



## GreenSpeed™ Halogen Free Laminates and Prepregs

**GreenSpeed™** is a halogen free base material that meets the requirements of traditional FR-4 materials. The resin matrix is based on a modified epoxy resin. Conventional E-glass-fabric is used for reinforcement. The requirements of flammability class V-0 as per UL-94 are met without addition of antimony compounds. Since this grade does not contain halogens, it displays greater thermal stability than standard FR-4 materials.

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

### 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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Halogen Free

# GreenSpeed™

## Data Sheet

Tg 180, Td 395

Dk 4.16, Df 0.0154

/94 /122 /125 /127 /128

### Features

- Thermal Performance
  - ▶ Tg: 180°C (DSC)
  - ▶ Td: 395°C (TGA @ 5% wt loss)
  - ▶ Superior performance through multiple thermal excursions
  - ▶ Superior chemical and thermal resistance
  - ▶ Lower CTE from ambient to 288°C
- T260: >60 minutes
- T288: >60 minutes
- RoHS Compliant
- UV Blocking and AOI Compatible
  - ▶ UV blocking and enhanced fluorescence
  - ▶ Compatible with all AOI equipment, including laser-enhanced reflectance systems
- Core Material Standard Availability
  - ▶ Thickness: 0.002" (0.05 mm) to 0.093" (2.4 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-4101C /94 /122 /125 /127 /128
  - ▶ UL - File Number E41625

# GreenSpeed Specifications

Property		Typical Values			
		Typical Value	Specification	Units	Test Method
				Metric (English)	IPC-TM-650 (or as noted)
<b>Glass Transition Temperature (Tg) by DSC</b>		180	150-200	°C	2.4.25
<b>Decomposition Temperature (Td) by TGA @ 5% weight loss</b>		395	–	°C	ASTM D3850
<b>T260</b>		>60	–	Minutes	2.4.25
<b>T288</b>		>60	–	Minutes	2.4.25
<b>CTE, Z-axis</b>	A. Pre-Tg	45	AABUS	ppm/°C	2.4.24
	B. Post-Tg	220	–		
<b>CTE, X-, Y-axes</b>	A. Pre-Tg	13	AABUS	ppm/°C	2.4.24
	B. Post-Tg	14	–		
<b>Z-axis Expansion (50-260°C)</b>		2.9	–	%	2.4.24
<b>Thermal Conductivity</b>		0.4	–	W/mK	ASTM D5930
<b>Thermal Stress 10 sec @ 288°C (550.4°F)</b>	A. Unetched	Pass	Pass Visual	Rating	2.4.13.1
	B. Etched				
<b>Dk, Permittivity (Laminate &amp; prepreg as laminated) Tested at 56% resin</b>	A. @ 100 MHz (HP4285A)	4.23	5.4	–	2.5.5.3
	B. @ 500 MHz (HP4285A)	4.19	–		2.5.5.3
	C. @ 1 GHz (HP4291A)	4.18	–		2.5.5.9
	D. @ 2 GHz (Bereskin Stripline)	4.16	–		2.5.5.5
	E. @ 5 GHz (Bereskin Stripline)	4.14	–		2.5.5.5
	F. @ 10 GHz (Bereskin Stripline)	4.14	–		2.5.5.5
<b>Df, Loss Tangent (Laminate &amp; prepreg as laminated) Tested at 56% resin</b>	A. @ 100 MHz (HP4285A)	0.0120	0.035	–	2.5.5.3
	B. @ 500 MHz (HP4285A)	0.0131	–		2.5.5.3
	C. @ 1 GHz (HP4291A)	0.0148	–		2.5.5.9
	D. @ 2 GHz (Bereskin Stripline)	0.0154	–		2.5.5.5
	E. @ 5 GHz (Bereskin Stripline)	0.0148	–		2.5.5.5
	F. @ 10 GHz (Bereskin Stripline)	0.0148	–		2.5.5.5
<b>Volume Resistivity</b>	A. 96/35/90	5.0x10 <sup>6</sup>	1.0x10 <sup>6</sup>	MΩ-cm	2.5.17.1
	B. After moisture resistance	3.0x10 <sup>7</sup>	–		
	C. At elevated temperature	2.8x10 <sup>6</sup>	1.0x10 <sup>3</sup>		
<b>Surface Resistivity</b>	A. 96/35/90	2.0x10 <sup>3</sup>	1.0x10 <sup>4</sup>	MΩ	2.5.17.1
	B. After moisture resistance	4.0x10 <sup>6</sup>	–		
	C. At elevated temperature	1.0x10 <sup>7</sup>	1.0x10 <sup>3</sup>		
<b>Dielectric Breakdown</b>		60	40	kV	2.5.6
<b>Arc Resistance</b>		115	60	Seconds	2.5.1
<b>Electric Strength (Laminate &amp; prepreg as laminated)</b>		36 1500	30 (750)	kV/mm (V/mil)	2.5.6.2
<b>Comparative Tracking Index (CTI)</b>		–	–	Volts	UL-746A ASTM D3638
<b>Peel Strength</b>	A. Low profile copper foil and very low profile – all copper weights >17 microns	7.0	4.0	lb/inch	2.4.8
	B. Standard profile copper	–	–		2.4.8.2
	1. After thermal stress	9.0	4.5		2.4.8.3
	2. At 125°C (257°F)	6.0	4.0		–
	3. After process solutions	7.0	3.0	–	
<b>Flexural Strength</b>	A. Lengthwise direction	TBD	–	lb/inch <sup>2</sup>	2.4.4
	B. Crosswise direction	TBD	–		
<b>Tensile Strength</b>	A. Lengthwise direction	TBD	–	lb/inch <sup>2</sup>	–
	B. Crosswise direction	TBD	–		
<b>Moisture Absorption</b>		0.1	–	%	2.6.2.1
<b>Flammability (Laminate &amp; prepreg as laminated)</b>		V-0	V-1	Rating	UL 94
<b>Max Operating Temperature</b>		130	UL Cert	°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.

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

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