

FR4 Data Sheet

<u>Test/Specification</u>	<u>FR4 Laminate Typical</u>
Thermal Stress, Solder bath 288 deg. C	>60
Dimensional Stability, E-2/150	<0.04% Warp/fill
	<1.00% Bow/Twist
Flammability, Classification UL94	V0
Water Absorption E-1/105	0.10%
Peel Strength After Thermal Stress	11 lb./in After 10s/288 Deg.
Flexural Strength	100,000 lbf/in ² Lengthwise
	75,000 lbf/in ² Crosswise
Resistivity After Damp Heat Volume	10 ⁸ M ohms cm
Resistivity After Damp Heat Surface	10 ⁸ M ohms
Dielectric Breakdown. Parallel to laminate	>60KV
Dielectric Constant @ 1MHz	4.70
Dissipation Factor @ 1MHz	0.014
Q-Resonance @ 1 MHz	>75
Q-Resonance @ 50 MHz	>95
Arc Resistance	125 s
Glass Transition Temperature	135 Deg. C
Temperature Index	130 Deg. C
<u>A Few Other Relevant Facts from other Sources</u>	
Specific Gravity	1.8-1.9
Rockwell Hardness (M scale)	110
Coefficient of Thermal Expansion	11 microns/m/Deg.C
	15 microns/m/Deg.C
Thermal Conductivity	2.2-2.5 cal/h. cm Deg C

Standard FR4 Thickness is 1.6mm (=63mil)
 But the others are available: 0.8mm(31mil),
 1.0mm(39mil), 1.2mm(47mil), 2.0mm(79mil),
 2.4mm(98mil), 3.2mm (126mil)

Most common copper thickness is 35um (1once)
 and 70um (2once)

FR-4 Glass/Epoxy Phenolic

FR-4 is a woven glass fabric with epoxy resin system. It is primarily used in the printed circuit board industry. It is flame retardant, meeting UL94 flammability classification of V-0. It is designated by MIL-I-24788/27 Type GEE-F and the NEMA grade is FR-4.

Property	Units	FR-4 Glass/Epoxy Phenolic
Physical		
Specific Gravity	-	1.80
Moisture Absorption (.062")	%	0.15
Mechanical		
Rockwell Hardness (.062")	M Scale	110
Flexural Strength (.062") LW	psi	70,000
CW	psi	60,000
Flexural Modulus (.062") LW	psi	2,700,000
CW	psi	2,400,000
Tensile Strength (.125") LW	psi	45,000
CW	psi	38,000
Izod Impact Strength E-48/50 (.500") LW	ft-lb/in	14.0
CW	ft-lb/in	12.0
Compressive Strength flatwise (.500")	psi	55,000
Bond Strength (.500")	lbs	2,200
Shear Strength (perpendicular) (.062")	psi	22,000
Thermal		
Maximum Operating Temperature	°F	284
Coefficient of Thermal Expansion (.062") X-axis	in/in/°F	5.5×10^{-6}
Y-axis	in/in/°F	6.6×10^{-6}
Flammability Rating - U. L. 94		V-0
Electrical		
Permittivity (.062") Condition D-24/23	-	4.80
Dissipation Factor (.062") Condition D-24/23	-	.025
Breakdown Voltage Condition - A (.062") D-48/50	V	65,000
Electric Strength Condition - A (.062") D-48/50	V/mil	800
Arc Resistance (.125") D-495	sec	100
Comparative Tracking Index (.125") D3638	-	150
Tg	°F	261

LW – Length Wise of the sheet, direction of manufacturing

CW – Cross Wise, perpendicular to Length Wise

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.