



High Frequency Laminates

Teflon woven glass fabric copper-clad laminates

F₄B – 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 Military Standards.				
Dimensions (mm)	300×250	380×350	440×550	500×500	460×610
	600×500	840×840	1200×1000	1500×1000	
	For special dimensions, customized lamination is available.				
Copper thickness	0.035mm		0.018mm		
Thickness and tolerance (mm)	Plate thickness	0.17, 0.25	0.5, 0.8, 1.0	1.5, 2.0	3.0, 4.0, 5.0
	Tolerance	±0.01	±0.03	±0.05	±0.06
	Plate thickness includes the copper thickness. For special dimensions, customized lamination is available.				
Mechanical properties	Angularity	Plate thickness (mm)	Maximum angularity mm/mm		
			Original board	Single-sided board	Double-sided board
		0.25~0.5	0.03	0.05	0.025
		0.8~1.0	0.025	0.03	0.020
		1.5~2.0	0.020	0.025	0.015
	3.0~5.0	0.015	0.020	0.010	
	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 separation.			
Peel strength	In normal state: ≥15N/cm; No bubbling, no separation and peel strength ≥12 N/cm when in the environment of constant humidity and temperature and kept in the melting solder of 260°C ±2°C for 20 seconds.				
Chemical properties	According to different properties of substrates, the chemical etching method for PCB can be used for the circuit processing, the dielectric properties of materials are not changed and the holes can be metallized.				

	Names	Test conditions	Unit	Specifications
Electrical properties	Gravity	Normal state	g/cm ³	2.2~2.3
	Water absorption rate	Dip in distilled water of 20±2°C for 24 hours.	%	≤0.02
	Operating temperature	high-low 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	$\leq 5 \times 10^{-5}$
Shrinkage factor	Two hours in boiling water	%	0.0002
Surface insulation resistance	500V DC	Normal state	$\geq 5 \times 10^3$
		Constant humidity and temperature	$\geq 5 \times 10^2$
volume resistance	Normal state		$\geq 5 \times 10^5$
	Constant humidity and temperature		$\geq 5 \times 10^4$
Pin resistance	500VDC	Normal state	$\geq 5 \times 10^4$
		Constant humidity and temperature	$\geq 5 \times 10^2$
Surface dielectric strength	Normal state		≥ 1.2
	Constant humidity and temperature		≥ 1.1
Permittivity	10GHZ	ϵ_r	2.55 2.65 (±2%)
Dielectric loss angle tangent	10GHZ	$\text{tg } \delta$	$\leq 1 \times 10^{-3}$

CLEC Group
ChuangLian Electronic Component (Group) Co.,Ltd.

No.3,Dianzixi Street,Xi'an 710065,China.

Phone: +86-29-88220746 / 68901529

Fax: +86-29-88260919 / 88233853

E-mail: clec@clecgroup.com

Homepage: www.clecgroup.com



High Frequency Laminates

Teflon woven glass fabric copper-clad laminates

F₄BK - 1/2

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).

Appearance	Meet the specification requirements for microwave PCB substrate specified in National and Military Standards.					
Types	F4BK225	F4BK265	F4BK300	F4BK350		
Permittivity	2.25	2.65	3.0	3.50		
Dimensions	300×250	350×380	440×550	500×500	460×610	
	600×500	840×840	1200×1000	1500×1000		
For special dimensions, customized lamination is available.						
Thickness and tolerance(mm)	Plate thickness	0.25	0.5	0.8	1.0	
	Tolerance	±0.02~±0.04				
	Plate thickness	1.5	2.0	3.0	4.0	5.0
	Tolerance	±0.05~±0.07				
Plate thickness includes the copper thickness. For special dimensions, customized lamination is available.						
Mechanical properties	Angularity	Plate thickness (mm)	Maximum angularity mm/mm			
			Original board	Single-sided board	Double-sided board	
		0.25~0.5	0.03	0.05	0.025	
		0.8~1.0	0.025	0.03	0.020	
		1.5~2.0	0.020	0.025	0.015	
	3.0~5.0	0.015	0.020	0.010		
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 separation.					
Peel strength	In normal state: ≥12N/cm; No bubbling, no separation and peel strength ≥10 N/cm when in the environment of constant humidity and temperature and kept in the melting solder of 260°C±2°C for 20 seconds.					
Chemical properties	According to different properties of substrates, the chemical etching method for PCB can be used for the circuit processing, the dielectric properties of materials are not changed and the holes can be metallized.					

	Names	Test conditions	Unit	Specifications
Electrical properties	Gravity	Normal state	g/cm ³	2.2~2.3
	Water absorption rate	Dip in distilled water of 20±2°C for 24 hours.	%	≤0.02
	Operating temperature	high-low temperature chamber	°C	-50~+260
	Thermal conductivity		Kcal /m . h . °C	0.8

coefficient				
Coefficient of thermal expansion	Temperature rise of 96°C per hour	Coefficient of thermal expansion×1		$\leq 5 \times 10^{-5}$
Shrinkage factor	Two hours in boiling water	%		0.0002
Surface insulation resistance	500V DC	Normal state	M. Ω	$\geq 1 \times 10^4$
		Constant humidity and temperature		$\geq 1 \times 10^3$
volume resistance	Normal state		M Ω .cm	$\geq 1 \times 10^6$
	Constant humidity and temperature			$\geq 1 \times 10^5$
Pin resistance	500V	Normal state	M Ω	$\geq 1 \times 10^5$
		Constant humidity and temperature		$\geq 1 \times 10^3$
Surface dielectric strength	Normal state		$\delta = 1\text{mm (kV/mm)}$	≥ 1.2
	Constant humidity and temperature			≥ 1.1
Permittivity	10GHZ	ϵ_r	2.25 2.65 ($\pm 2\%$) 3.0 3.5	
Dielectric loss angle tangent	10GHZ	tg δ		$\leq 1 \times 10^{-3}$

CLEC Group

ChuangLian Electronic Component (Group) Co.,Ltd.

No.3,Dianzixi Street,Xi'an 710065,China.

Phone: +86-29-88220746 / 68901529

Fax: +86-29-88260919 / 88233853

E-mail: clec@clecgroup.com

Homepage: www.clecgroup.com



High Frequency Laminates

Teflon woven glass fabric copper-clad laminates
with high permittivity **F₄BM – 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	F4BM265	F4BM300	F4BM350
Permittivity	2.20	2.55	2.65	3.0	3.50
Dimensions (mm)	300×250	350×380	440×550	500×500	460×610
	600×500	840×840	840×1200	1500×1000	
For special dimensions, customized lamination is available.					
Thickness and tolerance (mm)	Plate thickness	0.25	0.5	0.8	1.0
	Tolerance	±0.02~±0.04			
	Plate thickness	1.5	2.0	3.0	4.0
	Tolerance	±0.05~±0.07			
Plate thickness includes the copper thickness. For special dimensions, customized lamination is available.					
Mechanical properties	Angularity	Plate thickness (mm)	Maximum angularity mm/mm		
			Original board	Single-sided board	Double-sided board
		0.25~0.5	0.03	0.05	0.025
		0.8~1.0	0.025	0.03	0.020
	1.5~2.0	0.020	0.025	0.015	
3.0~5.0	0.015	0.020	0.010		
Cutting/ punching property	For the plate of $\leq 1\text{mm}$, no burrs after cutting, minimum space between two punching holes is 0.55mm, no separation. For the plate of $\geq 1\text{mm}$, no burrs after cutting, minimum space between two punching holes is 1.10mm, no separation.				
Peel strength	In normal state: $\geq 18\text{N/cm}$; No bubbling, no separation and peel strength $\geq 15\text{N/cm}$ when in the environment of constant humidity and temperature and kept in the melting solder of $260^\circ\text{C} \pm 2^\circ\text{C}$ for 20 seconds.				
Chemical properties	According to different properties of baseplates, the chemical etching method for PCB can be used for the circuit processing, the dielectric properties of materials are not changed and the holes can be metallized.				

Electrical properties	Names	Test conditions	Unit	Specifications
	Gravity	Normal state	g/cm ³	2.2~2.3
Water absorption rate	Dip in distilled water of $20 \pm 2^\circ\text{C}$ for 24 hours.	%	≤ 0.02	

Operating temperature	high-low 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	500V DC	Normal state	≥1×10 ⁴
		Constant humidity and temperature	≥1×10 ³
volume resistance	Normal state		≥1×10 ⁶
	Constant humidity and temperature		≥1×10 ⁵
Pin resistance	500V DC	Normal state	≥1×10 ⁵
		Constant humidity and temperature	≥1×10 ³
Surface dielectric strength	Normal state		≥1.2
	Constant humidity and temperature		≥1.1
Permittivity	10GHZ	ε r	2.20 2.55 2.65 (±2%) 3.0 3.5
Dielectric loss angle tangent	10GHZ	tg δ	≤7×10 ⁻⁴

CLEC Group

ChuangLian Electronic Component (Group) Co.,Ltd.

No.3,Dianzixi Street,Xi'an 710065,China.

Phone: +86-29-88220746 / 68901529

Fax: +86-29-88260919 / 88233853

E-mail: clec@clecgroup.com

Homepage: www.clecgroup.com



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 specification requirements for microwave PCB substrate specified in National and Military Standards.					
Dimensions (mm)	F4BMX217	F4BMX220	F4BMX245	F4BMX255	F4BMX265	F4BMX275
	F4BMX285	F4BMX295	F4BMX300	F4BMX320	F4BMX338	F4BMX350
	For special dimensions, customized lamination is available.					
Thickness and tolerance (mm)	Plate thickness	0.25	0.5	0.8	1.0	
	Tolerance	$\pm 0.02 \sim \pm 0.04$				
	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.					
Mechanical properties	Angularity	Plate thickness (mm)	Maximum angularity mm/mm			
			Original board	Single-sided board	Double-sided board	
		0.25~0.5	0.03	0.05	0.025	
		0.8~1.0	0.025	0.03	0.020	
		1.5~2.0	0.020	0.025	0.015	
	3.0~5.0	0.015	0.020	0.010		
	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 ≥ 1 mm, no burrs after cutting, minimum space between two punching holes is 1.10mm, no separation.				
Peel strength	In normal state: ≥ 18 N/cm; No bubbling, no separation and peel strength ≥ 15 N/cm when in the environment of constant humidity and temperature and kept in the melting solder of $260^\circ\text{C} \pm 2^\circ\text{C}$ for 20 seconds.					
Chemical properties	According to different properties of substrates, the chemical etching method for PCB can be used for the circuit processing, the dielectric properties of materials are not changed and the holes can be metallized.					

	Names	Test conditions	Unit	Specifications
Electrical properties	Gravity	Normal state	g/cm ³	2.2~2.3
	Water absorption rate	Dip in distilled water of $20 \pm 2^\circ\text{C}$ for 24 hours.	%	≤ 0.02
	Operating temperature	high-low temperature chamber	$^\circ\text{C}$	-50~+260
	Thermal conductivity		Kcal /m .h. $^\circ\text{C}$	0.8

coefficient			
Coefficient of thermal expansion	Temperature rise of 90°C per hour	Coefficient of thermal expansion×1	$\leq 5 \times 10^{-5}$
Shrinkage factor	Two hours in boiling water	%	0.0002
Surface insulation resistance	500V DC	Normal state	$\geq 1 \times 10^5$
		Constant humidity and temperature	$\geq 1 \times 10^3$
volume resistance	Normal state		$\geq 1 \times 10^6$
	Constant humidity and temperature		$\geq 1 \times 10^5$
Pin resistance	500V DC	Normal state	$\geq 1 \times 10^5$
		Constant humidity and temperature	$\geq 1 \times 10^3$
Surface dielectric strength	Normal state		≥ 1.2
	Constant humidity and temperature		≥ 1.1
Permittivity	10GHZ	ϵ_r	2. 2. 17, 2. 20, 2. 45, 2. 2. 55, 2. 65, 2. 75, ($\pm 2\%$) 2. 2. 85, 2. 95, 3. 00, 3. 20, 3. 38, 3. 50.
Dielectric loss angle tangent	10GHZ	$\text{tg } \delta$	$\leq 7 \times 10^{-4}$

CLEC Group
ChuangLian Electronic Component (Group) Co.,Ltd.

No.3,Dianzixi Street,Xi'an 710065,China.

Phone: +86-29-88220746 / 68901529

Fax: +86-29-88260919 / 88233853

E-mail: clec@clecgroup.com

Homepage: www.clecgroup.com



High Frequency Laminates

Teflon woven glass fabric copper-clad laminates with high permittivity F₄BME – 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 and the passive intermodulation can be enhanced.

Appearance	Meet the specification requirements for microwave PCB substrate specified in National and Military Standards.					
Types	F4BME217	F4BME220	F4BME245	F4BME255	F4BME265	F4BME275
	F4BME285	F4BME295	F4BME300	F4BME320	F4BME338	F4BME350
Dimensions (mm)	300×250	350×380	440×550	500×500	460×610	600×500
	840×840	840×1200	1500×1000			
	For special dimensions, customized lamination is available.					
Thickness and tolerance (mm)	Plate thickness	0.25	0.5	0.8	1.0	
	Tolerance	±0.02~±0.04				
	Plate thickness	1.5	2.0	3.0	4.0	5.0
	Tolerance	±0.05~±0.07				
	Plate thickness includes the copper thickness. For special dimensions, customized lamination is available.					
Mechanical properties	Angularity	Plate thickness (mm)	Maximum angularity mm/mm			
			Original board	Single-sided board	Double-sided board	
		0.25~0.5	0.03	0.05	0.025	
		0.8~1.0	0.025	0.03	0.020	
		1.5~2.0	0.020	0.025	0.015	
	3.0~5.0	0.015	0.020	0.010		
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 separation.					
Peel strength	In normal state: ≥18N/cm; No bubbling, no separation and peel strength ≥15 N/cm when in the environment of constant humidity and temperature and kept in the melting solder of 260°C ±2°C for 20 seconds.					
Chemical properties	According to different properties of substrates, the chemical etching method for PCB can be ≥15 N/cm used for the circuit processing, the dielectric properties of materials are not changed and the holes can be metallized.					
Electrical properties	Names	Test conditions	Unit	Specifications		
	Gravity	Normal state	g/cm ³	2.2~2.3		
	Water absorption rate	Dip in distilled water of 20±2°C for 24 hours.	%	≤0.02		
	Operating temperature	high-low 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	500V DC	Normal state	M. Ω	≥1×10 ⁴
		Constant humidity and temperature		≥1×10 ³
volume resistance	Normal state		MΩ . cm	≥1×10 ⁶
	Constant humidity and temperature			≥1×10 ⁵
Pin resistance	500V DC	Normal state	MΩ	≥1×10 ⁵
		Constant humidity and temperature		≥1×10 ³
Surface dielectric strength	Normal state		δ =1mm (kV/mm)	≥1.2
	Constant humidity and temperature			≥1.1
Permittivity	10GHZ		ε r	2. 2.17, 2.20, 2.45, 2. 2.55, 2.65, 2.75, (±2%) 2. 2.85, 2.95, 3.00, 3. 3.20, 3.38, 3.50.
Dielectric loss angle tangent	10GHZ		tg δ	≤7×10 ⁻⁴
PIMD	2.5GHZ		dbc	≤-120

CLEC Group
ChuangLian Electronic Component (Group) Co.,Ltd.

No.3,Dianzixi Street,Xi'an 710065,China.

Phone: +86-29-88220746 / 68901529

Fax: +86-29-88260919 / 88233853

E-mail: clec@clecgroup.com

Homepage: www.clecgroup.com



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 our 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 corresponding to the square resistance left	Tolerance
50 Ω / □	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.

CLEC Group
ChuangLian Electronic Component (Group) Co.,Ltd.

No.3,Dianzixi Street,Xi'an 710065,China.

Phone: +86-29-88220746 / 68901529

Fax: +86-29-88260919 / 88233853

E-mail: clec@clecgroup.com

Homepage: www.clecgroup.com



High Frequency Laminates

Metallic Teflon woven glass fabric copper-clad laminates F₄B – 1/Al (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.

Dimensions (mm)	300×300 400×400				
	For special dimensions, customized lamination is available.				
Thickness of underlay	Optional by the user.				
Angularity	The specification meets the design requirements for substrate .				
Electrical properties	Names	Test conditions	Unit	Specifications	
	Gravity	Normal state	g/cm ³	2.2~2.3	
	Water absorption rate	Dip in distilled water of 20±2℃ for 24 hours.	%	≤0.02	
	Operating temperature	high-low temperature chamber	℃	-50~+260	
	Thermal conductivity coefficient		Kcal /m . h. ℃	0.8	
	Coefficient of thermal expansion	Temperature rise of 96℃ per hour	Coefficient of thermal expansion×1	<5×10 ⁻⁵	
	Shrinkage factor	Two hours in boiling water	%	0.0002	
	Surface insulation resistance	500V DC	Normal state Constant humidity and temperature	M. Ω	≥1×10 ⁻⁴ ≥1×10 ⁻³
	volume resistance		Normal state Constant humidity and temperature	M Ω . cm	≥1×10 ⁶ ≥1×10 ⁵
	Pin resistance	500V DC	Normal state Constant humidity and temperature	M Ω	≥1×10 ⁵ ≥1×10 ³
	Surface dielectric strength		Normal state Constant humidity and temperature	δ =1mm (kV/mm)	≥1.2 ≥1.1
	Permittivity	10GHZ	ε r	2. 2.25 2.653.0 (±2%) 3.5	
	Dielectric loss angle tangent	10GHZ	tg δ	≤1×10 ⁻³	
	Thermal resistance	A	℃/W	≥2.0	

CLEC Group
ChuangLian Electronic Component (Group) Co.,Ltd.

No.3,Dianzixi Street,Xi'an 710065,China.

Phone: +86-29-88220746 / 68901529

Fax: +86-29-88260919 / 88233853

E-mail: clec@clecgroup.com

Homepage: www.clecgroup.com



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 general requirements for substrate of microwave PCB				
Dimensions (mm)	150×150	220×160	250×250	200×300	
	For special dimensions, customized lamination is available.				
Thickness and tolerance	0.5±0.05	1±0.1	1.5±0.15	2±0.2 3±0.3	
	Plate thickness includes the copper thickness. For special dimensions, customized lamination is available.				
Mechanical properties	Angularity	0.02mm/mm for double-layer board			
	Cutting/ punching property	No burrs after cutting, and the minimum space between two punching holes is 0.55mm.			
	Peel 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 properties of materials are not changed.				
Electrical properties	Names	Test conditions	Unit	Specifications	
	Gravity	Normal state	g/cm ³	2.2~2.3	
	Water absorption rate	Dip in distilled water of 20±2℃ for 24 hours.	%	≤0.01	
	Operating temperature	high-low temperature chamber	℃	-100~+150	
	Thermal conductivity coefficient		Kcal /m .h. ℃	0.4	
	Coefficient of thermal expansion	Temperature rise of 96℃ per hour	×1	9.8~10×10 ⁻⁵	
	Shrinkage factor	Two hours in boiling water	%	0.0005	
	Surface insulation resistance	500V DC	Normal state	M. Ω	≥1×10 ⁷
			Constant humidity and temperature		≥1×10 ⁵
	volume resistance	Normal state		MΩ.cm	≥1×10 ¹⁰
Constant humidity and temperature		≥1×10 ⁷			

	Pin resistance	500V DC	Normal state	MΩ	$\geq 1 \times 10^5$
			Constant humidity and temperature		$\geq 1 \times 10^5$
	Surface dielectric strength		Normal state	$\delta = 1\text{mm (kV/mm)}$	≥ 1.5
			Constant humidity and temperature		≥ 1.4
Permittivity		10GHZ	ϵ_r	2. 2.2 ($\pm 2\%$)	
Dielectric loss angle tangent		10GHZ	$\text{tg } \delta$	$\leq 1 \times 10^{-3}$	

CLEC Group
ChuangLian Electronic Component (Group) Co.,Ltd.

No.3,Dianzixi Street,Xi'an 710065,China.

Phone: +86-29-88220746 / 68901529

Fax: +86-29-88260919 / 88233853

E-mail: clec@clecgroup.com

Homepage: www.clecgroup.com



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 3~16 according to circuit requirements. The operating temperature is $-100^{\circ}\text{C}\sim+150^{\circ}\text{C}$.
- 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 $\text{tg}\delta\leq 1\times 10^{-3}$, 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.				
Dimension and Tolerance (mm)	Dimensions A×B (mm)			Tolerance	
	50×30	80×40	120×80	$\leq\pm 0.03$	
	120×100	150×150	180×180	220×160	$\leq\pm 0.05$
	Thickness and tolerance				
	δ (mm)	0.8 ± 0.03	1 ± 0.04	1.2 ± 0.05	1.5 ± 0.06
For special dimensions, customized lamination is available.					
Mechanical properties	Peel strength	In normal state: $\geq 6\text{N/cm}$; In the environment of alternating humidity and temperature: $\geq 4\text{N/cm}$.			
	Chemical properties	According to different properties of substrate, the chemical etching method for PCB can be used for the circuit processing, the dielectric properties of materials are not changed.			
Electrical properties	Names	Test conditions	Unit	Specifications	
	Gravity	Normal state	g/cm^3	2	
	Water absorption rate	Dip in distilled water of $20\pm 2^{\circ}\text{C}$ for 24 hours.	%	≤ 0.02	
	Operating temperature	high-low temperature chamber	$^{\circ}\text{C}$	$-100\sim+150$	
	Thermal conductivity coefficient		$\text{Kcal /m . h. }^{\circ}\text{C}$	0.5	
	Coefficient of thermal expansion	Temperature rise of 96°C per hour	Coefficient of thermal expansion×1	$<6\times 10^{-5}$	
	Shrinkage factor	Two hours in boiling water	%	0.0004	
	Surface insulation resistance	500V DC	Normal state	M. Ω	$\geq 1\times 10^7$
			Constant humidity and temperature		$\geq 1\times 10^5$
	volume resistance	Normal state		M Ω .cm	$\geq 1\times 10^9$
Constant humidity and		$\geq 1\times 10^6$			

		temperature		
Pin resistance	500V DC	Normal state	MΩ	$\geq 1 \times 10^6$
		Constant humidity and temperature		$\geq 1 \times 10^4$
Surface dielectric strength	Normal state		$\delta = 1\text{mm (kV/mm)}$	≥ 1.5
	Constant humidity and temperature			≥ 1.2
Permittivity	10GHZ		ϵ_r	2. 3~6 9. 6, 10. 2, 10. 5 ($\pm 2\%$) 11~16
Dielectric loss angle tangent	10GHZ		tg δ	$\leq 1 \times 10^{-3}$

CLEC Group
ChuangLian Electronic Component (Group) Co.,Ltd.

No.3,Dianzixi Street,Xi'an 710065,China.

Phone: +86-29-88220746 / 68901529

Fax: +86-29-88260919 / 88233853

E-mail: clec@clecgroup.com

Homepage: www.clecgroup.com



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 $-80^{\circ}\text{C}\sim+200^{\circ}\text{C}$, 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, $30\text{min}20\text{rad}/\text{cm}^2$.
- 4) The permittivity is stable and has a slight variation with the rise of temperature and frequency. Permittivity: $\epsilon_r=3.0; 6.0; 9.2; 9.6; 10.2$.

Appearance	Smooth and neat on both sides; no stain, scar and sunken.				
Dimensions	150×150 250×250 200×310				
	Thickness and tolerance are same as that for TP series. It is optional by the customer for special dimensions.				
Mechanical properties	Peel strength	$\geq 8\text{N}/\text{cm}$			
	Angularity	Same as that for TP series.			
	Cutting/ punching property	No burrs after cutting, and the minimum space between two punching holes is 0.55mm.			
Chemical properties	According to different properties of baseplates, the chemical etching method for PCB can be used for the circuit processing, the dielectric properties of materials are not changed and the holes can be metallized.				
Electrical properties	Names	Test conditions	Unit	Specifications	
	Gravity	Normal state	g/cm^3	3	
	Water absorption rate	Dip in distilled water of $20\pm 2^{\circ}\text{C}$ for 24 hours.	%	≤ 0.02	
	Operating temperature	high-low temperature chamber	$^{\circ}\text{C}$	$-80\sim+260$	
	Thermal conductivity coefficient		$\text{Kcal}/\text{m}\cdot\text{h}\cdot^{\circ}\text{C}$	0.5	
	Coefficient of thermal expansion	Temperature rise of 96°C per hour	Coefficient of thermal expansion×1	$\leq 1\times 10^{-5}$	
	Shrinkage factor	Two hours in boiling water	%	0.0001	
	Surface insulation resistance	500V DC	Normal state	M. Ω	$\geq 1\times 10^5$
			Constant humidity and temperature		$\geq 1\times 10^3$
	volume resistance	Normal state		M Ω .cm	$\geq 1\times 10^5$
Constant humidity and temperature		$\geq 1\times 10^4$			

Pin resistance	500V DC	Normal state	MΩ	≥1×10 ⁶
		Constant humidity and temperature		≥1×10 ⁴
Surface dielectric strength	Normal state		δ =1mm (kV/mm)	≥1.6
	Constant humidity and temperature			≥1.4
Permittivity	10GHZ		ε r	2; 3; 6 (±2%) ;9.2; 9.6; 10.2
Dielectric loss angle tangent	10GHZ		tg δ	≤1×10 ⁻³

CLEC Group

ChuangLian Electronic Component (Group) Co.,Ltd.

No.3,Dianzixi Street,Xi'an 710065,China.

Phone: +86-29-88220746 / 68901529

Fax: +86-29-88260919 / 88233853

E-mail: clec@clecgroup.com

Homepage: www.clecgroup.com