

IPC-4101 /21 UL - File Number E41625

FR402 consists of a modified tetrafunctional epoxy resin system engineered for multilayer applications that require performance characteristics exceeding those of difunctional epoxies.

PRODUCT FEATURES

Industry Recognition

- UL File Number: E41625
- RoHS Compliant

Processing Advantages

- FR-4 process compatible
- UV blocking and AOI fluorescence

PRODUCT AVAILABILITY

Standard Material Offering: Laminate

- 2 to 125 mil (0.05 to 3.2 mm)
- Available in full size sheet or panel form

Copper Foil Type

- HTE Grade 3
- RTF (Reverse Treat Foil)

Copper Weight

- ½ to 2 oz (18 to 70 µm) available
- Heavier copper available
- Thinner copper foil available

Standard Material Offering: Prepreg

- Roll or panel form
- Tooling of prepreg panels

Glass Fabric Availability

- E-glass
- Square weave glass

The formulation of FR402 is designed to enhance throughput and accuracy of laser based Automated Optical Inspection (AOI) equipment. FR402 offers superior resistance to chemical and thermal degradation.

PRODUCT ATTRIBUTES



Typical Values Table

Property	Typical Value	Units		Test Method
		Metric (English)		IPC-TM-650 (or as noted)
Glass Transition Temperature (Tg) by DSC	140		°C	2.4.25C
Decomposition Temperature (Td) by TGA @ 5% weight loss	315		°C	2.4.24.6
Time to Delaminate by TMA (Copper removed)	A. T260 B. T288 30 >5		Minutes	2.4.24.1
Z-Axis CTE	A. Pre-Tg B. Post-Tg C. 50 to 260°C, (Total Expansion) 50 250 4.2		ppm/°C ppm/°C %	2.4.24C
X/Y-Axis CTE	Pre-Tg 15		ppm/°C	2.4.24C
Thermal Conductivity	.36		W/m-K	ASTM E1952
Thermal Stress 10 sec @ 288°C (550.4°F)	A. Unetched B. Etched Pass		Pass Visual	2.4.13.1
Dk, Permittivity	A. @ 100 MHz B. @ 500 MHz C. @ 1 GHz 4.60 4.27 4.25		—	2.5.5.3 2.5.5.9 2.5.5.5
Df, Loss Tangent	A. @ 100 MHz B. @ 500 MHz 0.016 0.015		—	2.5.5.3 2.5.5.9
Dk, Permittivity	@ 1 GHz 0.015		—	2.5.5.5
Volume Resistivity	A. C-96/35/90 B. After moisture resistance C. At elevated temperature 4.0 x 10 ⁸ — 7.0 x 10 ⁷		MΩ-cm	2.5.17.1
Surface Resistivity	A. C-96/35/90 B. After moisture resistance C. At elevated temperature 3.0 x 10 ⁶ — 6.0 x 10 ⁶		MΩ	2.5.17.1
Dielectric Breakdown	>50		kV	2.5.6B
Arc Resistance	120		Seconds	2.5.1B
Electric Strength (Laminate & laminated prepreg)	29 (1100)		kV/mm (V/mil)	2.5.6.2A
Comparative Tracking Index (CTI)	3 (175-249)		Class (Volts)	UL 746A ASTM D3638
Peel Strength	A. Low profile copper foil and very low profile copper foil all copper foil >17 μm [0.669 mil] B. Standard profile copper 1. After thermal stress 2. At 125°C (257°F) 3. After process solutions 1.05 (8.0) 1.45 (9.0) 1.25 (8.0) 1.45 (9.0)		N/mm (lb/inch)	2.4.8C 2.4.8.2A 2.4.8.3 2.4.8.3
Flexural Strength	A. Length direction B. Cross direction 92.0 62.3		ksi	2.4.4B
Tensile Strength	A. Length direction B. Cross direction 60.0 43.2		ksi	ASTM D3039
Young's Modulus	A. Length direction B. Cross direction 3500 3000		ksi	ASTM D790-15e2
Moisture Absorption	0.3		%	2.6.2.1A
Flammability (Laminate & laminated prepreg)	V-0		Rating	UL 94
Relative Thermal Index (RTI)	130		°C	UL 796

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