

High Frequency Laminates Teflon woven glass fabric copper-clad laminates $F_4B - 1/2$

This product is formulated with excellent material according to the requirements of microwave circuit in electrical performance. It is a kind of excellent microwave PCB substrate due to its excellent electrical performance and higher mechanical strength.

Appearance	Meet the specification requirements for microwave PCB substrate							
		specified in	National and Militar	ry Standards.				
	300×250	380×350	440×550	500×500	460×610			
Dimensions (mm)	600×500	840×840	1200×1000	1500×1000				
		For special dimensio	ons, customized lamin	nation is available.				
Copper		0	0.25					
thickness		0	. 0550000 0. 01800	Ш				
	Plate thickness	0. 17, 0. 25	0. 5, 0. 8, 1. 0	1. 5, 2. 0	3. 0, 4. 0, 5. 0			
Thickness and	Tolerance	±0.01	± 0.03	± 0.05	± 0.06			
tolerance (mm)	Plate	thickness includes	the copper thickness	. For special dimens	ions,			
		customized lamination is available.						
		Plate thickness (mm)	Ма	Maximum angularity mm/mm				
			Original board	Single-sided board	Double-sided board			
	Angulanitu	0.25~0.5	0.03	0.05	0.025			
	Angularity	0.8~1.0	0.025	0.03	0.020			
		1.5~2.0	0.020	0.025	0.015			
Mechanical		3.0~5.0	0.015	0.020	0.010			
properties		For the plate of <1m	m, no burrs after cu	tting, minimum space	between two punching			
	Cutting/ punching		holes is 0.55mm	, no separation.				
	property	For the plate of≥1m	m, no burrs after cu	tting, minimum space	between two punching			
			holes is 1.10mm	, no separation.				
		In normal state:≥15	5N/cm; No bubbling, n	no separation and pee	el strength ≥12 N/cm			
	Peel strength	when in the environme	ent of constant humid	ity and temperature ar	nd kept in the melting			
		solder of $260^{\circ}C \pm 2^{\circ}C$	C for 20 seconds.					
Chemical	According to differer	nt properties of subst	trates, the chemical	etching method for PC	B can be used for the			
nronerties	circuit processing,	the dielectric proper	rties of materials a	re not changed and th	ne holes can be			
Properties	metallized.							

		Names	Test conditions	Unit	Specifications	
		Gravity	Normal state	g/cm3	2.2~2.3	
		Water elegention rate	Dip in distilled water of	0/.	< 0.00	
Flootnicel properties	properties	water absorption rate	20 ± 2 °C for 24 hours.	70	<0.02	
	properties	On anoting to many support	high-low temperature	Ŷ	50~ + 260	
		operating temperature	chamber	C	-30/~+200	
		Thermal conductivity		Kaal /m h °C	0.9	
		coefficient		NUAL / III . II. C	0.0	

Coefficie	ent of thermal	Temperature	rise of 96℃ per	Coefficient of thermal	$\leq 5 \times 10^{-5}$	
ex	pansion		hour	expansion×1	≪5×10−5	
Shrink	age factor	Two hours i	n boiling water	%	0.0002	
			Normal state		≥5×103	
Surface	e insulation	500V DC	Constant	мо		
res	istance	500V DC	humidity and	M. 52	$\geq 5 \times 102$	
			temperature			
		Norm	al state		≥5×105	
volume	volume resistance		humidity and	MΩ.cm	$> E \times 104$	
		tem	perature		≥3×104	
			Normal state	мо	≥5×104	
Pin r	ocistanco	500VDC	Constant			
	esistance	500700	humidity and	IAI 25	≥5×102	
			temperature			
Surface	diologtria	Norm	al state		≥1.2	
Surface	rength	Constant	humidity and	$\delta = 1 \text{mm} (\text{kV/mm})$	>1.1	
	I Elig til	temŗ	perature		≥1.1	
Dear			100117	6.77	2. 55	
Peril	11111111			¢ I.	2.65 (±2%)	
Dielectr	ic loss angle		10047	+α δ	<1×10-2	
ta	tangent		LUGHZ	ιgυ	≪1∧10−3	



This product with high permittivity is formulated with varnished glass cloth and Teflon resin through scientific formulation and strict technology procedures. It takes some advantages over F4B series in electrical performance (Mainly, wider range of dielectric constant).

	Meet the specif	ication requireme	ents for	· microwave	PCB substr	ate sp	ecified in Nat	ional	and Military
Appearance				Stand	ards.				
Types	F4BK225	F4BK265		F4BK300		F4BK350			
Permittivity	2.25	2.65		3.	0		3.50		
	300×250	350×380)	440×	550	5	i00×500		460×610
Dimensions	600×500	840×840)	1200×	< 1000	15	i00×1000		
		For special o	dimensi	ons, custon	nized lamin	ation :	is available.		
	Plate thickness	0.25		0.5	0.8		1.0		
	Tolerance				$\pm 0.02 \sim \pm$	0.04			
toloropoo(mm)	Plate thickness	1.5		2.0	3.0		4.0		5.0
	Tolerance		$\pm 0.05 \sim \pm 0.07$						
	Plate thickness includes the copper thickness. For special dimensions, customized lamination is available.								
		Plate thickness (mm)			Ma	ximum	angularity mm/n	nm	
				Origina	al board	Sing	le-sided board	Doubl	le-sided board
	Angularity	0.25~0.5		0	0.03		0.05		0.025
		0.8~1.0	0.8~1.0		0.025		0. 03		0.020
		1.5~2.0		0.	0.020		0.025		0.015
Mechanical		3.0~5.0		0.	015		0.020		0.010
properties		For the plate of \cdot	<1mm, r	o burrs af	ter cutting,	minin	um space betwee	en two	punching holes
1 1	Cutting/ punching			is O	.55mm, no s	eparat	ion.		
	property	For the plate of 🗦	≥1mm, n	o burrs aft	er cutting,	minim	um space betwee	en two	punching holes
				is 1	.10mm, no s	eparat	ion.		
		In normal state:≩	≥12N/cm	ı; No bubbl	ing, no sep	aratio	n and peel str	ength	\geq 10 N/cm when
	Peel strength	in the environmen	t of co	nstant hum:	idity and t	empera	ture and kept i	n the	melting solder
		of $260^{\circ}C \pm 2^{\circ}C$ for 20 seconds.							
Chemical	According to diff	erent properties (of subs	trates, the	chemical e	tching	method for PCE	3 can b	be used for the
properties	circuit processin	g, the dielectric	propert	ies of mate	rials are no	ot chan	ged and the hol	es can	be metallized.

Electrical propertie		Names	Names Test conditions		Specifications
		Gravity	Normal state	g/cm3	2.2~2.3
	properties	Water absorption rate	Dip in distilled water of 20±2℃ for 24 hours.	%	≪0. 02
		Operating temperature	high-low temperature chamber	°C	$-50 \sim +260$
		Thermal conductivity		Kcal ∕m .h.℃	0.8

	coefficient				
	Coefficient of thermal	Temperat	ure rise of 96℃	Coefficient of thermal	<5×10-5
	expansion]	per hour	expansion×1	~3/10 3
	Shrinkage factor	Two ho	urs in boiling water	%	0.0002
			Normal state		≥1×104
	Surface insulation resistance	500V DC	Constant humidity and temperature	<u>Μ</u> . Ω	≥1×103
		No	rmal state		≥1×106
	volume resistance	Constant humidity and temperature		MΩ.cm	≥1×105
	Pin resistance		Normal state		≥1×105
		500V	Constant humidity and temperature	MΩ	≥1×103
	Sumface dielectorie	No	rmal state		≥1.2
	strength	Constant humidity and temperature		$\delta = 1$ mm (kV/mm)	≥1.1
	Permittivity	10GHZ		εr	2. 2. 25 2. 2. 65 (±2%) 2. 3. 0 3. 5
	Dielectric loss angle tangent		10GHZ	tgδ	≤1×10-3

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High Frequency LaminatesTeflon woven glass fabric copper-clad laminateswith high permittivityF4BM - 1/2

This product is formulated with varnished glass cloth, prepreg and Teflon resin through scientific formulation and strict technology procedures. It takes some advantages over F4B series in electrical performance, including wider range of dielectric constant, low dielectric loss angle tangent, increased resistance and more stable in performance.

Appearance	Meet the specification requirements for microwave PCB baseplate specified in National and Military Standards							
Types	F4BM220	F4BM255	5	F4BM265		E4BM300		F4BM350
Pormittivity	2 20	2 55	,	2.65		1 4DM300		3 50
I CIMICCIVICY	2.20	2.00	2.33		<pre>/ EE0</pre>		5.0×500	460×610
Dimensions	500×250	840 × 840		4407	1000	1	500×500	400×010
(mm)	600×500	840×84	0	840×	. 1200	18	500×1000	
		For special	dimensio	ons, custor	nized lamina	ation :	is available.	
	Plate thickness	0. 25		0.5	0.8		1.0	
Thickness and	Tolerance	$\pm 0.02 \sim \pm 0.04$						
tolerance	Plate	1.5		2.0	2.0		4.0	5.0
(mm)	thickness	1. 0		2.0	5.0		4.0	5.0
	Tolerance				$\pm 0.05 \sim \pm 0.05$	0. 07		
	Plate thickness	includes the copper	thickne	ess. For sp	ecial dimens	ions,	customized lami	nation is available.
		Plate thickness (mm)			Maz	kimum	angularity mm/n	nm
	[Origina	al board	Sing	le-sided board	Double-sided board
		0.25~0.5	0.25~0.5		0.03		0.05	0.025
	Angularity	0.8~1.0		0.	0.025		0.03	0. 020
		1.5~2.0		0.	0. 020		0.025	0.015
Mechanical		3.0~5.0		0.	0.015		0.020	0.010
mechanical properties	Cutting/ punching property	For the plate of<1mm, no burrs after cutting, minimum space between two punching holes is 0.55mm, no separation. For the plate of≥1mm, no burrs after cutting, minimum space between two punching holes is 1.10mm, no concretion						
		In normal state:≥1	8N/cm; 1	No bubblin	g, no separa	tion a	and peel streng	th ≥15 N/cm when in
	Peel strength	the environment of 260℃±2℃ for 20 s	constan seconds.	t humidity	and temper	ature	and kept in th	e melting solder of
Chemical	According to di	fferent properties	of baser	plates, the	e chemical e	tching	method for PCE	3 can be used for the
properties	circuit process	sing, the dielectric	propert	ies of mate	rials are no	ot chan	ged and the hole	es can be metallized.

Electrical pro		Names	Test conditions	Unit	Specifications
	proportios	Gravity	Gravity Normal state		2. 2~2. 3
	properties-	Water absorption rate	Dip in distilled water of 20±2°C for 24 hours.	%	≤0.02

	Operating temperature	high-l	ow temperature chamber	°C	-50~+260
	Thermal conductivity coefficient			Kcal /m .h.°C	0.8
	Coefficient of thermal	Temperat	ure rise of 96℃	Coefficient of thermal	≤5×10-5
	expansion		per hour	expansion×1	
	Shrinkage factor	Two ho	ours in boiling % water		0.0002
			Normal state		≥1×104
	Surface insulation resistance	500V DC	Constant humidity and temperature	М. Ω	≥1×103
		No	rmal state	MΩ.cm	≥1×106
	volume resistance	Constar te	nt humidity and emperature		≥1×105
	Pin resistance		Normal state		≥1×105
		500V DC	Constant humidity and temperature	MΩ	≥1×103
	Surface dielectric	No	rmal state		≥1.2
	strength	Constar te	nt humidity and emperature	$\delta = 1$ mm (kV/mm)	≥1.1
	Permittivity	10GHZ		εr	2. 2. 20 2. 2. 55 2. 65 $(\pm 2\%)$ 2. 3. 0 3. 5
	Dielectric loss angle tangent		10GHZ	tgδ	≤7×10-4



High Frequency Laminates Teflon woven glass fabric copper-clad laminates with high permittivity F₄BMX – 1/2

This product is formulated with varnished glass cloth, prepreg and Teflon resin through scientific formulation and strict technology procedures. It takes some advantages over F4B series in electrical performance, including wider range of dielectric constant, low dielectric loss angle tangent, increased resistance and more stable in performance. Compared with the F4BM,using the pure imported woven glass as the main material of the PTFE microwave laminates ,the consistency of the laminate various properties can be insured

Appearance	Meet the specifica	tion requirements f	or micr	owave PCB s	substrate spe	cifie	d in National and	d Military Standards.	
D	F4BMX217	F4BMX220	F4B	MX245	F4BMX25	5	F4BMX265	F4BMX275	
Dimensions	F4BMX285	F4BMX295	F4BMX300		F4BMX320		F4BMX338	F4BMX350	
		For special dimensions, customized lamination is available.							
	Plate thickness	0.25). 5	0.8		1.0		
m1 · 1 1	Tolerance				$\pm 0.02 \sim \pm 0$	0.04			
toloropoo (mm)	Plate thickness	1.5	(2	2. 0	3.0		4.0	5.0	
	Tolerance				$\pm 0.05 \sim \pm 0.05$	0.07			
	Plate thickness in	ncludes the copper 1	thickne	ss. For sp	ecial dimensi	ions,	customized lami	nation is available.	
		Plata thickness	(mm)		Max	imum	angularity mm/mm		
		riate thickness (hui)		Origin	Original board Sing		le-sided board	Double-sided board	
	Angularity	0.25~0.5		(). 03		0.05	0.025	
		0.8~1.0		0	. 025		0.03	0.020	
		$1.5 \sim 2.0$		0.020		0.025		0.015	
Mechanical		3.0~5.0		0.015		0.020		0.010	
properties		For the plate of $<$	1mm, no	burrs aft	er cutting,	minim	um space betwee	n two punching holes	
	Cutting/ punching			is (.55mm, no se	parat	ion.		
	property	For the plate of \geqslant	1mm, no	burrs aft	er cutting,	minim	um space betwee	n two punching holes	
				is 1	.10mm, no se	parat	ion.		
		In normal state:≥	18N/cm;	No bubbli	ng, no separa	ation	and peel streng	gth \geqslant 15 N/cm when in	
	Peel strength	the environment of	consta	ant humidi	ty and temper	rature	e and kept in t	he melting solder of	
		$260^{\circ}C \pm 2^{\circ}C$ for 20 seconds.							
Chemical	According to different properties of substrates, the chemical etching method for PCB can be used for the								
properties	circuit processing	g, the dielectric p	roperti	es of mate	rials are not	chan	ged and the hole	es can be metallized.	

		Names Test conditions		Unit	Specifications	
		Gravity	Normal state	g/cm3	2. 2~2. 3	
		Water electron rate	Dip in distilled water of	0/.	≤0.02 -50~+260	
Electrical	properties	water absorption rate	20 ± 2 °C for 24 hours.	/0		
		Openating temperature	high-low temperature	ŶC		
		operating temperature	chamber	C		
		Thermal conductivity		Kcal ∕m .h.℃	0.8	

	coefficient					
	Coefficient of thermal	Temperatı	⊔re rise of 90℃	Coefficient of	<5×10-5	
	expansion	per hour		thermal expansion $ imes 1$	≪5×10−5	
	Shrinkage factor	Two hours in boiling water		%	0.0002	
			Normal state		≥1×105	
	Surface insulation	500V DC	Constant	мо		
	resistance	500V DC	humidity and	IVI. 52	≥1×103	
			temperature			
		Noi	rmal state		≥1×106	
	volume resistance	Constant humidity and		M.Ω.cm	$\geq 1 \times 105$	
		temperature				
	Pin resistance	500V DC	Normal state		≥1×105	
			Constant	М.Ω	≥1×103	
		0001 20	humidity and			
			temperature			
	Surface dielectric	Noi	rmal state		≥1.2	
	strength	Constan	t humidity and	$\delta = 1 \text{mm} (\text{kV/mm})$	≥1 1	
	50101601	te	mperature		> 1. 1	
					2. 2.17, 2.20, 2.45,	
	Permittivity		10GHZ	٤r	2. 2.55, 2.65, 2.75, $(\pm 2\%)$	
	Termitervity		100112		2. 2.85, 2.95, 3.00,	
					3. 20, 3. 38, 3. 50.	
	Dielectric loss angle tangent		10GHZ	tgδ	≤7×10-4	



This product is formulated with varnished glass cloth, prepreg and Teflon resin through scientific formulation and strict technology procedures. It takes some advantages over F4B series in electrical performance and the passive intermodulation can be enhanced.

Appearance	Meet the specification requirements for microwave PCB substrate specified in National and Military Standards.									
	F4BME217	F4E	3ME220	F4E	ME245	F4BME25	5 F4B	ME265	F4BME275	
Types	F4BME285	F4E	3ME295	F4E	ME300	F4BME320) F4B	3ME338	F4BME350	
	300×250	350)×380	440)×550	500×500) 460)×610	600×500	
Dimensions (mm)	840×840	840	×1200	1500)×1000					
		For s	special di	imensio	ns, custo	mized lamin	ation is av	ailable.	1	
	Plate thickness	0.25 0.5				0.8		1.0		
	Tolerance					$\pm 0.02 \sim \pm$	0.04			
Thickness and tolerance	Plate thickness		1.5		2.0	3.0		4.0	5.0	
(mm)	Tolerance					$\pm 0.05 \sim \pm$	0.07			
	Plate thickness	includes the copper thickness. For special dimensio					l dimension	ns, custo	omized lamination	
		is available.								
						Maxi	ximum angularity mm/mm			
		Plate thickness (mm)		Origin	al board	Single-s	ided	Double-sided		
					origin	ar board	board	d	board	
	Angularity	0.25~0.5		C	0.03	0.05		0.025		
		0.8~1.0			0.	. 025	0.03		0.020	
		1.5~2.0			0.	. 020	0.025	5	0.015	
Mechanical properties			3.0~5.0		0.	. 015	0.020	0	0.010	
	Cutting/	For the plate of < 1 mm, no burrs after c					g, minimum s	space bet	ween two punching	
	punching	holes is 0.55mm, no separation.								
	property	For the plate of≥1mm, no burrs after cutting, minimum space betwee						ween two punching		
	holes is 1.10mm, no se						separation	eparation.		
	Deel strength	In normal state:≥18N/cm; No bubbling, no separation and peel strength ≥15 N/							trength ≥15 N/cm	
	reer strength	meltin	n the env	of 260	C + 2C f	or 20 secon	lty and tem ls	perature	and kept in the	
	According to di	fferent	t properti	es of s	substrates	the chemi	cal etching	method f	or PCB can be≥15	
Chemical properties	N/cm used for	the ci	rcuit pro	cessing	, the die	lectric pro	perties of	materials	s are not changed	
	and the holes can be metallized.							_		
	Names		Test	condit	ions	Un	it	Spe	ecifications	
	Gravity		Normal state		ate	g/c	em3		2.2~2.3	
Electrical properties	Water absorption	n rate	Dip in distilled		l water of hours.	9	, 0		≤0.02	
	Operating temper	rature	high-lc	ow temp chamber	erature	°	2		-50~+260	

Thermal conductivity coefficient			Kcal /m .h.℃	0.8
Coefficient of thermal expansion	Temperature rise of 96°C per hour		Coefficient of thermal expansion×1	≪5×10−5
Shrinkage factor	Two hours	in boiling water	%	0.0002
		Normal state		≥1×104
Surface insulation resistance	500V DC	Constant humidity and temperature	<u>Μ</u> . Ω	≥1×103
	Nor	rmal state		≥1×106
volume resistance	Constant humidity and temperature		MΩ.cm	≥1×105
		Normal state		≥1×105
Pin resistance	500V DC	Constant humidity and temperature	MΩ	≥1×103
	Nor	mal state		≥1.2
strength	Constant humidity and temperature		$\delta = 1$ mm (kV/mm)	≥1.1
Permittivity	10GHZ 10GHZ		εr	 2. 2. 17, 2. 20, 2. 45, 2. 55, 2. 65, 2. 75, (±2%) 2. 85, 2. 95, 3. 00, 3. 3. 20, 3. 38, 3. 50.
Dielectric loss angle tangent			tg δ	≤7×10-4
PIMD		2.5GHZ	dbc	≤-120



High Frequency Laminates Teflon woven glass fabric planar resistor copper-clad laminates F₄BDZ294

A new kind of Teflon woven glass fabric planar resistor copper-clad laminates with permittivity of 2.94 is developed recently in out factory. This kind of RF laminates is formulated by Teflon woven glass fabric planar resistor copper-clad laminates with low permittivity and low loss. It features with excellent electrical and mechanical performance. Its high mechanical reliability and excellent electrical stability is suitable for the design of complicated microwave structure.

Specifications for resistance copper-clad

Different square resistance	Thickness of Layer of nickel-phosphorous alloy	Tolerance
	corresponding to the square resistance left	
$50 \Omega /\Box$	0. 20 µ m	5%
100 Ω / □	0. 10 µ m	5%

Structure: One side is coated with resistance copper-clad, and the other side is coated with non-resistance copper-clad, and the Teflon woven glass fabric is placed in the middle as the dielectric material. The permittivity is 2.94.

Features: Low permittivity and loss; excellent electrical/mechanical performance; low thermal coefficient; low exhaust

Applicable:

- (1) Ground-based and airborne radar system;
- (2) Phased array antenna;
- (3) GPS antenna;
- (4) Power backboard;
- (5) Multi-layer PCB;
- (6) Spotlight network.

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High Frequency Laminates Metallic Teflon woven glass fabric copper-clad laminates F₄B – 1/AI (Cu)

This is a kind of microwave circuit baseplate with underlay based on Teflon woven glass fabric copper-clad laminates, which is compressed with copper-clad on one side, and with aluminum (copper) plate on the other side.

	300×300 400×400								
Dimensions (mm)	For special dimensions, customized lamination is available.								
Thickness of underlay	Optional by the use	r.							
Angularity	The specification meets the design requirements for substrate .								
	Names	Test	conditions	Unit	Specifications				
	Gravity	No	rmal state	g/cm3	2. 2~2. 3				
	Water absorption rate	Dip in o of 20±2	distilled water ℃ for 24 hours.	%	≪0.02				
	Operating temperature	high-le	ow temperature chamber	°C	-50~+260				
	Thermal conductivity coefficient			Kcal /m .h.°C	0.8				
	Coefficient of thermal expansion	Temperature rise of 96°C per hour		Coefficient of thermal expansion×1	<5×10-5				
	Shrinkage factor	Two hours in boiling water		%	0.0002				
	Surface insulation resistance		Normal state		≥1×10-4				
		500V DC	Constant humidity and temperature	М.Ω	≥1×10-3				
		ume resistance Constant humidity and temperature			≥1×106				
	volume resistance			MΩ.cm	≥1×105				
			Normal state		≥1×105				
	Pin resistance	500V DC	Constant humidity and temperature	MΩ	≥1×103				
	Sunface dielectric	No	rmal state		≥1.2				
	strength	Constan te	nt humidity and emperature	$\delta = 1 \text{mm} (\text{kV/mm})$	≥1.1				
	Permittivity		10GHZ	εr	2. 2.25 2.653.0 ($\pm 2\%$) 3.5				
	Dielectric loss angle tangent		10GHZ	tg δ	≤1×10-3				
	Thermal resistance		А	°C/W	≥2.0				

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High Frequency Laminates Insulation Teflon woven glass fabric copper-clad laminates F₄T – 1/2

This is a kind of circuit substrate based on the insulative teflon plate, which is compressed with electrolytic copper foil (after oxidation treatment) on both sides, and then pressed together after high-temperature and high pressure treatment. This product is characterized by excellent electrical performance (i.e. low dielectric constant, low loss) and ideal mechanical strength, which is a good choice for substrate of microwave PCB.

Appearance	Meet	the gene	eral requirement	s for substrate of mic	rowave PCB					
Dimensions (mm)		150×10^{-1}	.50 220×160	250×250 200×3	300					
	For s	special	dimensions, cus	tomized lamination is a	vailable.					
	0.5	± 0.05	1 ± 0.1 1	$.5\pm 0.15$ 2 ± 0.2	3 ± 0.3					
Thickness and tolerance	Plate thickness incl	udes the	copper thicknes	ss. For special dimension	ns, customized lamination					
	is available.									
	Angularity		0.02mm/	mm for double-layer boa	ard					
Mechanical properties	Cutting/ punching property No burrs after cutting, and the minimum space between two punching holes is 0.55mm.									
	Peel strength In	el strength In normal state:≥18N/cm; In the environment of constant humidity and temperature:≥6 N/cm .								
Chemical properties	The chemical etching method for PCB can be used for the circuit processing, the dielectric									
		pro	operties of mate	erials are not changed.						
	Names	Test conditions		Unit	Specifications					
	Gravity	No	rmal state	g/cm3	2.2~2.3					
	Water absorption	Dip in distilled water		%	≪0.01					
	Operating	high-low temperature								
	temperature	iiigii i	chamber	°C	$-100 \sim +150$					
	Thermal conductivity coefficient			Kcal /m .h.°C	0. 4					
Electrical properties	Coefficient of thermal expansion	Temper 96°	rature rise of C per hour	×1	9.8~10×10−5					
	Shrinkage factor	Two hours in boiling water		%	0.0005					
			Normal state		≥1×107					
	Surface insulation resistance	500V DC	Constant humidity and temperature	М. Ω	≥1×105					
		No	rmal state		≥1×1010					
	volume resistance	Constar te	nt humidity and emperature	MΩ.cm	≥1×107					

			Normal state	MΩ		≥1×105
	Pin resistance	500V DC	Constant			
		JUUV DC	humidity and		≥1×105	$\geqslant 1 \times 105$
			temperature			
	Cunface dislastais		rmal state	$\delta = 1$ mm (kV/mm)		≥1.5
	strength	Constant humidity and			≥1.4	
	strength	temperature				
	Permittivity		10GHZ	٤r	2.	2.2 (±2%)
	Dielectric loss	100117		tα δ		$\leq 1 \times 10^{-2}$
angle tangent	TUGHZ		ιg U	≈1×10-3		

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High Frequency Laminates Microwave dielectric copper-clad substrate TP – 1/2

Features:

- 1) The dielectric constant is stable and can be optional within the range of $3\sim 16$ according to circuit requirements. The operating temperature is $-100^{\circ}C \sim +150^{\circ}C$.
- 2) The adhesive force between the copper-clad and the medium is more reliable than the vacuum film coating of ceramic substrate. It also has other advantages: easy for circuit processing, higher pass-rate of production, and the manufacturing cost is much lower than the ceramic substrate.
- 3) Dielectric loss angle tangent tgδ≤1×10-3, and the loss has a slight variation with the rise of the frequency.
- 4) It is easy for mechanical manufacturing, including drilling, punching, grinding, cutting, etching, etc.. For these, the ceramic substrate cannot be compared

Appearance	Smooth and neat on both sides; no stain, scar and sunken.										
	Dimensions $A \times B$ (mm)				Tolerance						
D	50×30 80×40	$\leq \pm 0.03$									
Dimension and	120×100 150×	(150	180×180	220×160	$\leq \pm 0.05$						
(mm)	Thickness and tolerance										
	δ (mm) 0.8±0.03 1±0.04 1.2±0.05 1.5±0.06 2±0.08										
	For special dimension	or special dimensions, customized lamination is available.									
	Peel strength	In norma	al state:≥6N/cm;	; In the environment of a temperature:≥4 N/cm .	lternating humidity and						
Mechanical properties		Accordir	ng to different pr	coperties of substrate, th	e chemical etching method						
	Chemical properties	for PCB	can be used for	the circuit processing, t	he dielectric properties						
		of mater	ials are not cha	nged.							
	Names	Tes	t conditions	Unit	Specifications						
	Gravity	Normal state		g/cm3	2						
	Water absorption rate	Dip in distilled water of 20±2℃ for 24 hours.		%	≪0. 02						
	Operating temperature	high-low temperature chamber		°C	-100~+150						
	Thermal conductivity coefficient			Kcal ∕m .h.℃	0. 5						
Electrical properties	Coefficient of thermal expansion	Temperature rise of 96℃ per hour		Coefficient of thermal expansion $ imes 1$	<6×10-5						
	Shrinkage factor	Two hours in boiling water		%	0.0004						
			Normal state		≥1×107						
	Surface insulation resistance	500V DC	Constant humidity and temperature	М. Ω	≥1×105						
		No	rmal state	21.0	≥1×109						
	volume resistance	Consta	nt humidity and	M \$2.CM	≥1×106						

		te	emperature		
	Pin resistance		Normal state	MΩ	≥1×106
		500V DC	Constant humidity and temperature		≥1×104
	Surface dielectric	No	rmal state		≥1.5
	strength	Constant humidity and temperature		$\delta = 1 \text{mm} (kV/\text{mm})$	≥1.2
	Permittivity		10GHZ	ε Γ	2.3~6 9.6,10.2,10.5(±2%)11~ 16
	Dielectric loss angle tangent		10GHZ	tgδ	≤1×10-3



High Frequency Laminates

Teflon ceramic dielectric substrate TF-1/2

This product is made by Teflon resin (with excellent microwave and temperature resistance performance) and natural minerals. The material is alternative with the products (such as RT/duroid 6006\6010\TMM10) from Rogers Corporation in USA.

Features

- 1) The operating temperature is much higher than TP series. It is applicable to long-term operation within the temperature range of -80°C~+200°C, and can be used for wave-welding and melt-back welding.
- 2) Used for the processing of microwave and millimeter wave printing circuits.
- 3) Better radiation performance, 30min20rad/cm2.
- 4) The permittivity is stable and has a slight variation with the rise of temperature and frequency. Permittivity: ϵr =3.0; 6.0; 9.2; 9.6; 10.2.

tomer for special							
tomer for special							
hickness and tolerance are same as that for TP series. It is optional by the customer for special limensions.							
o punching holes							
r PCB can be used							
ged and the holes							
cifications							
3							
≤0.02							
	$-80 \sim +260$						
0.5							
$\leq 1 \times 10-5$							
0.0001							
≥1×105							
≥1×103							
≥1×105							
≥1×104							

			Normal state		≥1×106
	Pin resistance	500V DC	Constant humidity and temperature	MΩ	≥1×104
	Surface dielectric	Normal state			≥1.6
	strength	Constant humidity and temperature		$\delta = 1 \text{mm} (\text{kV/mm})$	≥1.4
	Permittivity		10GHZ	ε Γ	2; 3; 6 (±2%);9.2; 9.6; 10.2
	Dielectric loss angle tangent		10GHZ	tgδ	≤1×10-3

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