



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

# NPLDII-R

**■ FEATURES**

- Low dielectric constant and low dissipation factor at high frequency range
- Greater design flexibility by allowing the same impedance
- Excellent dimensional stability and through-hole reliability
- Lead-free compatibility
- UL file number E98983

**■ PERFORMANCE LIST**

Characteristics	Unit	Conditioning	Typical Values	SPEC	Test Method	
Volume resistivity	MΩ-cm	C-96/35/90	$5.0 \times 10^8 \sim 5 \times 10^9$	$10^6 \uparrow$	2.5.17	
Surface resistivity	MΩ	C-96/35/90	$5.0 \times 10^6 \sim 5 \times 10^7$	$10^4 \uparrow$	2.5.17	
Permittivity 1MHZ	-	C-24/23/50	4.0-4.3	5.4 ↓	2.5.5.9	
Permittivity 1GHZ	-	C-24/23/50	3.6-3.9	-	2.5.5.9	
Loss Tangent 1MHZ	-	C-24/23/50	0.007~0.009	0.035 ↓	2.5.5.9	
Loss Tangent 1GHZ	-	C-24/23/50	0.006-0.007	-	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°Cx10" solder floating	9~10	6 ↑	2.4.8	
Thermal stress	SEC	288°C dipping	300 ↑	10 ↑	2.4.13.1	
Pressure cooker 1/2 hr (2 atm 120°C)	SEC	288°C dipping	300 ↑	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 Z-axis after Tg	ppm/°C	TMA	40-60	N/A	2.4.24	
	ppm/°C	TMA	230-320			
Glass transition temp	°C	DMA	170 ↑	N/A	2.4.25	
Decomposition Temperature (Td 5% W/L)	°C	TGA	360	N/A	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 modified epoxy resin  
 flame retardant copper clad laminate**

# NPLDII-TL

**■ FEATURES**

- Low dielectric constant and low dissipation factor at high frequency range
- Greater design flexibility by allowing the same impedance
- Excellent dimensional stability and through-hole reliability
- Lead-free compatibility
- UL file number E98983

**■ PERFORMANCE LIST**

Characteristics	Unit	Conditioning	Typical Values	SPEC	Test Method	
Volume resistivity	MΩ-cm	C-96/35/90	5x10 <sup>9</sup>	10 <sup>6</sup> ↑	2.5.17	
Surface resistivity	MΩ	C-96/35/90	5 x10 <sup>7</sup>	10 <sup>4</sup> ↑	2.5.17	
Permittivity 1MHZ	-	C-24/23/50	3.9-4.2	5.4 ↓	2.5.5.9	
Permittivity 1GHZ	-	C-24/23/50	3.5-3.8	-	2.5.5.9	
Loss tangent 1MHZ	-	C-24/23/50	0.007~0.009	0.035 ↓	2.5.5.9	
Loss tangent 1GHZ	-	C-24/23/50	0.006-0.007	-	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	<0.78mm	0.20	0.80 ↓	6.2.2.1
			≥0.78mm	0.20	0.35 ↓	6.2.2.1
Flammability	-	C-48/23/50	94V0	94V0	UL94	
Peel strength 1 oz	lb/in	288°C x10" solder floating	9~10	4.5 ↑	2.4.8	
Heat resistance	SEC	288°C dipping	300 ↑	10 ↑	2.4.13.1	
Glass transition temp	°C	DMA	170 ↑	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	ppm/°C	TMA	Z-axis before Tg	40-60	N/A	2.4.24
			Z-axis after Tg	230-320		
Decomposition Temperature (Td 5% W/L)	°C	TGA	360	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		CONSTRUCTION		THICKNESS		CONSTRUCTION	
mm	mil			mm	mil		
0.10	4	1080	2 plies	0.38	15	7628	2 plies
0.11	4	2116	1 ply	0.45	17	7628 x 2 + 1080 x 1	
0.13	5	1080	2 plies	0.50	20	7628	3 plies
0.13sp	5	2116	1 ply	0.53	21	7628	3 plies
0.15	6	1506	1 ply	0.60	24	7628	3 plies
0.16	6	2112	2 plies	0.77	30	7628	4 plies
0.21	8	7628	1 ply	0.8	31.5	7628	4 plies
0.26	10	2116	2 plies	0.9	36	7628	5 plies
0.30	12	2116	3 plies	1.0	39	7628	5 plies
0.30sp	12	1506	2 plies	1.1	43	7628	6 plies
0.35	14	7628	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 OZ (µm)	SIZE		THICKNESS TOLERANCE
		INCH	mm	
0.004 (0.1)	0.5 (17)	48.8 x 36.6	1240 x 0930	IPC-4101C SPEC CLASS C/M
to	1.0 (35)	48.8 x 40.5	1240 x 1030	
0.039 (1.0)	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.**



**Glass cloth base modified epoxy resin  
 Flame retardant prepreg**

# NPLDII-B

**■ FEATURES**

- Rheology of resin controlled to enhance the lamination of the multilayers.
- Other properties are similar to standard FR-4.

**■ PERFORMANCE LIST**

Specification : IPC-4101C is applicable

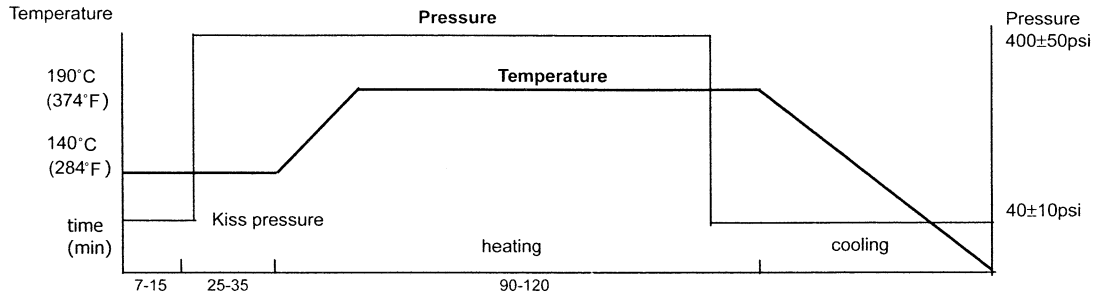
Glass style	RC%	RF%	GT sec (171°C)	VC%	After Pressed Thickness (per ply)	
					Mm	Mil
7628HR	52 ± 3	30 ± 5	300 ± 20	1.5 ↓	0.211 ± 0.01	8.3 ± 0.4
7628MR	49 ± 3	28 ± 5			0.206 ± 0.01	8.1 ± 0.4
7628	45 ± 3	22 ± 5			0.200 ± 0.01	7.9 ± 0.4
1506	50 ± 3	28 ± 5			0.173 ± 0.01	6.8 ± 0.4
2116HR	60 ± 3	38 ± 5			0.147 ± 0.01	5.8 ± 0.4
2116MR	56 ± 3	35 ± 5			0.135 ± 0.01	5.3 ± 0.4
2116	52 ± 3	30 ± 5			0.122 ± 0.01	4.8 ± 0.4
2113	58 ± 3	31 ± 5			0.109 ± 0.01	4.3 ± 0.4
2112	62 ± 3	35 ± 5			0.105 ± 0.08	4.1 ± 0.3
1080HR	70 ± 3	50 ± 5			0.097 ± 0.08	3.8 ± 0.3
1080MR	67 ± 3	40 ± 5			0.089 ± 0.08	3.5 ± 0.3
1080	64 ± 3	38 ± 5			0.081 ± 0.08	3.2 ± 0.3
106	70 ± 3	40 ± 5			0.053 ± 0.08	2.1 ± 0.3

Data shown are nominal values for reference only

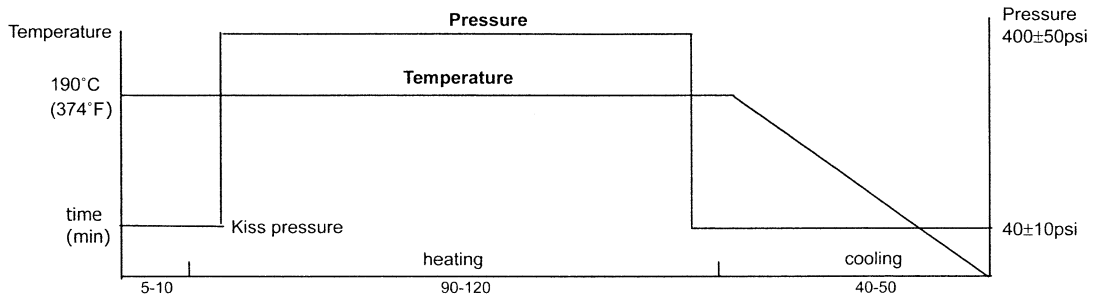


**Recommended press cycles:**

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 60min 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-4.0