



**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-4101E L127/128

**■ PERFORMANCE LIST**

Characteristics	Unit	Conditioning	Typical Values	SPEC	Test Method	
Volume resistivity	MΩ-cm	C-96/35/90	5.5 x10 <sup>9</sup>	10 <sup>6</sup> ↑	2.5.17	
Surface resistivity	MΩ	C-96/35/90	5.5 x10 <sup>7</sup>	10 <sup>4</sup> ↑	2.5.17	
Permittivity 1 MHz	-	C-24/23/50	4.2-4.4	5.4↓	2.5.5.9	
Permittivity 1 GHz	-	C-24/23/50	3.8-4.0	N/A	2.5.5.9	
Loss Tangent 1 MHz	-	C-24/23/50	0.013-0.015	0.035↓	2.5.5.9	
Loss Tangent 1 GHz	-	C-24/23/50	0.011-0.013	N/A	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	0.10-0.20	0.8↓	2.6.2.1	
Flammability	-	C-48/23/50	94V0	94V0	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	300↑	10↑	2.4.13.1	
Flexural strength*1	LW	N/mm <sup>2</sup>	A	510-580	415↑	2.4.4
	CW	N/mm <sup>2</sup>	A	410-480	345↑	2.4.4
Glass transition temp	°C	TMA	>150	150↑	2.4.24	
Dimensional stability X-Y axis	%	E 4/105	0.01-0.03	0.05↓	2.4.39	
Coefficient of thermal expansion	ppm/°C	TMA	X-Y axis	9-13	N/A	2.4.24
			Z-axis before Tg	30-50	60↓	
			Z-axis after Tg	200-230	300↓	

Data shown are nominal values for reference only.

**NOTE:**

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

\*1: The value measure by the sample of 0.062"

Test method per IPC-TM-650



**■ CONSTRUCTION**

THICKNESS mm      mil		CONSTRUCTION		THICKNESS mm      mil		CONSTRUCTION	
0.05	2	106	1 ply	0.35	14	7628	2 plies
0.08	3	2112	1 ply	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
0.25 2P	10	2155	2 plies	1.0	39	7628	5 plies
0.26	10	2116	2 plies	1.1	43	7628	6 plies
0.30	12	2116	3 plies	1.2	47	7628	6 plies
0.30sp	12	1506	2 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	
0.002 (0.05)	T (12)	H (17)	48.8 x 36.6	1240 x 0930	IPC-4101E SPEC CLASS C/M
to	1.0 (35)	2.0 (70)	48.8 x 40.5	1240 x 1030	
0.039 (1.0)	3.0 (102)		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-4101E is applicable
- Data shown are nominal values for reference only.

Glass style	RC%	RF%	GT sec (171°C)	VC%
1027	70 ± 3	39 ± 5	130 ± 20	1.5↓
1027MR	74 ± 3	46 ± 5		
1027HR	76 ± 3	51 ± 5		
106	70 ± 3	40 ± 5		
106MR	74 ± 3	47 ± 5		
1037	70 ± 3	38 ± 5		
1037MR	74 ± 3	45 ± 5		
106/1037HR	76 ± 3	50 ± 5		
1067	70 ± 3	41 ± 5		
1067MR	74 ± 3	50 ± 5		
1067HR	76 ± 3	55 ± 5		
1078	64 ± 3	40 ± 5		
1078MR	67 ± 3	45 ± 5		
1078HR	70 ± 3	47 ± 5		
1080	64 ± 3	40 ± 5		
1080MR	67 ± 3	45 ± 5		
1080HR	70 ± 3	47 ± 5		
2112	62 ± 3	40 ± 5	120 ± 20	1.5↓
2113	58 ± 3	36 ± 5		
2116	52 ± 3	30 ± 5		
2116MR	56 ± 3	35 ± 5		
2116HR	60 ± 3	43 ± 5		
1506	50 ± 3	28 ± 5		
1506MR	54 ± 3	35 ± 5		
7628	45 ± 3	19 ± 5		
7628MR	49 ± 3	25 ± 5		
7628HR	52 ± 3	28 ± 5		



■ **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						
		100%	Hoz Cu (um)			1oz Cu (um)		
			70%	50%	30%	70%	50%	30%
1017	74%	28	23	19	15	18	-	-
1017MR	76%	31	25	22	18	20	-	-
1017HR	79%	36	30	27	23	25	18	-
1015	74%	40	34	31	27	29	22	-
1015MR	76%	43	38	34	31	33	26	-
1015HR	79%	50	45	41	38	40	33	26
1027	70%	38	32	29	25	27	20	-
1027MR	74%	44	39	35	32	34	27	-
1027HR	76%	49	43	40	36	38	31	-
106/1037	70%	48	42	39	35	37	30	-
106MR/1037MR	74%	56	51	47	43	46	39	32
106HR/1037HR	76%	61	56	52	49	51	44	37
1067	70%	60	54	51	47	49	42	35
1067MR	74%	70	65	61	57	60	53	46
1067HR	76%	77	71	68	64	66	59	52
1078	64%	74	70	67	63	65	58	51
1078MR	67%	84	78	75	71	73	66	59
1078HR	70%	93	88	84	81	83	76	69
1080	64%	77	72	68	65	67	60	53
1080MR	67%	85	80	76	73	75	68	61
1080HR	70%	95	90	86	83	85	78	71
2112	62%	103	98	95	91	93	86	79
2113	58%	104	99	95	92	94	87	80
2116	52%	119	114	110	107	109	102	95
2116MR	56%	133	128	124	120	122	115	108
2116HR	60%	149	144	140	137	139	132	125
1506	50%	175	170	166	162	165	158	151
1506MR	54%	194	189	185	182	184	177	170
7628	45%	199	194	190	186	188	181	174
7628MR	49%	219	214	210	207	209	202	195
7628HR	52%	239	231	227	224	226	219	212

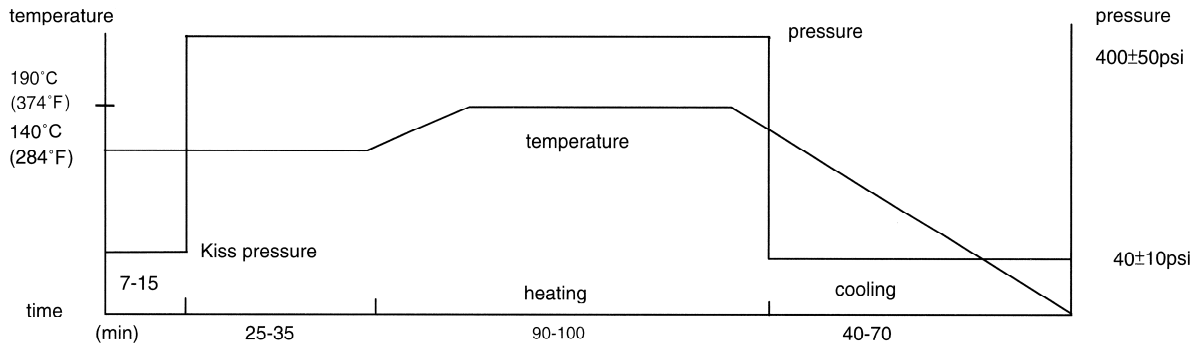
1. : Considered to be difficult to fill the Cu pattern  
 You should carefully examine the to mability of prepreg before mass production
2. Due to the pressed thickness could be effected by press related condition, the table showed for reference only.
3. The glass cloth minimum thickness customer must be concerned

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

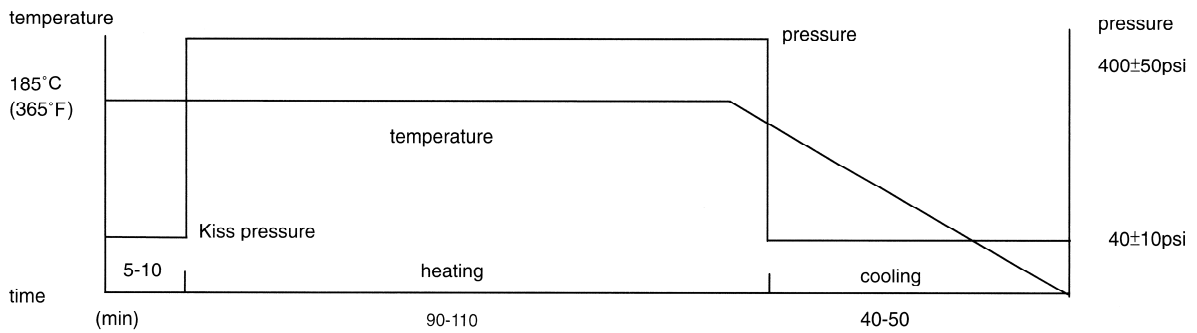


**Recommended press cycles:**

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 °C sec		UL 94 Flame Class
	Min. mils (mic)	Max. mils (mic)			Temp °C	Time sec	
0.002 (0.051)	0.67 (17)	4.02 (102)	2.0 (50.8)	130	288	30	94V-0