



## FR4-TLM510(HT)

### Halogen Free Laminate and Prepreg

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

TLM-510(HT) offers enhanced thermal resistance due to a high Tg value, Tg 170°C with lower z-CTE Value and designed to eliminate the use of halogenated resins due to the potential hazardous effects from the environmental concerns. These materials are compatible with the AOI process and exhibit the UV block characteristic.

TLM-510(HT) also exhibit superior chemical resistance, thermal stability and CAF-resistance.

### Performance and Processing Advantages

- High performance epoxy blend which yield a higher heat resistance
- Superior dielectric thickness control
- Wide processing window for maximum lamination performance
- Enhanced thermal and chemical resistance
- Compatible with automatic optical inspection process
- UV-block feature
- Lead free solder process compatible
- CAF-Resistance capability
- Meet IPC 4101D/130 specification

### Availability

**Thickness:** 0.0025" [0.05 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:** 1080, 2313, 2116 and 7628

### Industry Approvals

UL-Recognized – FR-4, File Number E174552



## TLM-510(HT) 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	170 min.	173	E-2/105	2.4.25	
Decomposition Temperature (Td)	°C	350 min.	365	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	ppm/°C	-	13	Ambient to Tg	2.4.24	
Y-Axis		-	15			
CTE Z-Axis	Pre-Tg	60 max.	~40	TMA	2.4.24	
	Post-Tg	300 max.	~225			
50- 260 °C	3.00% max.	135 (2.9%)				
Thermal Stress 10 Sec @ 288 °C	Unetched	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.	4.80	C-24/23/50	2.5.5.3
	500 MHz	-	-	4.50		
	1 GHz	-	-	4.40		
Loss Tangent (Df)	1 MHz	-	0.035 max.	0.015	C-24/23/50	2.5.5.3
	500 MHz	-	-	0.013		
	1 GHz	-	-	0.013		
Volume Resistivity	Mohm-cm	10 <sup>6</sup>	3.2 x 10 <sup>8</sup>	C-96/35/90	2.5.17.1	
Surface Resistivity	Mohm	10 <sup>4</sup>	2.4 x 10 <sup>7</sup>			
Dielectric Breakdown, spec minimum	kV	40 min.	>60	D-48/50	2.5.6	
Arc resistance	Seconds	60 min.	120		2.5.1	
Comparative Tracking Index (CTI)	Volts	-	175-250 (CL=3)	IEC 60112	UL-746A ASTM D3638	
Water Absorption	%	0.50 max.	0.25	E1/105+ D-24/23	2.6.2.1	
Flexural Strength	CW	psi	50,000 min.	65,000	As received	2.4.4
	LW	psi	60,000 min.	75,000		
Flammability	rating	V-0	V-0	C-24/23/50+E-24/125	UL-94	
Bow & Twist	%	0.75 max.	0.30	As received/Etched	2.4.22.1	

Material Thickness Tested 1.5 mm. thickness Copper 1/1 Oz.

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



### TLM-510(HT) 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
0106MRC	76 ± 3.0	50 ± 6.0	0.50 Max.	150 ± 30	2.0 ± 0.4	0.051 ± 0.01	2.6 ± 0.4	0.066 ± 0.01
1080MRC	66 ± 3.0	42 ± 6.0			2.5 ± 0.4	0.061 ± 0.01	3.1 ± 0.4	0.079 ± 0.01
1080HRC	68 ± 3.0	45 ± 6.0			2.7 ± 0.4	0.066 ± 0.01	3.3 ± 0.4	0.084 ± 0.01
2313MRC	57 ± 3.0	35 ± 5.0			3.4 ± 0.4	0.086 ± 0.01	4.0 ± 0.4	0.102 ± 0.01
2116MRC	55 ± 3.0	33 ± 5.0			4.0 ± 0.4	0.101 ± 0.01	5.0 ± 0.4	0.127 ± 0.01
7628LRC	41 ± 3.0	19 ± 4.0			6.6 ± 0.4	0.168 ± 0.01	7.0 ± 0.4	0.178 ± 0.01
7628MRC	43 ± 3.0	22 ± 4.0			6.7 ± 0.4	0.170 ± 0.01	7.3 ± 0.4	0.185 ± 0.01
7628HRC	47 ± 3.0	26 ± 4.0			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

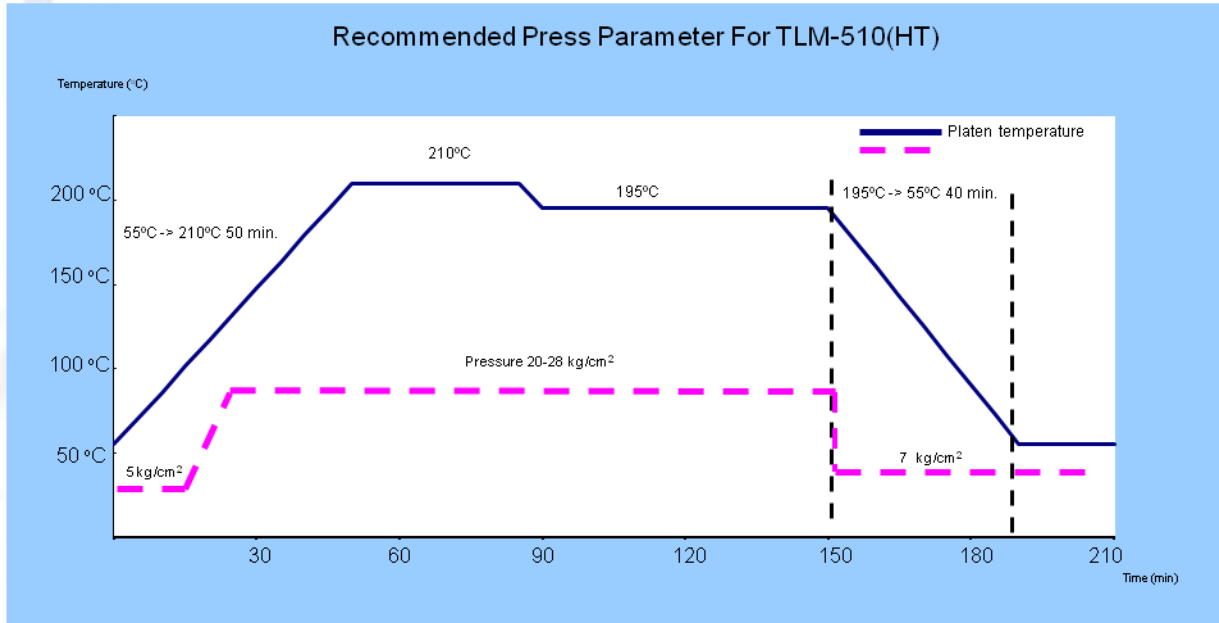
3 Volatile content for all prepregs is less than 0.5%

#### 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)	1.4– 2.0 °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.