



## FR402

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

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.

#### ORDERING INFORMATION:

Contact your local sales representative or visit [www.isola-group.com](http://www.isola-group.com) for further information.

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## Performance

**Tg 140°C**

**Td 320°C**

**Dk 4.25**

**Df 0.015**

**zIPC- 4101C /21 /24 /26 /98 /101 /126**

**UL - File Number E41625**

**Qualified to UL's MCIL Program**

### Product Features

- Industry Recognition
  - UL File Number: E41625
  - RoHS Compliant
- Performance Attributes
- 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

# FR402 Specifications

Property		Typical Value	Units	Test Method
			Metric (English)	IPC-TM-650 (or as noted)
Glass Transition Temperature (Tg) by DSC		140	°C	2.4.25
Decomposition Temperature (Td) by TGA @ 5% weight loss		315	°C	2.4.24.2
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 %	2.4.24
X/Y-Axis CTE	Pre-Tg	15	ppm/°C	2.4.24.1
Thermal Conductivity		.36	W/mK	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	$4.0 \times 10^8$ — $7.0 \times 10^7$	MΩ-cm	2.5.17.1
Surface Resistivity	A. C-96/35/90 B. After moisture resistance C. At elevated temperature	$3.0 \times 10^6$ — $6.0 \times 10^6$	MΩ	2.5.17.1
Dielectric Breakdown		>50	kV	2.5.6
Arc Resistance		120	Seconds	2.5.1
Electric Strength (Laminate & laminated prepreg)		29 (1100)	kV/mm (V/mil)	2.5.6.2
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)	2.4.8 2.4.8.2 2.4.8.3 2.4.8.3
Flexural Strength	A. Length direction B. Cross direction	92,000 62,300	lb/inch <sup>2</sup>	2.4.4
Tensile Strength	A. Length direction B. Cross direction	60,000 43,150	lb/inch <sup>2</sup>	ASTM D3039
Moisture Absorption		0.3	%	2.6.2.1
Flammability (Laminate & laminated prepreg)		V-0	Rating	UL 94
Max Operating Temperature		130	°C	UL 796

The data, while believed to be accurate and based on analytical methods considered to be reliable, is for information purposes only. Any sales of these products will be governed by the terms and conditions of the agreement under which they are sold.

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