



elementsix™

DE BEERS GROUP

Diafilm™ ETC700

The highest thermal conductivity material
is also electrically conductive

The first electrically conductive CVD diamond heat spreader, Diafilm™ ETC700, delivers the exceptional heat dissipation of diamond combined with minimized resistive and RF losses. Enabling smaller and more reliable high power devices without impeding electrical performance

Electrically conductive CVD diamond heat spreaders

Diafilm™ ETC700 CVD diamond heat spreaders are the first thermal management materials engineered to offer electrical conductivity alongside the exceptional thermal performance of diamond. This unique innovation from Element Six offers low dielectric and resistive losses, making it the ideal material for devices that demand optimal thermal management with minimal impact on electrical RF performance, such as high-power RF, optoelectronics and high-voltage semiconductors.

Outperforming metal-coated solutions

Diafilm™ ETC700 outperforms all other commercially available non-diamond heat spreader materials, such as metallized dielectrics.

- A high conduction cross-section enables better RF performance by improving the ground-plane isolation
- Reduces the slow wave mode and capacitive coupling between ground planes at low frequencies, maintaining a bulk thermal conductivity $>700 \text{ W m}^{-1} \text{ K}^{-1}$
- Reduces conductive losses at higher frequencies

Thermal conductivity



Proposed solutions to fit your applications

Our engineers and technologists analyse every aspect of the thermal and mechanical properties of a proposed application to recommend a diamond solution of the optimal size, shape and thickness, along with integration advice.

Property	Diafilm ETC700	Diafilm TM100	Diafilm TM130
Thermal conductivity			
@ 300K ($\text{W m}^{-1} \text{ K}^{-1}$)	>700	>1000	>1300
@ 425K ($\text{W m}^{-1} \text{ K}^{-1}$)	>500	>900	>1200
Thermal expansion coefficient			
@ 300K (ppm K^{-1})	1.10 ± 0.1	1.10 ± 0.1	1.10 ± 0.1
@ 1000K (ppm K^{-1})	4.4 ± 0.1	4.4 ± 0.1	4.4 ± 0.1
Thermal diffusivity			
@ 300K ($\text{cm}^2 \text{ s}^{-1}$)	>3.9	>5.5	>7.2
Specific heat capacity			
@ 300K ($\text{J kg}^{-1} \text{ K}^{-1}$)	520	520	520
Hardness			
GPa	81 ± 18	81 ± 18	81 ± 18
Fracture toughness			
($\text{MPa m}^{0.5}$)	8.5	5.3 - 7.0	5.3 - 7.0
Young's modulus			
(GPa)	1050	1050	1050
Poisson's ratio	0.1	0.1	0.1
Density			
(10^3 kg m^{-3})	3.52	3.52	3.52
Resistivity			
Bulk R_v ($\Omega \text{ cm}$)	0.05 - 0.07	10^{12}	10^{12}
Surface R_s ($\Omega \text{ cm}$)	0.05 - 0.07	10^{10}	10^{10}

* Measured at 293 K

Diafilm™ ETC700 - the latest innovation

Element Six Diafilm™ heat spreaders have the highest known thermal conductivity of any solid material at room temperature. They are proven in the market as an ideal thermal management solution for high-power RF, optoelectronics and high-voltage power semiconductor devices.

Advantages of Diafilm™ ETC700

- High thermal conductivity
- Electrically conductive
- Excellent for minimizing capacitance coupling
- Offering high conduction cross-section
- Sizes up to 130 mm with a range of thickness and metallization options available
- Broad range of die bonding solutions

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