

TECHNICAL DATA SHEET

FR-4

FR-4 glass epoxy is a popular and versatile high-pressure thermoset plastic laminate with good strength to weight ratio. With near zero water absorption, FR-4 is most commonly used as an electrical insulator possessing considerable mechanical strength. "FR" is an abbreviation for Flame Retardant, and Type "4" indicates woven glass reinforced epoxy resin. The material is known to retain its high mechanical values and electrical insulating qualities in both dry and humid conditions. These attributes, along with good fabrication characteristics offer many options for a wide variety of electrical and mechanical applications.

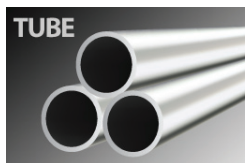
Benefits

- Electrically insulative
- Can be fabricated
- Good strength to weight ratio
- Near zero water absorption

Applications

- Printed circuit boards (PCB)
- Electrical insulation
- Relays
- Switches
- Standoffs
- Busbars

SHAPES AVAILABLE



FR-4 Glass Epoxy Technical Product Information

Property	Units	Value	Condition
Tg, min. (DSC)	°C	135	
CTE x-axis	ppm/°C	14	Ambient to Tg
CTE y-axis	ppm/°C	13	Ambient to Tg
CTE z-axis	ppm/°C	175	Ambient to 288 °C
Solder Float, 288 °C	seconds	>120	Condition A

Electrical Properties

Property	Units	Value	Condition
Permittivity (DK) max.		4.7	C-24/23/50
@ 500 Mhz		4.35	
@ 1 GHz (HP4291)		4.34	
Loss Tangent (DF), max. @			
1 MHz (2 Fluid Cell)		0.020	
500 Mhz		0.017	
1 GHz (2 Fluid Cell)		0.016	
Surface Resistivity, min.	megohms	2 X 10 ⁵	Condition F
		1 X 10 ⁸	E-24/125
Volume Resistivity, min.	min.	8 X 10 ⁷	Condition F
	megohm-cm	2 X 10 ⁷	E-24/125
Dielectric Breakdown, min	kV	55	D-48/50
Arc Resistance, min.	seconds	100	

Physical Properties

Property	Units	Value	Condition
Peel Strength, 1 oz.	lb./in.	9.0	Condition A
		9.0	After Thermal Stress
		9.0	E-1/125
Flexural Strength - LW	psi	80000	Condition A
Flexural Strength - CW	psi	60000	Condition A
Warp & Twist	%	0.5	Condition
Flammability		V-0	UL94
Moisture Absorption	%	< 0.25	D-24/23
Tensile Strength - LW	psi	50000	Condition A
Tensile Strength - CW	psi	40000	Condition A
Tensile Modulus (Young's) - LW	psi	3.5 X 10 ⁶	Condition A
Tensile Modulus (Young's) - CW	psi	3.0 X 10 ⁶	Condition A
Flexural Modulus (Taylor's) - LW	psi	2.7 X 10 ⁶	Condition A
Flexural Modulus (Taylor's) - CW	psi	2.4 X 10 ⁶	Condition A
Poisson's Ratio - LW		0.136	Condition A
Poisson's Ratio - CW		0.118	Condition A

NOTE: The information contained herein are typical values intended for reference and comparison purposes only. They should NOT be used as a basis for design specifications or quality control. Contact us for manufacturers' complete material property datasheets. All values at 73°F (23°C) unless otherwise noted.