Plugging – Filling - Tenting

Clearance of vias in solder mask

versus

via protection according to IPC 4761
Topics

1. Availability of methods in different productions

2. Clearance of vias

3. Via protection types acc. to IPC 4761:
   
   - The baseline for different production methods and quality

4. Summary
## 1. Availability of methods in different productions

<table>
<thead>
<tr>
<th>Method</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearance of vias</td>
<td></td>
</tr>
<tr>
<td>IPC 4761 / Type 3a</td>
<td></td>
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<tr>
<td>IPC 4761 / Type 5</td>
<td></td>
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<tr>
<td>IPC 4761 / Type 6a with solder mask, HASL only!</td>
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<tr>
<td>IPC 4761 / Type 6a with resin</td>
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<tr>
<td>IPC 4761 / Type 6b with solder mask</td>
<td></td>
</tr>
<tr>
<td>IPC 4761 / Type 6b with resin</td>
<td></td>
</tr>
<tr>
<td>IPC 4761 / Type 7</td>
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</tbody>
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<thead>
<tr>
<th>Method</th>
<th>Availability</th>
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</thead>
<tbody>
<tr>
<td>IPC 4761 / Type 1, 2, 3b, 4</td>
<td></td>
</tr>
<tr>
<td>IPC 4761 / Type 6a with solder mask and chem. surfaces</td>
<td></td>
</tr>
</tbody>
</table>
2. Clearance of vias
Circular opening of solder mask

Circular opening of solder mask acc. to WE standards
Circular opening of solder mask acc. to capability of our partners
3. Via protection acc. to IPC 4761
Description of type 3a

IPC 4761 type 3a / vias plugged
Only single-sided plugged with special plugging ink

Note:
• This protection method must be done after soldering surfaces because single-sided plugged vias may cause diversion of bath media and can also cause missing pad defect (battery effect by different electrical potentials)
• Special plugging ink, separated and clean curing oven must be used to avoid cross-contamination of soldering surfaces by chemicals and/or dust during curing phase
3. Via protection acc. to IPC 4761
Description of type 5

IPC 4761 type 5 / vias filled
Vias filled with resin (100% by using vacuum).
Less shrinkage of resin in comparison to filling with solder mask
3. Via protection acc. to IPC 4761
Description of type 6a

IPC 4761 type 6a / vias filled and single-sided covered with solder mask
Only possible for HASL surfaces, via 50% filled with solder mask

Annular ring with HASL surface
3. Via protection acc. to IPC 4761
Process overview type 6 with solder mask

1. Silkscreen machine

2. Sheet before processing; holes opened to absorb the ink

3. Vias 100% by silk-screen process

4. Silk in use with ink in the holes

5. Vias filled with solder mask and double-sided covered with solder mask. Coverage „wet on wet“ on the filled vias
3. Via protection acc. to IPC 4761
Description of type 6

IPC 4761 type 6b / vias filled and double-sided covered
Vias completely filled with solder mask, resin or copper paste and covered with solder mask

Filled with solder mask
(Asia only)

Filled with resin

Note:
The selection of Type 6 with resin means more cost because this method requires additional processes like manual handling and filling, drying, cleaning and drilling of not filled PTHs including plating.
3. Via protection acc. to IPC 4761
Description of type 7

IPC 4761 type7 / vias filled and capped
Via filled with resin and plated with copper
Process can also be used to fill vias on inner layers
3. Via protection acc. to IPC 4761
Type 1 (only for information)

IPC 4761 type 1 / single- or double-sided tented

Tenting quality is not stable

Tenting with wet or with dry film is not used in German or Asia plants.
3. Via protection acc. to IPC 4761
Type 4 (only for information)

IPC 4761 type 4 / vias double-sided plugged and covered

This method is not allowed at Würth Elektronik because it causes air bubbles in the vias.
3. Via protection acc. to IPC 4761
Type 6a with chem. surface

IPC 4761 type 6a / vias filled and single-sided covered with solder mask
Not possible for chem. surfaces (HASL only)

This method is not allowed, because chem. soldering surface at not covered side
will also be contaminated with solder mask.
# 4. Summary and recommendations

## Via protection acc. to IPC 4761

<table>
<thead>
<tr>
<th>Questions / potential risk</th>
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<tbody>
<tr>
<td>• Vias must be closed</td>
<td>Vias only single-sided plugged with special plugging ink (IPC 4761 type 3a)</td>
<td>Vias completely filled with solder mask and covered with solder mask (IPC 4761 type 6b)</td>
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<tr>
<td>• Clearance of vias not permitted</td>
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<td>• Soldering pad very close to via</td>
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<td>• Risk of solder leakage to via.</td>
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<tr>
<td>• Layout restrictions require soldering pad too close to vias, or if via ends directly in soldering pad</td>
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<td>Via filled with resin, plate with copper. (IPC 4761 type 7)</td>
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<td>• Buried vias (HDI)</td>
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## Specials

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<tbody>
<tr>
<td>• Via is too close to pad for plugging acc. to type 3a: outgassing of special plugging ink during curing process is possible and can cause wetting problems</td>
<td>Vias completely filled with resin (IPC 4761 type 5 &amp; 6)</td>
<td>Type 3a not available in Asia</td>
</tr>
<tr>
<td>• Filling with solder mask not permitted (IPC 4761 Typ 6a/6b)</td>
<td>Filling with solder mask is not available at German plants</td>
<td>Vias completely filled with resin and covered with solder mask (IPC 4761 type 6a + 6b)</td>
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<tr>
<td>• Requirement that vias are completely filled with solder mask, but some vias should only covered single side with solder-mask (IPC 4761 type 6a)</td>
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<tr>
<td></td>
<td>Chem. soldering surfaces &amp; HASL surfaces</td>
<td>HASL surfaces ONLY: Vias completely filled and covered with solder mask (IPC 4761Type 6a). If some vias are single-sided capped, Würth Elektronik will accept 50% filling level.</td>
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Thanks for your attention!