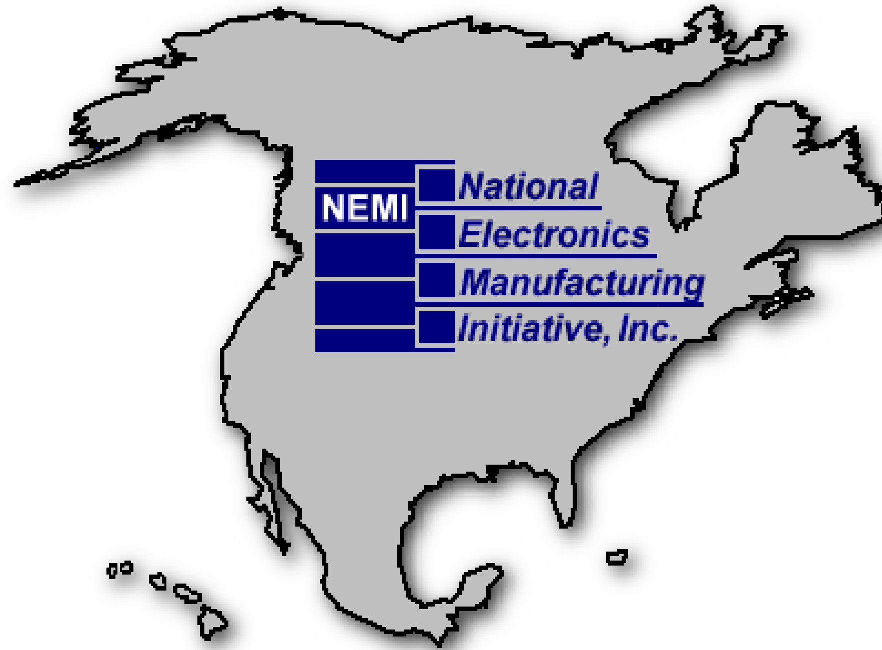
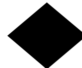


NEMI RoHS Transition Task Group
Process Standards
RoHS Summit - October 18th, 2004



Frank Grano, Sanmina-SCI

Scope:

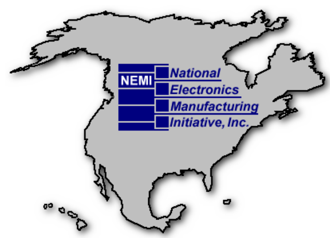
This project has been encompassing 2 areas.

- **Create a process definition document that describes the lead free process.**
- **Identify the industry standards that will need to be modified to reflect the lead free process.**

Assembly Process Specifications Project

Main Focus:

The main focus so far has been to establish acceptance criteria for IPC-610 Rev D scheduled to be released early next year.

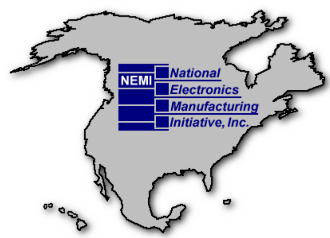


IPC 610 – Rev D

- Lead-Free content throughout the document
- Provides samples of solder joints and if possible lead and lead-free solder joints side by side
- In many cases there was no specific criteria for the lead-free alloy:
  - Basic wetting & filleting
  - Insufficient, non-wetting, solder paste reflow

IPC 610 – Rev D

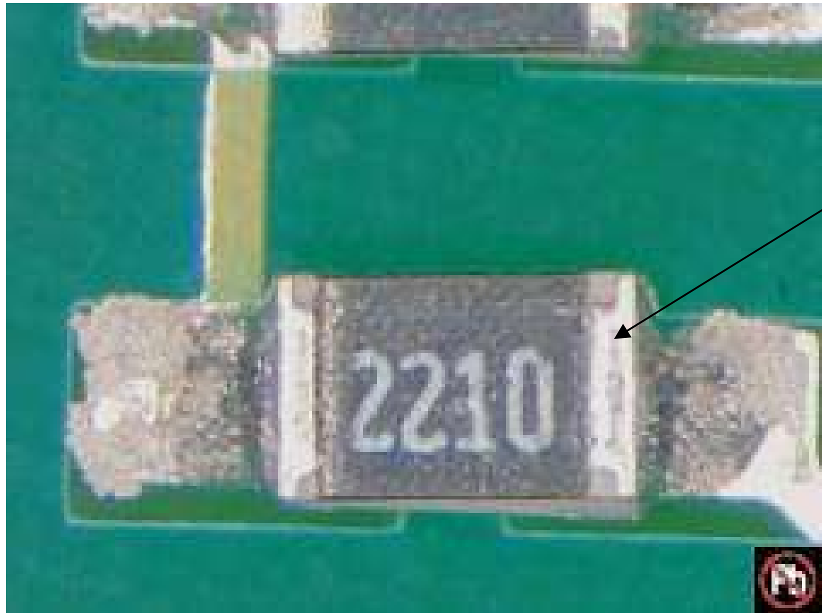
- Provide criteria where there is a difference between the 2 solder alloys:
  - Section 5 – Soldering
  - Section 6 – Terminal Connections
  - Section 7 – Through-Hole Technology
  - Section 8 – Surface Mount Assemblies



NEMI RoHS Process Standards Team

Firm	Name
Benchmark Electronics	Bob Farrell
Benchmark Electronics	Richard Garnick
Benchmark Electronics	Steve Beck
Celestica Corporate Technology	Thilo Sack
Cisco Systems	Vicki Chin
EMC Corporation	Bob Martel
GoodBye Chain Group, LLC	Jim Dills
Hewlett-Packard Company	Jerry Gleason
Honeywell Aerospace Electronic Systems	Judy Little
IBM Procurement Engineering	Jim Wilcox
Intel Corporation	Prawin Paulraj
Intel Corporation	Raul Acevedo
IR - HiRel Products	Richard M. Carrier
Jabil Circuit, Inc.	Marty Rodriguez
Jabil Circuit, Inc.	Quyen Chu
Lexmark International, Inc.	Rod Erickson
Molex Inc.	Pete Elmgren
Plexus	Denis Jean
RNTD	Ted Haas
Sanmina-SCI	Frank Grano
Sanmina-SCI	Alan Ater
Solectron Technology, Inc.	Jasbir Bath
Sun Microsystems	Ken Kochi
Sun Microsystems	Simon Chng
Sun Microsystems, Inc.	Frank DeCoito
TYCO Electronics	Paulette Lemond
U.S. Army Aviation and Missile Command, Redstone Arsenal, AL	David Locker
U.S. Army Aviation and Missile Command, Redstone Arsenal, AL	Jeff Jarvis

IPC 610 Rev D – Basic Picture Format



Lead-Free Picture

Lead-Free Symbol Used

IPC 610 Rev D – Section 5 Examples

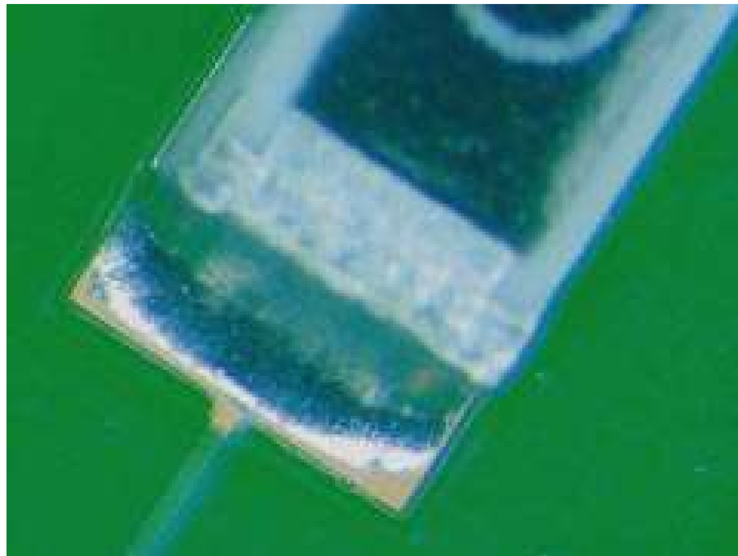


Figure 5-4 SnPb Solder; No Clean Process

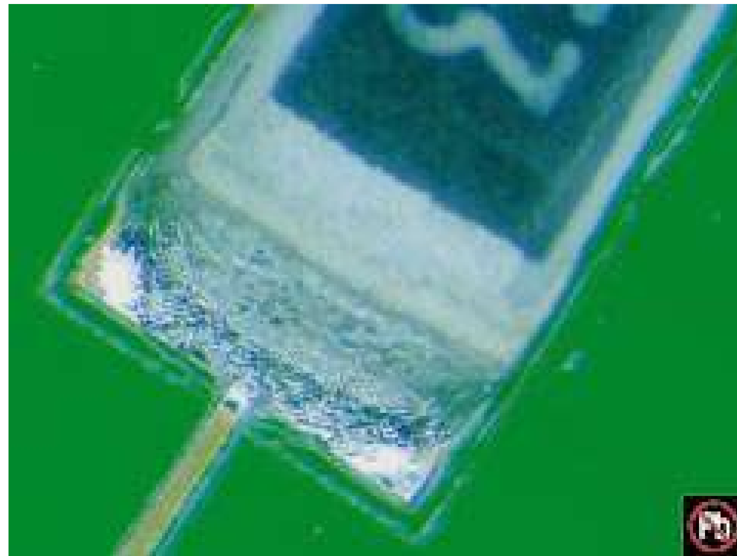


Figure 5-5 SnAgCu Solder; No Clean Process

IPC 610 Rev D – Section 5 Examples

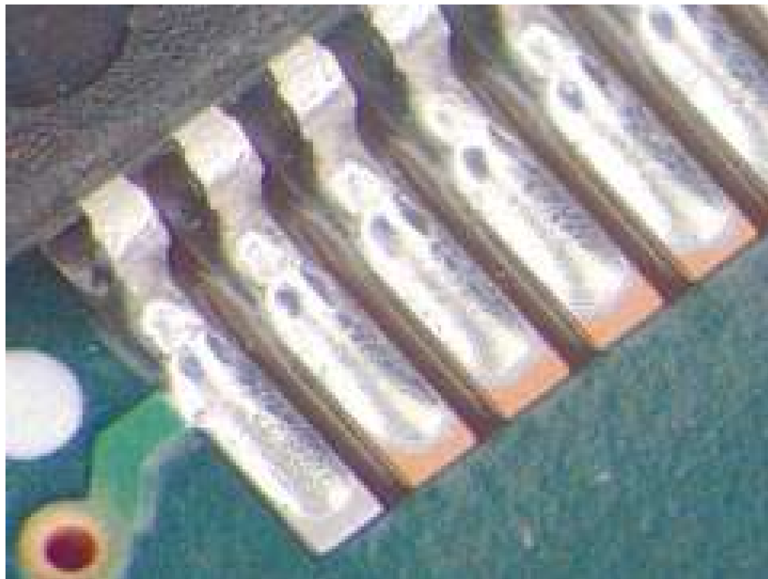


Figure 5-8 SnPb Solder; Water Soluble Flux

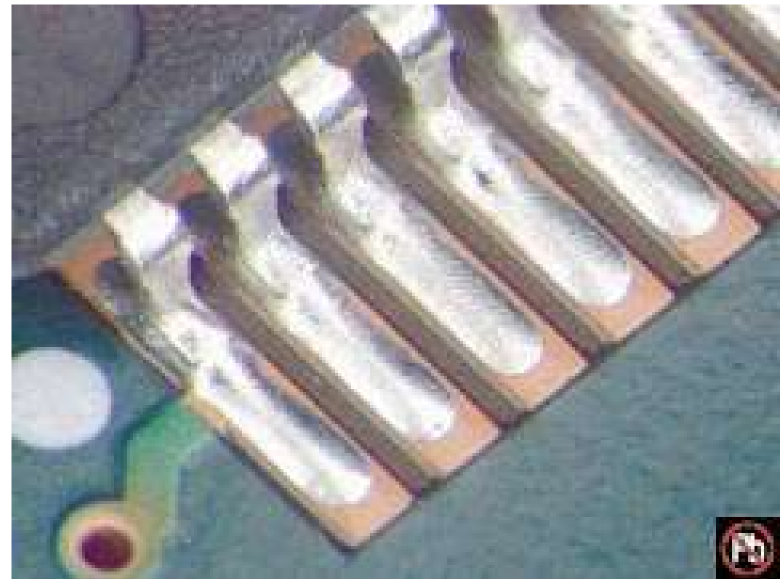


Figure 5-9 SnAgCu Solder; Water Soluble Flux

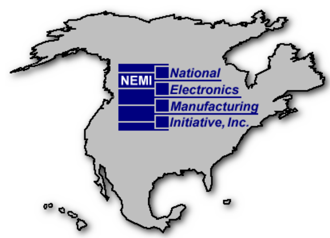
IPC 610 Rev D – Section 5 Examples

Figure 5-18 SnPb Solder

Figure 5-19 SnAgCu Solder

J–STD-001

- Lead-Free content throughout the document
- Current spec out for vote – expected release early 2005.
- Final meetings next week at IPC works – 2 days of joint meetings with the IPC-610 Committee



Assembly Process Specifications Project

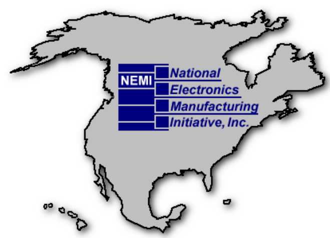
IPC/JEDEC Joint Standard 020C now released

Sn-Pb Eutectic Process		
Package Thickness	**Volume mm³ <350**	**Volume mm³ ≥ 350**
<2.5 mm	240 +0/-5 °C	225 +0/-5°C
≥ 2.5 mm	225 +0/-5°C	225 +0/-5°C

Range = 225C to 240C

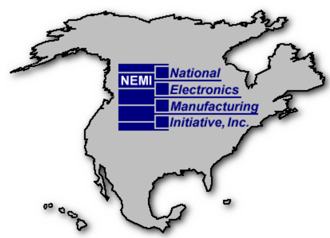
SAC (Lead Free) Process			
Package Thickness	**Volume mm³ < 350**	**Volume mm³ 350 - 2000**	**Volume mm³ > 2000**
< 1.6 mm	260 +0 °C	260 +0 °C	260 +0 °C
1.6 mm - 2.5 mm	260 +0 °C	250 +0 °C	245 +0 °C
> 2.5 mm	250 +0 °C	245 +0 °C	245 +0 °C

Range = 245C to 260C



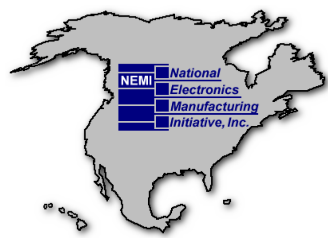
IPC/JEDEC Joint Standard 020C – 260 degree Rework Note

4.1 Compatibility with Pb-Free Rework Unless otherwise specified by the device manufacturer, a Pb-free component (classified per Table 4.2), **shall** be capable of being reworked at 260 °C within eight hours of removal from dry storage or bake, per J-STD-033. To verify this capability for a component classified at a temperature below 260 °C, a sample of the size per 5.1.2 **shall** be soaked per Level 6 conditions (see Table 5-1) using a Time on Label (TOL) of eight hours, and reflowed at a classification temperature of 260 °C. All devices in the sample **shall** pass electrical test and have a damage response per 6.1 and 6.2 not greater than that observed for the same package at its rated MSL level. A component rated at 260 °C does not require this rework compatibility verification.



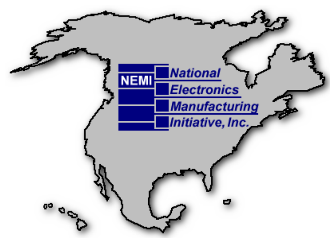
Other IPC / JEDEC Specs

Document Number	Specific LF Content Rev	Status	Title
J-STD-002B	Next Rev (C)	Rev B Released Feb03	Solderability Tests for Component Leads, Terminations, Lugs, Terminals and Wires; comment: Rev C work in progress to extend LF coverage; projected mid-2005
J-STD-003	Next Rev (B)	Rev A Released Feb03	Solderability Tests for Printed Boards; comment: Rev B work in progress to extend LF coverage; projected mid 2005
J-STD-004	Good in A; more in next (B)	Rev A Released Jan04	Requirements for Soldering Fluxes; comment: includes 12 new or updated test methods. Rev B work in progress to extend LF flux coverage; projected late 2005
J-STD-005	Next Rev (A)	Released Jan95 w/Amend 1 Jun96	Requirements for Soldering Pastes; comment: Rev A work in progress, tied to flux (J004) and solder alloy (J006) standards updates
IPC-HDBK-005	Some	In ballot	Soldering Pastes Handbook; comment: Projected publication by Feb 2005
J-STD-006	Yes in (A), more in next (B)	Rev A Released May01	Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders; comment: Rev A includes nearly all LF alloys; Rev B nearly complete to restore short titles to tables and enhance usability; projected publication Feb 2005



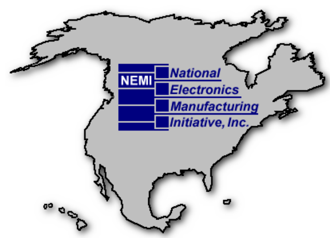
Other IPC / JEDEC Specs

Document Number	Specific LF Content Rev	Status	Title
J-STD-020	Yes, more in next Rev (D)	Rev C Released Jul04	Moisture/Reflow Sensitivity Classification for Non-Hermetic Solid State Surface Mount Devices; comment: Rev D work in progress to enhance LF content; aggressive development schedule; projected publication mid 2005.
J-STD-028	Limited	Released Aug99	Performance Standard for Construction of Flip Chip and Chip Scale Bumps
J-STD-029	Limited	In development	Performance and Reliability Test Methods for Flip Chip, Chip Scale, BGA and other Surface Mount Array Package Applications; comment: still in early draft stage
J-STD-030	Applicable	In ballot	Guidelines for Selection, Application of Underfill Material for Flip Chip and Other Micropackages; comment: projected publication Feb 2005
J-STD-032	Some	Released Jun02	Performance Standard for Ball Grid Array Balls
J-STD-033	Yes, more in next Rev (B)	Rev A Released Jul02	Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices; comment: aggressive development schedule; Projected publication Feb 2005
J-STD-035	Applicable	Released Apr99	Acoustic Microscopy for Non-Hermetic Encapsulated Electronic Components; comment: no updated needed for LF



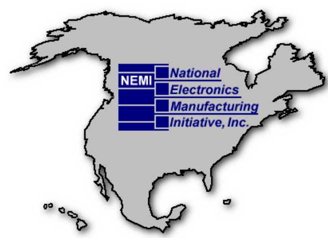
Other IPC / JEDEC Specs

Document Number	Specific LF Content Rev	Status	Title
IPC-T-50	Applicable	Rev G Released Dec03	Terms and Definitions for Interconnecting and Packaging Electronic Circuits; this is a "living document" with new terms added periodically as they are published in other IPC standards.
IPC-D-279	Applicable	Released Jul96	Design Guidelines for Reliable Surface Mount Technology Printed Board Assemblies
IPC-D-326A	Some	Rev A Released jan04	Information Requirements for Manufacturing Printed Circuit Boards and Other Electronic Assemblies
IPC-TR-464	Too dated	Released Dec87	Accelerated Aging for Solderability Evaluations; Comment: pretty dated; J-STD-003B will probably cover this better
IPC-A-600	Some	Released Jul04	Acceptability of Printed Boards
IPC-QE-605	Some	Released Feb99	Printed Board Quality Evaluation handbook; comment: picture book with limited support for surface finishes



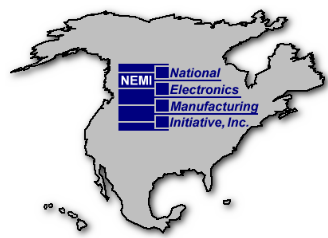
Other IPC / JEDEC Specs

IPC-MI-660	N/A	Released Feb84	Incoming Inspection of Raw Materials Manual; very dated and no ref to LF
IPC-CM-770	Limited	Rev E Released Jan04	Component Mounting Guidelines for Printed Boards
IPC-SM-782	Next Rev (IPC-7351)	A w/Amend 1,2 Released Jan00	Surface Mount Design 7 Land Pattern Standard; comment: major revision in progress; changing document number to 7351.
IPC-SM-817	N/A	Released Nov 89	General Requirements for Dielectric Surface Mounting Adhesives; comment: general thermal and "gluing" adhesives, not LF related; recommend 3406 and 3408 conductive adhesives instead
IPC-SM-821	N/A	Released Jan95	General Requirements for Thermally Conductive Adhesives; comment: general thermal adhesive document, usable with LF but no updates planned
IPC-SM-839	N/A	Released Apr90	Pre & Post Solder Mask Application Cleaning Guidelines
IPC-SM-840	Limited	Rev C w/Amend 1 Released Jan96	Qualification and Performance of Permanent Solder Mask
IPC-HDBK-840	Limited	In Development	Solder Resist Handbook
IPC-1065	Yes	Released Jul04	Material Declaration Handbook
IPC-1066	Yes	Released Oct04	Labeling of PCBs and Assemblies
IPC-2221	Limited	Released May03	Generic Standard on Printed Board Design



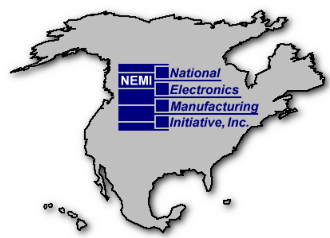
Other IPC / JEDEC Specs

Document Number	Specific LF Content Rev	Status	Title
IPC-2222	Next Rev (A)	Released Feb98	Sectional Design Standard for Rigid Printed Boards; comment: Rev B development in progress; will expand LF support
IPC-2546	N/A	Amend 2 development in progress	Sectional Requirements for Specific Printed Circuit Board Assembly Equipment
IPC-2577	N/A	Development in progress	Sectional Requirements for Supply Chain Communications of Manufacturing Quality Assessment — Product Data eXchange (PDX)
IPC-2581	N/A	Released Mar04	Generic Requirements for Printed Board Assembly Products Manufacturing Description Data and Transfer Methodology
IPC-3406	Some	Released Jul96	Guidelines for Electrically Conductive Surface Mount Adhesives
IPC-3408	Some	Released Nov96	General Requirements for Anisotropically Conductive Adhesives Films
IPC-4553	Yes		Specification for Immersion Silver Plating for Printed Circuit Boards; comment: preparing for ballot
IPC-4554	Yes		Specification for Immersion Tin Plating for Printed Circuit Boards; comment: preparing for ballot
IPC-4563	Some		Resin-Coated Metal Foil for Printed Boards; comment: preparing for ballot
IPC-5701	General		Users Guide for Cleanliness of Unpopulated Printed Boards
IPC-6012	Some	Rev B Released Aug04	Qualification and Performance Specification for Rigid Printed Boards



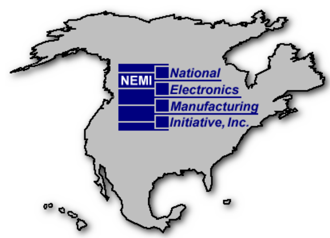
Other IPC / JEDEC Specs

Document Number	Specific LF Content Rev	Status	Title
IPC-6013	Next Rev (B)	Rev A Released Nov03	Qualification and Performance Specification for Flexible Printed Boards
IPC-7095	Some	Rev A Released Oct04	Design and Assembly Process Implementation for BGAs
IPC-7351	Some	Development in progress	Generic Standard on Surface Mount Land Pattern Design; comment: see IPC-782
IPC-7530	Applicable	Released May01	Guidelines for Temperature Profiling for Mass Soldering (Reflow & Wave) Processes
IPC-7711A/7721A	limited	Rev A Released Oct03; Living document	Rework and Repair Guide; comment: new procedures are constantly added as they are developed
IPC-7912	Applicable	Rev A Released Jan04	End-Item DPMO for Printed Circuit Board Assemblies
IPC-9151	Applicable	Released May03	Printed Board Process, Capability, Quality and Relative Reliability (PCQR^2) Benchmark Test Standard and Database
IPC-9261	Applicable	Released Mar02	In-Process DPMO and Estimated Yield for PWAs; Rev A in ballot
IPC-9701	Applicable	Released Jan02	Performance Test Methods and Qualification Requirements for Surface Mount Solder Attachments
IPC/JEDEC-9702	9702	Released Jun04	Monotonic Bend Characterization of Board-Level Interconnects
IPC-9850	N/A	Released Jul02	Surface Mount Placement Equipment Characterization
IPC-9851	N/A	Released Oct04	Equipment Interface Specification



Other IPC / JEDEC Specs

Document Number	Specific LF Content Rev	Status	Title
IPC-T-50	Applicable	Rev G Released Dec03	Terms and Definitions for Interconnecting and Packaging Electronic Circuits; this is a "living document" with new terms added periodically as they are published in other IPC standards.
IPC-D-279	Applicable	Released Jul96	Design Guidelines for Reliable Surface Mount Technology Printed Board Assemblies
IPC-D-326A	Some	Rev A Released jan04	Information Requirements for Manufacturing Printed Circuit Boards and Other Electronic Assemblies
IPC-TR-464	Too dated	Released Dec87	Accelerated Aging for Solderability Evaluations; Comment: pretty dated; J-STD-003B will probably cover this better
IPC-A-600	Some	Released Jul04	Acceptability of Printed Boards
IPC-QE-605	Some	Released Feb99	Printed Board Quality Evaluation handbook; comment: picture book with limited support for surface finishes
IPC/WHMA-A-620	620	Released Jan02	Requirements and Acceptance for Cable and Wire Harness Assemblies; Comment: Revision A near ballot; expect release by summer 05
IPC-TM-650	650	Continuously updated; each test method has it's own date	Test Methods Manual; comment: individual test methods free download from www.ipc.org/downloads



Contact Info:

Frank Grano
Sanmina-SCI
frank.grano@sanmina-sci.com
(256) 882-4903