

Park Advanced Circuitry Materials

Nelco® N4000-13 EP™

Nelco® N4000-13 EP™ SI®



High-Speed Multifunctional Epoxy Laminate & Prepreg

Nelco® N4000-13 EP™ is an enhanced epoxy resin system engineered for today's lead-free requirements where multiple solder reflow at temperatures approaching 260°C are required. N4000-13 EP provides enhanced thermal reliability without compromising the electrical and signal loss properties that have made the Nelco® N4000-13 product family the industry standard for demanding high speed / low loss designs. The N4000-13 EP™ SI® is excellent for applications that require optimum signal integrity and precise impedance control, while maintaining high CAF resistance² and thermal reliability.

Key Features

Lead-Free Assembly Compatible

- Suitable for assemblies with a maximum reflow temperature of 260°C¹

Tg >210°C, outstanding thermal, electrical and signal loss properties

- Excellent thickness control for tight tolerance impedance applications
- Low Df and Dk allows for low signal distortion and faster signal propagation required by high frequency (1 - 10 GHz) and high reliability applications

CAF resistant²

- The low Z-CTE and improved CAF resistance² provide long-term reliability for both RF and digital applications
- Provides excellent CAF resistance even after multiple lead-free assembly exposures

Signal Integrity and Buried Capacitance™ options

- When used, SI glass provides enhanced electrical performance for even the most demanding applications
- Approved ZBC-2000® substrate available for thinner, more reliable assemblies and increased board densities

Proprietary advanced resin technology

- Industry standard material with well documented dielectric constant and loss tangent properties

High-Tg FR-4 processing

- Identical processing to the Nelco® N4000-13, similar to traditional high Tg FR-4 materials
- 90 min press at 193°C and 275-350 psi

Available in a variety of constructions

- Available in a wide variety of constructions, copper weights and glass styles including standard copper, double treat and RTFOIL®
- Meets UL 94V-0 and IPC-4101/29 specifications
- All Nelco® materials are RoHS compliant.
- Vacuum laminated

Applications

- Fine-Line Multilayers
- Backplanes
- Surface-Mount Multilayers
- BGA Multilayers
- MCM-Ls
- CSP Attachment
- Wireless Communication Infrastructure
- High Speed Services
- High Speed Storage Networks
- Internet Switching / Routing Systems

Global Availability

Nelco Products, Inc. (California) - Americas

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Park's UL file number: E36295

¹ Max suitable reflow temperature for N4000-13 EP assemblies is dependent upon design and fabrication details.



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Nelco® N4000-13 EP™ / N4000-13 EP™ SI®

High-Speed Multifunctional Epoxy Laminate & Prepreg

	-13 EP	-13 EP SI	U.S. Units	-13 EP	-13 EP SI	Metric	Test Method
Mechanical Properties							
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]				10 - 14	9 - 13	ppm / °C	IPC-TM-650.2.4.41
Z Axis CTE Alpha 1 [50°C to Tg]				65	65	ppm / °C	IPC-TM-650.2.4.24
Z Axis CTE Alpha 2 [Tg to 260°C]				275	275	ppm / °C	IPC-TM-650.2.4.24
Z Axis Expansion [50°C to 260°C]	3.4	3.4	%	3.4	3.4	%	IPC-TM-650.2.4.24
Young's Modulus (X / Y)	4.2 / 3.3	2.5 / 2.3	psi x 10 ⁶	28.5 / 22.4	17.2 / 16.5	GN / m ²	ASTM D3039
Poisson's Ratios (X / Y)	0.13 / 0.11	0.18 / 0.17		0.13 / 0.11	0.18 / 0.17		ASTM D3039
Thermal Conductivity				0.350	0.294	W / mK	ASTM E1461
Specific Heat				1.20	1.30	J / gK	ASTM E1461
Electrical Properties							
Dielectric Constant (50% resin content)							
@ 1 GHz (RF Impedance)	3.7	3.4		3.7	3.4		IPC-TM-650.2.5.5.9
@ 2.5 GHz (Split Post Cavity)	3.7	3.2		3.7	3.2		
@ 10 GHz (Stripline)	3.6	3.2		3.6	3.2		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)	0.009	0.008		0.009	0.008		
@ 10 GHz (Stripline)	0.009	0.008		0.009	0.008		IPC-TM-650.2.5.5.5
@ 10 GHz (Split Post Cavity)	0.008	0.007		0.008	0.007		
Volume Resistivity							
C - 96 / 35 / 90				10 ⁸	10 ⁸	MΩ - cm	IPC-TM-650.2.5.17.1
E - 24 / 125				10 ⁷	10 ⁸	MΩ - cm	IPC-TM-650.2.5.17.1
Surface Resistivity							
C - 96 / 35 / 90	10 ⁷	10 ⁷	MΩ	10 ⁷	10 ⁷	MΩ	IPC-TM-650.2.5.17.1
E - 24 / 125	10 ⁷	10 ⁷	MΩ	10 ⁷	10 ⁷	MΩ	IPC-TM-650.2.5.17.1
Electric Strength	1200	1000	V / mil	4.7x10 ⁴	3.9x10 ⁴	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	123	123	seconds	123	123	seconds	IPC-TM-650.2.5.1
Thermal Properties							
Glass Transition Temperature (Tg)							
DSC (°C)	410	410	°F	210	210	°C	IPC-TM-650.2.4.25c
TMA (°C)	392	392	°F	200	200	°C	IPC-TM-650.2.4.24c
DMA (°C) (Tan d Peak)	464	464	°F	240	240	°C	IPC-TM-650.2.4.24.3
Degradation Temp (TGA) (5% wt. loss)	662	662	°F	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	30+	30+	minutes	30+	30+	minutes	IPC-TM-650.2.4.24.1
T288	10+	10+	minutes	10+	10+	minutes	IPC-TM-650.2.4.24.1
Chemical / Physical Properties							
Moisture Absorption	0.1	0.1	wt. %	0.1	0.1	wt. %	IPC-TM-650.2.6.2.1
Methylene Chloride Resistance	0.7	0.7	% wt. chg.	0.7	0.7	% wt. chg.	IPC-TM-650.2.3.4.3
Density [50% resin content]				1.91	1.79	g / cm ³	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, parts and assemblies. 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. Nelco reserves the right to make changes without further notice to any products herein to improve reliability, function or design. Nelco does not assume any liability arising out of the application or use of any product described herein; neither does it convey any license under its patent rights nor the rights of others. This disclaimer of warranty is in lieu of all warranties whether expressed, implied or statutory, including implied warranties of merchantability or fitness for a particular purpose.

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1Refer to the N4000-13 Best Practices document and Contract Manufacturing Q&A for PCB processing recommendations. Visit www.parkelectro.com for more information. 2CAF resistance has been established to greater than 500 hours using a specific OEM coupon design and test procedure. Visit www.parkelectro.com for more information.

