

## HF-350F Flame Retardant High Performance Thermoset

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.

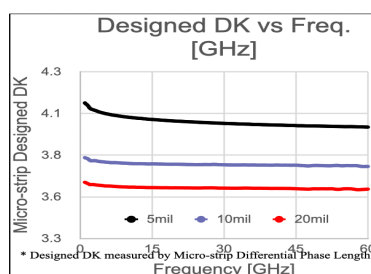
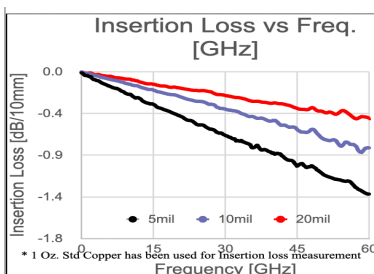
HF-350F can be fabricated using standard FR-4 PCB fabrication without special hole wall preparation. The low CTE values enable reliable hybrid multilayer constructions.

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

### Benefits & Applications:

- Low DF/Insertion loss
  - Controlled DK & Impedance
  - Enhanced Oxidation Resistance
  - Attractive Thermal Conductivity
  - Stable Dielectric Properties over Temperature & Frequency
  - Low Moisture Absorption
  - Low CTE for Multilayer Applications
  - Dimensionally Stable
  - High Performance/Price Ratio
  - Tight DK Tolerance
  - Minimal Signal Distortion
  - Enhanced Gain & Efficiency
  - High Power Handling Capability
  - Environmentally Stable
  - Excellent Reliability
  - Well Suited for Hybrid Multilayers
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- Power Amplifier
  - Broadcast/Satellite
  - Base Station Antenna
  - High Speed Computing Systems
  - Passive Components (Filters, Combiners, Dividers)
  - LNA/LNB
  - Aerospace

### HF-350F Offers Superior RF Performance Over Frequency.



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

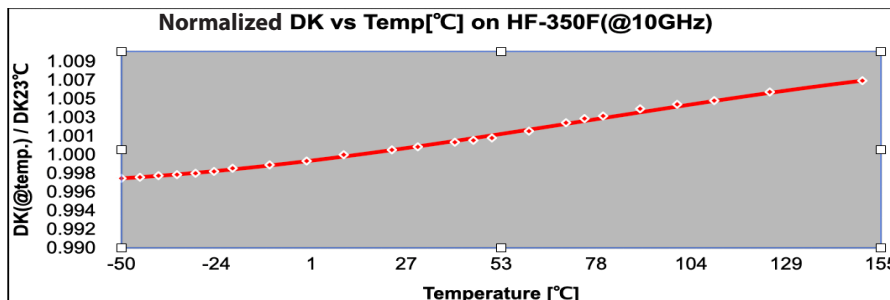
Designed DK measured by Micro-strip Differential Phase Length.

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

HF-350F Typical Values					
Property	Test Method	Unit	Value	Unit	Value
Dk @ 10 GHz	IPC-650 2.5.5.5.1 Mod.		3.50 ± 0.05		3.50 ± 0.05
Designed DK (20 mil)	MS Differential Phase Length		3.61		3.61
Df @ 2 GHz	IPC-650 2.5.5.5.1 Mod.		0.0024		0.0024
Df @ 10 GHz	IPC-650 2.5.5.5.1 Mod.		0.0029		0.0029
TcK (-50 to 150 °C)	IPC-650 2.5.5.5	ppm/°C	+50	ppm/°C	+50
Moisture Absorption	IPC-650 2.6.2.1	%	0.06	%	0.06
Peel Strength (1 oz. copper)	IPC-650 2.4.8 (Solder)	lbs/in	5	N/mm	0.9
Dimensional Stability)	IPC-650 2.4.39 (After Etch)	% (MD)	-0.000	% (CD)	-0.005
Dimensional Stability	IPC-650 2.4.39 (After Bake)	% (MD)	-0.038	% (CD)	-0.041
Dimensional Stability	IPC-650 2.4.39 (After Stress)	% (MD)	-0.048	% (CD)	-0.051
Flexural Strength (MD/CD)	IPC-TM-650 2.4.4	psi (MD)	27,000	psi (CD)	22,000
Tensile Strength (MD/CD)	IPC-TM-650 2.4.18.3	psi (MD)	16,000	psi (CD)	13,000
Density (Specific Gravity)	IPC-650 2.3.5	g/cm <sup>3</sup>	1.81	g/cm <sup>3</sup>	1.81
Specific Heat	IPC-650 2.4.50	J/g°C	0.8	J/g°C	0.8
Thermal Conductivity (Unclad)	IPC-650 2.4.50	W/M*K	0.69	W/M*K	0.69
T <sub>d</sub> (2% wt. loss)	IPC-650 2.4.24.6/TGA	°F	698	°C	370
T <sub>d</sub> (5% wt. loss)	IPC-650 2.4.24.6/TGA	°F	729	°C	387
CTE (X -Y axis) (50 to 150 °C)	IPC-650 2.4.41	ppm/°C	13-17	ppm/°C	13-17
CTE (Z axis) (50 to 150 °C)	IPC-650 2.4.41	ppm/°C	63	ppm/°C	63
T <sub>g</sub>	IPC-650 2.4.24	°F	>536	°C	>280
Flammability	Internal		V-0		V-0

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.

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



Dielectric layers of HF-350F are on the basis of hydrocarbon thermoset composite materials.

Standard HF-350F series can be manufactured in increments of 0.005"(5 mil). Please call for availability of additional thicknesses.

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

Please call for other types of cladding.

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

An example of 30 mil material with standard 1 oz. Cu on both sides is part# :  
**HF-350F-0300-C1/C1-18"x24"(HF-350F-0300-C1/C1-457mm x 610mm)**

