



ASSOCIATION CONNECTING  
ELECTRONICS INDUSTRIES®

**IPC-4552**

# **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



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

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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 multi-functional 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
<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 µm [118.1 to 236.2 µin]		
Immersion Gold Thickness	APPENDIX 4	0	0.05 µm minimum [1.97 µin minimum]		
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	J-STD-003	3.5	Meet solderability requirements of Category 3 durability with six months shelf life.		
<b>Chemical</b>					
Phosphorous/Boron Content	ASTM B-733-97 & 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 µg/cm <sup>2</sup>		

(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.