Webinar: Design recommendations HDI – HDI Design Guide

Würth Elektronik Circuit Board Technology
Agenda

Nomenclature and definition

Why Microvia technology?

Possibilities

Costs

Fence out a BGA
Nomenclature and definition

HDI
• High Density Interconnection

Microvia
• Smallest, laser drilled holes

Buried Via
• Buried drills on the inner layers

Pitch
• Middle of a pad to the middle of a pad
Nomenclature and definition

\[ 2 + 4 + 2 = 8 \text{ layer} \]

\[ 2 + 6b + 2 = 10 \text{ layer} \]
Nomenclature and definition

\[2 + 4 \text{(6b)} + 2 = 8 \text{ layer}\]

- Number Microvia layers
- Number inner layers between the Microvias
- Number Microvia layers with buried vias
Why Microvia technology?

- Fence out smallest BGA pitch
- High reliability
Why Microvia technology?

**TCT**

- i.d.R. -45° / +125°C

**Solderprocess**

**Aspect Ratio**

\[ AR = \frac{h}{\varnothing} \]

IPC-2221/2122

**Copper thickness**

\[ t \]

**Basic material**

\[ CTE_z \]

**Expand!**
Why Microvia technology?

- Fence out smallest BGA pitch
- High reliability
- Miniaturisation with ‘Via in Pad’ technology
- Cost-effective generation of high wiring density
- Future-proof technology – components are becoming smaller all the time
We will have a…

Whats the reason for, that plated thorough holes / vias could not be reduced to any small size?
Possibilities – Standard Microvias

Standard - Microvia

FinalØ 100µm
Pad Ø 300µm

With 60-70µm dielectric
Possibilities – Microvias with impedance

Standard - Microvia

FinalØ 125µm

Pad Ø 325µm

With 85-110µm dielectric

1 + 4 + 1

- 1 x pressed
- 1 x electroplated
Possibilities – Staggered Microvias

$2 + 4 \ (6b) + 2$
Possibilities – Staggered Microvias

- 2 x pressed
- 2 x electroplated
- Filling of the Micro- and buried vias with epoxy
Via Filling Prozess

Copper
FR4
Copper

Drilling

Metalization

Vacuum filling process

Hardening

Polish
Possibilities – Staggered Microvias

Pitch ≥ 300µm

3 + 4 (6b) + 3
Possibilities – Staggered Microvias

- 3 x pressed
- 3 x electroplated
- Filling of the Micro- and buried vias with epoxy
Possibilities – Staggered Microvias and Buried Vias

Pitch ≥ 400µm
PadØ 550µm
Possibilities – Staggered Microvias und Buried Vias

- 3 x pressed
- 3 x electroplated
- Filling of the buried vias with epoxy
Possibilities – Stacked Microvias

Stacked microvia

Copper filled

3 + 4 (6b) + 3
Possibilities – Stacked Microvias

- 3 x pressed
- Filling of Buried Vias with epoxy
- Filling of Microvias with epoxy
- 4 x electroplated, metallization of μVias have to be done separated to the buried vias
Possibilities – Stacked Microvias on Buried Vias

Stacked Microvia on Buried Via

Buried Via filled and capped

Not recommended according to IPC-2226A Design Standard

2 + 6b + 2
We will have a…

Why to use staggered Microvias with respect to the costs compared with the stacked option?
Via Filling Prozess

- Copper
- FR4
- Copper
- Drilling
- Metallization
- Vacuum filling process
- Hardening
- Polish
- Metallization
Possibilities – Stacked Microvias on Buried Vias

- 3 x electroplated
- Filling of Buried Vias with epoxy and capping
- Filling of Microvias with epoxy
- 4 x electroplated

Not recommended according IPC-2226A Design Standard
Costs

1 x pressed
- Microvias 1 to 2
- PTH 1 to 8
- Laserdrilling 1 to 3

2 x pressed
- Staggered Microvias
- Laserdrilling 1 to 3
- Microvias 1 to 2 + 1 to 3
- PTH 1 to 8
- Micropin 2 to 3
- Electroplated 8 to 6
- Laserdrilled 8 to 7

3 x pressed
- Buried Via 3 to 6
- Laserdrilled 2 x pressed
- Electroplated 2 x pressed
- Mech 1 x laserdrilled
- Mech 2 x laserdrilled

90 %
- ML08 ohne µ-Vias

100 %
- 1 + 6 + 1

115 %
- Laserdrilling 1 to 3

120 %
- Staggered Microvias

142 %
- extra buried Microvias

150 %
- buried Vias

175 %
- 2 + 4b + 2
Fence out

BGA Pitch 0,8mm

Fence out with mech. vias

<table>
<thead>
<tr>
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<th>Var. 1</th>
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<tbody>
<tr>
<td>BGA Lötpad</td>
<td>max. 400 µm</td>
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<tr>
<td>Lötstoppmaskenfreistellung</td>
<td>50 µm</td>
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<tr>
<td>Via Padgröße BGA Bereich</td>
<td>500 µm</td>
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<tr>
<td>Microvia Pad Außenlagen</td>
<td>-</td>
</tr>
<tr>
<td>Microvia Pad Innenlagen</td>
<td>-</td>
</tr>
<tr>
<td>Leiterbahnbreite /-abstand Außenlagen</td>
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</tr>
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Fence out

BGA Pitch 0,8mm

Fence out with Microvias, Dogbone

<table>
<thead>
<tr>
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<th>Var. 2</th>
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<tr>
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Fence out

BGA Pitch 0,8mm

Fence out with Via in Pad

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Fence out

NEXT TIME...

PERFECTION IN HDI—OPTIMAL USE OF THE HDI TECHNOLOGY

03.09.2013
Thank you for your attention!