

## Flame Retardant High Performance Thermoset

### Benefits

- Low DF/Insertion loss
- Controlled DK & Impedance
- Enhanced Oxidation Resistance
- Stable Dielectric Properties over Temperature & Frequency
- Low CTE for Multilayer Applications
- Dimensionally Stable
- Tight DK Tolerance
- Enhanced Gain & Efficiency
- High Power Handling Capability
- Well Suited for Hybrid Multilayers

### Applications

- Power Amplifier
- Broadcast/Satellite
- Base Station Antenna
- High Speed Computing Systems
- Passive Components (Filters, Combiners, Dividers)
- LNA/LNB
- Aerospace



HF-350F is a flame retardant, ceramic-filled hydrocarbon based copper clad laminate reinforced with woven fiberglass. The special ceramic-filled hydrocarbon composite offers low signal loss and distortion with controlled impedance in broadband applications.

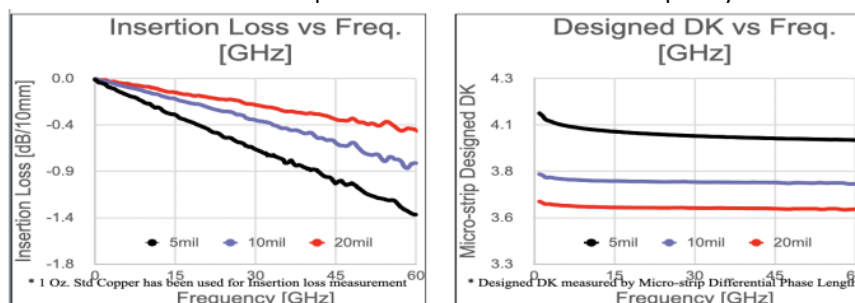
Traditional thermoset laminates can degrade over time by oxidation with time and elevated temperatures. Oxidation is permanent and leads to a shift toward a higher dielectric constant, elevated loss values, and changing color. The impact of shifting dielectric properties depends on circuit design, operating power, and use temperature. HF-350F has been developed with much better resistance to oxidation. HF-350F has been designed with a high thermal conductivity of 0.69 Watts/M\*K to reduce operating temperatures. The combination of high thermal conductivity and low dissipation factor result in composite that shows exceptional reliability and environmental stability over time and temperature.

HF-350F's low dissipation factor can reduce heat generation caused by the dielectric material at high power. The high thermal conductivity can efficiently radiate the heat. These benefits facilitate circuit design and allow for more margin related to RF power handling. These properties are particularly attractive for power amplifier applications.

HF-350F can be fabricated using standard FR-4 PCB fabrication without special hole wall preparation. The low CTE values enable reliable hybrid multilayer constructions.

HF-350F is a highly engineered composite designed to meet the demands of emerging RF/microwave applications.

HF-350F Offers Superior RF Performance Over Frequency.



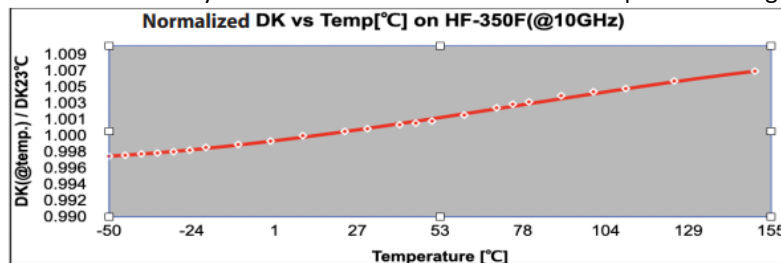
1 oz. Std. Copper has been used for Insertion Loss measurement.

Designed DK measured by Micro-strip Differential Phase Length.

For HF-350F – 20 mil products, 50Ω impedance line width is wider than  $\lambda/4$  from 20~30GHz.

Properties	Conditions	Typical Value	Unit	Test Method
<b>Electrical Properties</b>				
Dielectric Constant	@ 10 GHz	3.50 ± 0.05		IPC-650 2.5.5.1 Mod.
Designed DK(20 mil)	@ 10 GHz	3.61		MS Differential Phase Length
Dissipation Factor	@ 10 GHz	0.0029		IPC-650 2.5.5.1 Mod.
<b>Thermal Properties</b>				
Thermal Conductivity	Unclad	0.69	W/M*K	IPC-650 2.4.50
CTE (50 to 150 °C)	X	13	ppm/°C	IPC-650 2.4.41
	Y	17		
	Z	63		
TcK (-50 to 150 °C)		+50	ppm/°C	IPC-650 2.5.5.5
T <sub>d</sub>	2% wt. loss	370 (698)	°C (°F)	IPC-650 2.4.24.6/TGA
	5% wt. loss	387 (729)	°C (°F)	
T <sub>g</sub>		>280 (>536)	°C (°F)	IPC-650 2.4.24
<b>Mechanical Properties</b>				
Peel Strength	1 oz. copper	0.09 (5.0)	N/mm (lbs/in)	IPC-650 2.4.8 (Solder)
Dimensional Stability	MD	-0.000	%	IPC-650 2.4.39 (After Etch)
	CD	-0.005	%	
	MD	-0.038	%	IPC-650 2.4.39 (After Bake)
	CD	-0.041	%	
	MD	-0.048	%	IPC-650 2.4.39 (After Stress)
	CD	-0.051	%	
<b>Chemical / Physical Properties</b>				
Moisture Absorption		0.06	%	IPC-650 2.6.2.1
Density	Specific Gravity	1.81	g/cm <sup>3</sup>	IPC-650 2.3.5
Specific Heat		0.80	J/g°C	IPC-650 2.4.50

HF-350F Offers Very Stable Performance Over a Wide Temperature Range.



Typical Thicknesses		
Standard Dielectric Thickness (mil)	Standard Panel Size	Standard Copper
5, 10, 20, 30, 60 (available in 5 mil increments)	12" x 18", 18" x 24" 12" x 48", 36" x 48"	½ oz. Std. ED Foil 1 oz. Std. ED Foil

- \* All test data provided are typical values and not intended to be specification values. For review of critical specification tolerances, please contact a company representative directly.
- \* HF-350F can be manufactured in increments of 0.005"(0.125mm).
- \* Standard panel size is 18" x 24" (457 mm x 610 mm).
- \* Please contact AGC for availability of additional thicknesses, other sizes & any other type of cladding.

