

## Hydrocarbon resin ceramic glass fiber cloth substrate WL-CT series

### ■ Product Introduction

The WL-CT series of organic polymer ceramic fiberglass cloth copper clad plates is a high-frequency material of a thermosetting resin system. The dielectric layer is composed of hydrocarbon resin, ceramics, and fiberglass cloth, which has low loss performance and meets the requirements of high-frequency design. At the same time, the processability of PCB can refer to FR4 material processing. Compared with PTFE material processing, it is simpler, easier to process, and can replace similar foreign products.

Hydrocarbon resin and composite ceramics have good characteristics of low loss, high temperature resistance, temperature stability, etc., which make the dielectric constant and loss of this series of materials have stable temperature characteristics, low thermal expansion coefficient, and the material has a high TG value greater than 280 °C.

The dielectric constants of this series of products are 3.00, 3.30, 3.38, 3.48, 4.10, and 6.15 to choose from. This series of materials is paired with ED copper foil or reverse RTF copper foil. RTF copper foil has excellent PIM indicators, reducing conductor losses and insertion losses; RTF copper foil is treated with adhesive backing, which increases the material thickness by 0.018mm (0.7mil), making RTF copper foil have good adhesion.

This series can be paired with aluminum substrates to form aluminum based high-frequency materials. The circuit board can be processed using the reference FR4 board process technology. The excellent mechanical and physical properties of the board enable it to be pressed multiple times, making it suitable for multi-layer, high multi-layer, and backboard processing; At the same time, it exhibits excellent machinability in processing dense holes and fine lines.

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### ■ Product Features

- ◆ Low dielectric constant tolerance and low loss;
- ◆ Hydrocarbon ceramic thermosetting resin system with better PCB processability and heat resistance;
- ◆ Excellent dielectric constant temperature characteristics with low variation with temperature;
- ◆ Thermal expansion coefficient in X/Y direction, equivalent to copper foil; small thermal expansion coefficient in Z direction, ensuring dimensional thermal stability and hole copper reliability;
- ◆ High TG value greater than 280°C, still maintain dimensional stability and hole copper quality at high temperature;
- ◆ High thermal conductivity, better than thermoplastic materials in the same class, suitable for high-power applications;
- ◆ Commercial, high-volume, cost-effective products;
- ◆ Excellent irradiation resistance, maintain stable dielectric properties and physical properties after dose irradiation treatment.
- ◆ Low outgassing performance, tested according to the standard method of material volatility performance under vacuum conditions, meeting the requirements of vacuum outgassing for aerospace applications.

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### ■ Typical Applications

- ◆ Aerospace equipment, space, in-cabin equipment, aircraft
- ◆ Microwave, antenna, phase-sensitive antenna
- ◆ Early warning radar, airborne radar and other kinds of radar
- ◆ Phased array antennas, beamwave networks
- ◆ Satellite communication, navigation
- ◆ Power amplifier

Product technical parameters			Product model/data		
Product features	Test conditions	Unit	WL-CT300	WL-CT330	WL-CT330Z
Dielectric constant (typical value)	10GHz	/	3.00	3.30	3.30
Dielectric constant (design value)	10GHz	/	2.98	3.45	3.45
Dielectric constant tolerance	/	/	±0.05	±0.06	±0.06
Loss factor (typical value)	2GHz	/	0.0025	0.0021	0.0025
	10GHz	/	0.0030	0.0026	0.0030
	20GHz	/	0.0036	0.0033	0.0035
Dielectric constant temperature coefficient	-55 °~150°C	PPM/°C	27	43	43
Peel strength	1 OZ RTF copper foil	N/mm	0.85	1.0	0.85
	1 OZ RTF copper foil	N/mm	0.72	0.72	0.72
Volumetric resistivity	Normal	MΩ.cm	3×10 <sup>8</sup>	5×10 <sup>9</sup>	5×10 <sup>9</sup>
Surface resistance	Normal	MΩ	2×10 <sup>8</sup>	5×10 <sup>9</sup>	5×10 <sup>9</sup>
Electrical strength (Z-direction)	5KW, 500V/s	KV/mm	28	22	22
Breakdown voltage (XY direction)	5KW, 500V/s	KV	35	22	22
Thermal expansion coefficient (X, Y direction)	-55 °~288°C	ppm/°C	15,14	15,13	15,13
Thermal expansion coefficient (Z-direction)	-55 °~288°C	ppm/°C	31	39	39
Thermal stress	288°C, 10s, 3 times	/	Not stratified	Not stratified	Not stratified
Water absorption	20±2°C, 24h	%	0.15	0.02	0.05
Density	Normal temperature	g/cm <sup>3</sup>	1.57	1.82	1.78
Long-term use temperature	High and low temperature box	°C	-55~+260	-55~+260	-55~+260
Thermal conductivity	Z direction	W/(M.K)	0.41	0.59	0.59
PIM	With RTF copper foil	dBc	≤-158	≤-157	≤-157
Flame retardancy	UL-94	Grades	V-0	Non-flame-retardant	V-0
TG	General	°C	>280°C	>280°C	>280°C
TD	Start value	°C	412	421	386
Contains halogen or not			Halogenated	Halogen free	Halogenated
Material composition			Hydrocarbon +specialceramics +glass fiber cloth	Hydrocarbon+Ceramic+Fiberglass Fabric	



Product technical parameters			Product model/Data			
Product features	Test conditions	Unit	WL-CT338	WL-CT350	WL-CT440	WL-CT615
Dielectric constant (typical value)	10GHz	/	3.38	3.48	4.10	6.15
Dielectric constant (design value)	10GHz	/	3.55	3.66	4.38	6.4
Dielectric constant tolerance	/	/	±0.05	±0.05	±0.08	±0.15
Loss factor (typical value)	2GHz	/	0.0023	0.0030	0.0040	0.0032
	10GHz	/	0.0029	0.0039	0.0050	0.0040
	20GHz	/	0.0038	0.0048	/	/
Dielectric constant temperature coefficient	-55 °~150°C	PPM/°C	45	52	-21	-122
Peel strength	1 OZ ED copper foil	N/mm	1.0	0.85	1.0	0.9
	1 OZ RTF copper foil	N/mm	0.72	0.72	Mismatch	Mismatch
Volumetric resistivity	Normal	MΩ.cm	6×10 <sup>9</sup>	1×10 <sup>9</sup>	1×10 <sup>9</sup>	2×10 <sup>7</sup>
Surface resistance	Normal	MΩ	7×10 <sup>8</sup>	4×10 <sup>9</sup>	5×10 <sup>7</sup>	5×10 <sup>6</sup>
Electrical strength (Z-direction)	5KW, 500V/s	KV/mm	31	31	27	30
Breakdown voltage (XY direction)	5KW, 500V/s	KV	30	30	25	25
Thermal expansion coefficient(X, Y direction)	-55 °~288°C	ppm/°C	14,16	11.14	14,18	15,17
Thermal expansion coefficient(Z direction)	-55 °~288°C	ppm/°C	50	34	35	33
Thermal stress	288°C, 10s, 3 times	/	Not stratified	Not stratified	Not stratified	Not stratified
Water absorption	23.5±2°C, 24h	%	0.04	0.05	0.12	0.08
Density	Normal temperature	g/cm <sup>3</sup>	1.78	1.90	2.00	2.18
Long term use temperature	High and low temperature box	°C	-55~+260	-55~+260	-55~+260	-55~+260
Thermal conductivity	Z direction	W/(M.K)	0.70	0.70	0.66	0.72
PIM	With RTF copper foil	dBc	≤-158	≤-157	Maladaptive	Maladaptive
Flame retardancy	UL-94	Grades	Non-flame-retardant	V-0	V-0	V-0
TG	General	°C	>280°C	>280°C	>280°C	>280°C
TD	Start value	°C	421	386	402	398
Contains halogen or not			Halogen free	Halogenated	Halogenated	Halogen free
Material composition			Hydrocarbon+Ceramic+Fiberglass Fabric			

**Optional copper foil:**

Copper foil thickness: 0.5OZ (0.018mm) , 1OZ (0.035mm) ;Other thicknesses on request;

Copper foil type: ED copper foil, RTF copper foil. (RTF copper foil is adhesive backed copper foil, substrate thickness will be increased by 0.018mm (0.7mil))

Note: WL-CT440 and WL-CT615 are limited to provide ED copper foil, other models can provide two types of copper foil

**Available sizes (special sizes contact our company for customization):**

460×610mm (18×24<sup>ʹ</sup>)      915×1220mm (36×48<sup>ʹ</sup>)

**Media layer thickness and tolerances available:**

**WL-CT300 media thickness and tolerance**

WL-CT300 is the thinnest 0.127mm (5mil) thickness, we can provide 0.127mm (5mil) multiplier products, if it is more than 3.05mm, please contact us for customization, when it is matched with RTF copper foil The media thickness increases by 0.018mm (0.7mil) when matched with RTF copper foil.

With ED copper foil		With RTF copper foil	
Thickness mm (mil)	Tolerance mm (mil)	Thickness mm (mil)	Tolerance mm (mil)
0.127mm(5.0mil)	±0.012mm(0.5mil)	0.272mm(10.7mil)	±0.025mm(1.0mil)
0.254mm(10mil)	±0.025mm(1.0mil)	0.526mm(20.7mil)	±0.038mm(1.5mil)
0.508mm(20mil)	±0.038mm(1.5mil)	0.78mm (30.7mil)	±0.051mm(2.0mil)
0.762mm(30mil)	±0.05mm(2.0mil)	1.034mm(40.7mil)	±0.076mm(3.0mil)
1.016mm(40mil)	±0.076mm(3.0mil)	1.542mm(60.7mil)	±0.10mm(4.0mil)
1.524mm(60mil)	±0.10mm(4.0mil)	2.05mm(80.7mil)	±0.127mm(5.0mil)

**WL-CT330/330Z media thickness and tolerance**

WL-CT300/330Z is the thinnest 0.254mm (10mil) thickness, we can provide 0.254mm (10mil) multiplier products,contact us for customization if it is more than 3.05mm, with RTF copper foil thickness is increased by 0.018mm (0.7mil).

With ED copper foil		With RTF copper foil	
Thickness mm (mil)	Tolerance mm (mil)	Thickness mm (mil)	Tolerance mm (mil)
0.254mm(10mil)	±0.025mm(1.0mil)	0.272mm(10.7mil)	±0.025mm(1.0mil)
0.508mm(20mil)	±0.038mm(1.5mil)	0.526mm(20.7mil)	±0.038mm(1.5mil)
0.762mm(30mil)	±0.05mm(2.0mil)	0.78mm (30.7mil)	±0.051mm(2.0mil)
1.016mm(40mil)	±0.076mm(3.0mil)	1.034mm(40.7mil)	±0.076mm(3.0mil)
1.524mm(60mil)	±0.10mm(4.0mil)	1.542mm(60.7mil)	±0.10mm(4.0mil)
2.03mm (80mil)	±0.127mm(5.0mil)	2.05mm(80.7mil)	±0.127mm(5.0mil)



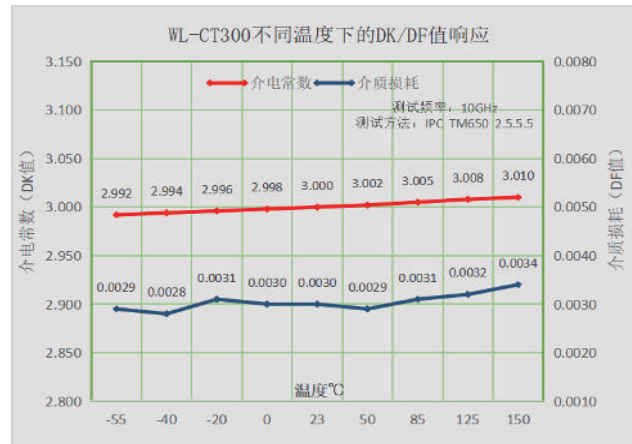
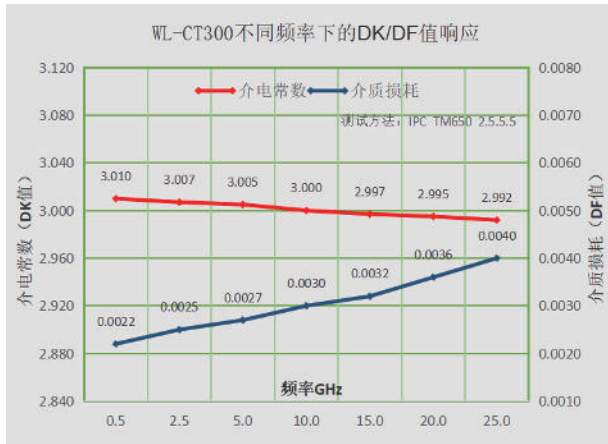
WL-CT338 media thickness and tolerance			
<p>WL-CT338 has the thinnest thickness of 0.102mm (4mil), we can provide 0.102mm (4mil) multiplier products,contactus for customization when it is more than 3.05mm, and the media thickness increases by 0.018mm (0.7mil) when matched with RTF copper foil. The media thickness increases by 0.018mm (0.7mil) when matched with RTF copper foil.</p>			
With ED copper foil		With RTF copper foil	
Thickness mm (mil)	Tolerance mm (mil)	Thickness mm (mil)	Tolerance mm (mil)
0.102mm(4mil)	±0.01mm(0.4mil)	0.221mm(8.7mil)	±0.025mm(1.0mil)
0.203mm(8mil)	±0.025mm(1.0mil)	0.526mm(20.7mil)	±0.038mm(1.5mil)
0.305mm(12mil)	±0.025mm(1.0mil)	0.831mm (32.7mil)	±0.051mm(2.0mil)
0.406mm(16mil)	±0.038mm(1.5mil)	1.034mm(40.7mil)	±0.076mm(3.0mil)
0.508mm(20mil)	±0.038mm(1.5mil)	1.542mm(60.7mil)	±0.10mm(4.0mil)
0.711mm (28mil)	±0.05mm(2.0mil)	2.05mm(80.7mil)	±0.127mm(5.0mil)
0.813mm (32mil)	±0.05mm(2.0mil)	/	/
1.016mm(40mil)	±0.076mm(3.0mil)	/	/
1.524mm(60mil)	±0.10mm(4.0mil)	/	/
WL-CT350 media thickness and tolerance			
<p>WL-CT350 has the thinnest thickness of 0.102mm (4mil), starting from 0.168mm (6.6mil) and increasing in multiples of 0.0838mm (3.3mil), when it exceeds 6.1mm, contact our company contact us for customization, the thickness of the media increases by 0.018 mm (0.7mil) when matched with RTF copper foil.</p>			
With ED copper foil		With RTF copper foil	
Thickness mm (mil)	Tolerance mm (mil)	Thickness mm (mil)	Tolerance mm (mil)
0.102mm(4mil)	±0.01mm(0.4mil)	0.272mm(10.7mil)	±0.025mm(1.0mil)
0.168mm(6.6mil)	±0.018mm(0.7mil)	0.526mm(20.7mil)	±0.038mm(1.5mil)
0.254mm(10mil)	±0.025mm(1.0mil)	0.78mm (30.7mil)	±0.051mm(2.0mil)
0.338mm(13.3mil)	±0.038mm(1.5mil)	1.034mm(40.7mil)	±0.076mm(3.0mil)
0.422mm(16.6mil)	±0.038mm(1.5mil)	1.542mm(60.7mil)	±0.10mm(4.0mil)
0.508mm(20mil)	±0.038mm(1.5mil)	3.066mm(120.7mil)	±0.15mm(6.0mil)
0.762mm(30mil)	±0.05mm(2.0mil)	/	/
1.016mm(40mil)	±0.076mm(3.0mil)	/	/
1.524mm(60mil)	±0.10mm(4.0mil)	/	/

WL-CT440 media thickness and tolerance							
WL-CT440 is the thinnest 0.254mm (8mil) thickness, available in 0.254mm (8mil) multiples, with ED copper foil only							
With ED copper foil				With RTF copper foil			
Thickness mm (mil)	Tolerance mm (mil)		Thickness mm (mil)	Tolerance mm (mil)			
0.254mm(10mil)	±0.025mm(1.0mil)		1.016mm(40mil)	±0.076mm(3.0mil)			
0.508mm(20mil)	±0.038mm(1.5mil)		1.524mm(60mil)	±0.10mm(4.0mil)			
0.762mm(30mil)	±0.05mm(2.0mil)		2.03mm (80mil)	±0.127mm(5.0mil)			
WL-CT615 Media thickness and tolerance							
WL-CT615 has the thinnest thickness of 0.203mm (8mil), we can provide 0.102mm (4mil) times products, if it is more than 6.15mm Contact us for customization, only with ED copper foil							
With ED copper foil				With RTF copper foil			
Thickness mm (mil)	Tolerance mm (mil)		Thickness mm (mil)	Tolerance mm (mil)			
0.203mm(8mil)	±0.025mm(1.0mil)		0.813mm (32mil)	±0.05mm(2.0mil)			
0.305mm(12mil)	±0.025mm(1.0mil)		1.016mm(40mil)	±0.076mm(3.0mil)			
0.406mm(16mil)	±0.038mm(1.5mil)		1.524mm(60mil)	±0.10mm(4.0mil)			
0.508mm(20mil)	±0.038mm(1.5mil)		2.03mm (80mil)	±0.127mm(5.0mil)			
0.711mm (28mil)	±0.05mm(2.0mil)		3.05mm (120mil)	±0.15mm(6.0mil)			
WL-CT series aluminum substrate:							
This series of products can be provided lined with aluminum base material, i.e. the dielectric layer is covered with copper foil on one side and the dielectric layer is covered with aluminum base on the other side to play the role of shielding or heat dissipation. The model number is WL-CT***-AL.							
Model	Metal base	Weight	Thermal conductivity	Coefficient of thermal expansion	Aluminum base available in thickness mm	Aluminum base thickness tolerance (mm)	Available sizes (mm)
WL-CT***-AL	Aluminum based	2.7	180	24	0.48, 0.98, 1.48, 1.98, 2.98, 3.98, For other thicknesses, please contact us our company contact to make	+0.02, -0.05	460×610 460×305
Example of model number: WL-CT350-AL stands for WL-CT350's aluminum-based laminate							

1. dielectric constant (typical value) test for material Z-direction, using GB/T 12636-1990 or IPC-TM650 2.5.5.5 strip line method test;
2. dielectric constant (design value) using 50Ω microstrip line method test, test for the material Z-direction
3. other performance tests are tested by or with reference to IPC-TM-650 or GBT4722-2017 specified test methods
4. All test data are typical measurements and are intended to assist customers in material selection and are not intended and do not constitute any express or implied warranty, nor do they ensure that customers will achieve all of the properties in the data sheet in a particular application, and customers are responsible for verifying and determining the suitability of Wangling materials for each application.

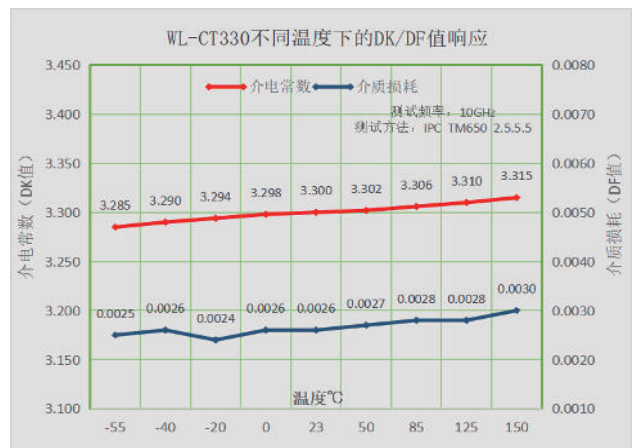
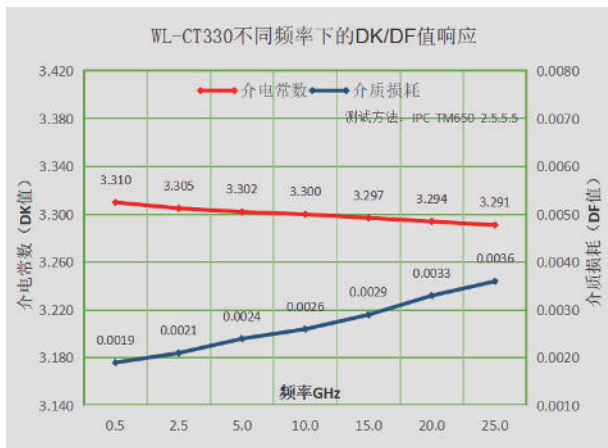
Electrical properties chart description: frequency change is based on the median dielectric constant and median loss at 10G, temperature change is based on the median dielectric constant and median loss at 23 degrees Celsius at room temperature, and the accumulated data statistics of the change law approximation, the ideogram in the expression of the type of material change law, does not mean that each piece of the product is the data marked in the chart, but the product change trend in line with the change law in the chart.

■ WL-CT300 electrical performance chart



- ◆ Excellent frequency stability: the material has a stable dielectric constant within 0.5 to 25 GHz frequency, maintaining low loss values to meet the design requirements at different frequencies;
- ◆ Excellent temperature stability characteristics: TCDK in the range of -55~150°C is about 27PPM/°C, with slight changes, and the actual usable temperature of the material far exceeds this temperature range.

■ WL-CT330 electrical performance chart

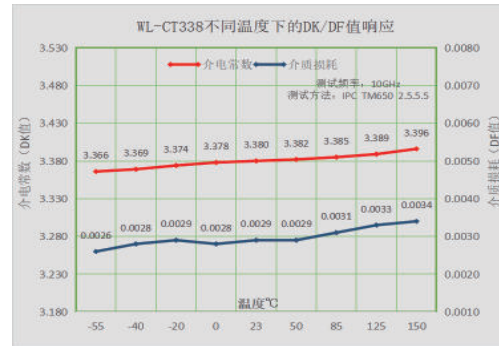
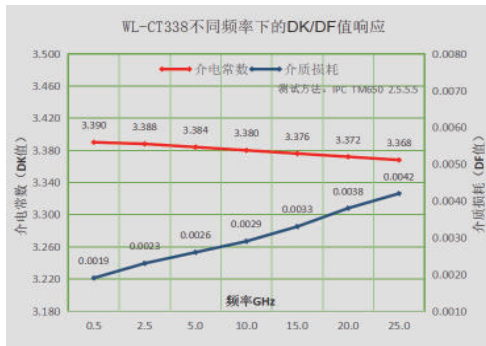


- ◆ Excellent frequency stability: the material has a stable dielectric constant within 0.5 to 25 GHz, maintaining a low loss value to meet the design at different frequencies. requirements;
- ◆ Excellent temperature stability characteristics: TCDK in the range of -55 to 150°C is about 43PPM/°C, with small changes, and the actual material can be used at a temperature far exceeds this temperature range.



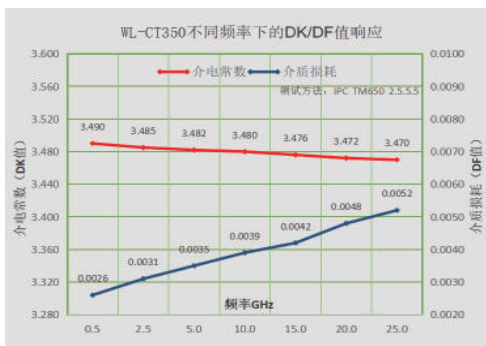
Electrical properties chart description: frequency change is based on the median dielectric constant and median loss at 10G, temperature change is based on the median dielectric constant and median loss at 23 degrees Celsius at room temperature, and the accumulated data statistics of the change law approximation, the ideogram in the expression of the type of material change law, does not mean that each piece of the product is the data marked in the chart, but the product change trend in line with the change law in the chart.

■ WL-CT338 electrical performance chart



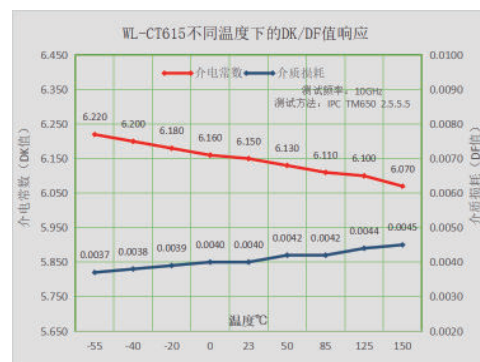
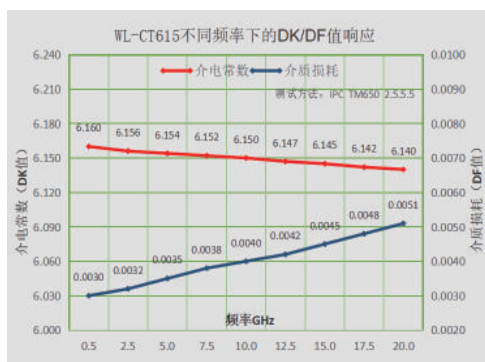
- ◆ Excellent frequency stability: the material has a stable dielectric constant within 0.5 to 25 GHz frequency, maintaining low loss values to meet the design requirements at different frequencies;
- ◆ Excellent temperature stability characteristics: TCDK in the range of -55~150°C is about 45PPM/°C, with slight changes, and the actual material can be used at temperatures far exceeding this temperature range.

■ WL-CT350 electrical performance chart



- ◆ Excellent frequency stability: the material has a stable dielectric constant within 0.5 to 25 GHz frequency, maintaining low loss values to meet the design requirements at different frequencies;
- ◆ Excellent temperature stability characteristics: TCDK in the range of -55~150°C is about 52PPM/°C, with slight changes, and the actual useable temperature of the material far exceeds this temperature range.

■ WL-CT615 electrical performance chart



- ◆ Excellent frequency stability: the material has a stable dielectric constant within 0.5 to 20 GHz frequency, maintaining a low loss value to meet the design requirements at different frequencies;
- ◆ Excellent temperature stability characteristics: TCDK in the range of -55~150°C is about 45PPM/°C, with slight changes, and the actual material can be used at temperatures far exceeding this temperature range.