



**Glass cloth base epoxy resin
Flame retardant copper clad laminate**

NP-155FR

■ FEATURES

- Dicy-Free
- Lead free Compatible
- Excellent dimensional stability and through-hole reliability
- Superior CAF-Resistance (Anti-migration)
- High luminance of multi-functional epoxy contrast with copper for A.O.I
- IPC-4101E L99/101

■ PERFORMANCE LIST

Characteristics		Unit	Condition	Typical Values	SPEC	Test Method
Volume resistivity		MΩ-cm	C-96/35/90	5 x10 ⁹ ~ 5x10 ¹⁰	10 ⁶ ↑	2.5.17
Surface resistivity		MΩ	C-96/35/90	5 x10 ⁸ ~ 5x10 ⁹	10 ⁴ ↑	2.5.17
Permittivity 1MHz		-	C-24/23/50	4.6-4.8	5.4 ↓	2.5.5.9
Permittivity 1GHz		-	C-24/23/50	4.2-4.4	-	2.5.5.9
Loss Tangent 1MHz		-	C-24/23/50	0.016-0.020	0.035 ↓	2.5.5.9
Loss Tangent 1GHz		-	C-24/23/50	0.014-0.016	-	2.5.5.9
Arc resistance		SEC	D-48/50+D-0.5/23	120 ↑	60 ↑	2.5.1
Dielectric breakdown		KV	D-48/50	45 ↑	40 ↑	2.5.6
Moisture absorption		%	D-24/23	0.05-0.10	0.5 ↓	2.6.2.1
Flammability		-	C-48/23/50	V-0	V-0	UL94
Peel strength 1 oz (≥0.5mm)		lb/in	288°Cx10" solder floating	8-10	6 ↑	2.4.8
Thermal stress		SEC	288°C solder dipping	600 ↑	10 ↑	2.4.13.1
Pressure cooker (2 atm 120°C)	1/2 hr	SEC	288°C dipping	600 ↑	N/A	-
	1 hr	SEC	288°C dipping	600 ↑	N/A	-
	2 hrs	SEC	288°C dipping	600 ↑	N/A	-
Flexural strength	LW	N/mm ²	A	480-550	415 ↑	2.4.4
	CW	N/mm ²	A	415-480	345 ↑	2.4.4
Dimensional stability X-Y axis		%	E-2/150	0.005-0.030	0.050 ↓	2.4.39
Coefficient of thermal expansion X/Y-axis		ppm/°C	TMA	12-17	N/A	2.4.24
Z-axis before Tg		ppm/°C	TMA	40-50	60 ↓	
Z-axis after Tg		ppm/°C	TMA	250-270	300 ↓	
50-260°C		%	TMA	3.5%	3.5% ↓	
Glass transition temperature		°C	DSC	155 ± 5	150 ↑	2.4.25
T260		min	TMA	>60	30 ↑	2.4.24.1
T288		min	TMA	>20	5 ↑	2.4.24.1
Decomposition temperature (Td 5% W/L)		°C	TGA	350	325 ↑	2.4.24.6

NOTE:

The average value in the table refers to samples of .062" 1/1.

Test method per IPC-TM-650

Data shown are nominal values for reference only.



**Glass cloth base epoxy resin
Flame retardant copper clad laminate**

NP-155FTL

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- Excellent dimensional stability and through-hole reliability
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- High luminance of multi-functional epoxy contrast with copper for A.O.I
- IPC-4101E L99/101

■ PERFORMANCE LIST

Characteristics	Unit	Condition	Typical Values	SPEC	Test Method
Volume resistivity	MΩ-cm	C-96/35/90	5.0 x10 ⁹	10 ⁶ ↑	2.5.17
Surface resistivity	MΩ	C-96/35/90	5.0 x10 ⁸	10 ⁴ ↑	2.5.17
Permittivity 1 MHz	-	C-24/23/50	4.4-4.6	5.4 ↓	2.5.5.9
Permittivity 1 GHz	-	C-24/23/50	3.9-4.1	-	2.5.5.9
Loss Tangent 1 MHz	-	C-24/23/50	0.016-0.020	0.035 ↓	2.5.5.9
Loss Tangent 1GMHz	-	C-24/23/50	0.012-0.014	-	2.5.5.9
Arc resistance	SEC	D-48/50+D-0.5/23	120 ↑	60 ↑	2.5.1
Dielectric breakdown	KV	D-48/50	45 ↑	40 ↑	2.5.6
Moisture absorption	%	D-24/23	0.20-0.30	0.5 ↓	2.6.2.1
Flammability	-	C-48/23/50	V-0	V-0	UL94
Peel strength 1 oz (≥0.5mm)	lb/in	288°Cx10" solder floating	8-10	6 ↑	2.4.8
Thermal stress	SEC	288°C solder dipping	600 ↑	10 ↑	2.4.13.1
Glass transition temperature	°C	DSC	155 ± 5	150 ↑	2.4.25
Dimensional stability X-Y axis	%	E-4/105	0.01-0.03	0.05 ↓	2.4.39
Coefficient of thermal expansion					
X/Y-axis	ppm/°C	TMA	12-17	N/A	2.4.24
Z-axis before Tg	ppm/°C	TMA	40-50	60 ↓	
Z-axis after Tg	ppm/°C	TMA	250-270	300 ↓	
50-260°C	%	TMA	3.5%	3.5% ↓	
T260	min	TMA	>60	30 ↑	2.4.24.1
T288	min	TMA	>20	5 ↑	2.4.24.1
Decomposition temperature (Td 5% W/L)	°C	TGA	350	325 ↑	2.4.24.6

NOTE:

The average value in the table refers to samples of .020" 1/1.
Test method per IPC-TM-650

Data shown are nominal values for reference only.



■ CONSTRUCTION

THICKNESS mm mil		CONSTRUCTION		THICKNESS mm mil		CONSTRUCTION	
0.05	2	106	1 ply	0.38	15	7628	2 plies
0.08	3	2112	1 ply	0.45	18	7628x2+1080x1	
0.10	4	1080	2 plies	0.50	20	7628	3 plies
0.11	4	2116	1 ply	0.53	21	7628	3 plies
0.13	5	1080	2 plies	0.60	24	7628	3 plies
0.13 sp	5	2116	1 ply	0.77	30	7628	4 plies
0.15	6	1506	1 ply	0.8	31.5	7628	4 plies
0.21	8	7628	1 ply	0.9	36	7628	5 plies
0.26	10	2116	2 plies	1.0	39	7628	5 plies
0.30	12	2116	3 plies	1.1	43	7628	6 plies
0.30 sp	12	1506	2 plies	1.2	47	7628	6 plies
0.35	14	7628	2 plies				

• 1.2, 1.1, 1.0, 0.9, 0.8, 0.77 mm THICKNESS INCLUDE CLADDING, ALL OTHERS EXCLUDE CLADDING

■ PRODUCT SIZE & THICKNESS

THICKNESS inch (mm)	COPPER CLADDING		SIZE		THICKNESS TOLERANCE
	oz (μm)		inch	mm	
0.002 (0.05) to 0.047 (1.2)	Q (9)	3.0 (102)	48.8 x 36.6	1240 x 0930	IPC-4101E SPEC CLASS C/M
	T (12)	4.0 (140)			
	H (17)	5.0 (175)			
	1.0 (35)	6.0 (210)			
	2.0 (70)		48.8 x 42.5	1240 x 1080	

- Keeping the core and prepreg in the same grain direction is crucial to ensure the flatness of multilayer boards.
- Grain direction is shown on the certificate of conformance.
- We recommend to evaluate the drilling property.
- Different oxide treatment may result in variations in the heat resistance properties of the laminates after processing. Pre-production batch runs are recommended to ensure compatibility of materials with chemicals.



Glass cloth base epoxy resin
Flame retardant prepreg

NP-155FB

FEATURES

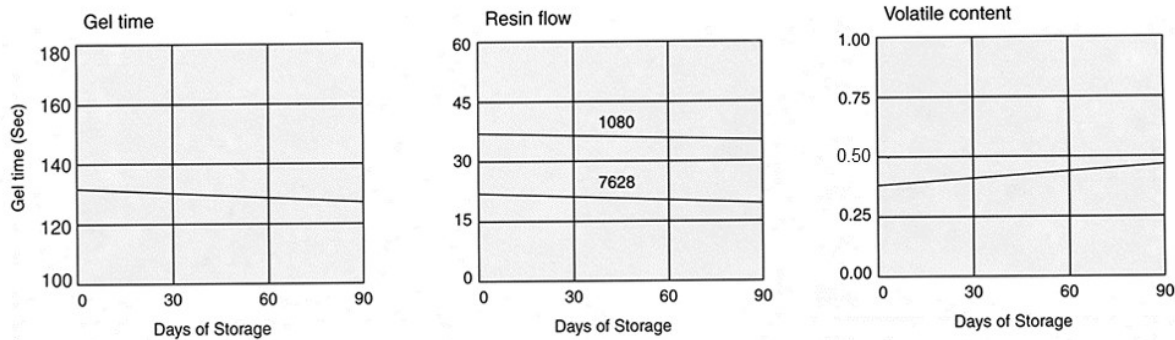
- Dicy-Free
 - Lead-Free compatible
 - Rheology of resin controlled to benefit the lamination of the boards.
 - Multi-functional epoxy provides outstanding heat resistance, better dimensional stability, and through-hole reliability.
 - Superior CAF-Resistance (Anti-migration)
 - We recommend to evaluate the drilling property.
 - Different oxide treatment may result in variations in the heat resistance properties of the laminates after processing.
- Pre-production batch runs are recommended to ensure compatibility of materials with chemicals.

PERFORMANCE LIST

Specification: IPC-4101E is applicable
Data shown are nominal values for reference only. (Remained Copper 70-80%)

Glass style	RC%	GT sec (171°C)	VC%	After Pressed Thickness (per ply)	
				mm	mil
7628HR	52 ± 3	130 ± 20	1.5 ↓	0.199 ± 0.01	7.8 ± 0.4
7628MR	49 ± 3			0.191 ± 0.01	7.5 ± 0.4
7628	45 ± 3			0.181 ± 0.01	7.1 ± 0.4
1506MR	54 ± 3			0.160 ± 0.01	6.3 ± 0.4
1506	50 ± 3			0.150 ± 0.01	6.0 ± 0.4
2116HR	60 ± 3			0.132 ± 0.01	5.2 ± 0.4
2116MR	56 ± 3			0.118 ± 0.01	4.6 ± 0.4
2116	52 ± 3			0.105 ± 0.01	4.1 ± 0.4
2113	58 ± 3			0.090 ± 0.01	3.5 ± 0.4
2112	62 ± 3			0.079 ± 0.008	3.1 ± 0.3
1080HR	70 ± 3			0.076 ± 0.008	3.0 ± 0.3
1080MR	67 ± 3			0.071 ± 0.008	2.8 ± 0.3
1080	64 ± 3			0.064 ± 0.008	2.5 ± 0.3
106	70 ± 3			0.048 ± 0.008	1.9 ± 0.3

Storage Stability

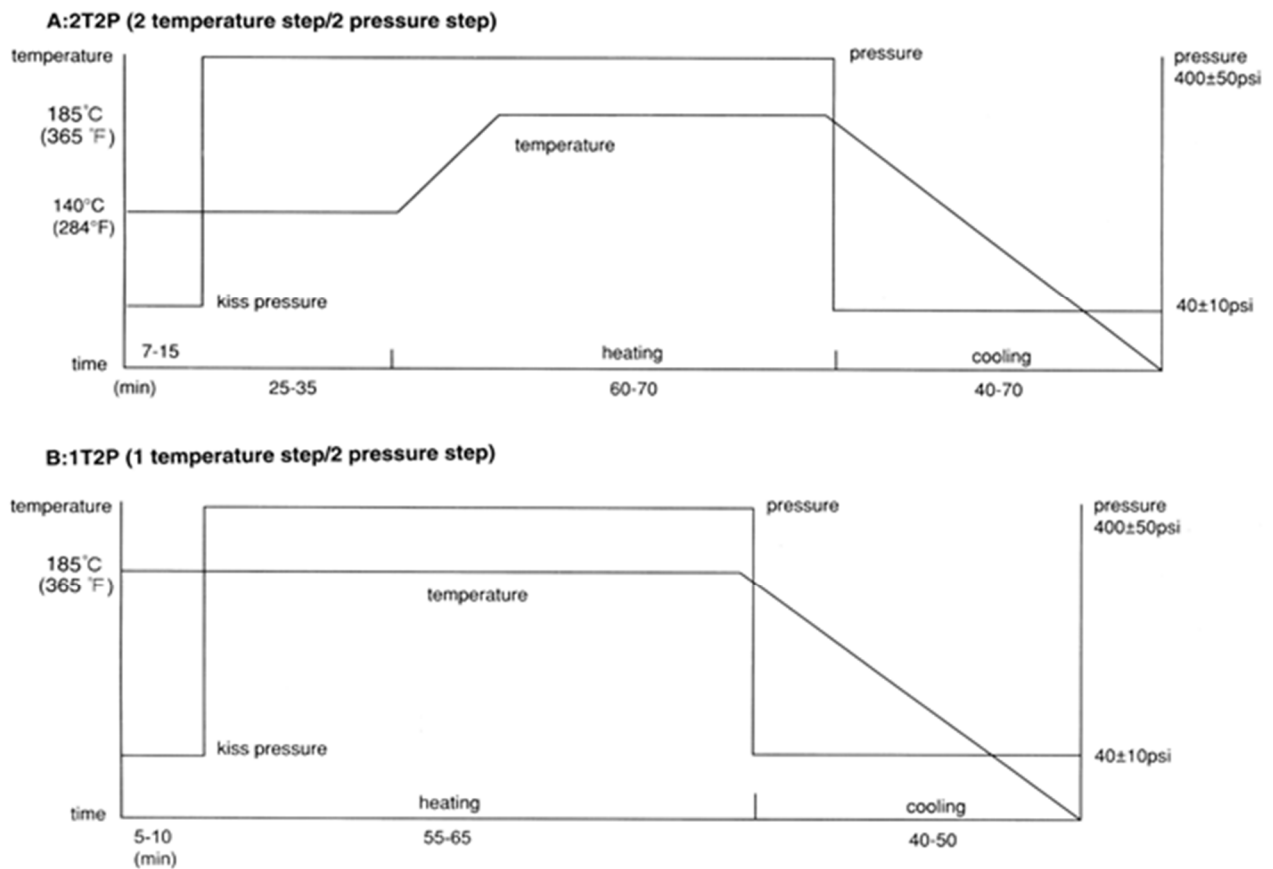


Condition 1: 180 days when stored at <5°C
Condition 2: 90 days when stored at <23°C and <50%RH
(cond.1 or cond. 2 for the applicable specification sheet requirements.)

Data shown are nominal values for reference only.



Recommended press cycles:



Suggestions:

1. Heating rate of material between 70°C and 140°C
1-3°C/min is acceptable.
1.5-2.5°C/min would be better.
2. Temperature of material over 170°C must be held for at least 60min. to allow epoxy resin to fully cure.
3. The pressure should be kept below 100psi during cooling to ambient temperature.
4. Cooling rate of material should be kept under 2.5°C/min when the temperature of material is over 100°C, in order to avoid introducing twist.

CERTIFICATION UL

- UL File No.: E98983
- ANSI TYPE: FR-4.0
- UL 746 Recognition

Minimum Material Thickness inch (mm)	Clad cond. Thickness Min. Max. mils mils (μ m) (μ m)	Max. Area Diameter inch (mm)	Solder Lts Temp Time °C sec	UL 94 Flame Class	Max. Operating Temp
0.002 (0.05)	0.36 8.40 (9) (210)	2.0 (50.8)	300 30	94V-0	130