



**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-4101C/99

**■ PERFORMANCE LIST**

Characteristics	Unit	Conditioning	Typical Values	SPEC	Test Method	
Volume resistivity	MΩ-cm	C-96/35/90	5 x10 <sup>9</sup> ~ 5x10 <sup>10</sup>	10 <sup>6</sup> ↑	2.5.17	
Surface resistivity	MΩ	C-96/35/90	5 x10 <sup>8</sup> ~ 5x10 <sup>9</sup>	10 <sup>4</sup> ↑	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	60 ↑	40 ↑	2.5.6	
Moisture absorption	%	D-24/23	0.05-0.10	0.35 ↓	2.6.2.1	
Flammability	-	C-48/23/50	94V0	94V0	UL94	
Peel strength 1 oz	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 hr	SEC	288°C dipping	600 ↑	N/A	-
Flexural strength	LW	N/mm <sup>2</sup>	A	480-550	415 ↑	2.4.4
	CW	N/mm <sup>2</sup>	A	415-480	345 ↑	2.4.4
Dimensional stability X-Y axis	%	E-0.5/170	0.005-0.030	0.050 ↓	2.4.39	
Coefficient of thermal expansion						
Z-axis before Tg	ppm/°C	TMA	40-60	60 ↓	2.4.24	
Z-axis after Tg	ppm/°C	TMA	250-270	300 ↓		
50-260°C	%	TMA	3.5%	3.5% ↓		
Glass transition temp	°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	
Td (5% Weight Loss)	°C	TGA, 10°C/min	350	325 ↑	-	

**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

**■ 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-4101C/99

**■ PERFORMANCE LIST**

Characteristics	Unit	Conditioning	Typical Values	SPEC	Test Method
Volume resistivity	MΩ-cm	C-96/35/90	5.0 x10 <sup>9</sup>	10 <sup>6</sup> ↑	2.5.17
Surface resistivity	MΩ	C-96/35/90	5.0 x10 <sup>8</sup>	10 <sup>4</sup> ↑	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	60 ↑	40 ↑	2.5.6
Moisture absorption	%	D-24/23	0.20-0.30	0.35 ↓	2.6.2.1
Flammability	-	C-48/23/50	94V0	94V0	UL94
Peel strength 1 oz	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 temp	°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					
Z-axis before Tg	ppm/°C	TMA	40-60	60 ↓	2.4.24
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
Td (5% Weight Loss)	°C	TGA, 10°C/min	350	325 ↑	-

Data shown are nominal values for reference only.

**NOTE:**

The average value in the table refers to samples of .020" 1/1.

Test method per IPC-TM-650



**■ CONSTRUCTION:**

THICKNESS		CONSTRUCTION	THICKNESS		CONSTRUCTION
mm	mil		mm	mil	
0.05	2	106 1 PLY	0.35	14	7628 2 plies
0.08	3	2112 1PLY	0.38	15	7628 2 plies
0.10	4	1080 2 plies	0.45	17	7628x2+1080x1
0.11	4	2116 1 ply	0.50	20	7628 3 plies
0.13	5	1080 2 plies	0.53	21	7628 3 plies
0.13sp 5		2116 1 ply	0.60	24	7628 3 plies
0.15	6	1506 1 ply	0.77	30	7628 4 plies
0.16	6	2112 2 plies	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
0.30sp	12	1506 2 plies	1.2	47	7628 6 plies

• 1.2, 1.1, 1.0, 0.9 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	
0.004 (0.1) to 0.039 (1.0)	Q (9)	3.0 (105)	48.8 x 36.6	1240 x 0930	IPC-4101C SPEC CLASS C/M
	T (12)	4.0 (140)			
	H (17)	5.0 (175)	48.8 x 40.5	1240 x 1030	
	1.0 (35)	6.0 (210)	48.8 x 42.5	1240 x 1080	
	2.0 (70)				

**■ 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.

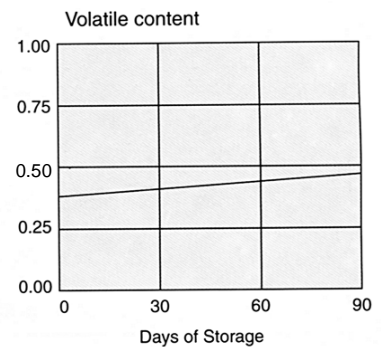
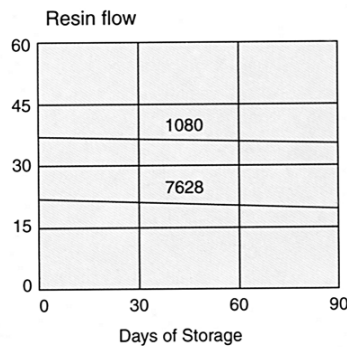
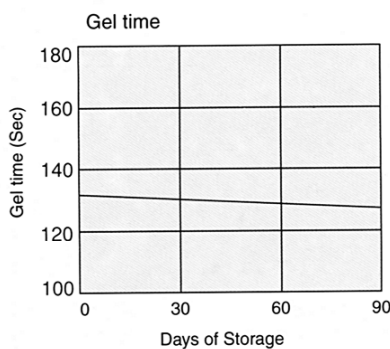
**■ PERFORMANCE LIST**

**Specification: IPC-4101C is applicable**

Data shown are nominal values for reference only. (Remained Copper 70-80%)

Glass style	RC%	RF%	GT sec (171°C)	VC%	After Pressed Thickness (per ply)	
					mm	Mil
7628HR	52 ± 3	31 ± 5	130 ± 20	1.5 ↓	0.199 ± 0.01	7.8 ± 0.4
7628MR	49 ± 3	28 ± 5			0.191 ± 0.01	7.5 ± 0.4
7628	45 ± 3	21 ± 5			0.181 ± 0.01	7.1 ± 0.4
1506MR	54 ± 3	34 ± 5			0.160 ± 0.01	6.3 ± 0.4
1506	50 ± 3	27 ± 5			0.150 ± 0.01	6.0 ± 0.4
2116HR	60 ± 3	40 ± 5			0.132 ± 0.01	5.2 ± 0.4
2116MR	56 ± 3	34 ± 5			0.118 ± 0.01	4.6 ± 0.4
2116	52 ± 3	28 ± 5			0.105 ± 0.01	4.1 ± 0.4
2313	57 ± 3	35 ± 5			0.090 ± 0.01	3.5 ± 0.4
2113	58 ± 3	35 ± 5			0.090 ± 0.01	3.5 ± 0.4
2112	62 ± 3	35 ± 5			0.079 ± 0.008	3.1 ± 0.3
1080HR	70 ± 3	50 ± 5			0.076 ± 0.008	3.0 ± 0.3
1080MR	67 ± 3	45 ± 5			0.071 ± 0.008	2.8 ± 0.3
1080	64 ± 3	40 ± 5			0.064 ± 0.008	2.5 ± 0.3
106	70 ± 3	42 ± 5			0.048 ± 0.008	1.9 ± 0.3

**Storage Stability**

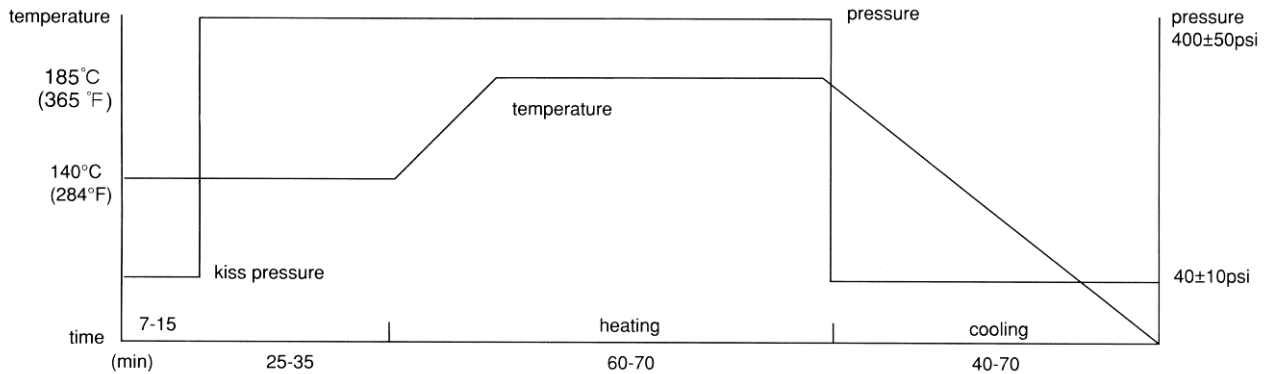


Storage Condition: 20°C, 50% RH for 3 months  
 : Max 5°C for 6 months

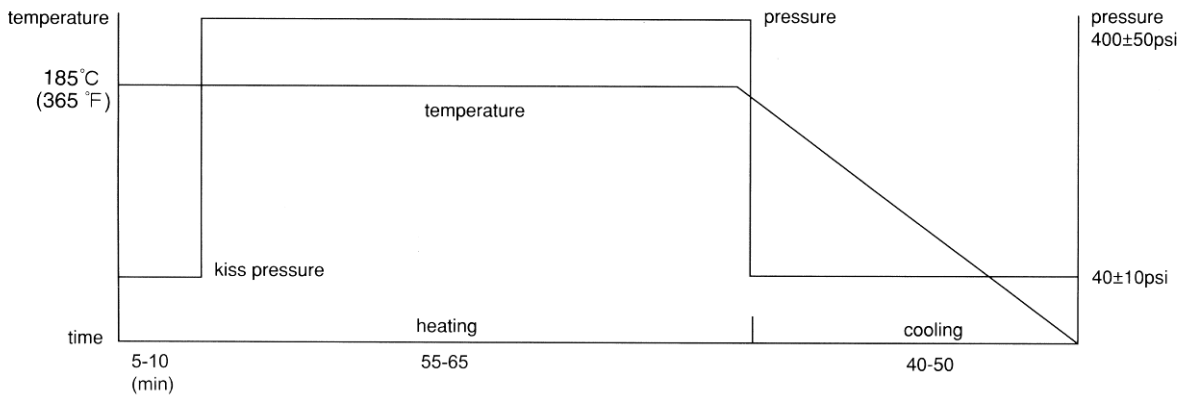


**Recommended press cycles:**

**A:2T2P (2 temperature step/2 pressure step)**



**B:1T2P (1 temperature step/2 pressure step)**



**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

UL 746 Recognition

Minimum Material Thickness inch (mm)	Clad cond. Thickness Min. Max. Mils Mils (mic) (mic)		Max. Area Diameter Inch (mm)	Sold Lts Temp Time °C sec	UL 94 Flame class	Max. Operating Temp
0.002 (0.051)	0.35 (9)	8.26 (210)	2.0 (50.8)	300 30	94V-0	130