IPC-4202A
Amendment 1
2014 - March

Flexible Base Dielectrics for Use in Flexible Printed Circuitry

A standard developed by IPC

Association Connecting Electronics Industries

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- Show relationship to Design for Manufacturability (DFM) and Design for the Environment (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

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Flexible Base Dielectrics for Use in Flexible Printed Circuitry

Replace 1st paragraph in Section 1.1.2 with the following:

1.1.2 Specific Designation The specific designation should be in the form shown in the following example, and is intended for use on material purchase orders by ***fabricators*** (see 6.1). The specific designation should not be used by designers on master drawings to indicate their material selection. Master drawings **shall** indicate the material design by designers on master drawings to indicate their material selection, as the designation is lengthy and requires fabricator level knowledge in making the detailed selections.

Replace 1st paragraph in Section 1.5 with the following:

1.5 New Materials The flexible base dielectrics contained in this standard represent known materials. As new materials become available, they will be added to future revisions. Users and material developers are encouraged to supply information on new flexible materials using the Blank Specification Sheet at end of this standard for review by the IPC Flexible Circuits Base Materials Subcommittee (D-13).

Replace all of Section 3.4.2 with the following:

3.4.2 Roll Material Each roll of flexible base dielectric material **shall** meet the requirements of 3.5 through 3.11. Defects are allowed such that the total of all defective areas **shall not** exceed 5% of the total roll area (roll length x roll width). Each defect area **shall** be defined in a 600 mm x 600 mm [23.6 in x 23.6 in] increment and suitably marked or flagged. Each defect area may contain single or multiple defects which are constrained within a square no larger than 300 mm x 300 mm [11.8 in x 11.8 in] centered within the defect area. If multiple defects are spaced such that they cannot be contained with a single 300 mm x 300 mm [11.8 in x 11.8 in] area, then more than one 600 mm x 600 mm [23.6 in x 23.6 in] defect area **shall** be marked or flagged on the roll or identified AABUS.

Replace all of Section 3.5.4 with the following:

3.5.4 Voids When tested in accordance with IPC-TM-650, Method 2.1.13, the size of the voids **shall not** be >75 µm [>0.003 in] in any direction.

Replace all of Section 3.10.3 with the following:

3.10.3 Flammability When specimens are tested in accordance with UL 94, the flammability classification **shall** be as indicated in the applicable specification sheet. The Ul 94 specification classifies flexible materials either with a V rating in accordance with UL 94 Thin Material Vertical Burning Test, based on the test specimen size and flame application.

The VTM test is intended to be performed on materials that due to their thinness, either distort, shrink and/or are consumed up to the holding clamp when tested in accordance with the V test. The VTM test **shall** only be performed after it has been determined that the test specimens cannot meet the requirements of the V test. The VTM test specimens **shall** also possess physical properties that allow a 200 mm ± 5 mm [nominally 8 in] long X 50 mm ± 1 mm [nominally 2 in] wide test specimen to be wrapped longitudinally around a 13 mm [nominally 0.5 in] diameter mandrel.

NOTES:

1. A test specimen with a thickness <25 µm [nominally 0.001 in] **shall not** be subjected to the V test prior to conducting the VTM test.
2. A test specimen with a thickness between 25 µm [nominally 0.001 in] ≤specimen ≤0.25 mm [nominally 0.01 in] that is capable of meeting the physical and performance requirements of both the V test and the VTM test **shall** be classified by the test of choice.

Replace all of Section 4.9 with the following:

4.9 Quality Conformance Inspection Quality conformance inspection **shall** consist of Groups A, C and D testing as listed in Table 4-1. The frequency of each group of inspections **shall** be performed and completed within 60 days, as follows:

Group A On a lot basis
Group C Every 12 months
Group D One time characterization (see 4.8.1)

Replace row 3.10.3 in Table 4-1 with the following:

Table 4-1 Test Method Frequency

Requirement Paragraph	Test	Test Method	Group
3.10.3	Flammability	UL-94, V or VTM Tests	D

Replace Specification Sheet IPC-4202/1 with the following:

Revision Date: March 2014

Specification Sheet

Specification Sheet # : IPC-4202/1
Supersedes : IPC-FC-231/1, IPC-FC-231/11, IPC-FC-231/12 and IPC-FC-231/16
Material Type : Polyimide Film
Material Designation : E1E__

Property to be tested	Requirement				Units	Test Method	Reference Paragraph
1. Wrinkles, Creases, Streaks and Scratches	Pass				–	Visual	3.5.2
2. Inclusions	Pass				–	Visual ASTM D-149	3.5.3
3. Voids	Pass				–	2.1.13	3.5.4
4. Holes, Tears and Delaminations	Pass				–	Visual	3.5.5
5. Dimensional Stability, maximum	0.10 [t3]		0.10 [t4]		%	2.2.4, Method A	3.7.1
6. Tensile Strength, minimum	1.4 E+8 [2.03 E+4] [t3]		1.7 E+8 [2.47 E+4] [t4]		Pa [psi]	2.4.19	3.7.2
7. Elongation, minimum percent	25 [t3]		25 [t4]		%	2.4.19	3.7.2
8. Initiation Tear Strength, minimum	100 [3.53] [t3]		500 [17.6] [t4]		g [oz]	2.4.16	3.7.3
9. Propagation Tear Strength, minimum	1 [0.035] [t3]	4 [0.14] [t5]	15 [0.529] [t11]	25 [0.882] [t12]	g [oz]	2.4.17.1	3.7.4
10. Chemical Resistance Tensile Strength, minimum Elongation, minimum	9.7 E+7 [1.40 E+4] [t3] 17 [t3]		1.7 E+8 [2.47 E+4] [t4] 25 [t4]		Pa [psi] %	2.3.2, Method C	3.8.1
11. Permittivity At 1 MHz At 1 GHz At 10 GHz	3.0 – 3.9 3.2 – 3.9 3.1 – 3.8				– – –	2.5.5.3 ASTM D-2520 ASTM D-2520	3.9.1
12. Loss Tangent, maximum At 1 MHz At 1 GHz At 10 GHz	0.015 0.020 0.022				– – –	2.5.5.3 ASTM D-2520 ASTM D-2520	3.9.2
13. Volume Resistivity (Damp Heat), minimum	10^6				MΩ-cm	2.5.17	3.9.3
14. Surface Resistance (Damp Heat), minimum	10^5				MΩ	2.5.17	3.9.4
15. Dielectric Strength, minimum	80 [2000]				V/µm [V/in]	ASTM D-149	3.9.5
16. Fungus Resistance	Non-nutrient				–	2.6.1	3.10.1
17. Moisture Absorption, maximum	4.0				%	2.6.2	3.10.2
18. Flammability, minimum	VTM-0				–	UL-94	3.10.3
19. Relative Temperature Index, minimum	200				°C	UL-746B	3.10.4

[t3] Flexible base dielectric materials with thickness <25 µm [<980 µin]
[t4] Flexible base dielectric materials with thickness ≥25 µm [≥980 µin]
[t5] Flexible base dielectric materials with 25 µm ≤ thickness <50 µm [980 µin ≤ thickness <1970 µin]
[t11] Flexible base dielectric materials with 50 µm ≤ thickness <102 µm [1970 µin ≤ thickness <4020 µin]
[t12] Flexible base dielectric materials with thickness ≥102 µm [thickness ≥4020 µin]

Replace Specification Sheet IPC-4202/2 with the following:

Revision Date: March 2014

Specification Sheet

Specification Sheet # : IPC-4202/2
Supersedes : IPC-FC-231/2
Material Type : Fluorocarbon Film
Material Designation : C1E__

Property to be tested	Requirement	Units	Test Method	Reference Paragraph
1. Wrinkles, Creases, Streaks and Scratches	Pass	–	Visual	3.5.2
2. Inclusions	Pass	–	Visual ASTM D-149	3.5.3
3. Voids	Pass	–	2.1.13	3.5.4
4. Holes, Tears and Delaminations	Pass	–	Visual	3.5.5
5. Dimensional Stability, maximum	5.0	%	2.2.4, Method A	3.7.1
6. Tensile Strength, minimum	1.7 E+7 [2.47 E+3]	Pa [psi]	2.4.19	3.7.2
7. Elongation, minimum percent	180	%	2.4.19	3.7.2
8. Initiation Tear Strength, minimum	N/A	g [oz]	2.4.16	3.7.3
9. Propagation Tear Strength, minimum	75 [2.64] [t6] / 90 [3.17] [t8] / 90 [3.17] [t12]	g [oz]	2.4.17.1	3.7.4
10. Chemical Resistance Tensile Strength, minimum Elongation, minimum	 1.7 E+7 [2.47 E+3] 180	 Pa [psi] %	2.3.2, Method C	3.8.1
11. Permittivity At 1 MHz At 1 GHz At 10 GHz	 1.9 – 2.2 1.9 – 2.2 1.9 – 2.2	 – – –	 2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.1
12. Loss Tangent, maximum At 1 MHz At 1 GHz At 10 GHz	 0.001 0.001 0.001	 – – –	 2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.2
13. Volume Resistivity (Damp Heat), minimum	10^7	MΩ-cm	2.5.17	3.9.3
14. Surface Resistance (Damp Heat), minimum	10^7	MΩ	2.5.17	3.9.4
15. Dielectric Strength, minimum	100 [2500]	V/µm [V/in]	ASTM D-149	3.9.5
16. Fungus Resistance	Non-nutrient	–	2.6.1	3.10.1
17. Moisture Absorption, maximum	0.1	%	2.6.2	3.10.2
18. Flammability, minimum	VTM-0	–	UL-94	3.10.3
19. Relative Temperature Index, minimum	N/A**	°C	UL-746B	3.10.4

N/A = Not applicable
** Low melt point prohibits measurement in accordance with UL 746B.

[t6] Flexible base dielectric materials with thickness <38 µm [<1500 µin]
[t8] Flexible base dielectric materials with 38 µm ≤ thickness <102 µm [1500 µin ≤ thickness <4020 µin]
[t12] Flexible base dielectric materials with thickness ≥102 µm [thickness ≥4020 µin]

Replace Specification Sheet IPC-4202/3 with the following:

Revision Date: March 2014

Specification Sheet

Specification Sheet # : IPC-4202/3
Supersedes : IPC-FC-231/3, IPC-FC-231/15
Material Type : Polyethylene Terapthalate (PET) Film
Material Designation : B1E__, L1E__

Property to be tested	Requirement	Units	Test Method	Reference Paragraph
1. Wrinkles, Creases, Streaks and Scratches	Pass	–	Visual	3.5.2
2. Inclusions	Pass	–	Visual ASTM D-149	3.5.3
3. Voids	Pass	–	2.1.13	3.5.4
4. Holes, Tears and Delaminations	Pass	–	Visual	3.5.5
5. Dimensional Stability, maximum	1.0	%	2.2.4, Method A	3.7.1
6. Tensile Strength, minimum	1.4 E+8 [2.03 E+4]	Pa [psi]	2.4.19	3.7.2
7. Elongation, minimum percent	50	%	2.4.19	3.7.2
8. Initiation Tear Strength, minimum	800 [28.22]	g [oz]	2.4.16	3.7.3
9. Propagation Tear Strength, minimum	8 [0.28] [t6] / 20 [0.71] [t8] / 50 [1.76] [t12]	g [oz]	2.4.17.1	3.7.4
10. Chemical Resistance Tensile Strength, minimum Elongation, minimum	1.4 E+8 [2.03 E+4] 50	Pa [psi] %	2.3.2, Method C	3.8.1
11. Permittivity At 1 MHz At 1 GHz At 10 GHz	3.5 DBD DBD	– – –	2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.1
12. Loss Tangent, maximum At 1 MHz At 1 GHz At 10 GHz	0.022 DBD DBD	– – –	2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.2
13. Volume Resistivity (Damp Heat), minimum	N/A	MΩ-cm	2.5.17	3.9.3
14. Surface Resistance (Damp Heat), minimum	N/A	MΩ	2.5.17	3.9.4
15. Dielectric Strength, minimum	80 [2000]	V/µm [V/in]	ASTM D-149	3.9.5
16. Fungus Resistance	Non-nutrient	–	2.6.1	3.10.1
17. Moisture Absorption, maximum	0.8	%	2.6.2	3.10.2
18. Flammability, minimum	VTM-2	–	UL-94	3.10.3
19. Relative Temperature Index, minimum	105	°C	UL-746B	3.10.4

N/A = Not applicable
DBD = Data being developed

[t6] Flexible base dielectric materials with thickness <38 µm [<1500 µin]
[t8] Flexible base dielectric materials with 38 µm ≤ thickness <102 µm [1500 µin ≤ thickness <4020 µin]
[t12] Flexible base dielectric materials with thickness ≥102 µm [thickness ≥4020 µin]

Replace Specification Sheet IPC-4202/4 with the following:

Revision Date: March 2014

Specification Sheet

Specification Sheet # : IPC-4202/4
Supersedes : IPC-FC-231/4, IPC-FC-231/5, IPC-FC-231/6, IPC-FC-231/7
Material Type : Reinforced Epoxy
Material Designation : H3A__

Property to be tested	Requirement	Units	Test Method	Reference Paragraph
1. Wrinkles, Creases, Streaks and Scratches	Pass	–	Visual	3.5.2
2. Inclusions	Pass	–	Visual ASTM D-149	3.5.3
3. Voids	Pass	–	2.1.13	3.5.4
4. Holes, Tears and Delaminations	Pass	–	Visual	3.5.5
5. Dimensional Stability, maximum	0.25	%	2.2.4, Method A	3.7.1
6. Tensile Strength, minimum	35 E+7 [5.08 E+3]	Pa [psi]	2.4.19	3.7.2
7. Elongation, minimum percent	2.5	%	2.4.19	3.7.2
8. Initiation Tear Strength, minimum	2000 [70.55]	g [oz]	2.4.16	3.7.3
9. Propagation Tear Strength, minimum	36 [1.27]	g [oz]	2.4.17.1	3.7.4
10. Chemical Resistance Tensile Strength, minimum Elongation, minimum	 N/A N/A	 Pa [psi] %	2.3.2, Method C	3.8.1
11. Permittivity At 1 MHz At 1 GHz At 10 GHz	 DBD DBD DBD	 – – –	 2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.1
12. Loss Tangent, maximum At 1 MHz At 1 GHz At 10 GHz	 DBD DBD DBD	 – – –	 2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.2
13. Volume Resistivity (Damp Heat), minimum	10^4	MΩ-cm	2.5.17	3.9.3
14. Surface Resistance (Damp Heat), minimum	10^2	MΩ	2.5.17	3.9.4
15. Dielectric Strength, minimum	5 [120]	V/µm [V/in]	ASTM D-149	3.9.5
16. Fungus Resistance	Non-nutrient	–	2.6.1	3.10.1
17. Moisture Absorption, maximum	1.5	%	2.6.2	3.10.2
18. Flammability, minimum	V-0	–	UL-94	3.10.3
19. Relative Temperature Index, minimum	105	°C	UL-746B	3.10.4

N/A = Not applicable
DBD = Data being developed

Replace Specification Sheet IPC-4202/8 with the following:

Revision Date: March 2014

Specification Sheet

Specification Sheet # : IPC-4202/8
Supersedes : IPC-FC-231/8
Material Type : Vinyl Film
Material Designation : A1E__

Property to be tested	Requirement	Units	Test Method	Reference Paragraph
1. Wrinkles, Creases, Streaks and Scratches	Pass	–	Visual	3.5.2
2. Inclusions	Pass	–	Visual ASTM D-149	3.5.3
3. Voids	Pass	–	2.1.13	3.5.4
4. Holes, Tears and Delaminations	Pass	–	Visual	3.5.5
5. Dimensional Stability, maximum	8.0	%	2.2.4, Method A	3.7.1
6. Tensile Strength, minimum	7.0 E+3 [1.02] [t3] / 6.2 E+7 [9.00 E+3] [t4]	Pa [psi]	2.4.19	3.7.2
7. Elongation, minimum percent	95	%	2.4.19	3.7.2
8. Initiation Tear Strength, minimum	420 [14.81]	g [oz]	2.4.16	3.7.3
9. Propagation Tear Strength, minimum	16 [0.564] [t3] / 28 [0.988] [t5] / 82 [2.89] [t11] / N/A [t12]	g [oz]	2.4.17.1	3.7.4
10. Chemical Resistance Tensile Strength, minimum Elongation, minimum	 N/A N/A	 Pa [psi] %	2.3.2, Method C	3.8.1
11. Permittivity At 1 MHz At 1 GHz At 10 GHz	 5.8 DBD DBD	 – – –	 2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.1
12. Loss Tangent, maximum At 1 MHz At 1 GHz At 10 GHz	 0.013 DBD DBD	 – – –	 2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.2
13. Volume Resistivity (Damp Heat), minimum	N/A	MΩ-cm	2.5.17	3.9.3
14. Surface Resistance (Damp Heat), minimum	10^6	MΩ	2.5.17	3.9.4
15. Dielectric Strength, minimum	130 [3300]	V/µm [V/in]	ASTM D-149	3.9.5
16. Fungus Resistance	Non-nutrient	–	2.6.1	3.10.1
17. Moisture Absorption, maximum	0.5	%	2.6.2	3.10.2
18. Flammability, minimum	HB	–	UL-94	3.10.3
19. Relative Temperature Index, minimum	125	°C	UL-746B	3.10.4

N/A = Not applicable
DBD = Data being developed

[t3] Flexible base dielectric materials with thickness <25 µm [<980 µin]
[t4] Flexible base dielectric materials with thickness ≥25 µm [≥980 µin]
[t5] Flexible base dielectric materials with 25 µm ≤ thickness <50 µm [980 µin ≤ thickness <1970 µin]
[t11] Flexible base dielectric materials with 50 µm ≤ thickness <102 µm [1970 µin ≤ thickness <4020 µin]
[t12] Flexible base dielectric materials with thickness ≥102 µm [thickness ≥4020 µin]

Replace Specification Sheet IPC-4202/9 with the following:

Revision Date: March 2014

Specification Sheet

Specification Sheet # : IPC-4202/9
Supersedes : IPC-FC-231/9
Material Type : Aramid Paper
Material Designation : F1E__

Property to be tested	Requirement	Units	Test Method	Reference Paragraph
1. Wrinkles, Creases, Streaks and Scratches	Pass	–	Visual	3.5.2
2. Inclusions	Pass	–	Visual ASTM D-149	3.5.3
3. Voids	Pass	–	2.1.13	3.5.4
4. Holes, Tears and Delaminations	Pass	–	Visual	3.5.5
5. Dimensional Stability, maximum	0.65	%	2.2.4, Method A	3.7.1
6. Tensile Strength, minimum	2.8 E+7 [4.06 E+3]	Pa [psi]	2.4.19	3.7.2
7. Elongation, minimum percent	4	%	2.4.19	3.7.2
8. Initiation Tear Strength, minimum	N/A	g [oz]	2.4.16	3.7.3
9. Propagation Tear Strength, minimum	50 [1.76] [t9] | 70 [2.47] [t10]	g [oz]	2.4.17.1	3.7.4
10. Chemical Resistance Tensile Strength, minimum Elongation, minimum	 2.8 E+7 [4.06 E+3] N/A	 Pa [psi] %	2.3.2, Method C	3.8.1
11. Permittivity At 1 MHz At 1 GHz At 10 GHz	 3.0 DBD DBD	 – – –	 2.5.5.3 ASTM D-2520 ASTM D-2520	3.9.1
12. Loss Tangent, maximum At 1 MHz At 1 GHz At 10 GHz	 0.013 DBD DBD	 – – –	 2.5.5.3 ASTM D-2520 ASTM D-2520	3.9.2
13. Volume Resistivity (Damp Heat), minimum	10^6	MΩ-cm	2.5.17	3.9.3
14. Surface Resistance (Damp Heat), minimum	10^6	MΩ	2.5.17	3.9.4
15. Dielectric Strength, minimum	15 [400]	V/µm [V/in]	ASTM D-149	3.9.5
16. Fungus Resistance	Non-nutrient	–	2.6.1	3.10.1
17. Moisture Absorption, maximum	13.0	%	2.6.2	3.10.2
18. Flammability, minimum	V-0	–	UL-94	3.10.3
19. Relative Temperature Index, minimum	220	°C	UL-746B	3.10.4

N/A = Not applicable
DBD = Data being developed

[t9] Flexible base dielectric materials with thickness <50 µm [<1970 µin]
[t10] Flexible base dielectric materials with thickness ≥50 µm [≥1970 µin]

Replace Specification Sheet IPC-4202/10 with the following:

Revision Date: March 2014

Specification Sheet

Specification Sheet # : IPC-4202/10
Supersedes : IPC-FC-231/10, IPC-FC-231/13 and IPC-FC-231/14
Material Type : Self Adhesive Polyimide Film
Material Designation : E1E__, J1E__

Property to be tested	Requirement	Units	Test Method	Reference Paragraph
1. Wrinkles, Creases, Streaks and Scratches	Pass	–	Visual	3.5.2
2. Inclusions	Pass	–	Visual ASTM D-149	3.5.3
3. Voids	Pass	–	2.1.13	3.5.4
4. Holes, Tears and Delaminations	Pass	–	Visual	3.5.5
5. Dimensional Stability, maximum	0.10	%	2.2.4, Method A	3.7.1
6. Tensile Strength, minimum	9.7 E+7 [1.41 E+4] [t3] / 1.0 E+8 [1.45 E+4] [t4]	Pa [psi]	2.4.19	3.7.2
7. Elongation, minimum percent	35	%	2.4.19	3.7.2
8. Initiation Tear Strength, minimum	100 [3.53] [t3] / 500 [17.6] [t4]	g [oz]	2.4.16	3.7.3
9. Propagation Tear Strength, minimum	1 [0.035] [t3] / 4 [0.14] [t5] / 15 [0.529] [t11] / 25 [0.882] [t12]	g [oz]	2.4.17.1	3.7.4
10. Chemical Resistance Tensile Strength, minimum Elongation, minimum	97 E+7 [1.41 E+4] [t3] / 1.0 E+8 [1.45 E+4] [t4] 35 [t3] / 35 [t4]	Pa [psi] %	2.3.2, Method C	3.8.1
11. Permittivity At 1 MHz At 1 GHz At 10 GHz	3.0 – 3.7 3.0 – 3.8 2.9 – 3.6	– – –	2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.1
12. Loss Tangent, maximum At 1 MHz At 1 GHz At 10 GHz	0.010 0.010 0.010	– – –	2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.2
13. Volume Resistivity (Damp Heat), minimum	10^6	MΩ-cm	2.5.17	3.9.3
14. Surface Resistance (Damp Heat), minimum	10^4	MΩ	2.5.17	3.9.4
15. Dielectric Strength, minimum	80 [2000]	V/µm [V/in]	ASTM D-149	3.9.5
16. Fungus Resistance	Non-nutrient	–	2.6.1	3.10.1
17. Moisture Absorption, maximum	2.0	%	2.6.2	3.10.2
18. Flammability, minimum	VTM-0	–	UL-94	3.10.3
19. Relative Temperature Index, minimum	140	°C	UL-746B	3.10.4

[t3] Flexible base dielectric materials with thickness <25 µm [<980 µin]
[t4] Flexible base dielectric materials with thickness ≥25 µm [≥980 µin]
[t5] Flexible base dielectric materials with 25 µm ≤ thickness <50 µm [980 µin ≤ thickness <1970 µin]
[t11] Flexible base dielectric materials with 50 µm ≤ thickness <102 µm [1970 µin ≤ thickness <4020 µin]
[t12] Flexible base dielectric materials with thickness ≥102 µm [thickness ≥4020 µin]

Replace Specification Sheet IPC-4202/11 with the following:

Revision Date: March 2014

Specification Sheet

Specification Sheet # : IPC-4202/11
Supersedes : N/A
Material Type : Polyethylene Naphthalate (PEN)
Material Designation : L1E__

Property to be tested	Requirement	Units	Test Method	Reference Paragraph
1. Wrinkles, Creases, Streaks and Scratches	Pass	–	Visual	3.5.2
2. Inclusions	Pass	–	Visual ASTM D-149	3.5.3
3. Voids	Pass	–	2.1.13	3.5.4
4. Holes, Tears and Delaminations	Pass	–	Visual	3.5.5
5. Dimensional Stability, maximum	0.30	%	2.2.4, Method A	3.7.1
6. Tensile Strength, minimum	17.2 E+7 [24.95 E+3]	Pa [psi]	2.4.19	3.7.2
7. Elongation, minimum percent	60	%	2.4.19	3.7.2
8. Initiation Tear Strength, minimum	1000 [35.270]	g [oz]	2.4.16	3.7.3
9. Propagation Tear Strength, minimum	4 [0.14] t3 / 8 [0.28] t5 / 20 [0.705] t11 / 40 [1.41] t12	g [oz]	2.4.17.1	3.7.4
10. Chemical Resistance Tensile Strength, minimum Elongation, minimum	 1.7 E+8 [2.47 E+4] 60	 Pa [psi] %	2.3.2, Method C	3.8.1
11. Permittivity At 1 MHz At 1 GHz At 10 GHz	 4.0 DBD DBD	 – – –	 2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.1
12. Loss Tangent, maximum At 1 MHz At 1 GHz At 10 GHz	 0.010 DBD DBD	 – – –	 2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.2
13. Volume Resistivity (Damp Heat), minimum	10^6	MΩ-cm	2.5.17	3.9.3
14. Surface Resistance (Damp Heat), minimum	10^5	MΩ	2.5.17	3.9.4
15. Dielectric Strength, minimum	80 [2000]	V/µm [V/in]	ASTM D-149	3.9.5
16. Fungus Resistance	Non-nutrient	–	2.6.1	3.10.1
17. Moisture Absorption, maximum	1.0	%	2.6.2	3.10.2
18. Flammability, minimum	VTM-2	–	UL-94	3.10.3
19. Relative Temperature Index, minimum	160	°C	UL-746B	3.10.4

DBD = Data being developed

t3 Flexible base dielectric materials with thickness <25 µm [<980 µin]
t5 Flexible base dielectric materials with 25 µm ≤ thickness <50 µm [980 µin ≤ thickness <1970 µin]
t11 Flexible base dielectric materials with 50 µm ≤ thickness <102 µm [1970 µin ≤ thickness <4020 µin]
t12 Flexible base dielectric materials with thickness ≥102 µm [thickness ≥4020 µin]

Replace Specification Sheet IPC-4202/12 with the following:

Revision Date: March 2014

Specification Sheet

Specification Sheet # : IPC-4202/12
Supersedes : N/A
Material Type : Thermotropic Liquid Crystal Polymer
Material Designation : M1E__0

Property to be tested	Requirement	Units	Test Method	Reference Paragraph
1. Wrinkles, Creases, Streaks and Scratches	Pass	–	Visual	3.5.2
2. Inclusions	Pass	–	Visual ASTM D-149	3.5.3
3. Voids	Pass	–	2.1.13	3.5.4
4. Holes, Tears and Delaminations	Pass	–	Visual	3.5.5
5. Dimensional Stability, maximum	0.05	%	2.2.4, Method A	3.7.1
6. Tensile Strength, minimum	9.8 E+7 [1.42 E+4]	Pa [psi]	2.4.19	3.7.2
7. Elongation, minimum percent	14	%	2.4.19	3.7.2
8. Initiation Tear Strength, minimum	1400 [49.4]	g [oz]	2.4.16	3.7.3
9. Propagation Tear Strength, minimum	7 [0.25]	g [oz]	2.4.17.1	3.7.4
10. Chemical Resistance Tensile Strength, minimum Elongation, minimum	 DBD DBD	 Pa [psi] %	2.3.2, Method C	3.8.1
11. Permittivity At 1 MHz At 1 GHz At 10 GHz	 DBD 2.9 2.9	 – – –	 2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.1
12. Loss Tangent, maximum At 1 MHz At 1 GHz At 10 GHz	 DBD 0.004 0.003	 – – –	 2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.2
13. Volume Resistivity (Damp Heat), minimum	10^{12}	MΩ-cm	2.5.17	3.9.3
14. Surface Resistance (Damp Heat), minimum	10^{10}	MΩ	2.5.17	3.9.4
15. Dielectric Strength, minimum	140 [3600]	V/µm [V/in]	ASTM D-149	3.9.5
16. Fungus Resistance	Pass	–	2.6.1	3.10.1
17. Moisture Absorption, maximum	0.05	%	2.6.2	3.10.2
18. Flammability, minimum	VTM-0	–	UL-94	3.10.3
19. Relative Temperature Index, minimum	DBD	°C	UL-746B	3.10.4

DBD = Data being developed

Replace Specification Sheet IPC-4202/0 with the following:

Submission Date:

Blank Specification Sheet for New Material Submission

Specification Sheet # : IPC-4202/NEW
Supersedes :
Material Type :
Material Designation :

Property to be tested	Requirement	Units	Test Method	Reference Paragraph
1. Wrinkles, Creases, Streaks and Scratches		–	Visual	3.5.2
2. Inclusions		–	Visual ASTM D-149	3.5.3
3. Voids		–	2.1.13	3.5.4
4. Holes, Tears and Delaminations		–	Visual	3.5.5
5. Dimensional Stability, maximum		%	2.2.4, Method A	3.7.1
6. Tensile Strength, minimum		Pa [psi]	2.4.19	3.7.2
7. Elongation, minimum percent		%	2.4.19	3.7.2
8. Initiation Tear Strength, minimum		g [oz]	2.4.16	3.7.3
9. Propagation Tear Strength, minimum		g [oz]	2.4.17.1	3.7.4
10. Chemical Resistance Tensile Strength, minimum Elongation, minimum		 Pa [psi] %	2.3.2, Method C	3.8.1
11. Permittivity At 1 MHz At 1 GHz At 10 GHz		 – – –	 2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.1
12. Loss Tangent, maximum At 1 MHz At 1 GHz At 10 GHz		 – – –	 2.5.5.3 2.5.5.9 or ASTM D-2520 2.5.5.5 or ASTM D-2520	3.9.2
13. Volume Resistivity (Damp Heat), minimum		MΩ-cm	2.5.17	3.9.3
14. Surface Resistance (Damp Heat), minimum		MΩ	2.5.17	3.9.4
15. Dielectric Strength, minimum		V/µm [V/in]	ASTM D-149	3.9.5
16. Fungus Resistance		–	2.6.1	3.10.1
17. Moisture Absorption, maximum		%	2.6.2	3.10.2
18. Flammability, minimum		–	UL-94	3.10.3
19. Relative Temperature Index, minimum		°C	UL-746B	3.10.4