Report # 34530ES

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-4101E-WAM1/134, IPC-TM-650 2.3.1.1, 2.3.4.2A, 2.4.4B, 2.4.8C, 2.4.8.3A, 2.4.13.1, 2.4.24C, 2.4.24.1, 2.4.24.4, 2.4.24.6, 2.4.25D, 2.4.39, 2.5.1B, 2.5.5.9, 2.5.6B, 2.5.6.2A, 2.5.17.1A, 2.6.2.1A, 2.6.16, UL94, Customer Technical Requirements
TEST ITEM:	Peel Strength, Volume Resistivity, Surface Resistivity, Moisture Absorption, Dielectric Breakdown , Permittivity and Loss Tangent, Flexural Strength, Arc Resistance, Thermal Stress, Electric Strength, Vertical Burning Test, Glass Transition Temperature, Decomposition Temperature, Z-Axis CTE (TMA), Time to Delamination, Glass Transition Temperature (DMA), Dimensional Stability, Solderability, Chemical Resistance, Metal Surface Cleanability, Pressure Cooker Test
SAMPLE:	CCL
TEST MATERIAL:	TU-883
SPECIFICATION:	IPC-4101E-WAM1/134
TEST RESULTS:	The specimens were tested by the indicated test methods within this report. The actual detailed test results are enclosed.
DATE OF REPORT:	17 August 2022
REPORT No.:	34530E

MICROTEK (CHANGZHOU) PRODUCT SERVICES CO., LTD. 美可罗泰克(常州)产品服务有限公司 2022.08.18 11:23:08 +08'00' 检测专用章

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Tel: 86 519 85487809 •Fax: 86 519 85487810 • WWW.THETESTLAB.CN

SUMMARIZED TEST RESULTS:

Test Item	Thin	Thick
Peel Strength	Pass	Pass
Volume Resistivity	Pass	Pass
Surface Resistivity	Pass	Pass
Moisture Absorption	--	Pass
Dielectric Breakdown	--	Pass
Permittivity at 1 MHz, 1 GHz, 10 GHz, 20 GHz	Pass	Pass
Loss Tangent at 1 MHz, 1 GHz, 10 GHz, 20 GHz	Pass	Pass
Flexural Strength	--	Pass
Arc Resistance	Pass	Pass
Thermal Stress	Pass	Pass
Electric Strength	Pass	--
Vertical Burning	Pass	Pass
Glass Transition Temperature	--	Pass
Decomposition Temperature	--	Pass
Z-Axis CTE (TMA)	--	Pass
Time to Delamination	--	Pass
Glass Transition Temperature (DMA)	--	Pass
Dimensional Stability	Pass	Pass
Solderability	Pass	Pass
Chemical Resistance	Report Only	Report Only
Metal Surfaces Cleanability	--	Report Only
Pressure Cooker Test	--	Report Only

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Peel Strength

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
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
Customer Technical Requirements

RESULTS

Table 1 Peel Strength After Thermal Stress Thin

Sample Designation	CCL		Sample Identification	TU-883
Test Date	2022-08-14		Ambient	25℃, 49%RH
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
34530-101-1-1	0.98			
34530-101-1-2	0.98			
34530-101-1-3		1.05		
34530-101-1-4		1.06		
34530-101-1-5			0.91	
34530-101-1-6			0.93	
34530-101-1-7				0.94
34530-101-1-8				0.95
Average	0.98	1.05	0.92	0.94
Requirement	⩾0.70			

Table 2 Peel Strength After Thermal Stress Thick

Sample Designation	CCL		Sample Identification	TU-883
Test Date	2022-08-14		Ambient	25℃, 49%RH
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
34530-103-1-1	1.12			
34530-103-1-2	1.14			
34530-103-1-3		1.13		
34530-103-1-4		1.13		
34530-103-1-5			1.10	
34530-103-1-6			1.10	
34530-103-1-7				1.13
34530-103-1-8				1.13
Average	1.13	1.13	1.10	1.13
Requirement	⩾0.70			

Table 3 Peel Strength At Elevated Temperature Thin

Sample Designation	CCL		Sample Identification	TU-883
Test Date	2022-08-15		Ambient	25℃, 49%RH
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
34530-101-2-1	0.79			
34530-101-2-2	0.83			
34530-101-2-3		0.83		
34530-101-2-4		0.84		
34530-101-2-5			0.71	
34530-101-2-6			0.73	
34530-101-2-7				0.73
34530-101-2-8				0.74
Average	0.81	0.84	0.72	0.73
Requirement	⩾0.70			

Table 4 Peel Strength At Elevated Temperature Thick

Sample Designation	CCL		Sample Identification	TU-883
Test Date	2022-08-15		Ambient	25℃, 49%RH
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
34530-103-2-1	0.87			
34530-103-2-2	0.89			
34530-103-2-3		0.86		
34530-103-2-4		0.86		
34530-103-2-5			0.85	
34530-103-2-6			0.85	
34530-103-2-7				0.85
34530-103-2-8				0.86
Average	0.88	0.86	0.85	0.85
Requirement	⩾0.70			

Table 5 Peel Strength After Process Solution Thin

Sample Designation	CCL		Sample Identification	TU-883
Test Date	2022-08-14		Ambient	25℃, 49%RH
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
34530-100-1-1	1.01			
34530-100-1-2	0.98			
34530-100-1-3		0.99		
34530-100-1-4		0.95		
34530-100-1-5			1.12	
34530-100-1-6			1.11	
34530-100-1-7				1.11
34530-100-1-8				1.14
Average	1.00	0.97	1.12	1.12
Requirement	⩾0.70			

Table 6 Peel Strength After Process Solution Thick

Sample Designation	CCL		Sample Identification	TU-883
Test Date	2022-08-14		Ambient	25℃, 49%RH
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
34530-102-1-1	1.11			
34530-102-1-2	1.12			
34530-102-1-3		1.18		
34530-102-1-4		1.14		
34530-102-1-5			1.20	
34530-102-1-6			1.13	
34530-102-1-7				1.12
34530-102-1-8				1.15
Average	1.11	1.16	1.17	1.14
Requirement	⩾0.70			

Table 7 Peel Strength Low Profile Copper Foil Thin

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

Table 8 Peel Strength Low Profile Copper Foil Thick

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

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Volume and Surface Resistivity

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 2.5.17.1A Volume and Surface Resistivity of Dielectric Materials
Customer Technical Requirements

RESULTS

Table 9 Volume and Surface resistivity Humidity Conditioning Thin

Sample Designation	CCL		Sample Identification	TU-883	
Test Date	2022-07-14~2022-07-18		Ambient	25 ℃, 52% 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)
34530-3-1	0.0117	8.0E+05	2.6E+08	5.8E+05	2.6E+08
34530-3-2	0.0114	7.0E+05	2.3E+08	6.0E+05	2.7E+08
34530-3-3	0.0115	7.5E+05	2.4E+08	6.0E+05	2.7E+08
Average		/	2.4E+08	/	2.7E+08
Requirement		/	$\geqslant 10^5$	/	$\geqslant 10^6$

Table 10 Volume and Surface Resistivity at Elevated Temperature Humidity Thin

Sample Designation	CCL		Sample Identification	TU-883	
Test Date	2022-07-19~2022-07-20		Ambient	25 ℃, 53% 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)
34530-4-1	0.0117	1.6E+05	5.2E+07	1.2E+05	5.3E+07
34530-4-2	0.0118	1.6E+05	5.2E+07	1.4E+05	6.1E+07
34530-4-3	0.0116	1.4E+05	4.5E+07	1.2E+05	5.3E+07
Average		/	4.9E+07	/	5.6E+07
Requirement		/	$\geqslant 10^5$	/	$\geqslant 10^6$

Table 11 Volume and Surface Resistivity Humidity Conditioning Thick

Sample Designation	CCL		Sample Identification	TU-883	
Test Date	2022-07-14~2022-07-21		Ambient	23 ℃, 53% 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)
34530-23-1	0.0616	8.0E+05	2.3E+07	7.5E+05	3.1E+08
34530-23-2	0.0617	1.0E+06	2.8E+07	8.0E+05	3.3E+08
34530-23-3	0.0615	9.0E+05	2.5E+07	8.0E+05	3.3E+08
Average		/	2.5E+07	/	3.3E+08
Requirement		/	$\geqslant 10^5$	/	$\geqslant 10^6$

Table 12 Volume and Surface Resistivity at Elevated Temperature Humidity Thick

Sample Designation	CCL		Sample Identification	TU-883	
Test Date	2022-07-14~2022-07-15		Ambient	24 ℃, 48% 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)
34530-24-1	0.0617	1.6E+05	4.5E+06	1.4E+05	5.8E+07
34530-24-2	0.0614	1.8E+05	5.1E+06	1.2E+05	5.0E+07
34530-24-3	0.0615	1.6E+05	4.5E+06	1.2E+05	5.0E+07
Average		/	4.7E+06	/	5.3E+07
Requirement		/	$\geqslant 10^5$	/	$\geqslant 10^6$

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Moisture Absorption

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.6.2.1A Water Absorption, Metal Clad Plastic Laminates
Customer Technical Requirements

RESULTS

Table 13 Moisture Absorption

Sample Designation	CCL		Sample Identification	TU-883
Test Date	2022-07-07~2022-07-14		Ambient	28 °C, (50~54)% RH
Sample No.	mass(g)		increasing weight percent of mass(%)	
	m_1	m_2		
34530-26-4	2.7270	2.7308	0.14	
34530-26-5	2.7325	2.7361	0.13	
34530-26-6	2.7090	2.7131	0.15	
Average			0.14	
Requirement			≤0.2	

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Dielectric Breakdown

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.5.6B Dielectric Breakdown of Rigid Printed Wiring Material
Customer Technical Requirements

RESULTS

Table 14 Dielectric Breakdown

Sample Designation		CCL	**Sample Identification**	TU-883
Test Date		2022-07-10~2022-07-12	**Ambient**	25 ℃, 50% RH
Sample No.		**Thickness (mm)**	**Voltage (kV)**	**Minimum Voltage (kV)**
34530-27-1	Machine direction	0.614	43.2+N.B	43+N.B
34530-27-2		0.613	43.2+N.B	
34530-27-3	Transverse direction	0.614	43.4+N.B	
34530-27-4		0.612	43.1+N.B	
Requirement				⩾40

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Permittivity and Loss Tangent

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.5.5.9 Permittivity and Loss Tangent, Parallel Plate, 1MHz to 1.5GHz
Customer Technical Requirements

RESULTS

Table 15 Permittivity and Loss Tangent

Sample Designation	CCL		Sample Identification	TU-883
Test Date	2022-07-07~2022-07-15		Ambient	(24~25) °C, (48~49)% RH
Sample No.	Test Frequency	Sample Thickness (mm)	Permittivity	Loss Tangent
34530-6-1	1 MHz	0.110	2.9	0.003
34530-6-2		0.109	2.9	0.003
34530-6-3		0.111	2.9	0.003
Average		0.110	2.9	0.003
Requirement			≤4.3	≤0.006
34530-26-7	1 MHz	0.608	3.7	0.002
34530-26-8		0.608	3.7	0.002
34530-26-9		0.609	3.7	0.002
Average		0.608	3.7	0.002
Requirement			≤4.3	≤0.006
34530-6-4	1 GHz	0.123	3.4	0.001
34530-6-5		0.125	3.3	0.001
34530-6-6		0.123	3.4	0.001
Average		0.124	3.4	0.001
Requirement			≤4.3	≤0.006
34530-26-10	1 GHz	0.624	3.8	0.003
34530-26-11		0.620	3.8	0.003
34530-26-12		0.620	3.8	0.003
Average		0.621	3.8	0.003
Requirement			≤4.3	≤0.006
34530-17-1	10 GHz	0.114	3.6	0.004
34530-17-2		0.150	3.6	0.005
34530-17-3		0.150	3.5	0.005
Average		0.138	3.6	0.004
Requirement			≤4.2	≤0.006
34530-40-1	10 GHz	0.660	3.8	0.005
34530-40-2		0.710	3.8	0.005
34530-40-3		1.066	3.8	0.005
Average		0.812	3.8	0.005
Requirement			≤4.2	≤0.006
34530-17-4	20 GHz	0.114	3.6	0.005
34530-17-5		0.150	3.6	0.005
34530-17-6		0.150	3.7	0.005
Average		0.138	3.6	0.005
Requirement			≤4.2	≤0.006
34530-40-4	20 GHz	0.660	3.8	0.005
34530-40-5		0.710	3.8	0.005
34530-40-6		1.066	3.8	0.005
Average		0.812	3.8	0.005
Requirement			≤4.2	≤0.006

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Flexural Strength

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 2.4.4B Flexural Strength of Laminates (at Ambient Temperature)
Customer Technical Requirement

RESULTS

Table 16 Flexural Strength Test

Sample Designation	CCL		Sample Identification		TU-883		
Test Date	2022-07-18		Ambient		24℃, 49%RH		
Sample No.	Span	Load	Width	Thickness	Flexural Strength S	Average	Requirement
	L	P	b	d			
	(mm)	(N)	(mm)	(mm)	(N/mm^2)	(N/mm^2)	(N/mm^2)
34530-28-1 （Length Direction）	15.90	155.269	26.04	0.611	381	372	⩾345
34530-28-2 (Length Direction)		148.628	25.70	0.616	363		
34530-28-3 （Cross Direction）		142.776	25.71	0.616	349	347	⩾345
34530-28-4 (Cross Direction)		138.795	25.44	0.615	344		

Arc Resistance

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.5.1B Arc Resistance of Printed Wiring Material
Customer Technical Requirements

RESULTS

Table 17 Arc Resistance

Sample Designation	CCL	Sample Identification	TU-883	
Test Date	2022-07-10~2022-07-12	Ambient	25 ℃, 49% RH	
Sample No.	Thickness	Times	Average	Requirement
	(mm)	(s)	(s)	(s)
34530-7-1	0.117	181	181	⩾60
34530-7-2	0.115	181		
34530-7-3	0.116	181		
34530-29-1	0.614	182	182	
34530-29-2	0.615	181		
34530-29-3	0.617	182		

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Thermal Stress

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.4.13.1 Thermal Stress of Laminates
Customer Technical Requirements

RESULTS

Table 18 Thermal Stress

Sample Designation	CCL			Sample Identification	TU-883
Test Date	2022-07-12			Ambient	25 ℃, 47%RH
Sample No.				Test result	
34530-8-1	Etched	Top	Thin	No evidence of blistering, delamination, wrinkling and cracking	
34530-8-2				No evidence of blistering, delamination, wrinkling and cracking	
34530-8-3				No evidence of blistering, delamination, wrinkling and cracking	
34530-8-4		Bottom		No evidence of blistering, delamination, wrinkling and cracking	
34530-8-5				No evidence of blistering, delamination, wrinkling and cracking	
34530-8-6				No evidence of blistering, delamination, wrinkling and cracking	
34530-30-1		Top	Thick	No evidence of blistering, delamination, wrinkling and cracking	
34530-30-2				No evidence of blistering, delamination, wrinkling and cracking	
34530-30-3				No evidence of blistering, delamination, wrinkling and cracking	
34530-30-4		Bottom		No evidence of blistering, delamination, wrinkling and cracking	
34530-30-5				No evidence of blistering, delamination, wrinkling and cracking	
34530-30-6				No evidence of blistering, delamination, wrinkling and cracking	
34530-9-1	Unetched	Top	Thin	No evidence of blistering, delamination, wrinkling and cracking	
34530-9-2				No evidence of blistering, delamination, wrinkling and cracking	
34530-9-3				No evidence of blistering, delamination, wrinkling and cracking	
34530-9-4		Bottom		No evidence of blistering, delamination, wrinkling and cracking	
34530-9-5				No evidence of blistering, delamination, wrinkling and cracking	
34530-9-6				No evidence of blistering, delamination, wrinkling and cracking	
34530-31-1		Top	Thick	No evidence of blistering, delamination, wrinkling and cracking	
34530-31-2				No evidence of blistering, delamination, wrinkling and cracking	
34530-31-3				No evidence of blistering, delamination, wrinkling and cracking	
34530-31-4		Bottom		No evidence of blistering, delamination, wrinkling and cracking	
34530-31-5				No evidence of blistering, delamination, wrinkling and cracking	
34530-31-6				No evidence of blistering, delamination, wrinkling and cracking	

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Electric Strength

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.5.6.2A Electric Strength of Printed Wiring Material
Customer Technical Requirements

RESULTS

Table 19 Electric Strength

Sample Designation	CCL	Sample Identification	TU-883
Test Date	2022-07-10~2022-07-12	Ambient	25 ℃, 50% RH
Sample No.	Average Thickness (mm)	Voltage (kV)	Electric Strength (kV/mm)
34530-10-1	0.116	8.4	72.41
34530-10-2	0.117	8.7	74.36
34530-10-3	0.118	8.7	73.73
Average			74
Requirement			≥30

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Vertical Burning Test

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
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
Customer Technical Requirements

RESULTS

Table 20 Vertical Burning Test Thin

Sample Designation		CCL			Sample Identification		TU-883		
Test Date		2022-07-14~2022-07-20			Ambient		25 °C, 51% 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:	34530-11-1	0.119	0	0	0	0	0	No	No
48 Hours	34530-11-2	0.117	0	0	0	0	0	No	No
(23±2) ℃	34530-11-3	0.118	0	0	0	0	0	No	No
(50±10)% RH	34530-11-4	0.119	0	0	0	0	0	No	No
	34530-11-5	0.118	0	0	0	0	0	No	No
	Avg:	0.118	Max: 0			Sum: 0	Max: 0	Pass	Pass
Condition B:	34530-11-6	0.120	0	0	0	0	0	No	No
24 Hours	34530-11-7	0.119	0	0	0	0	0	No	No
(125±2) ℃	34530-11-8	0.118	0	0	0	0	0	No	No
	34530-11-9	0.117	0	0	0	0	0	No	No
Results	34530-11-10	0.118	0	0	0	0	0	No	No
V-0	Avg:	0.118	Max: 0			Sum: 0	Max: 0	Pass	Pass
Requirement	V-0								

Table 21 Vertical Burning Test Thick

Sample Designation		CCL			Sample Identification		TU-883		
Test Date		2022-07-14~2022-07-20			Ambient		25 °C, 51% 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:	34530-32-1	0.617	8	0	0	8	0	No	No
48 Hours	34530-32-2	0.616	8	0	0	8	0	No	No
(23±2) ℃	34530-32-3	0.615	7	0	0	7	0	No	No
(50±10)% RH	34530-32-4	0.614	6	0	0	6	0	No	No
	34530-32-5	0.615	8	0	0	8	0	No	No
	Avg:	**0.615**	**Max: 8**			**Sum: 37**	**Max: 0**	**Pass**	**Pass**
Condition B:	34530-32-6	0.617	7	0	0	7	0	No	No
24 Hours	34530-32-7	0.615	6	0	0	6	0	No	No
(125±2) ℃	34530-32-8	0.618	8	0	0	8	0	No	No
	34530-32-9	0.617	6	0	0	6	0	No	No
Results	34530-32-10	0.616	7	0	0	7	0	No	No
V-0	**Avg:**	**0.617**	**Max: 8**			**Sum: 34**	**Max: 0**	**Pass**	**Pass**
Requirement	V-0								

Glass Transition Temperature

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.4.25D Glass Transition Temperature and Cure Factor by DSC
Customer Technical Requirement

RESULTS

Table 22 Glass Transition Temperature

Sample Designation	CCL	Sample Identification	TU-883
Test Date	2022-07-07~2022-07-12	Ambient	28 ℃, 52% RH
Sample Number	34530-37-7		
Element	Measurement (℃)		Requirement
Tg1	/		/
Tg2	/		/
Cure Factor △Tg	/		/

Decomposition Temperature

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 method 2.4.24.6 Decomposition Temperature (Td) of Laminate Material Using TGA
Customer Technical Requirements

RESULTS

Table 23 Decomposition Temperature

Sample Designation	CCL	Sample Identification	TU-883
Test Date	2022-07-07~2022-07-11	Ambient	28 °C, 56% RH
Sample Number	Decomposition temperature (℃)		
	mass loss at 2%	mass loss at 5%	
34530-26-3	427.75	444.57	
Requirement	/	≥400	

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Z-Axis CTE (TMA)

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.4.24C Glass Transition Temperature and Z-Axis Thermal Expansion by TMA
Customer Technical Requirements

RESULTS

Table 24 Z-Axis CTE（TMA）

Sample Designation	CCL		Sample Identification	TU-883	
Test Date	2022-07-07~2022-07-11		Ambient	28 °C, 56% RH	
Sample Number	Z-CTE(μm/m·℃)			PTE（%）	Tg(℃)
	(50~100)℃	(200~250)℃	(50~260)℃	(50~260)℃	
34530-26-1	49.05	183.9	101.1	2.12	197.27
34530-26-2	45.91	184.7	101.9	2.14	195.28
Requirement	≤50	≤275	/	≤2.8	≥170

Time to Delamination

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.4.24.1 Time to Delamination (TMA Method)
Customer Technical Requirements

RESULTS

Table 25 Time to Delamination

Sample Designation	CCL	Sample Identification	TU-883	
Test Date	2022-07-07~2022-07-14	Ambient	28 °C, (50~54)% RH	
Sample No.	Test Item	Time of Reversible Event (min)	Time of Delaminate (min)	Requirement (min)
34530-37-1	T260	/	＞60	≥60
34530-37-2		/	＞60	
34530-37-3	T288	/	＞60	≥60
34530-37-4		/	＞60	
34530-37-5	T300	/	＞30	≥30
34530-37-6		/	＞30	

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Glass Transition Temperature (DMA)

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.4.24.4 Glass Transition and Modulus of Materials Used in High Density Interconnection (HDI) and Microvias-DMA Method
Customer Technical Requirements

RESULTS

Table 26 Glass Transition Temperature(DMA)

Sample Designation	CCL	Sample Identification	TU-883
Test Date	2022-07-14	Ambient	25 ℃, 65% RH
Sample No.	Tg (℃)		
34530-39-1	231.14		
Requirement	≥170		

Dimensional Stability

REFERENCES

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.4.39A Dimensional Stability, Glass Reinforced Thin Laminates
Customer Technical Requirement

RESULTS

Table 27 Dimensional Stability Thin

Sample Designation	CCL		Sample Identification	TU-883			
Test Date	2022-07-28~2022-08-01		Ambient	23°C, 49% RH			
Sample No.	After Bake Process (ppm)				After Thermal Stress Process (ppm)			
	MD		TD		MD		TD	
34530-39	-132	-52	-51	-35	-172	-52	-129	-106
34530-40	-64	-60	-47	-28	-189	-217	-71	-110
34530-41	-76	-76	-75	-51	-169	-165	-165	-244
Requirement	-300~300							

Table 28 Dimensional Stability Thick

Sample Designation	CCL		Sample Identification	TU-883			
Test Date	2022-07-18~2022-07-20		Ambient	(23~25)℃, 49% RH			
Sample No.	After Bake Process (ppm)				After Thermal Stress Process (ppm)			
	MD		TD		MD		TD	
34530-33	-4	-32	-4	-47	-12	-100	-27	-126
34530-34	36	-32	0	-47	-36	-145	-82	-130
34530-35	12	-36	-98	-63	-80	-156	-122	-130
Requirement	-300~300							

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Solderability

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC J-STD-003C Solderability Tests for Printed Boards Section 4.2.1 Edge Dip Test
Customer Technical Requirements

RESULTS

Table 29 Solderability

Sample Designation	CCL	**Sample Identification**	TU-883
Test Date	2022-07-12	**Ambient**	25 ℃, 49% RH
Sample No.		**Test result**	
34530-15-1	Thin	Sample surface exhibits good wetting	
34530-15-2		Sample surface exhibits good wetting	
34530-15-3		Sample surface exhibits good wetting	
34530-36-1	Thick	Sample surface exhibits good wetting	
34530-36-2		Sample surface exhibits good wetting	
34530-36-3		Sample surface exhibits good wetting	

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Chemical Resistance

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.3.4.2A Chemical Resistance of Laminates, Prepreg, and Coated Foil Products, by Solvent Exposure
Customer Technical Requirements

RESULTS

Table 30 Chemical Resistance

Sample Designation	CCL			Sample Identification	TU-883	
Test Date	2022-07-07~2022-07-14			Ambient	28 °C, 54% RH	
Sample No.	Thickness（mm）	Weight (mg)		Increase Weight (mg)	Appearance Inspection	
		W_1	W_2	W_2-W_1	After Bake	After Immerse in the Solvent
34530-6-7	0.120	486.8	506.7	19.9	no any change	no any change
34530-6-8	0.120	481.2	499.8	18.6	no any change	no any change
34530-6-9	0.120	486.1	505.9	19.8	no any change	no any change
Average				19.4	/	
34530-26-13	0.622	2759.3	2779.4	20.1	no any change	no any change
34530-26-14	0.619	2730.2	2752.2	22.0	no any change	no any change
34530-26-15	0.619	2747.3	2771.2	23.9	no any change	no any change
Average				22.0	/	

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Metal Surface Cleanablility

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM-650 Method 2.3.1.1 Chemical Cleaning of Metal-Clad Laminate
Customer Technical Requirements

RESULTS

Table31 Metal Surface Cleanability

Sample Designation	CCL	Sample Identification	TU-883
Test Date	2022-07-07~2022-07-15	Ambient	28 °C, 50% RH
Sample Number	Test Result		
34530-37-8	The metal cladding on the test specimen shall be cleaned to a uniform matte finish. Deionized or distilled water poured on the metal surface does not bead or form puddles.		
34530-37-9	The metal cladding on the test specimen shall be cleaned to a uniform matte finish. Deionized or distilled water poured on the metal surface does not bead or form puddles.		
34530-37-10	The metal cladding on the test specimen shall be cleaned to a uniform matte finish. Deionized or distilled water poured on the metal surface does not bead or form puddles.		
Requirements	The metal cladding on the test specimen shall be cleaned to a uniform matte finish. Deionized or distilled water poured on the metal surface does not bead or form puddles.		

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Pressure Cooker Test

REFERENCE

IPC-4101E-WAM1 Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-TM 650 2.6.16 Pressure Vessel Method for Glass Epoxy Laminate Integrity
Customer Technical Requirements

RESULTS

Table 32 Pressure Cooker Test

Sample Designation	CCL	Sample Identification	TU-883
Test Date	2022-07-14	Ambient	25 °C, 50% RH
Sample No.	Test result		
34530-38-1	Grade 5: The sample have no measles, blisters, or surface erosion.		
34530-38-2	Grade 5: The sample have no measles, blisters, or surface erosion.		
34530-38-3	Grade 5: The sample have no measles, blisters, or surface erosion.		
34530-38-4	Grade 5: The sample have no measles, blisters, or surface erosion.		
34530-38-5	Grade 5: The sample have no measles, blisters, or surface erosion.		

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Edited by:	Reviewed by:	Approved by:
Sheadon Xu	Celina Gu	Gestar
Sheadon Xu Testing Engineer Date: 2022-08-18	Celina Gu Project Manager Date: 2022-08-18	Gestar Laboratory Manager Date: 2022-08-18