ROGERS CORPORATION

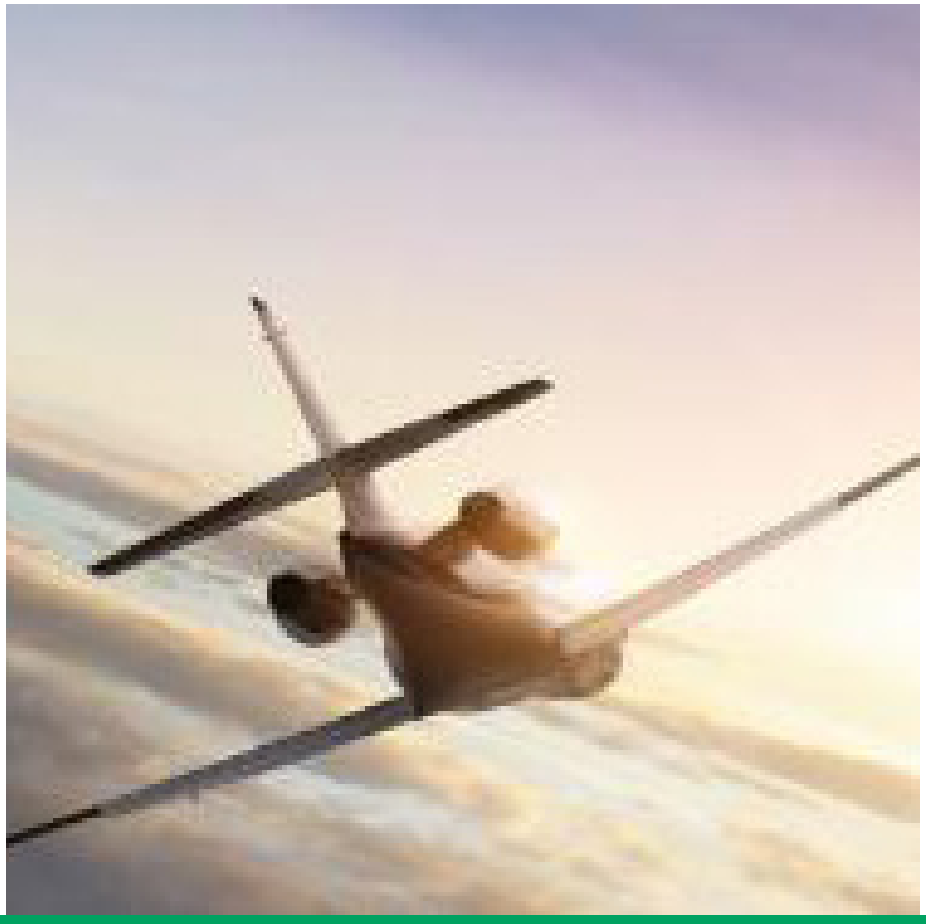
\\\ Datasheet

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 .0012 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 Properties Table

Properties	Typical Values[1] CLTE	Typical Values[1] CLTE-XT™	Units	Test Conditions		Unit
Electrical Properties						
Dielectric Constant (process)	2.98	See Table Below	-	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
Dissapation Factor	0.0021	0.0010	-	23˚C @ 50% RH	10 GHz	IPC TM-650 2.5.5.5
Thermal Coefficient of Dielectric Constant	6	-8	ppm/˚C	-50 to 150˚C	10 GHz	IPC TM-650 2.5.5.5
Volume Resistivity	1.4 X 10^9	4.25 X 10^8	Mohm-cm	C-96/35/90	-	IPC TM-650 2.5.17.1
Surface Resistivity	1.30 X 10^6	2.49 X 10^8	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	-	-	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)	25˚C ± 3˚C	-	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
Specifc Heat Capacity	0.60	0.61	J/g˚K	2 hours at 105˚C	-	ASTM E2716
NASA Outgassing — Total Mass Lost	0.02	0.02	%	-		ASTM E595
NASA Outgassing — Collected Volatiles	0.00	0.00	%			

[1] Typical values are a representation of an average value for the population of the property. For specification values contact Rogers Corp.

Property Charts

Chart 1

Microstrip Differential Phase Length Method , Dk vs Frequency

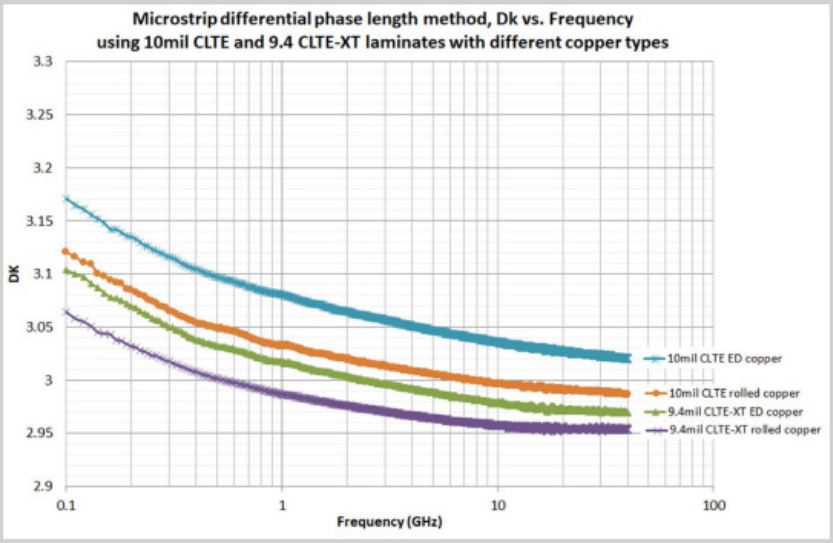
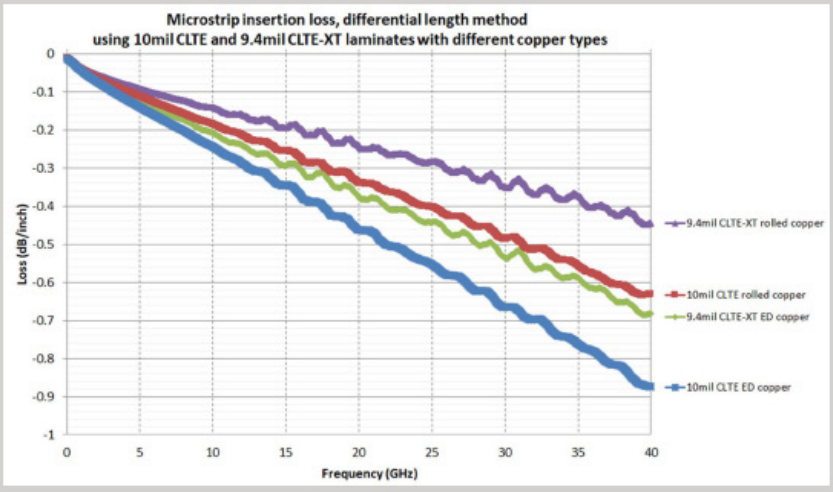


Chart 2

Microstrip Insertion Loss Differential Length Method With Different Copper Types



CLTE-XT Dielectric Constant Table

Grade	Panel Thickness	Process Dk	Tolerance
Dk by Thickness			
CLTE-XT	0.0051" (0.135 mm)	2.79	± 0.03
	0.0094" (0.254 mm)	2.89	± 0.03
	0.020" (0.508 mm)	2.92	± 0.03
	0.030" (0.762 mm)	2.94	± 0.03

Standard Offerings

Standard Thicknesses		Standard Panel Sizes	Standard Claddings
CLTE: 0.0053" (0.135 mm) ± 0.0005" 0.010" (0.254 mm) ± 0.0010" 0.020" (0.508 mm) ± 0.0020" 0.030" (0.762 mm) ± 0.0020"	**CLTE-XT:** 0.0051" (0.130 mm) ± 0.0005" 0.0094" (0.239 mm) ± 0.0007" 0.020" (0.508 mm) ± 0.0010" 0.030" (0.762 mm) ± 0.0010"	18" X 12" (457 X 305mm) 18" X 24" (457 X 610mm)	Electrodeposited Copper Foil 1/2 oz. (18µm) 1 oz. (35µm) Reverse Treated Electrodeposited Copper Foil 1/2 oz. (18µm) 1 oz. (35µm)

*Contact Customer Service or Sales Engineering to inquire about other available product configurations including additional thicknesses, panel sizes and claddings.

Issued 1665 101623 **Publication #92-201**