IPC-4552

with Amendments 1 & 2
2012 - December

Specification for Electroless Nickel/Immersion Gold (ENIG) Plating for Printed Circuit Boards

Supersedes IPC-4552
October 2002

A standard developed by IPC

Association Connecting Electronics Industries

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- Contain simple (simplified) language
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Developed by the Plating Processes Subcommittee (4-14) of the Fabrication Processes Committee (4-10) of IPC

Supersedes:

IPC-4552 - October 2002
Amendment 1 - June 2012
Amendment 2 - October 2012

Users of this standard are encouraged to participate in the development of future revisions.

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Acknowledgment

Any Standard involving a complex technology draws material from a vast number of sources. While the principal members of the Plating Processes Subcommittee (4-14) of the Fabrication Processes Committee (4-10) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

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Specification for Electroless Nickel/Immersion Gold (ENIG) Plating for Printed Circuit Boards

1 SCOPE

1.1 Scope This specification sets the requirements for the use of Electroless Nickel/Immersion Gold (ENIG) as a surface finish for printed circuit boards. This specification is intended to set requirements for ENIG deposit thicknesses based on performance criteria. It is intended for use by supplier, printed circuit manufacturer, electronics manufacturing services (EMS) and original equipment manufacturer (OEM).

1.2 Description ENIG is an electroless nickel layer capped with a thin layer of immersion gold. It is a multifunctional surface finish, applicable to soldering, aluminum wire bonding, press fit connections, and as a contact surface. The immersion gold protects the underlying nickel from oxidation/passivation over its intended life. However, this layer is not totally impervious and it will not pass the requirements of a 'classic' porosity test.

1.2.1 Phosphorus/Boron Content Phosphorus or boron containing reducing agents are used for the reduction of the electroless nickel during the deposition process. Phosphorus or boron is thus incorporated in the nickel deposit. The level of these co-deposited elements should be controlled within the specified process limit. Variation of phosphorus or boron level, outside the specified process limits, may have adverse effects on the solderability of the finish.

1.3 Objective This specification sets the requirements specific to ENIG as a surface finish (see Table 3-1 for a summary of these requirements). As other finishes require specifications, they will be addressed by the IPC Plating Processes Subcommittee as part of the IPC-4550 specification family. As this and other applicable specifications are under continuous review, the subcommittee will add appropriate amendments and make necessary revisions to these documents.

Table 3-1 Requirements of Electroless Nickel/Immersion Gold Plating

Tests	Test Method	Requirement Paragraph	Class 1	Class 2	Class 3
General					
Visual	Visual	3.1	Uniform plating and complete coverage of surface to be plated		
Electroless Nickel Thickness	APPENDIX 4	3.2.1	3 to 6 µm [118.1 to 236.2 µin]		
Immersion Gold Thickness **(Default for this IPC standard)**	APPENDIX 4	3.2.2.1	The minimum immersion gold deposit thickness **shall** be 0.05 µm [1.97 µin] at -4 sigma from the mean as measured on a pad size of 1.5 mm x 1.5 mm [0.060 in x 0.060 in] or equivalent area.		
Immersion Gold Thickness **(Exception required on procurement documentation)**	APPENDIX 4	3.2.2.2	The minimum immersion gold deposit thickness **shall** be 0.04 µm [1.58 µin] at -4 sigma from the mean as measured on a pad size of 1.5 mm x 1.5 mm [0.060 in x 0.060 in] or equivalent area.		
Porosity	N/A	3.3	N/A		
Physical					
Adhesion/Tape Test	IPC-TM-650, TM 2.4.1	3.4	No evidence of plating removed		
Solderability(2)	J-STD-003	3.5	Meet solderability requirements of Category 3 durability with 6 months shelf life.		
Chemical					
Phosphorous/Boron Content	ASTM B733-97 & ASTM B607-91(1998)	1.2.1	(Reference Only; Supplier Dependent - No Testing Required)		
Chemical Resistance	N/A	3.7	N/A		
Electrical					
High Frequency Signal Loss (1)		3.8	TBD		
Contact Resistance (1)		1.4.2	TBD		
Environmental					
Cleanliness	IPC-TM-650, TM 2.3.25	3.6	Max. 1.56 µg/cm^2		

(1) An appropriate IPC-TM-650 test method used to generate data for this electrical property is not available at the time of this writing.
(2) This applies to the default Immersion Au thickness, only.