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IPC-1066

Marking, Symbols and Labels for Identification of Lead-Free and Other Reportable Materials in Lead-Free Assemblies, Components and Devices

IPC-1066
January 2005 A standard developed by IPC

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Marking, Symbols and Labels for Identification of Lead-Free and Other Reportable Materials in Lead-Free Assemblies, Components and Devices

Developed by the Marking, Symbols and Labels for Identification of Assemblies, Components Task Group (4-34b) of the Environmental, Health & Safety Steering Committee (4-30) and the Technical Activities Executive Committee (TAEC) of IPC

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

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Acknowledgment

Any document involving a complex technology draws material from a vast number of sources. While the principal members of the Marking, Symbols and Labels for Identification of Assemblies, Components Task Group (4-34b) of the Environment, Health & Safety Steering Committee (4-30) and the Technical Activities Executive Committee (TAEC) 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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Table of Contents

Figures

Marking, Symbols and Labels for Identification of Lead-Free and Other Reportable Materials in Lead-Free Assemblies, Components and Devices

1 SCOPE

This standard establishes the requirements for a distinctive symbol and labels to be used to identify materials that are lead-free (Pb-free) and are capable of providing Pb-free 2nd level interconnects, and for indicating certain types of Pb-free material and the maximum assembly temperature. It also establishes the requirements for labeling a bare board if the base resin is halogen free and the type of conformal coating used after assembly.

This standard **shall** apply to all electronic components including passives, connectors, solid-state components and other devices that use solder to attach the device/component to the board or assembly.

This standard **shall not** apply to:

- Lead as an alloying element in steel containing up to 0.35% lead by weight, aluminum containing up to 0.4% lead by weight and as a copper alloy containing up to 4% lead by weight.
- Lead in electronic ceramic parts (e.g., piezoelectronic devices).

2 APPLICABLE DOCUMENTS

2.1 IPC[1]

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits

IPC-CC-830 Qualification and Performance of Electrical Insulating Compound for Printed Wiring Assemblies

2.2 IEC[2]

IEC 61249-2-21 Materials for Interconnection Structures

2.3 European Parliment[3]

Directive 2002/95/EC of the European Parliament and of the Council on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (**"RoHS Directive"**).

2.4 AIM[4]

BC4-1999 International Symbology Specification - Code 128

3 TERMS AND DEFINITIONS

3.1 2nd Level Interconnect The interconnect made by attachment of a device/component to a printed circuit board (see Figure 4-1).

3.2 2nd Level Interconnect Label A label identifying the lowest level shipping container as containing components capable of Pb-free 2nd level interconnects. This includes the Pb-free symbol, Pb-free category and the maximum assembly temperature (see Figure 4-2). If no label or marking is included, a tin-lead finish is assumed.

3.3 Bar Code Label A label that contains machine-readable code consisting of parallel bars and spaces, each of various specific widths, such as to the three-of-nine USS Code 39 standard or Code 128.

NOTE: For the purposes of this standard, the bar code label is on the lowest-level shipping container and includes information that describes the product, e.g., part number, quantity, lot information, supplier identification, moisture-sensitivity level, etc.

3.4 RoHS Acronym for European Directive "Restriction of Hazardous Substances."

3.5 Halogen-Free Printed board resins plus reinforcement matrix that contain maximum total halogens of 1,500 ppm with less than 900 ppm bromine, and less than 900 ppm chlorine (*per IEC 61249-2-21*).

NOTE: RoHS prohibited brominated substances (polybrominated biphenyls and polybrominated diphenyl ether) are not generally found in printed wiring board materials. This marking is an aid for recycling end-of-life electronic assemblies.

NOTE: While the above definition includes all halogens, the only specifically identified halogens in the IEC standard are bromine and chlorine. The IEC standard does not

1. www.ipc.org
2. www.iec.ch
3. europa.eu.int/eur-lex/pri/en/oj/dat/2003
4. www.aimglobal.org/aimstore/linearsymbologies.asp

address fluorine as found in substrate materials manufactured with fluorocarbons (e.g., PTFE, FEP, etc.) and in the chemical composition of fiberglass reinforcement.

3.6 Pb-Free Electrical and electronic assemblies and components in which the lead level in any of the raw materials and the end product is not greater than 0.1% by weight and also meets any Pb-free requirements/definitions adopted under the RoHS Directive 2002/95/EC.

3.7 Pb-Free Category A category assigned to Pb-free components, printed circuit boards, and assemblies indicating the general family of material used for the 2nd level interconnect including solder paste, lead/terminal finish, and terminal material/alloy if not plated or coated.

3.8 Pb-Free Identification Label A label that indicates that the enclosed components/devices and/or assemblies do not contain any Pb (i.e., they are Pb-free as defined in RoHS directive 2002/95/EC). It is not applicable to items that contain Pb but are exempt according to the RoHS directive (see Figure 4-3).

3.9 Pb-Free Symbol A symbol that can be used in place of the phrase ''Pb-free'' (see Figure 4-4).

4 LABELS AND SYMBOLS

The following labels and symbols are used in this standard:

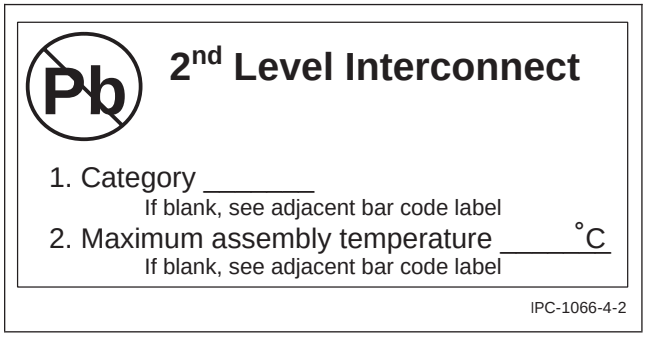

Figure 4-2 2nd Level Interconnect Label

Figure 4-3 Pb-Free Identification Label

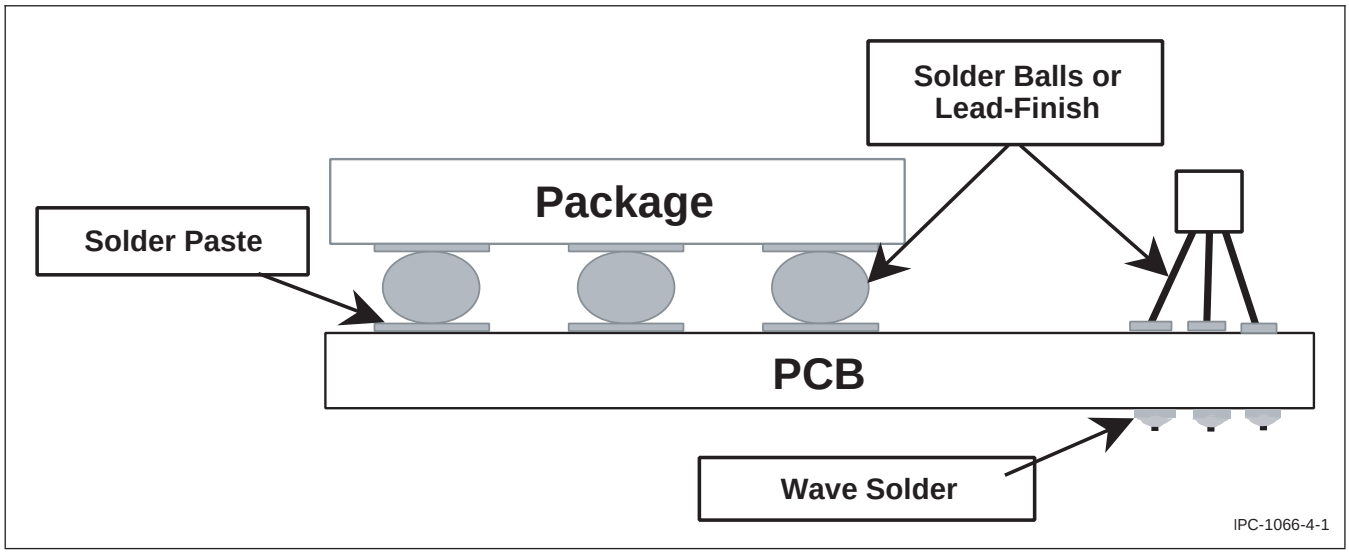

Figure 4-1 2nd Level Interconnect

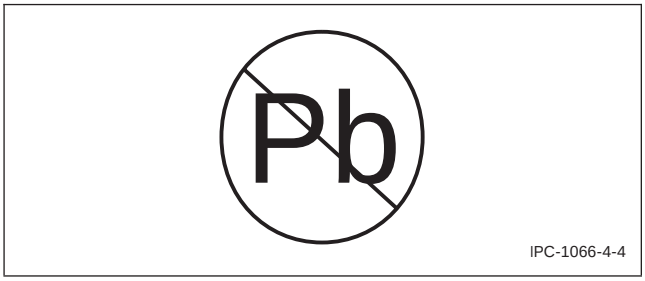

Figure 4-4 Pb-Free Symbol

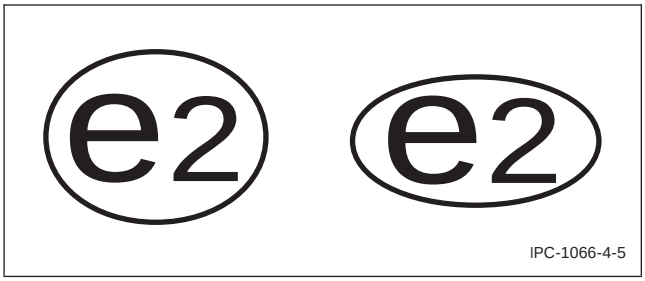

Figure 4-5 Example of Mark Showing Category 2 and Option of Circle or Ellipse

5 LABELING CATEGORIES

5.1 Solder Finish Categories The following categories are meant to describe the Pb-free 2nd level interconnect (see Figure 4-5) terminal finish/material of components and/or the solder paste/solder used in assembly.

e1 – SnAgCu
e2 – Other Sn alloys (ie. SnCu, SnAg, SnAgCuX, etc.) (No Bi or Zn)
e3 – Sn
e4 – Precious metals (ie. Ag, Au, NiPd, NiPdAu, but no Sn)
e5 – SnZn, SnZnX (no Bi)
e6 – Contains Bi
e7 – Low temperature solder (<150°C) containing indium but no bismuth

e8, e9 symbols are unassigned categories at this time.

Tin-lead soldered printed circuit boards and components **shall** have no assigned label. However, manufacturers who desire to label lead-bearing solder **shall** use ''Pb'' as the marking code.

NOTE: It is recognized that some manufacturers use ''PB'' or ''pb'' in certain part numbers.

5.2 Resin Category If the base resin and reinforcement matrix used in making the bare printed board is halogen free, the label/marking ''HF'' **shall** be noted on the bare printed circuit board identification label. If no ''HF'' is present, a halogen-containing base resin and reinforcement matrix is assumed.

5.3 Conformal Coating Categories When conformal coatings are applied, and if assembly-marking space permits, or if contractually required by purchasing agreement, coatings may be labeled/marked per IPC-CC-830B as follows:

ER – Epoxy Resin
UR – Urethane Resin
AR – Acrylic Resin
SR – Silicone Resin
XY – Paraxylylene

6 COMPONENT MARKING

If space permits the individual device/component **shall** be marked with the category designation enclosed within a circle/ellipse (see Figure 4-5). If the individual component cannot be marked, the category **shall** be indicated on the lowest-level shipping container utilizing the 2nd Level Interconnect Label (see Figure 4-2) and/or bar code label as noted in 3.3.

6.1 Size The size and location of the mark is optional but **shall** be legible to corrected, unmagnified vision.

6.2 Color The color for the 'e' and category number should be selected to provide sufficient contrast to be legible to corrected, unmagnified vision.

6.3 Font The font should be ''Arial'' or equivalent and the font style **shall** be regular.

6.4 Maximum Assembly Temperature This temperature **shall** be specified in degrees Centigrade.

7 PRINTED CIRCUIT BOARD/ASSEMBLY MARKING

Printed circuit boards/assemblies **shall** be identified as being assembled with Pb-free solders and using components with Pb-free 2nd level interconnect leads/terminals by marking with the words ''Pb-free'' or the Pb-free symbol shown in Figure 4-4. In addition, the category (with or without the circle or ellipse), as defined in 5.1, **shall** be shown on the board/assembly. If no circle or ellipse is used, the marking **shall** clearly define the category. (e.g., Category = e2) The assembler **shall** have the prime responsibility to mark the assembly with the bare printed circuit board finish and assembly solder used. If printers used to produce labels or markings do not have graphic capability, the parenthesis may be used in place of the circle/ellipse.

7.1 Category Hierarchy If two or more solder alloys are used (i.e., reflow and wave solder use different category solder alloys) the category of the reflow(s) should be shown first and with the wave solder category following.

7.2 Location The preferred location for marking of the categories is on printed circuit board layer 1 (topside) at the lower right hand segment.

7.3 Color The color for the 'e' and category number should be selected to provide sufficient contrast to be legible to corrected, unmagnified vision. The font should be ''Arial'' or equivalent and the font style **shall** be regular.

7.4 Size The size of the mark is optional but **shall** be legible to corrected, unmagnified vision.

7.5 Method The method, e.g., screen print, etch, etc., for marking of the printed circuit board is optional but it **shall** be legible to corrected, unmagnified vision.

7.6 Marking Sequence The sequence of marking should follow the production process, i.e., halogen-free (if applicable), reflow/wave solder finish, and conformal coating (if applicable).

e.g., | HF | e1/e1 | XY | (Sample layout. Boxes not required.)

7.7 Repair Marking The Pb-free solder category code **shall** be permanently obscured should any modification or repair with a lead-bearing material be used instead of a lead-free solder during a repair or rework procedure.

8 SYMBOL AND LABELS

8.1 Pb-Free Symbol This symbol (see Figure 4-4) may be used as an option to replace the phrase ''Pb-free'' on labels or wherever practical on components/devices, printed circuit boards, and assemblies, etc.

8.2 Pb-Free Identification Label This label (see Figure 4-3) **shall** only be used when the components/devices and/or board assemblies are Pb-free, according to the definitions in 3.6 and 3.8, and should be affixed to the lowest level shipping containers, or other containers that are not otherwise identified as Pb-free.

8.2.1 Size It is recommended the label be a minimum of 22 mm x 25 mm with the minimum diameter of the circle = 18 mm.

8.2.2 Color The background **shall** be white and the symbol and letters **shall** be of a contrasting color. The color red should be avoided as red suggests a personal hazard.

8.3 2nd Level Interconnect Label This label (see Figure 4-2) indicates that the 2nd level interconnect terminal finish/material of components and/or the solder paste/solder used in board assembly is Pb-free, per the categories defined in 5.1. It **shall** be placed/printed on the lowest level shipping container and any ''ESD'' or ''Dry pack'' bag/box, excluding tubes, trays or other carriers, within the lowest level shipping container. This label affirms the Pb-free content of the 2nd level interconnects only, and does not indicate that the components/devices or assemblies are Pb-free. If all of the information on the label including the ''Pb-free'' symbol, or the words ''Pb-free'' are included on a bar code label in conjunction with the words ''2nd level interconnect,'' legible to corrected, unmagnified vision, then the use of the 2nd level interconnect label is optional. If the enclosed components/devices or assemblies are Pb-free, then the words ''2nd level interconnect'' may be omitted from the bar code label.

8.3.1 Components If the label is affixed to containers holding components/devices the category field describes the terminal finish/material and the ''maximum assembly temperature'' indicates the maximum temperature the component/device should obtain during assembly.

8.3.2 Assemblies If the label is affixed to containers holding printed circuit boards/assemblies the category field describes the solder paste/solder used in the board assembly. The ''maximum assembly temperature'' field, if blank, does not apply.

8.3.3 Size It is recommended that the Pb-free label be a minimum of 75 mm by 50 mm.

8.3.4 Color The label **shall** be black letters/symbols on a white background.

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ANSI/IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits Definition Submission/Approval Sheet

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Name Title

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_____

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The information that you provide here will appear in the next edition of the IPC Membership Directory.

Our company supplies:

_____

_____

_____

_____

❑ GOVERNMENT AGENCY/ACADEMIC TECHNICAL LIAISON

This government agency or accredited university, college or technical training school is directly concerned with design, research and utilization of electronic interconnection devices. (Must be a non-profit or not-for-profit organization.)

Please proceed to page 2 to complete the membership application.

Application for IPC Site Membership

IPC
ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES®

Site Information: (Please print or type)

Company Name

Street Address

City	State	Zip/Postal Code	Country

Main Switchboard Phone No	Main Fax No.
Company E-Mail Address	Website URL
Name of Primary Contact for all IPC matters	Title	Mail Stop
Phone No.	Fax No	E-Mail
Name of Senior Management Contact:	Title:	Mail Stop
Phone No	Fax No	E-Mail

Please attach business card of primary contact here.

Please designate your site's Technical Representatives:

For PWB/PWA design-related information and activities:

Contact Name	Title	Phone	Fax	E-mail

For PCB fabrication-related information and activities:

Contact Name	Title	Phone	Fax	E-mail

For Electronics Assembly-related information and activities:

Contact Name	Title	Phone	Fax	E-mail

Please designate your site's Management Representatives:

For PWB/PWA design-related information and activities:

Contact Name	Title	Phone	Fax	E-mail

For PCB fabrication-related information and activities:

Contact Name	Title	Phone	Fax	E-mail

For Electronics Assembly-related information and activities:

Contact Name	Title	Phone	Fax	E-mail

Please proceed to page 3 to complete the membership application.

Application for IPC Site Membership

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ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES®

MEMBERSHIP DUES SCHEDULE

Please check one:

- ❑ **$1,000.00 –** Annual dues for Primary Site Membership Twelve months of IPC membership begins from the time the application and payment are received at the IPC office.
- ❑ **$800.00 –** Annual dues for Additional Facility Membership
  An additional membership for a site within an organization where there already is a current Primary Site IPC membership.
- ❑ **$600.00** –** Annual dues for an independent PCB/PWA fabricator or independent EMSI provider with annual sales of less than $1,000,000.00. USD
  ** Please provide proof of annual sales.
- ❑ **$250.00 –** Annual dues for Government Agency or Academic Technical Liaison Membership. Must be not-for-profit organization.

TMRC MEMBERSHIP

- ❑ Please send information on participation in the Technology Market Research Council (TMRC) program. Only current IPC member sites are eligible to participate in this **calendar year** program, which is available for an additional fee.
- ❑ **Yes, sign up our site now:**
  $950.00 - Primary TMRC member site
  $400.00 - Additional facility TMRC member. Another site within our organization is already a TMRC program participant.

Name of Primary Contact for all TMRC matters:

_____

_____
Phone Fax

_____
E-Mail

PAYMENT INFORMATION

Enclosed is our check/money order for $_____

Mail application with check or money order to:

IPC
3491 Eagle Way
Chicago, IL 60678-1349

Fax or mail application with credit card payment to:

IPC
***3000 Lakeside Drive, Suite 309S**
Bannockburn, IL. 60015-1249
Tel: 847-615-7100
Fax: 847-615-7105
**** Overnight deliveries to this address only***

Please bill my credit card (circle one) for $_____

❑ MasterCard ❑ American Express ❑ Visa ❑ Diners Club

_____
Account No Expiration Date

_____
Name of Card Holder

_____
Authorized Signature

_____
Phone Number

QUESTIONS?

Call the IPC Member Services Department in Bannockburn, Illinois, at 847-597-2809 or 847-597-2872, or fax us at 847-615-7105.

E-mail: JeanetteFerdman@ipc.org SusanStorck@ipc.org

Please proceed to page 4 to complete the membership application.

Application for IPC Site Membership

INFORMATION DISTRIBUTION

IPC has significant member benefits available to a wide range of individuals within your organization. To ensure that your facility takes advantage of these benefits, please provide the name of the individual responsible for each of the functional areas listed below. If one person has multiple responsibilities, please list that person's name as many times as necessary.

Chief Executive:

Name | Title/Mail Stop | Phone | Fax | E-mail

Sales/Marketing:

Name | Title/Mail Stop | Phone | Fax | E-mail

Finance (CFO)

Name | Title/Mail Stop | Phone | Fax | E-mail

Human Resources

Name | Title/Mail Stop | Phone | Fax | E-mail

Environmental/Safety

Name | Title/Mail Stop | Phone | Fax | E-mail

Design/Artwork

Name | Title/Mail Stop | Phone | Fax | E-mail

Product Assurance

Name | Title/Mail Stop | Phone | Fax | E-mail

Manufacturing

Name | Title/Mail Stop | Phone | Fax | E-mail

Training

Name | Title/Mail Stop | Phone | Fax | E-mail

Purchasing

Name | Title/Mail Stop | Phone | Fax | E-mail

IPC REVIEW SUBSCRIPTION LIST

One of the many benefits of IPC membership is a subscription to the IPC *Review,* our monthly magazine. Please list below the names of individuals who would benefit from receiving our magazine, which provides information about the industry, IPC news, and other items of interest. A subscription for the IPC Primary Contact person is entered automatically.

Name | Title/Mail Stop

Name | Title/Mail Stop

Name | Title/Mail Stop

Name | Title/Mail Stop

Name | Title/Mail Stop

Name | Title/Mail Stop

ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES®

Standard Improvement Form

IPC-1066

The purpose of this form is to provide the Technical Committee of IPC with input from the industry regarding usage of the subject standard.

Individuals or companies are invited to submit comments to IPC. All comments will be collected and dispersed to the appropriate committee(s).

If you can provide input, please complete this form and return to:

IPC
3000 Lakeside Drive, Suite 309S
Bannockburn, IL 60015-1219
Fax 847 615.7105
E-mail: answers@ipc.org

1. I recommend changes to the following:

___ Requirement, paragraph number _____

___ Test Method number _____, paragraph number _____

The referenced paragraph number has proven to be:

___ Unclear ___ Too Rigid ___ In Error

___ Other _____

2. Recommendations for correction:

3. Other suggestions for document improvement:

Submitted by:

Name Telephone

Company E-mail

Address

City/State/Zip Date

ASSOCIATION CONNECTING
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