



## GA-HF-PF5

GA-HF-PF5 is an advanced Halogen-free medium Tg150(DSC) multifunctional epoxy Laminate. Excellent heat resistance, CAF resistance and Low CTE, suitable for through-hole reliability, Lead Free process, high multilayer PCB and high order HDI process. Environmental-friendly material, absence of highly toxic dioxins, Antimony-free and no toxic evolution during waste burning.

Laminate:GA-HF-PF5  
Prepreg: GA-HFB-PF5

### Key Features

- **Tg: 153°C(DSC)**  
This material with high performance multi-function resin, Tg values can reach above 150 °C(DSC).
- **Df: 0.0100**  
Within the scope of the 1 MHz - 10GHz, the lower signal loss can ensure signal integrity.
- **Z-CTE(50-260):2.8%**  
Its remarkable very low expansion coefficient, is more suitable for making high multilayer PCB, ensure the reliability of high temperature welding.
- **Td: 370°C**  
Excellent resistance to aging temperature, keep the material performance in high thermal shock or high temperature environment impact.
- **T288: 60min ↑**  
Suitable for Lead-free process. Subjected to thermal shock for many times, still can maintain good material performance. And excellent dimensional stability and low expansion coefficient, apply to high order HDI.

### Applications

- High multilayer PCB
- High order HDI
- Cellular phone
- LCD Panels
- Servers
- Mobile Communication
- Storage

### Industrial Approvals

- IPC-4101E/127/128
- UL File Number : e186152
- UL Type Designation : FR-4.1
- Flammability Rating : 94V-0
- Maximum Operating Temperature : 130°C

### Normal Size & Thickness

Thickness Inch (mm)	Size Inch mm	Thickness Tolerance
0.0012 (0.03)	49×37 1244×0940	IPC-4101 Class C/M
To	49×41 1244×1042	
0.125 (3.2)	49×43 1244×1093	

Characteristic <b>GA-HF-PF5</b>		Unit	Test Method	Typical Values	SPEC.
			IPC-TM-650 (or as noted)		
Volume Resistivity		MΩ-cm	2.5.17.1	2X10 <sup>9</sup>	≥ 10 <sup>6</sup>
Surface Resistivity		MΩ	2.5.17.1	1X10 <sup>8</sup>	≥ 10 <sup>4</sup>
Permittivity (RC 50%)	At 1MHz	-	2.5.5.9	4.80	≤ 5.40
	At 1GHz		2.5.5.9/2.5.5.13	4.30/4.40	/
	At 5GHz		2.5.5.13	4.35	/
	At 10GHz		2.5.5.13	4.29	/
	At 15GHz		2.5.5.13	4.26	/
Loss Tangent (RC 50%)	At 1MHz	-	2.5.5.9	0.0070	≤ 0.035
	At 1GHz		2.5.5.9/2.5.5.13	0.0100/0.0120	/
	At 5GHz		2.5.5.13	0.0135	/
	At 10GHz		2.5.5.13	0.0145	/
	At 15GHz		2.5.5.13	0.0155	/
Arc Resistance		Sec	2.5.1	120	≥ 60
Dielectric Breakdown		KV	2.5.6	40	≥ 40
Electric Strength(thickness<0.5mm)		KV/mm	2.5.6.2	40	≥ 30
CTI		PLC(V)	ASTM D3638	3(175-249)	/
Thermal Stress Test		-	2.4.13.1	Pass	Pass
Td (5% Weight loss)		°C	2.4.24.6	370	≥ 325
Glass Transition Temperature	DMA	°C	2.4.24.4	165	/
	DSC	°C	2.4.25	153	≥ 150
Thermal Conductivity		W/mK	ASTM D5470	0.40	/
Most Operation Temperature(MOT)		°C	UL Cert	130	/
T288		Min	2.4.24.1	≥ 60	≥ 5
X/Y-Axis CTE	Before Tg	PPM/°C	2.4.24	14/14	/
Z-Axis CTE	Before Tg	PPM/°C	2.4.24	40	≤ 60
	After Tg	PPM/°C		225	≤ 300
Z-Axis CTE (50~260°C)		%	2.4.24	2.8	≤ 3.5
Peel Strength (HTE 1OZ)		Lb/in(N/mm)	2.4.8	8.8(1.57)	≥ 6(1.05)
Flexural Strength	LW	N/mm <sup>2</sup>	2.4.4	560	≥ 415
	CW	N/mm <sup>2</sup>		440	≥ 345
E-modulus	LW/CW	Gpa	---	24/23	/
Flexural Modulus	LW/CW	Gpa	---	22/20	/
Moisture Absorption		%	2.6.2.1	0.08	≤ 0.8
Flammability		-	UL94	V-0	V-0

Note: 1. Test sample is 62 mil 1/1(without special remark).

2. The data above is only for reference, and the actual data will have deviation, according to varieties of test equipment and method.