

## NF-30 Ceramic Filled PTFE Composite

NF-30 copper clad, non-reinforced laminates are ceramic-filled PTFE composites. The ceramic-filled PTFE composite technology offers low dielectric loss and minimal signal distortion in microwave applications.

NF-30 adheres well to smooth low profile copper types. The low dissipation factor of NF-30 combined with the use of very smooth copper results in reduced insertion losses at higher frequency where skin effect losses play a substantial role.

NF-30 laminates are engineered to provide excellent dimensional stability despite the lack of a woven fiberglass reinforcement. Dimensional movement is predictable and manageable during any shrinkage from etching or baking.

NF-30 laminates show low Z-axis expansion allowing excellent plated through-hole reliability in extreme thermal environments or multilayer applications. Relative to rigid copper clad laminates, NF-30 materials are unique in their flexibility, allowing NF-30 to be used in static designs having curvature.

NF-30 shows very stable isotropic properties. Minimized difference on dielectric and phase properties along with X, Y, Z planes can support constant performance over 77GHz.

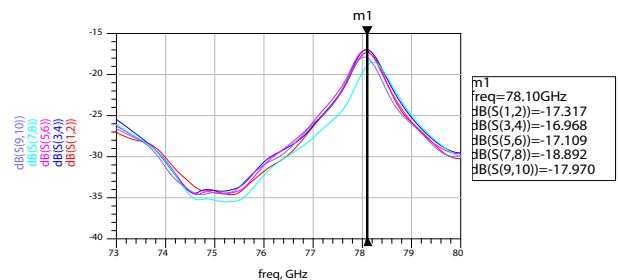
NF-30 laminates can be sheared, drilled, milled and plated using standard PTFE circuit board processing techniques. CO<sub>2</sub> laser ablation of NF-30 can make it possible to be used in precise microwave designs with dense PTH connection.

NF-30 offers superior RF performance at 77-79 GHz range.

### Benefits & Applications:

- Non-reinforced laminate
- Exceptional low electrical loss for microwave applications
- Excellent adhesion to Very Low Profile copper foils
- Stable dielectric properties vs. temperature & frequency
- Dimensionally stable for multilayer applications
- Isotropic Benefits
- Well suited for laser based microvia formation

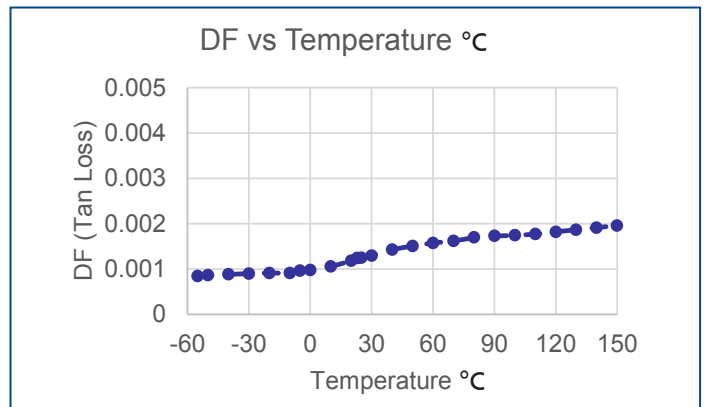
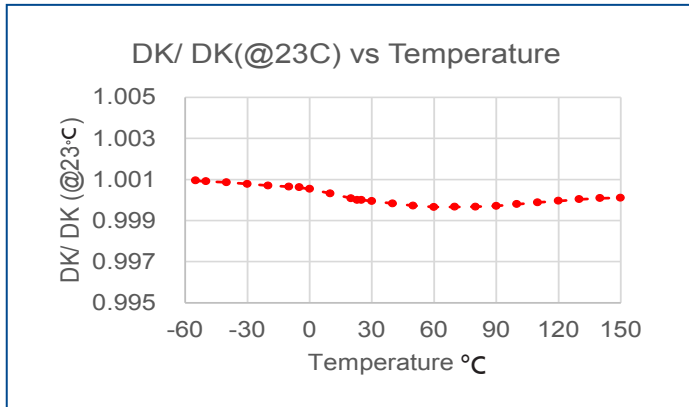
- Automotive Radar Sensors
- Global Positioning System Antennas
- Passive Components (Dividers, Filters & Couplers)
- Aerospace Components



Measured DK 3.0 @78.1 GHz by microstrip ring resonator

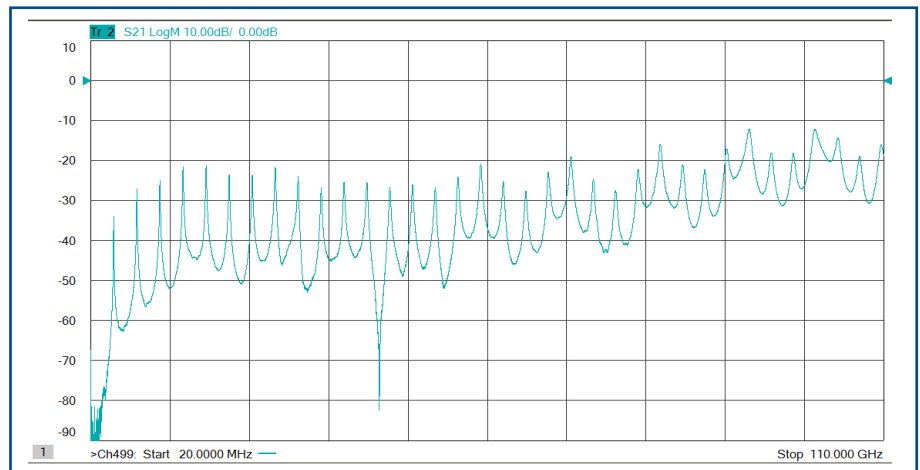
# NF-30 Ceramic Filled PTFE Composite

NF-30 offers very stable performance over a wide temperature range.

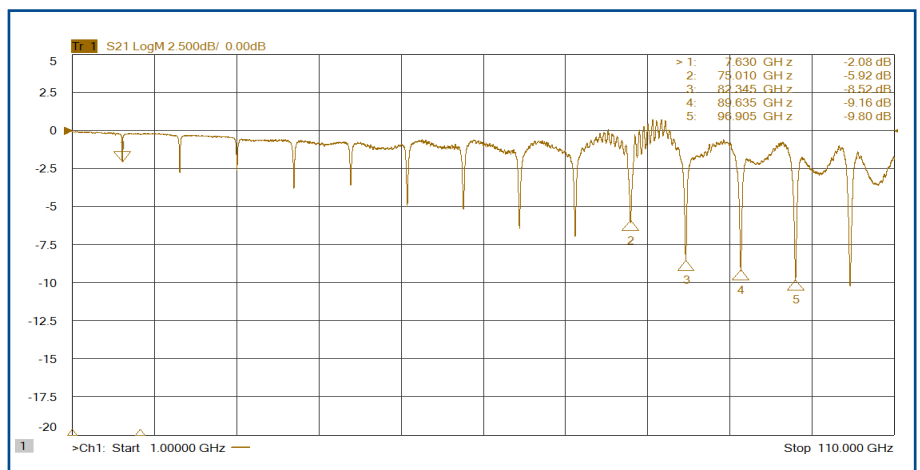


NF-30 offers very stable performance over a wide frequency range.

Microstrip forward Ring Resonator using NF-30-0050-ULPH/ULPH response to 110GHz.



Microstrip Reverse Ring Resonator using NF-30-0050-ULPH/ULPH response to 110GHz.

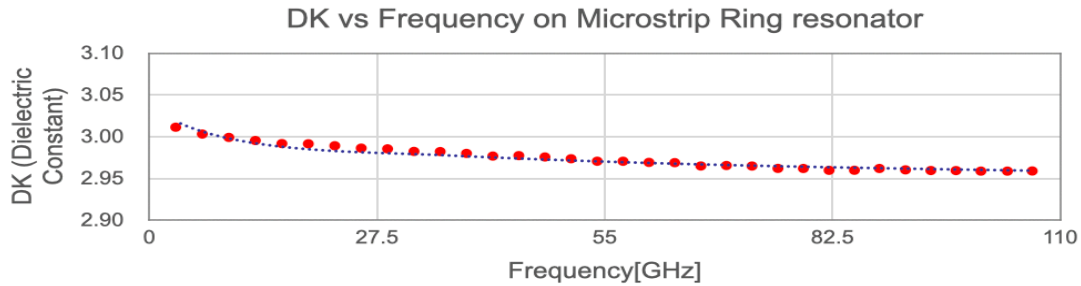


NF-30 Typical Values					
Property	Test Method	Unit	Value	Unit	Value
Dk @ 10 GHz	IPC-650 2.5.5.5.1 (Mod.)		3.00 +/-0.04		3.00 +/-0.04
Dk for Design at 77 GHz	Microstrip Resonator		2.98		2.98
Df @ 10 GHz	IPC-650 2.5.5.5.1 (Mod.)		0.0013		0.0013
T <sub>c</sub> DK (-55 -150 °C)	IPC-650 2.5.5.5	ppm/ °C	-4.07	ppm/ °C	-4.07
Moisture Absorption	IPC-650 2.6.2.1	%	0.05	%	0.05
Peel Strength (½ oz. ULPH Cu)	IPC-650 2.4.8 (Solder)	lbs/in	4	N/mm	0.7
Peel Strength (½ oz. RTF Cu)	IPC-650 2.4.8 (Solder)	lbs/in	8	N/mm	1.4
Volume Resistivity	IPC-650 2.5.17.1	Mohms/cm	10 <sup>7</sup>	Mohms/cm	10 <sup>7</sup>
Surface Resistivity	IPC-650 2.5.17.1	Mohm	10 <sup>7</sup>	Mohm	10 <sup>7</sup>
Dimensional Stability	IPC-650 2.4.39 (Etch)	% (5 mil-MD)	0.018	% (5 mil-CD)	0.044
Dimensional Stability	IPC-650 2.4.39 (Bake)	% (5 mil-MD)	-0.038	% (5 mil-CD)	-0.010
Dimensional Stability	IPC-650 2.4.39 (Stress)	% (5 mil-MD)	-0.065	% (5 mil-CD)	-0.034
Flexural Strength (MD)	IPC-650 2.4.4	psi	2756	N/mm <sup>2</sup>	19
Flexural Strength (CD)	IPC-650 2.4.4	psi	2611	N/mm <sup>2</sup>	18
Flexural Modulus (MD)	IPC-650 2.4.4	psi	146,488	N/mm <sup>2</sup>	1010
Flexural Modulus (CD)	IPC-650 2.4.4	psi	139,236	N/mm <sup>2</sup>	960
Tensile Strength (MD)	IPC-650 2.4.19	psi	943	N/mm <sup>2</sup>	6.5
Tensile Strength (CD)	IPC-650 2.4.19	psi	900	N/mm <sup>2</sup>	6.2
Elongation at Break (MD)	IPC-650 2.4.19	%	180	%	180
Elongation at Break (CD)	IPC-650 2.4.19	%	200	%	200
Young's Modulus (MD)	IPC-650 2.4.19	psi	104,427	N/mm <sup>2</sup>	720
Young's Modulus (CD)	IPC-650 2.4.19	psi	101,527	N/mm <sup>2</sup>	700
Hardness	ASTM D2240 (Durometer)		70		70
Density	IPC-650 2.3.5	g/cm <sup>3</sup>	2.09	g/cm <sup>3</sup>	2.09
Specific Heat	IPC-650 2.4.50	J/g °C	0.94	J/g °C	0.94
Thermal Conductivity (Unclad)	IPC-650 2.4.50	W/M*K	0.50	W/M*K	0.50
T <sub>d</sub> (2% wt. loss)	IPC-650 2.4.24.6/TGA	°F	959	°C	515
T <sub>d</sub> (5% wt. loss)	IPC-650 2.4.24.6/TGA	°F	986	°C	530
CTE (X-Y axis) (50-150 °C)	IPC-650 2.4.41	ppm/°C	11 - 15	ppm/°C	11 - 15
CTE (Z axis) (50-150 °C)	IPC-650 2.4.41	ppm/°C	30	ppm/°C	30
Flammability	UL-94		V-0		V-0
Lead Free Process Compatible	Internal		Yes		Yes

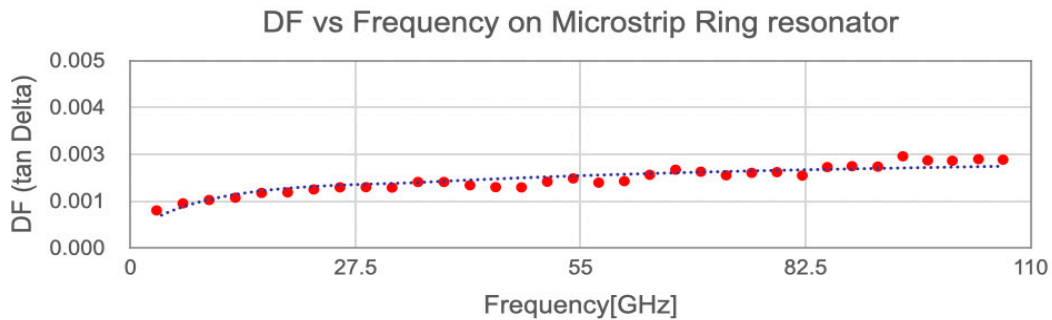
All reported values are typical and should not be used for specification purposes. In all instances, the user shall determine suitability in any given application.

## NF-30 Ceramic Filled PTFE Composite

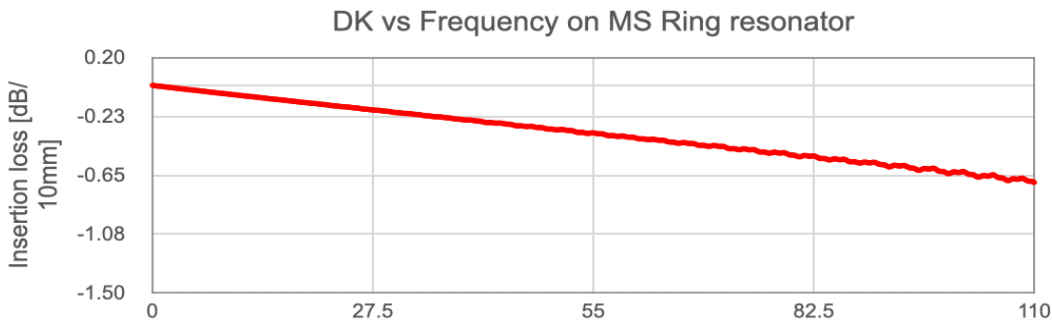
DK vs Frequency on Microstrip forward Ring resonator using NF-30-0050-ULPH/ULPH



DF vs Frequency on Microstrip forward Ring resonator using NF-30-0050-ULPH/ULPH



Insertion Loss vs Frequency on Microstrip-line using NF-30-0050-ULPH/ULPH



Standard cladding of NF-30 is ULP copper for best results at high frequency. An example of 5 mil material with ½ oz. ULP Copper on both sides is part #: **NF-30-0050-ULPH/ULPH - 18" x 24" (457 mm x 610 mm)**

Standard NF-30 series can be manufactured in increments of 0.005". Please call for availability of additional thicknesses.

Standard sheet size is 18" x 24" (457 mm x 610 mm). Please call for availability of other sizes.

Please contact AGC for availability of any other type of cladding.

