



meteorwave®

1000, 2000, 3000 & 4000 Very Low Loss & Ultra Low Loss Materials

Laminate & Prepreg

The Meteorwave family of materials offer very advanced electrical performance and very high reliability. They are intended for use in next generation core routers, high speed switches, supercomputers and applications where low signal attenuation, high reliability and high data transfer rates are critical. Meteorwave products are designed to facilitate high temperature lead-free assemblies and high layer count printed circuit board designs that require high reliability, CAF resistance and low Z-axis expansion.

Key Features

Excellent Electrical Properties

- Low Dk
- Very low loss and ultra low loss Df electrical performance
- Stable electrical properties versus frequency when tested over various environmental conditions

Lead-Free Compatibility

- Designed to withstand multiple lead-free assembly reflow cycles at 260°C

Highly CAF Resistant

- CAF resistant materials after high temperature reflow

Thermal and Mechanical Properties

- Very low Z-axis expansion for high reliability
- Good peel strength
- Excellent IST performance

High-Tg FR-4 Processing

- Processing similar to other high-Tg materials
- 30 min press at 177°C plus 60 min press at 216°C and 390 psi

Available in a variety of constructions

- Available in a wide variety of constructions, copper weights and glass styles, including ultra low profile copper, standard copper and RTFOIL®
- Available as 2 mil core products that meet the specifications of a capacitive laminate
- A rating of UL 94V-0 and 130°C MOT for the entire Meteorwave family of materials
- Meet IPC-4101/91 and /102 specifications
- All of Park's electronic materials are RoHS compliant

Applications

- 25 GHz Infrastructure
- Cloud Storage
- Core Routers
- High Speed Switches
- Servers
- Supercomputers
- RF/Microwave Applications

meteorwave® 1000 Very Low Loss

meteorwave® 2000 Ultra Low Loss

Laminate and Prepreg

	Meteorwave 1000	Meteorwave 2000	U.S. Units	Meteorwave 1000	Meteorwave 2000	Metric Units	Test Method
Mechanical Properties							
Peel Strength - 1 oz. (35 micron) Cu							
After Solder Float	6.6	6.6	lb / inch	1.16	1.16	N / mm	IPC-TM-650.2.4.8
At Elevated Temperature	5.6	5.6	lb / inch	0.98	0.98	N / mm	IPC-TM-650.2.4.8.2a
After Exposure to Process Solutions	5.3	5.3	lb / inch	0.93	0.93	N / mm	IPC-TM-650.2.4.8
X / Y CTE [-40°C to +125°C]	10-14	10-14	ppm / °C	10-14	10-14	ppm / °C	IPC-TM-650.2.4.41
Z Axis CTE Alpha 1 [50°C to Tg] 55% RC	55	55	ppm / °C	55	55	ppm / °C	IPC-TM-650.2.4.24
Z Axis CTE Alpha 2 [Tg to 260°C] 55% RC	260	260	ppm / °C	260	260	ppm / °C	IPC-TM-650.2.4.24
Z Axis Expansion [50°C to 260°C] 43% RC	1.5	1.5	%	1.5	1.5	%	IPC-TM-650.2.4.24
Z Axis Expansion [50°C to 260°C] 55% RC	1.9	1.9	%	1.9	1.9	%	IPC-TM-650.2.4.24
Young's Modulus (X / Y)	3.6 / 3.2	2.7 / 2.5	psi x 10 ⁶	24.4 / 21.7	18.3 / 17.0	GN / m ²	ASTM D3039
Poisson's Ratios (X / Y)	0.148 / 0.132	0.166 / 0.169		0.148 / 0.132	0.166 / 0.169		ASTM D3039
Thermal Conductivity	0.46	0.43	W / mK	0.46	0.43	W / mK	ASTM E1461
Specific Heat	0.92	0.97	J / gK	0.92	0.97	J / gK	ASTM E1461
Electrical Properties							
Dielectric Constant (Typical)							
@ 2 GHz (Stripline)	3.7	3.4		3.7	3.4		IPC-TM-650.2.5.5.5
@ 10 GHz (Stripline)	3.7	3.4		3.7	3.4		IPC-TM-650.2.5.5.5
Dissipation Factor (Typical)							
@ 2 GHz (Split Post Cavity)	0.004	0.003		0.004	0.003		
@ 10 GHz (Split Post Cavity)	0.0055	0.004		0.0055	0.004		
Volume Resistivity							
C - 96 / 35 / 90	1.93x10 ⁸	3.60x10 ⁷	MΩ - cm	1.93x10 ⁸	3.60x10 ⁷	MΩ - cm	IPC-TM-650.2.5.17.1
E - 24 / 125	3.22x10 ⁸	2.60x10 ⁸	MΩ - cm	3.22x10 ⁸	2.60x10 ⁸	MΩ - cm	IPC-TM-650.2.5.17.1
Surface Resistivity							
C - 96 / 35 / 90	6.12x10 ⁷	2.10x10 ⁶	MΩ	6.12x10 ⁷	2.10x10 ⁶	MΩ	IPC-TM-650.2.5.17.1
E - 24 / 125	9.34x10 ⁷	1.10x10 ⁸	MΩ	9.34x10 ⁷	1.10x10 ⁸	MΩ	IPC-TM-650.2.5.17.1
Electric Strength	1667	1800	V / mil	4.2x10 ⁴	4.6x10 ⁴	V / mm	IPC-TM-650.2.5.6.2
Dielectric Breakdown	>50	>50	kV	>50	>50	kV	IPC-TM-650.2.5.6
Arc Resistance	157	157	seconds	157	157	seconds	IPC-TM-650.2.5.1
Thermal Properties							
*Glass Transition Temperature (Tg)							
TMA (°C)	215	215	°C	215	215	°C	IPC-TM-650.2.4.24c
DMA (°C) (Tan d Peak)	240	240	°C	240	240	°C	IPC-TM-650.2.4.24.3
Degradation Temp (TGA) (5% wt. loss)	390	390	°C	390	390	°C	IPC-TM-650.2.3.40
Pressure Cooker-60 min then solder dip	pass	pass		pass	pass		IPC-TM-650.2.6.16
@288°C until failure (max 10 min.)							(modified)
T300	>120	>120	minutes	>120	>120	minutes	IPC-TM-650.2.4.24.1
Chemical / Physical Properties							
Moisture Absorption	0.12	0.12	wt. %	0.12	0.12	wt. %	IPC-TM-650.2.6.2.1
Methylene Chloride Resistance	0.27	0.27	% wt. chg.	0.27	0.27	% wt. chg.	IPC-TM-650.2.3.4.3
Density [50% resin content]	1.83	1.76	g / cm ³	1.83	1.76	g / cm ³	

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

Test data provided herein represents typical values and is not intended to be a substitute for specification values. For review of critical specification tolerances, please contact a company representative directly.

EP™, LD®, Mercurywave®, Meteorwave®, Nelco®, RTFoil® and SI® are trademarks of Park Electrochemical Corp.

meteorwave® 3000 Very Low Loss meteorwave® 4000 Ultra Low Loss Laminate and Prepreg

	Meteorwave 3000	Meteorwave 4000	U.S. Units	Meteorwave 3000	Meteorwave 4000	Metric Units	Test Method
Mechanical Properties							
Peel Strength - 1 oz. (35 micron) Cu							
After Solder Float	5.5	5.5	lb / inch	1.00	1.00	N / mm	IPC-TM-650.2.4.8
At Elevated Temperature	4.4	4.4	lb / inch	0.77	0.77	N / mm	IPC-TM-650.2.4.8.2
After Exposure to Process Solutions	5.0	5.0	lb / inch	0.88	0.88	N / mm	IPC-TM-650.2.4.8.2
X / Y CTE [-40°C to +125°C]	10-14	10-14	ppm / °C	10-14	10-14	ppm / °C	IPC-TM-650.2.4.4.1
Z Axis CTE Alpha 1 [50°C to Tg] 55% RC	55	55	ppm / °C	55	55	ppm / °C	IPC-TM-650.2.4.2.4
Z Axis CTE Alpha 2 [Tg to 260°C] 55% RC	260	260	ppm / °C	260	260	ppm / °C	IPC-TM-650.2.4.2.4
Z Axis Expansion [50°C to 260°C] 43% RC	2.1	2.1	%	2.1	2.1	%	IPC-TM-650.2.4.2.4
Z Axis Expansion [50°C to 260°C] 55% RC	2.6	2.6	%	2.6	2.6	%	IPC-TM-650.2.4.2.4
Young's Modulus (X / Y)	3.9 / 3.5	2.7 / 2.6	psi x 10 ⁶	26.9 / 24.1	18.6 / 17.9	GN / m ²	ASTM D3039
Poisson's Ratios (X / Y)	0.163 / 0.146	0.170 / 0.163		0.163 / 0.146	0.170 / 0.163		ASTM D3039
Thermal Conductivity	0.47	0.45	W / mK	0.47	0.45	W / mK	ASTM E1461
Specific Heat	0.82	0.84	J / gK	0.82	0.84	J / gK	ASTM E1461
Flexural Strength							
@125°C (W/F)	56.3 / 47.0	51.7 / 47.6	psi x 10 ⁶	388 / 214	356 / 328	GN / m ²	IPC-TM-650.2.4.4.1
@150°F (W/F)	51.8 / 44.5	50.2 / 44.3	psi x 10 ⁶	357 / 307	346 / 305	GN / m ²	IPC-TM-650.2.4.4.1
Electrical Properties							
Dielectric Constant (Typical)							
@ 2 GHz (Stripline)	3.8	3.5		3.8	3.5		IPC-TM-650.2.5.5.5
@ 10 GHz (Stripline)	3.8	3.5		3.8	3.5		IPC-TM-650.2.5.5.5
Dissipation Factor (Typical)							
@ 2 GHz (Split Post Cavity)	0.0032	0.0020		0.0032	0.0020		
@ 10 GHz (Split Post Cavity)	0.0048	0.0028		0.0048	0.0028		
Volume Resistivity							
C - 96 / 35 / 90	3.00x10 ⁷	4.70x10 ⁶	MΩ·cm	3.00x10 ⁷	4.70x10 ⁶	MΩ·cm	IPC-TM-650.2.5.17.1
E - 24 / 125	5.20x10 ⁸	5.20x10 ⁸	MΩ·cm	5.20x10 ⁸	5.20x10 ⁸	MΩ·cm	IPC-TM-650.2.5.17.1
Surface Resistivity							
C - 96 / 35 / 90	7.60x10 ⁶	1.30x10 ⁶	MΩ	7.60x10 ⁶	2.10x10 ⁶	MΩ	IPC-TM-650.2.5.17.1
E - 24 / 125	1.20x10 ⁸	7.40x10 ⁷	MΩ	1.20x10 ⁸	1.30x10 ⁶	MΩ	IPC-TM-650.2.5.17.1
Electric Strength	1300	1800	V / mil	3.3x10 ⁴	4.6x10 ⁴	V / mm	IPC-TM-650.2.5.6.2
Dielectric Breakdown	>50	>50	kV	>50	>50	kV	IPC-TM-650.2.5.6
Arc Resistance	210	210	seconds	210	210	seconds	IPC-TM-650.2.5.1
Thermal Properties							
*Glass Transition Temperature (Tg)							
TMA (°C)	170	170	°C	170	170	°C	IPC-TM-650.2.4.24c
DMA (°C) (Tan d Peak)	200	200	°C	200	200	°C	IPC-TM-650.2.4.24.3
Degradation Temp (TGA) (5% wt. loss)	390	390	°C	390	390	°C	IPC-TM-650.2.3.4.0
Pressure Cooker-60 min then solder dip @288°C until failure (max 10 min.)	pass	pass		pass	pass		IPC-TM-650.2.6.16
T300	>120	>120	minutes	>120	>120	minutes	(modified) IPC-TM-650.2.4.24.1
Chemical / Physical Properties							
Moisture Absorption	0.12	0.12	wt. %	0.12	0.12	wt. %	IPC-TM-650.2.6.2.1
Methylene Chloride Resistance	0.27	0.27	% wt. chg.	0.27	0.27	% wt. chg.	IPC-TM-650.2.3.4.3
Density [50% resin content]	2.08	1.95	g / cm ³	2.08	1.95	g / cm ³	Internal Method

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

Test data provided herein represents typical values and is not intended to be a substitute for specification values. For review of critical specification tolerances, please contact a company representative directly.

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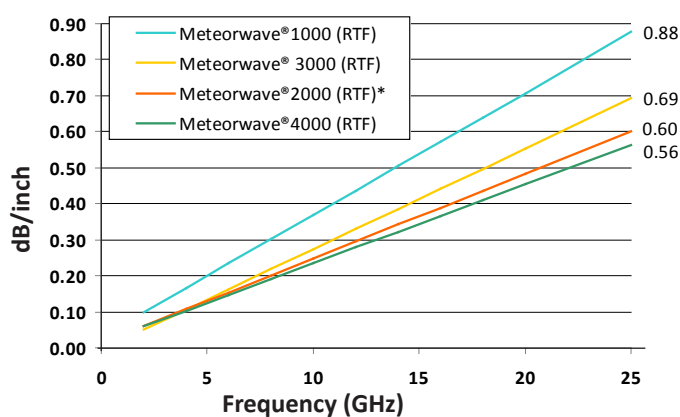


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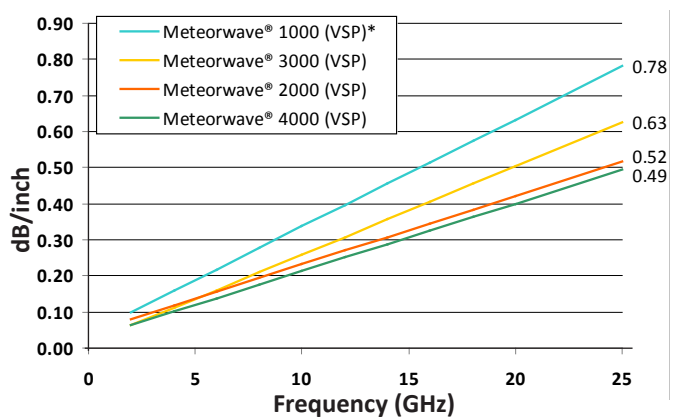
meteorwave®

Laminate Properties	Meteorwave 1000	Meteorwave 2000	Meteorwave 3000	Meteorwave 4000	N4800-20	N4800-20 SI®	N4000-13	N4000-13 SI®
Tg (DMA)°C	240	240	200	200	220	220	220	220
Td (TGA)°C	390	390	390	390	350	350	350	350
T288 (min)					>40	>40	>10	>10
T300 (min)	>120	>120	>120	>120	>10	>10	>2	>2
Dielectric Constant (Dk) 10 GHz Stripline (50% RC)	3.7	3.4	3.8	3.5	3.8	3.4	3.6	3.2
Dissipation Factor (Df) 10 GHz Open Resonator (50% RC)	0.0055	0.0040	0.0048	0.0028	0.0075	0.0060	0.0085	0.0075
Z CTE % Expansion (50°C to 260°C)								
43% RC	1.5%	1.5%	2.1%	2.1%	1.8%	1.8%	3.0%	3.0%
55% RC	1.9%	1.9%	2.6%	2.6%	2.0%	2.0%	3.5%	3.5%

Meteorwave with RTF Copper



Meteorwave with VSP® Copper



VSP® is a registered trademark of Mitsui

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