



## 415HR High Thermal Performance Epoxy Material

415HR is a proprietary high-performance 190°C glass transition temperature (Tg) FR-4 system for multilayer Printed Wiring Board (PWB) applications where maximum thermal performance and reliability are required. This product is also ideally suited for designs requiring high signal integrity. 415HR has a lower Z-axis CTE and provides superior moisture resistance at reflow, resulting in a product that bridges the gap from both a thermal and electrical perspective.

[www.isola-group.com/products/415HR](http://www.isola-group.com/products/415HR)

### 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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High Performance

**415HR**  
**Preliminary**  
**Data Sheet**  
**Tg 190, Td 350**  
**Dk 4.02, Df 0.011**  
**IPC-4101 - /133**

### Features

- High Thermal Performance
  - ▶ High Tg: 190°C (DSC)
  - ▶ High Td: 350°C (TGA @ 5% wt loss)
  - ▶ Low CTE in the Z-axis – 2.5% (50-260°C)
- T260: 60 minutes
- T288: >15 minutes
- Lead-free Compatible and RoHS Compliant
- UV Blocking and AOI Compatible
  - ▶ High throughput and accuracy during PCB fabrication and assembly
- Superior Processing
  - ▶ Closest to conventional FR-4 processing of all high-speed materials
- Core Material Standard Availability
  - ▶ Thickness: 0.002 (0.05 mm) to 0.028 (0.71 mm)
  - ▶ Available in full size sheet or panel form
- Prepreg Standard Availability
  - ▶ Roll or panel form
  - ▶ Tooling of prepreg panels available
- Copper Foil Type Availability
  - ▶ Standard HTE Grade 3
  - ▶ RTF (Reverse Treat Foil)
- Copper Weights
  - ▶ ½, 1 and 2 oz (18, 35 and 70 µm) available
  - ▶ Heavier copper available upon request
  - ▶ Thinner copper foil available upon request
- Glass Fabric Availability
  - ▶ Standard E-glass
  - ▶ Square weave glass fabric available
  - ▶ Spread glass fabric available
- Industry Approvals
  - ▶ IPC-4101 - /133
  - ▶ UL - File Number E41625
  - ▶ Qualified to UL's MCIL Program

# 415HR Typical Values

Property		Typical Values		
		Typical Value	Units	Test Method
			Metric (English)	IPC-TM-650 (or as noted)
Glass Transition Temperature (Tg) by DSC		190	°C	2.4.25
Decomposition Temperature (Td) by TGA @ 5% weight loss		350	°C	ASTM D3850
T260		60	Minutes	ASTM D3850
T288		>15	Minutes	ASTM D3850
CTE, Z-axis	A. Pre-Tg	45	ppm/°C	2.4.24
	B. Post-Tg	240		
CTE, X-, Y-axes	A. Pre-Tg	13	ppm/°C	2.4.24
	B. Post-Tg	14		
Z-axis Expansion (50-260°C)		2.5	%	2.4.24
Thermal Conductivity		0.4	W/mK	ASTM D5930
Thermal Stress 10 sec @ 288°C (550.4°F)	A. Unetched	Pass	Rating	2.4.13.1
	B. Etched			
Dk, Permittivity (Laminate & prepreg as laminated) Tested at 56% resin	A. @ 1 GHz (HP4291A)	4.02	-	2.5.5.9
	B. @ 2 GHz (Bereskin Stripline)	-		2.5.5.5
	C. @ 5 GHz (Bereskin Stripline)	-		2.5.5.5
	D. @ 10 GHz (Bereskin Stripline)	-		2.5.5.5
Df, Loss Tangent (Laminate & prepreg as laminated) Tested at 56% resin	A. @ 1 GHz (HP4291A)	0.011	-	2.5.5.9
	B. @ 2 GHz (Bereskin Stripline)	-		2.5.5.5
	C. @ 5 GHz (Bereskin Stripline)	-		2.5.5.5
	D. @ 10 GHz (Bereskin Stripline)	-		2.5.5.5
Volume Resistivity	A. 96/35/90	-	MΩ-cm	2.5.17.1
	B. After moisture resistance	1.76x10 <sup>8</sup>		
	C. At elevated temperature	1.24x10 <sup>9</sup>		
Surface Resistivity	A. 96/35/90	-	MΩ	2.5.17.1
	B. After moisture resistance	2.45x10 <sup>7</sup>		
	C. At elevated temperature	1.91x10 <sup>8</sup>		
Dielectric Breakdown		>80	kV	2.5.6
Arc Resistance		120	Seconds	2.5.1
Electric Strength (Laminate & prepreg as laminated)		40 (1100)	kV/mm (V/mil)	2.5.6.2
Comparative Tracking Index (CTI)		3 (175-249)	Class (Volts)	UL-746A ASTM D3638
Peel Strength	Low profile copper foil and very low profile copper foil – all copper foil >17µm [0.669 mil].	0.58 (3.3)	N/mm (lb/inch)	2.4.8.2
				2.4.8.3
Flexural Strength	A. Lengthwise direction	77.7	ksi	2.4.4
	B. Crosswise direction	62.8		
Tensile Strength	A. Lengthwise direction	43.8	ksi	ASTM D3039-95a
	B. Crosswise direction	31.5		
Young's Modulus	A. Grain direction	3530	ksi	ASTM D790-15e2
	B. Fill direction	3200		
Poisson's Ratio	A. Grain direction	0.158	-	ASTM D3039-95a
	B. Fill direction	0.138		
Moisture Absorption		0.15	%	2.6.2.1
Flammability (Laminate & prepreg as laminated)		V-0	Rating	UL 94
Max Operating Temperature		130	°C	-

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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