

Capabilities for Class 3 and 3/A IPC circuits

Introduction

Section 1.2 of the IPC 6011 standard for generic specification on the performance of printed circuits sets forth the classification criteria for printed circuit boards according to their degree of functionality and performance. According to these criteria, these are grouped into three classes:

- Class 1: General and consumer electronics products.
- Class 2: Professional electronics products.
- Class 3: High performance and reliability electronics products. Printed circuit boards for avionics are given the classification 3/A.

The IPC 6012 standard defines the classification and qualification requirements for rigid circuits. These requirements are summarized in the following appendices of the standard itself:

- Appendix A: Requirements for Class 3/A military and/or space avionics circuits.
- Appendix B: Requirements for Class 1-2-3 general and high performance electronic circuits.

The eligibility criteria for rigid printed circuits are defined in the IPC-A-600 standard.

Lab Circuits, S.A. has the technology and capacity to manufacture any of the three classes defined, under the ISO 9001 and EN-UNE-9100 quality certifications and the ISO 14001 environmental certification.



ER-0036/1996



OP-0018/2012



GA-2002/0298

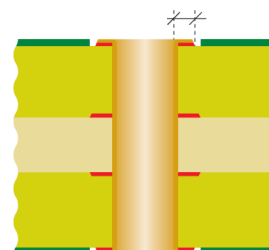
Restrictions

In the commitment of Lab Circuits, S.A. to offer customers the highest quality and guarantee 100% compliance with the classification and qualification requirements under these standards, we present the following corrections to establish the current certification limits of Lab Circuits, S.A. in some parameters for Class 3 and 3/A circuits:

1. Minimum annular ring:

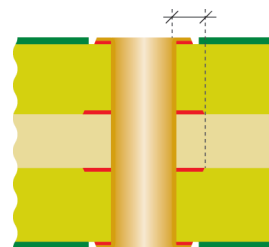
1. Minimum annular ring in outer layers: **0.13 mm**

With external annular rings below this minimum, Lab Circuits, S.A. cannot guarantee 100% and in all cases the 50 μm minimum annular ring requirement under paragraph 3.4.2 (Class 3 characteristic) of the IPC 6012 standard (fig. A).



2. Minimum annular ring in inner layers: **0.175 mm**

With external annular rings below this minimum, Lab Circuits, S.A. cannot guarantee 100% and in all cases the 25 μm minimum annular ring requirement under paragraph 3.4.2 (Class 3 characteristic) of the IPC 6012 standard (fig. A).



3.4.2 Annular Ring and Breakout (External) The minimum external annular ring shall meet the requirements of Table 3-8.

Table 3-8 Minimum Annular Ring^{1,2}

Characteristic	Class 1	Class 2	Class 3
External PTHs	Not greater than 180° breakout of hole from land when visually assessed. The land/conductor junction shall not be reduced below the allowable width reduction in 3.5.3.1.	Not greater than 90° breakout of hole from land when visually assessed. The land/conductor junction shall not be reduced below the allowable width reduction in 3.5.3.1. The conductor junction should never be less than 50 µm [1,969 µin] or the minimum line width, whichever is smaller.	The minimum annular ring shall be 50 µm [1,969 µin]. The minimum external annular ring may have 20% reduction of the minimum annular ring in isolated areas due to defects such as pits, dents, nicks, pinholes, or splay in the annular ring of isolated areas.
Internal PTHs	Hole breakout is allowed provided the land/conductor junction is not reduced below the allowable width reduction in 3.5.3.1	90° hole breakout is allowed provided the land/conductor junction is not reduced below the allowable width reduction in 3.5.3.1	The minimum internal annular ring ³ shall be 25 µm [984 µin].

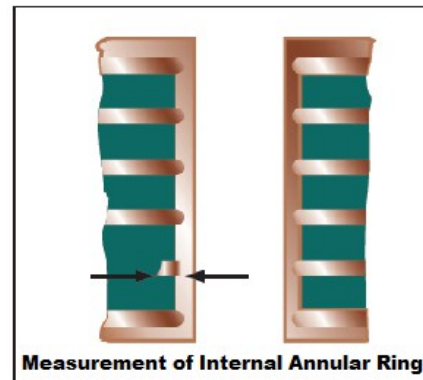
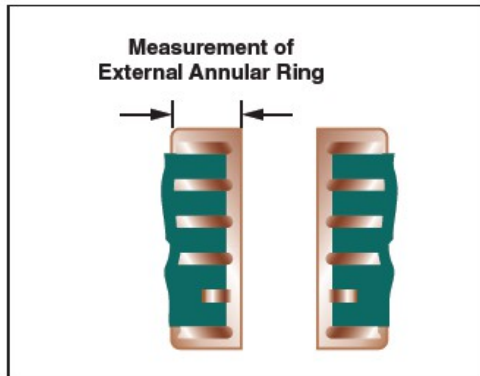


Fig. A

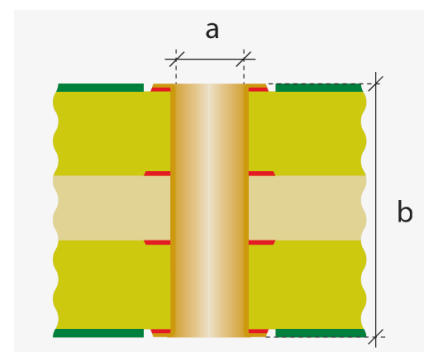
1.3. Minimum annular ring downgrading

If the original design of the printed circuit has minimum annular ring parameters below these values, Lab Circuits, S.A. will ask the client for downgrading to Class 2 with regard to these parameters.

2. Aspect ratio (b/a; circuit thickness/minimum hole):

- 1. Maximum aspect ratio 10:** For Class 3 requirements for average coating thickness of 25 µm (Fig. B).

With an aspect ratio greater than 10, Lab Circuits, S.A. cannot guarantee 100% and in all cases the requirement for average coating thickness of 25 µm in Class 3 (Fig. B), according to paragraph 3.6.2.11, Table 3-3 of the IPC 6012 standard.



3.6.2.11 Plating/Coating Thickness Based on microsection examination or on the use of suitable electronic measuring equipment, plating/coating thicknesses **shall** meet the requirements of Table 3-2 through Table 3-5. Deviations to these requirements **shall** be AABUS. Measurements in the PTH **shall** be reported as an average thickness per side of the hole. Isolated thick or thin sections **shall not** be used for averaging. Isolated areas of reduced copper thickness due to glass fiber protrusions **shall** meet the minimum thickness requirements of Table 3-3 through Table 3-5 as measured from the end of the protrusion to the hole wall.

If copper thickness less than the minimum specified in Table 3-3 through Table 3-5 is detected in isolated areas, it should be considered a void and resampled in accordance with Table 4-2 using samples from the same lot to determine if the defect is random. If the additional test coupons or production printed boards have no isolated areas of reduced copper thickness, the product which the test coupons or production printed boards represent are considered acceptable; however, if reduced copper thickness is present in the microsections, the product **shall** be considered nonconforming.

Table 3-3 Surface and Hole Copper Plating Minimum Requirements for Buried Vias ≥ 2 Layers, Through-Holes and Blind Vias¹

	Class 1	Class 2	Class 3
Copper - average ^{2,4}	20 μm [787 μin]	20 μm [787 μin]	25 μm [984 μin]
Thin areas ⁴	18 μm [709 μin]	18 μm [709 μin]	20 μm [787 μin]
Wrap ³	AABUS	5 μm [197 μin]	12 μm [472 μin]

Fig. B

2.1.1. Class 3 aspect ratio downgrading

For Class 3 requirements, if the original design of the printed circuit has aspect ratio parameters above these maximums, Lab Circuits, S.A. will ask the client for downgrading to Class 2 with regard to the average coating thickness, which becomes 20 μm .

2.2. Maximum aspect ratio 8: For Class 3/A requirements for average copper-plating thickness of 37 μm (Fig. C).

With an aspect ratio greater than 8, Lab Circuits, S.A. cannot guarantee 100% and in all cases the requirement for average copper-plating thickness of 37 μm in Class 3/A (Fig. C), according to Appendix A and paragraph 3.6.2.11 (Class 3/A characteristic) of the IPC 6012 standard.

APPENDIX A Space and Military Avionics Class 3/A Performance Requirements

A.1 SCOPE

A.1.1 Intent This Appendix defines supplemental requirements to existing Class 3 performance attributes of this base specification for use by the space and military avionics sector of the electronics interconnect industry. These Class 3/A supplemental requirements are reflective of existing performance attributes within internal OEM and recognized Industry Specifications.

A.1.2 Purpose When Class 3/A is specified in procurement documentation, the following Class 3/A supplemental requirements in Table A.1 apply. Specify space applications when required.

Note: Class 3/A product **shall** meet all IPC-6012 Class 3 requirements in addition to the supplemental requirements listed in Table A.1.

Table A.1 Class 3/A Supplemental Requirements

Requirement Attribute	IPC-6012 Requirement Section	Class 3/A Requirement	Inspection/ Test Method	Test Frequency	
				Remarks	Class 3/A
Plating/Coating Thickness	3.6.2.11	The following apply to minimum copper average and minimum thin areas: 12 μm [472 μin] above Class 3 requirement in Table 3-3 8 μm [315 μin] above Class 3 requirement in Table 3-4 5 μm [197 μin] above Class 3 requirement in Table 3-5	Microsection	A and B or A/B	Per Panel

Fig. C

2.2.1. Class 3/A aspect ratio downgrading

For Class 3/A requirements, if the original design of the printed circuit has aspect ratio parameters above this maximum, Lab Circuits, S.A. will ask the client for downgrading to Class 3 with regard to the average copper-plating thickness, which becomes 25 μm .

Lab Circuits, S.A.