

GE 313 LAMINATE.

PROPERTIES TESTED IN ACCORDANCE WITH MIL-P-13949

GENERAL PROPERTIES

Thermal stress. Solder bath 288°C

	Unit	Typical value
unetched	s	>60
etched	s	>60

Measling. Pressure cooker test

	Unit	Typical value
Measling	-	Pass

Dimensional stability. Conditioning E-2/150

	Unit	Typical value
Warp/Fill	%	<0.04

Bow and twist. Conditioning E-2/150

	Unit	Typical value
Bow/twist	%	<1.0

Flammability.

	Unit	Typical value
Classification UL94	-	V0

Water absorption.

Conditioning E-1/105 + Des. + D24/23

Values depend on laminate buildup (glass/resin ratio).

Absorption	Unit	Typical value
1.6 mm	%	0.10

PEEL STRENGTH

Peel strength after thermal stress. Conditioning 10s/288°C

Copper	Unit	Typical value
5 μm (1/8 oz)*	lb/in	9
9 μm (1/4 oz)*	lb/in	9
18 μm (1/2 oz)	lb/in	8
35 μm (1 oz)	lb/in	11
70 μm (2 oz)	lb/in	13

* Plated up to 35 μm (1 oz)

Peel strength at elevated temperature. Conditioning E-1/125

Copper	Unit	Typical value
5 μm (1/8 oz)*	lb/in	8
9 μm (1/4 oz)*	lb/in	8
18 μm (1/2 oz)	lb/in	6
35 μm (1 oz)	lb/in	9
70 μm (2 oz)	lb/in	11

* Plated up to 35 μm (1 oz)

Peel strength after exp. to plating solutions.

Copper	Unit	Typical value
5 μm (1/8 oz)*	lb/in	9
9 μm (1/4 oz)*	lb/in	9
18 μm (1/2 oz)	lb/in	8
35 μm (1 oz)	lb/in	11
70 μm (2 oz)	lb/in	13

* Plated up to 35 μm (1 oz)

Conversion table.

1 N/mm	5.71 lb/in
1 lb/in	0.175 N/mm

ELECTRICAL PROPERTIES

Resistivity after damp heat. Conditioning C-96/35/90

Resistivity	Unit	Typical value
Volume	MΩcm	10 ⁸
Surface	MΩ	10 ⁸

Resistivity at elevated temperature. Conditioning E-24/125

Resistivity	Unit	Typical value
Volume	MΩcm	10 ⁷
Surface	MΩ	10 ⁷

Dielectric breakdown. Conditioning D-48/50+D-0.5/23

Direction	Unit	Typical value
Parallel to lam.	kV	> 60

Dielectric constant. Conditioning C-40/23/50

Values depend on laminate buildup (glass/resin ratio).

Frequency	Unit	Typical value
1 MHz	-	4.5

Dissipation factor. Conditioning C-40/23/50

Values depend on laminate buildup (glass/resin ratio).

Frequency	Unit	Typical value
1 MHz	-	0.018

Q-Resonance. Conditioning D-24/23

Frequency	Unit	Typical value
1 MHz	-	>75
50 MHz	-	>95

Arc resistance. Conditioning D-48/50+D-0.5/23

	Unit	Typical value
Resistance	s	125

MECHANICAL PROPERTIES

Flexural strength. Conditioning A

Direction	Unit	Typical value
Lengthwise	Lbf/in ²	100,000
Crosswise	Lbf/in ²	75,000

PRODUCT

Product nature.

Corresponding standard	FR4
Resin	Epoxy
Filler	Glass fabric
Glass transition temperature	>125°C
Temperature Index	130°C
Colour	Pale green
Identification	Red P
Warp direction is parallel to the stroke of P	

Thickness range.

Thickness Inches	mm (nom.)	Class II tolerance	
		Min.	Max.
1/32	0.80	0.70	0.90
-	1.00	0.87	1.13
1/20	1.20	1.07	1.33
1/16	1.55	1.47	1.63
-	2.00	1.82	2.18
1/10	2.40	2.22	2.58
1/8	3.20	2.97	3.43

Test information.

Tested thickness	1.55 (1/16")
Date of Issue	Feb. 3, 1992
Supersedes	May 18, 1989

Recognitions.

Institution	Number
UL	File # E44688
MIL	QPL 13949
British Standards	BS 415:1990 (20.1)
NF	93750&93751
VDE	IEC 249-1:4.3.4

Validity.

The data given are average values from running production. Deviations may occur. All invoiced material is tested and approved in accordance with MIL-P-13949.