



Subsidiary of Park Electrochemical Corp.

# Microwave Performance, Modified Epoxy

## N4350-13 RF

## N4380-13 RF

### Application

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

### Key Features

- **T<sub>g</sub> >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

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.

- 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.

Property/Condition	Value (u.S. Units)			Value (Metric Units)			Test Method
	N4350	N4380		N4350	N4380		
<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	10 - 14	10 - 14	ppm / °C	IPC-TM-650.2.4.41
Z Axis Expansion [50°C to 260°C]	3.5	3.5	%	3.5	3.5	%	IPC-TM-650.2.4.41
Thermal Conductivity	0.350	0.350	W / mK	0.35	0.350	W / mK	ASTM E1461
Specific Heat	1.20	1.20	J / gK	1.20	1.30	J / gK	ASTM E1461
<b>Electrical Properties</b>							
Dielectric Constant (50% resin content) @ 10 GHz (Stripline)	3.8	3.8		3.5	3.5		IPC-TM-650.2.5.5.5
Dissipation Factor (50% resin content) @ 10 GHz (Stripline)	0.065	0.007		0.065	0.007		IPC-TM-650.2.5.5.5
Volume Resistivity							
C - 96 / 35 / 90	10 <sup>8</sup>	10 <sup>8</sup>	MΩ - cm	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	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)	210	210	°C	210	210	°C	IPC-TM-650.2.4.25c
TMA (°C)	200	200	°C	200	200	°C	IPC-TM-650.2.4.24c
DMA (°C) [Tan δ Peak]	240	240	°C	240	240	°C	IPC-TM-650.2.4.24.3
Degradation Temp (TGA) (5% wt. loss)	365	365	°C	350	365	°C	IPC-TM-650.2.3.40
Pressure Cooker-60 min then solder dip @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>280</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>	1.77	1.77	g / cm <sup>3</sup>	Internal Method