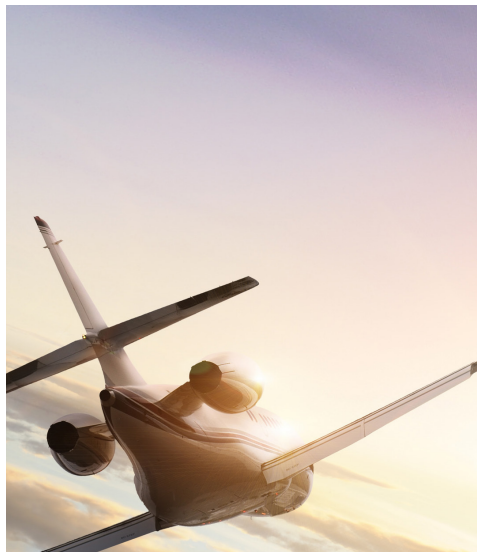


CLTE™ and CLTE-XT™ Circuit Materials High Frequency Laminates

CLTE laminates have proven excellent dimensional stability and low planar CTE, providing consistent performance for embedded resistors: among the lowest variance available for PTFE-based laminates.

CLTE laminates have a long history of use with Resistor Foil and are available with a full range of other cladding types (including electrodeposited, reverse treated copper, rolled copper foil and more).

CLTE laminates' tried and tested performance continues to make them a top choice for a wide range of ground-based and airborne communications and radar systems.



Features and Benefits:

Loss Tangent of 0.0010 at 10 GHz

- Reduced circuit losses without sacrificing dimensional stability

Low Z-axis CTE of 20 ppm /°C

- High plated through hole reliability

Dielectric constant stability with temperature change

- Reduced stress attachment to ceramic active devices

Available with heavy metal backing (aluminum, brass and copper)

- Reliably designed with embedded resistor networks

Typical Applications:

- Advanced Driver Assistance Systems (ADAS)
- Patch Antennas
- Phased Array Antennas
- Power Amplifiers

Standard Thicknesses		Standard Panel Sizes	Standard Claddings
<p>CLTE</p> <p>0.0053" (0.135 mm) ± 0.0005"</p> <p>0.010" (0.254 mm) ± 0.0010"</p> <p>0.020" (0.508 mm) ± 0.0020"</p> <p>0.030" (0.762 mm) ± 0.0020"</p> <p>*Additional non-standard thicknesses available from 0.003" - 0.200" in varying increments</p>	<p>CLTE-XT</p> <p>0.0051" (0.130 mm) ± 0.0005"</p> <p>0.0094" (0.239 mm) ± 0.0007"</p> <p>0.020" (0.508 mm) ± 0.0010"</p> <p>0.030" (0.762 mm) ± 0.0010"</p> <p>*Contact Customer Service or Sales Engineering to inquire about additional available product configurations</p>	<p>18" X 12" (457 X 305 mm)</p> <p>18" X 24" (457 X 610 mm)</p> <p>*Additional panel sizes available.</p>	<p><u>Electrodeposited Copper Foil</u></p> <p>½ oz. (18µm) HH/HH</p> <p>1 oz. (35µm) H1/H1</p> <p><u>Reverse Treated Electrodeposited Copper Foil</u></p> <p>½ oz. (18µm) SH/SH</p> <p>1 oz. (35µm) S1/S1</p> <p>*Additional claddings, such as heavy metal, resistive foil and unclad, are available.</p>

Standard Properties Table

Properties	Typical Value		Units	Test Conditions		Test Method
	CLTE	CLTE-XT				
Electrical Properties						
Dielectric Constant	2.98	2.94	-	23°C @ 50% RH	10 GHz	IPC TM-650 2.5.5.5
Dissipation Factor	0.0021	0.0010	-	23°C @ 50% RH	10 GHz	IPC TM-650 2.5.5.5
Dielectric Constant (design)	2.98	2.93	-	C-24/23/50	10 GHz	Microstrip Differential Phase Length
Thermal Coefficient of Dielectric Constant	6	-8	ppm/°C	-50°C to 150°C	10 GHz	IPC TM-650 2.5.5.5
Volume Resistivity	1.40x10 ⁹	4.25x10 ⁸	Mohm-cm	C-96/35/90	-	IPC TM-650 2.5.17.1
Surface Resistivity	1.30x10 ⁶	2.49x10 ⁸	Mohm	C-96/35/90	-	IPC TM-650 2.5.17.1
Electrical Strength (dielectric strength)	1100	1000	V/mil	-	-	IPC TM-650 2.5.6.2
Dielectric Breakdown	64	58	kV	D-48/50	X/Y direction	IPC TM-650 2.5.6
PIM (For antenna only)	-	-	dBc	-	50 ohm 0.060"	43dBm 1900 MHz
Thermal Properties						
Decomposition Temperature (Td)	538	539	°C	2hrs @ 105°C	5% Weight Loss	IPC TM-650 2.3.40
Coefficient of Thermal Expansion - x	9.9	12.7	ppm/°C	-	-55°C to 288°C	IPC TM-650 2.4.41
Coefficient of Thermal Expansion - y	9.4	13.7	ppm/°C	-	-55°C to 288°C	IPC TM-650 2.4.41
Coefficient of Thermal Expansion - z	57.9	40.8	ppm/°C	-	-55°C to 288°C	IPC TM-650 2.4.41
Thermal Conductivity	0.5	0.56	W/(m-K)	-	z direction	ASTM D5470
Time to Delamination	>60	>60	minutes	as-received	288°C	IPC TM-650 2.4.24.1
Mechanical Properties						
Copper Peel Strength after Thermal Stress	1.2 (7)	1.7 (9)	N/mm (lbs/in)	10s @288°C	35 µm foil	IPC TM-650 2.4.8
Flexural Strength (MD, CMD)	92.4, 86.9 (13.4, 12.6)	40.7, 40.0 (5.9, 5.8)	MPa (ksi)	25°C ± 3°C	-	ASTM D790
Tensile Strength (MD, CMD)	73.8, 71.0 (10.7, 10.3)	29.0, 25.5 (4.2, 3.7)	MPa (ksi)	23C/50RH	-	ASTM D638
Flex Modulus (MD, CMD)	8122, 7984 (1178, 1158)	3247, 3261 (471, 473)	MPa (ksi)	25C ± 3C	-	ASTM D790
Dimensional Stability (MD, CMD)	-0.07, -0.02	-0.37, -0.67	mm/m	4 hr at 105°C	-	IPC-TM-650 2.4.39a
Physical Properties						
Flammability	V-0	V-0	-	-	C48/23/50 & C168/70	UL 94
Moisture Absorption	0.04	0.02	%	E1/105+D24/23	-	IPC TM-650 2.6.2.1
Density	2.31	2.17	g/cm ³	C-24/23/50	-	ASTM D792
Specific Heat Capacity	0.60	0.61	J/g°K	2 hours at 105°C	-	ASTM E2716
NASA Outgassing	0.02 / 0.00	0.02 / 0.00	%	-	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.

Chart 1

Microstrip Differential Phase Length Method , Dk vs Frequency

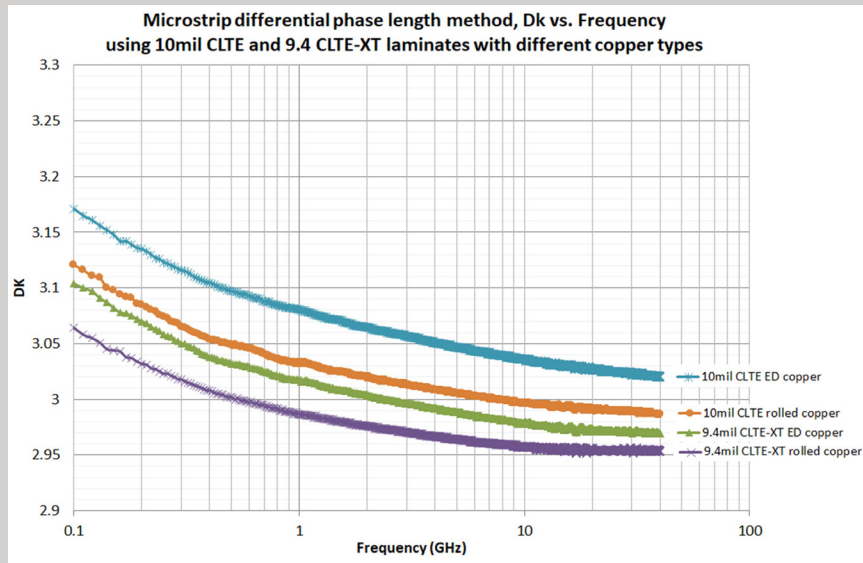
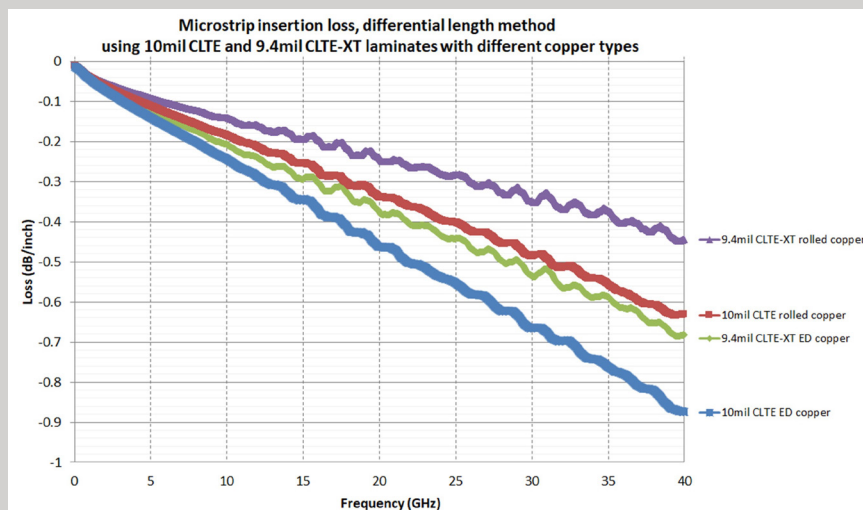


Chart 2

Microstrip Insertion Loss Differential Length Method With Different Copper Types



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\\\ IPC Slash Sheet # 4103B/006 \\\ UL File #

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