

# Park Advanced Circuitry Materials

## Nelco® N4350-13 RF Nelco® N4380-13 RF

### Microwave Performance, Modified Epoxy

*The Nelco® N4350-13 RF and N4380-13 RF series are enhanced epoxy resin systems specifically engineered to provide a unique solution for design applications that demand outstanding thermal properties, tight dielectric constant tolerances and low signal loss properties. These next generation modified epoxies combine tightly controlled RF electrical properties with the mechanical reliability and competitive advantages of FR-4.*

#### Key Features

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

- Lead-free assembly compatibility
- Suitable for high-layer count, sophisticated PWB, RF and Antenna designs

##### **CAF\* Resistant**

- Providing long term reliability in end products

##### **Tightly controlled electrical properties**

- Consistency in performance-sensitive applications
- Suitable for designs that would otherwise require PTFE or ceramic-loaded hydrocarbon materials
- Can be used for both the RF and the digital layers in hybrid multilayer applications

##### **N4000-13 based material**

- Industry standard material providing years of usage data
- Well-known excellent electrical and loss properties
- Does not use expensive and abrasive ceramic fillers

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

- Ease of processing through more conventional processes.
- 90 min press at 193°C and 275-350 psi.
- Most epoxy prepregs will adhere

##### **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-4101/29 specifications
- All Nelco materials are RoHS compliant.



#### Applications

- 802.11 a, b and g Antennas
- Automotive
- Power Amplifiers
- Hybrid RF Multilayers
- Telecommunications
- High Speed Computing
- Commercial RF Applications
- Lead-Free Assembly Substrates

#### Global Availability

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

# Nelco® N4350-13 RF / N4380-13 RF

Microwave Performance, Modified Epoxy

Property / Condition	Value (U.S. Units)			Value (Metric Units)			Test Method
	N4350-13	N4380-13	U.S. Units	N4350-13	N4380-13	Metric	
<b>Mechanical Properties</b>							
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	10 - 14	ppm / °C	IPC-TM-650.2.4.41
Z Axis Expansion [50°C to 260°C]				3.5	3.5	%	IPC-TM-650.2.4.24
Thermal Conductivity				0.350	0.350	W / mK	ASTM E1461
Specific Heat				1.20	1.30	J / gK	ASTM E1461
<b>Electrical Properties</b>							
Dielectric Constant							
@ 10 GHz (Stripline)	3.5	3.8		3.5	3.8		IPC-TM-650.2.5.5.5
Dissipation Factor							
@ 10 GHz (Stripline)	0.0065	0.007		0.0065	0.008		IPC-TM-650.2.5.5.5
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>7</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>7</sup>	10 <sup>7</sup>	MΩ	10 <sup>7</sup>	10 <sup>7</sup>	MΩ	IPC-TM-650.2.5.17.1
Electric Strength	1200	1200	V / mil	4.7x10 <sup>4</sup>	4.7x10 <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	123	123	seconds	123	123	seconds	IPC-TM-650.2.5.1
<b>Thermal Properties</b>							
Glass Transition Temperature (T <sub>g</sub> )							
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)
T <sub>260</sub>	>50	>50	minutes	>50	>50	minutes	IPC-TM-650.2.4.24.1
T <sub>288</sub>	>8	>8	minutes	>8	>8	minutes	IPC-TM-650.2.4.24.1
<b>Chemical / Physical Properties</b>							
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]				1.77	1.77	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, 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.

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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.parkelco.com](http://www.parkelco.com).

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