Report # 34749ES

TEST REPORT SUMMARY

(Short Report)

CLIENT:	IPC Validation Services 3000 Lakeside Drive Suite 105N Bannockburn, IL 60015 Attention: Mr. Randy Cherry Phone: 1-847-597-2806
REFERENCE:	IPC-4103B/17, IPC-TM-650 2.4.4B, 2.4.8C, 2.4.8.3A, 2.4.13.1, 2.5.5.5, 2.5.6B, 2.5.6.2A, 2.5.17.1A, 2.6.2.1A, UL94, Customer Technical Requirements
TEST ITEM:	Peel Strength, Volume Resistivity, Surface Resistivity, Moisture Absorption, Dielectric Breakdown , Permittivity and Loss Tangent, Flexural Strength, Thermal Stress, Electric Strength, Vertical Burning Test
SAMPLE:	CCL
TEST MATERIAL:	TU-1300N
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:	30 August 2022
REPORT No.:	34749E

MICROTEK (CHANGZHOU) PRODUCT SERVICES CO., LTD. 麦可罗泰克(常州)产品服务有限公司 检测专用章

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SUMMARIZED TEST RESULTS:

Test Item	Thin	Thick
Peel Strength	NA	NA
Volume Resistivity	Pass	Pass
Surface Resistivity	Pass	Pass
Moisture Absorption	Pass	Pass
Dielectric Breakdown	Pass	Pass
Permittivity at 10 GHz	Pass	Pass
Loss Tangent at 10 GHz	Pass	Pass
Flexural Strength	--	Pass
Thermal Stress	Pass	Pass
Electric Strength	Pass	Pass
Vertical Burning	Pass	Pass

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Peel Strength

REFERENCE

IPC-4103B Specification for Base Materials for High Speed/High Frequency Applications
IPC-TM-650 Method 2.4.8C Peel Strength of Matallic Clad Laminates
IPC-TM-650 Method 2.4.8.3A Peel Strength of Matallic Clad Laminates at Elevated

RESULTS

Table 1 Peel Strength After Thermal Stress Thin

Sample Designation	/		Sample Identification	/
Test Date	/		Ambient	/
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
No Requirement				

TUC products are not commercially produced with this type of copper foil, letter on file at IPC.

Table 2 Peel Strength After Thermal Stress Thick

Sample Designation	/		Sample Identification	/
Test Date	/		Ambient	/
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
No Requirement				

TUC products are not commercially produced with this type of copper foil, letter on file at IPC.

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Volume and Surface Resistivity

REFERENCE

IPC-4103B Specification for Base Materials for High Speed/High Frequency Applications
IPC-TM-650 2.5.17.1A Volume and Surface Resistivity of Dielectric Materials
Customer Technical Requirements

RESULTS

Table 3 Volume and Surface resistivity Humidity Conditioning Thin

Sample Designation	CCL		Sample Identification	TU-1300N	
Test Date	2022-08-18~2022-08-22		Ambient	25 °C, 49% RH	
Sample No.	Average Thickness T	Surface Resistance R'	Surface Resistivity $r'=R'P/D_4$	Volume Resistance R	Volume Resistivity r=RA/T
	(cm)	(MΩ)	(MΩ)	(MΩ)	(MΩ·cm)
34749-2-1	0.0212	1.6E+04	5.2E+06	3.4E+05	8.3E+07
34749-2-2	0.0213	2.0E+04	6.4E+06	3.0E+05	7.3E+07
34749-2-3	0.0211	2.0E+04	6.4E+06	4.0E+05	9.8E+07
Average		/	6.0E+06	/	8.5E+07
Requirement		/	$\geqslant 10^5$	/	$\geqslant 10^6$

Table 4 Volume and Surface Resistivity Humidity Conditioning Thick

Sample Designation	CCL		Sample Identification	TU-1300N	
Test Date	2022-08-18~2022-08-22		Ambient	25 °C, 49% RH	
Sample No.	Average Thickness T	Surface Resistance R'	Surface Resistivity $r'=R'P/D_4$	Volume Resistance R	Volume Resistivity r=RA/T
	(cm)	(MΩ)	(MΩ)	(MΩ)	(MΩ·cm)
34749-9-1	0.0916	5.0E+05	1.4E+07	5.8E+05	1.6E+08
34749-9-2	0.0913	4.0E+05	1.1E+07	4.2E+05	1.2E+08
34749-9-3	0.0914	2.7E+05	7.6E+06	4.4E+05	1.2E+08
Average		/	1.1E+07	/	1.3E+08
Requirement		/	$\geqslant 10^5$	/	$\geqslant 10^6$

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Moisture Absorption

REFERENCE

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

RESULTS

Table 5 Moisture Absorption

Sample Designation	CCL		Sample Identification	TU-1300N
Test Date	2022-08-03~2022-08-04		Ambient	(27~28) °C, (50~52)% RH
Sample No.	mass(g)		increasing weight percent of mass(%)	
	m_1	m_2		
34749-4-1-1	0.8728	0.8738	0.11	
34749-4-1-2	0.8657	0.8667	0.12	
34749-4-1-3	0.8683	0.8694	0.13	
Average			0.12	
Requirement			≤0.4	
34749-11-3-1	3.9492	3.9555	0.16	
34749-11-3-2	3.9466	3.9532	0.17	
34749-11-3-3	3.9506	3.9568	0.16	
Average			0.16	
Requirement			≤0.4	

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Dielectric Breakdown

REFERENCE

IPC-4103B Specification for Base Materials for High Speed/High Frequency Applications
IPC-TM-650 Method 2.5.6B Dielectric Breakdown of Rigid Printed Wiring Material

RESULTS

Table 6 Dielectric Breakdown Thin

Sample Designation		CCL	Sample Identification	TU-1300N
Test Date		2022-08-24~2022-08-26	Ambient	25 °C, 49% RH
Sample No.		Thickness (mm)	Voltage (kV)	Minimum Voltage (kV)
34749-3-14	Machine direction	0.208	42.4+N.B	42+N.B
34749-3-15		0.207	42.9+N.B	
34749-3-16	Transverse direction	0.206	43.1+N.B	
34749-3-17		0.206	42.7+N.B	
Requirement				⩾20

Table 7 Dielectric Breakdown Thick

Sample Designation		CCL	Sample Identification	TU-1300N
Test Date		2022-08-24~2022-08-26	Ambient	25 °C, 49% RH
Sample No.		Thickness (mm)	Voltage (kV)	Minimum Voltage (kV)
34749-10-14	Machine direction	0.907	43.8+N.B	43+N.B
34749-10-15		0.908	43.0+N.B	
34749-10-16	Transverse direction	0.908	42.7+N.B	
34749-10-17		0.907	42.8+N.B	
Requirement				⩾20

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Permittivity and Loss Tangent

REFERENCE

IPC-4103B Specification for Base Materials for High Speed/High Frequency Applications
IPC-TM-650 Method 2.5.5.5 Stripline Test for Permittivity and Loss Tangent (Dielectric Constant and Dissipation Factor) at X-Band
Customer Technical Requirements

RESULTS

Table 8 Permittivity and Loss Factor at 10 GHz

Sample Designation	CCL	Sample Identification	TU-1300N
Test Date	2022-08-10	Ambient	25 °C, 49% RH
Sample No.	Sample Thickness (mm)	Permittivity	Loss Tangent
34749-4-2	0.42	3.15	0.001
Requirement		/	≤0.005
34749-11-1	1.84	3.35	0.002
Requirement		/	≤0.005

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Flexural Strength

REFERENCE

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

RESULTS

Table 9 Flexural Strength Test

Sample Designation	CCL		Sample Identification		TU-1300N		
Test Date	2022-08-03		Ambient		25℃, 48%RH		
Sample No.	Span L (mm)	Load P (N)	Width b (mm)	Thickness d (mm)	Flexural Strength S (N/mm^2)	Average (N/mm^2)	Requirement (N/mm^2)
34749-11-2-1 (Cross Direction)	25.40	155.718	26.56	0.909	270	270	⩾207
34749-11-2-2 (Cross Direction)		152.852	26.11	0.908	271		
34749-11-2-3 (Length Direction)		177.628	26.35	0.907	312	313	⩾276
34749-11-2-4 (Length Direction)		174.589	25.83	0.905	314		

Thermal Stress

REFERENCE

IPC-4103B Specification for Base Materials for High Speed/High Frequency Applications
IPC-TM-650 Method 2.4.13.1 Thermal Stress of Laminates

RESULTS

Table 10 Thermal Stress

Sample Designation	CCL			Sample Identification	TU-1300N
Test Date	2022-08-25			Ambient	26 °C, 50%RH
Sample No.				Test result	
34749-3-18	Etched	Top	Thin	No evidence of blistering, delamination, wrinkling and cracking	
34749-3-19				No evidence of blistering, delamination, wrinkling and cracking	
34749-3-20				No evidence of blistering, delamination, wrinkling and cracking	
34749-3-21		Bottom		No evidence of blistering, delamination, wrinkling and cracking	
34749-3-22				No evidence of blistering, delamination, wrinkling and cracking	
34749-3-23				No evidence of blistering, delamination, wrinkling and cracking	
34749-10-18		Top	Thick	No evidence of blistering, delamination, wrinkling and cracking	
34749-10-19				No evidence of blistering, delamination, wrinkling and cracking	
34749-10-20				No evidence of blistering, delamination, wrinkling and cracking	
34749-10-21		Bottom		No evidence of blistering, delamination, wrinkling and cracking	
34749-10-22				No evidence of blistering, delamination, wrinkling and cracking	
34749-10-23				No evidence of blistering, delamination, wrinkling and cracking	
34749-5-1	Unetched	Top	Thin	No evidence of blistering, delamination, wrinkling and cracking	
34749-5-2				No evidence of blistering, delamination, wrinkling and cracking	
34749-5-3				No evidence of blistering, delamination, wrinkling and cracking	
34749-5-4		Bottom		No evidence of blistering, delamination, wrinkling and cracking	
34749-5-5				No evidence of blistering, delamination, wrinkling and cracking	
34749-5-6				No evidence of blistering, delamination, wrinkling and cracking	
34749-12-1		Top	Thick	No evidence of blistering, delamination, wrinkling and cracking	
34749-12-2				No evidence of blistering, delamination, wrinkling and cracking	
34749-12-3				No evidence of blistering, delamination, wrinkling and cracking	
34749-12-4		Bottom		No evidence of blistering, delamination, wrinkling and cracking	
34749-12-5				No evidence of blistering, delamination, wrinkling and cracking	
34749-12-6				No evidence of blistering, delamination, wrinkling and cracking	

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Electric Strength

REFERENCE

IPC-4103B Specification for Base Materials for High Speed/High Frequency Applications
IPC-TM-650 Method 2.5.6.2A Electric Strength of Printed Wiring Material

RESULTS

Table 11 Electric Strength Thin

Sample Designation	CCL	Sample Identification	TU-1300N
Test Date	2022-08-24~2022-08-26	Ambient	25 °C, 49% RH
Sample No.	Average Thickness (mm)	Voltage (V)	Electric Strength (V/mm)
34749-3-11	0.207	13000	62802
34749-3-12	0.206	13200	64078
34749-3-13	0.205	12900	62927
Average			63269
Requirement			≥15748

Table 12 Electric Strength Thick

Sample Designation	CCL	Sample Identification	TU-1300N
Test Date	2022-08-24~2022-08-26	Ambient	25 °C, 49% RH
Sample No.	Average Thickness (mm)	Voltage (V)	Electric Strength (V/mm)
34749-10-11	0.907	25200	27784
34749-10-12	0.907	25600	28225
34749-10-13	0.908	26800	29515
Average			28508
Requirement			≥15748

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Vertical Burning Test

REFERENCE

IPC-4103B Specification for Base Materials for High Speed/High Frequency Applications
UL94 STANDARD FOR SAFETY Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Section 8 50W (20 mm) Vertical Burning Test; V-0, V-1, or V-2

RESULTS

Table 13 Vertical Burning Test Thin

Sample Designation		CCL			Sample Identification		TU-1300N		
Test Date		2022-08-16~2022-08-25			Ambient		24 °C, 50% RH		
Pre-conditioning	Sample No.	Sample Thk (mm)	Afterflames (s)		Afterglow (s)	Sum of after flames (s)	Sum of afterflame and afterglow (s)	Did samples burn to the clamp?	Did the cotton ignite?
			(t_1)	(t_2)	(t_3)	(t_1 + t_2)	(t_2 + t_3)		
Condition A:	34749-3-1	0.206	0	0	0	0	0	No	No
48 Hours	34749-3-2	0.207	0	0	0	0	0	No	No
(23±2) ℃	34749-3-3	0.206	0	0	0	0	0	No	No
(50±10)% RH	34749-3-4	0.207	0	0	0	0	0	No	No
	34749-3-5	0.205	0	0	0	0	0	No	No
	Avg:	0.206	Max: 0			Sum: 0	Max: 0	Pass	Pass
Condition B:	34749-3-6	0.207	0	0	0	0	0	No	No
168 Hours	34749-3-7	0.206	0	0	0	0	0	No	No
(70±2) °C	34749-3-8	0.208	0	0	0	0	0	No	No
	34749-3-9	0.206	0	0	0	0	0	No	No
Results	34749-3-10	0.205	0	0	0	0	0	No	No
V-0	Avg:	0.206	Max: 0			Sum: 0	Max: 0	Pass	Pass
Requirement	V-0								

Table 14 Vertical Burning Test Thick

Sample Designation		CCL			Sample Identification		TU-1300N		
Test Date		2022-08-16~2022-08-25			Ambient		24 °C, 50% RH		
Pre-conditioning	Sample No.	Sample Thk (mm)	Afterflames (s)		Afterglow (s)	Sum of after flames (s)	Sum of afterflame and afterglow (s)	Did samples burn to the clamp?	Did the cotton ignite?
			(t_1)	(t_2)	(t_3)	($t_1 + t_2$)	($t_2 + t_3$)		
Condition A:	34749-10-1	0.904	10	0	0	10	0	No	No
48 Hours	34749-10-2	0.908	9	0	0	9	0	No	No
(23±2) ℃	34749-10-3	0.908	6	0	0	6	0	No	No
(50±10)% RH	34749-10-4	0.906	8	0	0	8	0	No	No
	34749-10-5	0.907	8	0	0	8	0	No	No
	Avg:	**0.907**	**Max: 10**			**Sum: 41**	**Max: 0**	**Pass**	**Pass**
Condition B:	34749-10-6	0.908	7	0	0	7	0	No	No
168 Hours	34749-10-7	0.908	8	0	0	8	0	No	No
(70±2) ℃	34749-10-8	0.909	7	0	0	7	0	No	No
	34749-10-9	0.907	9	0	0	9	0	No	No
Results	34749-10-10	0.908	9	0	0	9	0	No	No
V-0	**Avg:**	**0.908**	**Max: 9**			**Sum: 40**	**Max: 0**	**Pass**	**Pass**
Requirement	V-0								

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CERTIFICATE OF CONFORMANCE

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