

PCL-FR-226 Laminate/PCL-FRP-226 Prepreg **PCL-FR-240 Laminate/PCL-FRP-240 Prepreg**

Tetrafunctional FR-4 Laminate and Prepreg
(Tg 140°C)

GENERAL INFORMATION

PCL-FR-226/240 is the industry benchmark 140°C glass transition temperature (Tg) FR-4 system for multilayer printed wiring board (PWB). FR-226/240 laminate and prepreg products are manufactured using a precise blend of tetrafunctional and difunctional epoxy resins, reinforced with electrical grade (E-glass) glass fabric. This combination provides an exceptional PWB performance and excellent FR-4 processability due to the superior thermal, mechanical, chemical and moisture resistance properties. The FR-226/240 system is also laser fluorescing and UV blocking for maximum compatibility with automated optical inspection systems (AOI), optical positioning systems and photoimagable soldermask imaging.

LAMINATE AVAILABILITY

PCL-FR-226/240 laminate is available in standard thicknesses, using a variety of glass style constructions, from .002 inches (.05 mm) to .125 inches (3.2 mm). Single ply laminate is available in thicknesses from .002 inches (.05 mm) to .008 inches (.20 mm) and multiple ply laminate is available from .004 inches (.10 mm) to .125 inches (3.2 mm). Standard copper claddings are available from ¼ ounce (9 micron) to 3 ounce (103 microns). Polyclad's patented DSTFoil® copper foil, traditional copper foil and double treat clad products are available. Single side clad laminate is not available. Other thicknesses and copper claddings can be custom made to meet specific performance requirements. FR-226 laser-drillable laminate is also available, for product availability information refer to Polyclad's LG (laser-drillable glass) Product Availability Bulletin.

PREPREG AVAILABILITY

PCL-FRP-226/240 prepreg is available in a variety of standard E-glass styles. PCL-FRP-226 prepreg is also available in glass styles compatible with laser drilling, for product availability information refer to Polyclad's LG (laser-drillable glass) Product Availability Bulletin. Other non-standard glass styles may be available to meet specific needs. When fully cured FR-226/240 prepreg has the same performance attributes as FR-226/240 laminate. Standard flow and fill performance parameters designed to meet typical process and application requirements are available. Special performance and no/low flow variations can be custom made for some glass styles for specific applications.

PROCESSING AND STORAGE

FR-226/240 laminate and prepreg are compatible with standard FR-4 process techniques. General process recommendation technical bulletins are available from Polyclad. For specific processing guidelines please contact Polyclad Technical Services.

Storage of FR-226/240 laminate and prepreg is the same as FR-4 material. Prepreg should be stored at 68±3° F (18±2°C) and 30-50% relative humidity. Prepreg stored below recommended temperatures should be allowed to equilibrate to the above specified conditions for a minimum of eight hours prior to use. More detailed storage recommendation technical bulletins are available from Polyclad.

APPLICABLE SPECIFICATIONS AND RECOGNITIONS

Polyclad's UL file number is E45456. PCL-FR-226/240 laminate is UL listed under the generic designation PCL-FR- (a)(a) and PCL-FRP-226/240 prepreg is listed under the generic designation PCL-FRP- (a)(a). FR-226/240 laminate and prepreg and PWBs constructed from them are all capable of achieving a UL 94-V0 flammability rating and the highest UL maximum continuous operating temperature for FR-4 grades of 130°C, and are interchangeable from a UL listing standpoint with all Polyclad FR-4 grades. Certain other more specific parts of Polyclad's UL listing may be applicable in some cases. FR-226/240 laminate and prepreg can be certified to IPC-4101A, Specification for Base Materials for Rigid and Multilayer Printed Boards, Specification Sheet IPC-4101A/21. Other industry or customer specific specifications, recognitions or designations may be applicable or certifiable to in certain cases. If you need additional information or have questions, please contact Polyclad Technical Services.

POLYCLAD LAMINATE/PREPREG GRADE - PCL-FR-226/PCL-FRP-226/ PCL-FR-240/PCL-FRP-240
IPC-4101A SPECIFICATION SHEET(S) /21

LAMINATE

Property	Typical Values/IPC-4101/21 Specification				Units	Test Method	
	Thickness <0.50 mm (< 0.0197 in) 50% RC		Thickness ≥0.50 mm (≥ 0.0197 in) 40% RC				
	Typical Value	Specification	Typical Value	Specification	Metric (English)	IPC-TM-650 (or as noted)	
Glass Transition Temperature (Tg) by DSC, spec minimum	140	110 -150	140	110 -150	°C	2.4.25	
Decomposition Temperature (Td)	320	—	320	—	°C	ASTM D3850	
CTE, Z-axis	A. Pre-Tg	—	AABUS	50	AABUS	ppm/°C	2.4.24
	B. Post-Tg	—	—	250	—		
CTE, X-, Y-axes	A. Pre-Tg	—	AABUS	15	AABUS	ppm/°C	2.4.24
	B. Post-Tg	—	—	17	—		
% Z-Axis Expansion (50-260C)	—	—	4.2	AABUS	%	2.4.24	
Thermal Conductivity	—	—	0.36	—	W/mK	ASTM D5930	
Thermal Stress 10 Sec @ 288°C (550.4°F), spec minimum	A. Unetched	Pass	Pass Visual	Pass	Pass Visual	Rating	2.4.13.1
	B. Etched	Pass	Pass Visual	Pass	Pass Visual		
Permittivity, spec maximum (Laminate & prepreg as laminated)	A. @ 1 MHz	4.60	5.40	4.80	5.40	—	2.5.5.3
	B. @ 100 MHz	4.50	—	4.60	—		
	C. @ 1 GHz	4.30	—	4.50	—		
	D. @ 2 GHz	4.30	—	4.45	—		
	E. @ 5 GHz	4.20	—	4.40	—		
Loss Tangent, spec maximum (Laminate & prepreg as laminated)	A. @ 1 MHz	0.0150	0.0350	0.0150	0.0350	—	2.5.5.3
	B. @ 100 MHz	0.0160	—	0.0160	—		
	C. @ 1 GHz	0.0160	—	0.0160	—		
	D. @ 2 GHz	0.0165	—	0.0165	—		
	E. @ 5 GHz	0.0170	—	0.0170	—		
Volume Resistivity, spec minimum	A. 96/35/90	4.0x10 ⁸	10 ⁶	—	—	MΩ -cm	2.5.17.1
	B. After moisture resistance	—	—	4.0x10 ⁸	10 ⁶		
	C. At elevated temperature	7.0x10 ⁷	10 ³	7.0x10 ⁷	10 ³		
Surface Resistivity, spec minimum	A. 96/35/90	3.0x10 ⁶	10 ⁴	—	—	MΩ	2.5.17.1
	B. After moisture resistance	—	—	3.0x10 ⁶	10 ⁴		
	C. At elevated temperature	6.0x10 ⁶	10 ³	6.0x10 ⁶	10 ³		
Dielectric Breakdown, spec minimum	—	—	60	40	kV	2.5.6	
Arc Resistance, spec minimum	105	60	105	60	Seconds	2.5.1	
Electric Strength, spec minimum (Laminate & prepreg as laminated)	48 (1200)	30 (750)	—	—	kV/mm (V/mil)	2.5.6.2	
Comparative Tracking Index (CTI)	—	—	205 (CL=3)	—	Volts	UL-746A ASTM D3638	
Peel Strength, spec minimum	A. Low profile copper foil and very low profile – all copper weights >17 microns B. Standard profile copper 1. After thermal stress 2. At 125°C (257°F) 3. After process solutions	105 (1.05) (6.0)	70 (0.70) (4.0)	105 (1.05) (6.0)	70 (0.70) (4.0)	N/mm (kg/M) (lb/inch)	2.4.8 2.4.8.2 2.4.8.3
		145 (1.45) (8.0)	80 (0.80) (4.5)	145 (1.45) (8.0)	105 (1.05) (6.0)		
		125 (1.25) (7.0)	70 (0.70) (4.0)	125 (1.25) (7.0)	70 (0.70) (4.0)		
		145 (1.45) (8.0)	55 (0.55) (3.0)	145 (1.45) (8.0)	80 (0.80) (4.5)		
Flexural Strength, minimum	A. Lengthwise direction B. Crosswise direction	—	—	442 (64,100)	415 (60,190)	G.Pa (lb/inch ²)	2.4.4
		—	—	435 (63,100)	345 (50,040)		
Moisture Absorption, spec maximum	0.30	—	0.20	0.80	%	2.6.2.1	
Flammability (Laminate & prepreg as laminated), spec minimum	V-0	V-1	V-0	V-1	Rating	UL-94	

PREPREG

Property	Typical Value	IPC-4101 Specification	Unit	Test Method
Volatile Content Spec maximum	0.25	0.75	%	2.3.19
Shelf life, spec minimum (Condition 1 / Condition 2)	Meets requirements	180/90	Days	IPC-TM-650

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



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