

IPC Publications

Standards, guidelines and multimedia training for...

- > **ELECTRONICS ASSEMBLY**
- > **PRINTED BOARDS**
- > **DESIGN**
- > **QUALITY & TEST**
- > **ENVIRONMENTAL & REGULATORY COMPLIANCE**
- > **MANAGEMENT, MARKET RESEARCH STUDIES AND MORE**



IPC



IPC standards are associated with nearly every step of printed board production and assembly. From design and purchasing to assembly and acceptance, IPC offers a standard to help assure superior quality, reliability and consistency in the electronic assemblies that go into an electronic product.

Because of the involvement of industry members like you, IPC standards are accepted worldwide as the key manufacturing standards for the printed board and electronics manufacturing industries. More than 3,000 electronics industry professionals worldwide draft, edit and vote on these standards — assuring that they meet today's technical, business and regulatory challenges. To these volunteers, we offer our most sincere thanks.

In addition to industry standards and guidelines, this catalog also contains multimedia training tools, market research reports, regulatory compliance information and best practices for the entire supply chain. Because IPC offers an extensive selection, it is not possible to include every item in this catalog. If you don't find what you need in these pages, I encourage you to visit IPC's online store at www.ipc.org/onlinestore.

Thank you for looking to IPC for the documents you need to promote excellence in your company.

Best regards,

John Mitchell
President & CEO, IPC

OUR MISSION

IPC is a global industry association dedicated to furthering the competitive excellence and financial success of its members, who are participants in the electronics industry.

In pursuit of these objectives, IPC will devote resources to management improvement and technology enhancement programs, the creation of relevant standards, protection of the environment and pertinent government relations. IPC encourages the active participation of all its members in these activities and commits to full cooperation with all related organizations.

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IPC LOCATIONS

Main Office

3000 Lakeside Drive, Suite 105 N
Bannockburn, IL 60015-1249 U.S.A.
General Phone: +1 847-615-7100
Fax: +1 847-615-7105
Customer Service: +1 847-597-2862
Customer Service Fax: +1 847-615-7114
E-mail: orderipc@ipc.org

IPC Media Training

Ranchos De Taos, New Mexico
Phone: +1 505-758-7937
E-mail: service@ipcvideo.org

IPC China HQ

5F B3-1, Block B, International Innovation Park,
#1 First Keyuanwei Rd., Laoshan District,
Qingdao, 266101 PRC
Phone: +86 400 6218 610
Fax: +86 532 8099 0700
E-mail: infoasia@ipc.org

IPC India

IPC Technology Consulting Pvt. Ltd
No. 238/34, 1st floor, Above Zon Motors
32nd Cross, 7th Block, Jayanagar
Bangalore – 560070
Phone: +91 80 41570637
E-mail: IPCIndia@ipc.org

IPC Europe

Boulevard du Souverain 280
1160 Brussels (Auderghem)
Belgium
Phone: +32 (0) 2 743 1540
E-mail: AlesSinkovec@ipc.org

IPC Europe

Bromma, Sweden
Phone: +46 8 26 10 07
E-mail: LarsWallin@ipc.org

IPC Russian Representative Office

Moscow, Russia
Phone/Fax: +7 4499-943-44-02
E-mail: YuryKovalevsky@ipc.org

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ABOUT THIS CATALOG

Organization — Documents in this catalog are grouped by subjects and subtopics.

Document Formats — IPC documents are provided in electronic and hard copy formats. Each description in this catalog includes a series of format codes to indicate which formats are available for that specific document.

Key — H – Hard Copy; C – CD-ROM; D – Download; K – Kit; S – Site License; G – Global License

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Joint Industry Standards — A number of joint industry standards appear in this catalog. Due to the functionality of the search and ordering system in IPC's online store, the Product ID listed under each joint standard includes only "IPC." Organizations involved in developing joint standards are listed in document descriptions to help identify the standards and to give credit where due.

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IPC TRAINING AND CERTIFICATION PROGRAMS

Through its international network of licensed and audited training centers, IPC offers globally recognized, industry traceable training and certification programs on key industry standards. Developed by users, academics and professional trainers, IPC programs reflect a standardized industry consensus. Periodic recertification is required and course materials are updated for each document revision with support from the same industry experts who contributed to the standard.

Certification Programs for Six Key Standards

- IPC-A-610, *Acceptability of Electronic Assemblies*
- IPC-A-600, *Acceptability of Printed Boards*
- *IPC/WHMA-A-620, *Requirements and Acceptance for Cable and Wire Harness Assemblies*
- *J-STD-001, *Requirements for Soldered Electrical and Electronic Assemblies*
- IPC-7711/IPC-7721, *Rework, Modification, and Repair of Printed Boards and Electronic Assemblies*
- IPC-6012, *Qualification and Performance Specification for Rigid Printed Boards*

*Additional documentation and training tailored to specific industry segments is available.

Other IPC Certification Programs

- CID (Certified Interconnect Designer — Basic) and CID+ (Advanced)

For more information about IPC's training and certification programs, or to find an authorized training center near you, go to www.ipc.org/certification.



SATISFACTORY QUALITY OR SUPREMACY.

Take Your Quality to the Next Level. Evolve to New IPC Standards Revisions. Find out how to get your team certified.

Success in the electronics industry happens when companies—and individuals—take every opportunity to push themselves to climb to a higher level of performance. Well, this is one of those opportunities. IPC has updated our most popular standards to the latest industry requirements, including IPC J-STD-001F, *Requirements for Soldered Electrical and Electronic Assemblies* and IPC-A-610F, *Acceptability of Electronic Assemblies*. The F revisions will help your company dominate through your commitment to outstanding quality assurance and rigorous performance standards. And, among the electronics supply chain, you will raise your profile while you improve communications with your partners.

IPC now delivers **online exams** through our global network of licensed training centers.

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DATA TRANSFER

IPC-2581

Generic Requirements for printed Board Assembly Products Manufacturing Description Data and Transfer Methodology

This standard specifies the XML schema that represents the intelligent data file format used to describe printed board and printed board assembly products with details sufficient for tooling, manufacturing, assembly, and inspection requirements. This format may be used for transmitting information between a printed board designer and a manufacturing or assembly facility. The data is most useful when the manufacturing cycle includes computer-aided processes and numerical control machines. The standard also covers legal compliance with international environmental regulations.

Latest Revision IPC-2581B, September 2013

Formats: H, C, D, K, S, G

Definition for Web-Based Exchange of XML Data

ANSI Approved. IPC-2501

Formats: H, D

Generic Requirements for Implementation of Product Manufacturing Description Data and Transfer Methodology

ANSI Approved. IPC-2511B

Sectional Requirements for Implementation of Administrative Methods for Manufacturing Data Description

IPC-2582

Sectional Requirements for Implementation of Design Characteristics for Manufacturing Data Description

IPC-2583

Sectional Requirements for Implementation of Printed Board Fabrication Data Description

IPC-2584

Sectional Requirements for Implementation of Part List Product Data Description

IPC-2588

MATERIAL DECLARATION

IPC-1751

Generic Requirements for Declaration Process Management

This standard provides the principles and details for declarations necessary between members of a supply chain relationship. This standard contains general information and is supplemented by sectional standards requiring more detailed information such as material declarations.

Latest Revision IPC-1751A, November 2012

Formats: H, D

DOWNLOAD THESE DATA TRANSFER DOCUMENTS FOR FREE!

- *Generic Requirements for Implementation of Product Manufacturing Description Data and Transfer XML Schema Methodology* — Product ID: IPC-2511B
- *Generic Requirements for Printed Board Assembly Products Manufacturing Description Data and Transfer Methodology* — Product ID: IPC-2581A
- *Sectional Requirements for Implementation of Administrative Methods for Manufacturing Data Description* — Product ID: IPC-2582
- *Sectional Requirements for Implementation of Design Characteristics for Manufacturing Data Description* — Product ID: IPC-2583
- *Sectional Requirements for Implementation of Printed Board Fabrication Data Description* — Product ID: IPC-2584
- *Sectional Requirements for Implementation of Part List Product Data Description* — Product ID: IPC-2588

IPC-1752

Materials Declaration Management

IPC-1752 defines material declaration data exchange between supply chain participants and supports reporting of bulk materials, components, printed boards (PBs), sub-assemblies and products. Third-party solution providers have developed tools that are compatible with IPC-1752.

Latest Revision IPC-1752A-WAM1-2, February 2014

Formats: H, D

IPC-1755

Conflict Minerals Data Exchange Standard

IPC-1755 *Conflict Minerals Data Exchange* establishes a standard reporting format for exchange of information between supply chain participants about conflict minerals contained in suppliers' products. IPC-1755 supports reporting at the company and product level, as mutually agreed upon between partners.

Latest Revision IPC-1755-WAM1, April 2015

Formats: H, D

REQUIREMENTS

IPC-2220

Family of Design Documents

The series is built around IPC-2221, *Generic Standard on Printed Board Design*, the base document that covers all generic requirements for printed board design, regardless of materials. From there, the designer chooses the appropriate sectional standard for a specific technology. All five sectional standards are included in the IPC-2220 series: IPC-2221, *Generic Standard on Printed Board Design*; IPC-2222, *Sectional Design Standard for Rigid Organic Printed Boards*; IPC-2223, *Sectional Design Standard for Flexible Printed Boards*; IPC-2225, *Sectional Design Standard for Organic Multichip Modules (MCM-L) and MCM-L Assemblies*; and IPC-2226, *Sectional Design Standard for High Density Interconnect (HDI) Printed Boards*.

Formats: H, C, D, K, S, G

IPC-2221

Generic Standard on Printed Board Design

IPC-2221 is the foundation design standard for all documents in the IPC-2220 series. It establishes the generic requirements for the design of printed boards and other forms of component mounting or interconnecting structures, whether single-sided, double-sided or multilayer. Criteria for conductor characteristics, surface finishes, via protection, board electrical test, dielectric properties, board housings, thermal stress, compliant pins, panelization and internal and external foil thicknesses are found in the standard. Appendix A provides new test coupon designs used for lot acceptance and quality conformance testing.

Languages: DE, FR

Latest Revision IPC-2221B, November 2012

Formats: H, C, D, K, S, G

IPC-2221B Coupon Generator

IPC-2221B Gerber Coupon Generator Subscription

The IPC-2221B *Gerber Coupon Generator* provides for the rapid and efficient generation of electronic Gerber files used for the fabrication of "AB/R" and "D" test coupon outlined in Appendix A of the IPC-2221B, *Generic Standard on Printed Board Design*. The AB/R and D coupons, designed by IPC to be representative of the complex designs used in today's printed board market, may be used for structural integrity verification for the acceptance of production lots of printed boards either as agreed between user and supplier or in accordance with the IPC-6012C-TC *Test Coupon Addendum*. The tool provides an easy-to-use "Design Parameters/ Input File" that prompts users for their own design parameters (e.g., layer count, drilled hole size, etc.) and provides automatic error-checking against IPC-2221B design rules, saving users hours in the generation of Gerber files. The IPC-2221B *Gerber Coupon Generator* is available as an annual subscription solution for IPC Member facilities only.

Released January 2016

Format: Subscription Service

IPC-2222***Sectional Design Standard for Rigid Organic Printed Boards***

IPC-2222 establishes the specific requirements for the design of rigid organic printed boards and other forms of component mounting and interconnecting structures. This standard applies to single-sided, double-sided or multi-layered boards. Key concepts in this document are: rigid laminate properties, design requirements for printed board assembly and design requirements for holes/interconnections. Design guidance and requirements for dielectric spacing, lead-free laminate materials, scoring and routing parameters, printed board thickness tolerance, nonfunctional lands, hole aspect ratios and clearance areas in planes are found in the standard.

Languages: CN, DE, FR

Latest Revision IPC-2222A, December 2010

Formats: H, C, D, K, S, G

IPC-2223***Sectional Design Standard for Flexible Printed Boards***

IPC-2223 establishes the specific requirements for the design of flexible printed boards and forms of component mounting and interconnecting structures. The flexible materials used in the structures are comprised of insulating films, reinforced and/or non-reinforced dielectric in combination with metallic materials. Design guidance and requirements for bends, folds and creases, staggered flexible layer bands and strain relief fillets are also found in the documents.

Languages: CN, DE,

Latest Revision IPC-2223C, November 2011

Formats: H, C, D, K, S, G

IPC-2225***Sectional Design Standard for Organic Multichip Modules (MCM-L) and MCM-L Assemblies***

Latest Revision IPC-2225, May 1998

Formats: H, C, D, S, G

IPC-2226***Sectional Design Standard for High Density Interconnect (HDI) Boards***

Latest Revision IPC-2226, May 2003

Formats: H, C, D, S, G

ADVANCED PACKAGING**IPC-7092*****Design and Assembly Process Implementation for Embedded Components***

This document describes the design and assembly challenges for implementing passive and active components, in either formed or placed methodology, into a printed board. It provides useful and practical information to decision makers of formed or placed, passive or active components and helps establish inspection techniques, testing processes, and reliability validations. Users will also learn characteristics that influence the successful implementation of a robust embedded component process.

Latest Revision IPC-7092, February 2015

Formats: H, C, D, K, S, G

IPC-7093***Design and Assembly Process Implementation for Bottom Termination Components***

Describes the design and assembly challenges for implementing bottom termination components (BTCs) whose external connections consist of metallized terminals that are an integral part of the component body. The BTCs in this document include all types and forms of bottom-only termination components intended for surface mounting. This includes industry descriptive nomenclature such as QFN, DFN, SON, LGA, MLP and MLF. The focus of the information is on critical design, assembly, inspection, repair and reliability issues associated with BTCs.

Languages: CN, DE,

Latest Revision IPC-7093, March 2011

Formats: H, C, D, K, S, G

IPC-7094***Design and Assembly Process Implementation for Flip Chip and Die Size Components***

Delivers useful and practical information for products that employ the very complex and high density methods needed for flip-chip technology. This standard provides information on system-level issues, flip-chip and die-size assembly and the requirements for board and module-level reliability. The standard also covers outsourcing manufacturing and the procurement of known good die to optimize the return on investment when developing products that use flip-chip technology.

Latest Revision IPC-7094, February 2009

Formats: H, C, D, K, S, G

IPC-7095***Design and Assembly Process Implementation for BGAs***

Implementing ball grid array (BGA) and fine-pitch ball grid array (FBGA) technology presents some unique challenges for design, assembly, inspection and repair personnel. In addition to providing guidelines for BGA inspection and repair, IPC-7095 addresses reliability issues and the use of lead-free joint criteria associated with BGAs. There are many photographs of X-ray and endoscope illustrations to identify some of the conditions that the industry is experiencing in the implementation of BGA assembly processes.

Latest Revision IPC-7095C, January 2013

Formats: H, C, D, K, S, G

IPC J-STD-030***Selection and Application of Board Level Underfill Materials***

Latest Revision IPC J-STD-030A, March 2014

Formats: H, C, D, K, S, G

HIGH SPEED/HIGH FREQUENCY***Design Guide for High-Speed Controlled Impedance Circuit Boards***

Latest Revision IPC-2141A, March 2004

Formats: H, C, D, K, S, G

Design Guide for the Packaging of High Speed Electronic Circuits

Latest Revision IPC-2251, November 2003

Formats: H, C, D, S, G

Design Guide for RF/Microwave Circuit Boards

Latest Revision IPC-2252, June 2002

Formats: H, C, D, S, G

BASE MATERIALS FOR PRINTED BOARDS**IPC-4101**
Specification for Base Materials for Rigid and Multilayer Printed Boards

This specification covers the requirements for base materials that are referred to as laminate or prepreg. These are to be used primarily for rigid and multilayer printed boards for electrical and electronic circuits. This document contains individual specification sheets that can be searched using keywords.

Languages: CN, DE

Latest Revision IPC-4101D-WAM1, July 2015

Formats: H, C, D, K, S, G

IPC-4103
Specification for Base Materials for High Speed/High Frequency Applications

This specification covers the requirements for clad and unclad plastic laminate and bonding layer materials to be used for the fabrication of printed boards for microstrip, stripline, and high speed digital electrical and electronic circuits. Also included are testing parameters, inspection lot requirements, visual acceptance criteria, specification sheet format for new materials that provides both mandatory (e.g., Df and Dk) requirements as well as "loose" requirements (e.g., thermal conductivity and moisture absorption) that can be certified to or called out on fabrication drawings.

Latest Revision IPC-4103A-WAM1, January 2014

Formats: H, C, D, K, S, G

4103A-WAM1-AM2(D)1
Amendment 2 to Specification for Base Materials for High Speed/High Frequency Applications

Released December 2015

Format: Single Download

IPC-4104
IPC/JPCA Specification for High Density Interconnect (HDI) and Microvia Materials

Latest Revision IPC-4104, May 1999

Formats: H, C, D, S, G

IPC-4552
Specification for Electroless Nickel/Immersion Gold (ENIG) Plating for Printed Circuit Boards

Latest Revision IPC-WAM1-2, December 2012

Formats: H, C, D, S, G

IPC-4553
Specification for Immersion Silver Plating for Printed Circuit Boards

Latest Revision IPC-4553A, May 2009

Formats: H, C, D, S, G

IPC-4554
Specification for Tin Plating for Printed Circuit Boards – Amendment 1

Latest Revision IPC-4554, January 2012

Formats: H, C, D, S, G

IPC-4556
Specification for Electroless Nickel/Electroless Palladium/Immersion Gold (ENEPIG) for Printed Circuit Boards

Latest Revision IPC-4556, January 2013

Formats: H, C, D, S, G

IPC-4202
Flexible Base Dielectrics for Use in Flexible Printed Circuitry

This document provides comprehensive data to help users determine both material capability and compatibility of flexible base dielectric materials of flexible printed circuitry and flexible flat cables. It includes flexible base material specification sheets with the newest properties for specification material types. It establishes the most current classification system, qualification and quality conformance requirements, including high frequency dielectric properties.

Languages: CN

Latest Revision IPC-4202A, April 2010

Formats: H, C, D, K, S, G

IPC-4203
Cover and Bonding Material for Flexible Printed Circuitry

This standard establishes the classification system, the qualification and quality conformance requirements for dielectric films coated with an adhesive on one or both sides. These materials are to be used as cover material for flexible printed circuitry as well as supported or unsupported adhesive films to be used in the fabrication of flexible printed circuitry.

Latest Revision IPC-4203A, January 2013

Formats: H, C, D, K, S, G

IPC-4204
Flexible Metal-Clad Dielectrics for Use in Fabrication of Flexible Printed Circuitry

This standard establishes the classification system and qualification and quality performance requirements for flexible metal-clad dielectric materials used for flexible printed circuitry and flexible flat cable. It encompasses specification sheets that result from the combinations of various copper foil claddings; a polymer base dielectric selected from at least two polyesters, multiple polyimides or liquid crystal polymers; and at least seven versions of polymer adhesives as well as adhesiveless bonding agents. The results of these material combinations provide the industry with suitable clad, flexible dielectrics for fabricating flexible printed circuitry interconnections.

Languages: CN

Latest Revision IPC-4204A-WAM1, October 2013

Formats: H, C, D, K, S, G

IPC-SM-840
Qualification and Performance Specification of Permanent Solder Mask and Flexible Cover Materials

Establishes the requirements for the evaluation of liquid and dry film solder mask material and for the determination of the acceptability of use on a standard printed board system. The standard provides two classes of requirements to reflect functional performance requirements and testing severity based on industry/end-use requirements. It covers adhesion, material qualification, resistances to solvents and electrical requirements.

Languages: CN

Latest Revision IPC-SM-840E, December 2010

Formats: H, C, D, K, S, G

IPC-HDBK-840
Solder Mask Handbook

This handbook is a supplement to IPC solder mask requirements by providing detailed information on solder mask types, application processes, pre- and post-assembly processes, characteristics and properties that are useful in the selection and use of the most appropriate mask type for a given application.

Latest Revision IPC-HDBK-840(E)1, September 2006

Formats: C, D, S, G

ACCEPTABILITY/QUALIFICATIONS FOR PRINTED BOARDS

IPC-6010-Series

Family of Board Performance Requirements — includes 7 documents

This series includes IPC's current qualification and performance specification standards for all major types of printed boards, including:

- IPC-6011, *Generic Performance Specification for Printed Boards*
- IPC-6012, *Qualification and Performance Specification for Rigid Printed Boards*
- IPC-6013, *Qualification and Performance Specification for Flexible Printed Boards*
- IPC-6015, *Qualification & Performance Specification for Organic Multichip Module (MCM-L) Mounting & Interconnecting Structures*
- IPC-6017, *Qualification and Performance Specification for Printed Boards Containing Embedded Passive Devices*
- IPC-6018, *Qualification and Performance Specification for High Frequency (Microwave) Printed Boards*

See below for complete descriptions of the included documents.

IPC-6010-Series

Formats: H, C, D, K, S, G

IPC-6011

Generic Performance Specification for Printed Boards

This specification establishes the general requirements and responsibilities for suppliers and users of printed boards. Serving as the foundation for the IPC-6010 *Board Performance Requirements* series, IPC-6011 describes quality and reliability assurance requirements that must be met.

Languages: CN, DE

Latest Revision IPC-6011, July 1996

Formats: H, C, D, S

IPC-6012

Qualification and Performance Specification for Rigid Printed Boards

This specification covers qualification and performance of rigid printed boards, including single-sided, double-sided, with or without plated-through holes, multilayer with or without blind/buried vias, and metal core boards. It addresses final finish and surface plating coating requirements, conductors, holes/vias, frequency of acceptance testing and quality conformance as well as electrical, mechanical and environmental requirements. Other requirements covered are surface finishes, hole plating thickness, measing, weave exposure, copper cap plating of filled holes, laminate cracks and voids, etchback, blind and buried via fill, acceptance testing and frequency, and requirements for thermal stress testing.

Languages: CN, DE, FR, IT, PL, RU, SW

Latest Revision IPC-6012D, September 2015

Formats: H, C, D, K, S, G

Training/Certification on IPC-A-6012

Visit www.ipc.org/certification for details.

IPC-6012DS

Space and Military Avionics Applications Addendum to IPC-6012D, Qualification and Performance Specification for Rigid Printed Boards

Languages: DE

Released September 2015

Formats: H, C, D, K, S, G

IPC-6012D-RL(D)1

Qualification and Performance Specification for Rigid Printed Boards-Red Line

Redline Document Released September 2015

Format: Download Single Use

IPC-6013

Qualification and Performance Specification for Flexible Printed Boards

Covers qualification and performance requirements for flexible printed boards designed to IPC-2221 and IPC-2223. The flexible printed board may be single-sided, double-sided, multilayer or rigid-flex multilayer. All of these constructions may include stiffeners, plated-through holes (PTH) and blind/buried vias. Additional requirements for surface plating, measing, foreign inclusions, adhesive squeeze-out, solderable annular ring, PTH copper wrap, plating folds, microsection evaluations, acceptance testing frequency and more are covered.

Languages: CN, DE

Latest Revision IPC-6013C,

Formats: H, C, D, K, S, G

IPC-6015

Qualification & Performance Specification for Organic Multichip Module (MCM-L) Mounting & Interconnecting Structures

This standard establishes the specific requirements for organic mounting structures used to interconnect chip components which in combination form the completed functional organic single-chip module (SCM-L) or organic multichip module (MCM-L) assembly. Includes the quality and reliability assurance requirements that must be met for their acquisition.

Latest Revision IPC-6015, February 1998

Formats: H, C, D, S, G

IPC-6017

Qualification and Performance Specification for Printed Boards Containing Embedded Passive Devices

This new standard supplements existing IPC-6010 series specifications with qualification and performance requirements for in-process and finished printed boards

Containing embedded passive circuitry (distributive capacitive planes and capacitive or resistive components).

Latest Revision IPC-6017, March 2009

Formats: H, C, D, K, S, G

IPC-6018

Qualification and Performance Specification for High Frequency (Microwave) Printed Boards

Establishes requirements for qualification and performance of high frequency (microwave) printed boards. Covers both end product inspection and test of microwave boards for microstrip, stripline, mixed dielectric and multilayer stripline applications. It addresses final finish and surface plating coating requirements, conductors, holes/vias, and frequency of acceptance and quality conformance testing, as well as electrical, mechanical and environmental requirements. Surface finishes, microvia requirements including hole plating thickness and copper wrap/cap plating of filled holes, laminate cracks and voids, etchback, PTFE resin smear, and thermal stress testing can be found in the standard.

Languages: CN

Latest Revision IPC-6018B, November 2011

Formats: H, C, D, K, S, G

IPC-1601***Printed Board Handling and Storage Guidelines***

The industry's sole guideline on the handling, packaging and storage of printed boards, this document provides guidelines to protect printed boards from contamination, physical damage, solderability degradation and moisture uptake. Consideration is given to packaging material types and methods, production environment, handling and transport of product, establishing recommended moisture levels, establishing baking profiles for moisture removal and the impact of baking on printed board solderability.

Languages: CN, DE

Latest Revision IPC-1601, August 2010

Formats: H, C, D, K, S, G

IPC-A-600***Acceptability of Printed Boards***

The definitive illustrated guide to printed board acceptability! This four-color document includes photographs and illustrations of the target, acceptable and nonconforming conditions that are either internally or externally observable on bare printed boards. Make sure your operators, inspectors and engineers have the most current industry consensus information. Additional topics covered are copper wrap plating, copper cap plating of filled holes, and hole wall/barrel separation along with updated and expanded coverage for measling of printed boards, delamination and haloing, laminate voids/cracks, etchback, blind and buried via fill, and flexible circuits. The document synchronizes to the acceptability requirements expressed in IPC-6012 and IPC-6013.

Languages: CN, DE, FR, JP, PL, RU, SE

Latest Revision IPC-A-600H, April 2010

Formats: H, C, D, K, S, G

Training/Certification on IPC-A-600H

Visit www.ipc.org/certification for details.

IPC-DVD-88C***Bare Board Defect Recognition (Training Resource Material)*****IPC-OVT-88C(SD)*****Bare Board Defect Recognition (Online Video Training Resource Material)*****IPC-9252*****Requirements for Electrical Testing of Unpopulated Printed Boards***

IPC-9252 defines levels of appropriate testing and assists in the selection of the test analyzer, test parameters, test data and fixturing required to perform electrical test(s) on unpopulated printed boards and innerlayers.

Languages: CN

Latest Revision IPC-9252A, November 2008

Formats: H, C, D, K, S, G

EXPERIENCE THE BENEFITS OF THE ELECTRONICS INDUSTRY'S PREMIER ASSOCIATION

For more than 55 years, company leaders have looked to IPC for the tools, information and forums they need to thrive in the ever-changing electronics industry. Whatever your role in the industry, you can join 3,700 companies worldwide that enjoy access to unparalleled opportunities to participate in, and shape the direction of, our collective future.

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**REQUIREMENTS FOR SOLDERED
ELECTRONICS ASSEMBLIES****IPC-J-STD-001****Requirements for Soldered Electrical and Electronic Assemblies**

J-STD-001 is recognized worldwide as the sole industry-consensus standard covering soldering assembly material and process requirements. The standard fully complements IPC-A-610 and includes information on lead-free manufacturing, requirements for all three classes of acceptance, color illustrations, easier to understand criteria for materials, methods and verification for producing quality soldered interconnections and assemblies.

Languages: CN, DE, DK, FR, RO, RU, SP
Latest Revision IPC-J-STD-001F, July 2014
Formats: H, C, D, K, S, G

Training/Certification on J-STD-001
Visit www.ipc.org/certification for details.

IPC J-STD-001FAM1(D)1**Requirements for Soldered Electrical and Electronic Assemblies – Amendment 1**

Released January 2016
Formats: D, S, G

IPC-J-STD-001FS**Space Applications Electronic Hardware Addendum to IPC-J-STD-001F**

Released IPC-6012DS, December 2014
Formats: H, C, D, K, S, G

IPC-HDBK-001**Handbook and Guide to Supplement J-STD-001**

This handbook is a companion reference to J-STD-001. It describes materials, methods and verification criteria that, when applied as recommended or required, will produce quality soldered electrical and electronic assemblies. The intent of the handbook is to explain the how-to, why and fundamentals of these processes, and to help implement control over processes rather than depending on end-item inspection.

Latest Revision IPC-HDBK-001F, February 2016
Formats: H, C, D, K, S, G

IPC-AJ-820**Assembly and Joining Handbook**

This handbook contains general information and descriptions of proven techniques for assembly and soldering electronic assemblies. Sections include: handling electronic assemblies, design considerations, PCBs, components, solderability, materials, component mounting, solder techniques and connections, cleaning, conformal coating, encapsulation and potting, and rework and repair.

Latest Revision IPC-AJ-820A, February 2012
Formats: H, C, D, K, S, G

IPC-DVD-PREP-J001F**Preparatory Course for IPC-J-STD-001F CIS Certification**

Training Resource Material Released
January 2016
Formats: DVD

SOLDERABILITY**IPC-J-STD-002****EIA/IPC/JEDEC Solderability Tests for Component Leads, Terminations, Lugs, Terminals and Wires**

This standard prescribes test methods, defect definitions, acceptance criteria, and illustrations for assessing the solderability of electronic component leads, terminations, solid wires, stranded wires, lugs and tabs. A test method for the resistance to dissolution/dewetting of metallization is also included in the standard. Intended for use by both vendors and users, J-STD-002D was developed by EIA, IPC and JEDEC.

Languages: CN
Latest Revision IPC-J-STD-002D, June 2013
Formats: H, C, D, K, S, G

IPC-J-STD-003**Solderability Tests for Printed Boards**

The standard prescribes test methods, defect definitions and illustrations for assessing the solderability of printed board surface conductors, attachment lands, and plated-through holes utilizing either tin-lead or lead-free solders. This standard is intended for use by both vendor and user. The objective of the solderability test methods described in this standard is to determine the ability of printed board surface conductors, attachment lands, and plated-through holes to wet easily with solder and to withstand the rigors of the printed board assembly processes. This standard describes test methods by which both the surface conductors (and attachment lands) and plated-through holes may be evaluated for solderability.

Languages: CN
Latest Revision IPC-J-STD-003C-WAM1, May 2014
Formats: H, C, D, K, S, G

MATERIALS**IPC-J-STD-004****Requirements for Soldering Fluxes**

Classifies and characterizes tin-lead and lead-free soldering flux materials for use in electronic metallurgical interconnections for printed board assembly. Soldering flux materials include the following: liquid flux, paste flux, solder paste, solder cream, and flux-coated and flux-cored solder wires and preforms.

Languages: CN, JP, RU
Latest Revision IPC-J-STD-004B, November 2011
Formats: H, C, D, K, S, G

IPC-J-STD-005**Requirements for Soldering Pastes**

This standard lists requirements for qualification and characterization of solder paste. It references test methods and criteria for metal content, viscosity, slump, solder ball, tack and wetting of solder pastes. Additional support is provided in IPC-HDBK-005.

Languages: CN, JP, RU
Latest Revision IPC-J-STD-005A, February 2012
Formats: H, C, D, K, S, G

IPC-HDBK-005**Guide to Solder Paste Assessment**

Use this handbook with the solder paste standard J-STD-005, as a guide to help assess the applicability of a solder paste for its use in surface mount technology (SMT) processes. This document also suggests test methods that can help with designing and testing solder pastes. It is intended for use by both vendors and users of solder paste.

Latest Revision IPC-HDBK-005, January 2006
Formats: H, C, D, K, S, G

IPC-J-STD-006**IPC/EIA Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications**

This standard prescribes the nomenclature, requirements and test methods for electronic-grade solder alloys; fluxed and non-fluxed bar, ribbon and powder solders for electronic soldering applications; and "special" electronic-grade solders. This is a quality control standard and is not intended to relate directly to the materials performance in the manufacturing process.

Languages: CN
Latest Revision IPC-J-STD-006C, July 2013
Formats: H, C, D, K, S

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

This is the industry standard for qualification and quality conformance of conformal coating. Its intent is to show how to obtain maximum information with minimum test redundancy. Includes requirements and evaluations of material properties using standardized test vehicles.

Languages: CN
Latest Revision IPC-CC-830B, October 2008
Formats: H, C, D, K, S, G

IPC-HDBK-830**Guidelines for Design, Selection, and Application of Conformal Coatings**

This is the industry standard for qualification and quality conformance of conformal coating. Its intent is to show how to obtain maximum information with minimum test redundancy. Includes requirements and evaluations of material properties using standardized test vehicles.

Latest Revision IPC-HDBK-830A, October 2013

Formats: H, C, D, K, S, G

IPC-HDBK-850**Guidelines for Design, Selection, and Application of Potting Materials and Encapsulation Processes Used for Electronics Printed Circuit Board Assembly**

This handbook has been written to assist the designers and users of potting and encapsulation in understanding the characteristics of various materials, as well as the factors that can modify those characteristics when the potting or encapsulation is applied. The equipment and processes involved in the preparation and application of potting and encapsulation are also covered. From glob-top to dam-and-fill, this document uses terminology associated with processes related only to electronic printed circuit board assembly and protection. Understanding and accounting for these materials can ensure the reliability and function of electronics.

Latest Revision IPC-HDBK-850, July 2012

Formats: H, C, D, K, S, G

IPC-7525**Stencil Design Guidelines**

Provides guidelines for the design and fabrication of stencils for solder paste and surface mount adhesive with discussion on through-hole and mixed technology. These guidelines detail the differences for tin-lead and lead-free solder paste, overprint, two-print and step stencil designs.

Languages: CN, DE

Latest Revision IPC-7525B, October 2011

Formats: H, C, D, K, S, G

IPC-7526**Stencil and Misprinted Board Cleaning Handbook**

This handbook provides a basic understanding of stencil/misprint cleaning processes. Fine and ultra-fine pitch lands, together with other advanced packages, place new demands on stencil cleaning. Paste volume is a critical issue for fine, ultra-fine, chip-scale, BGA and flip-chip components.

Languages: RU

Latest Revision IPC-7526, February 2007

Formats: H, D

IPC-7527**Requirements for Solder Paste Printing**

This standard is a collection of visual quality acceptability criteria for solder paste printing. The purpose of this guideline document is to support the user in the visual evaluation of the solder paste printing process, which makes subsequent process optimizing possible.

Languages: DE, DK

Latest Revision IPC-7527, May 2012

Formats: H, C, D, K, S, G

ELECTRONICS ASSEMBLY ACCEPTABILITY**IPC-A-610****Acceptability of Electronic Assemblies**

IPC-A-610 is the most widely used electronics assembly standard in the world. A must for all quality assurance and assembly departments, IPC-A-610 illustrates industry-accepted workmanship criteria for electronic assemblies with full-color photographs and illustrations. Topics include flex attachment; board in board; part on part; lead free; component orientation and soldering criteria for through-hole, SMT (new termination styles) and discrete wiring assemblies; mechanical assembly; cleaning; marking; coating; and laminate requirements. This document synchronizes to other industry consensus documents and is used with the material and process standard IPC J-STD-001.

Languages: CN, DE, DK, FR, HU, JP, RO, RU, SE, SP, VN

Latest Revision IPC-A-610F, July 2014

Formats: H, C, D, K, S, G

Training/Certification on IPC-A-610

Visit www.ipc.org/certification for details.

IPC-A-610FAM1(D)1**Acceptability of Electronic Assemblies – Amendment 1**

Released January 2016

Formats: D, S, G

IPC-DVD-PREP-A6101F**Preparatory Course for IPC-A-610F CIS Certification**

Training Resource Material Released January 2016

Formats: DVD

IPC-DRM-SMT**Surface Mount Solder Joint Evaluation Training & Reference Guide**

This training and reference guide conforms to IPC standards IPC-A-610 and IPC-J-STD-00 and illustrates critical acceptance criteria for the evaluation of surface mount solder connections. Useful in the classroom or on the shop floor, IPC-DRM-SMT contains computer generated color illustrations of chip component, gull wing and J-lead solder joints. Each drawing clearly shows the minimum acceptable condition for all three classes of product, including: misalignment, minimum/maximum solder joint size, fillet heights and lengths, and more.

Latest Revision IPC-DRM-SMT-F, 2015

Formats: H

IPC-DVD-SMT**Through Hole Solder Joint Quality Standards**

This media-based training program is a cost-effective and efficient way to train and test your entire workforce to the most widely recognized industry standard on surface mount solder joint criteria. The DVD-SMT uses state-of-the-art computer graphics and animations, as well as microphotography to insure operator-level comprehension of some of the key acceptance requirements from the IPC-A-610 for Chip, J-Lead, and Gull Wing solder joints. This video covers many of the class 2 and class3 requirements found in IPC-A-610.

Latest revision IPC-DVD-SMT-F, 2015

Formats: H

IPC-DVD-PTH**Through Hole Solder Joint Quality Standards**

This media-based training program is a cost-effective and efficient way to train and test your entire workforce to the most widely recognized industry standard on plated-through hole solder joint acceptance criteria. The DVD-PTH uses sophisticated computer graphics/animations and microphotography to insure operator-level comprehension of some of the key acceptance requirements from the IPC-A-610 standard. This video covers many of the Class 2 and Class 3 requirements found in IPC-A-610.

Latest Revision IPC-DVD-PTH-F, 2015

Formats: H

IPC-DRM-PTH***Through-Hole Solder Joint Evaluation Training & Reference Guide***

This training and reference guide conforms to IPC standards IPC-A-610 and J-STD-001 and illustrates critical acceptance criteria for the evaluation of through-hole solder connections. Useful in the classroom or on the shop floor, DRM-PTH contains computer generated color illustrations of component, barrel and solder-side perspectives of a plated-through hole. Each drawing clearly shows the minimum acceptable condition for requirements such as land coverage, vertical fill, wetting of lead, land and barrel and contact angle.

Latest Revision IPC-DRM-PTH-F, 2015

Formats: H

IPC-DRM-53***Introduction to Electronics Assembly Training & Reference Guide***

This *Desk Reference Manual (DRM-53)* is a learning resource for new hires, operators, sales, purchasing, human resources, administrative personnel, students or anyone interested in understanding electronics assembly terminology, the basic processes of both through-hole and surface mount assembly.

IPC/WHMA-A-620***IPC/WHMA Requirements and Acceptance for Cable and Wire Harness Assemblies***

IPC and the Wire Harness Manufacturers Association (WHMA) developed this standard to address requirements and acceptance of cable and wire harness assemblies. The standard covers criteria for wire prep, soldering to terminals, crimping of stamped and formed contacts and machined contacts, insulation displacement connectors, ultrasonic welding, splicing, connectors, molding, marking, coax/biax cables, wrapping/lacing, shielding, assembly and wire-wrap terminations.

Languages: CN, DE, DK, EE, FR, HU, KR, PL, RO, RU, SP, TR, VN, IL-Hebrew

Latest Revision IPC-A-620B, October 2012

Formats: H, C, D, K, S, G

Training/Certification on IPC-A-620

Visit www.ipc.org/certification for details.

IPC-D-620***Design and Critical Process Requirements for Cable and Wiring Harnesses***

This standard is the cable and wiring harness and systems level design requirements companion to IPC/WHMA-A-620, *Requirements and Acceptance for Cable and Wire Harness Assemblies* and its associated space addendum. The intent of this standard is to set forth the general design requirements for electrical wiring harnesses and cable assemblies.

Latest Revision IPC-D-620, February 2016

Formats: H, C, D, K, S, G

IPC-DRM-WHA***Wire Harness Assembly Training & Reference Guide***

This handy reference and training tool explains all the basic acceptance criteria for wire harness assemblers, crimp operators and even QA personnel. Using easy-to-understand computer-generated graphics and language geared for basic factory-level employees, the guide covers: wire types, gauges, insulation stripping, wire tinning, terminals and contact types, coaxial cables, IPC product categories and acceptance criteria, wire preparation, strand and insulation damage, conductor deformations, open and closed barrel crimp definitions and criteria, crimp deformations, cut-off tabs, punctures, insulation support crimps, inspection windows, bellmouth, conductor crimp requirements, conductor brush, closed barrel crimps, insulation damage, ribbon cable, discrete wire, cup terminals and a glossary of related wire harness terminology.

Latest Revision IPC-DRM-WHA-B, 2012

IPC-A-630***Acceptability Standard for Manufacture, Inspection and Testing of Electronic Enclosures***

This standard contains the acceptability criteria that pertains to "box build" of the assembly process. The standard has been written to direct manufacturers and end users of electronic enclosures of electrical and electronic equipment to understand the best practices to meet requirements, ensuring the reliability and function of the end-tem assembly for its intended design life.

Languages: CN

Latest Revision IPC-A-630, September 2013

Formats: H, C, D, K, S, G

Training/Certification on IPC-A-630

Visit www.ipc.org/certification for details.

IPC-HDBK-630***Acceptability Standard for Manufacture, Inspection and Testing of Electronic Enclosures Handbook***

A highly recommended companion document to IPC-A-630, *Acceptability Standard for Manufacture, Inspection and Testing of Electronic Enclosures*.

Latest Revision IPC-HDBK-630, June 2014

Formats: H

IPC-7711/21***Rework, Modification and Repair of Electronic Assemblies***

The guideline includes everything needed for the repair and rework of electronic assemblies and printed boards for both lead-free and traditional SnPb soldered assemblies. The document includes procedures for BGAs (including reballing) and flex-print repair. Part 1 is General Requirements includes procedures common to rework, repair and modification. Part 2 is IPC-7711 and procedures that include tools, materials and methods to be used in removing and replacing surface mount and through-hole components. Part 3 is IPC-7721 and includes procedures for modifying assemblies and accomplishing laminate and conductor repairs. There are many color illustrations to help with ease of understanding.

Languages: CN, CZ, DE, DK, FR, HU, IT, KR, RO, RU, SP, TR,

Latest Revision IPC-7711/21B, November 2007

Formats: H, C, D, K, S, G

Training/Certification on IPC-7711/21

Visit www.ipc.org/certification for details.

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

This essential industry standard provides descriptions and illustrations of electronic interconnect industry terminology to help users and their customers break down language barriers. Commonly used industry acronyms are included in the document.

Languages: FR

Latest Revision IPC-T-50M, 2015

Formats: H, C, D, K, S, G

IPC-9592**Requirements for Power Conversion Devices for the Computer and Telecommunications Industries**

This document standardizes the requirements for power conversion devices (PCDs) for the computer and telecommunications industries. The phrase "power conversion devices" refers to AC-to-DC and DC-to-DC modules, converters and power supplies. This specification sets the requirements for design, qualification testing, conformance testing and manufacturing quality/reliability processes, but does not include the functional requirements of the specific equipment. PCDs addressed in this document are used in the electronics industry to provide conversion of main power sources, usually AC to lower DC voltages for direct use of electronic circuits or as a secondary source for additional DC-to-DC PCDs to provide several DC voltage levels for various electronic devices in a product.

Latest Revision IPC-9592B, November 2012

Formats: H, C, D, K, S, G

IPC-TM-650**Test Methods Manual**

Contains more than 150 industry approved test techniques and procedures for chemical, electrical and environmental tests on all forms of printed boards and connectors. Updated regularly as test methods are revised or developed.

IPC-TM-650

Formats: H, C

IPC-J-STD-609A**IPC/JEDEC Marking and Labeling of Components, PCBs and PCBA's to Identify Lead (Pb), Lead-Free (Pb-Free) and Other Attributes**

Provides a marking and labeling system that aids in assembly, rework, repair and recycling and provides for the identification of: 1) assemblies that are assembled with lead-containing or lead-free solder; 2) components that have lead-containing or lead-free second level interconnect terminal finishes and materials; 3) the maximum component temperature not to be exceeded during assembly or rework processing; 4) base materials used in PCB construction, including PCBs that use halogen-free resin; 5) the surface finish of PCBs; and 6) the conformal coating on PCBA's.

Languages: CN

Latest Revision IPC-J-STD-609A, March 2010

Formats: H, C, D, K, S, G

PRINTED ELECTRONICS**IPC-2291****IPC/JPCA Design Guideline for Printed Electronics**

Developed by IPC and Japan Electronics Packaging and Circuits Association (JPCA), this guideline provides an overview of the design process flow for printed electronics based devices, modules and units, and final products. The intent of IPC/JPCA-2291 is to establish a design process flow that will facilitate and improve the practice of printed electronics design.

Latest Revision IPC-2291, June 2013

Formats: H, C, D, K, S, G

IPC-4591,**IPC/JPCA Requirements for Printed Electronics Functional Conductive Materials**

This document provides comprehensive data to help users more easily determine material performance, capabilities, and compatibility of functional conductive materials for the manufacture of printed electronics. It includes: classification schemes based on composition, conductor type, and post-processing structure; functional conductive material specification sheets to present properties for the different conductive material types; and the most current classification system, qualification and quality conformance requirements, including those raw material properties of particular interest to the printed electronics designer, fabricator, or other user. This standard is a joint standard published by IPC and JPCA, Japan Electronics Packaging and Circuits Association.

Latest Revision IPC-4591, December 2012

Formats: H, D, K, S, G

IPC-4921,**IPC/JPCA Requirements for Printed Electronics Base Materials (Substrates)**

This document provides comprehensive data to help users more easily determine both material capability and compatibility for flexible and rigid base dielectric materials for manufacture of printed electronics. It includes base material specification sheets that have been updated with the newest properties for the specification material types. It establishes the most current classification system, qualification and quality conformance requirements, including those raw material properties of particular interest to the printed electronics designer, fabricator, or user.

Latest Revision IPC-4921, June 2012

Formats: H, D, K, S, G

IPC-6901**IPC/JPCA Application Categories for Printed Electronics**

This standard establishes a Market Classification System and Level Classification System for printed electronics assemblies and provides a list of performance criteria and testing methods. It provides a standardized product category structure for designing and manufacturing printed electronics and assemblies which conform to industry-established performance metrics as determined by accepted testing methods.

Latest Revision IPC-6901, July 2015

Formats: H, D, K, S, G

IPC-6903**Terms and definition for the Design and Manufacture of Printed Electronics (Additive Circuitry)**

This standard provides industry-approved terms and definitions to create a common language for users and suppliers to develop electronics products that utilize printed electronics alone or as additive processes combined with traditional rigid, flexible and rigid-flex PWB assemblies.

Latest Revision IPC-6903, October 2015

Formats: H, D, K, S, G

IPC-9121**Troubleshooting for Printed Board Fabrication Processes**

Latest Revision IPC-9121, March 2016

MARKET RESEARCH STUDIES

2014WORLDPCB *World PCB Production Report for the Year 2014*

IPC's *World PCB Production Report* offers consensus estimates of PCB production value by country and by product type, commentary on global and regional PCB industry trends, special sections on specialty laminates and metal-clad PCBs, and historical data on regional PCB production trends. The estimates are developed by a team of the world's leading industry analysts.

Released IPC-2012WORLDPCB, September 2015
Formats: D, S, G

MR-PCB15 *2015 Analysis & Forecast for the North American PCB Industry*

This survey-based study offers data and analysis on trends in the North American PCB industry, including market size estimates and forecasts through 2017, sales and production growth, materials, sales by product type, product mix (high-volume vs. quick turn vs. prototype), revenue trends from value added services, operational metrics, vertical markets, and US PCB imports and exports. The survey sample includes 37 PCB manufacturers with total sales of \$1.7 billion, representing approximately 50 percent of the North American PCB market.

Released IPC-MR-PCB15, November 2015
Formats: D, S, G

WAGEA-15 *2015 Wage Rate and Salary Study for the North American Electronics Assembly Industry*

Results of IPC's biennial wage and salary survey for electronics assembly companies (both contract manufacturers/EMS companies and OEMs) presents averages, average ranges, and percentile data on 2015 hourly wages, annual salaries and sales compensation in the USA and Canada. Data on 31 positions are segmented by industry segment, region and company size. Salary budget growth in 2015 and estimates for 2016 are included. Sales compensation data covers base salaries, commissions, bonuses and total compensation, as well as compensation of independent manufacturers' representatives. Data on current HR policies cover hiring, performance appraisal, shifts, paid leave, team activities and other topics. Coverage of employee benefits includes several types of retirement plans, profit-sharing, stock ownership, various types of health insurance plans, life insurance, coverage of dependents, company contributions to these benefits, and tuition assistance.

Released IPC-WAGEA-15, December 2015
Format: D

BENCHE-15 *IPC Study of Quality Benchmarks for the Electronics Assembly 2015*

This survey-based study covers production data, assembly attributes, yields, defect rates (DPMO), customer returns, supplier performance, customer satisfaction and certification data. This report enables electronics assembly companies to compare their performances to industry averages. The survey sample includes 65 electronics assembly companies from North America, Europe and Asia with total sales revenue ranging from under \$10 million to more than \$500 million. Aggregate data are segmented by company size, region and type of production.

Released IPC-BENCHE-15, August 2015
Formats: D, S, G

MARKET RESEARCH SUBSCRIPTION SERVICES

IPC offers market research reports by subscription, providing monthly or quarterly updates on the electronics supply chain, PCB markets, EMS trends and more.

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www.ipc.org/market-research-subscriptions.

TRAINING RESOURCES

IPC has been producing industry-approved, training videos for more than 30 years ... covering electronics assembly acceptance standards, hand soldering, lead free, repair and rework, ESD control, component ID, cable/wire harness assemblies and circuit board fabrication.

For the online catalog of our DVDs, online video training resources, reference guides, wall posters and image archives go to
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ONLINE VIDEO TRAINING

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OVT-PREP-7711-21B(SD) *Preparatory Course for IPC-7711-21B CIS Certification*

OVT-PREP-A610F(SD) *Preparatory Course for IPC-A-610F CIS Certification*

OVT-PREP-A620B(SD) *Preparatory Course for IPC-A-620B CIS Certification*

TRAINING & REFERENCE GUIDES

Handy and portable spiral-bound reference guides on surface mount and through hole solder joint acceptability, component identification, wire prep/crimp acceptability and basic electronics assembly.

IMAGE RESOURCES

Clip art sets from IPC-A-610F — individually, by chapter or complete set — as well as a lead-free solder joint image library — photographed in extreme microscopic detail, and the complete set of images from IPC/WHMA-A-620B are available. Create your own learning tools using IPC's graphic resources.

WALL POSTERS

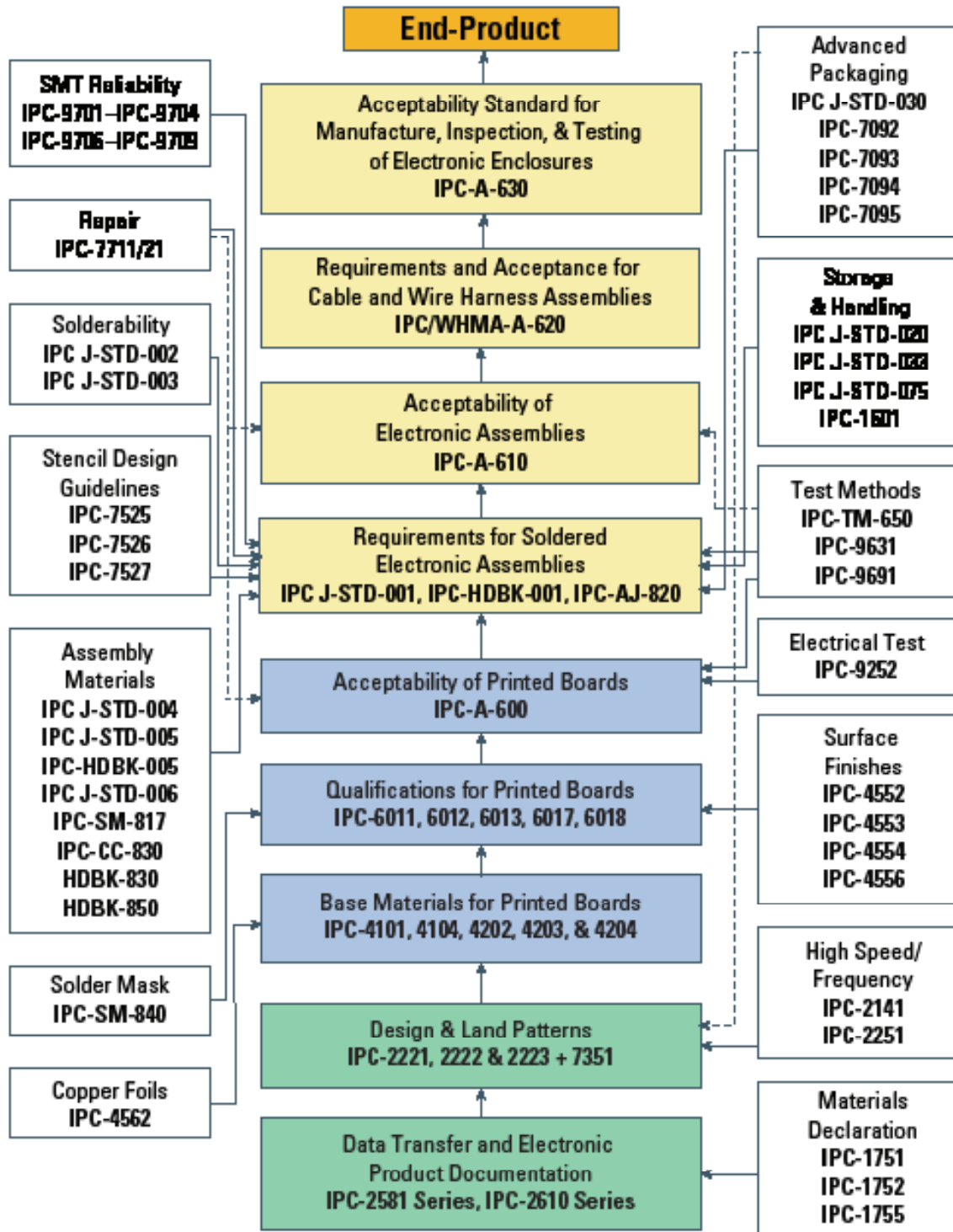
Make a "big" impression with these surface mount and through hole solder joint evaluation posters. TH and SMT evaluation posters contain the critical acceptance criteria from IPC-A-610F and IPC-J-STD-001F for solder connections, and are laminated for easy display.

For technical questions, please contact
IPC Training at +1 847-597-2940, or e-mail
trainingsupport@ipc.org.

Association Connecting Electronics Industries



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847-615-7100 **tel**
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