99 Series

Thermally Conductive Multilayerable Epoxy Laminate And Prepreg

Arlon 99 series ceramic filled thermally conductive multifunctional epoxy laminate and prepreg products are engineered to provide thermally conductive multilayer PWB's for applications requiring thermal management throughout the entire board volume.

Features:

- Thermal Conductivity 1.1 W/m-K, 3-4x that of FR-4, reduces dependence on thermal vias to dissipate heat
- Glass Transition Temperature 170°C provides excellent plated through hole reliability, lead-free solder application
- Superior PTH reliability, validated with over 1000 Interconnect Stress Test (IST) cycles
- Coefficient of Thermal Expansion close to that of Copper and Aluminum for planar stability during process
- Electrical Strength >1000 Volts/mil for use in high power handling Applications
- Engineered for use with metal backing for producing Metal-Clad PCBs
- Compatible with 99N Low Flow Thermally Conductive prepreg for bonding assemblies to heat sinks
- Certified to the flammability requirements of UL-94 V-0
- RoHS & WEEE Compliant

Typical Applications:

- High Brightness LED's
- DC-DC Power Converters
- Automotive Electronics
- Electronic designs with limited thermal management alternatives

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Typical Properties:

99 Series

Property	Units	99ML	Test Method
1. Electrical Properties			
Dielectric Constant *(will vary with Resin %)*			
@ 1 MHz	-	5.1	IPC TM-650 2.5.5.3
@ 1 GHz	-		IPC TM-650 2.5.5.9
Dissipation Factor			
@ 1 MHz	-	0.02	IPC TM-650 2.5.5.3
@ 1 GHz	-		IPC TM-650 2.5.5.9
Volume Resistivity			
C96/35/90	MΩ-cm	4.7×10^8	IPC TM-650 2.5.17.1
E24/125	MΩ-cm	8.4×10^6	IPC TM-650 2.5.17.1
Surface Resistivity			
C96/35/90	MΩ	2.1×10^8	IPC TM-650 2.5.17.1
E24/125	MΩ	3.1×10^6	IPC TM-650 2.5.17.1
Electrical Strength	Volts/mil (kV/mm)	>1000	IPC TM-650 2.5.6.2
Dielectric Breakdown	kV		IPC TM-650 2.5.6
Arc Resistance	sec		IPC TM-650 2.5.1
2. Thermal Properties			
Glass Transition Temperature (Tg)			
TMA	°C		IPC TM-650 2.4.24
DSC	°C	170	IPC TM-650 2.4.25
Decomposition Temperature (Td)			
Initial	°C	291	IPC TM-650 2.3.41
5%	°C	303	IPC TM-650 2.3.41
T260	min	5	IPC TM-650 2.4.24.1
T288	min	0	IPC TM-650 2.4.24.1
T300	min	0	IPC TM-650 2.4.24.1
CTE (x,y)	ppm/°C	19	IPC TM-650 2.4.41
CTE (z)			
< Tg	ppm/°C	44	IPC TM-650 2.4.24
> Tg	ppm/°C	264	IPC TM-650 2.4.24
z-axis Expansion (50-260°C)	%	2.9	IPC TM-650 2.4.24
3. Mechanical Properties			
Peel Strength to Copper (1 oz/35 micron)			
After Thermal Stress	lb/in (N/mm)	5.0	IPC TM-650 2.4.8
At Elevated Temperatures	lb/in (N/mm)		IPC TM-650 2.4.8.2
After Process Solutions	lb/in (N/mm)		IPC TM-650 2.4.8
Young's Modulus	Mpsi (GPa)	2.4	IPC TM-650 2.4.18.3
Flexural Strength	kpsi (MPa)	30	IPC TM-650 2.4.4
Tensile Strength	kpsi (MPa)	17	IPC TM-650 2.4.18.3
Compressive Modulus	kpsi (MPa)		ASTM D-695
Poisson's Ratio (x, y)	-		ASTM D-3039
4. Physical Properties			
Water Absorption	%	0.13	IPC TM-650 2.6.2.1
Specific Gravity	g/cm^3	2.05	ASTM D792 Method A
Thermal Conductivity	W/mK	1.1	ASTM E1461
Flammability	class	V-0	UL-94

Results listed above are typical properties, provided without warranty, expressed or implied, and without liability. Properties may vary, depending on design and application. Arlon reserves the right to change or update these values.

Availability:

Arlon Part Number	Glass Style	Resin %	Nominal Press Thickness	Notes/Applications
99ML0690	106	90%	5.0	Multilayer
99ML8084	1080	84%	5.8	Multilayer

Laminate available with standard nominal thicknesses of 5, 6, 10 & 12 mils with 1/2, 1 or 2 oz copper. Inquire about Aluminum, Copper or Brass plate availability.

Recommended Process Conditions:

Process inner-layers through develop, etch, and strip using standard industry practices. Bake inner layers in a rack for 30 minutes at 225°F - 250°F (107°C - 121°C) immediately prior to lay-up. Vacuum desiccate the prepreg for 8 - 12 hours prior to lamination.

Lamination Cycle:

1) Control the heat rise to 9°F - 12°F (5°C - 7°C) per minute between 180°F and 280°F (82°C and 121°C)

2) Starting point laminating pressure for 99ML for standard panel sizes are as follows:

Panel Size		Pressure	
in	cm	psi	kg/sq cm
12 x 18	30 x 40	250–300	17-21
18 x 24	40 x 61	300-350	21-24

3) Product temperature at start of cure = 360°F (182°C).

4) Cure time at temperature = 90 minutes

5) Cool down under pressure at ≤ 10°F/min (5°C/min)

Drill at 350 SFM. Undercut bits are recommended for vias 0.018” and smaller

De-smear using alkaline permanganate or plasma with settings appropriate for multifunctional epoxy.

Conventional plating processes are compatible with 99 Series

Standard profiling parameters may be used.

Bake for 2 hours at 250°F (121°C) prior to solder reflow or HASL

Optimal processing requirements may vary depending on specific equipment and operating conditions. These recommendations are offered only as a starting point.

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