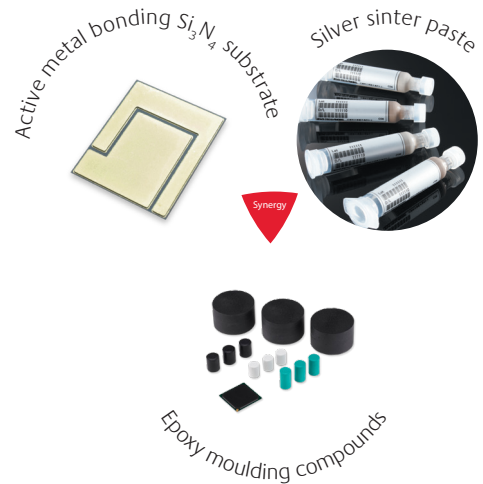


Power Module Ceramic Substrates

Total material solution for EV/HEV inverters

Kyocera provides advanced Si₃N₄ power module substrate to innovate highly efficient automotive inverters.

KYOCERA Synergy



APPLICATIONS

- ▶ HEV / EV inverters
- ▶ Power switch

FEATURES

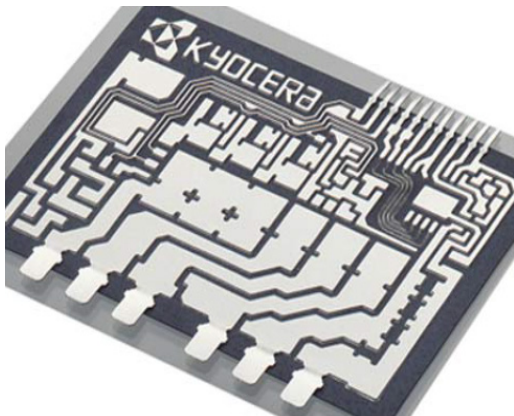
- ▶ High reliable silver plating to silver-sintering paste for SiC chip assembly
- ▶ High thermal conductivity / high flexural strength
- ▶ Si₃N₄ (ceramic): 85 W/mK / 820 MPa
- ▶ Copper thickness: ~ 0.8 mmt
- ▶ Fine pitch design rule: 1.0 mm gap between copper patterns

AMB SUBSTRATE ROADMAP

Automotive Inverters

CY		New Si ₃ N ₄ 85 W/mK					
		2015	2016	2017	2018	2019	2020
Product roadmap	AMB Silicon nitride substrate	Case type (substrate size > 20 mm)					
		0.3 t Cu/0.32 t Si ₃ N ₄ Au plating	0.3 t Cu/0.32 t Si ₃ N ₄ Ag plating				0.5t Cu/0.25 Si ₃ N ₄ Ag plating
Tech. trend	AMB Silicon nitride substrate	Mould type (substrate size < 20 mm)					
		0.8 t Cu/0.32 t Si ₃ N ₄ Ag plating					4 t Cu/0.32 t Si ₃ N ₄ Ag plating
Tech. trend	Thermal conductivity	58 W	58 W/85 W				
	Insulation voltage	400 V~4 kV					
	TCT	-40 ~ 175 °C					200 °C
	Plating	NiPdAu full	NiPdAg full/selective			Electrolytic Ag selective	

AMB Ceramic Substrate for Power Module Applications

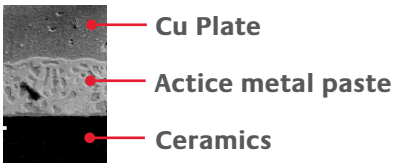


FEATURES

- ▶ High reliability (AMB Technology)
- ▶ Variety of platings (Ni, Ni/Au, NiPdAu, Ni/Pd/Ag, Ag)
- ▶ High thermal conductivity
- ▶ Multilayer structure feasible
- ▶ Different Cu thickness plates on same substrate
- ▶ Various connector possibilities

Reliability AMB process

- ▶ Active Metal Bonding
- ▶ Ti Compound - alloy (Ag-Cu)
- ▶ High adhesion strength to Ceramics



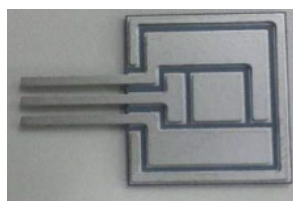
Plating options

- ▶ Partial silver plating
- ▶ Direct silver plating
- ▶ Nickel-palladium-gold or silver plating
- ▶ Nickel-gold plating
- ▶ Nickel plating

Connector Technologies



Lead type



Long lead type

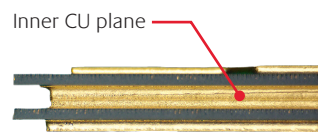


Cu PIN type



Screwable (SiN) type

Multilayer structure



- ▶ Multilayer AMB structure
- ▶ Low inductance
- ▶ 3 dimensional routing

Materials availability

- ▶ Si₃N₄: High flexural strength (85 W/mK)
- ▶ AlN: High thermal conductivity (170WmK)
- ▶ Al₂O₃: Low cost applications