EZ-IO-F

Spread Weave Next Generation Laminate

AGC
Your Dreams, Our Challenge

Benefits

- Extremely Low Skew
- Nanotechnology Based PTFE Laminate
- Drill Quality of FR4 (1000+ Hits/Bit)
- Registration of FR4
- Extremely Low Fiberglass Content (~10%)
- <0.18% Dielectric Constant Variation within a lot
- Standard with ULP or Rolled Copper
- Temperature Stable DK
- Capable of 40+ Layer Large Format PWBs
- CAF Resistant

Applications

- Semiconductor Testing at 25 gbps and Higher
- Test and Measurement
- Optical Data Transport and Backplane Routers
- Hybrid FR4 PWBs Combining Microwave and Digital Signals
- Space and Defense

EZ-IO-F is a thermally stable composite based on nanotechnology, spread weave, and PTFE. Nanoparticle silica ensures a drill quality on par with FR4 materials. EZ-IO-F is based on a very low (~10 wt%) fiberglass content. The nature of the spread weave provides a uniform dielectric constant and impedance as suggested by skew testing. EZ-IO-F was created for the next generation of digital circuitry where digital transmission speeds start at 25 gbps and reach 112 gbps.

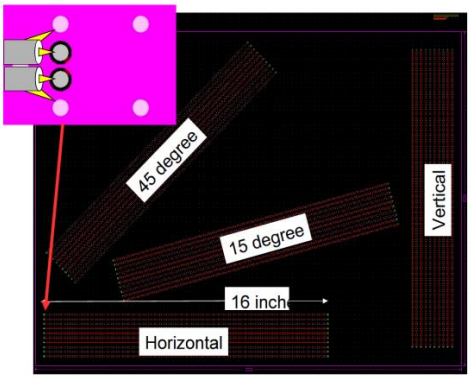
EZ-IO-F was also designed for microwave applications operating at increasingly higher frequencies where there is a need to combine both digital and microwave circuitry onto one PWB. EZ-IO-F was developed to challenge the best FR4 materials at the fabricator level in the most difficult 30-40 layer digital applications.
Skew testing suggests a maximum skew of 0.3 picoseconds/inch and an average skew of <0.1 ps/inch with no artwork rotation. Artwork rotation of 15° shows a maximum skew of ~0.05 ps/inch and an average skew close to zero. Interestingly enough, skew is flat over frequency when tested from 1-20 GHz.

EZ-IO-F is manufactured on industry leading no profile copper. The newer ULP copper outperforms rolled copper and is the new benchmark for high performance laminates. Significant reductions in insertion loss can be achieved with ULP copper vs. HVLP or rolled copper.

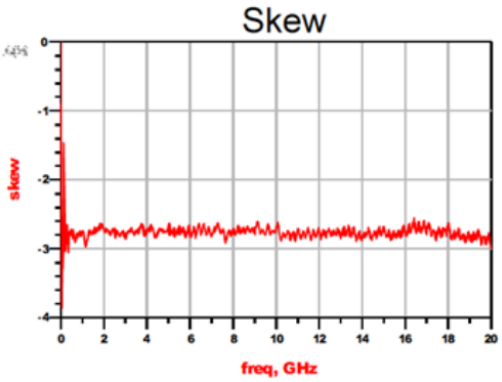
EZ-IO-F is best combined with AGC's FR-28-0040-50S (DF = 0.0018 @ 10 GHz) non-reinforced prepreg to achieve a stripline channel having ~5 wt% fiberglass. AGC's fastRise™ prepregs are the lowest loss prepregs commercially available that can be laminated at FR4-like 420 °F lamination temperatures. The low insertion loss of EZ-IO-F/fastRise™ is only rivaled by the fusion bonding of pure PTFE laminates, an expensive process which causes excessive movement. fastRise™ is typically used at 77 GHz and will compete favorably with any fusion bonded laminate without the cost and challenges of fusion bonding.

EZ-IO-F can be obtained with the lowest profile resistor foils. The nanoparticle's design and lack of surface porosity enable the etching of very fine lines (2-4 mil lines and spaces).

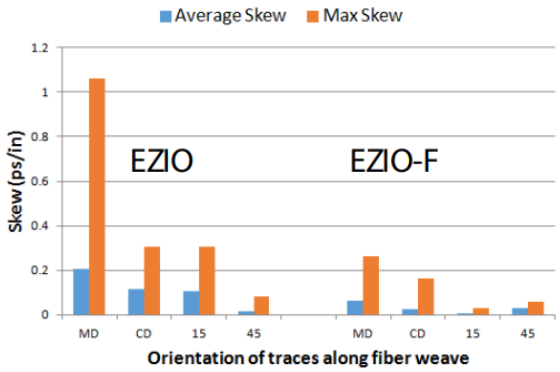
Skew Testing of EZ-IO/EZ-IO-F using fastRise™ Prepreg



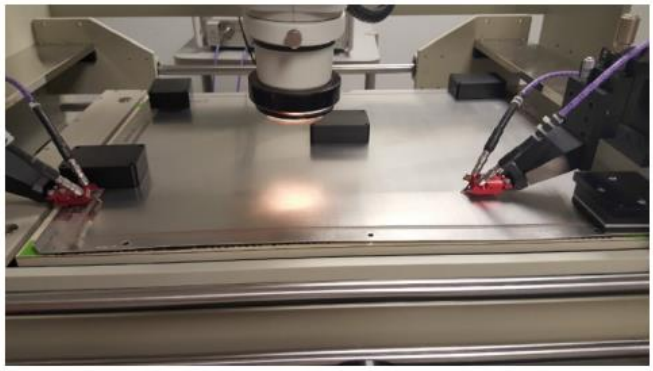
out of skew test vehicle for EZIO/EZIO Layout of skew test vehicle for EZ-IO/EZ-IO-F and fastRise™ prepreg.



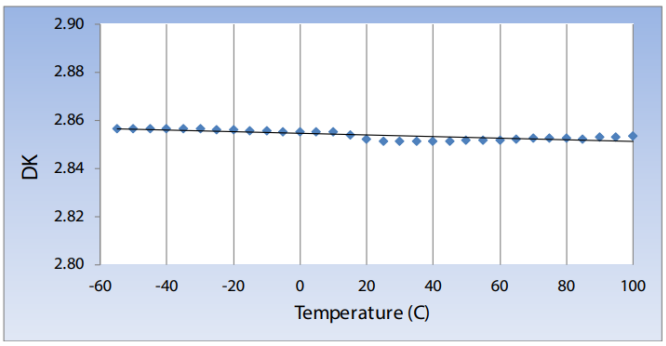
Skew testing of EZ-IO/EZ-IO-F and fastRise™ consistently showed the skew to be independent of frequency.



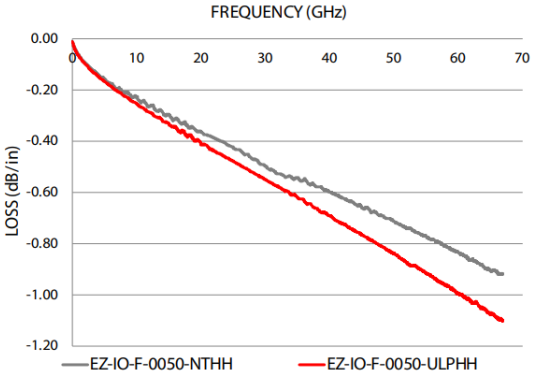
Average skew and maximum skew of paired transmission lines as a function of angle.



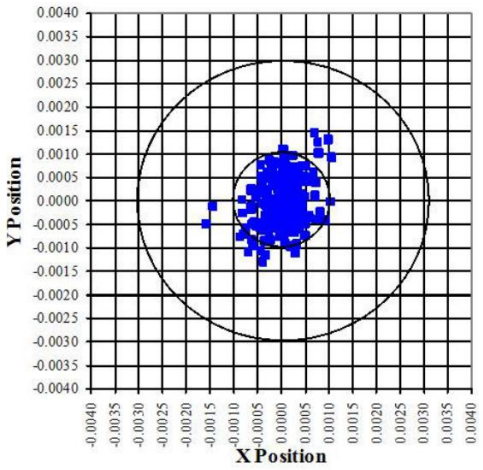
Probe testing of EZ-IO/EZ-IO-F and fastRise™ Physical aspects of the stripline test vehicle were 5.2 mil lines, 7.4 mil spacing, 13.3 mils ground to ground, 7 mils of EZ-IO-F, 6.3 mils of fastRise™ prepreg.

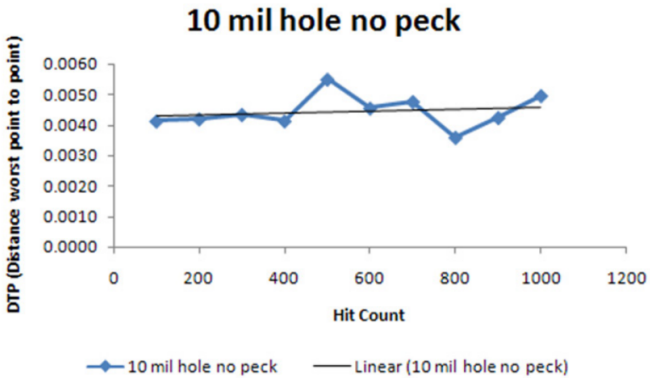


Variation of Dielectric Constant with temperature, TcK = -20 ppm/C

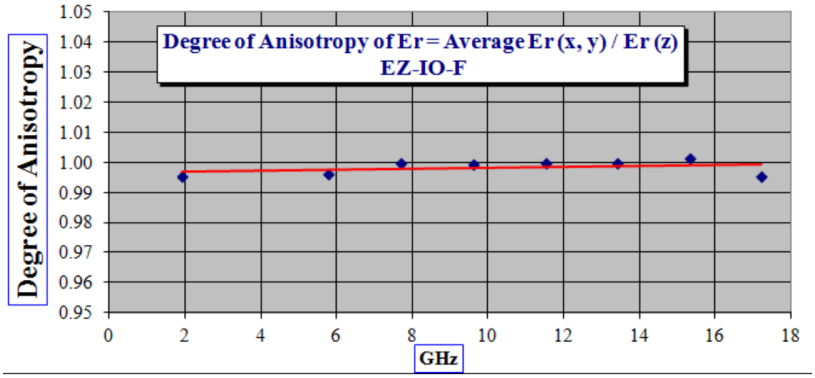


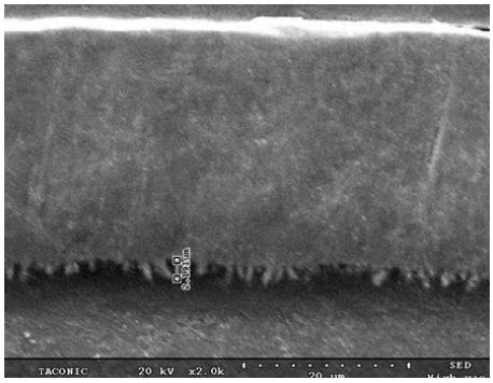
Microstrip Insertion Loss of EZ-IO-F-0050 over frequency, ULP and NT 0.5 oz copper foils using Southwest Connectors (12 mil wide traces, Southwest: 1892-04A-5 (1.85 mm female end launch), pin .005D, diel. .0290D)



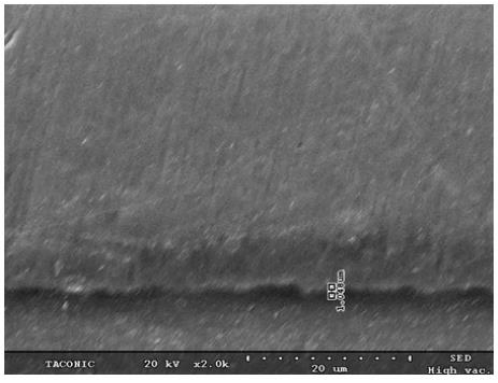


Positional accuracy of EZ-IO mechanical drilling showing no increase in drill wander with 1000 hits/bit.



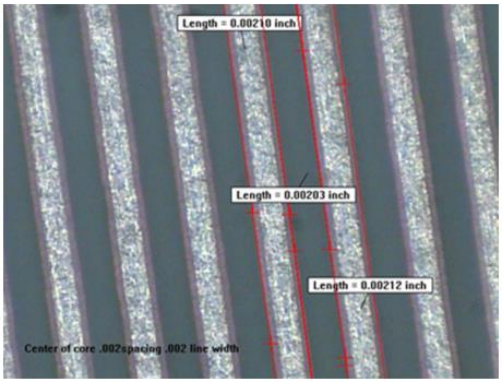


HVLP Copper



ULP Copper

Scanning Electron Microscopy Comparing Copper Roughness of HVLP Copper to ULP Copper, x2,000



2 mil lines and spaces etched on EZ-IO, courtesy of Sanmina

Properties	Conditions	Typical Value	Unit	Test Method
Electrical Properties				
Dielectric Constant	@ 10 GHz	2.80 ± 0.05		IPC-650 2.5.5.5.1 (Modified)
Dissipation Factor	@ 10 GHz	0.0015		IPC-650 2.5.5.5.1 (Modified)
Surface Resistivity		1.67×10^6	Mohms (Mohms/cm)	IPC-650 2.5.17.1A (Elevated Temp.)
		2.29×10^4	Mohms (Mohms/cm)	IPC-650 2.5.17.1A (Humidity
Volume Resistivity		3.58×10^7	Mohms (Mohms/cm)	IPC-650 2.5.17.1 Sec. 5.2.1 (Elevated Temp.)
		3.94×10^{10}	Mohms (Mohms/cm)	IPC-650 2.5.17.1 Sec. 5.2.1 (Humidity Cond.)
Dimensional Stability	MD	0.45	mm/M (mils/in)	IPC-650 2.4.39A (After Etch)
	CD	0.44	mm/M (mils/in)	
	MD	0.42	mm/M (mils/in)	IPC-650 2.4.39A (Thermal Stress)
	CD	0.33	mm/M (mils/in)	
Thermal Properties				
Thermal Conductivity		0.49	W/M*K	ASTM E1530-11
		0.53	W/M*K	ASTM E1461
CTE (45 - 125 °C)	X	19	ppm/°C	IPC-650 2.4.41/ASTM D3386
	Y	25		
	Z	49		
Mechanical Properties				
Peel Strength	0.5 oz. ULP	1.05 (6)	N/mm (lbs/in)	IPC-650 2.4.8, sec. 5.2.2
	1 oz. ULP - MD	1.05 (6)	N/mm (lbs/in)	
	1 oz. ULP - CD	1.05 (6)	N/mm (lbs/in)	
	1 oz. ULP - MD	1.05 (6)	N/mm (lbs/in)	IPC-650 2.4.8, sec. 5.2.2 (Thermal Stress)
	1 oz. ULP - CD	1.05 (6)	N/mm (lbs/in)	
	1 oz. ULP - MD	1.05 (6)	N/mm (lbs/in)	IPC-650 2.4.8, sec. 5.2.2 (Chemical Exp.)
	1 oz. ULP - CD	1.05 (6)	N/mm (lbs/in)	
Compressive Modulus		3,496 (507,000)	N/mm^2 (psi)	ASTM D695-15
Chemical / Physical Properties				
Density	Specific Gravity	2.12	g/cm^3	STM D792 -13 (Method A)
Dielectric Breakdown		39.8	kV	IPC-650 2.5.6/ASTM 229-13
		23.8	kV	IPC-650 2.5.6.2/ASTM D149-09
Arc Resistance		248	Seconds	ASTM D495-14

*2.80 uses low DK spread weave glass; **2.85 uses regular DK spread weave glass.

* All test data provided are typical values and not intended to be specification values. For review of critical specification tolerances, please contact a company representative directly.
* EZ-IO-F can be manufactured in increments of 0.005”(0.125mm).
* Standard panel size is 18” x 24” (457 mm x 610 mm).
* Please contact AGC for availability of additional thicknesses, other sizes & any other type of cladding.

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