

**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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IPC-4552 with Amendments 1 & 2

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

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 is with 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	Requirements Paragraph	Class 1	Class 2	Class 3
<b>General</b>					
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 $\mu\text{m}$ [118.1 to 236.2 $\mu\text{in}$ ]		
Immersion Gold Thickness (Default for this IPC standard)	APPENDIX 4	3.2.2.1	The minimum immersion gold deposit thickness <b>shall</b> be 0.05 $\mu\text{m}$ [1.97 $\mu\text{in}$ ] 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 <b>shall</b> be 0.04 $\mu\text{m}$ [1.58 $\mu\text{in}$ ] 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		
<b>Physical</b>					
Adhesion/Tape Test	IPC-TM-650, TM 2.4.1	3.4	No evidence of plating removed		
Solderability <sup>(2)</sup>	J-STD-003	3.5	Meet solderability requirements of Category 3 durability with 6 months shelf life.		
<b>Chemical</b>					
Phosphorus/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		
<b>Electrical</b>					
High Frequency Signal Loss <sup>(1)</sup>		3.8	TBD		
Contact Resistance <sup>(1)</sup>		1.4.2	TBD		
<b>Environmental</b>					
Cleanliness	IPC-TM-650, TM 2.3.25	3.6	Max. 1.56 $\mu\text{g}/\text{cm}^2$		

<sup>(1)</sup> An appropriate IPC-TM-650 test method used to generate data for this electrical property is not available at the time of this writing.

<sup>(2)</sup> This applies to the default Immersion Au thickness, only.