

## PTFE Ceramic Composite Dielectric Substrate TFA Series

### ■ Products

PTFE ceramic composite dielectric substrate TFA series of products of the dielectric layer composition of PTFE resin and ceramic, do not use the glass fiber cloth dipping method to make prefabricated sheet, but the use of new technology to make prefabricated sheet, and then pressed by a special pressing process. With the same level of dielectric constant excellent electrical properties, thermal properties, mechanical properties, is aerospace grade high frequency high reliability materials, can replace similar foreign products.

This series of substrate does not contain glass fiber cloth, using a large number of uniform special nano-ceramics and resin mixture, electromagnetic wave propagation without glass fiber effect, excellent frequency stability, dielectric loss of the same level of the lowest, the material X / Y / Z the lowest anisotropy, the material at the same time has the same as the copper foil low thermal expansion coefficient, stable dielectric temperature characteristics.

The dielectric constant of this series is 2.94, 3.0, 6.15, 10.2.

The TFA series comes standard with RTF low roughness copper foil, which reduces conductor loss while providing excellent peel strength.

TFA294 and TFA300 can be matched with buried 50Ω resistive copper foil to form resistive film sheets.

The circuit board can be processed by standard PTFE sheet technology. The excellent mechanical and physical properties of the sheet make it suitable for multilayer, high multilayer and backplane processing; at the same time, it shows excellent processability in the processing of dense holes and fine lines.

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### ■ Product Features

- ◆ Small dielectric constant tolerance and excellent batch-to-batch consistency;
- ◆ lowest dielectric loss in its class;
- ◆ Use of frequencies up to 77G for millimeter wave and automotive radar applications;
- ◆ Excellent frequency stability and phase stability from -55°C to 150°C;
- ◆ Excellent irradiation resistance, maintaining stable dielectric 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;
- ◆ Excellent thermal expansion coefficient, equal to copper foil; ensures the reliability and dimensional thermal stability of copper hole;
- ◆ Low water absorption, ensuring the stability of the material under humid environment.

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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 Parameter			Product model/Data			
Product Features	Test conditions	Unit	TFA294	TFA300	TFA615	TFA1020
Dielectric constant (typical value)	10GHz	/	2.94	3.00	6.15	10.20
Dielectric constant (design value)	10GHz	/	2.94	3.00	6.4	10.7
Dielectric constant tolerance	/	/	±0.04	±0.04	±0.12	±0.20
Loss factor (typical value)	10GHz	/	0.001	0.001	0.0015	0.0015
	20GHz	/	0.001	0.001	0.0017	0.0017
	40GHz	/	0.0012	0.0012	/	/
Dielectric constant temperature coefficient	-55 °~150°C	PPM/°C	-5	-8	-215	-340
Peel strength	1 OZ RTF copper foil	N/mm	>1.6	>1.6	>1.6	>1.6
Volumetric resistivity	Normal	MΩ.cm	≥5×10 <sup>7</sup>	≥5×10 <sup>7</sup>	≥5×10 <sup>7</sup>	≥5×10 <sup>7</sup>
Surface resistance	Normal	MΩ	≥5×10 <sup>7</sup>	≥5×10 <sup>7</sup>	≥5×10 <sup>7</sup>	≥5×10 <sup>7</sup>
Electrical strength (Z-direction)	5KW, 500V/s	KV/mm	>35	>32	>30	>30
Breakdown voltage (XY direction)	5KW, 500V/s	KV	>40	>40	>30	>25
Thermal expansion coefficient(X,Y direction)	-55 °~288°C	ppm/°C	18,18	18,18	16,16	16,16
Thermal expansion coefficient (Z-direction)	-55 °~288°C	ppm/°C	32	30	29	30
Thermal stress	260°C, 10s, 3 times	-	Not stratified	Not stratified	Not stratified	Not stratified
Water absorption	20±2°C, 24h	%	0.03	0.04	0.06	0.015
Density	Normal temperature	g/cm <sup>3</sup>	2.14	2.15	2.5	3.0
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)	0.59	0.60	0.80	0.88
Flame retardancy	/	UL-94	V-0	V-0	V-0	V-0
TD	Starting value	°C	498	498	503	505
Material composition	/	/	PTFE, ceramics (a very small amount of glass fiber cloth is added when the media thickness exceeds 1.5 mm)			

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 Wantling materials for each application.

**Optional copper foil:**  
 Copper foil thickness: 0.5OZ (0.018mm), 1OZ (0.035mm); other thicknesses on request;  
 Copper foil type: RTF low roughness copper foil, as standard  
 Choose from 50Ω buried resistance copper foil, calendered copper foil, copper-based, aluminum-based  
 50Ω buried resistor copper foil introduction: resistor film composition is nickel-phosphorus alloy, resistor film thickness of 0.2 microns, square resistance value per square centimeter resistance value of 50 ± 5Ω.

Available sizes (special sizes contact our company for customization):  
 305×460mm (12×18ʳ) 460×610mm (18×24ʳ)

**Media layer thickness and tolerance can be provided (special thickness contact our company for customization):**  
 TFA series products are the thinnest 0.127mm and available in 0.127mm multiples

Thickness mm (mil)	Tolerance mm (mil)	Thickness mm (mil)	Tolerance mm (mil)
0.127mm(5.0mil)	±0.0127mm(0.5mil)	1.905mm(75mil)	±0.09mm(3.5mil)
0.254mm(10mil)	±0.02mm(1.0mil)	2.03mm (80mil)	±0.09mm(3.5mil)
0.508mm(20mil)	±0.03mm(1.19mil)	2.54mm(100mil)	±0.13mm(5.0mil)
0.635mm(25mil)	±0.03mm(1.58mil)	3.175mm(125mil)	±0.20mm(8.0mil)
0.762mm(30mil)	±0.04mm(1.58mil)	3.81mm(150mil)	±0.25mm(10.0mil)
1.016mm(40mil)	±0.05mm(2.0mil)	4.06mm(160mil)	±0.25mm(10.0mil)
1.270mm(50mil)	±0.05mm(2.0mil)	5.08mm(200mil)	±0.25mm(10.0mil)
1.524mm(60mil)	±0.07mm(2.5mil)	6.35mm(250mil)	±0.32mm(12.6mil)

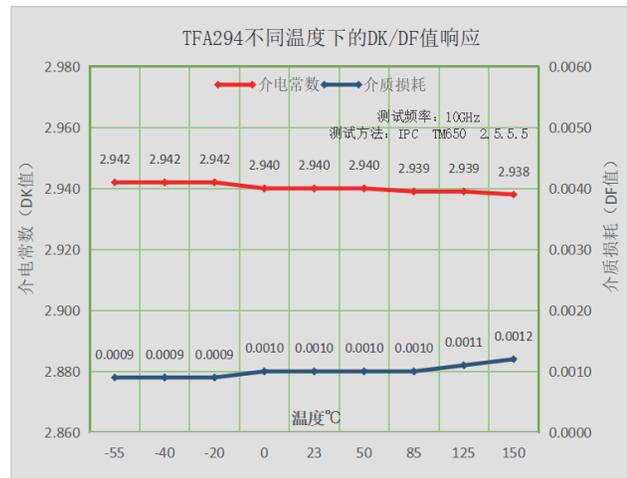
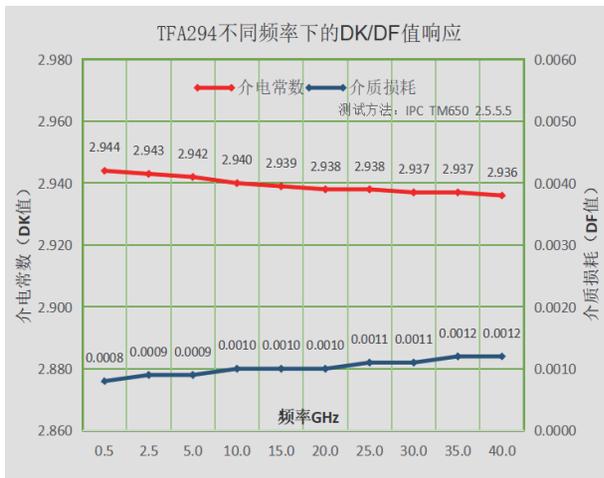
**TFA series aluminum base/copper substrate:**  
 This series of products can be provided lined with aluminum base or copper base material, that is, the dielectric layer is covered with copper foil on one side, and the other side of the dielectric layer is covered with copper base or aluminum base, which plays a shielding or heat dissipation role.the model number is TFA\*\*\*-AL or TFA\*\*\*-CU.

Model	Metal base	Specific gravity	Thermal conductivity	Coefficient of thermal expansion	Copper or aluminum based available thickness (mm)	Metal base thickness tolerancemm	Available in size mm
TFA***-CU	Red copper/brass	8.9	380	17	0.48, 0.98, 1.48, 1.98, 2.98, 3.98 Contact our company to formulate other thicknesses	+0.02, -0.05	460×610 460×305
TFA***-AL	Aluminum based	2.7	180	24			

**Model Example:**  
 TFA294- AL represents the aluminum clad base plate of TFA 294  
 TFA1020- CU represents the copper clad base plate of TFA 1020

Explanation of electrical performance chart: The frequency change is based on the median dielectric constant and loss at 10G, while the temperature change is based on the median dielectric constant and loss at 23 °C at room temperature, and the cumulative data shows an approximate change pattern. This table represents the change pattern of the material model and does not mean that every product is labeled in the chart, but the change trend of the product conforms to the change pattern in the chart.

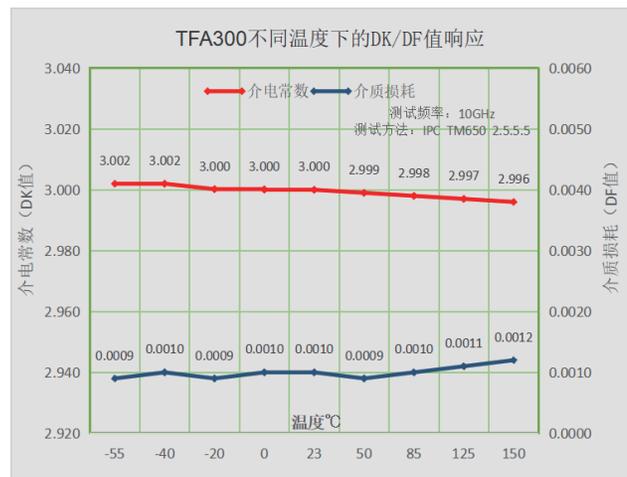
### TF A294 electrical performance chart



◆ Excellent frequency stability. The dielectric constant and loss of the material are stable in the frequency range of 0.5~40GHz by using the stripline method, and the ultra-low loss value is maintained; Limited by the frequency of the stripline test method, it does not mean that this material can only be used at the frequency of 0.5~40GHz. The excellent performance makes the frequency reach 77GHz or even higher.

◆ Excellent temperature stability characteristics, with a TCDK of around -5PPM/°C within the range of -55~150 °C, with minimal changes. The actual usable temperature of the material far exceeds this temperature range.

### TFA300 electrical performance chart

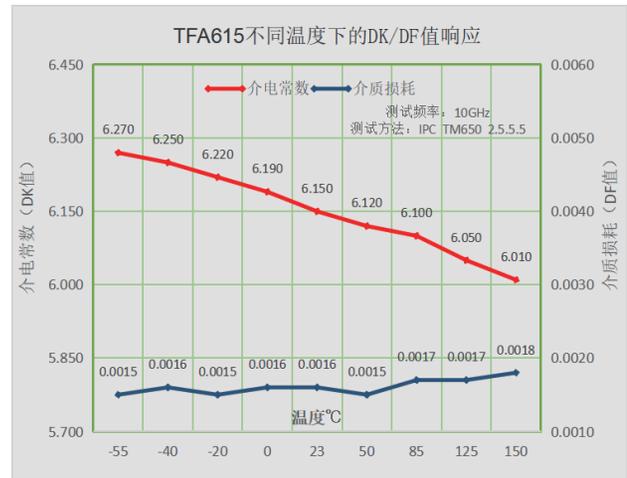


◆ Excellent frequency stability: use the stripline method to test the dielectric constant and loss stability of the material in the frequency range of 0.5~40GHz, and maintain the ultra-low loss value; Limited by the frequency of the stripline test method, it does not mean that this material can only be used at the frequency of 0.5~40GHz. The excellent performance makes the frequency reach 77GHz or even higher.

◆ Excellent temperature stability characteristics: The TCDK within the range of -55~150 °C is around -8PPM/°C, with minimal changes. The actual usable temperature of the material far exceeds this temperature range.

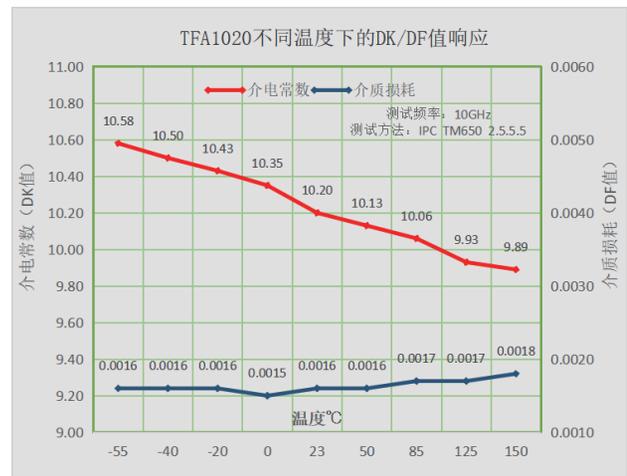
Explanation of electrical performance chart: The frequency change is based on the median dielectric constant and loss at 10G, while the temperature change is based on the median dielectric constant and loss at 23 ° C at room temperature, and the cumulative data shows an approximate change pattern. This table represents the change pattern of the material model and does not mean that every product is labeled in the chart, but the change trend of the product conforms to the change pattern in the chart.

■ TFA615 electrical performance chart



- ◆ Excellent frequency stability: The dielectric constant of the material is stable within the frequency range of 0.5~20GHz, maintaining low loss values and meeting design requirements at different frequencies;
- ◆ -The TCDK within the range of 55-150 ° C is around -215PPM/°C, providing reference data for different temperature designs. The actual material can be used at temperatures far beyond this temperature range.

■ TFA1020 electrical performance chart



- ◆ Excellent frequency stability, stable dielectric constant of the material within the frequency range of 0.5~20GHz, maintaining low loss values, meeting design requirements at different frequencies;
- ◆ -The TCDK within the range of 55-150 ° C is around -340PPM/°C, providing reference data for different temperature designs. The actual material can be used at temperatures far beyond this temperature range.