TLY-5Z Low DK/Low Z Axis Expansion/Low Density Laminates

TLY-5Z laminates are advanced composites consisting of ceramic, PTFE and a woven fiberglass reinforcement. The composite structure was designed for low density applications such as aerospace having optimally low weight requirements. The combination of ceramic and woven fiberglass results in a dimensionally stable composite which is otherwise not possible with non reinforced PTFEs. The low density approach also makes for a composite with a low Z axis expansion which is also not otherwise possible with PTFE-rich composites. TLY-5Z is much more thermally stable with respect to z axis expansion induced stress on plated through holes than conventional low dielectric constant PTFE-composites.

TLY-5Z is also an attractive choice from a cost perspective. The ceramic/fiberglass structure is a cost-effective solution versus standard PTFE-rich copper clad laminates. TLY-5Z can be used in high volume commercial microwave applications where PTFE-rich substrates would be cost prohibitive. TLY-5Z can be used in PWB designs which would be extremely difficult to manufacture or thermally unreliable with conventional PTFE-rich substrates. Often, plated through holes in conventional PTFE-rich substrates suffer from drilling defects and must be plated with thick copper to have any hope of reliability. These PWBs may suffer from thermal cycle induced cracks. TLY-5Z has half the thermal expansion of PTFE-rich substrates, offers improved drilling and can be thermally cycled. Ground stitching along transmission lines can be readily accomplished and they will be thermally reliable. TLY-5Z offers a much better option for complex multilayer stripline design than older PTFE rich substrates. TLY-5Z can support Substrate Integrated Waveguide (SIW) applications with many mode suppression vias.

TLY-5Z can be combined with the flattest of coppers such as the new ULP ultra low profile copper foils.

Benefits & Applications:

- **Low Z Axis CTE**
- **Plated Through Hole Stability**
- **Low Density (1.92 g/cm³)**
- **Attractive Price/Performance Ratio**
- **Excellent Peel Strength**
- **Compatible with Flat Copper**

- **Aerospace Components**
- **Low Weight Antennas for Aircraft**
- **RF Passive Components**

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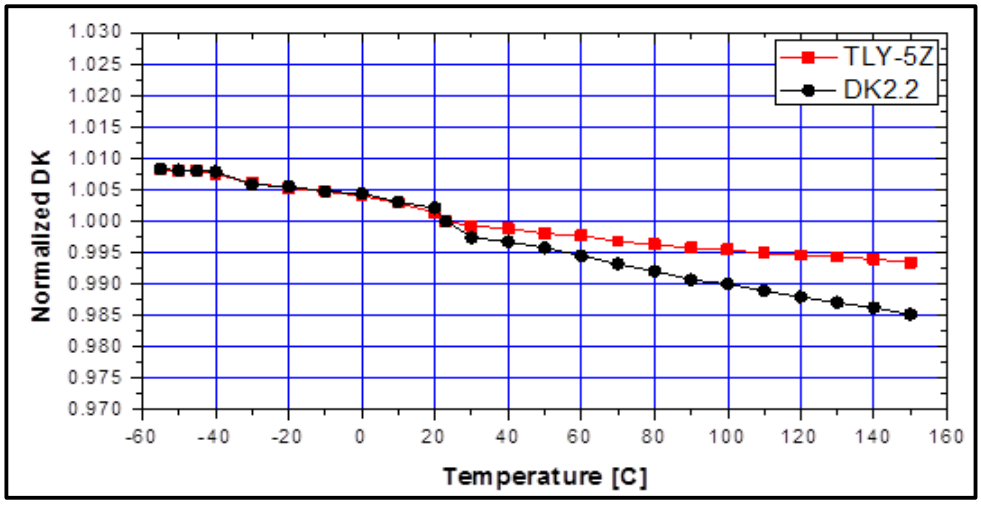
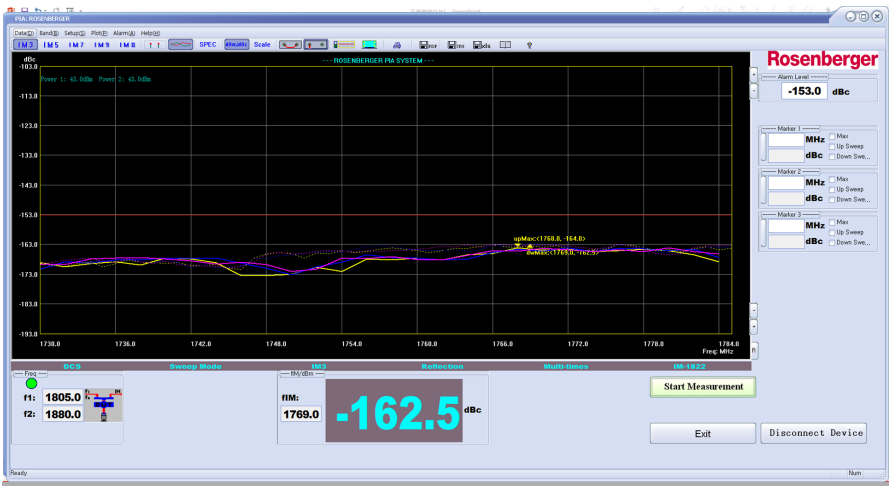
TLY-5Z shows reduced temperature coefficient of dielectric constant (TcK) relative to conventional 2.2 dielectric constant materials.

Conventional 2.2 DK PTFE Subtrates

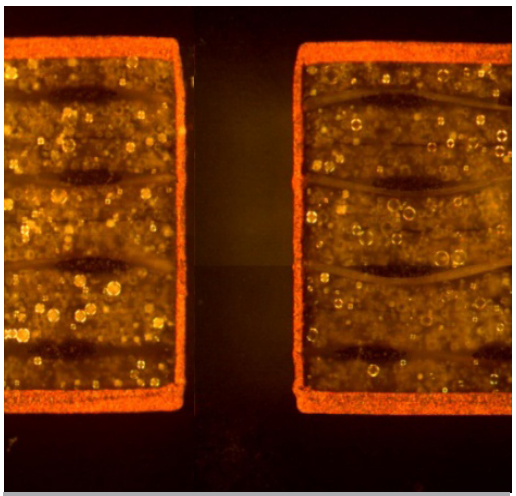


PIMD (Passive Intermodular Distortion) occurs in complex communications systems where multiple frequencies induce unwanted harmonic distortion. PIM can result from many sources other than the copper clad laminates. However, laminates such as Taconic's TLY and TLY-5Z exceed PIM requirements of PCBs of -153 dBc (measured between 880 and 960 M, from 1710 to 1880 MHz and from 1920 to 2100 MHz). Data was collected using 20 Watt signal carriers and reverse treated copper (CL1).

TLY-5Z's improved PTH reliability results in consistent PIMD levels in pwb designs with plated through holes even after repeated thermal cycling.



PIMD example of TLY-5Z-0300-CL1/CL1



PTH example after thermal cycle

TLY-5Z Typical Values					
Property	Test Method	Unit	Value	Unit	Value
Dk @ 1.9 GHz	IPC-650 2.5.5.5.1 Mod.		2.20+/- 0.04		2.20+/- 0.04
Df @ 1.9 GHz	IPC-650 2.5.5.5.1 Mod.		0.0010		0.0010
Df @ 10 GHz	IPC-650 2.5.5.5.1 Mod.		0.0015		0.0015
Tc(D)K (-55 ~150°C)	IPC-650 2.5.5.6 Mod.	ppm/°C	-72	ppm/°C	-72
Dielectric Breakdown Voltage	IPC-650 2.5.6	kV	45	kV	45
Dielectric Strength	IPC-650 2.5.6.2	V/mil	770	V/mm	30,315
Moisture Absorption	IPC-650 2.6.2.1	%	0.03	%	0.03
Peel Strength (1 oz. copper)	IPC-650 2.4.8	lbs./inch	7	N/mm	1.3
Volume Resistivity	IPC-650 2.5.17.1	Mohms/cm	10^9	Mohms/cm	10^9
Surface Resistivity	IPC-650 2.5.17.1	Mohms	10^8	Mohms	10^8
Tensile Strength (MD)	IPC-650 2.4.18.3	psi	9137	N/mm^2	63
Tensile Strength (CD)	IPC-650 2.4.18.3	psi	9572	N/mm^2	66
Tensile Modulus (MD)	IPC-650 2.4.18.3	psi	182,748	N/mm^2	1260
Tensile Modulus (CD)	IPC-650 2.4.18.3	psi	165,344	N/mm^2	1140
Elongation (MD)	IPC-650 2.4.18.3	%	6.0	%	6.0
Elongation (CD)	IPC-650 2.4.18.3	%	6.9	%	6.9
Flex Strength (MD)	ASTM D790	psi	10,300	N/mm^2	71
Flex Strength (CD)	ASTM D790	psi	11,600	N/mm^2	80
Flex Modulus (MD)	ASTM D790	psi	377,100	N/mm^2	2600
Flex Modulus (CD)	ASTM D790	psi	432,213	N/mm^2	2980
Dimensional Stability (MD)	IPC-650 2.4.39 (Bake)	% (10 mil)	-0.05	% (30 mil)	-0.05
Dimensional Stability (CD)	IPC-650 2.4.39 (Bake)	% (10 mil)	-0.17	% (30 mil)	-0.11
Dimensional Stability (MD)	IPC-650 2.4.39 (Stress)	% (10 mil)	-0.07	% (30 mil)	-0.07
Dimensional Stability (CD)	IPC-650 2.4.39 (Stress)	% (10 mil)	-0.22	% (30 mil)	-0.14
Density (Specific Gravity)	IPC-650 2.3.5	g/cm^3	1.92	g/cm^3	1.92
Specific Heat	IPC-650 2.4.50	J/g°C	0.95	J/g°C	0.95
Thermal Conductivity	IPC-650 2.4.50	W/M*K	0.2	W/M*K	0.2
CTE (x-y) (50 - 150˚C)	IPC-650 2.4.41	ppm/°C	30-40	ppm/°C	30-40
CTE (z) (50 - 150˚C)	IPC-650 2.4.41	ppm/°C	130	ppm/°C	130
Hardness	ASTM D2240 (Durometer)	-	68	-	68
UL-94 Flammability Rating	UL-94		V-0		V-0

All reported values are typical and should not be used for specification purposes. In all instances, the user shall determine suitability in any given application.

TLY-5Z Low DK/Low Z Axis Expansion/Low Density Laminates

Designation	Dk
TLY-5Z	2.20 +/- 0.04

Typical Thicknesses[1]	
Inches	mm
0.0010	0.25
0.0020	0.51
0.0030	1.76
0.0060	1.52

Available Sheet Sizes[2]	
Inches	mm
12 x 18	305 x 457
16 x 18	406 x 457
18 x 24	457 x 610
36 x 48	914 x 1220

1Standard TLY-5Z can be manufactured in increments of 0.010". Please call for iavailability of additional thicknesses.
[2]Our standard sheet size is 36" x 48" (914 mm x 1220 mm). Please contact our customer service department for availability of other sizes.

Please see our Product Selector Guide for information on available copper cladding.

An example of a 30 mil material with 1 oz. RTF copper on both sides is part #:
TLY-5Z-0300-CL1/CL1 - 18" x 24" (457 mm x 610 mm)