

METEORWAVE® 4000M

High Frequency / Ultra Low Loss Laminate For Automotive Radar Applications

Benefits

- Stable dielectric performance over a wide frequency range
- Excellent Electrical Properties utilizing SI® Technology
- Very high reliability and fracture toughness
- High Conductive Anodic Filament (CAF) resistance

Applications

- Short-Range (24GHz) Automotive Radar
- Long-Range (77 GHz) Automotive Radar



Meteorwave® 4000M high frequency / ultra-low loss electronic materials offer advanced electrical performance and high reliability for automotive radar applications. Meteorwave® 4000M is ideal for automotive radar programs up to 77GHz.

Excellent Electrical Properties utilizing SI® Technology

- Stable Dk/Df versus frequency and temperature
- Very low loss
- High aging resistance

Very High Reliability

- $T_{300} > 120$ minutes
- High fracture toughness
- Very high Conductive Anodic Filament (CAF) resistance
- Lead-free assembly compatibility
- Tight thickness and resin content controls

Highly CAF Resistant

- All constructions utilize super spread weaves and fiberglass finishes optimized for CAF performance.

High-Tg FR-4 Processing

- Processes similar to other high-Tg materials
- 90 minutes cure at 216°C and 400-500 psi

Meets UL 94V-0 and IPC-4101/102 Specifications
UL file number: E36295

| Properties | Conditions | Typical Value | Unit | Test Method |
|---------------------------------------|-----------------------------------------|-------------------------------------|-----------------------------------------------|------------------------------------------------------------|
| Electrical Properties | | | | |
| Dielectric Constant | @ 10 GHz | 3.2 | | IPC-TM-650.2.5.5.5 |
| | @ 77 GHz | 3.18 (RTF-2) 3.20 (HVLP2) | | Ring Resonator method |
| Dissipation Factor | @ 10 GHz | 0.0020 | | Split-Post Dielectric Resonator |
| TcDk (-50 – 140°C) | @ 10 GHz | 15 | ppm/ °C | IPC-TM-650.2.5.5.5 |
| Volume Resistivity | C - 96 / 35 / 90 | 4.70 x 10 ⁶ | MΩ - cm | IPC-TM-650.2.5.17.1 |
| | E - 24 / 125 | 5.20 x 10 ⁷ | | |
| Surface Resistivity | C - 96 / 35 / 90 | 1.30 x 10 ⁶ | MΩ | IPC-TM-650.2.5.17.1 |
| | E - 24 / 125 | 7.40 x 10 ⁷ | | |
| Electric Strength | | 4.6x10 ⁴ (1800) | V/mm (V/mil) | IPC-TM-650.2.5.6.2 |
| Thermal Properties | | | | |
| *Glass Transition Temperature (Tg) | TMA(°C) | 170 | °C | IPC-TM-650.2.4.24c |
| | DMA(°C) (Tan d Peak) | 200 | °C | IPC-TM-650.2.4.24.2 |
| Degradation Temperature (TGA) | Degradation Temp (TGA) (5% wt. loss) | 390 | °C | IPC-TM-650.2.3.40 |
| T-300 | Time to delamination @ 300°C | >120 | minutes | IPC-TM-650.2.4.24.1 |
| Thermal Conductivity | | 0.46 | W/mK | ASTM E1461 |
| Specific Heat | | 0.84 | J/gK | ASTM E1461 |
| Mechanical Properties | | | | |
| Peel Strength | 1/2 oz Cu (18μ) | 0.5 (3) (RTF-2) 0.6 (3) (H-VLP2) | N/mm (lbf/inch) | IPC-TM-650.2.4.8 |
| | After Solder Float | 0.5 (3) (RTF-2) 0.6 (3) (H-VLP2) | N/mm (lbf/inch) | IPC-TM-650.2.4.8 |
| X / Y CTE | -40°C to + 125°C | 24 / 25 | ppm/°C | IPC-TM-650.2.4.41 (modified): 5 mil 1x1078 construction |
| Z Axis CTE Alpha 1 / Alpha 2 | 50°C to Tg / Tg to 260°C | 55 | ppm/°C | IPC-TM-650.2.4.24 |
| Z Axis Expansion | 50°C to 260°C | 2.6 | % | IPC-TM-650.2.4.24 |
| Young's Modulus (X / Y) | | 18.6/17.9 (3.9/3.5) | GN/m ² (psi x 10 ⁶) | ASTM D3039 |
| Flexural Strength (X / Y) | @ 125°C | 356/328 (51.7 / 47.6) | GN/m ² (psix10 ⁶) | |
| | @ 150°C | 346/305 (50.2/44.3) | GN/m ² (psi x 10 ⁶) | |
| Chemical / Physical Properties | | | | |
| Moisture Absorption | | 0.12 | wt. % | IPC-TM-650.2.6.2.1 |

* DMA is the preferred method for measuring Tg - other methods may be less accurate.

- 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
- Meteorwave® 4000M is available in most common panel sizes.
- Please contact AGC for availability of any other constructions, copper weights and types, and glass styles.
- The resistor foil manufacturer covers the warranty for the copper foil that includes the resistor layer, as well as the performance and workability related to the copper foil. Our company does not take responsibility for the processing of resistor layers and the performance or workability of the final products

