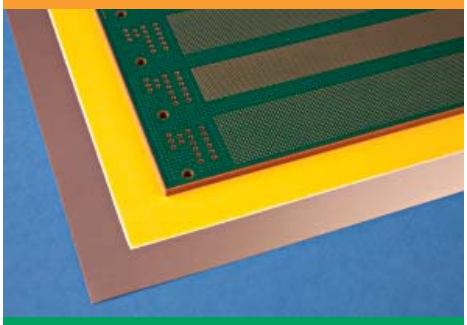
ROGERS CORPORATION

Data Sheet

# Theta® Circuit Materials

## MCL-HE-679G Laminate, GHA-679G Prepreg

Halogen Free, Low Dielectric Constant, High Heat Resistant Multilayer Materials



### Features and Benefits:

Low insertion loss
- Improved signal integrity

Improved thermal characteristics
- High Tg, suitable for lead free processing

Superior thermal/mechanical reliability
- Z-axis CTE 30% lower than standard FR-4

Enhanced design flexibility
- Wide range of laminate and prepreg thickness options

Halogen free
- Environmentally friendly chemistry with no sacrifice to thermal, mechanical or electrical performance

Theta® circuit materials are halogen free and have good dielectric characteristics suitable for high speed digital applications. Theta® materials, in part due to their superior heat resistance, have proven to be extremely reliable through lead free processing and in high layer count HDI designs requiring sequential laminations.

### Typical Values

Theta® Circuit Materials

| Property | Typical 30 mil (0.8mm) | Direction | Units | Conditions | Test Method |
|---|---|---|---|---|---|
| Dielectric Constant, $\varepsilon_r$ | 3.85~4.02 | Z | | 1 GHz(1) | JPCA-TM001 |
| | 3.79~3.96 | | | 10 GHz (2) | IPC-TM-650 2.5.5.5 |
| Dissipation Factor, tan $\delta$ | 0.0092~0.0100 | Z | | 1 GHz (1) | JPCA-TM001 |
| | 0.0120~0.0126 | | | 10 GHz (2) | IPC-TM-650 2.5.5.5 |
| Glass transition Temperature (Tg) | 180~190 | | °C | TMA | IPC-TM-650 2.4.24 |
| Coefficient of Thermal Expansion (CTE) | (<Tg) 35~45 | Z | ppm/°C | | IPC-TM-650 2.4.24 |
| | (>Tg) 190~220 | | | | |
| Solder Heat Resistance | >300 | | Sec. | 260°C A | |
| Decomposition Temperature | 370~390 | | °C | TGA 5% weight loss | IPC-TM-650 2.3.40 |
| Copper Peel Strength | 0.8~1.1 | | kN/m | ½ EDC foil (18µm) A | IPC-TM-650 2.4.8 |
| Conductive Anodic Filament Growth (CAF) | >1000 | | Hrs | 85°C/85% RH, 100V | |
| Water Absorption | 0.03~0.04 | | % | E-24/50+D-24/23 | IPC-TM-650 2.6.2.1 |
| Flammability (UL-94) | V-0 | | | | IPC-TM-650 2.3.10 |

1): Measured by triplate-line resonator.
2): Measured by clamped stripline.
Typical values are a representation of an average value for the population of the property. For specification values contact Rogers Corporation.



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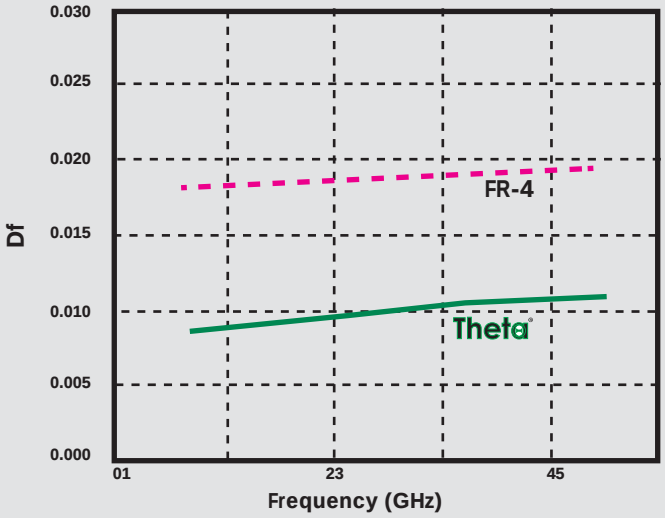
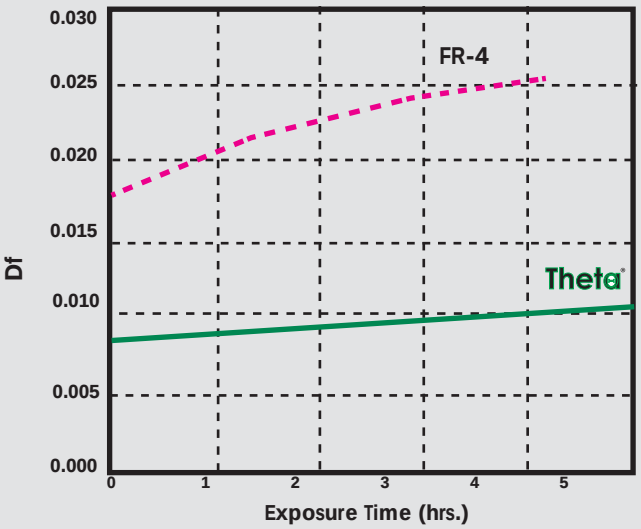
Proven Reliability

### Dissipation Factor and Frequency



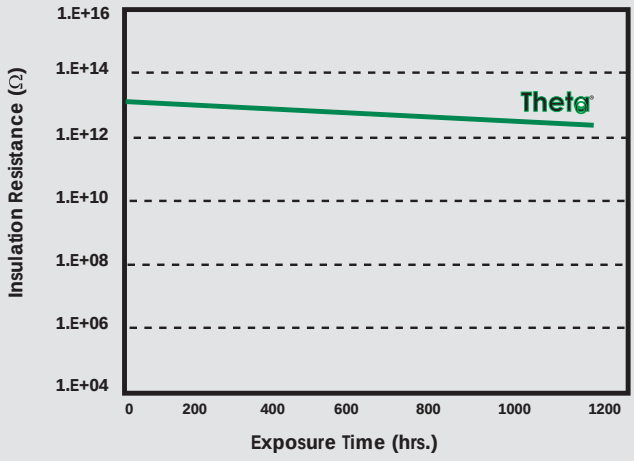

### Dissipation Factor after Water Absorption (1GHz)

PCT Condition: 121°C 0.22MPS



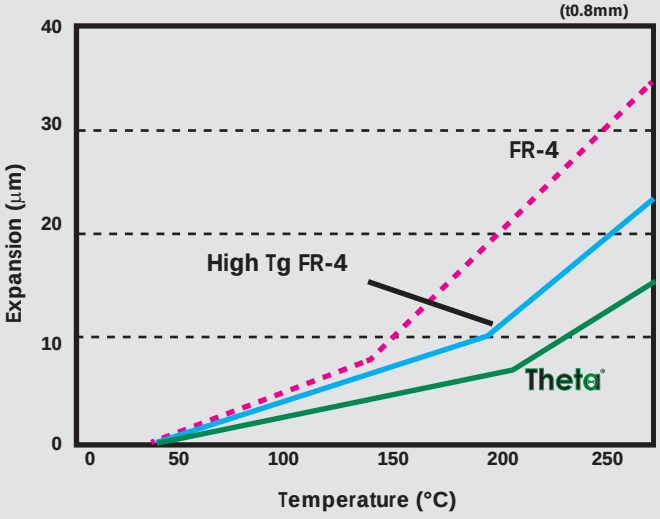

### CAF Resistance (85°C 85% RH, DC 100V)

Distance between Through-Hole: 0.3mm (t0.8mm)




### Coefficient of Thermal Expansion (CTE) Z-direction

(t0.8mm)





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## THETA® 100 (MCL-HE-679G) Laminate - Globally available constructions.

| Thickness | | Glass Style | RC Wt (%) | Estimated Dk | | | | Estimated Df | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (mm) | (in) | | | 1 GHz | 3 GHz | 5 GHz | 10 GHz | 1 GHz | 3 GHz | 5 GHz | 10 GHz |
| 0.056 | 0.0022 | 1037 | 72 | 3.85 | 3.83 | 3.81 | 3.79 | 0.0100 | 0.0113 | 0.0120 | 0.0126 |
| 0.064 | 0.0025 | 1080 | 55 | 3.96 | 3.94 | 3.92 | 3.90 | 0.0095 | 0.0107 | 0.0114 | 0.0124 |
| 0.076 | 0.0030 | 1080 | 64 | 3.90 | 3.88 | 3.86 | 3.84 | 0.0097 | 0.0110 | 0.0116 | 0.0126 |
| 0.081 | 0.0032 | 3313 | 45 | 3.97 | 3.95 | 3.93 | 3.91 | 0.0093 | 0.0105 | 0.0111 | 0.0121 |
| 0.089 | 0.0035 | 3313 | 49 | 3.98 | 3.96 | 3.94 | 3.92 | 0.0094 | 0.0106 | 0.0113 | 0.0123 |
| 0.102 | 0.0040 | 2116 | 45 | 3.97 | 3.95 | 3.94 | 3.91 | 0.0093 | 0.0105 | 0.0111 | 0.0121 |
| 0.102 | 0.0040 | 3313 | 56 | 3.95 | 3.93 | 3.91 | 3.89 | 0.0095 | 0.0107 | 0.0114 | 0.0124 |
| 0.114 | 0.0045 | 1037 X 2 | 72 | 3.85 | 3.83 | 3.81 | 3.79 | 0.0100 | 0.0113 | 0.0120 | 0.0126 |
| 0.127 | 0.0050 | 1080 X 2 | 55 | 3.96 | 3.94 | 3.92 | 3.90 | 0.0095 | 0.0107 | 0.0114 | 0.0124 |
| 0.127 | 0.0050 | 2116 | 54 | 3.97 | 3.95 | 3.93 | 3.91 | 0.0095 | 0.0107 | 0.0114 | 0.0124 |
| 0.152 | 0.0060 | 1501 | 43 | 4.02 | 4.00 | 3.98 | 3.96 | 0.0092 | 0.0104 | 0.0110 | 0.0120 |
| 0.152 | 0.0060 | 1080 X 2 | 64 | 3.90 | 3.88 | 3.86 | 3.84 | 0.0097 | 0.0110 | 0.0116 | 0.0126 |
| 0.178 | 0.0070 | 3313 X 2 | 49 | 3.96 | 3.94 | 3.92 | 3.90 | 0.0094 | 0.0106 | 0.0113 | 0.0123 |
| 0.203 | 0.0080 | 3313 X 2 | 56 | 3.95 | 3.93 | 3.91 | 3.89 | 0.0095 | 0.0107 | 0.0114 | 0.0124 |
| 0.254 | 0.0100 | 2116 X 2 | 54 | 3.97 | 3.95 | 3.93 | 3.91 | 0.0095 | 0.0107 | 0.0114 | 0.0124 |
| 0.305 | 0.0120 | 1501 X 2 | 43 | 4.02 | 4.00 | 3.98 | 3.96 | 0.0092 | 0.0104 | 0.0110 | 0.0120 |
| 0.406 | 0.0160 | 7629 X 2 | 43 | 4.02 | 4.00 | 3.98 | 3.96 | 0.0092 | 0.0104 | 0.0110 | 0.0120 |
| 0.508 | 0.0200 | 1501 X 2<br>7629 X 1 | 43 | 4.02 | 4.00 | 3.98 | 3.96 | 0.0092 | 0.0104 | 0.0110 | 0.0120 |
| 0.610 | 0.0240 | 7629 X 3 | 43 | 4.02 | 4.00 | 3.98 | 3.96 | 0.0092 | 0.0104 | 0.0110 | 0.0120 |
| 0.813 | 0.0320 | 7629 X 4 | 43 | 4.02 | 4.00 | 3.98 | 3.96 | 0.0092 | 0.0104 | 0.0110 | 0.0120 |
| 1.016 | 0.0400 | 7629 X 5 | 43 | 4.02 | 4.00 | 3.98 | 3.96 | 0.0092 | 0.0104 | 0.0110 | 0.0120 |
| 1.626 | 0.0640 | 7629 X 8 | 43 | 4.02 | 4.00 | 3.98 | 3.96 | 0.0092 | 0.0104 | 0.0110 | 0.0120 |

| Standard Panel Size | Standard Copper Cladding |
|---|---|
| 24"X18" (609mm X 457mm)<br>24.25" X 18.25" (616mm X 464mm)<br>24.50" X 18.50" (622mm X 470mm)<br>Grain direction is the short dimension. | IPC-4562 Grade 3<br>0.5, 1, and 2 oz<br>Other foils available upon request |

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## THETA® 200 (GHA-679G) Prepreg - Globally available constructions.

| Thickness Post Lam | | Glass Style | RC Wt (%) | Estimated Dk | | | | Estimated Df | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (mm) | (in) | | | 1 GHz | 3 GHz | 5 GHz | 10 GHz | 1 GHz | 3 GHz | 5 GHz | 10 GHz |
| 0.051 | 0.0020 | 1037 | 72 | 3.85 | 3.83 | 3.81 | 3.79 | 0.0100 | 0.0113 | 0.0120 | 0.0126 |
| 0.064 | 0.0025 | 1037 | 75 | 3.78 | 3.76 | 3.74 | 3.72 | 0.0100 | 0.0113 | 0.0120 | 0.0126 |
| 0.079 | 0.0031 | 1078 | 64 | 3.90 | 3.88 | 3.86 | 3.84 | 0.0097 | 0.0110 | 0.0116 | 0.0126 |
| 0.079 | 0.0031 | 1080 | 64 | 3.90 | 3.88 | 3.86 | 3.84 | 0.0097 | 0.0110 | 0.0116 | 0.0126 |
| 0.094 | 0.0037 | 1080 | 69 | 3.91 | 3.89 | 3.87 | 3.85 | 0.0100 | 0.0113 | 0.0120 | 0.0126 |
| 0.107 | 0.0042 | 3313 | 56 | 3.95 | 3.93 | 3.91 | 3.89 | 0.0095 | 0.0107 | 0.0114 | 0.0124 |
| 0.127 | 0.0050 | 3313 | 62 | 3.94 | 3.96 | 3.98 | 4.00 | 0.0096 | 0.0108 | 0.0115 | 0.0125 |
| 0.127 | 0.0050 | 2116 | 54 | 3.97 | 3.95 | 3.93 | 3.91 | 0.0095 | 0.0107 | 0.0114 | 0.0124 |
| 0.150 | 0.0059 | 2116 | 60 | 3.98 | 4.00 | 4.02 | 4.04 | 0.0095 | 0.0107 | 0.0114 | 0.0124 |
| 0.178 | 0.0070 | 1501 | 49 | 3.98 | 3.96 | 3.94 | 3.92 | 0.0094 | 0.0106 | 0.0113 | 0.0123 |

### Standard Panel Sizes:

24"X18" (609mm X 457mm)
24.25" X 18.25" (616mm X 464mm)
24.50" X 18.50" (622mm X 470mm)
Grain direction is the short dimension.

### IPC 4101 Compliance

Theta circuit materials meet or exceed the full specification sheet requirements for halogen-free materials in IPC-4101 slash sheets: 127, 128, and 130

Theta circuit materials also comply with the laminate requirements for brominated materials in IPC-4101 slash sheets 24, 32, 97, 99, 101 and 126.

For more information about Rogers' High Speed Digital products.