IPC-6012A
with Amendment 1

Qualification and Performance Specification for Rigid Printed Boards
FOREWORD

This specification is intended to provide information on the detailed performance criteria of rigid printed boards. It supersedes IPC-RB-276 and IPC-6012 and was developed as a revision to those documents. The information contained herein is also intended to supplement the generic requirements identified in IPC-6011. When used together, these documents should lead both manufacturer and customer to consistent terms of acceptability.

IPC’s documentation strategy is to provide distinct documents that focus on specific aspects of electronic packaging issues. In this regard, document sets are used to provide the total information related to a particular electronic packaging topic. A document set is identified by a four digit number that ends in zero (0) (i.e., IPC-6010).

Included in the set is the generic information, which is contained in the first document of the set. The generic specification is supplemented by one or multiple performance documents, each of which provide a specific focus on one aspect of the topic or the technology selected.

Failure to have all information available prior to building a board may result in a conflict in terms of acceptability.

As technology changes, a performance specification will be updated, or new focus specifications will be added to the document set. The IPC invites input on the effectiveness of the documentation and encourages user response through completion of “Suggestions for Improvement” forms located at the end of each document.
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Qualification and Performance Specification for Rigid Printed Boards

1 SCOPE

1.1 Scope This specification covers qualification and performance of rigid printed boards. The printed board may be single-sided, double-sided, with or without plated-through holes, multilayer with plated-through holes, multilayer with or without buried/blind vias, and metal core boards.

1.2 Purpose The purpose of this specification is to provide requirements for qualification and performance of rigid printed boards.

1.3 Performance Classification and Type

1.3.1 Classification This specification recognizes that rigid printed boards will be subject to variations in performance requirements based on end-use. The printed boards are classified by a Performance Class of 1, 2 or 3. Performance classes are defined in IPC-6011, Generic Performance Specification for Printed Boards.

1.3.2 Board Type Printed boards without plated-through holes (Type 1) and with plated-through holes (Types 2-6) are classified as follows:

<table>
<thead>
<tr>
<th>Type 1</th>
<th>Single-Sided Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 2</td>
<td>Double-Sided Board</td>
</tr>
<tr>
<td>Type 3</td>
<td>Multilayer board without blind or buried vias</td>
</tr>
<tr>
<td>Type 4</td>
<td>Multilayer board with blind and/or buried vias</td>
</tr>
<tr>
<td>Type 5</td>
<td>Multilayer metal core board without blind or buried vias</td>
</tr>
<tr>
<td>Type 6</td>
<td>Multilayer metal core board with blind and/or buried vias</td>
</tr>
</tbody>
</table>

1.3.3 Selection for Procurement For procurement purposes, performance class shall be specified in the procurement documentation.

The documentation shall provide sufficient information to the supplier so that he can fabricate the printed board and ensure that the user receives the desired product. Information that should be included in the procurement documentation is shown in IPC-D-325.

1.3.3.1 Selection (Default) The procurement documentation should specify the requirements that can be selected within this specification; however, in the event selections are not made in the documentation, Table 1-1 shall apply.

1.3.4 Material, Plating Process and Final Finish

1.3.4.1 Laminate Material Laminate material is identified by numbers and/or letters, classes, types as specified by the appropriate specification listed in the procurement documentation.

1.3.4.2 Plating Process The copper plating process which is used to provide the main conductor in the holes is identified by one number as follows:

1. Acid copper electroplating only
2. Pyrophosphate copper electroplating only
3. Acid and/or pyrophosphate copper electroplating
4. Additive/electroless copper

1.3.4.3 Final Finish The final finish can be but is not limited to one of the finishes specified below or a combination of several platings and is dependent on assembly processes and end-use. Thickness, where required, shall be specified in the procurement documentation unless listed in Table 3-2. Coating thickness may be exempted in Table 3-2 (i.e., tin-lead plate or solder coating). Designators for final finish are as follows:

### Table 1-1 Default Requirements

<table>
<thead>
<tr>
<th>Category</th>
<th>Default Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Class</td>
<td>Class 2</td>
</tr>
<tr>
<td>Material</td>
<td>Epoxy-Glass Laminate</td>
</tr>
<tr>
<td>Final Finish</td>
<td>Finish X (Electrodeposited tin-lead, fused or solder coated)</td>
</tr>
<tr>
<td>Minimum Starting Foil</td>
<td>1/2 oz. for all internal and external layers except Type 1 which shall start with 1 oz.</td>
</tr>
<tr>
<td>Copper Foil Type</td>
<td>Electrodeposited</td>
</tr>
<tr>
<td>Hole Diameter Tolerance</td>
<td></td>
</tr>
<tr>
<td>Plated, components</td>
<td>(±) 100 µm [0.0040 in]</td>
</tr>
<tr>
<td>Plated, via only</td>
<td>(+) 80 µm [0.0031 in], (-) no requirement, (may be totally or partially plugged)</td>
</tr>
<tr>
<td>Unplated</td>
<td>(±) 80 µm [0.0031 in]</td>
</tr>
<tr>
<td>Conductor Width tol.</td>
<td>Class 2 requirements per para. 3.5.1</td>
</tr>
<tr>
<td>Conductor Spacing tol.</td>
<td>Class 2 requirements per para. 3.5.2</td>
</tr>
<tr>
<td>Dielectric Separation</td>
<td>90 µm [0.0035 in] minimum</td>
</tr>
<tr>
<td>Lateral Conductor Spacing</td>
<td>100 µm [0.0040 in] minimum</td>
</tr>
<tr>
<td>Marking Ink</td>
<td>Contrasting color, nonconductive</td>
</tr>
<tr>
<td>Solder Resist</td>
<td>Not applied, if not specified</td>
</tr>
<tr>
<td>Solder Resist, specified</td>
<td>Class T of IPC-SM-840 if class not specified</td>
</tr>
<tr>
<td>Solderability Test</td>
<td>Category 2 of J-STD-003</td>
</tr>
<tr>
<td>Test Voltage, Insulation Resistance</td>
<td>40 Volts</td>
</tr>
<tr>
<td>Qualification not specified</td>
<td>See IPC-6011</td>
</tr>
</tbody>
</table>
S Solder Coating ................................. (Table 3-2)
T Electrodeposited Tin-Lead, (fused) ............................. (Table 3-2)
X Either Type S or T ............................................... (Table 3-2)
TLU Electrodeposit Tin-Lead (unfused) .............................. (Table 3-2)
G Gold Electroplate for Edge Board Connectors ...................... (Table 3-2)
GS Gold Electroplate for Areas to be Soldered .......................... (Table 3-2)
N Nickel for Edge Board Connectors ........................................ (Table 3-2)
NB Nickel as a Barrier to Copper-Tin Diffusion ........................... (Table 3-2)
OSP Organic Solderability Protector (tarnish and solderability protection during storage and assembly processes) (Table 3-2)
C Bare Copper ..................................... (Table 3-2)
SMOBC Solder Mask over Bare Copper
EN Electroless Nickel
EG Electroless Gold
IG Immersion Gold
IS Immersion Silver
IT Immersion Tin
TN Tin-Nickel
R Rhodium
P Palladium
TP Tin Plating
Y Other

2 APPLICABLE DOCUMENTS
The following specifications of the revision in effect at the time of order form a part of this document to the extent specified herein. If a conflict of requirements exists between IPC-6012 and the listed applicable documents, IPC-6012 shall take precedence.

2.1 IPC

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits
IPC-DD-135 Qualification for Deposited Organic Interlayer Dielectric Materials for Multichip Modules
IPC-CF-148 Resin Coated Metal for Printed Boards
IPC-CF-152 Composite Material Specifications for Printed Wiring Boards

IPC-FC-232 Adhesive Coated Dielectric Films for Use as Cover Sheets for Flexible Printed Wiring and Flexible Bonding Films
IPC-D-325 Documentation Requirements for Printed Boards, Assemblies, and Support Drawings
IPC-A-600 Acceptability of Printed Boards
IPC-AI-642 User Guideline for Automated Inspection of Artwork, Innerlayer and Unpopulated PWBs
2.1.1D 03/98 Microsectioning
2.1.1.2 07/93 Microsectioning, Semi or Automatic Technique Microsection Equipment (Alternate)
2.3.15C 08/92 Purity, Copper Foil or Plating
2.3.25B 08/97 Detection and Measurement of Ionizable Surfact Contaminants
2.3.38B 08/97 Surface Organic Contaminant Detection Test
2.3.39B 08/97 Surface Organic Contaminant Identification Test (Infrared Analytical Method)
2.4.1D 08/97 Adhesion, Tape Testing
2.4.18.1 08/97 Tensile Strength and Elongation, In-House Plating
2.4.21D 08/97 Land Bond Strength, Unsupported Component Hole
2.4.22C 06/99 Bow and Twist
2.4.28.1C 03/98 Adhesion, Solder Resist (Mask), Tape Test Method
2.4.36B 08/97 Rework Simulation, Plated-Through Holes for Leaded Components
2.4.41.2 08/97 Coefficient of Thermal Expansion, Strain Gage Method
2.5.5.7 11/92 Characteristic Impedance and Time Delay of Lines on Printed Boards by TDR
2.5.7C 08/97 Dielectric Withstand Voltage, PWB
2.6.1E 08/97 Fungus Resistance, Printed Wiring Materials
2.6.3E 08/97 Moisture and Insulation Resistance, Rigid Boards
2.6.4A 08/97 Outgassing, Printed Boards
2.6.5C 08/97 Physical Shock, Multilayer Printed Wiring

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