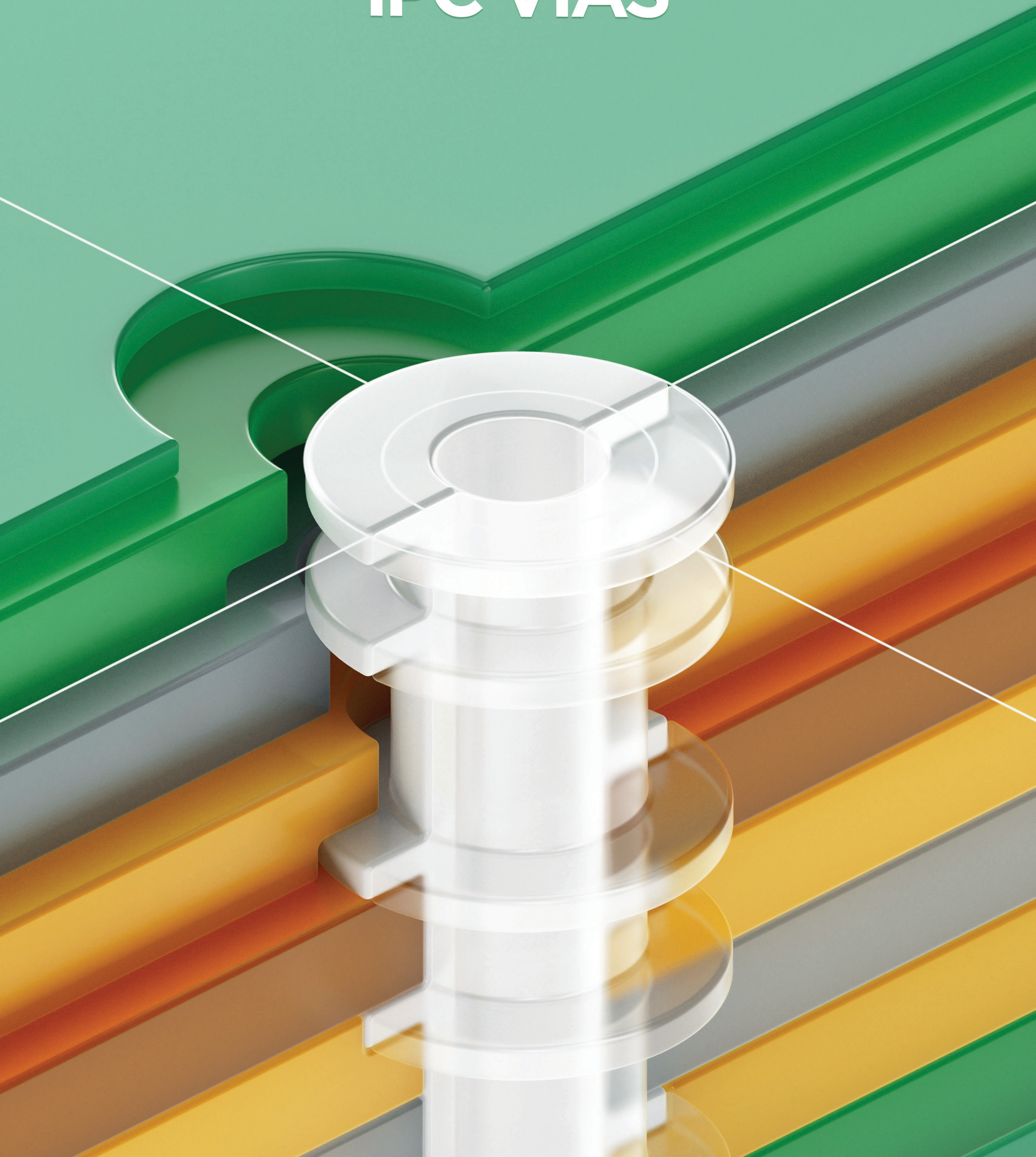
Altium

QUICK GUIDE

IPC VIAS

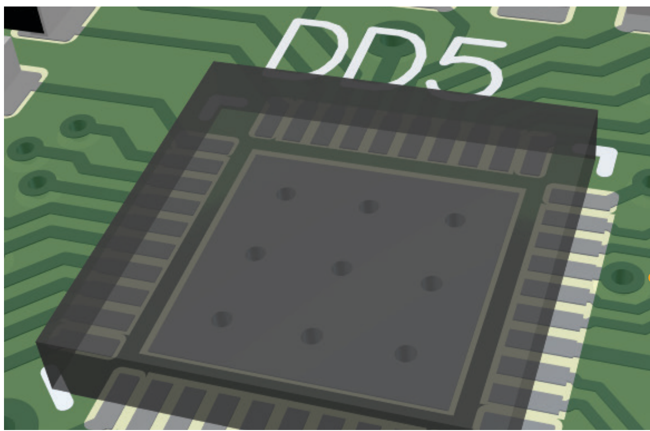


Advantages of Via protection

Via protection is an important part of modern PCB design. It provides additional benefits in PCB manufacturing and assembly, increasing the number of acceptable products. There are several types of vias protection detailed in the **IPC-4761 Design Guide for Protection of Printed Board Via Structures** and on pages 5-11 of this document.

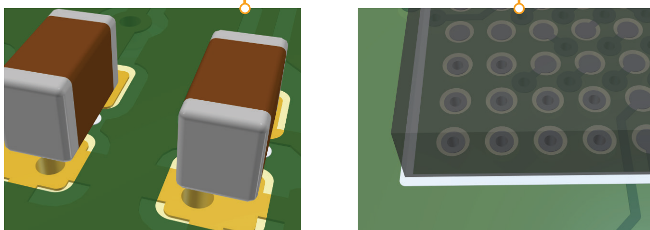
Common situations where vias protection is required:

THERMAL PADS



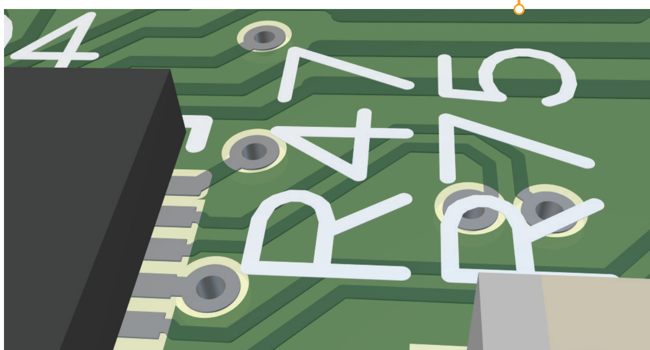
Conductive via plugging provide good thermal transfer

VIA-IN-PAD DESIGN



Filling and capping prevent solder wicking into vias

COMMON PCB



Vias tenting prevent silkscreen trimming

Support for via types in Altium Designer

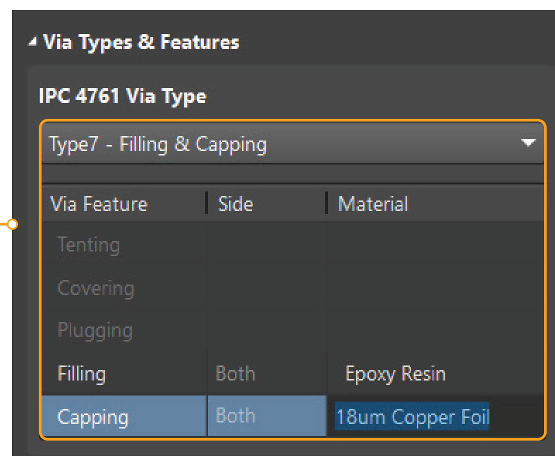
Altium Designer supports vias types according to IPC-4761.

To configure the type of protection for vias:

- Select the desired vias;
- Set a type in the Properties panel;
- Specify the coating side and material in the table.

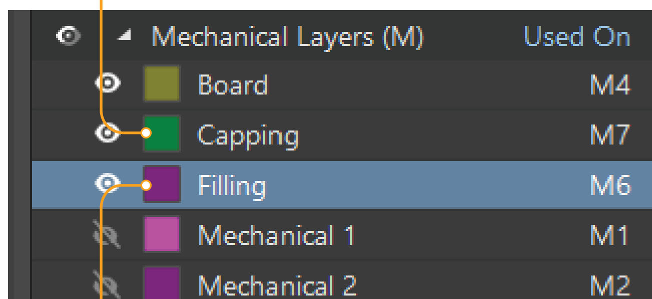
VIA-IN-PAD (BGA)

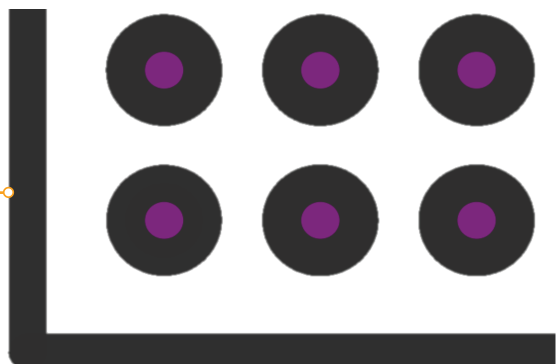
VIA PROPERTIES



Specify side and material

When a via type is set to IPC-4761, new types of mechanical layers and component layer pairs are automatically added to the design, with corresponding shapes on these layers.



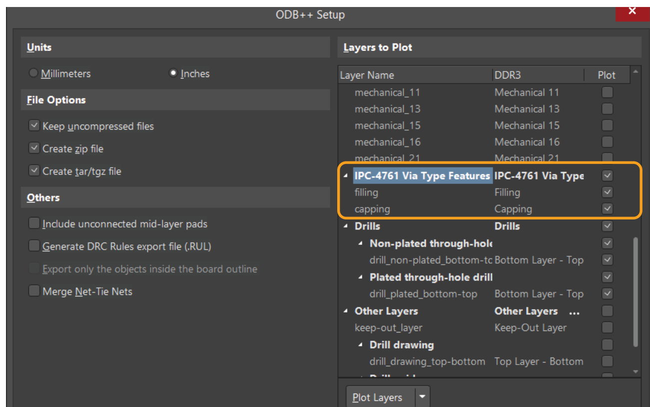


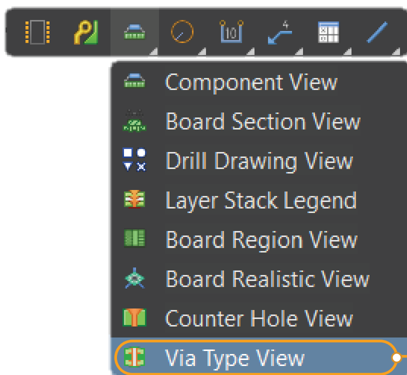
Special Mechanical Layers

Support for via types in Altium Designer

The via protection types are also supported when creating output files for manufacturing, as well as when creating drawings in Draftsman.

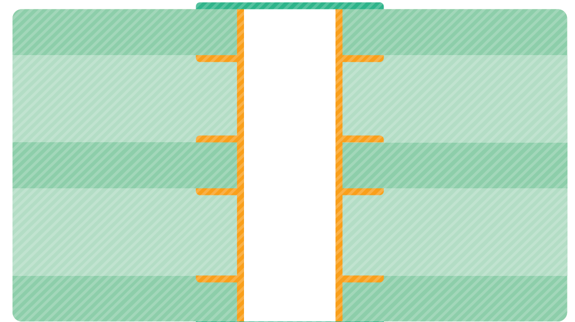
ODB++ OUTPUT





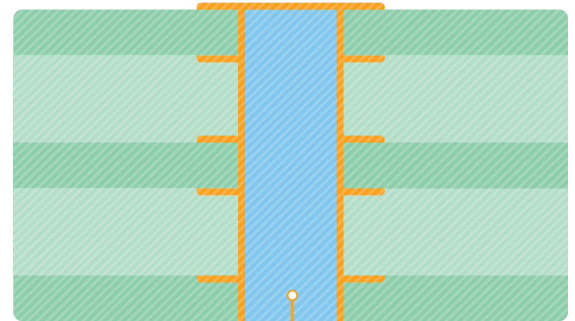
DRAFTSMAN DOCUMENT

VIA TYPE 1B



Tented

VIA TYPE 7



Capped

Filled

DRILL TABLE

Symbol	Count	Hole size	Plated	Via Type	Via Feature
☒	364	0.20mm	Plated	Type 1B	Tenting Both
☒	22	0.20mm	Plated	Type 7	Filling, Capping Both
○	1	4.00mm	Plated		
◇	1	4.50mm	Plated		
	388 Total				

Via protection definitions and types

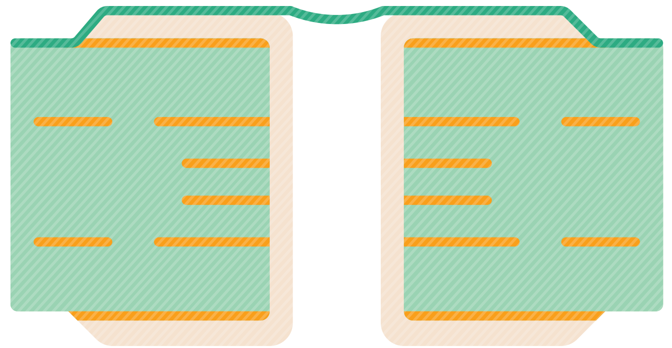
Tented Via (Type I Via) A via with a dry film mask material applied bridging over the via wherein no additional materials are in the hole. It may be applied to one side (Type I-a) or both sides (Type I-b) of the via structure.

Process: Vacuum laminated film material that is photo-definable.

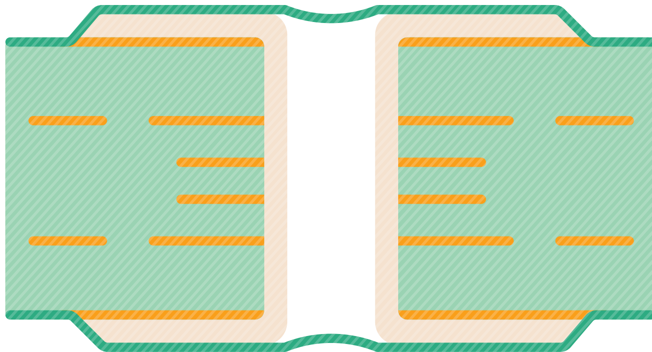
Benefits: A consistent and repeatable process providing excellent hole tenting and uniform thickness.

TYPE I-A NOT RECOMMENDED

Concerns: One side protection should not be used with bare copper hole walls! Chemical entrapment.



TYPE I-B



Concerns: Dimples may be a concern for adhesive processes where a glue dot is used for component placement.

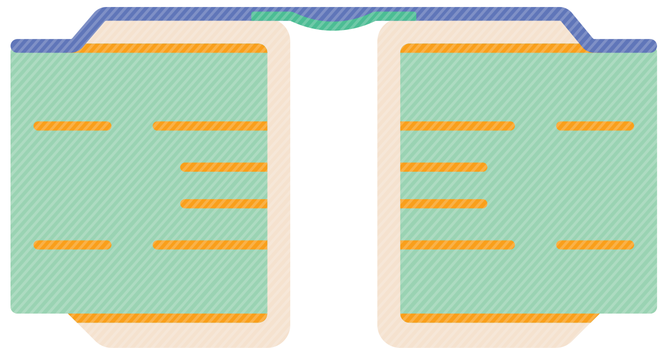
Via protection definitions and types

Tented and Covered Via (Type II Via) A Type I via with a secondary covering of mask material applied over the tented via. The material may be applied to one side (Type II-a) or both sides (Type II-b) of the via structure:

Process: Application of mask over Type I.

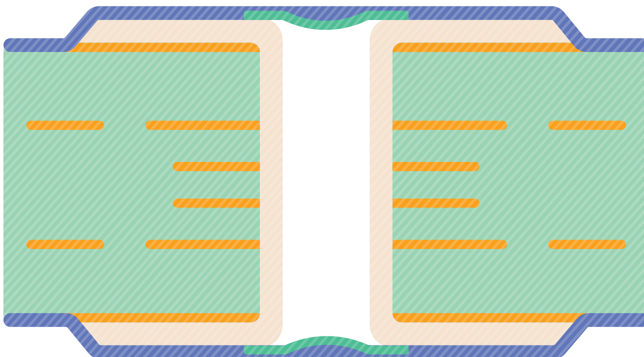
Benefits: Improved tenting strength over Type I.

TYPE II-A NOT RECOMMENDED



Concerns: One side protection should not be used with bare copper hole walls! Chemical entrapment.

TYPE II-B



Concerns: Bumps may be a concern in lifting the solder paste stencil. A conforming mask material is recommended to prevent significant increases in bump height.

Via protection definitions and types

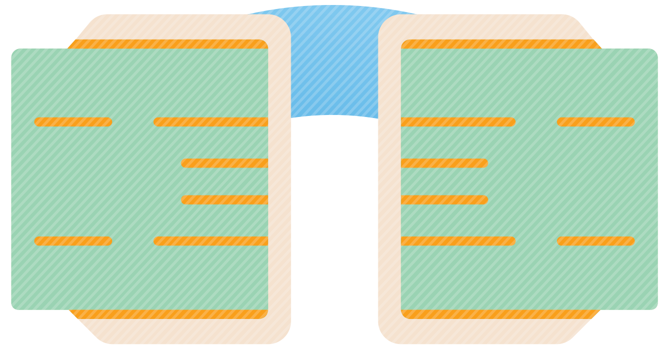
Plugged Via (Type III Via) A via with material applied allowing partial penetration into the via. The plug material may be applied from either one side (Type III-a) or both sides (Type III-b) of the via structure.

Process: Screened and Roller Coated.

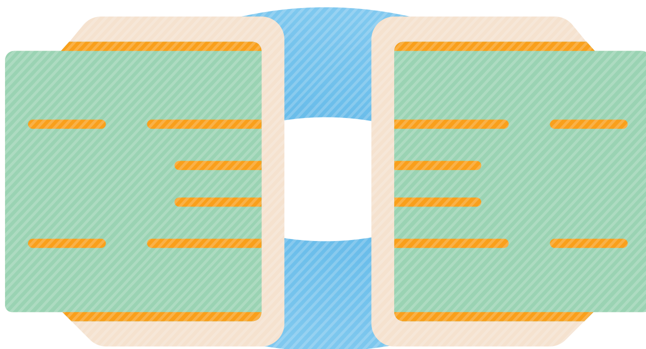
Benefits: Ease of processing. There are few manufacturing constraints.

TYPE III-A NOT RECOMMENDED

Concerns: One side protection should not be used with bare copper hole walls! The plug material may protrude out one side of the via.



TYPE III-B



Concerns: Air expansion or even entrapped solvents can have a significant effect on plugs as they are being cured, causing «blow-out».

Via protection definitions and types

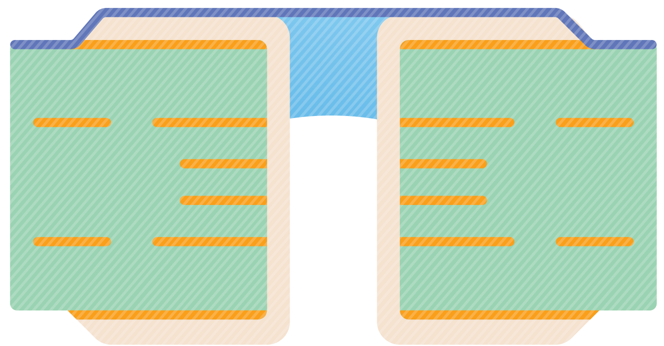
Plugged and Covered Via (Type IV Via) A Type III via with a secondary covering of material applied over the via. The plug and secondary covering material may be applied from either one side (Type IV-a) or both sides (Type IV-b) of the via structure.

Process: Application of mask over Type III.

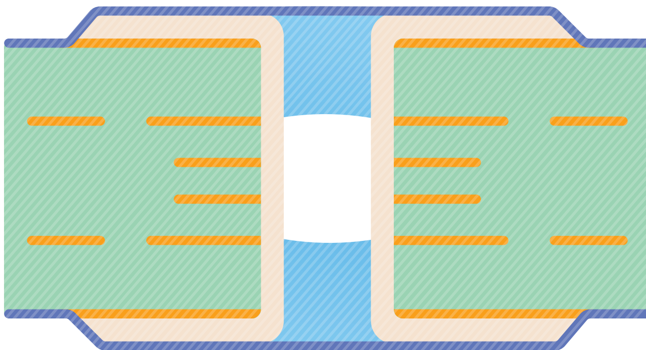
Benefits: Increased plug strength. Pin holes that occur through the use of Type III plugging can be mitigated through the use of this type.

TYPE IV-A NOT RECOMMENDED

Concerns: One side protection should not be used with bare copper hole walls! Final finishes should be applied prior to plugging.



TYPE IV-B



Concerns: Air expansion or entrapped solvents can have a significant effect on plugs as they are being cured, causing «blow-out».

Via protection definitions and types

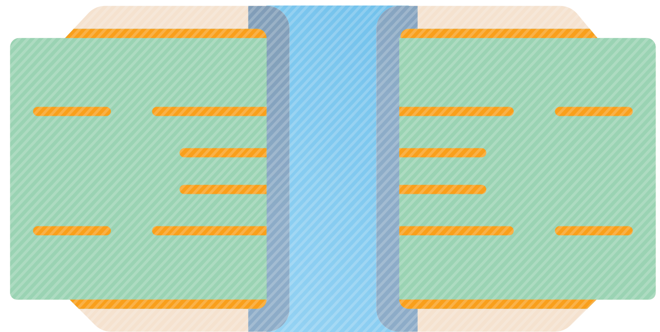
Filled Via (Type V Via) A via with material applied into the via targeting a full penetration and encapsulation of the hole.

Process: Screened, roller-coated, or squeegeed.

Benefits: Complete fill of conductive or non-conductive material which eliminates contaminants. Process prevents solder balling. Benefits useful in sequential lamination processes.

Concerns: Voiding. The removal of excess material from the surface. Surface planarity. Complete curing. Excess process variables. Complexity of obtaining complete fill. CTE mismatch between the fill material and substrate.

TYPE V



Via protection definitions and types

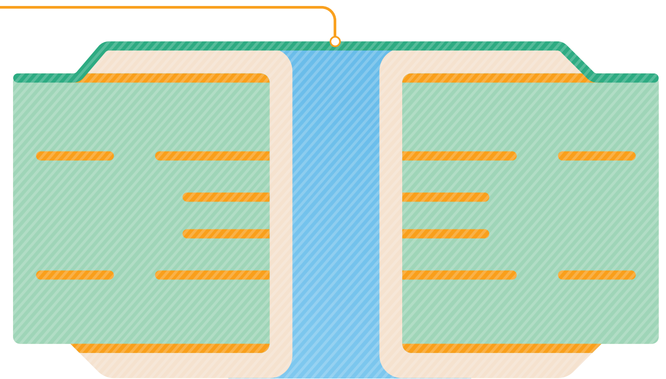
Filled and Covered Via (Type VI Via) A Type V via with a secondary covering of material (liquid or dry film soldermask) applied over the via. The covering material may be applied from either one side (Type VI-a) or both sides (Type VI-b) of the via structure.

Process: Application of mask over Type V. Fill material can be electrically and/or thermally conductive depending on end use.

Benefits: Protection of the pad over Type V. The effects of surface voids possibly caused by using Type V method can be minimized with Type VI.

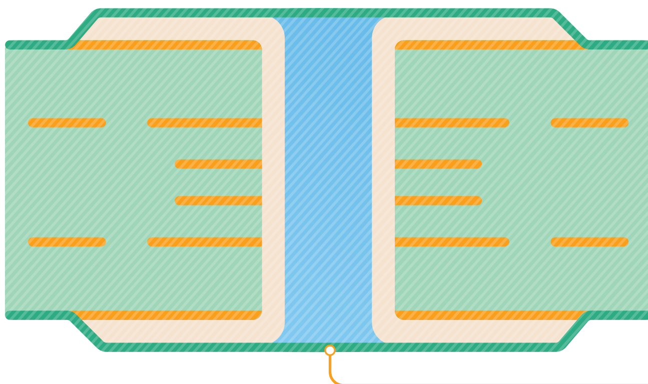
Concerns: Voiding. The removal of excess material from the surface. Surface planarity. Complete curing. Excess process variables. Complexity of obtaining complete fill. CTE mismatch between the fill material and substrate. Additional processing.

TYPE VI-A



Liquid or dry film soldermask

TYPE VI-B



Via protection definitions and types

Filled and Capped Via (Type VII Via) A Type V via with a secondary metallized coating covering the via. Metallization is on both sides.

Process: Metallized coating over Type V. Applicable where high density features are required.

Benefits: Via-In-Pad and Ball-on-Via pad. Via stacking. Applicable where high density features are required. Benefits useful in sequential lamination processes.

Concerns: Adhesion of the metallized coating to the via fill and copper pad. Copper thickness. The planarity between the fill material and the copper surface. CTE mismatch between the fill material and metallization resulting in air gap (fill material shrinkage). Less than 100% via fill may result in a metallized cap that is too thin or a dimple that can also cause entrapped air resulting in voids in BGA solder joints. Pinholes in the metallized coatings result in non-solderable areas of a land where the capped via is intended for a BGA solder joint. Reduced solder volume is also a concern with dimples.

TYPE VII