

# GA-150-LL/ GA-150B-LL



*Low Z-CTE Multi-functional epoxy resin CCL and prepreg  
Phenolic cured epoxy with fillers*

## Features

- Low Z-CTE and excellent through hole reliability
- Middle Tg 150°C
- Outstanding thermal resistance
- Suitable for Lead Free Process
- CAF resistance
- Designed for using for multi-layer PCB

## Designation Introduction

GA-150-LL	Single or double side PCB and thin core for multi-layer PCB	ANSI grade: FR-4
GA-150B-LL	Prepreg for multi-layer PCB	

## Certification UL (File No: E186152)

Model	Min. Thickness (Inch)	Clad cond. Thickness		Max. Area Diameter (mm)	Solder Lts.		UL 94 Flame Class	MOT (°C)
		Min. (µm)	Max. (µm)		Temp. (°C)	Time (sec)		
GA-150-LL/ GA-150B-LL	0.002	17	102	50.8	288	30	94V-0	130
	0.015	17	102	50.8	288	30	94V-0	130

## Performance List for Laminate (Specification sheet IPC-4101/98/99/101)

Characteristic	Unit	Condition	Specification <0.50mm		Specification ≥0.50mm		
			Typical Values	SPEC.	Typical Values	SPEC.	
Volume Resistivity	MΩ-cm	C-96/35/90	$7.1 \times 10^8$	$\geq 10^6$	$7.1 \times 10^8$	$\geq 10^6$	
Surface Resistivity	MΩ	C-96/35/90	$2.3 \times 10^7$	$\geq 10^4$	$2.3 \times 10^7$	$\geq 10^4$	
Permittivity (RC42.5%)	At 1MHz	-	C-24/23/50	$\leq 5.4$	4.77	$\leq 5.4$	
	At 1GHz		C-24/23/50		4.38		
Loss Tangent (RC42.5%)	At 1MHz	-	C-24/23/50	$\leq 0.035$	0.0115	$\leq 0.035$	
	At 1GHz		C-24/23/50		0.0153		
Arc Resistance	Sec	D-48/50+D-0.5/23	120	$\geq 60$	120	$\geq 60$	
Dielectric Breakdown	KV	D-48/50	40	-	40	$\geq 40$	
Moisture Absorption	%	D-24/23	0.25	-	0.095	$\leq 0.5$	
Flammability	-	C-24/23/50+E-24/125	94 V-0	94 V-0	94 V-0	94 V-0	
Peel Strength (HTE 1OZ)	Lb/in (N/mm)	After thermal stress 288°C×10Sec solder floating	9(1.58)	$\geq 4.57(0.8)$	9(1.58)	$\geq 6(1.05)$	
Thermal Stress Test	-	288°C×10Sec× 6cycle floating	Pass	Pass	Pass	Pass	
Flexural Strength	LW	N/mm <sup>2</sup>	A	-	501	$\geq 415$	
	CW	N/mm <sup>2</sup>	A	-	441	$\geq 345$	
CTE-X	PPM/°C	TMA	14	-	14	-	
CTE-Y	PPM/°C		16	-	16	-	
Z-Axis CTE	Alpha 1	PPM/°C	TMA	45	-	45	$\leq 60$
	Alpha 2	PPM/°C		250	-	250	$\leq 300$
Z-Axis CTE (50~260°C)	%		3.3	-	3.3	$\leq 3.5$	
Time to Delaminate (Copper removed)	T260	Min	TMA	$\geq 30$	-	$\geq 60$	$\geq 30$
	T288	Min	TMA	$\geq 5$	-	$\geq 5$	$\geq 5$
Td (5% Weight loss)	°C	TGA	340	-	340	$\leq 325$	
Glass Transition Temperature	°C	DSC	152	$\geq 150$	152	$\geq 150$	
		TMA	150	$\geq 145$	150	$\geq 145$	

Note: For specification  $\geq 0.50$  mm , test sample is 1.6mm 1/1; For specification <0.50 mm , test sample is 0.20 mm 1/1.

## Normal Size & Thickness

Thickness Inch (mm)	Copper Cladding OZ (µm)		Size		Thickness Tolerance
			Inch	mm	
0.002 (0.051)	1/3(12)	0.5(17)	49×36.8	1244×0935	IPC-4101 Class C/M
To	1.0(35)	2.0(70)	49×40.7	1244×1035	
0.125 (3.2)	3.0(105)	4.0(140)	49×42.7	1244×1085	

Note:

1. The effective area of laminate is 36" (Grain) ×48", 40" (Grain) ×48", 42" (Grain) ×48".
2. Copper cladding type can be selected from HTE, super HTE, double treated, reversed, very low profile or ultra thin copper foil, depended on customer needs.
3. Keeping the core and prepreg in the same grain direction is critical to ensure flatness of the multilayer boards. Grain direction is shown on the "Certificate of Conformance".

## Construction

Thickness		Normal Construction		Thickness		Normal Construction	
mm	mil			mm	mil		
1.00	39	7628	5 ply	0.35	14	7628	2 ply
0.90	36	7628	5 ply	0.30	12	1506	2 ply
0.77	31	7628	4 ply	0.25	10	2116	2 ply
0.74	29	7628	4 ply	0.20	8	7628	1 ply
0.71	28	7628	4 ply	0.15	6	1506	1 ply
0.53	21	7628	3 ply	0.13	5	2116	1 ply
0.50	20	7628	3 ply	0.10	4	2116	1 ply
0.40	16	7628	2 ply	0.08	3	1080	1 ply
0.38	15	7628	2 ply	0.05	2	106	1 ply

Note: 1.00, 0.90, 0.77, 0.74mm thickness include cladding, all others exclude cladding. Other thickness and constructions are available to special order.

## Performance List for prepreg

Nominal Thickness (mm)	Glass Style	Resin Content (%)	Resin Flow (%)	Gel Time (sec)	Volatile Content (%)	Scaled Flow Thickness (per ply)	
						mm	mil
0.20	7628	50±3	28±5	100±20	≤ 1.5	0.179±0.010	7.0±0.4
0.20	7628	45±3	22±5			0.175±0.010	6.9±0.4
0.15	1506	50±3	28±5			0.148±0.010	5.8±0.4
0.10	2116	53±3	28±5			0.102±0.010	4.0±0.4
0.08	2113	56±3	26±5			0.087±0.0075	3.4±0.3
0.06	1080	65±3	35±5			0.062±0.0075	2.4±0.3
0.03	106	75±3	42±5			0.047±0.0075	1.9±0.3

Note: Grace can provide special specifications to meet customers' requirement.

## Prepreg Storage Requirement

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Condition 1: Six months when stored at <5°C

Condition 2: Three months when stored at <23°C and <50 % RH

Note:

1. Prepreg should be stored in the absence of a catalytic environment such as UV light or excessive radiation.
2. Prepreg exceeding the shelf life requirements prior to shipment to the user must be retested and recertified to agree upon specifications.

## Recommended Press Cycle

1. Heating rate suggestions when material temperature range is 90~130°C  
Heating rate: 1.2~2.5°C/min for 350~400psi pressure (24.1~27.6 Bar)  
Heating rate: 3.2~5.5°C/min for 250~300psi pressure (17.2~20.7 Bar)
2. Temperature of material reach 180°C must is held for at least 60min to allow epoxy resin to cure fully.
3. In order to avoid warpage and twist issue, cooling rate of material suggest to be kept under 1.5°C/min, when the temperature of material is still above 130°C

Note: All values mentioned above are just for reference, clients can modify relative parameters according to the machines and designs.