

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

## MCL-E-705G GEA-705G (Prepreg)

### High Tg Glass Epoxy Multilayer Materials

#### ■ Features

- MCL-E-705G has low CTE values in x,y directions and reduces warpage of package substrate significantly.
- MCL-E-705G Type(L) has ultra low CTE value( $\leq 5\text{ppm}/^\circ\text{C}$ ).
- MCL-E-705G Type(LH) has ultra low CTE value( $3\text{ppm}/^\circ\text{C}$ ).
- Well-suited for build-up construction.

#### ■ Standard Specifications

| Part Number | Type       | Copper Foil Thickness    | Code Name | Actual Thickness and Tolerance |
|-------------|------------|--------------------------|-----------|--------------------------------|
| MCL-E-705G  | (-)<br>(L) | 2 $\mu\text{m}$          | U0.03     | 0.03 $\pm$ 0.013mm             |
|             |            | 3 $\mu\text{m}$          | U0.04     | 0.04 $\pm$ 0.013mm             |
|             |            | 5 $\mu\text{m}$          | T0.06     | 0.06 $\pm$ 0.013mm             |
|             |            | 12 $\mu\text{m}$ (LP,PF) | M0.06     | 0.06 $\pm$ 0.02mm              |
|             |            | 2 $\mu\text{m}$          | 0.1       | 0.11 $\pm$ 0.02mm              |
|             |            | 3 $\mu\text{m}$          | M0.11     | 0.10 $\pm$ 0.02mm              |
|             |            | 5 $\mu\text{m}$          | M0.15     | 0.15 $\pm$ 0.02mm              |
|             |            | 12 $\mu\text{m}$         | M0.22     | 0.21 $\pm$ 0.03mm              |
|             |            | 18 $\mu\text{m}$         | 0.2       | 0.21 $\pm$ 0.03mm              |
|             |            | (STD,LP,PF)              | 0.31      | 0.31 $\pm$ 0.03mm              |
|             | (LH)       | 2 $\mu\text{m}$          | 0.41      | 0.41 $\pm$ 0.04mm              |
|             |            | 3 $\mu\text{m}$          | 0.51      | 0.52 $\pm$ 0.05mm              |
|             |            | 5 $\mu\text{m}$          | 0.61      | 0.62 $\pm$ 0.06mm              |
|             |            | 12 $\mu\text{m}$         | 0.71      | 0.72 $\pm$ 0.07mm              |
|             |            | 18 $\mu\text{m}$         | 0.81      | 0.82 $\pm$ 0.08mm              |
|             |            | 35 $\mu\text{m}$         | M0.06     | 0.06 $\pm$ 0.02mm              |
|             |            | 70 $\mu\text{m}$         | 0.1       | 0.11 $\pm$ 0.02mm              |
|             |            | (STD,LP,PF)              | D0.15     | 0.15 $\pm$ 0.02mm              |
|             |            | 2 $\mu\text{m}$          | 0.2       | 0.21 $\pm$ 0.03mm              |
|             |            | 3 $\mu\text{m}$          | 0.26      | 0.26 $\pm$ 0.03mm              |

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

Note2) STD:12 $\mu\text{m}$ ,18 $\mu\text{m}$ , 35 $\mu\text{m}$ , 70 $\mu\text{m}$ ; LP:2 $\mu\text{m}$ , 3 $\mu\text{m}$ , 5 $\mu\text{m}$ , 12 $\mu\text{m}$ , 18 $\mu\text{m}$ ; PF:2 $\mu\text{m}$ , 3 $\mu\text{m}$ , 5 $\mu\text{m}$ , 12 $\mu\text{m}$ . 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

(t0.1mm)

| Item   | Condition             | Unit                     | Actual Value                             |                    |                     | Test Method (IPC-TM-650) |         |
|--|-----------------------|--------------------------|--|--------------------|---------------------|--------------------------|---------|
|  |                       |                          | MCL-E-705G                               | MCL-E-705G Type(L) | MCL-E-705G Type(LH) |                          |         |
| Tg   | TMA                   | °C                       | 250~270                                  |                    |                     | 2.4.24                   |         |
|  | DMA                   |                          | 295~305                                  |                    |                     | —                        |         |
| CTE *1   | X                     | ppm/°C                   | 5~7                                      | 3~4                | 2.5~3.5             | 2.4.24                   |         |
|  |                       |                          | Y  | 5~7                | 3~4                 |                          | 2.5~3.5 |
|  | Z                     |                          | (<Tg)                                    | 10~15              |                     |                          |         |
|  |                       |                          | (>Tg)                                    | 70~90              |                     |                          |         |
| Solder Heat Resistance(260°C)                  | A                     | sec.                     | >300                                     |                    |                     | —                        |         |
| T260 (Without copper)                          | TMA                   | min.                     | >60                                      |                    |                     | 2.4.24.1                 |         |
| T288 (Without copper)                          |                       |                          | >60                                      |                    |                     |                          |         |
| Decomposition Temperature(5% Weight Loss)      | TGA                   | °C                       | 430~450                                  |                    |                     | 2.3.40                   |         |
| Heat Resistance for HDI Process(Semi-Additive) | 260°CReflow           | cycles                   | >20                                      |                    |                     | —                        |         |
| Copper Peel Strength                           | A                     | kN/m                     | 0.8~1.0                                  |                    |                     | 2.4.8                    |         |
|  |                       |                          | 0.9~1.1                                  |                    |                     |                          |         |
| Surface Roughness(Ra)                          | A                     | $\mu\text{m}$            | 2~3                                      |                    |                     | 2.2.17                   |         |
| Flexural Modulus(Lengthwise)                   | A                     | GPa                      | 32~34                                    | 34~36              | 37~39               | 2.4.4                    |         |
| Dielectric Constant                            | C-96/20/65            | —                        | 4.5~4.7                                  | 4.3~4.5            | 4.3~4.5             | 2.5.5.1                  |         |
|  |                       |                          | 4.2~4.4                                  | 4.0~4.2            | 4.0~4.2             | 2.5.5.5                  |         |
| Dissipation Factor                             | C-96/20/65            | —                        | 0.0060~0.0008                            | 0.0060~0.0080      | 0.0060~0.0080       | 2.5.5.1                  |         |
|  |                       |                          | 0.0070~0.0090                            | 0.0070~0.0090      | 0.0070~0.0090       | 2.5.5.5                  |         |
| Volume Resistivity                             | C-96/20/65+C-96/40/90 | $\Omega \cdot \text{cm}$ | $1 \times 10^{15} \sim 1 \times 10^{16}$ |                    |                     | 2.5.17                   |         |
| Surface Resistance                             | C-96/20/65+C-96/40/90 | $\Omega$                 | $1 \times 10^{13} \sim 1 \times 10^{15}$ |                    |                     |                          |         |
| Insulation Resistance                          | C-96/20/65            | $\Omega$                 | $1 \times 10^{14} \sim 1 \times 10^{16}$ |                    |                     | —                        |         |
|  | C-96/20/65+D-2/100    |                          | $1 \times 10^{13} \sim 1 \times 10^{15}$ |                    |                     | —                        |         |
| Water Absorption                               | E-24/50+D-24/23       | %                        | 0.4~0.6                                  |                    |                     | 2.6.2.1                  |         |

\*1) Heating Rate:10°C/min. \*2) Measured by Triplate-Line Resonator.

Thickness core is used depending on test item.

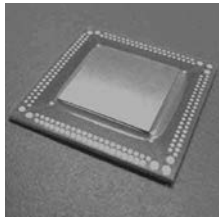
## ●Prepreg

| Part Number | Type |       | Glass Cloth |                        | Properties        |                      |                      |  |       |
|-------------|------|-------|-------------|------------------------|-------------------|----------------------|----------------------|--|-------|
|             |      |       | Style       | Yarn Count (warp×fill) | Resin Content (%) | Volatile Content (%) | Gelation Time (sec.) | Dielectric Thickness after Lamination*1 (mm) |       |
| GEA-705G    | —    | 0.025 | (1017N73)   | 1017                   | 95×95             | 73±2                 | ≤2.0                 | 160±30                                       | 0.025 |
|             |      | 0.03  | (1027N73)   | 1027                   | 75×75             | 73±2                 |                      | 180±30                                       | 0.040 |
|             |      | 0.04  | (1037N73)   | 1037                   | 69×72             | 73±2                 |                      | 180±30                                       | 0.048 |
|             |      | 0.06  | (1078N65)   | 1078                   | 53×53             | 65±2                 |                      | 200±30                                       | 0.071 |
|             |      | 0.1   | (2116N58)   | 2116                   | 60×58             | 58±2                 |                      | 200±30                                       | 0.126 |
|             | (L)  | 0.025 | (L1017N73)  | 1017                   | 95×95             | 73±2                 |                      | 160±30                                       | 0.025 |
|             |      | 0.03  | (L1027N73)  | 1027                   | 75×75             | 73±2                 |                      | 180±30                                       | 0.040 |
|             |      | 0.035 | (L1024N70)  | 1024                   | 90×90             | 70±2                 |                      |  | 0.042 |
|             |      | 0.035 | (L1024N75)  | 1024                   | 90×90             | 75±2                 |                      |  | 0.050 |
|             |      | 0.04  | (L1037N73)  | 1037                   | 69×72             | 73±2                 |                      |  | 0.048 |
|             |      | 0.045 | (L1030N69)  | 1030                   | 90×90             | 69±2                 |                      |  | 0.050 |
|             |      | 0.045 | (L1030N73)  | 1030                   | 90×90             | 73±2                 |                      | 0.060  |       |
|             |      | 0.06  | (L1078N65)  | 1078                   | 53×53             | 65±2                 |                      | 200±30                                       | 0.071 |
|             |      | 0.1   | (L2116N58)  | 2116                   | 60×58             | 58±2                 |                      |  | 0.126 |

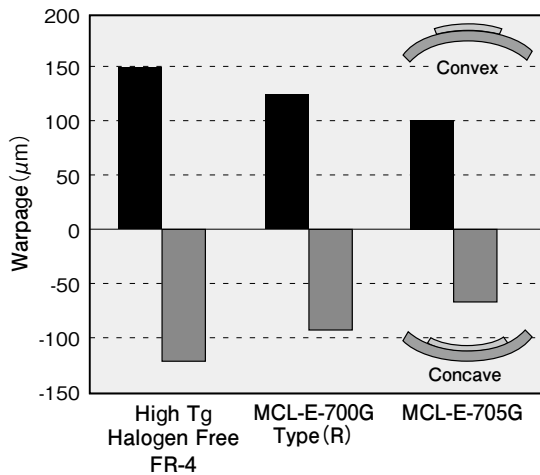
|                          |          |        |        |   |
|--------------------------|----------|--------|--------|---|
| Test Method (IPC-TM-650) | 2.3.16.1 | 2.3.19 | 2.3.18 | — |
|--------------------------|----------|--------|--------|---|

\*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.

## ●Warpage of FC-BGA

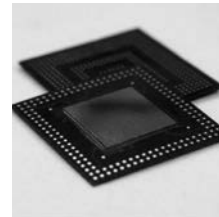


**TEG Chip**  
 \*Chip size:20mm×20mm  
 \*Chip thickness:0.725mm  
 \*Bump diameter:80μm  
 \*Bump pitch:200μm  
**TEG Substrate**  
 \*Sub size:35mm×35mm  
 \*Core thickness:0.4mm  
 \*Build up thickness:30μm×2stack  
 \*SR thickness:20μm

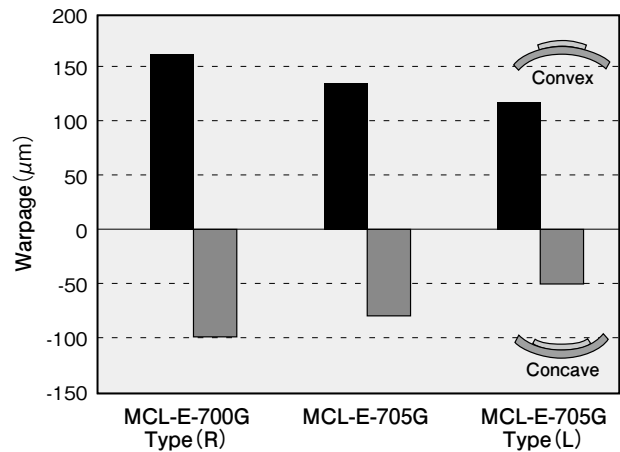


■ 25°C  
 ■ 260°C

## ●Warpage Evaluation Results



**TEG Substrate spec**  
 \*Size:14mm×14mm  
 \*Total thickness:250μm  
 \*SR thickness:20μm  
 (SR-7200G:Hitachi Chemical)  
 \*Prepreg thickness:40μm  
 \*Core thickness:110μm



■ 25°C  
 ■ 260°C