*fast*Rise™ DS Prepreg

*fast*Rise™ DS is a thermally stable, industry leading low loss (DF = 0.0018 @ 10 GHz), low temperature prepreg (215 ºC lamination temperature) that is designed to enable the creation of very low loss stripline structures when combined with TSM-DS laminate core material (DF = 0.0010 at 10 GHz). *fast*Rise™ DS is a ceramic filled material with very low fiberglass content (~7 wt%) that rivals the best epoxy materials for registration alignment when fabricating large format advanced multilayers.

*fast*Rise™ DS differs from *fast*Rise™ 27 prepreg (DF = 0.0014 at 10 GHz) in that *fast*Rise™ DS is designed with fiberglass reinforcement where low X-Y CTEs are necessary for CTE matching with plastic or ceramic chip packages.

RF designers generally resort to fusion bonding (the melting of PTFE at very high temperatures) to create symmetrical striplines above and below the signal layer. Fusion bonding is expensive, there are few capable fabricators and it is prone to unpredictable dimensional movement and poor layer to layer registration*. *fast*Rise™ DS is a **low cost** solution that enables any fabricator capable of fabricating epoxy multilayers to fabricate well registered stripline structures that have the performance of fusion bonding without the associated costs.

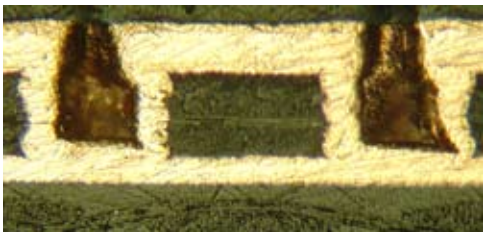
When combined with Ticer or Ohmega resistor foil, *fast*Rise™ DS leads to a lower likelihood of resistor cracking, a typical defect in fusion bonded structures.

*fast*Rise™ DS is a low flow prepreg that is suitable for microvia formation and foil lamination. The low fiberglass content does not yield an unusual level of defects normally associated with lasing through fiberglass.

Benefits & Applications:

- Industry Best DF = 0.0018 at 10 GHz
- 215 ºC lamination temperature reduces cost
- Rivals epoxy in dimensional consistency and predictability of registration
- Low X – Y CTEs for ceramic chip packaging
- Temperature stable DK +/- 0.19% (-30 to 110 ºC)
- Low 7 wt% fiberglass
- Low PTFE content (< 25 wt%)

- Military
- Phase Array Antennas
- mmWave Antenna/Automotive
- Semiconductor/ATE testing



6 mil microvia laser ablated by Micron Technology, Inc. Preliminary data suggests that the optimal lasing conditions are a combination of CO_2 and UV lasers.

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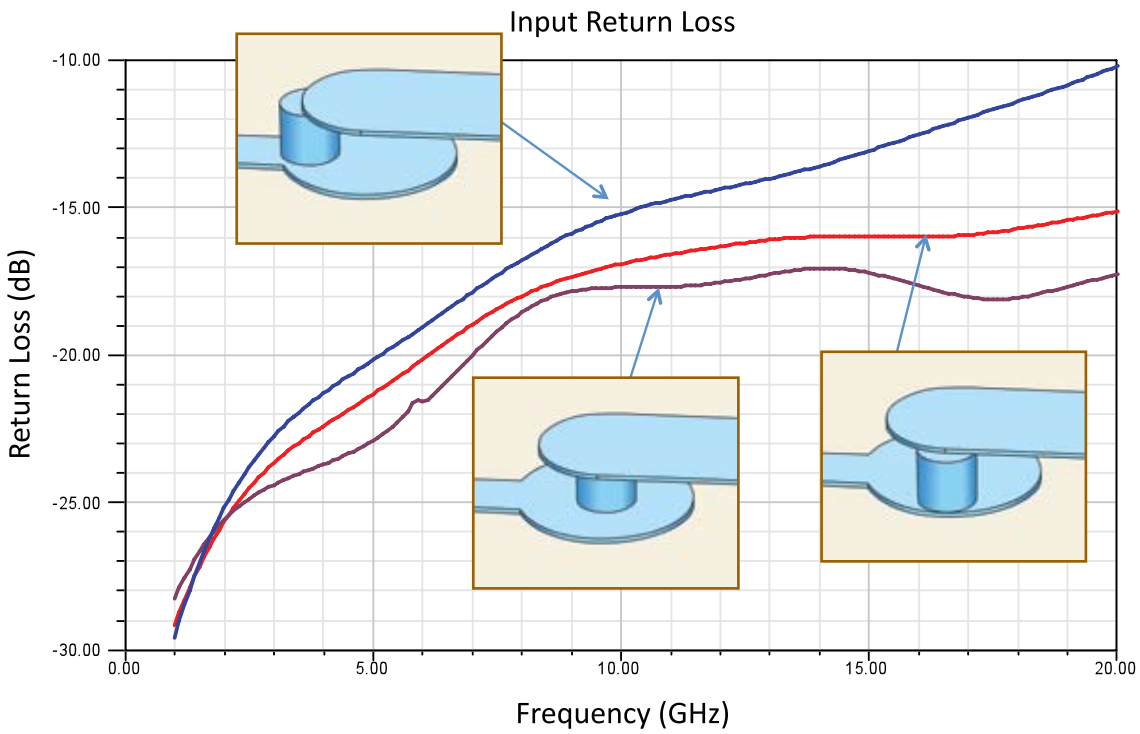


RF designers use stripline structures for the following reasons:

1. Allow densification
2. Eliminate cross talk between multiple channels
3. Create more confined fields
4. EM field distribution is more symmetrical, offering better control over even/odd mode impedances
5. Stripline structures do not radiate as readily
6. Allow for broadband multi-octave couplers and filters

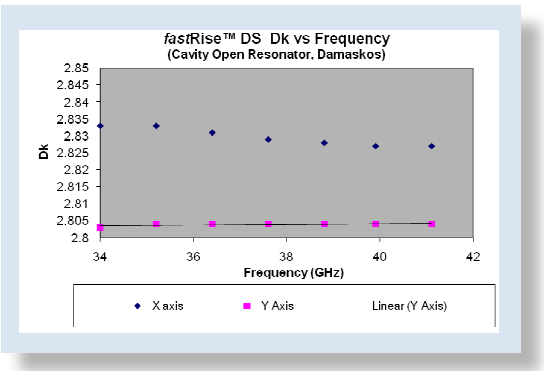
To achieve these goals without compromising RF properties, registration is critical to stripline structures.

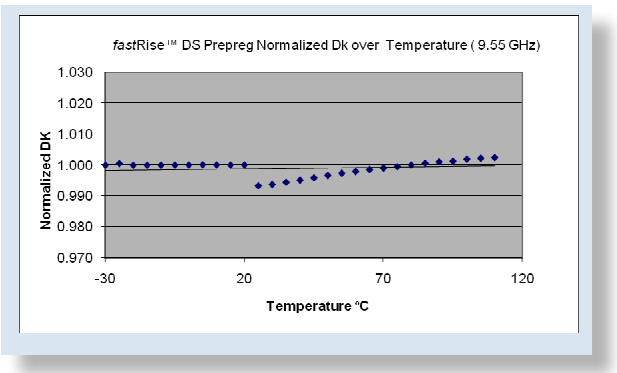
Fusion bonding is the melting of PTFE cores with PTFE unclad "prepregs" or modified PTFE materials like FEP or PFA. Similar prepregs are available with high levels of FEP, PFA or PTFE to enable the bonding. Pure PTFE is the worst case with fusion bonding in the 350-400 ºC range. FEP is the lowest temperature material suitable for fusion bonding at 295 ºC. FEP and PFA both lead to thermal shock problems and drilling defects**. FEP, PFA and PTFE melt during drilling causing drill smear and reliability risks, FEP being the lowest melting of the group (mp = 255 ºC). *fast*Rise™ DS contains no FEP or PFA and contains less than 25% PTFE.

** For more information, please visit **www.taconic-add.com** and view **Technical Topic: TSM-DS Manufactured with Various Prepregs.**

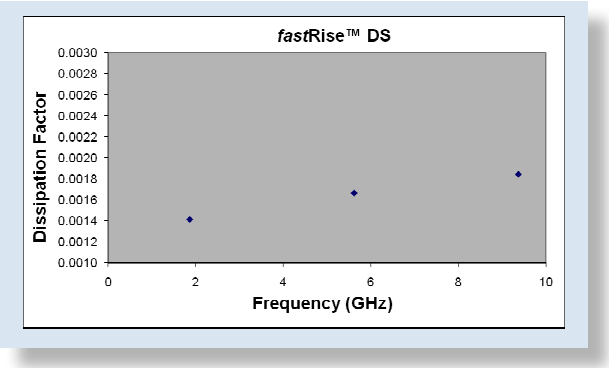
*fast*Rise™ DS Typical Values					
Property	Test Method	Unit	Value	Unit	Value
Pressed Thickness Between Ground Planes		mils	5.0		
Dk @ 10 GHz	IPC-650 2.5.5.5.1 (modified)		2.96		2.96
Dk @ 40 GHz	IPC-650 2.5.5.5.1 (modified)		2.81		2.81
T_cK (-30 to 100 °C)	IPC-650 2.5.5.5.1 (modified)	ppm/°C	15	ppm/°C	15
Df @ 10 GHz	IPC-650 2.5.5.5.1 (modified)		0.0018		0.0018
Df @ 40 GHz	Damaskos Open Resonator		0.0030		0.0030
Dielectric Breakdown	ASTM D 149/IPC-650 2.5.6	kV	61.6	kV	61.6
Dielectric Strength	ASTM D 149 (Through Plane)	V/mil	814	V/mm	32,047
Moisture Absorption	IPC-650 2.6.2.1	%	0.10	%	0.10
Flexural Strength (MD)	ASTM D 790(02)	psi	17,200	N/mm^2	118.59
Flexural Strength (CD)	ASTM D 790(02)	psi	8,360	N/mm^2	57.64
Tensile Strength (MD)	ASTM D 3039/IPC-650 2.4.19	psi	12,400	N/mm^2	85.49
Tensile Strength (CD)	ASTM D 3039/IPC-650 2.4.19	psi	4,870	N/mm^2	33.58
Elongation at Break (MD)	ASTM D 3039/IPC-650 2.4.19	%	2.93	%	2.93
Elongation at Break (CD)	ASTM D 3039/IPC-650 2.4.19	%	1.14	%	1.14
Young's Modulus (MD)	ASTM D 3039/IPC-650 2.4.19	psi	968,000	psi	968,000
Young's Modulus (CD)	ASTM D 3039/IPC-650 2.4.19	psi	803,000	psi	803,000
Poisson's Ratio (MD)	ASTM D 3039/IPC-650 2.4.19		0.256		0.256
Poisson's Ratio (CD)	ASTM D 3039/IPC-650 2.4.19		0.185		0.185
Thermal Conductivity	ASTM F433	W/M*K	0.36	W/M*K	0.36
Dimensional Stability (MD)	IPC-650 2.4.39 (After Bake)	mils/in.	-0.8	mm/M	-0.8
Dimensional Stability (CD)	IPC-650 2.4.39 (After Bake)	mils/in.	-1.3	mm/M	-1.3
Dimensional Stability (MD)	IPC-650 2.4.39 (Thermal Stress)	mils/in.	-1.5	mm/M	-1.5
Dimensional Stability (CD)	IPC-650 2.4.39 (Thermal Stress)	mils/in.	-2.5	mm/M	-2.5
Surface Resistivity	IPC-650 2.5.17.1 (after temp./humidity)	Mohms	8.22×10^6	Mohms	8.22×10^6
Volume Resistivity	IPC-650 2.5.17.1 (after temp./humidity)	Mohms/cm	1.01×10^8	Mohms/cm	1.01×10^8
CTE (X axis) (25 to 125 °C)	IPC-650 2.4.41/TMA	ppm/°C	10	ppm/°C	10
CTE (Y axis) (25 to 125 °C)	IPC-650 2.4.41/TMA	ppm/°C	17	ppm/°C	17
CTE (Z axis) (25 to 125 °C)	IPC-650 2.4.41/TMA	ppm/°C	66	ppm/°C	66
Density (Specific Gravity)	ASTM D 792	g/cm^3	1.83	g/cm^3	1.83
Hardness	ASTM D 2240 (Shore D)		80.8		80.8
T_d (2% wt loss)	IPC-650 2.4.24.6 (TGA)	°F	788	°C	420
T_d (5% wt loss)	IPC-650 2.4.24.6 (TGA)	°F	856	°C	458
Resin Flow	IPC-650 2.3.17	%	5.0	%	5.0

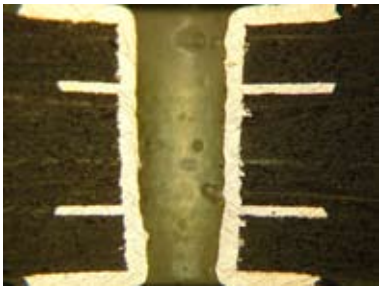
All reported values are typical and should not be used for specification purposes. In all instances, the user shall determine suitability in any given application.



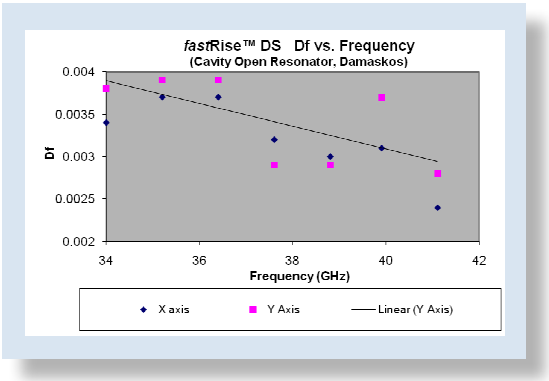


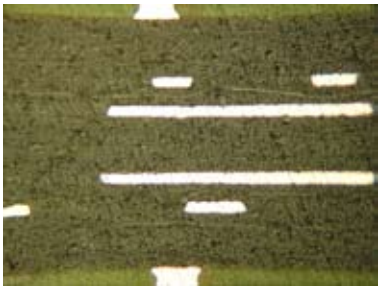
*fast*Rise™ DS Prepreg

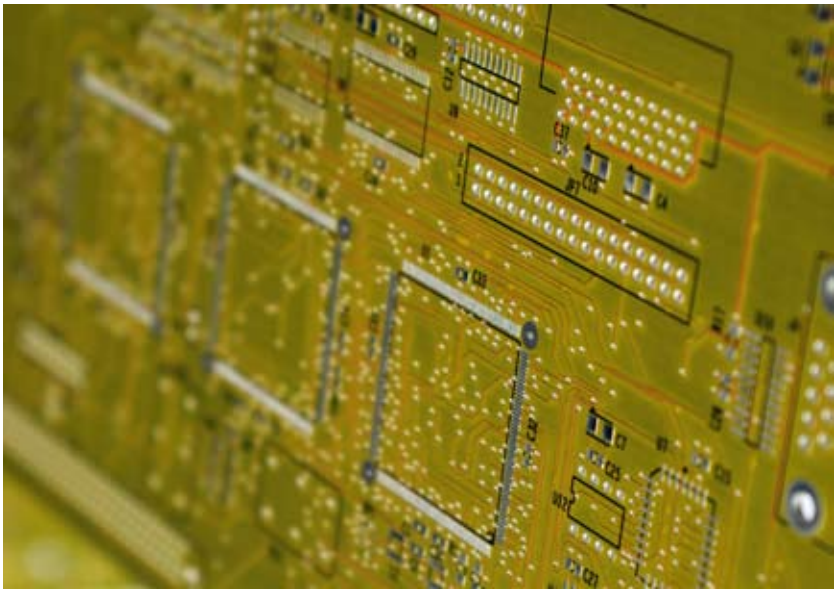




Microsection of 6 copper layer multilayer containing TSM-DS-0100 and *fast*Rise™ DS-0050-40 prepreg (PWBs courtesy of **Delta Circuits, Fairfield, NJ**)







*PWB fabrication and development courtesy of **Delta Circuits, Fairfield, NJ**.
PWBs passed 5X lead free SMT assembly cycles with no defects; 100% electrical retest passed.

Notes for fabricating with *fast*Rise™ DS: These grades of *fast*Rise™ are lower flowing grades of the *fast*Rise™ prepreg series and care must be taken during lamination to avoid lamination voids caused by low pressure areas. *fast*Rise™ is shipped at a very low degree of cure. The best flow conditions are achieved when the prepreg spends the maximum amount of time possible at a temperature of 250 ºF (121 ºC) using the highest possible pressure. For difficult flow and fill designs, lamination should begin at 250 ºF (121 ºC) and held for 30-60 minutes at maximum pressure, followed by a slow 2.0-4.0 ºC/min. ramp rate to 420 ºF (216 ºC). These prepregs are not recommended for blind and buried via fill. Because of the large number of possible applications for the *fast*Rise™ prepreg series and the complexity of many multilayer printed circuit designs, Taconic does not warranty or guarantee the performance of *fast*Rise™ when combined with any supplier's core materials. It is the responsibility of the end user to determine the suitability of *fast*Rise™ with various core materials for each application.

RoHS WEEE Compliant

rev. 10/11