



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

NPG-151

■ FEATURES

- Halogen, antimony, and red phosphorous free
- Flammability meets UL 94 V-0
- Excellent thermal resistance and reliability
- U.L file number E98983
- Excellent CAF resistance (Anti-migration)
- Lower C.T.E will provide excellent through-hole reliability
- IPC-4101C//127

■ PERFORMANCE LIST

Characteristics	Unit	Conditioning	Typical Values	SPEC	Test Method
Volume resistivity	MΩ-cm	C-96/35/90	5.5 x10 ⁹	10 ⁶ ↑	2.5.17
Surface resistivity	MΩ	C-96/35/90	5.5 x10 ⁷	10 ⁴ ↑	2.5.17
Permittivity 1 MHZ	-	C-24/23/50	4.3-4.5	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	0.014-0.016	0.035 ↓	2.5.5.9
Loss Tangent 1 GHZ	-	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	0.2-0.3	0.35 ↓	2.6.2.1
Flammability	-	C-48/23/50	94V0	94V0	UL94
Peel strength 1 oz	lb/in	288°C x10" solder floating	8-10	6 ↑	2.4.8
Thermal stress	SEC	288°C solder dipping	300 ↑	10 ↑	2.4.13.1
Glass transition temp	°C	DSC	150 ↑	N/A	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	9-13	N/A	2.4.24
Z-axis before Tg	ppm/°C	TMA	30-50		
Z-axis after Tg	ppm/°C	TMA	200-230		
Decomposition Temperature (Td 5% W/L)	°C	TGA	380	N/A	2.4.24.6

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 AND 1GHz-10GHz Dk/Df:

Mil	mm	Construction	Dk±0.25				DF±0.0005			
			1GHz	3GHz	5GHz	10GHz	1GHz	3GHz	5GHz	10GHz
1.2	0.03	1027*1	3.80	3.77	3.74	3.73	0.014	0.014	0.014	0.014
1.6	0.04	1037*1	3.80	3.77	3.74	3.73	0.014	0.014	0.014	0.014
2	0.05	106*1	3.90	3.87	3.84	3.83	0.014	0.014	0.014	0.014
2	0.05SP	1067*1	4.00	3.97	3.94	3.93	0.014	0.014	0.014	0.014
2.3	0.05SR	106*1	3.89	3.86	3.83	3.82	0.014	0.014	0.014	0.014
2.5	0.06	1080*1	4.11	4.07	4.06	4.03	0.013	0.013	0.013	0.013
2.5	0.061P	1078*1	4.11	4.07	4.06	4.03	0.013	0.013	0.013	0.013
2.5	0.06SP	1067*1	3.95	3.92	3.89	3.86	0.014	0.014	0.014	0.014
3	0.08	2112*1	4.10	4.05	4.05	4.01	0.013	0.013	0.013	0.013
3	0.081P	1086*1	4.00	3.95	3.95	3.90	0.013	0.013	0.013	0.013
3.5	0.09	2112*1	4.09	4.04	4.04	4.00	0.013	0.013	0.013	0.013
4	0.10	1080*2	4.24	4.20	4.19	4.15	0.013	0.013	0.013	0.013
4	0.11	2116*1	4.37	4.35	4.33	4.29	0.012	0.012	0.012	0.012
5	0.13	1080*2	4.02	3.97	3.96	3.91	0.014	0.014	0.014	0.014
5	0.13SP	2116*1	4.09	4.08	4.07	4.05	0.013	0.013	0.013	0.013
6	0.15	1506*1	4.01	3.97	3.96	3.91	0.013	0.013	0.013	0.013
7	0.18	7628*1	4.49	4.41	4.40	4.39	0.012	0.012	0.012	0.012
8	0.21	7628*1	4.39	4.35	4.33	4.29	0.012	0.012	0.012	0.012
9	0.23	2116*2	4.10	4.05	4.04	4.01	0.013	0.013	0.013	0.013
10	0.25	2116*2	4.11	4.04	4.04	4.00	0.013	0.013	0.013	0.013
12	0.30	1506*2	4.44	4.35	4.34	4.32	0.012	0.012	0.012	0.012
14	0.36	7628*2	4.45	4.34	4.34	4.32	0.012	0.012	0.012	0.012
15	0.38	7628*2	4.44	4.35	4.34	4.32	0.012	0.012	0.012	0.012
16	0.41	7628*2	4.38	4.35	4.33	4.29	0.012	0.012	0.012	0.012
18	0.46	2116*1+7628*2	4.38	4.35	4.33	4.29	0.012	0.012	0.012	0.012
20	0.51	7628*3	4.50	4.41	4.40	4.39	0.012	0.012	0.012	0.012
21	0.53	7628*3	4.50	4.41	4.40	4.39	0.012	0.012	0.012	0.012
22	0.56	7628*3	4.44	4.35	4.34	4.32	0.012	0.012	0.012	0.012
24	0.61	7567*3	4.38	4.35	4.33	4.29	0.012	0.012	0.012	0.012
28	0.71	7628*4	4.45	4.34	4.34	4.32	0.012	0.012	0.012	0.012
29	0.74	7628*4	4.44	4.35	4.34	4.32	0.012	0.012	0.012	0.012
31	0.79	7628*4	4.38	4.35	4.33	4.29	0.012	0.012	0.012	0.012

Above data shown are nominal values for reference only.

■ PRODUCT SIZE & THICKNESS

THICKNESS INCH(mm)	COPPER CLADDING		SIZE		THICKNESS TOLERANCE
	OZ	(µm)	INCH	mm	
0.002 (0.05)	T (12)		48.8 x 36.6	1240 x 0930	IPC-4101C SPEC CLASS C/M
to	H (17)	2.0 (70)	48.8 x 40.5	1240 x 1030	
0.039 (1.0)	1.0 (35)	3.0 (105)	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.



**Glass cloth base epoxy resin
 flame retardant prepreg**

NPG -151B

■ FEATURES

- Rheology of resin controlled to benefit the lamination of the boards.
- Modified phosphorous epoxy provides excellent heat and chemical resistance.
- Other properties are similar to standard FR-4

■ PERFORMANCE LIST

Specification : IPC-4101C is applicable

Data shown are nominal values for reference only.

Glass style	RC%	RF%	GT sec (171°C)	VC%	Dk±0.25				DF±0.0005			
					1GHz	3GHz	5GHz	10GHz	1GHz	3GHz	5GHz	10GHz
1027	70±3	39±5	130±20	1.5↓	3.90	3.87	3.85	3.84	0.014	0.014	0.014	0.014
1027MR	74±3	48±5			3.83	3.80	3.78	3.78	0.014	0.014	0.014	0.014
1027HR	76±3	51±5			3.80	3.77	3.75	3.75	0.014	0.014	0.014	0.014
106/1037	70±3	38±5			3.90	3.87	3.85	3.84	0.014	0.014	0.014	0.014
106MR/1037MR	74±3	47±5			3.83	3.80	3.78	3.78	0.014	0.014	0.014	0.014
106HR/1037HR	76±3	50±5			3.80	3.77	3.75	3.75	0.014	0.014	0.014	0.014
1067	70±3	41±5			3.90	3.87	3.85	3.84	0.014	0.014	0.014	0.014
1067MR	74±3	50±5			3.83	3.80	3.78	3.78	0.014	0.014	0.014	0.014
1067HR	76±3	55±5			3.80	3.77	3.75	3.75	0.014	0.014	0.014	0.014
1080	64±3	39±5			3.99	3.96	3.94	3.94	0.014	0.014	0.014	0.014
1080MR	67±3	45±5			3.93	3.90	3.88	3.88	0.014	0.014	0.014	0.014
1080HR	70±3	49±5			3.89	3.86	3.84	3.84	0.014	0.014	0.014	0.014
1078	64±3	39±5			3.98	3.97	3.93	3.93	0.014	0.014	0.014	0.014
1078MR	67±3	45±5			3.92	3.89	3.87	3.87	0.014	0.014	0.014	0.014
1078HR	70±3	49±5			3.88	3.85	3.83	3.83	0.014	0.014	0.014	0.014
2112	62±3	38±5			4.02	3.99	3.97	3.97	0.014	0.014	0.014	0.014
2113	58±3	34±5			4.10	4.07	4.05	4.05	0.013	0.013	0.013	0.013
2116	52±3	28±5			4.22	4.19	4.17	4.17	0.013	0.013	0.013	0.013
2116MR	56±3	35±5			4.14	4.11	4.09	4.09	0.013	0.013	0.013	0.013
2116HR	60±3	40±5			4.06	4.03	4.01	4.01	0.013	0.013	0.013	0.013
1506	50±3	28±5	4.15	4.12	4.10	4.10	0.013	0.013	0.013	0.013		
1506MR	54±3	35±5	4.01	3.98	3.96	3.96	0.013	0.013	0.013	0.013		
7628	45±3	22±5	4.33	4.30	4.28	4.28	0.013	0.013	0.013	0.013		
7628MR	49±3	27±5	4.19	4.16	4.14	4.14	0.013	0.013	0.013	0.013		
7628HR	52±3	32±5	4.08	4.05	4.03	4.03	0.013	0.013	0.013	0.013		



■ After Pressed Theoretical Thickness of prepreg (per ply)

Data shown are nominal values for reference only.

Copper thickness of inner layer Hoz/1oz/2oz

Type	RC%	Press Thk Per Ply						
		Hoz Cu (um)				1oz Cu (um)		
		100%	70%	50%	30%	70%	50%	30%
1027	70%	37	33	30	27	27	20	13
1027MR	74%	43	39	36	33	33	26	19
1027HR	76%	47	42	39	36	36	29	22
106/1037	70%	48	43	39	36	38	31	24
106MR/1037MR	74%	56	51	47	44	46	39	32
106HR/1037HR	76%	61	56	52	49	50	44	37
1067	70%	60	55	51	48	49	43	36
1067MR	74%	70	65	61	58	59	53	46
1067HR	76%	76	71	67	64	66	59	52
1080	64%	78	73	69	66	68	61	54
1080MR	67%	86	81	77	74	76	69	62
1080HR	70%	96	90	87	84	85	78	72
1078	64%	78	73	69	66	68	61	54
1078MR	67%	86	81	77	74	76	69	62
1078HR	70%	96	90	87	84	85	78	72
2112	62%	107	102	98	95	96	90	83
2113	58%	106	100	97	94	95	88	82
2313	57%	107	101	98	95	96	89	83
2116	52%	118	113	109	106	108	101	94
2116MR	56%	131	126	122	119	121	114	107
2116HR	60%	147	142	138	135	136	130	123
1506	50%	175	170	166	163	165	158	151
1506MR	54%	194	189	185	182	184	177	170
7628	45%	196	191	188	185	186	179	172
7628MR	49%	216	211	208	204	206	199	192
7628HR	52%	233	228	225	221	223	216	209

1.  :Considered to be difficult to fill the Cu pattern.

You should carefully examine the to mability of prepreg before mass production

2. Due to the pressed thickness could be effected by press related condition, the table showed for reference only.

3. The glass cloth minimum thickness customer must be concerned

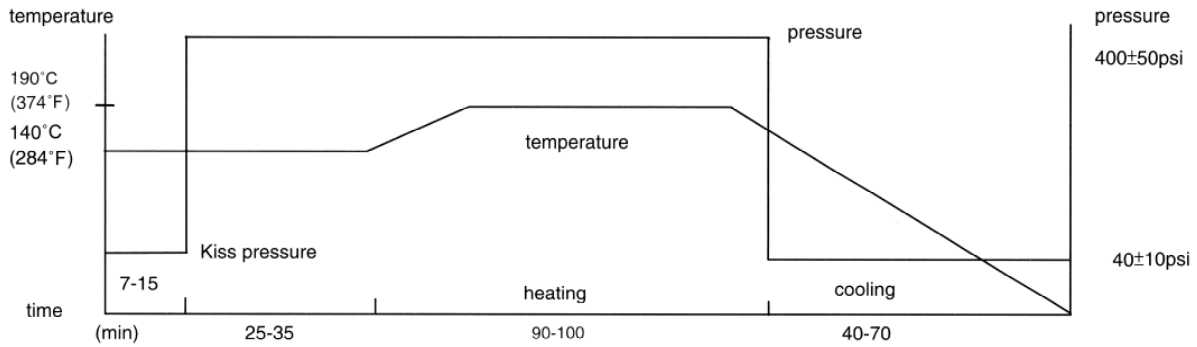
Storage Condition: 20°C 50% RH for 3 months.

Max 5°C for 6 months

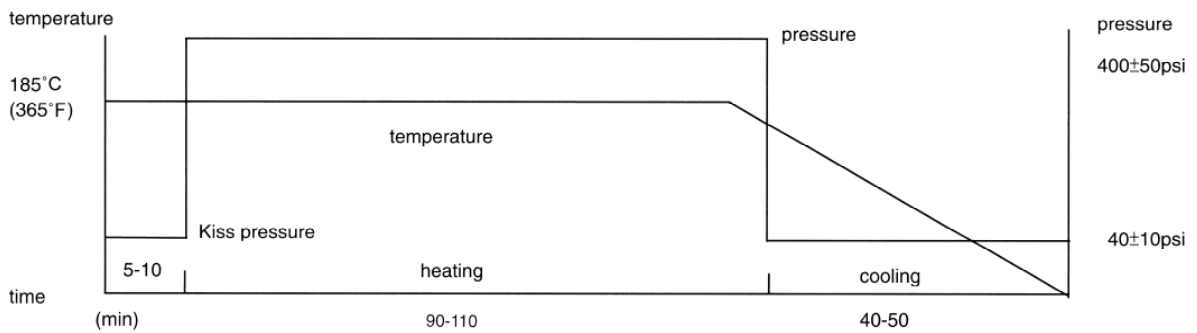


■ **Recommended press cycles:**

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(158°F) and 140°C(284°F).
 1-3°C/min (1.8~5.4°F/min) is acceptable.
 1.5-2.5°C/min (2.7~4.5°F/min) would be better.
2. Temperature of material over 170°C(338°F) must be held for at least 60 min to allow 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 (4.5°F/min) when the temperature of material is over 100°C(212°F), in order to avoid introducing twist.

■ **CERTIFICATION UL**

• UL File No. : E98983 • ANSI TYPE:FR-4.1

UL 746 Recognition

Minimum Material Thickness Inch (mm)	Clad cond. Thickness		Max. Area Diameter inch (mm)	Max. Operating Temp	Sold Lts Temp Time		UL 94 Flame class
	min. mils (mic)	max. mils (mic)			°C	sec	
0.002 (0.051)	0.67 (17)	4.02 (102)	2.0 (50.8)	130	288	30	94V-0