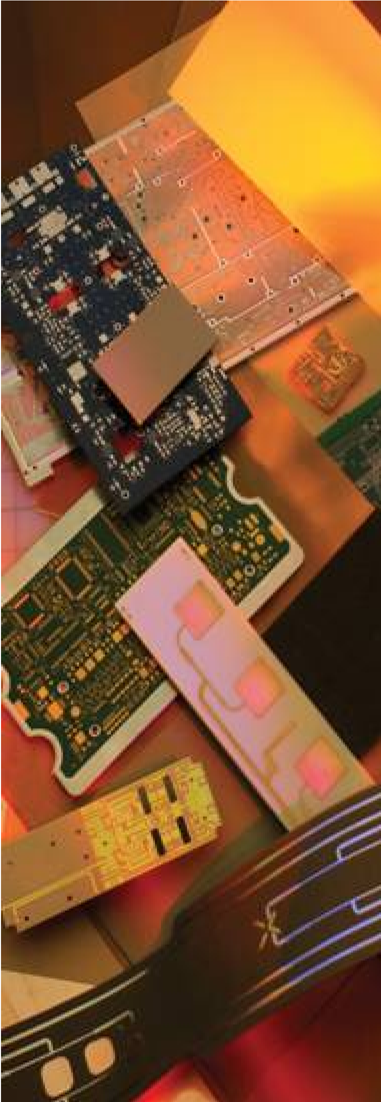
# 92ML

**PRELIMINARY DATASHEET**

## Thermally Conductive Multilayerable Epoxy Laminate And Prepreg



Arlon 92ML ceramic filled thermally conductive multifunctional epoxy laminate and prepreg products are provide best-in-class thermal performance with increased thermal conductivity of 2 W/mK for multilayer PWB's for applications requiring thermal management throughout the entire board volume.

**Features:**

- Thermal Conductivity 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 170°C provides excellent plated through hole reliability, lead-free solder application
- Decomposition temperature >350°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 T260>60 minutes, T280>15 minutes and T300 > 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 IPC4101 specifications

**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: PRELIMINARY DATASHEET 92ML

| Property | Units | Value | Test Method |
|---|---|---|---|
| **1. Electrical Properties** | | | |
| Dielectric Constant *(will vary with Resin %)* | | | |
| @ 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 | 1.7 x $10^8$ | IPC TM-650 2.5.17.1 |
| E24/125 | MΩ-cm | 2.9 x $10^7$ | IPC TM-650 2.5.17.1 |
| Surface Resistivity | | | |
| C96/35/90 | MΩ | 6.8 x $10^7$ | IPC TM-650 2.5.17.1 |
| E24/125 | MΩ | 2.7 x $10^7$ | IPC TM-650 2.5.17.1 |
| Electrical Strength | Volts/mil (kV/mm) | >1500 | IPC TM-650 2.5.6.2 |
| Dielectric Breakdown | kV | >50 | IPC TM-650 2.5.6 |
| Arc Resistance | sec | | IPC TM-650 2.5.1 |
| **2. Thermal Properties** | | | |
| Glass Transition Temperature (Tg) | | | |
| TMA | °C | 180 | IPC TM-650 2.4.24 |
| DSC | °C | 170 | 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 | 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 | IPC TM-650 2.4.8 |
| Young's Modulus | Mpsi (GPa) | | IPC TM-650 2.4.18.3 |
| Flexural Strength | kpsi (MPa) | | IPC TM-650 2.4.4 |
| Tensile Strength | kpsi (MPa) | | 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 | % | 0.12 | IPC TM-650 2.6.2.1 |
| Specific Gravity | g/cm³ | 2.2 | ASTM D792 Method A |
| Thermal Conductivity—Z-Axis | W/mK | 2.0 | ASTM E1461 |
| Thermal Conductivity—X/Y-Axis | W/mK | 3.5 | ASTM E1461 |
| Flammability | class | Meets 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. * Expected value based on similar systems*

## Availability:

| Arlon Part Number | Glass Style | Resin % | Nominal Press Thickness | Notes/Applications |
|---|---|---|---|---|
| 92ML0488 | 104 | 88% | 3.4 | Multilayer |
| 92ML0690 | 106 | 90% | 4.4 | 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 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 92ML 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 92ML

Standard profiling parameters may be used.

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



*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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