**Via in Pad**

- **Via in Pad** is a **Surface Mount Pad** that serves double duty as a **Surface Mount Pad** and a **Via Hole**.

- A **Via in Pad** is a **Surface Mount Pad** with a **Via Underneath**.

- It can be a **Double Sided Via**, a **Multilayer Via**, or a **Blind Via**.
A Surface Mount Pad with a Via Underneath, also known as a “Via in Pad”
Via In Pad

- **Via in pad** is used to increase component density.

- It serves double duty as a via and as a surface mount pad for a component.
Via in Pad Construction

• Our Standard process for constructing single wrap Via in Pad is shown in the next series of slides.

• We will also pay attention to certain aspects of processing, just for clarification.
Multilayer out of the press

Surface Copper = .0007” (1/2 Ounce)

• This is an example of an 8 Layer.
• When Via in Pad is manufactured we separate out all other Plated and Non-Plated holes.

• This isolates the Via in Pad holes and simplifies the Via Fill process later on.

• Then after the Via Fill is complete we Drill and process the remaining holes and final image.
Only Holes for **Via** in **Pad** are drilled

Drilled Hole

Surface Copper = .0007” (1/2 Ounce)
Plasma Etching, Desmear
Electroless

Copper in Hole = .00003 (Very Thin!)

Surface Copper = .00075
Target copper thickness in the hole is .0013"
What is \textit{Wrap Plating}?

- \textbf{Wrap Plating}
  The electrolytic hole plating deposition continuously extending onto the surface from a plated via structure. (From IPC-T-50)
Simply put:

• **Wrap Plating** is copper plating from the hole that wraps around the surface foil.

• **Wrap Plating** is done without any image defined by photoresist.

• Panels are taken from the deposition line and **Wrap Plated**.
• **Wrap Plating** is the same process as **Flash Plating**, only we put on more copper by extending the plating time.

• **Flash Plating** puts on about .00015”, while **Wrap Plating** puts on .0003-.0006” (2X to 4X more copper).
• We **Wrap Plate** the minimum amount to keep the thickness of the copper on the surface to a bare minimum so etching is easier.
Why **Wrap Plate**?

- Wrap Plating was introduced in IPC-6012B Amendment 1.
- Its sole purpose is to increase Via in Pad reliability in the field.
Old Method, No Wrap Plate

Wrap Plate Method

Wrap Plating
• No Wrap Plating leads to the Separation of the Surface Plating from the Hole Plating.
Button (Spot) Plate Resist and Image
What is Button (Spot) Plating?

- **Button Plating**
  The process of plating only in the holes and on pads.
Why **Button Plate**?

- When we **Wrap Plate** we only put the minimum amount of copper required for the wrap plate in the hole and on the surface (plus a little extra to compensate for Planerizing).
• **Button Plate** brings the thickness of copper in the hole up to the finished requirement without adding extra copper to the surface.
• Remember, **Wrap Plate** goes in the hole and on the surface, but **Button Plate** goes only in the hole and on the pad, not the entire surface.

• So to build up the correct amount of copper in the hole before **Via Fill**, we **Wrap Plate** first, then **Button Plate**.
Copper in Hole .0015"

Surface Copper .0013"
Resist Stripped
60% filled for Class 3
Planerize

Careful!
Easy to sand too much!
Why Planerize?

• Planerizing removes the surface copper from the Button Plate process, leaving a perfectly flat surface.
• Remember: we plate as little copper on the surface as possible to aid in etching.
• Generally we try to add only .0001” to .0002” extra copper to allow for losses at Planarization.
A Note about Planerizing

• Because we only plate an extra .0001” during Wrap Plating to allow for Planerizing, we have to measure the copper frequently to ensure we have not cut below our minimum wrap requirement.
Remaining Holes Drilled
Electroless # 2
Plating Resist / Final Image
Final Copper Plating

.0008” Average for Class 2  .001” Average for Class 3
Tin Strip
Solder Mask
Immersion Gold Plating
This is our standard procedure for **Via Fill**.

- **Base Foil**
- **Electroless 1**
- **Electroless 2**
- **Wrap Plating**
- **Final Plating**
- **Filled Via Plating**
- **Via Fill**
- **Nickel Plating**
- **Gold Plating**
• There is also a double and a triple wrap. The process is the same as depicted in the slides above, it’s just repeated by multiple lamination, Drill, and Plate Cycles.
Blind and Buried Via

• 12 Layers Built using 3 segments.
• Segment 1 Layers 1-4
• Segment 2 Layers 9-12
• Segment 3 Layers 5-8
• Then a final Lamination to put it all together.
Segment 1

• Layer 1-4  Blind Via Segment
Core Material

- We call Innerlayer Core’s
Image Etched

• Image, Etch, Inspect Layer 2/3
• Layup using Prepreg and foil.
Press

- Press Segment 1
Drill

- Drill Segment 1
Wrap Plate
Plating Resist
Copper Plate
Etch Layer 4  Cover Layer 1
Segment 2

- Layer 9-12 Blind Via Segment
Layers 9-12 are the mirror image of Layers 1-4.

Layer 9 is etched

Layer 12 is Preserved
Segment 3

• Layers 5 – 8 Buried Via Segment
Pull Material
Etch Innerlayer
Press
Drill
Plasma
Electroless
Plate Copper
Plate Tin
Etch
Strip Tin & Test
Oxide
Final Lamination

• Segment 1-3-2
Planerize Excess Epoxy
Plasma
Tin Plate
Etching Details

Class 3 Wrap Plating Limits the Final Line width to .00425/.00425”.

- Base Copper .0007”
- Final Copper Plating
- Electroless .00003”
- Wrap .0005”
- Electroless .00003”
- .00070 “
- .00126”

Using Quarter Ounce

- .00003”
- .00050”
- .00003”
- .00070 “
- .00126”

- .00003”
- .00050”
- .00003”
- .00035 “
- .00091”
• Copper does not etch straight up and down. Instead, it makes an hourglass shape.
• The smallest line you can etch is dependent upon the thickness of copper.
• Spacing also plays an equal role.
Yellow box shows the original size.
• Started with ½ ounce foil, but the total copper thickness increased because of the wrap plating.

• This was a single wrap so .0012”, or about 1 ounce, is the amount of copper to etch.

• For a double wrap this would increase to .0018”.

• For a triple wrap this would increase to .0024”, or about 2 ounces.
Soldermask
Immersion Gold
Blind Via With Via in Pad