

TacPreg®/TacLam®

Prepregs & Laminates

Excellent Peel Strength
Dissipation Factor Flat Over Frequency
Enables Manufacture of 20+ Layer PWBs
Laminates at Standard PWB Temperatures & Pressures
Enhanced Stiffness Over PTFE-Based Laminates

TACONIC

An ISO 9001:2000 Registered Company

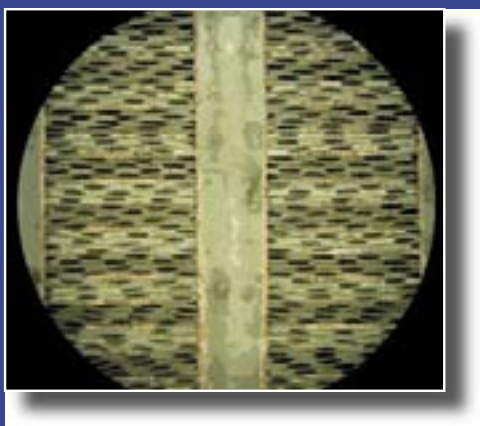
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APPLICATIONS

Backpanels

RF Multilayer Designs

Hybrid Multilayer Designs



TacPreg®/TacLam®

Prepregs & Laminates

TacPreg® and TacLam® are the result of Taconic's expertise and extensive experience in providing the printed circuit board market with state-of-the-art high performance laminate materials.

TacPreg® is an excellent prepreg for other Taconic products including, but not limited to, RF-35 and RF-35P.

TacLam® laminates are designed for thin core, high speed digital applications requiring excellent electrical performance.

TacLam® laminates are a combination of fluoropolymer resin based on woven fiberglass reinforcement, BT epoxy, and ceramic. TacLam® is made from, and used in conjunction with, TacPreg® prepregs.

The TacPreg® / TacLam® system is dimensionally stable due to the woven fiberglass reinforcement used in its design.

TacPreg® enables foil lamination processing in either digital or RF board designs.

The TacPreg® / TacLam® system can be processed using typical epoxy processes and lamination cycles, detailed below. Vacuum lamination is recommended.

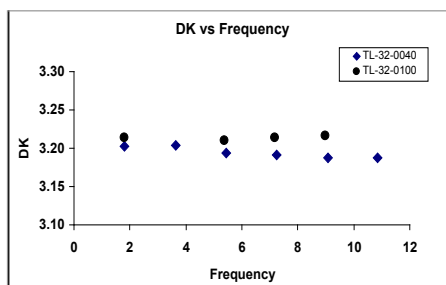
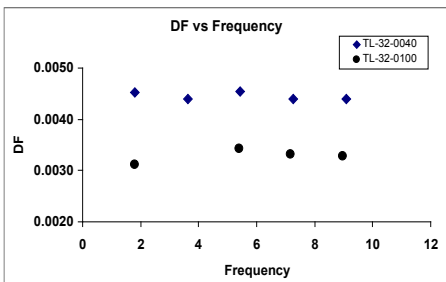
- Heat rise 10°F /5°C/min to 392°F / 200°C (flow window 200°F/93°C - 302°F/150°C)
- Kiss pressure 73 psi / 5 bar until package reaches 150°F/66°C then apply full pressure (450 psi /31 bar)
- Hold (cure) for 1 hour
- Cool down under pressure at <6°F/3°C /min
- Inner-layer copper should be treated with an oxide or alternative treatment

TacPreg® - US Patent #6,500,529

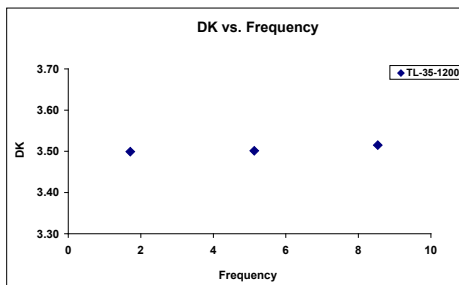
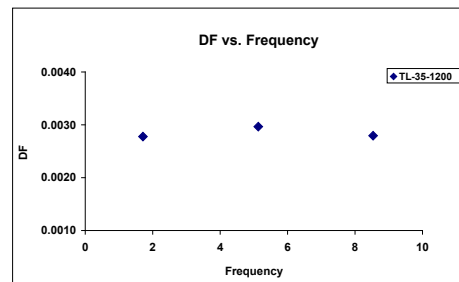
TacPreg®/ TacLam® Typical Values

Property	Units	Value	Test Method	Units	Value
Dielectric Constant (1 MHz / 10 GHz)		3.20 / 3.19	IPC-TM 650 2.5.5.3 / (US 5,083,088)		3.20 / 3.19
Dissipation Factor (1 MHz / 10 GHz)		0.0022 / 0.0050	IPC-TM 650 2.5.5.3 / (US 5,083,088)		0.0022 / 0.0050
Dielectric Constant (10 GHz - TL-35)		3.50	PC-TM 650 2.5.5.3	3.50	
Dissipation Factor (10 GHz - TL-35)		0.0030	PC-TM 650 2.5.5.3	0.0030	
Moisture Absorption	%	0.1	IPC-TM 650 2.6.2.1	%	0.1
Peel Strength - 0.5 oz copper	lbs./linear in	5.0	IPC-TM 650 2.4.8	N/mm	0.9
Peel Strength - 1.0 oz copper	lbs./linear in	7.0	IPC-TM 650 2.4.8	N/mm	1.2
T260 / T288 / T300	min.	>600 / >60 / >30	IPC-TM 650 2.4.24.1	min.	>600 / >60 / >30
PTFE:Thermoset Resin Ratio		5:1			5:1
Liquid to Liquid Thermal Shock Test (-35° to 125°C)	cycles	400 / pass	0.180" 20 layer test vehicle, 0.0225" holes	cycles	400 / pass
6X Solder Float	pass / fail	pass	0.180" 20 layer test vehicle, 0.0225" holes	pass / fail	pass
Shore Hardness	D Scale	75	ASTM D 785	D Scale	75
Volume Resistivity	Ohm/cm	7.1 x 10 ¹⁴		Ohm/cm	7.1 x 10 ¹⁴
Compression Modulus (23C, 125C, 200C)	kpsi	218, 171, 74	ASTM D 695 (23°C)	bar	15031, 11790, 5102
Compression Strength	kpsi	23	ASTM D 695 (23°C)	bar	1586
Yield Stress (shear)	psi	4750	ASTM D 5379 V-Notched Beam	bar	328
Yield Strength (shear) MD / CD	psi	5010 / 4840	ASTM D 5379 V-Notched Beam	bar	345 / 334
Glass Transition of PTFE	°F	70, 79	DSC, DMA	°C	21, 26
Interconnect Stress Testing	cycles	>800	0.100", 12 layer test vehicle, 0.012" holes	cycles	>800
Dielectric Breakdown	kV	38.5	IPC-TM-650 2.5.6 (0.008")	kV	38.5
Strain at Break (MD)	%	1.2	ASTM D 790	%	1.2
Strain at Break (CD)	%	1.1	ASTM D 790	%	1.1
Flexural Modulus (MD)	psi	1.67 x 10 ⁶	ASTM D 790	bar	1.15 x 10 ⁵
Flexural Modulus (CD)	psi	1.69 x 10 ⁶	ASTM D 790	bar	1.16 x 10 ⁵
Flexural Strength (MD)	psi	1.90 x 10 ⁴	ASTM D 790	bar	1310
Flexural Strength (CD)	psi	1.60 x 10 ⁴	ASTM D 790	bar	1103
Tensile Strength (MD)	psi	1.98 x 10 ⁴	ASTM D 3039	bar	1365
Tensile Strength (CD)	psi	1.80 x 10 ⁴	ASTM D 3039	bar	1241
Tensile 0.2% Offset Yield Strength (MD)	psi	1.73 x 10 ⁴	ASTM D 3039	bar	1193
Tensile 0.2% Offset Yield Strength (CD)	psi	1.70 x 10 ⁴	ASTM D 3039	bar	1172
Young's Modulus (MD)	psi	1.77 x 10 ⁶	ASTM D 3039	bar	1.22 x 10 ⁵
Young's Modulus (CD)	psi	1.76 x 10 ⁶	ASTM D 3039	bar	1.21 x 10 ⁵
Poisson's Ratio (MD)		0.131	ASTM D 3039		0.131
Poisson's Ratio (CD)		0.136	ASTM D 3039		0.136
UL Rating		V0			V0
MOT / RTI Ratings	°F	266 expected		°C	130 expected
Resin flow	%	2 - 8	IPC-TM 650 2.3.17	%	2 - 8
Volatile Content Maximum	%	0.7	IPC-TM 650 2.3.19	%	0.7
Shelf Life		6+ months	Store flat in a cool, dry environment - < 70°F (21°C), 50% RH. For extended storage, reduce temperature to < 40°F (4°C) Reseal open packages.		

Typical values: TL-32



Typical values: TL-35



How to Order

Designation		Dielectric Constant	Available Thicknesses	Available Sheet Sizes		Grain Direction	
TacPreg®	TP-32	3.20	0.0040", 0.0045"*, 0.0050", 0.0060", 0.0100"	18" x 24" 18" x 12"	457mm x 610mm 457mm x 304mm	24" 12"	610mm 304mm
			(0.100mm, 0.110mm, 0.125mm, 0.150mm, 0.250mm)				
	TP-35	3.50	0.0045"*				
			(0.110mm)				
TacLam®	TL-32	3.20	0.0040", 0.0050", 0.0060", 0.0100"	18" x 24" 18" x 12"	457mm x 610mm 457mm x 304mm	24" 12"	610mm 304mm
			(0.100mm, 0.125mm, 0.150mm, 0.250mm)				
	TL-35	3.50	0.0100"				
			(0.250mm)				

Values listed above are typical. Please contact our customer service department for availability of other thicknesses and dimensions.

*Materials recommended for foil lamination

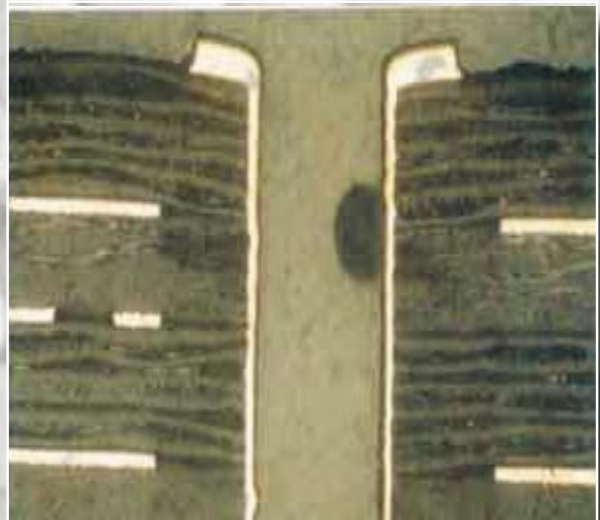
Thermal Reliability

Most technologists associate the thermal reliability of a material with the z axis coefficient of thermal expansion. This is correct for some materials. The stress on a plated through hole is related to the mismatch in CTE of the copper barrel and the resin material. Polymeric resins are constrained by the fiberglass in the x, y directions. Expansion in the z direction occurs at roughly a 3x rate than for linear expansion. The copper barrel is stressed in tension in the z direction. The inner-layer connections are also stressed in tension. FR4 can be considered as a frozen fluid. An increase in temperature results in expansion and an increase in stress. In the simplest case, stress is proportional to the modulus multiplied by the strain. FR4 has a constant modulus over temperature. Because the modulus of FR4 does not change until its glass transition temperature, stress can be directly related to the CTE and the resulting strain (ϵ). Polytetrafluoroethylene, PTFE, is not a thermosetting resin like FR4, it is a thermoplastic. PTFE is a collection of spherical particles and air. The spherical particles fuse somewhat where the spheres come into contact. However, there is a large air volume associated with PTFE. A PTFE laminator presses out air during lamination. There is no flow like a thermoset or even like a conventional thermoplastic. During PTFE lamination, the compression of the particles and the pressing out of the air is directly related to the pressure and temperature. However, because PTFE does not flow, even at pressures exceeding 1000 psi, air contributes significantly to the dielectric properties of PTFE.

PTFE does not have a constant Young's modulus. The Young's modulus of PTFE drops by three orders of magnitude when heated from 25 to 100°C. Therefore, as PTFE is heated, because the modulus drops significantly the resulting stress is far less.

Secondly, because PTFE has a compression modulus that drops by two thirds over the temperature range from room temperature to 200°C, PTFE compresses far more readily at elevated temperatures. Therefore, because the plated through hole acts to restrict the z axis expansion, it is likely that while the PTH is experiencing some tensile stress in the z direction, PTFE is experiencing a compressive stress, pressing out air between the particles.

In a recent study, TacPreg®/TacLam® had no failures after 800 cycles while many thermosetting systems did far worse and no resin system matched TacPreg®'s performance. This performance was verified by another major board shop on 0.020" holes. These results are consistent with two lots of 20 layer backpanels produced using TacPreg®/TacLam® that had no thermal stress induced failures after exposure to a liquid to liquid thermal shock test (-35 to 125°C).



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