台燿科技股份有限公司
Taiwan Union Technology

TEST REPORT

CLIENT: IPC Validation Services
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Attention: Mr. Randy Cherry
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TEST ITEMS: Peel Strength, Volume Resistivity, Surface Resistivity, Moisture Absorption, Dielectric Breakdown, Permittivity @ 10 GHz, Loss Tangent @ 10 GHZ, Flexural Strength, Thermal Stress, Electric Strength, Flammability,

SAMPLE: Copper-Clad Laminate

TEST MATERIAL: TU-1300E

SPECIFICATION: IPC-4103B/17

TEST RESULTS: The specimens were tested by the indicated test methods within this report. The actual detailed test results are enclosed.

DATE OF REPORT: 26 October 2022

SUMMARIZED TEST RESULTS:

Test Item	Thin	Thick
Peel Strength	N/A	N/A
Volume Resistivity	Pass	Pass
Surface Resistivity	Pass	Pass
Moisture Absorption	Pass	Pass
Dielectric Breakdown	Pass	Pass
Permittivity @ 10 GHz	Pass	Pass
Loss Tangent @ 10 GHz	Pass	Pass
Flexural Strength	--	Pass
Thermal Stress	Pass	Pass
Electric Strength	Pass	Pass
Flammability	Pass	Pass

Peel Strength

Reference:

IPC-TM-650 Method 2.4.8 Peel Strength of Metal Clad Laminates

IPC-TM-650 Method 3.4.8.3 Peel Strength of Metal Clad Laminates at Elevated Temperature IPC-4103B/17 Specification for Base Materials for High Speed / High Frequency Applications

Results:

Table 1 Peel Strength After Thermal Strength Thin

Side A Cross-Wise and Length-Wise Average	Standard Copper Not Supplied Commercially	
Side B Cross-Wise and Length-Wise Average		
Requirement	≥ 0.70	N/A

Table 2 Peel Strength After Thermal Strength Thick

Side A Cross-Wise and Length-Wise Average	Standard Copper Not Supplied Commercially	
Side B Cross-Wise and Length-Wise Average		
Requirement	≥ 0.70	N/A

Volume & Surface Resistivity

Reference:

IPC-TM-650 Method 2.5.17.1 Volume and Surface Resistivity of Dielectric Materials
IPC-4103B/17 Specification for Base Materials for High Speed / High Frequency Applications

Results:

Table 3 Volume and Surface Resistivity Humidity Conditioning Thin

Volume Resistivity	Average of three specimens	4.30 E+09	
Requirement C-96/35/90		≥ 1.00 E+06	Pass
Surface Resistivity	Average of three specimens	1.30 E+10	
Requirement C-96/35/90		≥ 1.00 E+05	Pass

Table 4 Volume and Surface Resistivity Humidity Conditioning Thick

Volume Resistivity	Average of three specimens	1.60 E+10	
Requirement after moisture		1.00 E+06	Pass
Surface Resistivity	Average of three specimens	4.70 E+09	
Requirement after moisture		≥ 1.00 E+05	Pass

Moisture Absorption

Reference:

IPC-TM-650 Method 2.6.2.1 Water Absorption of Metal Clad Plastic Laminates
IPC-4103B/17 Specification for Base Materials for High Speed / High Frequency Applications

Results:

Table 5 Moisture Absorption Thick

Moisture Absorption	Average of three specimens	0.19	
Requirement		$\leq$ 0.4	Pass

Dielectric Breakdown

Reference:

IPC-TM-650 Method 2.5.6 Dielectric Breakdown
IPC-4103B/17 Specification for Base Materials for High Speed / High Frequency Applications

Results:

Table 6 Dielectric Breakdown Thin

Dielectric Breakdown	Average of four specimens	44	
Requirement		≥ 20	Pass

Table 7 Dielectric Breakdown Thick

Dielectric Breakdown	Average of four specimens	44	
Requirement		≥ 20	Pass

Permittivity and Loss Tangent @ 10 GHz

Reference:

IPC-TM-650 Method 2.5.5.15 Permittivity and Loss Tangent, SPDR, IPC-4103B/17 Specification for Base Materials for High Speed / High Frequency Applications

Results:

Table 8 Permittivity and Loss Tangent at 10 GHz

Permittivity @ 10 GHz	Average of three specimens	3.30	
Requirement Thin		N/A	Pass
Loss Tangent @ 10 GHz	Average of three specimens	0.003	
Requirement Thin		≤ 0.005	Pass
Permittivity @ 10 GHz	Average of three specimens	3.70	
Requirement Thick		N/A	Pass
Loss Tangent @ 10 GHz	Average of three specimens	0.004	
Requirement Thick		≤ 0.005	Pass

Flexural Strength

Reference:

IPC-TM-650 Method 2.4.4 Flexural Strength of Laminates at Ambient Temperature
IPC-4103B/17 Specification for Base Materials for High Speed / High Frequency Applications

Results:

Table 9 Flexural Strength

Flexural Strength Length Direction	Average of two specimens	309	
Requirement		≥ 276	Pass
Flexural Strength Cross Direction	Average of two specimens	277	
Requirement		≥ 207	Pass

Thermal Stress

Reference:

IPC-TM-650 Method 2.4.13.1 Thermal Stress of Laminates

IPC-4103B/17 Specification for Base Materials for High Speed / High Frequency Applications

Results:

Table 10 Thermal Stress

Thermal Stress Thin Etched A Side	No obvious blister, delamination or damage	Pass
Thermal Stress Thin Etched B Side	No obvious blister, delamination or damage	Pass
Thermal Stress Thick Etched A Side	No obvious blister, delamination or damage	Pass
Thermal Stress Thick Etched B Side	No obvious blister, delamination or damage	Pass
Thermal Stress Thin Un-Etched A Side	No obvious blister, delamination or damage	Pass
Thermal Stress Thin Un-Etched B Side	No obvious blister, delamination or damage	Pass
Thermal Stress Thick Un-Etched A Side	No obvious blister, delamination or damage	Pass
Thermal Stress Thick Un-Etched B Side	No obvious blister, delamination or damage	Pass

Electric Strength

Reference:

IPC-TM-650 Method 2.5.6.2 Electric Strength

IPC-4103B/17 Specification for Base Materials for High Speed / High Frequency Applications

Results:

Table 11 Electric Strength Thin

Electric Strength Thin	Average of three specimens	53,092	
Requirement		≥ 15,748	Pass

Table 12 Electric Strength Thick

Electric Strength Thin	Average of three specimens	52,563	
Requirement		≥ 15,748	Pass

Flammability Vertical Burning

Reference:

UL94 Section 8 50W (20mm) Vertical Burning Test; V-0, V-1, V-2

IPC-4103B/17 Specification for Base Materials for High Speed / High Frequency Applications

Results:

Table 13 Vertical Burning Test Thin

The specimens were tested by the methods given above.
The flammability Classification Condition A of specimens is V-0
The flammability Classification Condition A of specimens is V-0
The specimens pass.

Table 14 Vertical Burning Test Thick

The specimens were tested by the methods given above.
The flammability Classification Condition A of specimens is V-0
The flammability Classification Condition B of specimens is V-0
The specimens pass.

CERTIFICATE OF CONFORMANCE

The TAWIAN UNION TECHNOLOGY CORPORATION (TUC) certifies that the test equipment used complies with the requirements of correlation criterion and that data contained in this report is accurate within the tolerance limitation of the equipment.

The report is invalid without the signature of the reviewer and the approver.

Reviewed by:	Approved by:
Weiting Shen	Money Wang
QA Engineer	QA Manager
26 October 2022	26 October 2022

Douglas J. Solver

For IPC
26 October 2022