

TSM-DS3b



Your Dreams, Our Challenge

Dimensionally Stable Low Loss Laminate

Benefits

- Industry best Df (Df = 0.0011 @10 GHz)
- High thermal conductivity (TC = 0.65 W/m*K)
- Low (~5%) fiberglass content
- Dimensional stability rivals epoxy
- Enables large format high layer count PWBs
- Builds complex PWBs in yield w/ consistency and predictability
- Temperature stable Dk +/- 0.25% (-30 to 120° C)
- Compatible with resistive foils

Applications

- Couplers
- Phased Array Antennas
- Radar Manifolds
- mmWave Antenna/Automotive
- Oil Drilling
- Semiconductor/ATE Testing



TSM-DS3b is a thermally stable, industry leading low loss core (Df = 0.0011 at 10 GHz) that can be manufactured with the predictability and consistency of the best fiberglass reinforced epoxies. TSM-DS3b is a ceramic-filled reinforced material with very low fiberglass content (~ 5%) that rivals epoxies in fabricating large format complex multilayers.

TSM-DS3b was developed for high power applications (TC = 0.65 W/m*K) where it is necessary for the dielectric material to conduct heat away from other heat sources in a PWB design. TSM-DS3b was also developed to have very low coefficients of thermal expansion for demanding thermal cycling.

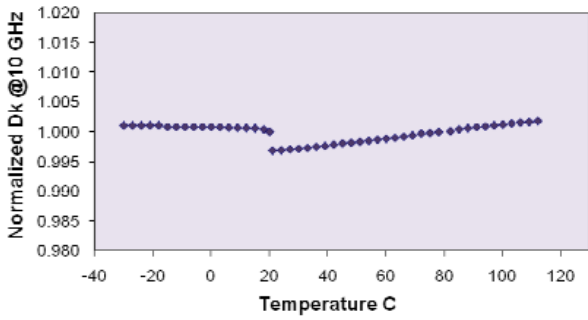
A TSM-DS3b core combined with fastRise™27 (Df = 0.0014 at 10 GHz) prepreg is an industry leading solution for the lowest possible dielectric losses that can be attained at epoxy-like 420F (215°C) fabrication temperatures. The low insertion losses of TSM-DS3b/fastRise™27 are only rivaled by fusion bonding (PTFE laminates melt from 550 to 650°F (288 - 343°C)). Fusion bonding is expensive, it causes excessive material movement and it puts stress on plated through holes. For complex multilayers, the price of poor yield drives up the final material cost. fastRise™27 enables the sequential lamination of TSM-DS3b at a low 420F (215°C) with consistency and predictability that reduces cost.

For microwave applications, the low x, y and z CTE values assure that critical spacings between traces in filters and couplers have very low movement with temperature. TSM-DS3b can be used with very low profile copper foils yielding a smooth copper edge between coupled lines. Registration over many layers is critical for yield and variations in copper weight and copper etching across a panel can cause nonlinear movement. Non-linear movement over large panels leads to a lack of registration of the drilled hole to the pad and possibly open circuits.

TSM-DS3b is compatible with Ticer® and OhmegaPly® resistive foils. Resistor foil stability is best achieved when laminating at low temperatures using AGC's fastRise™27 family of prepreps.

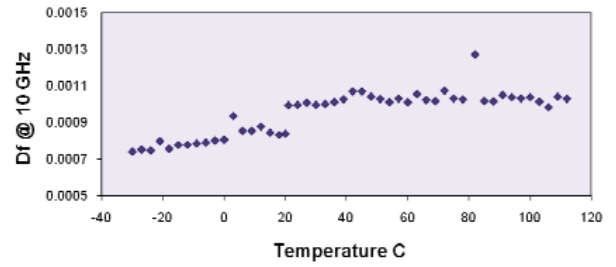
TSM-DS3b is intended for RF circuitry and requires OEM design validation for digital circuitry.

TSM-DS3b: DK over Temperature



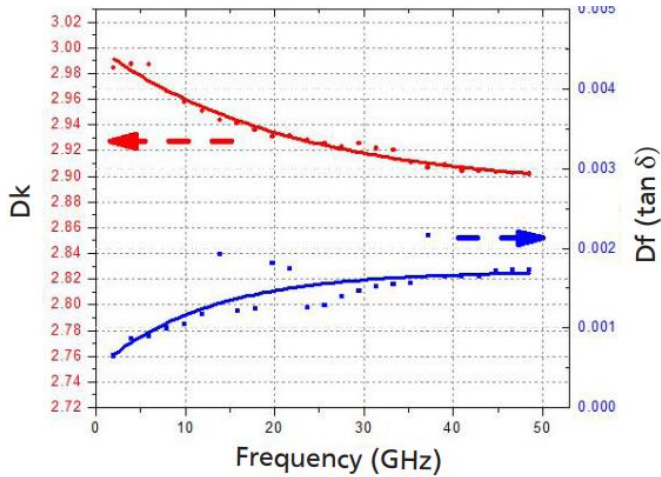
The TSM-DS3b dielectric constant shows a +/- 0.2% deviation with temperature.

TSM-DS3b: DF over Temperature

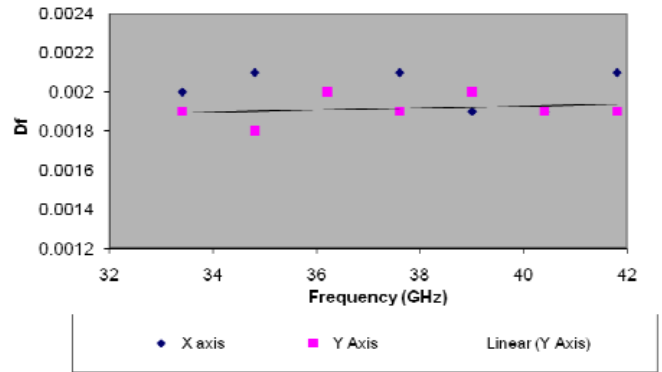


The dissipation factor varies from 0.0007 - 0.0011 over a typical application temperature range.

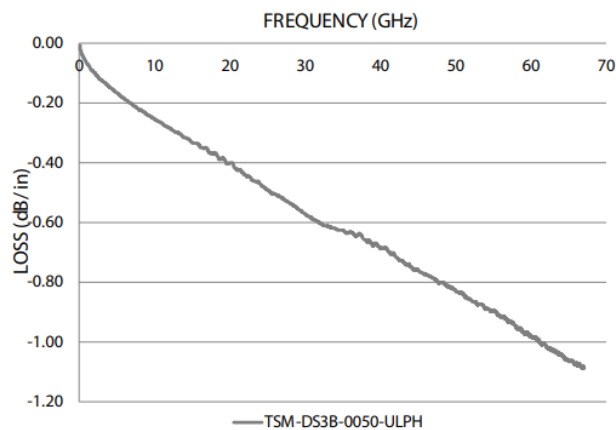
Ring Resonator Properties vs. Frequency on TSM-DS3b-0100. (Test set up as shown on page 4).



TSM-DS3b at mmWave (Damaskos)

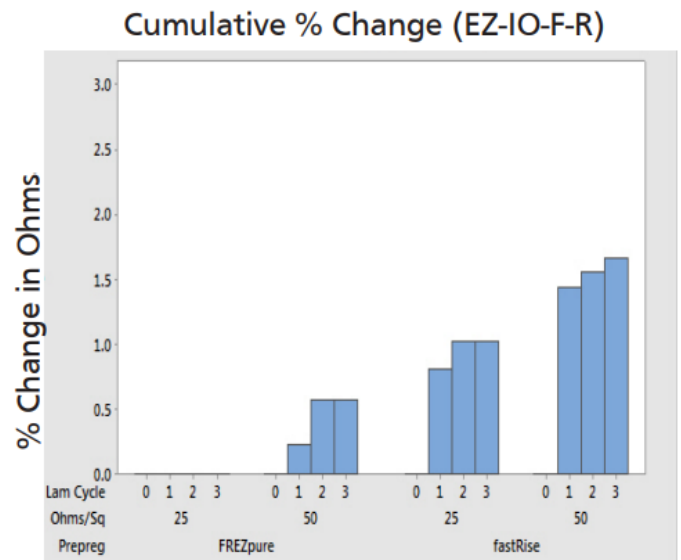
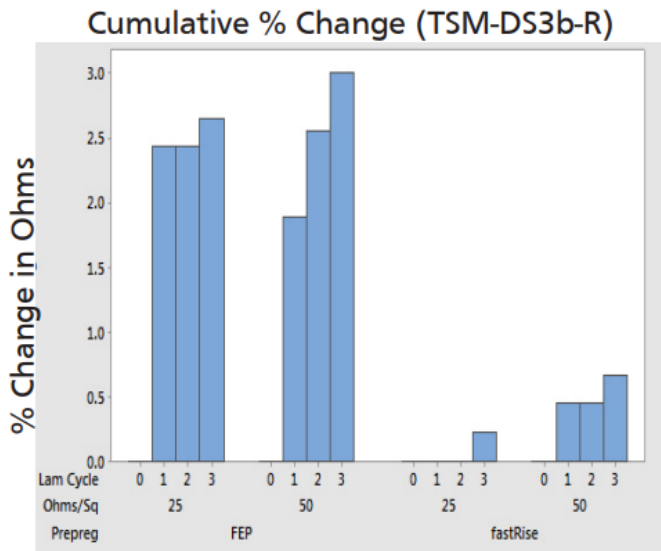


Insertion loss of TSM-DS3b-0050-ULPH



Microstrip insertion loss of TSM-DS3b-0050 ULPH using Southwest Connectors (11.7 mil trace width).
Southwest: 1892-04A-5 (1.85 mm female end launch, pin .005D, diel. 0.0290D)

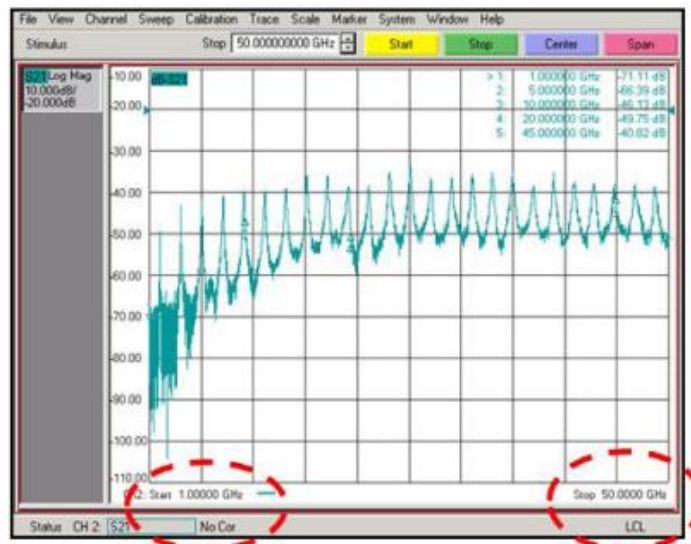
TSM-DS3b-R Resistor Foil Stability with Prepreg Lamination



Measurement Instrument and Captured Results



Agilent E8364A PNA Network Analyzer and Universal test fixture 3830 K (by ANRITSU) were used for ring resonator testing.



- R version should be used if resistive foils are being used in a manner that requires tight tolerances.

| Properties | Conditions | Typical Value | Unit | Test Method |
|---------------------------------------|------------------|-----------------------|-------------------------|----------------------------------|
| Electrical Properties | | | | |
| Dielectric Constant | @ 10 Ghz | 3.00 ± 0.04 | | IPC-650 2.5.5.3 |
| Dissipation Factor | @ 10 Ghz | 0.0014 | | IPC-650 2.5.5.5.1 (Modified) |
| Volume Resistivity | | 2.3 x 10 ⁶ | Mohms/cm | IPC-650 2.5.17.1 Sec. 5.2.1 (ET) |
| | | 2.1 x 10 ⁷ | Mohms/cm | IPC-650 2.5.17.1 Sec. 5.2.1 (HC) |
| Surface Resistivity | | 1.1 x 10 ⁷ | Mohms | IPC-650 2.5.17.1 Sec. 5.2.1 (ET) |
| | | 1.8 x 10 ⁸ | Mohms | IPC-650 2.5.17.1 Sec. 5.2.1 (HC) |
| Thermal Properties | | | | |
| Thermal Conductivity | unclad | 0.65 | W/M*K | ASTM F 433/ASTM 1530-06 |
| T _d | 2% Weight Loss | 526 | °C | IPC-650 2.4.24.6 (TGA) |
| | 5% Weight Loss | 551 | °C | |
| CTE (RT to 125°C) | X | 10 | ppm/°C | IPC-650 2.4.41/TMA |
| | Y | 16 | | |
| | Z | 23 | | |
| Mechanical Properties | | | | |
| Density | Specific Gravity | 2.11 | g/cm ³ | ASTM D 792 |
| Flexural Strength | MD | 81 (11,811) | N/mm ² (psi) | ASTM D 790/ IPC-650 2.4.4 |
| | CD | 51 (7,512) | N/mm ² (psi) | ASTM D 3039/IPC-650 2.4.19 |
| Tensile Strength | MD | 48 (7,030) | N/mm ² (psi) | ASTM D 3039/IPC-650 2.4.19 |
| | CD | 26 (3,830) | N/mm ² (psi) | |
| Elongation at Break | MD | 1.6 | % | ASTM D 3039/IPC-650 2.4.19 |
| | CD | 1.5 | % | |
| Young's Modulus | MD | 6,708 (973,000) | N/mm ² (psi) | ASTM D 3039/IPC-650 2.4.19 |
| | CD | 6,784 (984,000) | N/mm ² (psi) | |
| Poisson's Ratio | MD | 0.24 | | ASTM D 3039/IPC-650 2.4.19 |
| | CD | 0.20 | | |
| Chemical / Physical Properties | | | | |
| Dielectric Breakdown | | 47.5 | kV | IPC-650 2.5.6 (ASTM D 149) |
| Dielectric Strength | | 21,575 (548) | V/mm (V/mil) | ASTM D 149 (Through Plane) |
| Arc Resistance | | 226 | Seconds | IPC-650 2.5.1 |
| Moisture Absorption | | 0.07 | % | IPC-650 2.6.2.1 |

* ET - Elevated Temperature

* HC - Humidity Conditioning

* TS - Thermal Stress

| Typical Thicknesses ¹ | |
|----------------------------------|------------------|
| Inches | mm |
| 0.0050, 0.0100, 0.0200 | 0.13, 0.25, 0.51 |
| 0.0300, 0.0600, 0.0900 | 0.76, 1.52, 2.29 |

| Available Sheet Sizes ² | | | |
|------------------------------------|-----------|---------|-------------|
| Inches | mm | Inches | mm |
| 12 x 18 | 305 x 457 | 16 x 36 | 406 x 914 |
| 16 x 18 | 406 x 457 | 24 x 36 | 610 x 914 |
| 18 x 24 | 457 x 610 | 18 x 48 | 457 x 1,220 |

* 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.

* TSM-DS3b 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.

