAs absolutely necessary
HDI – Cost Aspect Design Rules

0.50 mm pitch BGA

75 µm fine line structures in any case on the inner layers, outer layers: different options

0.650 mm pitch

BGA pad Ø 350 µm

track width 100 µm

clearance
solder mask 50 / 62.5 µm
HDI – Cost Aspect Drilling Costs

Ø 200 µm (1 € / drill bit)
Endurance: 1000 holes
Frequency: 3 / s

Ø 300 µm (0,60 € / drill bit)
Endurance: 2000 holes
Frequency: max. 8 / s

Microvia:
Ø 125 µm (0,0 € / Microvia)
Frequency: 150 – 180 / s
HDI – Cost Aspect Microvia Filling

IPC-7095C: „max. 22% of the image diameter“

The appearance of voids depends on:
- Flux, solder paste
- Temperature profil
- …..

Customer / EMS have to decide for themselves which variant could be used!
HDI – other Cost Aspects

High speed / signal integrity

HDI Technology instead of expensive high frequency material

Made in Germany

Technical advice and support,
Product Management, local sales representatives and engineering

Version 1: PTH

Version 2: Microvia / Buried Via

“open ended antennas”
HDI – Cost Aspects Summary

• Components
• Total complexity
• Reliability requirements
  ➢ Determine which PCB Technology should be utilised

• PCB size
• Build-up
• Drilling costs
• Design Rules
  ➢ Are the determining cost factors
    and they could be decisively influenced by HDI technology
  ➢ The relationships should be considered
  ➢ Miniaturisation is really possible only with HDI technology
HDI Cost Aspects

HDI = expensive?

This is a thing of the past!

Can no longer be generally said!
Knowing the relationships - is a secret of success!

We are looking forward to good cooperation!

Stefan Keller
Product Manager

stefan.keller@we-online.de