



## GA-LD-HF

GA-LD-HF is an advanced Halogen-free high Tg 170(DSC) low Dk/Df multifunctional epoxy laminate. Excellent heat resistance, CAF resistance and Low CTE, suitable for through-hole reliability, Lead Free process, and is more suitable for high multilayer PCB process, and HDI process. And what's more, superior electrical performance, suitable for high frequency high-speed telecommunications.

### Key Features

- **Tg: 172°C(DSC)**  
This material with high performance, multi-function resin, crosslink density is high. Material Tg values can reach above 170 °C(DSC).
- **Dk: 3.90 & Df: 0.0080**  
Within the scope of the 1 MHz - 20 GHZ, material has superior electrical properties, is conducive to the high frequency high-speed transmission, and high density wiring design. And the lower signal loss can ensure signal integrity.
- **Z-CTE(50-260):2.6%**  
Its remarkable very low expansion coefficient, is more suitable for making high multilayer PCB, ensure the reliability of high temperature welding and assembly process.
- **Td: 370°C**  
Excellent resistance to aging temperature, keep the material performance in high thermal shock or high temperature environment impact.

Laminate:GA-LD-HF  
Prepreg: GA-LDB-HF

### Applications

- High Multilayer PCB
- Servers
- Storage
- Router/Switch
- RF/Wireless Communication
- Line cards

### Industrial Approvals

- IPC-4101E/127/128/130
- UL File Number : e186152
- UL Type Designation : FR-4.1  
FR-15.1
- Flammability Rating : 94V-0
- Maximum Operating Temperature :  
130°C

### Normal Size & Thickness

Thickness Inch (mm)	Size Inch mm	Thickness Tolerance
0.002 (0.05)	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-LD-HF</b>		Unit	Test Method	Typical data	spec
			IPC-TM-650 (or as noted)		
Volume Resistivity		MΩ-cm	2.5.17.1	7X10 <sup>9</sup>	≥ 10 <sup>6</sup>
Surface Resistivity		MΩ	2.5.17.1	2X10 <sup>8</sup>	≥ 10 <sup>4</sup>
Permittivity (RC50%)	At 1GHz	-	2.5.5.9/2.5.5.13	3.90/3.95	/
	At 5GHz		2.5.5.13	3.84	/
	At 10GHz		2.5.5.13	3.80	/
	At 15GHz		2.5.5.13	3.80	/
Loss Tangent (RC50%)	At 1GHz	-	2.5.5.9/2.5.5.13	0.0080/0.0090	/
	At 5GHz		2.5.5.13	0.0100	/
	At 10GHz		2.5.5.13	0.0100	/
	At 15GHz		2.5.5.13	0.0105	/
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	2(250-399)	/
Thermal Stress Test		-	2.4.13.1	Pass	Pass
Td (5% Weight loss)		°C	2.4.24.6	370	≥ 340
Glass Transition Temperature	DMA	°C	2.4.24.4	185	/
	DSC	°C	2.4.25	172	≥ 170
Thermal Conductivity		W/mK	ASTM D5470	0.40	/
Most Operation Temperature(MOT)		°C	UL Cert	130	/
T288		Min	2.4.24.1	≥ 60	≥ 15
T300		Min	2.4.24.1	≥ 30	≥ 2
X/Y-Axis CTE	Before Tg	PPM/°C	2.4.24	13/14	/
Z-Axis CTE	Before Tg	PPM/°C	2.4.24	40	≤ 60
	After Tg	PPM/°C		220	≤ 300
Z-Axis CTE (50~260°C)		%	2.4.24	2.6	≤ 3.0
Peel Strength (RTF 1OZ)		Lb/in(N/mm)	2.4.8	4.5(0.79)	≥ 4(0.7)
Flexural Strength	LW	N/mm <sup>2</sup>	2.4.4	460	≥ 415
	CW	N/mm <sup>2</sup>		370	≥ 345
Moisture Absorption		%	2.6.2.1	0.07	≤ 0.8
Flammability		-	UL94	V-0	V-0

Note: 1. Test sample is 62mil 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.