ParagonLED Ceramic Substrate CTAC Technology Breakthrough

Technical White Paper

Application: Extreme Temperature × High Radiation × Low EMI × EMP Resistance × High Surge

1. Substrate Technology Comparison

Parameter	Ceramic Substrate (CTAC Technology: Al_2O_3 / AlN / Si_3N_4)	Metal Core (BT Resin + Cu Base)
Thermal Conductivity	24–170 W/m·K (AlN, Si_3N_4 optimal)	1–3 W/m·K (BT resin), overall 1.5–2.5 W/m·K
Thermal Expansion (CTE)	4–6 ppm/°C, matched with GaN/SiC dies	~17–20 ppm/°C, higher thermal stress
Temperature Capability	Continuous 250 °C, transient up to 400 °C	Continuous ≤105 °C, special design up to 115 °C
Electrical Insulation	Excellent, withstands 2–5 kV/mm	Typically <1.5 kV/mm
EMI / RF Behavior	Non-magnetic, low parasitic, ultra-low EMI	Cu base may generate eddy currents and reflection noise
Surge Protection	Dielectric withstands high voltage; excellent ground-surge protection	Ground conduction may introduce surge energy
Radiation Resistance	No aging, no carbonization; suitable for nuclear/military	Resin layer deteriorates or carbonizes
EMP / EMI Immunity	Non-polar dielectric, low parasitic effect	EMP reflection or interference on Cu plane
Mechanical Stability	High rigidity, no warping	May delaminate or expand under heat cycles
Processing & Cost	High precision, requires laser or grinding	Low cost, suitable for mass production
Product Service Life	For high-temp (>120 °C) industries, lifespan extended severalfold, target 5+ years	TTL series base; ≤105 °C (up to 115 °C), 1–3 year warranty
Typical Applications	Nuclear, aerospace, defense, steel, pulp, mining, high radiation (>130 °C), >1 MGy gamma, 5–7 year life	High-temp (105–115 °C) environments, 300 kGy gamma, 1–3 year life

2. ParagonLED Light Engine Features

• Full solid-state ACCOB architecture – AC direct drive without driver or surge current.

• CTAC ceramic substrate supports Tc 145 °C, transient 200 °C.

• Low EMI / electro-optical isolation design minimizes common-mode current.

• EMP / Surge resistance – ground potential changes do not propagate to the active layer.

• Gamma / Neutron resistance – removes organic materials that carbonize or degrade under radiation; no carbonization, no outgassing.

3. Conclusion

Application	Recommended Substrate
High-temp (105–115 °C) industrial environment, 1–3 year lifespan, 300 kGy Gamma	Metal Core (BT Resin)
High-temp (>130 °C), >1 MGy Gamma radiation, 5–7 year lifespan	Ceramic (CTAC)
High Radiation / Military / EMP	Ceramic (CTAC)
Precision / Ultra-Low EMI Systems	Ceramic (CTAC)