



Standard Specification for Integrated Circuit Lead Frame Material ¹

This standard is issued under the fixed designation F 375; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers the special requirements for metal strip to be used to fabricate integrated-circuit lead frames by stamping or photochemical milling.

1.2 The metals that are applicable to these parts include copper and copper alloys, ferrous alloys usually containing nickel or cobalt or chromium, nickel and nickel alloys, and other metallic materials.

1.3 The general chemical, physical, and mechanical property requirements of these materials are covered by other ASTM specifications (specifically Specifications B 103/B 103M, B 122/B 122M, B 152, B 162, B 465, F 15, F 30, F 31, F 49 and F 68), and these should be consulted for properties and tempers that are different for the different metals. For metals for which no ASTM specification is available, other specifications should be adopted by agreement of the parties concerned.

1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 ASTM Standards:

- B 103/B 103M Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar ²
- B 122/B 122M Specification for Copper-Nickel-Tin Alloy, Copper-Nickel-Zinc Alloy (Nickel Silver), and Copper-Nickel Alloy Plate, Sheet, Strip, and Rolled Bar ²
- B 152 Specification for Copper Sheet, Strip, Plate, and Rolled Bar ²
- B 162 Specification for Nickel Plate, Sheet, and Strip ³
- B 465 Specification for Copper-Iron Alloy Plate, Sheet, Strip, and Rolled Bar ²
- E 112 Test Methods for Determining the Average Grain Size ⁴
- F 15 Specification for Iron-Nickel-Cobalt Sealing Alloy ⁵

¹ This specification is under the jurisdiction of ASTM Committee F-1 on Electronics and is the direct responsibility of Subcommittee F01.03 on Metallic Materials.

Current edition approved March 1, 1989. Published May 1989. Originally published as F 375 – 73 T. Last previous edition F 375 – 77 (1989).

² *Annual Book of ASTM Standards*, Vol 02.01.

³ *Annual Book of ASTM Standards*, Vol 02.04.

⁴ *Annual Book of ASTM Standards*, Vol 03.01.

⁵ *Annual Book of ASTM Standards*, Vol 10.04.

F 30 Specification for Iron-Nickel Sealing Alloys ⁵

F 31 Specification for 42 Percent Nickel-6 Percent Chromium-Iron Sealing Alloy ⁵

F 49 Specification for Molybdenum Strip for Electron Tubes ⁶

F 68 Specification for Oxygen-Free Copper in Wrought Forms for Electron Devices ²

3. Ordering Information

3.1 Orders for material under this specification shall include the following information:

- 3.1.1 Quantity of each size,
- 3.1.2 Material and specification number appropriate to the material (see 2.1),
- 3.1.3 Temper or mechanical properties (see 4.1),
- 3.1.4 Dimensions: thickness, width, length if applicable (see 6.2-6.4),
- 3.1.5 How furnished: coils and coil size or lengths (see 10.1),
- 3.1.6 ASTM designation, referencing this specification number, and the fabricating process to be used,
- 3.1.7 Certification or test report requirements (see 11.1), and
- 3.1.8 Packing and marking requirements (see 12.1 and 12.2).

4. Materials and Manufacture

4.1 The materials covered by this specification shall conform to the chemical, physical, and mechanical property requirements prescribed in the material specification covering the metal or alloy and the temper (see 2.1).

4.2 The material shall conform to the requirements for lead frames as prescribed in this specification and shall be characteristically suitable for fabrication into lead frames by the fabricating process to be specified. Any special requirements relating to the material properties or the fabricating process, to be specified by the user, shall be agreed upon between the supplier and purchaser.

5. Chemical Composition

5.1 The material shall conform to the requirements as to chemical composition specified for flat products in the ASTM specification for the metal or alloy specified, unless otherwise agreed upon between supplier and purchaser.

⁶ Discontinued—See 1977 *Annual Book of ASTM Standards*, Part 43.

6. Dimensions and Tolerances

6.1 *General*—For the purposes of determining conformance with the dimensional requirements prescribed in this specification, any measured value outside the specified limiting values for any dimension shall be cause for rejection.

6.2 *Thickness*—The thickness tolerances shall be those shown in Table 1.

6.3 *Width*—The width of material shall conform to tolerances shown in Table 2.

6.4 *Length*—The length tolerances shall be those shown in the appropriate table for flat products in the ASTM specification covering the metal or alloy.

6.5 *Straightness*—The maximum edgewise curvature (camber) in any 96-in. (2.44-m) length shall be that shown in Table 3.

6.5.1 *Test Method*—Cut a length greater than 96 in. (2.44 m), representative of the material, and lay it on a flat surface. Place an 8-ft long straightedge against the concave edge of the strip. Measure the maximum distance of the straightedge from the edge of the material (curvature is usually uniform and the point of maximum departure will usually be equidistant from the ends of the straightedge).

6.6 *Flatness*—Depending upon the method of manufacture of lead frames, flatness may be a major determinant of suitability for the intended fabricating process.

6.6.1 For flatness for photochemically milled lead frames, strip shall be free of waves, buckles, undulations, and ripples to the extent that special flattening operations may be required, and agreement of flatness requirements should be negotiated between purchaser and supplier, but in any case the maximum percent out-of-flatness shall be not over 5 % as defined in paragraph 6.1.1.3 of the Dimensions and Tolerances Section of Specification F 49.

6.7 *Coil Set*—This is dependent on alloy, temper, and coil diameter, and where the combination of these requirements result in coil set, it shall be uniformly in the direction of coiling.

6.7.1 Coil set shall not exceed 1.5 in. (38 mm) in a 36-in. (0.91-m) length.

6.7.2 *Test Method*—Cut a 36-in. (0.91-m) length and hold one end against a flat vertical surface. Measure the distance between the reference surface and the free hanging end of the strip that is positioned for maximum distance from the reference surface.

6.8 *Edge Burrs* are undesirable and, if present, their height shall not exceed 10 % of the metal thickness.

7. Grain Size

7.1 Methods of measuring and indicating grain size vary for

TABLE 1 Thickness Tolerances

| Thickness, in. (mm) | Thickness tolerance, ±, in. (mm) for widths up to 24 in. (610 mm), incl |
|---|---|
| 0.0040 (0.102) to 0.0060 (0.152), incl | 0.0003 (0.007) |
| Over 0.0060 (0.152) to 0.0090 (0.229), incl | 0.0004 (0.010) |
| Over 0.0090 (0.229) to 0.0130 (0.330), incl | 0.0006 (0.015) |
| Over 0.0130 (0.330) to 0.0170 (0.432), incl | 0.0008 (0.020) |
| Over 0.0170 (0.432) to 0.0210 (0.533), incl | 0.0009 (0.022) |
| Over 0.0210 (0.533) to 0.0300 (0.762), incl | 0.0010 (0.025) |

TABLE 2 Width Tolerances

| Width, in. (mm) | Width tolerances, ±, in. (mm) for thickness in the range 0.004 in. (0.10 mm) to 0.030 in. (0.76 mm), incl |
|---|---|
| 2.000 (50.80) and under | 0.003 (0.07) |
| Over 2.000 (50.80) to 6.000 (152.40), incl | 0.005 (0.12) |
| Over 6.000 (152.40) to 12.000 (304.80), incl | 0.010 (0.25) |
| Over 12.000 (304.80) to 24.000 (609.60), incl | 0.016 (0.40) |

TABLE 3 Straightness (Camber) Tolerances

| Specified Width, in. (mm) | Tolerance Per Unit Length of Any 96-in. (2.44-m) Length, in. (mm) |
|---------------------------|---|
| Up to 1 1/2 (38.1), incl | 1/2 (12.7) |
| Over 1 1/2 (38.1) | 1/4 (6.3) |

different metals. These are defined in Test Methods E 112.

7.2 *Grain Size of Annealed Tempers*—The grain-size requirements for annealed tempers are covered by the specification covering the metal, and the particular grain-size requirement shall be as agreed upon between purchaser and supplier.

7.3 *Grain Size of Rolled Tempers*—The grain size of rolled tempers of metals supplied shall be in accordance with the normal mill practice for the metal unless otherwise specified.

8. Inclusions

8.1 A limitation on the severity and number of inclusions shall be negotiated between purchaser and supplier.

9. Surface Finish

9.1 Finish is to be 16 µin. (0.41 µm) rms or less when measured with a profilometer. There shall be no scratches over 0.001 in. (0.025 mm) deep.

10. Coil Size

10.1 Unless otherwise specified, coils shall be supplied with an inside diameter that provides for good packing practice without resulting in excessive coil set.

11. Certification or Test Reports

11.1 Requests for a manufacturer’s certification that the material was manufactured in accordance with this specification or a report of the test results or both, if required, shall be made at the time of order entry or contract agreement. They shall be furnished by the manufacturer at the time of shipment.

12. Packaging, Marking, Shipping, and Preservation

12.1 The material shall be separated by size, composition, and temper, and prepared for shipment in such a manner as to ensure acceptance by common carrier for transportation at the lowest rate applicable and to afford protection from the normal hazards of transportation.

12.2 Each shipping unit shall be legibly marked with the purchase order number, metal or alloy designation, temper, size, gross and net weight, and name of supplier. The specification number shall be shown when specified.

13. Keywords

13.1 copper alloys; iron-nickel alloys; iron-nickelchromium alloy; iron-nickel-cobalt alloys; lead frame material; molybdenum

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