

# N4000-12 & N4000-12 SI

## High Speed / Low Loss Epoxy

### Laminate & Prepreg

*Nelco N4000-12 is an enhanced epoxy resin system designed for use in high speed, low loss applications requiring thermal stability, excellent signal speed and CAF resistance.*

#### Key Features

##### Lead-Free Assembly Compatible

- Suitable for assemblies with a maximum reflow temperature of 245 - 260°C

##### Tg >190°C, robust thermal stability

- Designed for high-reliability assemblies demanding wide bandwidth and increased thermal performance
- T<sub>260</sub> >60 minutes
- Low Z-Axis CTE

##### High Speed and Low Loss Properties

- Appropriate for applications in the 1-10 GHz range
- Low Df and Dk allows for low signal distortion and faster signal propagation for high frequency and high reliability applications

##### CAF Resistant

- The low Z-CTE and proven CAF resistance provide long-term reliability for both RF and digital applications

##### SI (Signal Integrity) option

- When used, SI glass provides enhanced electrical performance for even the most demanding applications

##### High-Tg FR-4 processing

- Processes similar to traditional high Tg FR-4 materials
- Provides excellent drilling
- Chemical desmear compatible
- 75 min press at 193°C and 200-300 psi.

##### And Much More

- Vacuum laminated
- Available in a wide variety of constructions, copper weights and glass styles including standard copper, double treat and RTFOIL® laminate.
- Available as a 2 mil core product meeting the specifications of a capacitive laminate
- Meets UL 94V-0 and IPC-4101/29 specifications
- RoHS compliant.

#### Applications

- Lead-Free Assemblies
- Fine-Line Multilayers
- Backplanes
- Surface-Mount Multilayers
- BGA Multilayers
- SIPs
- MCM-Ls
- Direct Chip Attach
- Network Storage
- Wireless Communications Infrastructure
- High Speed Computing

# N4000-12 & N4000-12 SI

## High Speed / Low Loss Epoxy Laminate and Prepreg

Mechanical Properties	N4000-12	-12 SI	U.S. Units	N4000-12	-12 SI	Metric	Test Method
Peel Strength - 1 oz. (35 micron) Cu							
After Solder Float	9.2	9.2	lb / inch	1.61	1.61	N / mm	IPC-TM-650.2.4.8
At Elevated Temperature	8.7	8.7	lb / inch	1.53	1.53	N / mm	IPC-TM-650.2.4.8.2a
After Exposure to Process Solutions	9.3	9.3	lb / inch	1.62	1.62	N / mm	IPC-TM-650.2.4.8
X / Y CTE [-40°C to +125°C]				12 - 15.5	12 - 15.5	ppm / °C	IPC-TM-650.2.4.4.1
Z Axis CTE Alpha 1 [50°C to Tg]				60	60	ppm / °C	IPC-TM-650.2.4.24
Z Axis CTE Alpha 2 [Tg to 260°C]				260	260	ppm / °C	IPC-TM-650.2.4.24
Z Axis Expansion [50°C to 260°C]	3.6	3.6	%	3.6	3.6	%	IPC-TM-650.2.4.24
Young's Modulus (X / Y)	4.1 / 3.4	TBD	psi x 10 <sup>6</sup>	28.3 / 23.4	TBD	GN / m <sup>2</sup>	ASTM D3039
Poisson's Ratios (X / Y)	0.16 / 0.14	TBD		0.16 / 0.14	TBD		ASTM D3039
Thermal Conductivity					0.3 - 0.5	0.29	W / mK ASTM E1461
Specific Heat				1.20	1.14	J / gK	ASTM E1461
<b>Electrical Properties</b>							
Dielectric Constant (50% resin content)							
@ 1 GHz (RF Impedance)	3.7	3.4		3.7	3.4		IPC-TM-650.2.5.5.9
@ 10 GHz (Stripline)	3.6	3.3		3.6	3.3		IPC-TM-650.2.5.5.5
@ 10 GHz (Split Post Cavity)	3.7	3.3		3.7	3.3		
Dissipation Factor (50% resin content)							
@ 2.5 GHz (Split Post Cavity)	0.008	0.006		0.008	0.006		
@ 10 GHz (Split Post Cavity)	0.008	0.007		0.008	0.007		
Volume Resistivity							
C - 96 / 35 / 90				10 <sup>8</sup>	10 <sup>8</sup>	MΩ - cm	IPC-TM-650.2.5.17.1
E - 24 / 125				10 <sup>7</sup>	10 <sup>8</sup>	MΩ - cm	IPC-TM-650.2.5.17.1
Surface Resistivity							
C - 96 / 35 / 90	10 <sup>7</sup>	10 <sup>7</sup>	MΩ	10 <sup>7</sup>	10 <sup>7</sup>	MΩ	IPC-TM-650.2.5.17.1
E - 24 / 125	10 <sup>6</sup>	10 <sup>6</sup>	MΩ	10 <sup>6</sup>	10 <sup>6</sup>	MΩ	IPC-TM-650.2.5.17.1
Electric Strength	1470	TBD	V / mil	5.8x10 <sup>4</sup>	TBD	V / mm	IPC-TM-650.2.5.6.2
Dielectric Breakdown	>50	>50	kV	>50	>50	kV	IPC-TM-650.2.5.6
Arc Resistance	65	65	seconds	65	65	seconds	IPC-TM-650.2.5.1
<b>Thermal Properties</b>							
Glass Transition Temperature (Tg)							
DSC (°C)	190	190	°C	190	190	°C	IPC-TM-650.2.4.25c
TMA (°C)	180	180	°C	180	180	°C	IPC-TM-650.2.4.24c
DMA (°C) (Tan δ Peak)	210	210	°C	210	210	°C	IPC-TM-650.2.4.24.3
Degradation Temp (TGA) (5% wt. loss)	350	350	°C	350	350	°C	IPC-TM-650.2.4.24.6
Pressure Cooker-60 min then solder dip							IPC-TM-650.2.6.16
@288°C until failure (max 10 min.)	Pass	Pass		Pass	Pass		(modified)
T260	>60	>60	minutes	>60	>60	minutes	IPC-TM-650.2.4.24.1
<b>Chemical / Physical Properties</b>							
Moisture Absorption	0.09	0.09	wt. %	0.09	0.09	wt. %	IPC-TM-650.2.6.2.1
Methylene Chloride Resistance	1.0	1.0	% wt. chg.	1.0	1.0	% wt. chg.	IPC-TM-650.2.3.4.3
Density [50% resin content]				1.90	1.78	g / cm <sup>3</sup>	Internal Method

\*DMA is the preferred method for measuring Tg - other methods may be less accurate.

All test data provided are typical values and not intended to be specification values. For review of critical specification tolerances, please contact a company representative directly.