



# 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 155°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.	160	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.	>60	TMA	2.4.24.1
CTE X-Axis Y-Axis	Ambient to Tg	-	13	TMA	2.4.24
		-	15		
CTE Z-Axis	Pre-Tg	60 max.	~40	TMA	2.4.24
	Post-Tg	300 max.	~200		
	50 - 260 °C	3.0% max.	135 (3.0%)		
Thermal Stress	Unetched	Pass visual	>300	288°C solder float x 10 sec.	2.4.13.1
	Etched	Pass visual	>300		
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	
	500 MHz	-	-	4.80	C-24/23/50
	1 GHz	-	-	4.70	
	1 MHz	-	0.035 max.	0.020	
Loss Tangent (Df)	500 MHz	-	-	0.018	C-24/23/50
	1 GHz	-	-	0.018	
Volume Resistivity	Mohm-cm	10 <sup>6</sup>	1 x 10 <sup>10</sup>	C-96/35/90	2.5.17.1
Surface Resistivity	Mohm	10 <sup>4</sup>	1 x 10 <sup>8</sup>	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	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 <sup>1</sup>	Resin Content <sup>2</sup> (%)	Resin Flow <sup>2</sup> (%)	Volatile Content <sup>3</sup> (%)	Gel Time <sup>2</sup> (sec)	Scale flow Thickness <sup>2</sup>		After Pressed Thickness <sup>2</sup>	
					mil	mm	mil	mm
1080MRC	66 ± 3.0	42 ± 6.0	0.50 Max.	150 ± 30	2.5 ± 0.4	0.061 ± 0.01	3.1 ± 0.4	0.079 ± 0.01
1080HRC	68 ± 3.0	45 ± 6.0		150 ± 30	2.7 ± 0.4	0.066± 0.01	3.3 ± 0.4	0.084 ± 0.01
2313MRC	57 ± 3.0	35 ± 5.0		150 ± 30	3.4 ± 0.4	0.086 ± 0.01	4.0 ± 0.4	0.102 ± 0.01
2116MRC	55 ± 3.0	34 ± 5.0		150 ± 30	4.0± 0.4	0.101 ± 0.01	5.0 ± 0.4	0.127 ± 0.01
2116HRC	57 ± 3.0	35 ± 5.0		150 ± 30	4.3 ± 0.4	0.109 ± 0.01	5.5 ± 0.4	0.140 ± 0.01
7628LRC	41 ± 3.0	19 ± 5.0		150 ± 30	6.6 ± 0.4	0.168 ± 0.01	7.0 ± 0.4	0.178 ± 0.01
7628MRC	43 ± 3.0	22 ± 5.0		150 ± 30	6.7 ± 0.4	0.170 ± 0.01	7.3 ± 0.4	0.185 ± 0.01
7628HRC	47 ± 3.0	26 ± 5.0		150 ± 30	6.9 ± 0.4	0.175 ± 0.01	7.9 ± 0.4	0.201 ± 0.01

Note: 1 Other fabric styles are available upon request.

2 Property values are adjustable for special processing needs

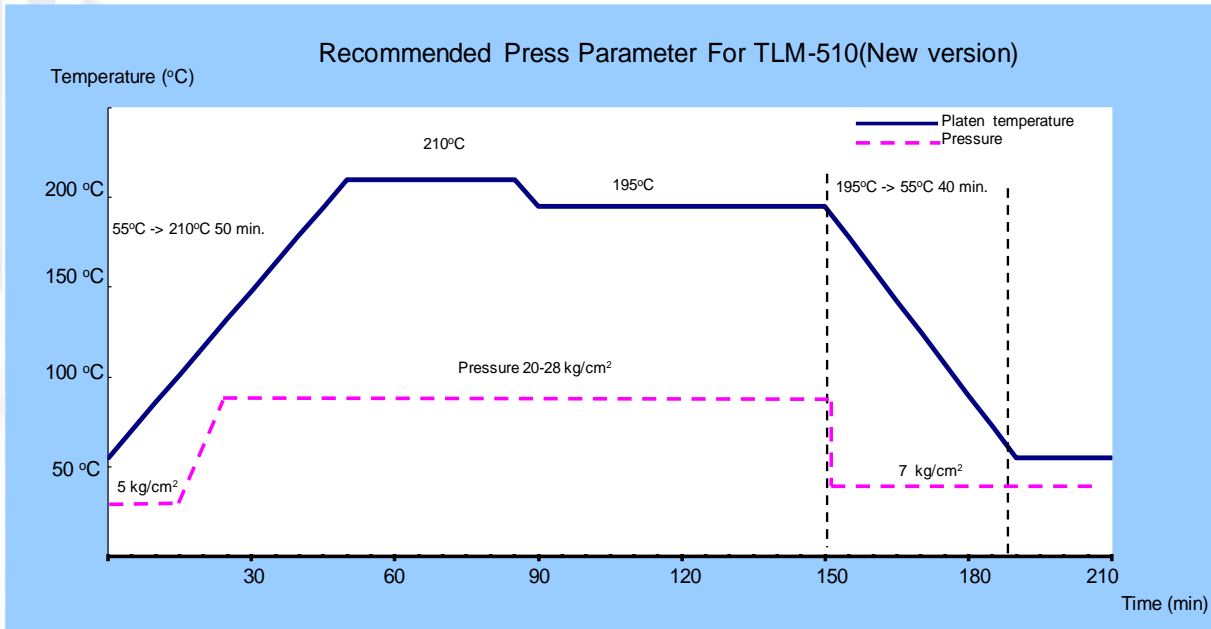
3 Volatile content for all prepregs is less than 0.5%

#### 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/m<sup>2</sup> top and bottom 9-12 sheets each  
 Number of sheets: 6-8 layers

Product heating rate (@ 60-120°C)	2.0 – 3.0 °C/min
Cure time @ 190 °C	70 - 90 min.
Full Pressure	20-28 kg/cm <sup>2</sup>
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.