

# Nelco Advanced Circuitry Materials

## Nelco® N4000-7 Nelco® N4000-7 SI®



### CAF Resistant, Low-CTE FR-4 Epoxy Laminate & Prepreg

*The Nelco® N4000-7 low-CTE epoxy laminate and prepreg system is a cost-effective solution for use in a broad range of multilayer PCB designs requiring low Z-axis expansion, excellent thermal stability and superior hole-wall integrity.*

#### Key Features

##### Outstanding Z-axis, thermal stability and hole wall integrity

- Improved thermal, mechanical and chemical properties that meet or exceed those of many high-Tg materials
- Suitable for cost-sensitive, high-reliability applications

##### Automotive Testing

- Passes the stringent Q1000 thermal cycle tests of -40°C to +125°C for 1000 cycles
- Passes the European K8 specification for automotive electronic assemblies

##### SI (Signal Integrity) option

- When used, SI glass provides enhanced electrical performance which can be used for high speed, low loss designs when needed

##### CAF\* resistant

- The low Z-CTE and proven CAF resistance allow N4000-7 to be used in high reliability applications typically reserved for higher Tg materials

##### Cost-effective standard FR-4 processing

- Key processing parameters of drilling, desmear and lamination use standard low Tg FR-4 methods
- Accelerated press cycles and drilling when compared to high Tg materials
- 45 min press at 170°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.
- Meets UL 94V-0 and IPC-4101/98 specifications\*
- All Nelco® materials are RoHS compliant.

\* material also meets the specifications of IPC-4101/24 unfilled slash sheet.

#### Applications

- Wireless Handsets
- Wireless Infrastructure
- Digital Broadband Multilayers
- Automotive
- Underhood Automotive
- Backplanes
- Fine-Line Multilayers
- Fine Pitch BGA Multilayers
- Direct Chip Attach

#### Global Availability

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**Park's UL file number: E36295**

# Nelco® N4000-7 and N4000-7 SI®

## CAF Resistant, Low-CTE FR-4 Epoxy Laminate & Prepreg

Mechanical Properties	N4000-7	N4000-7 SI	U.S. Units	N4000-7	N4000-7 SI	Metric	Test Method
Peel Strength - 1 oz. (35 micron) Cu							
After Solder Float	7.5	7.5	lb/inch	1.31	1.31	N/mm	IPC-TM-650.2.4.8
At Elevated Temperature	8.1	8.1	lb/inch	1.42	1.42	N/mm	IPC-TM-650.2.4.8.2a
After Exposure to Process Solutions	9.0	9.0	lb/inch	1.58	1.58	N/mm	IPC-TM-650.2.4.8
X/Y CTE [-40°C to +125°C]	12 - 15	12 - 15	ppm/°C	12 - 15	12 - 15	ppm/°C	IPC-TM-650.2.4.41
Z Axis CTE Alpha 1 [50°C to Tg]	50	50	ppm/°C	50	50	ppm/°C	IPC-TM-650.2.4.41
Z Axis CTE Alpha 2 [Tg to 260°C]	270	270	ppm/°C	270	260	ppm/°C	IPC-TM-650.2.4.41
Z Axis Expansion [50°C to 260°C]	3.7	3.7	%	3.7	3.7	%	IPC-TM-650.2.4.41
Young's Modulus (X/Y)	3.5/2.8	TBD	psi x 10 <sup>6</sup>	24.1/19.3	TBD	GN/m <sup>2</sup>	ASTM D3039
Poisson's Ratios (X/Y)	0.13/0.11	TBD		0.13/0.11	TBD		ASTM D3039
Thermal Conductivity	0.525	0.525	W/mK	0.525	0.525	W/mK	ASTM E1461
Specific Heat	1.22	1.22	J/gK	1.22	1.22	J/gK	ASTM E1461
<b>Electrical Properties</b>							
Dielectric Constant (50% resin content)							
@ 1 MHz (TFC/LCR Meter)	4.5	4.0		4.5	4.0		IPC-TM-650.2.5.5.3
@ 1 GHz (RF Impedance)	4.0	3.6		4.0	3.6		IPC-TM-650.2.5.5.9
@ 2.5 GHz (Stripline)	3.9	3.4		3.9	3.4		IPC-TM-650.2.5.5.5
@ 10 GHz (Stripline)	3.9	3.3		3.9	3.3		IPC-TM-650.2.5.5.5
Dissipation Factor (50% resin content)							
@ 1 MHz (TFC/LCR Meter)	0.018	0.016		0.018	0.016		IPC-TM-650.2.5.5.3
@ 2.5 GHz (Stripline)	0.017	0.015		0.017	0.015		IPC-TM-650.2.5.5.9
@ 10 GHz (Stripline)	0.017	0.016		0.017	0.016		IPC-TM-650.2.5.5.5
Volume Resistivity							
C - 96/35/90	10 <sup>8</sup>	10 <sup>8</sup>	Mμ - cm	10 <sup>8</sup>	10 <sup>8</sup>	Mμ - cm	IPC-TM-650.2.5.17.1
E - 24/125	10 <sup>7</sup>	10 <sup>7</sup>	Mμ - cm	10 <sup>7</sup>	10 <sup>7</sup>	Mμ - cm	IPC-TM-650.2.5.17.1
Surface Resistivity							
C - 96/35/90	10 <sup>8</sup>	10 <sup>8</sup>	Mμ	10 <sup>8</sup>	10 <sup>8</sup>	Mμ	IPC-TM-650.2.5.17.1
E - 24/125	10 <sup>7</sup>	10 <sup>7</sup>	Mμ	10 <sup>7</sup>	10 <sup>7</sup>	Mμ	IPC-TM-650.2.5.17.1
Electric Strength	1250	1250	V/mil	4.3x10 <sup>4</sup>	4.3x10 <sup>4</sup>	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	124	124	seconds	124	124	seconds	IPC-TM-650.2.5.1
<b>Thermal Properties</b>							
Glass Transition Temperature (Tg)							
DSC (°C)	155	155	°C	155	155	°C	IPC-TM-650.2.4.25c
TMA (°C)	150	150	°C	150	150	°C	IPC-TM-650.2.4.24c
DMA (°C) (Tan δ Peak)	160	160	°C	160	160	°C	IPC-TM-650.2.4.24.3
Degradation Temp (TGA) (5% wt. loss)	330	330	°C	330	330	°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)
T <sub>260</sub>	16	16	minutes	16	16	minutes	IPC-TM-650.2.4.24.1
<b>Chemical/Physical Properties</b>							
Moisture Absorption	0.07	0.07	wt. %	0.07	0.07	wt. %	IPC-TM-650.2.6.2.1
Methylene Chloride Resistance	0.31	0.31	% wt. chg.	0.31	0.31	% wt. chg.	IPC-TM-650.2.3.4.3
Density [50% resin content]	1.97	1.97	g/cm <sup>3</sup>	1.97	1.97	g/cm <sup>3</sup>	Internal Method

Park Electrochemical Corp. is a global advanced materials company which develops and manufactures high-technology digital and RF/microwave printed circuit materials and advanced composite materials. The company operates under the Nelco®, Nelcote® and Nova™ names.

All test data provided are typical values and not intended to be specification values. For review of critical specification tolerances, please contact a Nelco representative directly. Nelco reserves the right to change these typical values as a natural process of refining our testing equipment and techniques.

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\*CAF resistance has been established to greater than 500 hours using a specific OEM coupon design and test procedure. For details on this or other CAF tests, please visit [www.parkellectro.com](http://www.parkellectro.com).

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