

# TECHNICAL CHARACTERISTICS OF THE LAMINATES

Average values refer to 1,5mm (FR3/FRG/FR4) & 0,3mm(FR4 ML) samples. Copper is 35µ/35µ for all types of laminates  
Version(0410)

Specifications	MAS			FPC-16	FR4 (Fotoboard)	FR4-ML (Multi-layer)	
	NEMA LI-1			CEM-1	FR4	FR4	
	MIL P-13949				GF	GF	
	IEC 249				249-2-5-IEC EP-CP-Cu	249-2-12-IEC EP-CP-Cu	
Non-electrical tests on Base materials	Characteristics	Conditioning	Unit	Values	Values	Values	Methodology
	Flexural Strength	Lengthwise / Crosswise A	N/mm <sup>2</sup>	400.30 / 250.00	530.00 / 425.50	- / -	ASTM D 229
Non-electrical test on Metal-clad materials	Punchability	A	-	1	1	-	DIN 40802
	Hardness	A	M Scale	105	115	-	-
	Shear Strength	A	N/mm <sup>2</sup>	105	138.5	-	-
	Flammability	A; E-168/70	s	25 (V-O)	25 (V-O)	12 (V-O)	UL 94
	Temperature Index	A	°C	130°	130°	130°	UL746
	Water Absorption	E-1/105 + D-24/23	%	0.300	1.120	-	NEMA LI-1
	Measling	A	-	-	NO measling, blistering or delamination	-	IEC249
	Solder Float	A	s	> 40	> 40	> 20	MIL P-13949
	Peel Strength	After thermal stress	N/mm	1.85	1.90	1.90	MIL P-13949
	Peel Strength	* 5 (E-1/2/125 + 1/4/25 + 1/2/-65 + 1/4/25)	N/mm	1.90	1.95	1.90	MIL P-13949
Electrical tests	Peel Strength	*** E-1/125	N/mm	1.60	1.55	1.40	MIL P-13949
	Peel Strength	After exposure to processing solution	N/mm	1.70	1.85	1.80	MIL P-13949
	Warp on panels 304 x 304mm	A	%	≤ 1.0	≤ 0.5	-	MIL P-13949 IPC-L-112
	Electrolytic Corrosion	C-96/40/92	-	A/ 1	A/ 1.4	-	IEC249
	Dielectric Breakdown	To lamination D-45/80	KV	52	58		ASTM D-149
	Electric Strength	D-48/50 +D-1/2/23	V/mil	-	-	1300	MIL P-13949
	Permittivity	1 MHz D-24/23	-	4.20	4.55	4.00	MIL P-13949
	Dissipation Factor	1 MHz D-24/23	-	0.0300	0.0175	0.0160	MIL P-13949
	Surface Resistance	C-96/40/92 **E-24/125	Ω	4-10 <sup>10</sup> / 7 -10 <sup>10</sup>	22-10 <sup>12</sup> / 5 -10 <sup>12</sup>	10-10 <sup>13</sup> / 4 -10 <sup>13</sup>	MIL P-13949 IEC 249
	Volume Resistivity	C-90/40/92 **E-24/125	Ω cm	5-10 <sup>12</sup> / 8 -10 <sup>9</sup>	27-10 <sup>12</sup> / 3 -10 <sup>12</sup>	6-10 <sup>14</sup> / 9 -10 <sup>12</sup>	MIL P-13949 IEC 249
Qualifications	Arc Resistance	D-48/50 +D-1/2/23	s	> 60	> 60	> 60	ASTM D-229
	Underwriters' Laboratories			E41668	E41668	E41668	
	Defence Supply Agency			-	13949-861	55617-255	
	British Standards			5254	5046	-	
	British Telecom			M976/B Appendix A 1.10	M976/B Appendix A1.2	-	
	Comité de Coordination des Télécommunications			-	82.049		

\* for product FR3-34 the cyle is 5 (E-1/2/105 + 1/4/25 + 1/2/-65 + 1/4/25)

\*\* for products FR-34 the conditioning temperature is E-24/105

\*\*\* for product FR3-34 the conditioning temperature is E-1/105