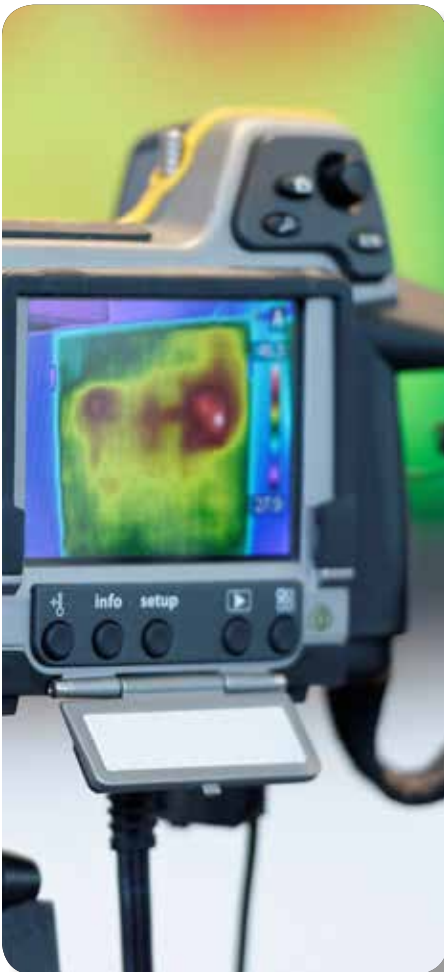


Thermally Conductive MultiLayerable Epoxy Laminate and Prepreg



Arlon 92ML ceramic filled thermally conductive multifunctional epoxy laminate and prepreg products provide a cost-effective, lead-free solder compatible, system with enhanced coefficient of thermal conductivity ($T_c=2.0 \text{ W/m-K}$) for multilayer PWB application that require thermal management throughout the board. 92ML has a UL-94 V0 halogen-free flame retardant system that is compliant with ROHS and WEEE and IPC-4101 requirements.



Features:

- Thermal Conductivity (T_c) 2.0 W/m-K , 6-8x that of FR-4, reduces hot-spots and dependence on thermal vias and heat-sinks to dissipate heat
- Glass Transition Temperature 160°C provides excellent plated through hole reliability, lead-free solder application
- Decomposition temperature $>350^\circ\text{C}$ is ideally suited for lead-free solder processing and offers significant improvement over other thermally conductive laminate materials
- Coefficient of Thermal Expansion close to that of Copper and Aluminum for planar stability during process
- Best-in-class thermal performance with $T_{260} > 60$ minutes, $T_{280} > 15$ minutes and $T_{300} > 5$ minutes.
- Electrical Strength >1000 Volts/mil for use in high power handling Applications
- Engineered for use with metal backing for producing Metal-Clad PCBs
- Meets the flammability requirements of UL-94 V-0
- Halogen-free per IPC-4101 specifications
- ROHS and 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:

Property	Units	Value	Test Method
1. Electrical Properties			
Dielectric Constant			
@ 1 MHz	-	5.2	IPC TM-650 2.5.5.3
@ 1 GHz	-	4.9	IPC TM-650 2.5.5.9
Dissipation Factor			
@ 1 MHz	-	0.013	IPC TM-650 2.5.5.3
@ 1 GHz	-		IPC TM-650 2.5.5.9
Volume Resistivity			
C96/35/90	MΩ-cm	1.2 x 10 ⁹	IPC TM-650 2.5.17.1
E24/125	MΩ-cm	1.5 x 10 ⁹	IPC TM-650 2.5.17.1
Surface Resistivity			
C96/35/90	MΩ	2.8 x 10 ⁸	IPC TM-650 2.5.17.1
E24/125	MΩ	4.4 x 10 ⁸	IPC TM-650 2.5.17.1
Electrical Strength	Volts/mil (kV/mm)	>1000	IPC TM-650 2.5.6.2
Dielectric Breakdown	kV	>50	IPC TM-650 2.5.6
Arc Resistance	sec	>150	IPC TM-650 2.5.1
Dielectric Withstand Voltage (HiPot)	VDC	>5000	IPC TM-650 2.5.7.2
2. Thermal Properties			
Glass Transition Temperature (Tg)			
DSC	°C	160	IPC TM-650 2.4.25
Decomposition Temperature (Td)			
Initial	°C	340	IPC TM-650 2.3.41
5%	°C	400	IPC TM-650 2.3.41
T260	min	>60	IPC TM-650 2.4.24.1
T288	min	>15	IPC TM-650 2.4.24.1
T300	min	>5	IPC TM-650 2.4.24.1
CTE (X,Y)	ppm/°C	19-20	IPC TM-650 2.4.41
CTE (Z)			
< Tg	ppm/°C	22	IPC TM-650 2.4.24
> Tg	ppm/°C	175	IPC TM-650 2.4.24
z-axis Expansion (50-260°C)	%	1.8	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 (0.88)	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)	4.8 (0.84)	IPC TM-650 2.4.8
Young's Modulus	Mpsi (GPa)	2.6 (18)	IPC TM-650 2.4.18.3
Flexural Strength	kpsi (MPa)	26.1 (180)	IPC TM-650 2.4.4
Tensile Strength	kpsi (MPa)	8.7 (60)	IPC TM-650 2.4.18.3
Compressive Modulus	kpsi (MPa)		ASTM D-695
4. Physical Properties			
Water Absorption	%	0.12	IPC TM-650 2.6.2.1
Specific Gravity	g/cm ³	2.2	ASTM D792 Method A
Thermal Conductivity-Z-Axis	W/mK	2	ASTM E1461
Thermal Conductivity - X/Y-Axis	W/mK	3.5	ASTM E1461
Flammability	class	V-0	UL-94

Availability:

Arlon Part Number	Glass Style	Approx Resin %	Nominal Press Thickness (mils)	Notes/ Applications
92ML0488	104	88	3.2	Multilayer
92ML0690	106	90	4.2	Multilayer
92ML8085	1080	85	6.0	Multilayer

Laminate available in a wide variety of thicknesses 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 107°C - 121°C (225°F - 250°F) immediately prior to lay-up. Vacuum desiccate the prepreg for 8 - 12 hours prior to lamination.

Lamination Cycle:

- 1) Control the heat rise to 5°C - 7°C (9°F - 12°F) per minute between 82°C and 121°C (180°F and 280°F)
- 2) Starting point laminating pressure for 92ML for standard panel sizes are as follows:

Panel Size		Pressure	
in	cm	psi	kg/cm ²
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 = 182°C (360°F).
- 4) Cure time at temperature = 90 minutes
- 5) Cool down under pressure at ≤ 5°C/min (10°F/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 92ML Standard profiling parameters may be used.

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

*Typical values of thermal conductivity for 92ML0485 are 1.6-1.7 W/mK
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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