



# Standard FR4 TG135 Datasheet

Classification according to IPC-4101 E / 21

Reinforcement: Woven E-Glass  
Resin System: Epoxy, unfilled

**Explanations :**  
C = preconditioning in humidity chamber  
E = preconditioning at temperature

The figures following the letter symbols indicate with the first digit the duration of the preconditioning in hours, with the second digit the preconditioning temperature in °C and with the third digit the relative humidity.

Laminate Requirements	Thickness < 0,50mm		Thickness ≥ 0,5mm		Units	Test Method
	Typical Value	Specification	Typical Value	Specification	Metric	IPC-TM-650 or as described
Peel Strength, minimum A: Low profile copper foil and very low profile copper foil – all copper foil > 17µm B: Standard profile copper foil 1. After thermal stress 2. At 125°C 3. After process solutions C: All other foil - composite	0,9 1,05 0,95 0,8	0,70 0,80 0,70 0,55 AABUS	0,95 1,20 1,15 1,0	0,70 1,05 0,70 0,80 AABUS	N/mm	2.4.8 2.4.8.2 2.4.8.3 2.4.8
Volume Resistivity, minimum A: C-96/35/90 B: After humidity conditioning C: At elevated temperature E-24/125	4 10 <sup>6</sup> 7 10 <sup>6</sup>	10 <sup>6</sup> 10 <sup>3</sup>	6 10 <sup>6</sup> 4 10 <sup>6</sup> 7 10 <sup>6</sup>	10 <sup>6</sup> 10 <sup>3</sup>	MΩ cm	2.5.17.1
Surface Resistivity, minimum A: C-96/35/90 B: After humidity conditioning C: At elevated temperature E-24/125	1 10 <sup>6</sup> 6 10 <sup>6</sup>	10 <sup>4</sup> 10 <sup>3</sup>	3 10 <sup>6</sup> 6 10 <sup>6</sup>	10 <sup>4</sup> 10 <sup>3</sup>	MΩ	2.5.17.1
Moisture Absorption, maximum	0,4		0,4	0,80	%	
Dielectric Breakdown, minimum			45	40	kV	2.5.6
Permittivity @ 1MHz (Laminate and prepreg as laminated)	4,2-4,6	5,4	4,6-4,9	5,4		2.5.5.2 2.5.5.3 2.5.5.9
Loss Tangent @ 1MHz (Laminate and prepreg as laminated)	0,015-0,02	0,035	0,015-0,02	0,035		2.5.5.2 2.5.5.3 2.5.5.9
Flexural Strength , minimum A: Length direction B: Cross direction			440 400	415 345	N/mm <sup>2</sup>	2.4.4
Arc Resistance, minimum	105	60	105	60	s	2.5.1
Thermal Stress 10 s @288°C, minimum Unetched Etched	Pass Pass	Pass Visual Pass Visual	Pass Pass	Pass Visual Pass Visual	rating	2.4.13.1
Electric Strength, minimum (Laminate and prepreg as laminated)	39	30			kV/mm	2.5.6.2
Flammability (Laminate and prepreg as laminated)	V0	min. V0	V0	min. V0	rating	UL94
Halogen content , maximum Chlor Brom Chlor + Brom	- - -		- - -		ppm	2.3.41
Glass Transition Temperature			135	min. 110	°C	2.4.24
Decomposition Temperature		-	310	-	°C	2.4.24.6 (5% weight loss)
CTE Z-axis A: Alpha 1 B: Alpha 2 C: 50°C – 260°C		- - -		- - 3,8-4,2	ppm/°C ppm/°C %	2.4.24
Time to Delamination (TMA) (copper removed) A: T260 B: T288 C: T300		- - -	15	- - -	Minutes	2.4.24.1 and corresponding adjustments in 3.10.1.2
Others PLC CTI			3 200	175 - 250	Class V	UL IEC 112