



*The Institute for
Interconnecting
and Packaging
Electronic Circuits*

IPC-CC-110A

Guidelines for Selecting Core Constructions for Multilayer Printed Wiring Board Applications

IPC-CC-110A

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A standard developed by the Institute for Interconnecting
and Packaging Electronic Circuits

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Standardization

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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 feed back 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

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The material in this standard was developed by the Design Guidelines for MLB Materials Task Group (3-11c) of the Base Materials Committee (3-10) of the Institute for Interconnecting and Packaging Electronic Circuits.



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

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Acknowledgment

Any Standard involving a complex technology draws material from a vast number of sources. While the principal members of the IPC Design Guidelines for MLB Materials Task Group (3-11c) of the Base Materials Committee (3-10) 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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Guidelines for Selecting Core Constructions for Multilayer Printed Wiring Board Applications

1.0 SCOPE

1.1 Purpose This specification defines guidelines for selecting core constructions in terms of fiberglass fabric style and configuration for use in multilayer printed wiring board applications. Each core construction is given a registration number for ordering purposes. Every effort shall be made to review the construction guideline periodically and include or exclude constructions based on current data.

1.2 Recommendations This document groups the core constructions into categories based on relative nominal thickness. Within a nominal thickness category, the different core constructions are characterized in terms of resin content, dielectric thickness, glass transition temperature, availability, and cost. The core constructions are also compared for performance attributes including machinability, dimensional stability, Z-axis expansion, measles resistance, chemical resistance, and flatness.

1.3 Clarifications

1.3.1 Resin System The guideline to registered core constructions is applicable only to laminates as referenced in the appropriate slash sheet.

1.3.1.1 Slash Sheet 01 Laminates comprised of majority difunctional epoxy resin with a glass transition temperature of 110°C to 150°C.

1.3.1.2 Slash Sheet 02 Laminates comprised of a modified difunctional epoxy resin with a glass transition range of 150°C to 200°C.

1.3.1.3 Slash Sheet 03 Laminates comprised of a majority cyanate ester resin with a glass transition range of 170°C to 230°C.

1.3.1.4 Slash Sheet 04 Laminates comprised of a bis-maleimide triazine resin with a glass transition temperature range of 170°C to 230°C.

1.3.1.5 Slash Sheet 05 Laminates comprised of a majority polyimide resin with a minimum glass transition temperature of 200°C.

1.3.2 Reinforcement The guideline to registered core constructions is applicable only to laminates comprised of woven E glass based fabrics of plain weave as documented in IPC-EG-140.

1.3.2.1 Fabric Interchangeability When glass style 2113, 2313 or 3313 is utilized in a construction, the guideline only refers to 2113. Glass styles 2313 and 3313 can be used as an alternate. *Note:* Glass styles 2113, 2313 and 3313 are not identical in terms of thickness and basis weight.

1.3.3 Alternate Constructions For each thickness category, other possibilities for constructions may exist and be manufactured commercially. The constructions indicated in the construction selection guide have been chosen based on the consensus of industry experts, from both laminate suppliers and PWB fabricators. Alternate constructions may be found that perform better than those listed in the guideline for specific applications and may be used upon agreement between user and supplier.

1.3.4 Grading System The grading system utilizes circles, which indicate the relative performance between constructions for a particular property or characteristic. A filled-in circle indicates a core construction with the most applicable performance and an open circle indicates the least applicable performance. Intermediate levels of performance are indicated by partially filled circles.

2.0 APPLICABLE DOCUMENTS

2.1 IPC-T-50 Terms and Definitions

2.2 IPC-L-108 Specification for Thin Metal Clad Base Materials for Printed Wiring Board Applications

2.3 IPC-EG-140 Specification for Finished Fabric Woven From "E" Glass for Printed Boards

3.0 TERMS AND DEFINITIONS

3.1 Registration Number (REG#) The assigned code for ordering a laminate of a particular core construction.

3.2 Thickness The dielectric spacing of the laminate core measured without the metal cladding.

3.3 Construction The layers of prepreg comprising a laminate in terms of glass style and configuration. For example, 1080 indicates a construction comprised of 1 ply of 1080 style prepreg while 2 X 2116 indicates a construction comprised of 2 plies of 2116 style prepreg.

3.4 Resin Content (%RC) The resin portion by weight of the manufactured laminate expressed as a percent. The

approximate resin content for the construction indicated yields the DK shown. Resin contents between different manufacturers can be expected to be within $\pm 1.5\%$ of the value indicated for resin content.

3.5 Dielectric Constant (DK) The ratio of the capacitance of a configuration of electrodes with a specific material as the dielectric between them to the capacitance of the same electrode configuration with a vacuum or air as the dielectric.

3.6 Dielectric Constant Tolerance (DK TOL) The variation in the measured dielectric constant for laminate materials made from the same core construction due to variations in the resin to glass ratio during manufacture.

3.7 Dimensional Stability (DS) A measure of the dimensional change of a material that is caused by factors such as temperature changes, humidity changes, chemical treatment, and stress exposure.

3.8 Coefficient of Thermal Expansion (Z-CTE) The linear dimensional change of a material per unit change in temperature. *Note:* Z-axis expansion refers to the dimensional change in terms of the thickness of the laminate as a function of temperature change.

3.9 Thickness Tolerance (THICK TOL) The variation in dielectric spacing for the laminate material due to variation in the resin to glass ratio and the variation in resin flow during manufacture.

3.10 Chemical Resistance (CHEM) The ability of a laminate material to resist absorption or swelling due to various processing chemicals. Finer weave fabrics on the laminate surface and higher resin contents generally improve chemical resistance. Coarse fabrics on the laminate surface or low resin contents generally reduce chemical resistance.

3.11 Measling (MEASLE) A condition that occurs in laminated base material in which internal glass fibers are separated from the resin at the weave intersection. (This condition manifests itself in the form of discrete white spots or “crosses” that are below the surface of the base

material. It is usually related to thermally-induced stress.) Finer weave fabrics on the laminate surface and higher resin contents generally improve resistance to measling. Coarse fabrics on the laminate surface or low resin contents generally reduce resistance to measling.

3.12 Availability (AVAIL) An indication of the number of vendors producing the same construction for a particular core thickness and stocking practices.

3.13 Cost The summation of raw material prices for the materials used in the manufacture of a particular core construction. *Note:* The raw material cost of the laminate is not an indication of the overall quality cost for that particular core construction.

3.14 Flatness (FLAT) The ability of a laminate to resist warping, bowing, or twisting during printed board manufacture. An asymmetric construction generally will generate a (-) rating.

3.15 Smoothness (SMOOTH) The surface condition of the laminate material in terms of roughness usually associated with the texture of the surface plies of glass. In general constructions having a fine weave fabric on the surface yield a smoother (+) rating. Laminates comprised of 7628 prepregs on the surface layers were given a (-) rating.

3.16 Drillability (DRILL) The ability to drill clean holes in a laminate associated with the core being comprised of fine weave fabrics only. Laminates comprised of 7628 style prepregs were given a (-) rating.

4.0 RECOMMENDATIONS

4.1 Construction Comparison The relative comparison for the core constructions in terms of property characteristics and performance considerations can be found in Slash Sheets 1-5.

4.2 Thickness Categories Performance attributes are compared within a box only. Comparisons of core constructions based on the circle indicators of two different boxes are not valid.

Slash Sheet 1

FR-4 COPPER CLAD LAMINATE CONSTRUCTION SELECTION GUIDE

REG#	THICKNESS	CONSTRUCTION	% RC	DK	DK. TOL.	DS	Z CTE	THICK TOL	CHEM	MEASLE	AVAIL	COST	FLAT	SMOOTH	DRILL
FR-4 00	0.05mm(0.002")	106	70	4.08	○	○	○	○	●	●	○	○	○	+	+
FR-4 01	0.07mm(0.003")	1080	60	4.25	○	●	○	○	●	●	○	●	○	+	+
FR-4 02	0.08mm(0.003")	2x106	64	4.15	○	○	○	○	●	●	○	○	○	+	+
FR-4 03	0.11mm(0.004")	2x106	72	4.10	○	●	○	○	○	○	○	○	○	+	+
FR-4 04	0.11mm(0.004")	2113	57	4.30	○	○	○	○	○	○	○	○	○	+	+
FR-4 05	0.14mm(0.005")	106/2113	56	4.30	○	●	○	○	○	○	○	○	○	+	+
FR-4 06	0.13mm(0.005")	2x1080	59	4.25	○	○	○	○	○	○	○	○	○	+	+
FR-4 07	0.13mm(0.005")	2116	53	4.40	○	○	○	○	○	○	○	○	○	+	+
FR-4 08	0.16mm(0.006")	106/2116	51	4.45	○	○	○	○	○	○	○	○	○	+	+
FR-4 09	0.16mm(0.006")	1080/2113	54	4.40	○	○	○	○	○	○	○	○	○	+	+
FR-4 10	0.18mm(0.007")	2x2113	50	4.50	○	○	○	○	○	○	○	○	○	+	+
FR-4 11	0.18mm(0.007")	7628	40	4.75	○	○	○	○	○	○	○	○	○	-	-
FR-4 12	0.21mm(0.008")	2113/2116	50	4.50	○	○	○	○	○	○	○	○	○	-	-
FR-4 13	0.21mm(0.008")	2x2116	47	4.55	○	○	○	○	○	○	○	○	○	+	+
FR-4 14	0.25mm(0.010")	2x2116	52	4.4	○	○	○	○	○	○	○	○	○	+	+
FR-4 15	0.26mm(0.010")	7628/1080	47	4.6	○	○	○	○	○	○	○	○	○	-	-
FR-4 16	0.26mm(0.010")	2x1080/2116	55	4.6	○	○	○	○	○	○	○	○	○	+	+
FR-4 17	0.31mm(0.012")	2x1080/7628	47	4.6	○	○	○	○	○	○	○	○	○	+	+
FR-4 18	0.32mm(0.012")	7628/2116	47	4.6	○	○	○	○	○	○	○	○	○	-	-
FR-4 19	0.37mm(0.014")	2x7628	41	4.7	○	○	○	○	○	○	○	○	○	+	+
FR-4 20	0.37mm(0.014")	2x2113/7628	46	4.8	○	○	○	○	○	○	○	○	○	+	+
FR-4 21	0.43mm(0.016")	2x2116/7628	48	4.5	○	○	○	○	○	○	○	○	○	-	-
FR-4 22	0.43mm(0.016")	2x7628/1080	43	4.7	○	○	○	○	○	○	○	○	○	-	-
FR-4 23	0.48mm(0.018")	2x7628/2116	43	4.8	○	○	○	○	○	○	○	○	○	-	-
FR-4 24	0.51mm(0.021")	2x1080/2x7628	46	4.5	○	○	○	○	○	○	○	○	○	+	+
FR-4 25	0.53mm(0.021")	3x7628	40	4.7	○	○	○	○	○	○	○	○	○	-	-
FR-4 26	0.64mm(0.024")	2x2116/2x7628	47	4.6	○	○	○	○	○	○	○	○	○	+	+
FR-4 27	0.61mm(0.024")	3x7628/1080	42	4.7	○	○	○	○	○	○	○	○	○	-	-
FR-4 28	0.74mm(0.028")	4x7628	41	4.7	○	○	○	○	○	○	○	○	○	-	-
FR-4 29	0.74mm(0.028")	2x2113/3x7628	44	4.7	○	○	○	○	○	○	○	○	○	+	+
FR-4 30	0.75mm(0.029")	4x7628/1080	42	4.7	○	○	○	○	○	○	○	○	○	-	-
FR-4 31	1.52mm(0.059")	8x7628	42	4.7	○	○	○	○	○	○	○	○	○	+	+

	Better +
	Blank
	Worse

Slash Sheet 2 HIGH TG FR-4 COPPER CLAD LAMINATE CONSTRUCTION SELECTION

REG#	THICKNESS	CONSTRUCTION	% RC	DK	DK. TOL.	DS	Z CTE	THICK TOL	CHEM	MEASLE	AVAIL	COST	FLAT	SMOOTH	DRILL
HFR-4 00	0.05mm(0.002")	106	70	4.08	○	○	○	○	●	●	○	○	○	+	+
HFR-4 01	0.07mm(0.003")	1080	60	4.25	○	●	○	○	●	●	○	●	○	+	+
HFR-4 02	0.08mm(0.003")	2x106	64	4.15	○	○	○	○	●	●	○	○	○	+	+
HFR-4 03	0.11mm(0.004")	2x106	72	4.10	○	●	○	○	○	○	○	○	○	+	+
HFR-4 04	0.11mm(0.004")	2113	57	4.30	○	○	○	○	○	○	○	○	○	+	+
HFR-4 05	0.14mm(0.005")	106/2113	56	4.30	○	●	○	○	○	○	○	○	○	+	+
HFR-4 06	0.13mm(0.005")	2x1080	59	4.25	○	○	○	○	○	○	○	○	○	+	+
HFR-4 07	0.13mm(0.005")	2116	53	4.40	○	○	○	○	○	○	○	○	○	+	+
HFR-4 08	0.16mm(0.006")	106/2116	51	4.45	○	○	○	○	○	○	○	○	○	+	+
HFR-4 09	0.16mm(0.006")	1080/2113	54	4.40	○	○	○	○	○	○	○	○	○	+	+
HFR-4 10	0.18mm(0.007")	2x2113	50	4.50	○	○	○	○	○	○	○	○	○	+	+
HFR-4 11	0.18mm(0.007")	7628	40	4.75	○	○	○	○	○	○	○	○	○	+	+
HFR-4 12	0.21mm(0.008")	2113/2116	50	4.50	○	○	○	○	○	○	○	○	○	+	+
HFR-4 13	0.21mm(0.008")	2x2116	47	4.55	○	○	○	○	○	○	○	○	○	+	+
HFR-4 14	0.25mm(0.010")	2x2116	52	4.4	○	○	○	○	○	○	○	○	○	+	+
HFR-4 15	0.26mm(0.010")	7628/1080	47	4.6	○	○	○	○	○	○	○	○	○	+	+
HFR-4 16	0.26mm(0.010")	2x1080/2116	55	4.6	○	○	○	○	○	○	○	○	○	+	+
HFR-4 17	0.31mm(0.012")	2x1080/7628	47	4.6	○	○	○	○	○	○	○	○	○	+	+
HFR-4 18	0.32mm(0.012")	7628/2116	47	4.6	○	○	○	○	○	○	○	○	○	+	+
HFR-4 19	0.37mm(0.014")	2x7628	41	4.7	○	○	○	○	○	○	○	○	○	+	+
HFR-4 20	0.37mm(0.014")	2x2113/7628	46	4.8	○	○	○	○	○	○	○	○	○	+	+
HFR-4 21	0.43mm(0.016")	2x2116/7628	48	4.5	○	○	○	○	○	○	○	○	○	+	+
HFR-4 22	0.43mm(0.016")	2x7628/1080	43	4.7	○	○	○	○	○	○	○	○	○	+	+
HFR-4 23	0.48mm(0.018")	2x7628/2116	43	4.8	○	○	○	○	○	○	○	○	○	+	+
HFR-4 24	0.51mm(0.021")	2x1080/2x7628	46	4.5	○	○	○	○	○	○	○	○	○	+	+
HFR-4 25	0.53mm(0.021")	3x7628	40	4.7	○	○	○	○	○	○	○	○	○	+	+
HFR-4 26	0.64mm(0.024")	2x2116/2x7628	47	4.6	○	○	○	○	○	○	○	○	○	+	+
HFR-4 27	0.61mm(0.024")	3x7628/1080	42	4.7	○	○	○	○	○	○	○	○	○	+	+
HFR-4 28	0.74mm(0.028")	4x7628	41	4.7	○	○	○	○	○	○	○	○	○	+	+
HFR-4 29	0.74mm(0.028")	2x2113/3x7628	44	4.7	○	○	○	○	○	○	○	○	○	+	+
HFR-4 30	0.75mm(0.029")	4x7628/1080	42	4.7	○	○	○	○	○	○	○	○	○	+	+
HFR-4 31	1.52mm(0.059")	8x7628	42	4.7	○	○	○	○	○	○	○	○	○	+	+



Slash Sheet 3 CYANATE ESTER (170 to 230° Tg) COPPER CLAD LAMINATE CONSTRUCTION SELECTION GUIDE

REG#	THICKNESS	CONSTRUCTION	% RC	DK	DK. TOL.	DS	Z CTE	THICK TOL	CHEM	MEASLE	AVAIL	COST	FLAT	SMOOTH	DRILL
CE 00	0.05mm(0.002")	106	70	3.10	○	○	○	○	●	○	○	○	+	+	+
CE 01	0.07mm(0.003")	1080	62	3.37	●	○	○	○	●	○	○	○	+	+	+
CE 02	0.08mm(0.003")	2x106	60	3.44	○	○	○	○	●	○	○	○	+	+	+
CE 03	0.11mm(0.004")	2x106	68	3.28	●	○	○	○	○	○	○	○	+	+	+
CE 04	0.11mm(0.004")	2113	54	3.70	○	○	○	○	○	○	○	○	+	+	+
CE 05	0.14mm(0.005")	106/2113	52	3.71	○	○	○	○	○	○	○	○	+	+	+
CE 06	0.13mm(0.005")	2x1080	56	3.58	○	○	○	○	○	○	○	○	+	+	+
CE 07	0.13mm(0.005")	2116	52	3.71	○	○	○	○	○	○	○	○	+	+	+
CE 08	0.16mm(0.006")	106/2116	51	3.80	○	○	○	○	○	○	○	○	+	+	+
CE 09	0.16mm(0.006")	1080/2113	51	3.80	○	○	○	○	○	○	○	○	+	+	+
CE 10	0.18mm(0.007")	2x2113	50	3.78	○	○	○	○	○	○	○	○	+	+	+
CE 11	0.18mm(0.007")	7628	40	4.08	○	○	○	○	○	○	○	○	+	+	+
CE 12	0.21mm(0.008")	2113/2116	48	3.85	○	○	○	○	○	○	○	○	+	+	+
CE 13	0.21mm(0.008")	2x2116	44	3.90	○	○	○	○	○	○	○	○	+	+	+
CE 14	0.25mm(0.010")	2x2116	52	3.71	○	○	○	○	○	○	○	○	+	+	+
CE 15	0.26mm(0.010")	7628/1080	45	3.93	○	○	○	○	○	○	○	○	+	+	+
CE 16	0.26mm(0.010")	2x1080/2116	54	3.70	○	○	○	○	○	○	○	○	+	+	+
CE 17	0.31mm(0.012")	2x1080/7628	45	3.93	○	○	○	○	○	○	○	○	+	+	+
CE 18	0.32mm(0.012")	7628/2116	44	3.90	○	○	○	○	○	○	○	○	+	+	+
CE 19	0.37mm(0.014")	2x7628	38	4.15	○	○	○	○	○	○	○	○	+	+	+
CE 20	0.37mm(0.014")	2x2113/7628	44	3.90	○	○	○	○	○	○	○	○	+	+	+
CE 21	0.43mm(0.016")	2x2116/7628	44	3.90	○	○	○	○	○	○	○	○	+	+	+
CE 22	0.43mm(0.016")	2x7628/1080	39	4.11	○	○	○	○	○	○	○	○	+	+	+
CE 23	0.48mm(0.018")	2x7628/2116	39	4.11	○	○	○	○	○	○	○	○	+	+	+
CE 24	0.51mm(0.021")	2x1080/2x7628	41	4.05	○	○	○	○	○	○	○	○	+	+	+
CE 25	0.53mm(0.021")	3x7628	38	4.15	○	○	○	○	○	○	○	○	+	+	+
CE 26	0.64mm(0.024")	2x2116/2x7628	44	3.90	○	○	○	○	○	○	○	○	+	+	+
CE 27	0.61mm(0.024")	3x7628/1080	41	4.05	○	○	○	○	○	○	○	○	+	+	+
CE 28	0.74mm(0.028")	4x7628	38	4.15	○	○	○	○	○	○	○	○	+	+	+
CE 29	0.74mm(0.028")	2x2113/3x7628	41	4.05	○	○	○	○	○	○	○	○	+	+	+
CE 30	0.75mm(0.029")	4x7628/1080	38	4.15	○	○	○	○	○	○	○	○	+	+	+
CE 31	1.52mm(0.059")	8x7628	40	4.08	○	○	○	○	○	○	○	○	+	+	+

	Better +
	Blank
	Worse

Slash Sheet 4 BT COPPER CLAD LAMINATE CONSTRUCTION SELECTION GUIDE

REG#	THICKNESS	CONSTRUCTION	% RC	DK	DK. TOL.	DS	Z CTE	THICK TOL	CHEM	MEASLE	AVAIL	COST	FLAT	SMOOTH	DRILL
BT 00	0.05mm(0.002")	106	70	3.60	○	○	○	○	●	●	○	○	○	+	+
BT 01	0.07mm(0.003")	1080	60	3.73	○	●	○	○	●	●	○	●	○	+	+
BT 02	0.08mm(0.003")	2x106	64	3.65	○	○	○	○	●	●	○	○	○	+	+
BT 03	0.11mm(0.004")	2x106	72	3.55	○	●	○	○	○	○	○	○	○	+	+
BT 04	0.11mm(0.004")	2113	57	3.81	○	○	○	○	○	○	○	○	○	+	+
BT 05	0.14mm(0.005")	106/2113	56	3.83	○	●	○	○	○	○	○	○	○	+	+
BT 06	0.13mm(0.005")	2x1080	59	3.75	○	○	○	○	○	○	○	○	○	+	+
BT 07	0.13mm(0.005")	2116	53	3.92	○	○	○	○	○	○	○	○	○	+	+
BT 08	0.16mm(0.006")	106/2116	51	3.97	○	○	○	○	○	○	○	○	○	+	+
BT 09	0.16mm(0.006")	1080/2113	54	3.89	○	○	○	○	○	○	○	○	○	+	+
BT 10	0.18mm(0.007")	2x2113	50	4.00	○	○	○	○	○	○	○	○	○	+	+
BT 11	0.18mm(0.007")	7628	40	4.30	○	○	○	○	○	○	○	○	○	+	+
BT 12	0.21mm(0.008")	2113/2116	50	4.00	○	○	○	○	○	○	○	○	○	+	+
BT 13	0.21mm(0.008")	2x2116	47	4.10	○	○	○	○	○	○	○	○	○	+	+
BT 14	0.25mm(0.010")	2x2116	52	4.0	○	○	○	○	○	○	○	○	○	+	+
BT 15	0.26mm(0.010")	7628/1080	47	4.1	○	○	○	○	○	○	○	○	○	+	+
BT 16	0.26mm(0.010")	2x1080/2116	55	3.9	○	○	○	○	○	○	○	○	○	+	+
BT 17	0.31mm(0.012")	2x1080/7628	47	4.1	○	○	○	○	○	○	○	○	○	+	+
BT 18	0.32mm(0.012")	7628/2116	47	4.1	○	○	○	○	○	○	○	○	○	+	+
BT 19	0.37mm(0.014")	2x7628	41	4.3	○	○	○	○	○	○	○	○	○	+	+
BT 20	0.37mm(0.014")	2x2113/7628	46	4.2	○	○	○	○	○	○	○	○	○	+	+
BT 21	0.43mm(0.016")	2x2116/7628	48	4.1	○	○	○	○	○	○	○	○	○	+	+
BT 22	0.43mm(0.016")	2x7628/1080	43	4.3	○	○	○	○	○	○	○	○	○	+	+
BT 23	0.48mm(0.018")	2x7628/2116	43	4.3	○	○	○	○	○	○	○	○	○	+	+
BT 24	0.51mm(0.021")	2x1080/2x7628	46	4.2	○	○	○	○	○	○	○	○	○	+	+
BT 25	0.53mm(0.021")	3x7628	40	4.3	○	○	○	○	○	○	○	○	○	+	+
BT 26	0.64mm(0.024")	2x2116/2x7628	47	4.1	○	○	○	○	○	○	○	○	○	+	+
BT 27	0.61mm(0.024")	3x7628/1080	42	4.3	○	○	○	○	○	○	○	○	○	+	+
BT 28	0.74mm(0.028")	4x7628	41	4.3	○	○	○	○	○	○	○	○	○	+	+
BT 29	0.74mm(0.028")	2x2113/3x7628	44	4.2	○	○	○	○	○	○	○	○	○	+	+
BT 30	0.75mm(0.029")	4x7628/1080	42	4.3	○	○	○	○	○	○	○	○	○	+	+
BT 31	1.52mm(0.059")	8x7628	42	4.3	○	○	○	○	○	○	○	○	○	+	+



Slash Sheet 5

POLYIMIDE COPPER CLAD LAMINATE CONSTRUCTION SELECTION GUIDE

REG#	THICKNESS	CONSTRUCTION	% RC	DK	DK. TOL.	DS	Z CTE	THICK TOL	CHEM MEASLE	AVAIL	COST	FLAT	SMOOTH	DRILL
POLY 00	0.05mm(0.002")	106	72	4.00	○	○	○	○	●	○	●	+	+	+
POLY 01	0.07mm(0.003")	1080	63	4.02	●	○	○	○	●	○	●	+	+	+
POLY 02	0.08mm(0.003")	2x106	61	4.05	●	○	○	○	●	○	●	+	+	+
POLY 03	0.11mm(0.004")	2x106	59	3.89	●	○	○	○	●	○	●	+	+	+
POLY 04	0.11mm(0.004")	2113	55	4.21	●	○	○	○	○	○	○	+	+	+
POLY 05	0.14mm(0.005")	106/2113	53	4.26	●	○	○	○	○	○	○	+	+	+
POLY 06	0.13mm(0.005")	2x1080	57	4.15	○	⊗	○	○	○	○	○	-	+	+
POLY 07	0.13mm(0.005")	2116	54	4.23	○	○	○	○	○	○	○	-	+	+
POLY 08	0.16mm(0.006")	106/2116	52	4.28	●	○	○	○	○	○	○	-	-	-
POLY 09	0.16mm(0.006")	1080/2113	52	4.28	●	○	○	○	○	○	○	-	-	-
POLY 10	0.18mm(0.007")	2x2113	50	4.34	○	○	○	○	○	○	○	-	+	+
POLY 11	0.18mm(0.007")	7628	39	4.66	○	○	○	○	○	○	○	-	-	-
POLY 12	0.21mm(0.008")	2113/2116	49	4.37	○	○	○	○	○	○	○	-	-	-
POLY 13	0.21mm(0.008")	2x2116	45	4.48	○	○	○	○	○	○	○	-	+	+
POLY 14	0.25mm(0.010")	2x2116	54	4.23	○	○	○	○	○	○	○	-	+	+
POLY 15	0.26mm(0.010")	7628/1080	42	4.42	○	○	○	○	○	○	○	-	-	-
POLY 16	0.26mm(0.010")	2x1080/2116	56	4.18	○	○	○	○	○	○	○	-	+	+
POLY 17	0.31mm(0.012")	2x1080/7628	47	4.42	○	○	○	○	○	○	○	-	+	+
POLY 18	0.32mm(0.012")	7628/2116	46	4.45	○	○	○	○	○	○	○	-	-	-
POLY 19	0.37mm(0.014")	2x7628	39	4.66	○	○	○	○	○	○	○	-	-	-
POLY 20	0.37mm(0.014")	2x2113/7628	45	4.48	○	○	○	○	○	○	○	-	-	-
POLY 21	0.43mm(0.016")	2x2116/7628	45	4.18	○	○	○	○	○	○	○	-	-	-
POLY 22	0.43mm(0.016")	2x7628/1080	41	4.60	○	○	○	○	○	○	○	-	-	-
POLY 23	0.48mm(0.018")	2x7628/2116	40	4.63	○	○	○	○	○	○	○	-	-	-
POLY 24	0.51mm(0.021")	2x1080/2x7628	42	4.57	○	○	○	○	○	○	○	-	+	+
POLY 25	0.53mm(0.021")	3x7628	39	4.66	○	○	○	○	○	○	○	-	-	-
POLY 26	0.64mm(0.024")	2x2116/2x7628	45	4.48	○	○	○	○	○	○	○	-	-	-
POLY 27	0.61mm(0.024")	3x7628/1080	42	4.57	○	○	○	○	○	○	○	-	-	-
POLY 28	0.74mm(0.028")	4x7628	39	4.66	○	○	○	○	○	○	○	-	-	-
POLY 29	0.74mm(0.028")	2x2113/3x7628	42	4.57	○	○	○	○	○	○	○	-	-	-
POLY 30	0.75mm(0.029")	4x7628/1080	40	4.63	○	○	○	○	○	○	○	-	-	-
POLY 31	1.52mm(0.059")	8x7628	41	4.60	○	○	○	○	○	○	○	-	-	-

●	○	○	⊗
Better +	Blank		Worse



Standard Improvement Form

IPC-CC-110A

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
2215 Sanders Road
Northbrook, IL 60062-6135
Fax 847 509.9798

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

Address

City/State/Zip

Date



THE INSTITUTE FOR

INTERCONNECTING

AND PACKAGING

ELECTRONIC CIRCUITS

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

The purpose of this form is to keep current with terms routinely used in the industry and their definitions. Individuals or companies are invited to comment. Please complete this form and return to:

IPC
2215 Sanders Road
Northbrook, IL 60062-6135
Fax: 847-509-9798

SUBMITTOR INFORMATION:

Name: _____

Company: _____

City: _____

State/Zip: _____

Telephone: _____

Date: _____

- This is a **NEW** term and definition being submitted.
- This is an **ADDITION** to an existing term and definition(s).
- This is a **CHANGE** to an existing definition.

Term	Definition

If space not adequate, use reverse side or attach additional sheet(s).

Artwork: Not Applicable Required To be supplied

Included: Electronic File Name: _____

Document(s) to which this term applies: _____

Committees affected by this term: _____

Office Use	
IPC Office	Committee 2-30
Date Received: _____	Date of Initial Review: _____
Comments Collated: _____	Comment Resolution: _____
Returned for Action: _____	Committee Action: <input type="checkbox"/> Accepted <input type="checkbox"/> Rejected
Revision Inclusion: _____	<input type="checkbox"/> Accept Modify
IEC Classification	
Classification Code • Serial Number	
Terms and Definition Committee Final Approval Authorization:	
Committee 2-30 has approved the above term for release in the next revision.	
Name: _____	Committee: IPC 2-30 Date: _____

Technical Questions

The IPC staff will research your technical question and attempt to find an appropriate specification interpretation or technical response. Please send your technical query to the technical department via:

tel 847/509-9700
http://www.ipc.org

fax 847/509-9798
e-mail: answers@ipc.org

IPC Technical Forums

IPC technical forums are opportunities to network on the Internet. It's the best way to get the help you need today! Over 2,500 people are already taking advantage of the excellent peer networking available through e-mail forums provided by IPC. Members use them to get timely, relevant answers to their technical questions.

TechNet@ipc.org

TechNet forum is for discussion of technical help, comments or questions on IPC specifications, or other technical inquiries. IPC also uses TechNet to announce meetings, important technical issues, surveys, etc.

ChipNet@ipc.org

ChipNet forum is for discussion of flip chip and related chip scale semiconductor packaging technologies. It is cosponsored by the National Electronics Manufacturing Initiative (NEMI).

ComplianceNet@ipc.org

ComplianceNet forum covers environmental, safety and related regulations or issues.

DesignerCouncil@ipc.org

Designers Council forum covers information on upcoming IPC Designers Council activities as well as information, comment, and feedback on current design issues, local chapter meetings, new chapters forming, and other design topics.

Roadmap@ipc.org

The IPC Roadmap forum is the communication vehicle used by members of the Technical Working Groups (TWGs) who develop the IPC National Technology Roadmap for Electronic Interconnections.

IPCsm840@ipc.org

This peer networking forum is specific to solder mask qualification and use.

ADMINISTERING YOUR SUBSCRIPTION STATUS:

All commands (such as subscribe and signoff) must be sent to listserv@ipc.org. Please DO NOT send any command to the mail list address, (i.e. <mail list> @ipc.org), as it would be distributed to all the subscribers.

Example for subscribing:

To: LISTSERV@IPC.ORG

Subject:

Message: subscribe TechNet Joseph H. Smith

Example for signing off:

To: LISTSERV@IPC.ORG

Subject:

Message: sign off DesignerCouncil

Please note you must send messages to the mail list address ONLY from the e-mail address to which you want to apply changes. In other words, if you want to sign off the mail list, you must send the signoff command from the address that you want removed from the mail list. Many participants find it helpful to signoff a list when travelling or on vacation and to resubscribe when back in the office.

How to post to a forum:

To send a message to all the people currently subscribed to the list, just send to <mail list>@ipc.org. Please note, use the mail list address that you want to reach in place of the <mail list> string in the above instructions.

Example:

To: TechNet@IPC.ORG

Subject: <your subject>

Message: <your message>

The associated e-mail message text will be distributed to everyone on the list, including the sender. Further information on how to access previous messages sent to the forums will be provided upon subscribing.

For more information, contact Dmitriy Sklyar

tel 847/509-9700 x311

fax 847/509-9798

e-mail: sklydm@ipc.org

http://www.ipc.org/html/forum.htm

IPC World Wide Web Page <http://www.ipc.org>

Our home page provides access to information about upcoming events, publications and videos, membership, and industry activities and services. Visit soon and often.

Education and Training

IPC conducts local educational workshops and national conferences to help you better understand emerging technologies. National conferences have covered Ball Grid Array and Flip Chip/Chip Scale Packaging. Some workshop topics include:

Printed Wiring Board Fundamentals	High Speed Design
Troubleshooting the PWB Manufacturing Process	Design for Manufacturability
Choosing the Right Base Material Laminate	Design for Assembly
Acceptability of Printed Boards	Designers Certification Preparation
New Design Standards	

IPC video tapes and CD-ROMs can increase your industry know-how and on the job effectiveness.

For more information on programs, contact John Riley

tel 847/509-9700 ext. 308 fax 847/509-9798

e-mail: rilejo@ipc.org <http://www.ipc.org>

For more information on IPC Video/CD Training, contact Mark Pritchard

tel 505/758-7937 ext. 202 fax 505/758-7938

e-mail: markp@taos.newmex.com

<http://www.ipc.org>

Training and Certification

IPC-A-610 Training and Certification Program

"The Acceptability of Electronic Assemblies" (ANSI/IPC-A-610) is the most widely used specification for the PWB assembly industry. An industry consensus Training and Certification program based on the IPC-A-610 is available to your company.

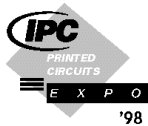
For more information, contact John Riley

tel 847/509-9700 ext. 308 fax 847/509-9798

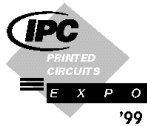
e-mail: rilejo@ipc.org <http://www.ipc.org/html/610.htm>

IPC Printed Circuits Expo

IPC Printed Circuits Expo is the largest trade exhibition in North America devoted to the PWB industry. Over 90 technical presentations make up this superior technical conference.



April 28-30, 1998
Long Beach, California



March 16-18, 1999
Long Beach, California

For more information, contact Kim Behr

tel 847/509-9700 ext. 319 fax 847/509-9798

e-mail: behrki@ipc.org <http://www.ipc.org>

How to Get Involved

The first step is to join IPC. An application for membership can be found on page 74.

Once you become a member, the opportunities to enhance your competitiveness are vast. Join a technical committee and

learn from our industry's best while you help develop the standards for our industry. Participate in market research programs which forecast the future of our industry. Participate in Capitol Hill Day and lobby your Congressmen and Senators for better industry support. Pick from a wide variety of educational opportunities: workshops, tutorials, and conferences. More up-to-date details on IPC opportunities can be found on our web page: <http://www.ipc.org>.

For information on how to get involved, contact:

Jeanette Ferdman, Membership Manager

tel 847/509-9700 ext. 309 fax 847/509-9798

e-mail: JeanetteFerdman@ipc.org <http://www.ipc.org>



APPLICATION FOR SITE MEMBERSHIP

PLEASE CHECK APPROPRIATE CATEGORY

Thank you for your decision to join IPC members on the "Intelligent Path to Competitiveness"! IPC Membership is **site specific**, which means that IPC member benefits are available to all individuals employed at the site designated on the other side of this application.

To help IPC serve your member site in the most efficient manner possible, please tell us what your facility does by choosing the most appropriate member category.

INDEPENDENT PRINTED BOARD MANUFACTURERS

Our facility manufactures and sells to other companies, printed wiring boards or other electronic interconnection products on the merchant market.

WHAT PRODUCTS DO YOU MAKE FOR SALE?

- | | | |
|---|--|--|
| <input type="checkbox"/> One-sided and two-sided rigid printed boards | <input type="checkbox"/> Flexible printed boards | <input type="checkbox"/> Discrete wiring devices |
| <input type="checkbox"/> Multilayer printed boards | <input type="checkbox"/> Flat cable | <input type="checkbox"/> Other interconnections |
| | <input type="checkbox"/> Hybrid circuits | |

Name of Chief Executive Officer/President _____

INDEPENDENT PRINTED BOARD ASSEMBLERS EMSI COMPANIES

Our facility assembles printed wiring boards on a contract basis and/or offers other electronic interconnection products for sale.

- | | | |
|--|---|--------------------------------------|
| <input type="checkbox"/> Turnkey | <input type="checkbox"/> Through-hole | <input type="checkbox"/> Consignment |
| <input type="checkbox"/> SMT | <input type="checkbox"/> Mixed Technology | <input type="checkbox"/> BGA |
| <input type="checkbox"/> Chip Scale Technology | | |

Name of Chief Executive Officer/President _____

OEM – MANUFACTURERS OF ANY END PRODUCT USING PCB/PCAs OR CAPTIVE MANUFACTURERS OF PCBs/PCAs

Our facility purchases, uses and/or manufactures printed wiring boards or other electronic interconnection products for our own use in a final product. Also known as original equipment manufacturers (OEM).

IS YOUR INTEREST IN:

- purchasing/manufacture of printed circuit boards
- purchasing/manufacturing printed circuit assemblies

What is your company's main product line? _____

INDUSTRY SUPPLIERS

Our facility supplies raw materials, machinery, equipment or services used in the manufacture or assembly of electronic interconnection products.

What products do you supply? _____

GOVERNMENT AGENCIES/ ACADEMIC TECHNICAL LIAISONS

We are representatives of a government agency, university, college, technical institute who are directly concerned with design, research, and utilization of electronic interconnection devices. (Must be a non-profit or not-for-profit organization.)

Please be sure both sides of this application are correctly completed



APPLICATION FOR SITE MEMBERSHIP

Site Information:

Company Name _____

Street Address _____

City _____ State _____ Zip _____ Country _____

Main Phone No. _____ Fax _____

Primary Contact Name _____

Title _____ Mail Stop _____

Phone _____ Fax _____ e-mail _____

Alternate Contact Name _____

Title _____ Mail Stop _____

Phone _____ Fax _____ e-mail _____

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)
- \$800.00 Annual dues for Additional Facility Membership: Additional membership for a site within an organization where another site is considered to be the primary IPC member.
- \$600.00** Annual dues for an independent PCB/PWA fabricator or independent EMSI provider with annual sales of less than \$1,000,000.00. **Please provide proof of annual sales.
- \$250.00 Annual dues for Government Agency/University/not-for-profit organization

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