



FR4-TLM510

Halogen free Laminates and Prepregs

TLM-510 products are Halogen free materials manufactured with a unique high performance epoxy resin reinforced with electrical grade (E-glass) glass fabric.

TLM-510 offers enhanced thermal resistance due to a high Tg value, Tg 150°C with low z-CTE value and achieve flammability class of UL94V-0.

These materials are compatible with the AOI process and exhibit the UV block characteristic.

TLM-510 products also exhibit superior chemical resistance, thermal stability and CAF-resistance.

Performance and Processing Advantages

- Halogen, antimony and red phosphorous free
- Low coefficient of thermal expansion
- Compatible processing characteristics
- Very low moisture absorption
- CAF-resistance capability
- Meet IPC-4101E /128 specifications

Availability

Thickness: 0.0025" [0.0635 mm] to 0.125" [3.2 mm]

Size: 40"x48", 42"x42", 42"x48", 48"x48", 54"x48"

Option: Special size available.

Copper Foil Cladding: Grade 3 (HTE), 0.5 to 3.0 oz.

Option: Low profile & Very low profile copper foil.

Prepreg: Available in roll form

Glass Styles: 0106, 1080, 2313, 2116, 1506 and 7628

Industry Approvals

UL-Recognized – FR-4, File Number E174552



TLM-510 TYPICAL LAMINATE PROPERTIES

| Property | | UNITS | Specification | Typical Value | CONDITION | Test Method (IPC-TM-650 or As noted) |
|--|---------------------|----------------|-----------------|----------------------|---------------------------------|--|
| Glass Transition Temperature (Tg) by DSC, spec minimum | | °C | 150 min. | 153 | E-2/105 | 2.4.25 |
| Decomposition Temperature (Td) | | °C | 350 min. | 360 | TGA | ASTM D3850 |
| TD-260 | | Minutes | 35 min. | >60 | TMA | 2.4.24.1 |
| TD-288 | | Minutes | 10 min. | >50 | TMA | 2.4.24.1 |
| CTE X-Axis Y-Axis | Ambient to Tg | ppm/°C | - | 13 | TMA | 2.4.24 |
| | | | - | 15 | | |
| CTE Z-Axis | Pre-Tg | ppm/°C | 60 max. | ~40 | TMA | 2.4.24 |
| | Post-Tg | | 300 max. | ~200 | | |
| | 50 - 260 °C | | 3.0% max. | 135 (3.0%) | | |
| Thermal Stress | Unetched | Seconds | Pass visual | >200 | 288°C solder float x 10 sec. | 2.4.13.1 |
| | Etched | | Pass visual | >200 | | |
| Thermal Conductivity | | W/mK | - | 0.35 | - | ASTM D5930 |
| Peel Strength (spec minimum) | 1.0 oz. (35 micron) | Lb/inch (N/mm) | 6.0(1.05) | 7-9 (1.22-1.58) | After thermal stress | 2.4.8 |
| Dielectric Constant (DK) | 1 MHz | - | 5.4 max. | 4.90 | | 2.5.5.3 |
| | 500 MHz | - | - | 4.80 | C-24/23/50 | 2.5.5.9 |
| | 1 GHz | - | - | 4.70 | | 2.5.5.9 |
| | 1 MHz | - | 0.035 max. | 0.020 | | 2.5.5.3 |
| Loss Tangent (Df) | 500 MHz | - | - | 0.018 | C-24/23/50 | 2.5.5.9 |
| | 1 GHz | - | - | 0.018 | | 2.5.5.9 |
| Volume Resistivity | | Mohm-cm | 10 ⁶ | 1 x 10 ¹⁰ | C-96/35/90 | 2.5.17.1 |
| Surface Resistivity | | Mohm | 10 ⁴ | 1 x 10 ⁸ | C-96/35/90 | 2.5.17.1 |
| Dielectric Breakdown, spec minimum | | kV | 40 min. | 80 | D-48/50 | 2.5.6 |
| Arc resistance | | Seconds | 60 min. | 125 | D-48/50 | 2.5.1 |
| Comparative Tracking Index (CTI) | | Volts | - | 175-250 (CL=3) | IEC 60112 | UL-746A ASTM D3638 |
| Moisture Absorption | | % | 0.35 max. | 0.12 | E1/105+ D-24/23 | 2.6.2.1 |
| Flexural Strength | CW | psi | 50,000 min. | 65,000 | As received | 2.4.4 |
| | LW | | 60,000 min. | 75,000 | | |
| Flammability | | rating | V-0 min. | V-0 | C-24/23/50+E- 24/125 | UL94 |
| Bow & Twist | | % | 0.75 max. | 0.30 | As received/Etched | 2.4.22.1 |

Material Thickness Tested 1.5mm thickness , Cu 1/1 Oz.

Information contained in this data sheet represents typical or average values and does not constitute any warranty or guarantee.



TLM-510 PREPREG TYPICAL PROPERTY VALUES

| Fabric Style ¹ | Resin Content ² (%) | Resin Flow ² (%) | Volatile Content ³ (%) | Gel Time ² (sec) | Scale flow Thickness ² | | After Pressed Thickness ² | |
|---------------------------|-----------------------------------|--------------------------------|--------------------------------------|--------------------------------|-----------------------------------|--------------|--------------------------------------|--------------|
| | | | | | mil | mm | mil | mm |
| 1080LRC | 64 ± 3.0 | 39 ± 6.0 | 0.50 Max. | 120 ± 20 | 2.3 ± 0.4 | 0.058 ± 0.01 | 2.7 ± 0.4 | 0.069 ± 0.01 |
| 1080MRC | 67 ± 3.0 | 45 ± 6.0 | | 120 ± 20 | 2.5 ± 0.4 | 0.064 ± 0.01 | 2.9 ± 0.4 | 0.074 ± 0.01 |
| 1080HRC | 70 ± 3.0 | 49 ± 6.0 | | 120 ± 20 | 2.6 ± 0.4 | 0.066 ± 0.01 | 3.1 ± 0.4 | 0.079 ± 0.01 |
| 1080VHRC | 71 ± 3.0 | 50 ± 6.0 | | 120 ± 20 | 2.6 ± 0.4 | 0.066 ± 0.01 | 3.1 ± 0.4 | 0.079 ± 0.01 |
| 2313MRC | 58 ± 3.0 | 35 ± 5.0 | | 120 ± 20 | 3.5 ± 0.4 | 0.089 ± 0.01 | 4.0 ± 0.4 | 0.102 ± 0.01 |
| 2116MRC | 55 ± 3.0 | 31 ± 5.0 | | 120 ± 20 | 4.0 ± 0.4 | 0.106 ± 0.01 | 5.0 ± 0.4 | 0.127 ± 0.01 |
| 2116HRC | 57 ± 3.0 | 35 ± 5.0 | | 120 ± 20 | 4.3 ± 0.4 | 0.109 ± 0.01 | 5.5 ± 0.4 | 0.140 ± 0.01 |
| 1506MRC | 47 ± 3.0 | 24 ± 5.0 | | 120 ± 20 | 5.3 ± 0.4 | 0.135 ± 0.01 | 6.0 ± 0.4 | 0.152 ± 0.01 |
| 7628LRC | 42 ± 3.0 | 20 ± 5.0 | | 120 ± 20 | 6.5 ± 0.4 | 0.165 ± 0.01 | 7.0 ± 0.4 | 0.178 ± 0.01 |
| 7628MRC | 44 ± 3.0 | 21 ± 5.0 | | 120 ± 20 | 6.55 ± 0.4 | 0.166 ± 0.01 | 7.3 ± 0.4 | 0.185 ± 0.01 |
| 7628HRC | 46 ± 3.0 | 25 ± 5.0 | | 120 ± 20 | 6.6 ± 0.4 | 0.168 ± 0.01 | 7.9 ± 0.4 | 0.201 ± 0.01 |
| 7628VHRC | 48 ± 3.0 | 28 ± 5.0 | | 120 ± 20 | 6.7 ± 0.4 | 0.173 ± 0.01 | 8.2 ± 0.4 | 0.208 ± 0.01 |

Note: 1 Other fabric styles are available upon request.

2 Property values are adjustable for special processing needs

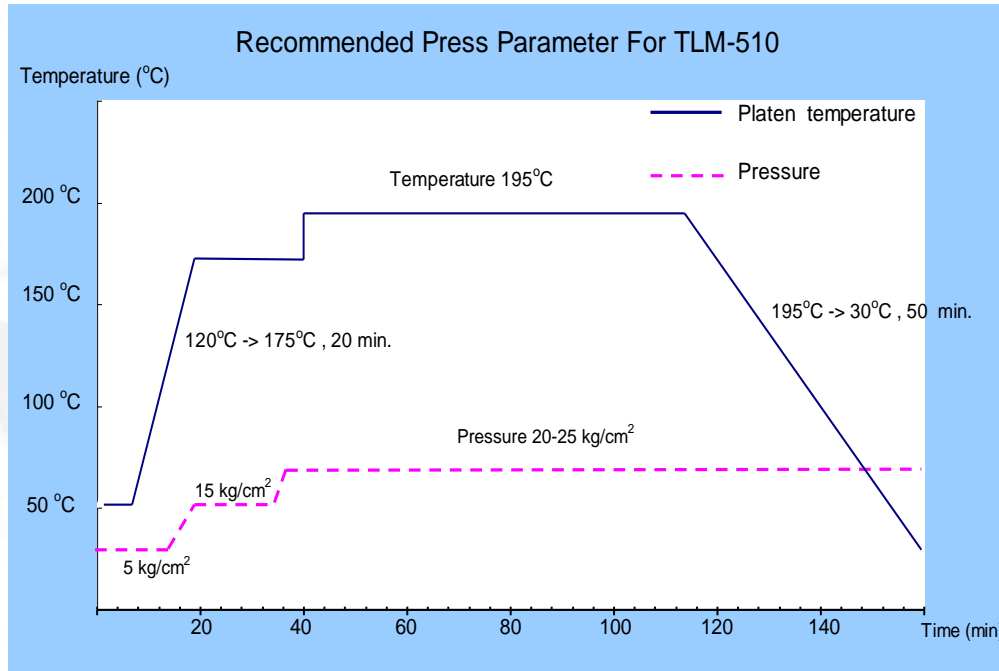
3 Volatile content for all prepregs is less than 0.5%

Storage condition:

- Prepreg properties will maintained for 3 months when keep it under 23°C and under 50%RH
- Beware of moisture, always keep it wrapped in damp proof material.

Recommendation

Press Cycle :



Cushion: Craft paper 162 g/m² top and bottom 9-12 sheets each
 Number of sheets: 6-8 layers

| | |
|-----------------------------------|--------------------------|
| Product heating rate (@ 60-120°C) | 1.4 – 2.0 °C/min |
| Cure time @ 180 °C | 45 - 55 min. |
| Full Pressure | 20-25 kg/cm ² |
| Cool down rate | < 2 °C/min |

Note : This press cycle is just recommendation only.
 PCB Manufacturer may adjust it based on genuine process .

PCB packaging :

PCB packaging shall be a proper packaging to prevent moisture uptake by PCB with vacuum seal condition include adequate desiccant material to prevent PCB from moisture which diffuse in the packaging material. Using the right packaging materials and maintain in a good condition, PCB's can be stored for up to one year without absorbing excess moisture.