



ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES

IPC-FA-251

Assembly Guidelines for Single-Sided and Double-Sided Flexible Printed Circuits

ANSI/IPC-FA-251

Original Publication

February 1992

A standard developed by IPC

2215 Sanders Road, Northbrook, IL 60062-6135
Tel. 847.509.9700 Fax 847.509.9798
www.ipc.org

The Principles of Standardization

In May 1995 the IPC's Technical Activities Executive Committee adopted Principles of Standardization as a guiding principle of IPC's standardization efforts.

Standards Should:

- Show relationship to DFM & DFE
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

Standards Should Not:

- Inhibit innovation
- Increase time-to-market
- Keep people out
- Increase cycle time
- Tell you how to make something
- Contain anything that cannot be defended with data

Notice

IPC Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards and Publications shall not in any respect preclude any member or nonmember of IPC from manufacturing or selling products not conforming to such Standards and Publication, nor shall the existence of such Standards and Publications preclude their voluntary use by those other than IPC members, whether the standard is to be used either domestically or internationally.

Recommended Standards and Publications are adopted by IPC without regard to whether their adoption may involve patents on articles, materials, or processes. By such action, IPC does not assume any liability to any patent owner, nor do they assume any obligation whatever to parties adopting the Recommended Standard or Publication. Users are also wholly responsible for protecting themselves against all claims of liabilities for patent infringement.

IPC Position Statement on Specification Revision Change

It is the position of IPC's Technical Activities Executive Committee (TAEC) that the use and implementation of IPC publications is voluntary and is part of a relationship entered into by customer and supplier. When an IPC standard/guideline is updated and a new revision is published, it is the opinion of the TAEC that the use of the new revision as part of an existing relationship is not automatic unless required by the contract. The TAEC recommends the use of the latest revision.

Adopted October 6, 1998

Why is there a charge for this standard?

Your purchase of this document contributes to the ongoing development of new and updated industry standards. Standards allow manufacturers, customers, and suppliers to understand one another better. Standards allow manufacturers greater efficiencies when they can set up their processes to meet industry standards, allowing them to offer their customers lower costs.

IPC spends hundreds of thousands of dollars annually to support IPC's volunteers in the standards development process. There are many rounds of drafts sent out for review and the committees spend hundreds of hours in review and development. IPC's staff attends and participates in committee activities, typesets and circulates document drafts, and follows all necessary procedures to qualify for ANSI approval.

IPC's membership dues have been kept low in order to allow as many companies as possible to participate. Therefore, the standards revenue is necessary to complement dues revenue. The price schedule offers a 50% discount to IPC members. If your company buys IPC standards, why not take advantage of this and the many other benefits of IPC membership as well? For more information on membership in IPC, please visit www.ipc.org or call 847/790-5372.

Thank you for your continued support.

Table of Contents

1.0	INTRODUCTION	1	8.1	Quality Concepts	29
1.1	Scope	1	8.2	Requirements	30
1.2	Purpose.....	1	9.0	MECHANICAL INSTALLATION	30
1.3	Classification.....	1			
1.4	Dimensions/Tolerances	1			
2.0	APPLICABLE DOCUMENTS	1		Figures	
2.1	IPC	1	Figure 1	Copper reinforcement for mechanical fastener	3
2.2	Electronic Industries Association (EIA)	2	Figure 2	ESD drawing.....	4
2.3	Military	2	Figure 3a	Axial-leaded, auto-assembly package.....	5
2.4	Federal	2	Figure 3b	Typical axial-leaded components	5
2.5	American National Standards Institute (ANSI)	2	Figure 4	Typical radial-leaded components	6
3.0	GUIDELINES	2	Figure 5	Chip components types	6
3.1	Terms and Definitions.....	2	Figure 6	Typical Small-Outline Transistor (SOT) packages.....	7
3.2	Materials.....	2	Figure 7	Typical Small-Outline Integrated Circuit (SOIC) package	7
3.3	Assembly Process Considerations	4	Figure 8	Typical SIP.....	7
4.0	COMPONENT ASSEMBLY CONSIDERATIONS	5	Figure 9a	Typical dual, in-line package	8
4.1	Connectors.....	10	Figure 9b	DIP modification for surface mount	8
4.2	Connector Assembly Considerations	10	Figure 10	Ribbon-leaded components.....	8
4.3	Unpackaged Semiconductor Components	11	Figure 11	Through-hole mounting of ribbon-leaded components	9
4.4	Mechanical and Electromechanical Components.....	18	Figure 12	Typical surface-mount configuration for ribbon-leaded component	9
5.0	ASSEMBLY TECHNIQUES	18	Figure 13	Typical leadless and leaded chip carriers	9
5.1	Soldering Preparation	18	Figure 14	Typical PGA.....	9
5.2	Manual Soldering.....	18	Figure 15	PAD grid array	10
5.3	Machine Soldering	19	Figure 16	Plastic Leaded Chip Carrier (PLCC)	10
5.4	IR Reflow	21	Figure 17	50 Bonding Variables.....	11
5.5	Vapor Phase Reflow	22	Figure 18	Through hole connectors.....	12
5.6	Tape Automated Bonding (TAB)	22	Figure 19	Insulation displacement connectors	12
5.7	Laser Reflow Soldering	23	Figure 20	Surface mount connectors.....	13
5.8	Conductive Adhesive	24	Figure 21	Pressure Contacts	13
5.9	Encapsulation	26	Figure 22	Typical flexible etched circuitry-to-board application (ZIF Connectors)	14
6.0	CLEANING TECHNIQUES	27	Figure 23	Thermocompression stitch wire bonding.....	15
6.1	Pre-solder Cleaning.....	27	Figure 24	Ultrasonic bonding steps	15
6.2	Post Solder Cleaning	28	Figure 25	Mechanics of ultrasonic wire bonding	16
6.3	Cleaning Systems.....	28	Figure 26a	Typical ball bonding cycle.....	17
6.4	Testing and Qualification.....	28	Figure 26b	Mechanics of thermosonic wire bonding	17
7.0	HANDLING CONSIDERATIONS	29	Figure 27	ESD basic symbol	29
7.1	General Guidelines	29			
8.0	QUALITY ASSURANCE	29		Tables	
			Table 1	Some Commonly Used Flex Circuit Components	5
			Table 2	Wire Bonding Comparisons	14