ROGERS CORPORATION

CLTE-MW™ Laminates

Data Sheet

CLTE-MW™ laminates are ceramic filled, woven glass reinforced PTFE composites. CLTE-MW laminates were developed to provide a cost effective, high performance material for the circuit designer. This unique laminate system is well suited for applications that have limitations in thickness due to either physical or electrical constraints. The seven available thickness options from 3 mils to 10 mils ensure that ideal signal to ground spacing exists for today's 5G and other millimeter wave designs. In addition, a variety of copper foil options are available including rolled, reverse treated ED, and standard ED. Resistive foil and metal plate options are also available upon request.

The CLTE-MW laminates are reinforced with spread glass, which along with a high filler loading help minimize the high frequency glass weave effects on electromagnetic wave propagation. The woven glass reinforcement also provides excellent dimensional stability. Other key features of the laminate include low z-axis CTE (30ppm/°C) for excellent plated through hole reliability, a low loss tangent of 0.0015 at 10 GHz to enable low loss designs, and low moisture absorption of 0.03% to ensure stable performance in a range of operating environments. Thermal conductivity of 0.42 W/(m·K) enables heat dissipation in aggressive designs along with a high dielectric strength of 630 V/mil to ensure good z-axis insulation between conductor layers. The UL94 V-0 flammability rating enables the use of CLTE-MW laminates in commercial applications.

CLTE-MW laminates are well suited for a range of applications including Amplifiers, Antennas, Baluns, Couplers and Filters. Applicable markets range from Commercial and Consumer to Defense and Aerospace.

Features and Benefits:

Excellent Dimensional Stability

- Critical for Registration of Small Circuit Features

Low X, Y & Z-axis CTE

- Reliable Mechanical Performance under Thermally Challenging Environments

Low Loss Tangent

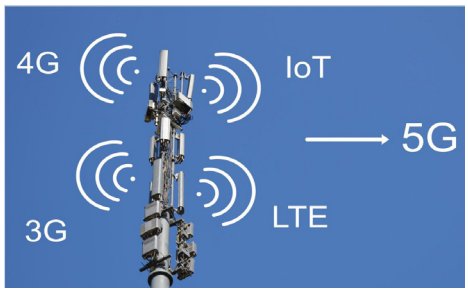
- Low Circuit Losses

Available in thicknesses from 3-10mils

- Suitable for very high frequency applications

Typical Applications:

- Commercial Communications and Avionics
- Military/ Aerospace Applications
  - Microwave Feed Networks
  - Phase Sensitive Electronic Structures
  - Satellite Communication Systems
- Passive Components (couplers, filters & baluns)



100 S. Roosevelt Avenue, Chandler, AZ 85226
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CLTE-MW Property	Typical Value[1]	Units	Test Conditions		Test Method
Electrical Properties					
Dielectric Constant, (ε_r) [2]	2.94 to 3.02 ± 0.04	-	23C @ 50% RH	10 GHz	IPC TM-650 2.5.5.5
Dielectric Constant (design) [2]	3.03 to 3.10		C-24/23/50	8-40 GHz	Microstrip Differential Phase Length
Dissipation Factor	0.0015	-	23C @ 50% RH	10 GHz	IPC TM-650 2.5.5.5
Thermal Coefficient of Dielectric Constant	-35	ppm/°C	0 to 100°C	10GHz	IPC TM-650 2.5.5.5
Volume Resistivity	1.3×10^7	Mohm-cm	C-96/35/90		IPC TM-650 2.5.17.1
Surface Resistivity	2.5×10^6	Mohm	C-96/35/90		IPC TM-650 2.5.17.1
Electrical Strength (dielectric strength)	630	V/mil			IPC TM-650 2.5.6.2
Dielectric Breakdown	44	kV	D-48/50	X/Y direction	IPC TM-650 2.5.6
Comparative Tracking Index	600V/ PLC 0	class/volts	C-40/23/50		UL-746A, ASTM D6054
Thermal Properties					
Decomposition Temperature (Td)	500	°C	2hrs @ 105°C	5% Weight Loss	IPC TM-650 2.3.40
Coefficient of Thermal Expansion	8	X/Y	ppm/°C	-55°C to 288°C	IPC TM-650 2.4.41
	30	Z			
Thermal Conductivity	0.42	W/(m·K)		Z direction	ASTM D5470
Time to Delamination	>60	minutes	as-received	288°C	IPC TM-650 2.4.24.1
Mechanical Properties					
Copper Peel Strength after Thermal Stress	1.1 (6.0)	N/mm (lbs/ in)	10s @288°C	35 µm foil	IPC TM-650 2.4.8
Flexural Strength MD CMD	113 (16.4) 99 (14.4)	MPa (ksi)	25C +/- 3C		ASTM D790
Tensile Strength MD CMD	83 (12.0) 80 (11.6)	MPa (ksi)	23C/50RH		ASTM D3039/ D3039-14
Flex Modulus MD CMD	6468 (938.1) 6360 (922.4)	MPa (ksi)	25C +/- 3C		IPC-TM-650 Test Method 2.4.4
Dimensional Stability (MD/CMD)	0.22/0.22	mil/inch	after etch + bake		IPC-TM-650 2.4.39a
Physical Properties					
Flammability	V-0	-		-	UL94
Moisture Absorption	0.03	%	E1/105 +D48/50		IPC TM-650 2.6.2.1
Density	2.1	g/cm^3	C-24/23/50		ASTM D792
Specific Heat Capacity	0.93	J/g°K	2 hours at 105°C		ASTM E2716
Nasa Outgassing	0.03/<0.01	%	24 hours at 125°C	TML/CVCM	ASTM E595

(1) Typical values are a representation of an average value for the population of the property. For specification values contact Rogers Corp.
(2) See Table 1 for more detailed design information

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Thickness (mils)	Process Dk (10 GHz)	Design Dk (AH/AH)
3	2.94	3.10
4	2.97	3.08
5	2.96	3.07
6	3.02	3.07
7	3.00	3.06
8	3.01	3.05
10	3.00	3.03

Table 1. Process and Design Dk data for CLTE-MW Laminate

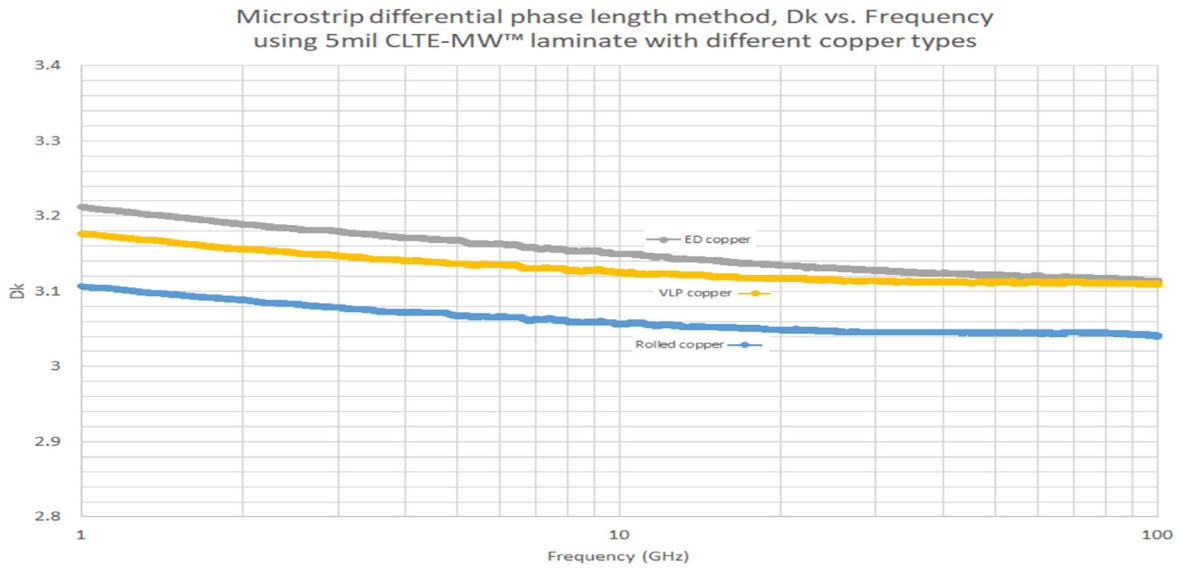

Figure 1. Microstrip Differential Phase Length Method, Dk vs Frequency

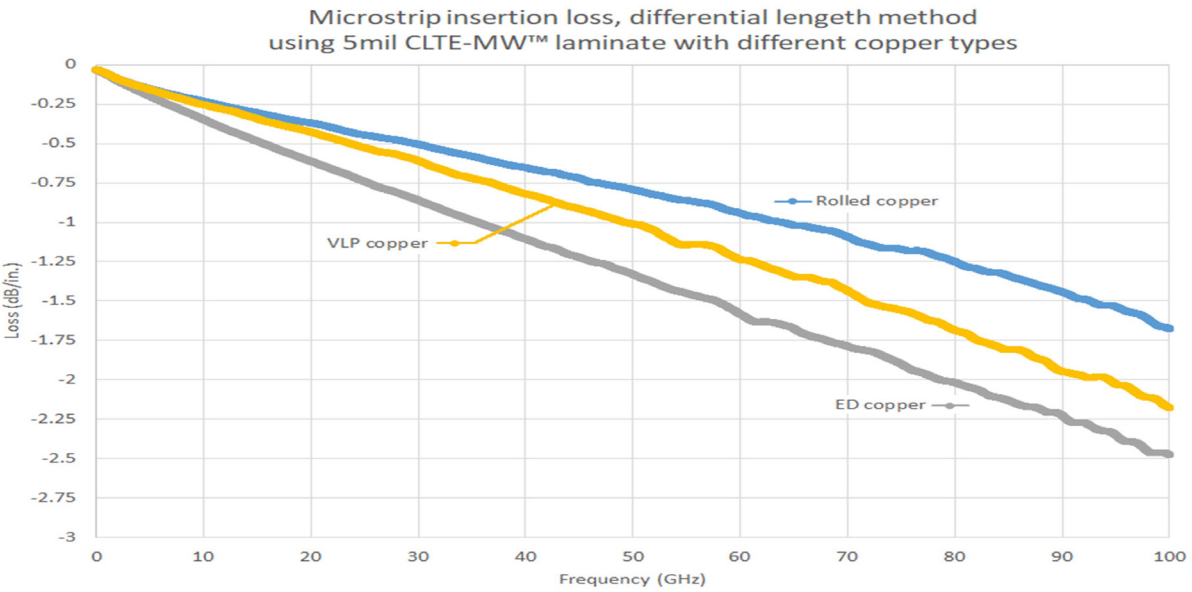

Figure 2. Microstrip Insertion Loss, Differential Length Method

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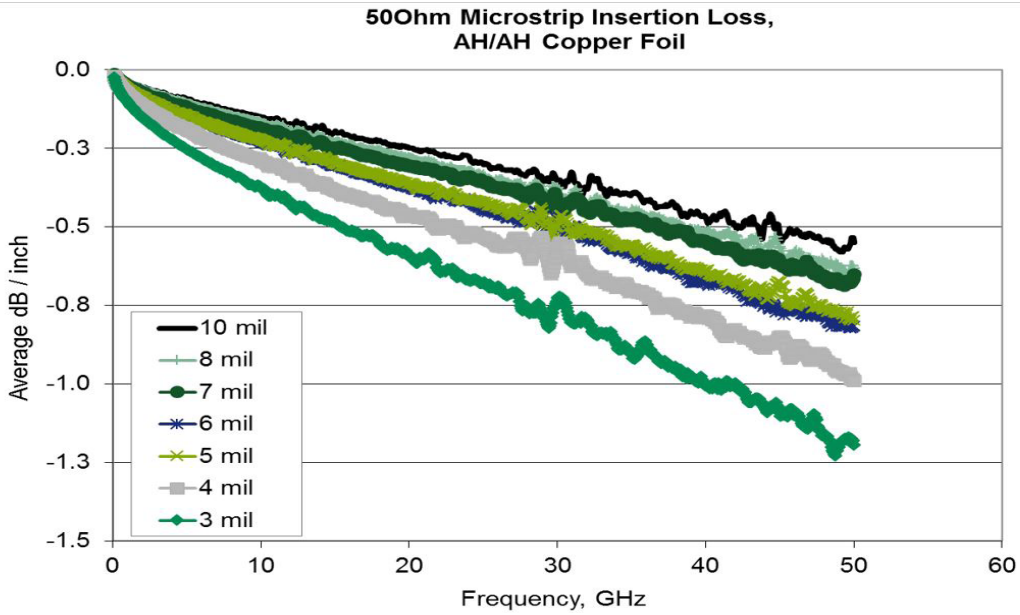

Figure 3. 50 Ohm Microstrip Insertion Loss

Standard Thickness	Standard Panel Size	Standard Copper Cladding
0.003" (0.076 mm) 0.004" (0.102 mm) 0.005" (0.127 mm) 0.006" (0.152 mm) 0.007" (0.178 mm) 0.008" (0.203 mm) 0.010" (0.254 mm)	12" X 18" (305 X 457 mm) 24" X 18" (610 X 457 mm Additional panel sizes available upon request	¼ oz (9µm) ½ oz (18µm), 1 oz. (35µm), very low profile ED (TQ, TH, T1) ½ oz (18µm), 1 oz. (35µm), 2 oz (70µm) ED (HH, H1, H2) ½ oz (18µm), 1 oz. (35µm), 2 oz (70µm) RT (SH, S1, S2) ½ oz (18µm), 1 oz. (35µm), Rolled (AH, A1)

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