

# Halogen Free, High Elastic Modulus, Low CTE Multilayer Material

## MCL-E-679FG MCL-E-679FGB (Black Type) GEA-679FG (Prepreg)

### High Tg Glass Epoxy Multilayer Material (FR-4)

#### ■ Features

- Halogen free material for environmental concerns.
- CTE (Z-direction) is 50% lower than that of our standard FR-4.
- Elastic modulus is 20% higher than that of our standard FR-4. Even thin laminate has less warpage and deflection.
- Superior heat resistance for soldering (suitable for lead free process).
- Suitable for fine patterning with 1/4 surface roughness of our standard FR-4 pattern possible.

#### ■ Applications

- Semiconductor packages. (FC-BGA, BGA, CSP)
- Core material for HDI.

#### ■ Standard Specifications

Part Number	Type	Copperfoil Thickness	Code Name	Actual Thickness and Tolerance
MCL-E-679FG MCL-E-679FGB	(S)	2μm	U0.03	0.030±0.013mm
		3μm	U0.04	0.040±0.013mm
		5μm	U0.05	0.050±0.013mm
		12μm (LP,PF)	T0.04	0.040±0.013mm
			T0.06	0.060±0.013mm
		2,3,5,12,18μm (STD,LP,PF)	T0.07	0.070±0.013mm
	(R) (S)	2μm	M0.06	0.07±0.02mm
		3μm	0.1	0.11±0.02mm
		5μm	0.15	0.16±0.03mm
		12μm	0.2	0.21±0.04mm
		18μm	0.41	0.40±0.05mm
		35μm 70μm (STD,LP,PF)	0.61	0.60±0.06mm
	0.81	0.80±0.08mm		

Note1) STD:Standard copper foil, LP:Low profile copper foil, PF:Hitachi profile-free copper foil.

Note2) STD:12μm,18μm,35μm,70μm; LP:2μm,3μm,5μm,12μm,18μm; PF:2μm,3μm,5μm,12μm. Please contact us for details. Note3) "U" for 1-ply; "T" for 2-ply.

Note4) In case laminate thickness lies in between two thickness figures shown above, the tolerance of such laminate would be equal to the tolerance of the thicker one.

Note5) The thickness means that of dielectric layer.

#### ■ Characteristics

##### ● Thin Laminate

(t0.4mm)

Item	Condition *3	Unit	Actual Value		Test Method (IPC-TM-650)
			MCL-E-679FG Type(R)	MCL-E-679FG Type(S)	
Tg	TMA	°C	165~175	175~185	2.4.24
	DMA		200~220	210~230	—
CTE *1	X Y	(30~120°C)	13~15	12~14	2.4.24
			13~15	12~14	
	Z	(<Tg)	23~33	20~30	
		(>Tg)	140~170	130~160	
Solder Heat Resistance (260°C)	A	sec.	>300		—
T-260 (Without Copper)	TMA	min.	>60		2.4.24.1
T-288 (Without Copper)			>60		
Decomposition Temperature (5% Weight Loss)	TGA	°C	340~360		2.3.40
Heat Resistance for HDI Process (Semi-Additive)	260°C Reflow	cycles	>10		—
Copper Peel Strength	A	kN/m	0.9~1.1	1.1~1.2	2.4.8
			1.1~1.2	1.2~1.3	
Surface Roughness (Ra)	A	μm	2~3		2.2.17
Flexural Modulus (Lengthwise)	A	GPa	23~28	24~29	2.4.4
Dielectric Constant	C-96/20/65	—	5.2~5.4	5.0~5.2	2.5.5.9
			4.6~4.8		JPCA TM-001
Dissipation Factor	C-96/20/65	—	0.0080~0.0100		2.5.5.9
			0.0160~0.0180		JPCA TM-001
Volume Resistivity	C-96/35/90	Ω·cm	1×10 <sup>15</sup> ~1×10 <sup>16</sup>		2.5.17
Surface Resistance		Ω	1×10 <sup>13</sup> ~1×10 <sup>15</sup>		
Insulation Resistance	C-96/20/65	Ω	1×10 <sup>14</sup> ~1×10 <sup>16</sup>		—
	C-96/20/65+D-2/100		1×10 <sup>13</sup> ~1×10 <sup>15</sup>		—
Water Absorption	E-24/50+D-24/23	%	0.4~0.6	0.3~0.5	2.6.2.1
Flammability	A	—	V-0		UL94

\*1) Heating Rate:10°C/min. \*2) Measured by Triplate-Line Resonator. \*3) Refer to last page "Condition Note"  
0.8mm thickness core is used depending on test item.

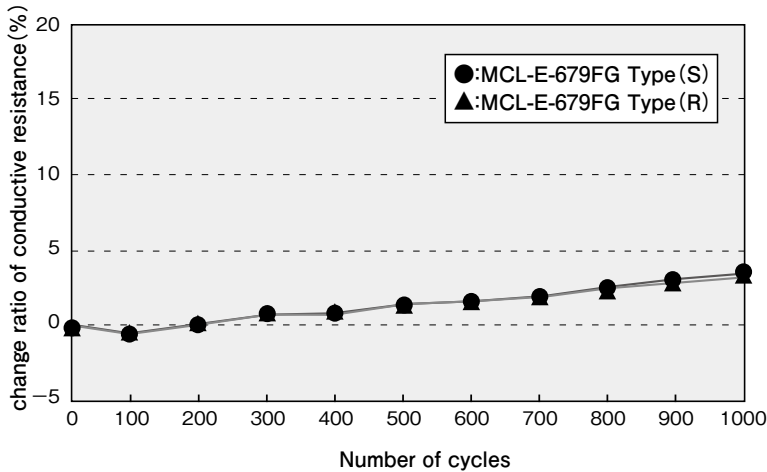
## ●Prepreg

Part Number	Type		Glass Cloth		Properties				
			Style	Yarn Content (warp×fill)	Resin Content (%)	Volation Content (%)	Gelation Time (sec.)	Dielectric Thickness (mm) *1 After pattern filling	
GEA-679FG	(R)	0.03 (GBPE)	1027	75×75	73±2	≤1.5	175±30	0.040	
		0.04 (GRZPE)	1037	69×72	73±2		165±30	0.048	
		0.06 (GRROE)	1078	53×53	68±2	≤1.0	155±30	0.079	
		0.1 (GRSKE)	2116	60×58	58±2			0.127	
	(S)	0.03 (GSAPE)	1017	95×95	78±2	≤1.5	175±30	0.031	
		0.03 (GSBPE)	1027	75×75	73±2			0.040	
		0.03 (GSBSE)	1027	75×75	78±2			0.050	
		0.04 (GSZPE)	1037	69×72	73±2	≤1.0		0.048	
		0.06 (GSROE)	1078	53×53	68±2			0.079	
		0.1 (GSSKE)	2116	60×58	58±2			165±30	0.127
Test Method (IPC-TM-650)					2.3.16	2.3.19	2.3.18	—	

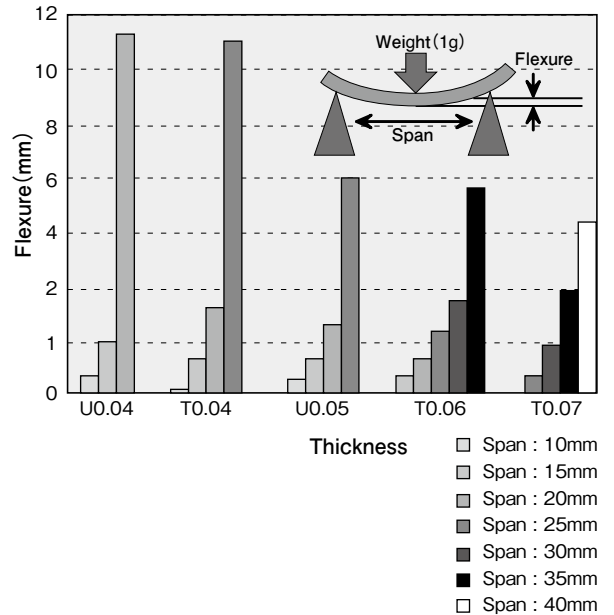
\*1) The dielectric thickness after lamination is defined as the thickness of one sheet of prepreg when the resin flow is 0%.  
This value changes depending on the press condition or inner layer pattern.

## ●Through-hole reliability

Test condition: -55°C, 30min. ⇄ 150°C, 30min.  
Pattern: Wall to wall distance 0.3mm, Laminate thickness: t0.8mm  
Pre-condition: 260°C reflow × 2times ⇒ Solder dipping (260°C 10sec.)



## ●Stiffness Properties



## ●Prepreg thickness after pattern filling

(Inner layer copper 15μm)

