



# 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-WAM1/126, 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, 2.4.24.6, 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,  
Dimensional Stability, Solderability, Chemical Resistance, Metal  
Surface Cleanability, Pressure Cooker Test

**SAMPLE:** CCL

**TEST MATERIAL:** TU-872SLK

**SPECIFICATION:** IPC-4101E-WAM1/126

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

**DATE OF REPORT:** 4 August 2022

**REPORT No.:** 34528E



**"INTEGRITY, HONESTY AND KNOWLEDGE"**

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## **SUMMARIZED TEST RESULTS:**

<b><u>Test Item</u></b>	<b><u>Thin</u></b>	<b><u>Thick</u></b>
Peel Strength	Pass	Pass
Volume Resistivity	Pass	Pass
Surface Resistivity	Pass	Pass
Moisture Absorption	--	Pass
Dielectric Breakdown	--	Pass
Permittivity at 1 MHz, 1 GHz	Pass	Pass
Loss Tangent at 1 MHz, 1 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
Dimensional Stability	Pass	Pass
Solderability	Pass	Pass
Chemical Resistance	Report Only	Report Only
Metal Surfaces Cleanability	--	Report Only
Pressure Cooker Test	--	Report Only



## 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 Requirement

### RESULTS

**Table 1 Peel Strength After Thermal Stress Thin**

Sample Designation	CCL		Sample Identification	TU-872SLK
Test Date	2022-07-16		Ambient	24°C, 48%RH
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
34528-1-1-1	0.81			
34528-1-1-2	0.81			
34528-1-1-3		0.81		
34528-1-1-4		0.81		
34528-1-1-5			0.81	
34528-1-1-6			0.81	
34528-1-1-7				0.81
34528-1-1-8				0.81
Average	0.81	0.81	0.81	0.81
Requirement	≥0.80			



Table 2 Peel Strength After Thermal Stress Thick

Sample Designation	CCL		Sample Identification	TU-872SLK
Test Date	2022-07-16		Ambient	24°C, 48%RH
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
34528-21-1-1	1.06			
34528-21-1-2	1.06			
34528-21-1-3		1.06		
34528-21-1-4		1.05		
34528-21-1-5			1.06	
34528-21-1-6			1.06	
34528-21-1-7				1.06
34528-21-1-8				1.06
Average	1.06	1.05	1.06	1.06
Requirement	≥1.05			

Table 3 Peel Strength At Elevated Temperature Thin

Sample Designation	CCL		Sample Identification	TU-872SLK
Test Date	2022-07-15		Ambient	25°C, 49%RH
Sample No.	Peel Strength (N/mm)			
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise
34528-1-2-1	0.71			
34528-1-2-2	0.71			
34528-1-2-3		0.72		
34528-1-2-4		0.72		
34528-1-2-5			0.71	
34528-1-2-6			0.71	
34528-1-2-7				0.71
34528-1-2-8				0.71
Average	0.71	0.72	0.71	0.71
Requirement	≥0.70			



Table 4 Peel Strength At Elevated Temperature Thick

Sample Designation	CCL			Sample Identification	TU-872SLK
Test Date	2022-07-15			Ambient	25°C, 49%RH
Sample No.	Peel Strength (N/mm)				
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise	
34528-21-2-1	0.92				
34528-21-2-2	0.93				
34528-21-2-3		0.96			
34528-21-2-4		0.94			
34528-21-2-5			0.93		
34528-21-2-6			0.94		
34528-21-2-7				0.92	
34528-21-2-8				0.93	
Average	0.93	0.95	0.93	0.93	
Requirement	≥0.70				

Table 5 Peel Strength After Process Solution Thin

Sample Designation	CCL			Sample Identification	TU-872SLK
Test Date	2022-07-19			Ambient	24°C, 48%RH
Sample No.	Peel Strength (N/mm)				
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise	
34528-2-1-1	0.80				
34528-2-1-2	0.79				
34528-2-1-3		0.81			
34528-2-1-4		0.82			
34528-2-1-5			0.80		
34528-2-1-6			0.79		
34528-2-1-7				0.84	
34528-2-1-8				0.84	
Average	0.79	0.81	0.79	0.84	
Requirement	≥0.55				



Table 6 Peel Strength After Process Solution Thick

Sample Designation	CCL			Sample Identification	TU-872SLK
Test Date	2022-07-19			Ambient	24°C, 48%RH
Sample No.	Peel Strength (N/mm)				
	Top Crosswise	Top Lengthwise	Bottom Crosswise	Bottom Lengthwise	
34528-22-1-1	1.02				
34528-22-1-2	1.00				
34528-22-1-3		1.08			
34528-22-1-4		1.04			
34528-22-1-5			1.10		
34528-22-1-6			1.09		
34528-22-1-7				1.11	
34528-22-1-8				1.13	
Average	1.01	1.06	1.10	1.12	
Requirement	≥0.80				

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					



## 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-872SLK	
Test Date	2022-07-14~2022-07-18		Ambient	25 °C, 52% RH	
Sample No.	Average Thickness T	Surface Resistance R	Surface Resistivity $r=RP/D_4$	Volume Resistance R	Volume Resistivity $r=RA/T$
	(cm)	(MΩ)	(MΩ)	(MΩ)	(MΩ·cm)
34528-3-1	0.0104	9.0E+05	2.9E+08	8.0E+05	4.0E+08
34528-3-2	0.0105	8.0E+05	2.6E+08	9.0E+05	4.4E+08
34528-3-3	0.0103	1.0E+06	3.2E+08	8.0E+05	4.0E+08
<b>Average</b>		/	2.9E+08	/	4.1E+08
<b>Requirement</b>		/	$\geq 10^4$	/	$\geq 10^6$





Table 10 Volume and Surface Resistivity at Elevated Temperature Humidity Thin

Sample Designation	CCL		Sample Identification	TU-872SLK	
Test Date	2022-07-19~2022-07-20		Ambient	25 °C, 53% RH	
Sample No.	Average Thickness T	Surface Resistance R'	Surface Resistivity $r'=RP/D_4$	Volume Resistance R	Volume Resistivity $r=RA/T$
	(cm)	(MΩ)	(MΩ)	(MΩ)	(MΩ·cm)
34528-4-1	0.0105	1.8E+06	5.8E+08	9.0E+05	4.4E+08
34528-4-2	0.0106	2.0E+06	6.4E+08	1.0E+06	4.9E+08
34528-4-3	0.0105	2.0E+06	6.4E+08	9.0E+05	4.4E+08
Average		/	6.2E+08	/	4.6E+08
Requirement		/	$\geq 10^3$	/	$\geq 10^3$

Table 11 Volume and Surface Resistivity Humidity Conditioning Thick

Sample Designation	CCL		Sample Identification	TU-872SLK	
Test Date	2022-07-14~2022-07-21		Ambient	23 °C, 53% RH	
Sample No.	Average Thickness T	Surface Resistance R'	Surface Resistivity $r'=RP/D_4$	Volume Resistance R	Volume Resistivity $r=RA/T$
	(cm)	(MΩ)	(MΩ)	(MΩ)	(MΩ·cm)
34528-23-1	0.0618	8.0E+05	2.3E+07	5.0E+05	2.1E+08
34528-23-2	0.0617	1.2E+06	3.4E+07	8.0E+05	3.3E+08
34528-23-3	0.0619	9.0E+05	2.5E+07	6.5E+05	2.7E+08
Average		/	2.7E+07	/	2.7E+08
Requirement		/	$\geq 10^4$	/	$\geq 10^4$



Table 12 Volume and Surface Resistivity at Elevated Temperature Humidity Thick

Sample Designation	CCL		Sample Identification	TU-872SLK	
Test Date	2022-07-14~2022-07-15		Ambient	24 °C, 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)
34528-24-1	0.0619	2.0E+06	5.7E+07	1.6E+06	6.6E+08
34528-24-2	0.0617	4.0E+06	1.1E+08	1.8E+06	7.5E+08
34528-24-3	0.0618	1.8E+06	5.1E+07	1.0E+06	4.2E+08
<b>Average</b>		/	7.4E+07	/	6.1E+08
<b>Requirement</b>		/	$\geq 10^3$	/	$\geq 10^3$



## 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-872SLK
Test Date	2022-07-07~2022-07-14		Ambient	28 °C, (50~54)% RH
Sample No.	mass(g)		increasing weight percent of mass(%)	
	m <sub>1</sub>	m <sub>2</sub>		
34528-26-4	2.8348	2.8403		0.19
34528-26-5	2.8142	2.8194		0.18
34528-26-6	2.8360	2.8409		0.17
<b>Average</b>				0.18
<b>Requirement</b>				≤0.5



## 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-872SLK
Test Date		2022-07-10~2022-07-12	Ambient	25 °C, 50% RH
Sample No.		Thickness (mm)	Voltage (kV)	Minimum Voltage (kV)
34528-27-1	Machine direction	0.616	43.3+N.B	43+N.B
34528-27-2		0.617	42.9+N.B	
34528-27-3	Transverse direction	0.618	43.2+N.B	
34528-27-4		0.617	43.0+N.B	
Requirement				≥40



## 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-872SLK
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
34528-6-1	1 MHz	0.106	3.3	0.008
34528-6-2		0.107	3.2	0.007
34528-6-3		0.107	3.4	0.008
Average		0.107	3.3	0.008
Requirement			≤5.4	≤0.035
34528-26-7	1 MHz	0.617	4.0	0.007
34528-26-8		0.618	4.0	0.008
34528-26-9		0.617	4.1	0.008
Average		0.617	4.0	0.008
Requirement			≤5.4	≤0.035
34528-6-4	1 GHz	0.111	3.3	0.002
34528-6-5		0.112	3.2	0.003
34528-6-6		0.111	3.3	0.002
Average		0.111	3.3	0.002
Requirement			≤5.2	≤0.035
34528-26-10	1 GHz	0.621	3.9	0.006
34528-26-11		0.620	3.9	0.006
34528-26-12		0.620	3.9	0.006
Average		0.620	3.9	0.006
Requirement			≤5.2	≤0.035



## 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-872SLK		
Test Date	2022-07-18		Ambient		24°C, 49%RH		
Sample No.	Span	Load	Width	Thickness	Flexural Strength S	Average	Requirement
	L	P	b	d			
	(mm)	(N)	(mm)	(mm)			
34528-28-1 (Length Direction)	15.90	170.853	25.90	0.615	416	420	≥415
34528-28-2 (Length Direction)		172.538	25.80	0.614	423		
34528-28-3 (Cross Direction)		160.813	26.00	0.612	394	386	≥345
34528-28-4 (Cross Direction)		148.615	25.24	0.610	377		



## 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-872SLK	
Test Date	2022-07-10~2022-07-12	Ambient	25 °C, 49% RH	
Sample No.	Thickness	Times	Average	Requirement
	(mm)	(s)	(s)	(s)
34528-7-1	0.105	127	127	≥60
34528-7-2	0.106	127		
34528-7-3	0.105	127		
34528-29-1	0.617	142	141	
34528-29-2	0.618	143		
34528-29-3	0.617	139		



## 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-872SLK
Test Date	2022-07-12		Ambient	25 °C, 47%RH
Sample No.			Test result	
34528-8-1	Etched	Top	Thin	No evidence of blistering, delamination, wrinkling and cracking
34528-8-2				No evidence of blistering, delamination, wrinkling and cracking
34528-8-3				No evidence of blistering, delamination, wrinkling and cracking
34528-8-4		Bottom		No evidence of blistering, delamination, wrinkling and cracking
34528-8-5				No evidence of blistering, delamination, wrinkling and cracking
34528-8-6				No evidence of blistering, delamination, wrinkling and cracking
34528-30-1	Unetched	Top	Thick	No evidence of blistering, delamination, wrinkling and cracking
34528-30-2				No evidence of blistering, delamination, wrinkling and cracking
34528-30-3				No evidence of blistering, delamination, wrinkling and cracking
34528-30-4		Bottom		No evidence of blistering, delamination, wrinkling and cracking
34528-30-5				No evidence of blistering, delamination, wrinkling and cracking
34528-30-6				No evidence of blistering, delamination, wrinkling and cracking
34528-9-1	Unetched	Top	Thin	No evidence of blistering, delamination, wrinkling and cracking
34528-9-2				No evidence of blistering, delamination, wrinkling and cracking
34528-9-3				No evidence of blistering, delamination, wrinkling and cracking
34528-9-4		Bottom		No evidence of blistering, delamination, wrinkling and cracking
34528-9-5				No evidence of blistering, delamination, wrinkling and cracking
34528-9-6				No evidence of blistering, delamination, wrinkling and cracking
34528-31-1	Unetched	Top	Thick	No evidence of blistering, delamination, wrinkling and cracking
34528-31-2				No evidence of blistering, delamination, wrinkling and cracking
34528-31-3				No evidence of blistering, delamination, wrinkling and cracking
34528-31-4		Bottom		No evidence of blistering, delamination, wrinkling and cracking
34528-31-5				No evidence of blistering, delamination, wrinkling and cracking
34528-31-6				No evidence of blistering, delamination, wrinkling and cracking





## 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-872SLK
Test Date	2022-07-10~2022-07-12	Ambient	25 °C, 50% RH
Sample No.	Average Thickness (mm)	Voltage (kV)	Electric Strength (kV/mm)
34528-10-1	0.104	7.8	75.00
34528-10-2	0.105	7.4	70.48
34528-10-3	0.106	7.6	71.70
<b>Average</b>			72
<b>Requirement</b>			≥30



## 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-872SLK		
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 <sub>1</sub> )	(t <sub>2</sub> )	(t <sub>3</sub> )	(t <sub>1</sub> + t <sub>2</sub> )	(t <sub>2</sub> + t <sub>3</sub> )		
<b>Condition A:</b>	34528-11-1	0.106	0	0	0	0	0	No	No
<b>48 Hours</b>	34528-11-2	0.104	0	0	0	0	0	No	No
<b>(23±2) °C</b>	34528-11-3	0.105	0	0	0	0	0	No	No
<b>(50±10)% RH</b>	34528-11-4	0.106	0	0	0	0	0	No	No
	34528-11-5	0.105	0	0	0	0	0	No	No
	<b>Avg:</b>	<b>0.105</b>	<b>Max: 0</b>			<b>Sum: 0</b>	<b>Max: 0</b>	<b>Pass</b>	<b>Pass</b>
<b>Condition B:</b>	34528-11-6	0.105	0	0	0	0	0	No	No
<b>24 Hours</b>	34528-11-7	0.104	0	0	0	0	0	No	No
<b>(125±2) °C</b>	34528-11-8	0.106	0	0	0	0	0	No	No
	34528-11-9	0.104	0	0	0	0	0	No	No
<b>Results</b>	34528-11-10	0.105	0	0	0	0	0	No	No
<b>V-0 Requirement</b>	<b>Avg:</b>	<b>0.105</b>	<b>Max: 0</b>			<b>Sum: 0</b>	<b>Max: 0</b>	<b>Pass</b>	<b>Pass</b>
					V-0				



Table 21 Vertical Burning Test Thick

Sample Designation		CCL		Sample Identification			TU-872SLK		
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 <sub>1</sub> )	(t <sub>2</sub> )					
<b>Condition A:</b>	34528-32-1	0.619	0	1	0	1	1	No	No
<b>48 Hours</b>	34528-32-2	0.621	2	0	0	2	0	No	No
<b>(23±2) °C</b>	34528-32-3	0.618	4	0	0	4	0	No	No
<b>(50±10)% RH</b>	34528-32-4	0.620	4	0	0	4	0	No	No
	34528-32-5	0.618	3	0	0	3	0	No	No
	<b>Avg:</b>	<b>0.619</b>	<b>Max: 4</b>			<b>Sum: 14</b>	<b>Max: 1</b>	<b>Pass</b>	<b>Pass</b>
<b>Condition B:</b>	34528-32-6	0.619	3	0	0	3	0	No	No
<b>24 Hours</b>	34528-32-7	0.618	2	0	0	2	0	No	No
<b>(125±2) °C</b>	34528-32-8	0.620	4	0	0	4	0	No	No
	34528-32-9	0.619	2	0	0	2	0	No	No
<b>Results</b>	34528-32-10	0.619	2	0	0	2	0	No	No
<b>V-0</b>	<b>Avg:</b>	<b>0.619</b>	<b>Max: 4</b>			<b>Sum: 13</b>	<b>Max: 0</b>	<b>Pass</b>	<b>Pass</b>
<b>Requirement</b>	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**

<b>Sample Designation</b>	CCL	<b>Sample Identification</b>	TU-872SLK
<b>Test Date</b>	2022-07-07~2022-07-12	<b>Ambient</b>	28 °C, 52% RH
<b>Sample Number</b>	34528-37-7		
<b>Element</b>	<b>Measurement (°C)</b>		<b>Requirement</b>
<b>Tg1</b>	201.18		≥170
<b>Tg2</b>	192.61		/
<b>Cure Factor <math>\Delta Tg</math></b>	8.57		/



## 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**

<b>Sample Designation</b>	CCL	<b>Sample Identification</b>	TU-872SLK
<b>Test Date</b>	2022-07-07~2022-07-11	<b>Ambient</b>	28 °C, 56% RH
<b>Sample Number</b>	<b>Decomposition temperature (°C)</b>		
	<b>mass loss at 2%</b>	<b>mass loss at 5%</b>	
34528-26-3	344.26	346.51	
Requirement	/	≥340	



## 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-872SLK	
Test Date	2022-07-07~2022-07-09		Ambient	28 °C, 50% RH	
Sample Number	Z-CTE( $\mu\text{m}/\text{m}\cdot^{\circ}\text{C}$ )			PTE (%)	Tg( $^{\circ}\text{C}$ )
	(50~100) $^{\circ}\text{C}$	(220~260) $^{\circ}\text{C}$	(50~260) $^{\circ}\text{C}$	(50~260) $^{\circ}\text{C}$	
34528-26-1	48.68	268.8	134.1	2.82	184.66
34528-26-2	48.59	250.9	126.2	2.65	184.53
Requirement	$\leq 60$	$\leq 300$	/	$\leq 3.0$	$\geq 170$



## 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-872SLK	
Test Date	2022-07-07~2022-07-12	Ambient	28 °C, (52~56)% RH	
Sample No.	Test Item	Time of Reversible Event (min)	Time of Delaminate (min)	Requirement (min)
34528-37-1	T260	/	>60	≥30
34528-37-2		/	>60	
34528-37-3	T288	/	>15	≥15
34528-37-4		/	>15	
34528-37-5	T300	/	>2	≥2
34528-37-6		/	>2	



## 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 26 Dimensional Stability Thin**

Sample Designation	CCL				Sample Identification	TU-872SLK			
Test Date	2022-07-18~2022-07-20				Ambient	(23~25)°C, 49% RH			
Sample No.	After Bake Process (ppm)				After Thermal Stress Process (ppm)				
	MD		TD		MD		TD		
34528-12	-285	-261	-294	-275	-293	-289	-239	-283	
34528-13	-233	-205	-184	-283	-265	-289	-287	-295	
34528-14	-164	-181	-192	-208	-289	-277	-240	-283	
Requirement	-300~300								

**Table 27 Dimensional Stability Thick**

Sample Designation	CCL				Sample Identification	TU-872SLK			
Test Date	2022-07-18~2022-07-20				Ambient	(23~25)°C, 49% RH			
Sample No.	After Bake Process (ppm)				After Thermal Stress Process (ppm)				
	MD		TD		MD		TD		
34528-33	-161	-173	-55	-35	-169	-169	-106	-102	
34528-34	-72	-108	-82	-12	-108	-120	-133	-122	
34528-35	-108	28	-98	-12	-108	-28	-71	-28	
Requirement	-300~300								





## 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 28 Solderability**

Sample Designation	CCL	Sample Identification	TU-872SLK
Test Date	2022-07-12	Ambient	25 °C, 49% RH
Sample No.		Test result	
34528-15-1	Thin	Sample surface exhibits good wetting	
34528-15-2		Sample surface exhibits good wetting	
34528-15-3		Sample surface exhibits good wetting	
34528-36-1	Thick	Sample surface exhibits good wetting	
34528-36-2		Sample surface exhibits good wetting	
34528-36-3		Sample surface exhibits good wetting	



## 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 29 Chemical Resistance**

Sample Designation	CCL			Sample Identification	TU-872SLK	
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 <sub>1</sub>	W <sub>2</sub>		W <sub>2</sub> -W <sub>1</sub>	After Bake
34528-6-7	0.109	471.8	484.7	12.9	no any change	no any change
34528-6-8	0.111	472.1	484.7	12.6	no any change	no any change
34528-6-9	0.109	471.4	485.5	14.1	no any change	no any change
Average				13.2	/	
34528-26-13	0.619	2804.7	2818.1	13.4	no any change	no any change
34528-26-14	0.619	2844.7	2858.1	13.4	no any change	no any change
34528-26-15	0.619	2819.7	2832.6	12.9	no any change	no any change
Average				13.2	/	



## Metal Surface Cleanability

### 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

**Table 30 Metal Surface Cleanability**

Sample Designation	CCL	Sample Identification	TU-872SLK
Test Date	2022-07-07~2022-07-15	Ambient	28 °C, 50% RH
Sample Number	Test Result		
34528-37-8	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.		
34528-37-9	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.		
34528-37-10	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.		



## 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 31 Pressure Cooker Test**

Sample Designation	CCL	Sample Identification	TU-872SLK
Test Date	2022-07-14	Ambient	25 °C, 50% RH
Sample No.	Test result		
34528-38-1	Grade 5: The sample have no measles, blisters, or surface erosion.		
34528-38-2	Grade 5: The sample have no measles, blisters, or surface erosion.		
34528-38-3	Grade 5: The sample have no measles, blisters, or surface erosion.		
34528-38-4	Grade 5: The sample have no measles, blisters, or surface erosion.		
34528-38-5	Grade 5: The sample have no measles, blisters, or surface erosion.		



Report # 34528ES

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