

SEMI G21-94

SPECIFICATION FOR PLATING INTEGRATED CIRCUIT LEADFRAMES

This Standard was technically approved by the Assembly & Packaging Global Technical Committee.
Originally published in 1980.

1 Preface

1.1 *Purpose* — This Specification details the requirements for plating layers on leadframes intended for use in plastic semiconductor packages. It is intended as a design guideline.

1.2 *Scope* — The specifications and test procedures detailed in this Document apply to all plating applied to the internal section of leadframes. External leadframe finishes are not included.

1.3 *Units* — U.S. Customary (inch-pound) or SI units may be used at the customer's discretion. This Specification uses U.S. Customary units as the prime unit.

2 Referenced Documents

2.1 *Applicable Documents* — To avoid conflicts, the order of precedence when ordering plated leadframes shall be as follows:

- Purchase Order
- Customer's Leadframe Drawing
- This Specification
- Referenced Documents
- Related Documents

2.2 *Referenced Documents*

2.2.1 *SEMI Standards*

SEMI G4 — Integrated Circuit Leadframe Materials used in the Production of Stamped Leadframes

SEMI G18 — Materials Used in the Production of Etched Leadframes for Semiconductor Devices

SEMI — All leadframe specifications

2.2.2 *ASTM Standards*¹

ASTM B567 — Method for Measurement of Coating Thickness by the Beta Backscatter Method

ASTM B568 — Method for Measuring Coating Thickness by X-Ray Spectrometry

ASTM B847 — Test Method for Measurement of Metal and Oxide Coating Thicknesses by Microscopic Examination of a Cross-Section

ASTM E384 — Standard Test Method for Microhardness of Materials

ASTM F1269 — Test Methods for Destructive Shear Testing of Ball Bonds

2.2.3 *Military and Federal Specifications*²

MIL-C-14550 — Copper Plating, Electrodeposited

MIL-G-45204 — Gold Plating, Electrodeposited

¹ ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA; Telephone: +1.610.832.9585, Fax: +1.610.832.9555, <http://www.astm.org>

² United States Military Standards, Available through the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120-5099, USA; Telephone: +1.215.697.3321.

MIL-T-10727 — Tin Plating, Electrodeposits or Hot Dipped, for Ferrous and Non-Ferrous Metals

MIL-STD-883 — Test Methods and Procedures for Microelectronics

QQ-N-290 — Nickel Plating, Electrodeposited

QQ-S-3651 — General Requirements for Electrodeposited Silver Plating

2.3 Related Documents

2.3.1 Military and Federal Specifications

MIL-P-81728 — Plating Tin/Lead (Sn/Pb) Electrodeposited

MIL-STD-105 — Sampling Procedures and Tables for Inspection by Attributes

MIL-STD-202 — Test Methods for Electronic and Electrical Component Parts

MIL-S-19500 — General Specification for Semiconductor Devices

2.3.2 ISO Standard³

ISO-3497 — Metallic Coating Measurement of Coating Thickness, X-Ray Spectrometry Method

3 Terminology

3.1 *finish (plating)* — the final plating layer.

3.2 *resin bleed-out (die attach)* — the surface creep of a resin used for die attach beyond the outer perimeter of the bulk of the resin (filler). For a given resin formulation, the resin creep may be exacerbated by the micro-structure and cleanliness of the die attach surface.

4 Ordering Information

Purchase orders for material furnished to this Specification shall include the following information:

4.1 Leadframe drawing showing the areas to be plated and tolerances for the location.

4.2 *Plating Metal, Type, and Grade* — Underplate and finish plate.

4.3 Plating(s) thickness and tolerance.

4.4 Certification or Test Report requirements.

4.5 Reference to this Specification.

4.6 Any additions to or variations from this Specification.

5 Materials

5.1 *Base Material* — See SEMI G4 and SEMI G18 for leadframe base metal specifications.

5.2 *Underplates* — When underplates are specified, the materials specified in Table 1 shall be used.

Table 1 Underplates

Platings	Type Grade	Specifications	Specifications
Nickel			QQN-290
Copper			MIL-C-14550
Gold	III	A	MIL-G-45204
Silver	I, II, III	B	QQ-S-365

³ International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland; Telephone: +41.22.749.01.11, Fax: +41.22.733.34.30, <http://www.iso.org>

5.3 *Finish/Underplates* — The recommended finish plating options for copper and nickel-iron alloys and the suggested underplates are shown in Table 2.

Table 2 Undercoat Finishes

<i>Finish</i>	<i>Copper Alloys</i>	<i>Nickel/Iron Alloy</i>
Gold MIL-G-45204		
Over Base Material		X
Acceptable Underplate		
Nickel ^{#1}	X	X
Silver QQ-S-365		
Over Base Material	X	
Acceptable Underplate		
Gold		X
Copper	X	X
Tin MIL-T-10727		
Over Base Material	X	X
Acceptable Underplate		
Nickel	X	X
Copper	X	X
Copper MIL-C-14550		
Over Base Material	X	X
Acceptable Underplate		
Nickel QQN-290		
Over Base Material	X	X
Acceptable Underplate		
Palladium		
Over Base Material		
Acceptable Underplate Nickel	X	X
Copper	X	X

#1 Copper strike may be used under nickel

6 Sampling

6.1 The sampling plan shall be agreed between user and supplier.

7 Equipment

7.1 Beta Backscatter system.

7.2 Die Attach equipment.

7.3 Eutectic Die Attach heater block or hot plate capable of $450^{\circ}\text{C} \pm 10^{\circ}\text{C}$.