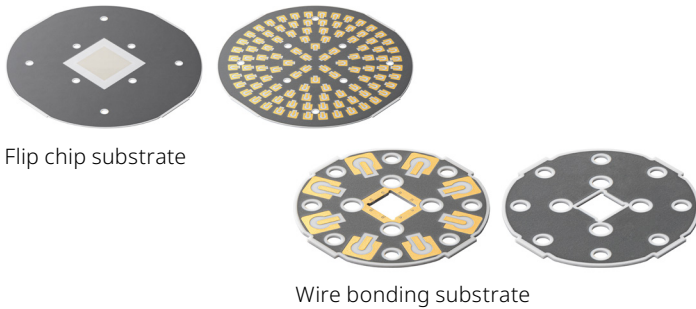




IC PACKAGES & LIDS FOR QUANTUM APPLICATION

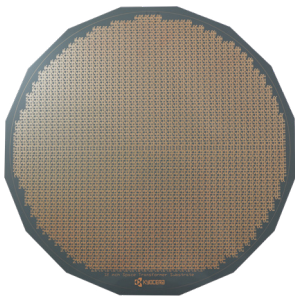
MULTILAYER CERAMIC PCB



Flip chip substrate

Wire bonding substrate

WAFER SIZE CERAMIC PCB



SAPPHIRE SUBSTRATE



SUPERCONDUCTING

FEATURES

- ▶ HTCC (Material A473)
- ▶ CTE 6.9 ppm at RT -400 °C
- ▶ Through-hole (optional)
- ▶ Metal / RF connector attachment available
- ▶ Wire bond / Flip chip assembly pad design
- ▶ Sapphire heat sink (optional)

FEATURES

- ▶ HTCC (Material ST300)
- ▶ CTE 4.7 ppm at RT -400 °C
- ▶ Thin-film metallization on multilayer ceramics
- ▶ Good rigidity / flatness

FEATURES

- ▶ High thermal conductivity >100 W/mK at low temperature
- ▶ Low dielectric loss at cryogenic environment
- ▶ High precision processing: laser machining/ drilling

Material properties in cryogenic environment are under evaluation.

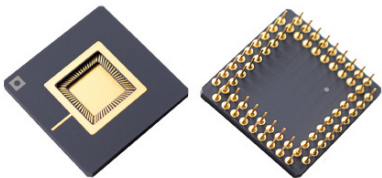


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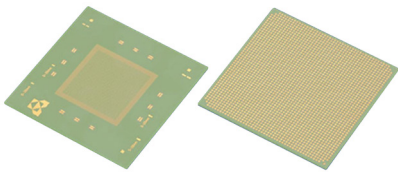


IC PACKAGES & LIDS FOR QUANTUM APPLICATION

CERAMIC PGA PACKAGE



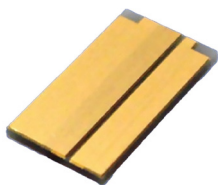
CERAMIC LGA PACKAGE



MULTI-SIDED WINDOW LID under development



ALUMINUM NITRIDE CARRIER



PHOTONIC

FEATURES

- ▶ HTCC (Material A440)
- ▶ CTE 7.1 ppm at RT -400 °C
- ▶ Hermetic sealing available
- ▶ Flexible structure design

FEATURES

- ▶ LTCC (Material GL773)
- ▶ CTE 11.7 ppm at RT -400 °C
- ▶ Copper conductor
- ▶ High-density routing

TRAPPED ION

FEATURES

- ▶ AR coated window
- ▶ Hermetic sealing available
- ▶ Flexible window size & location
- ▶ Open-tooled package available for set use (lid customized)

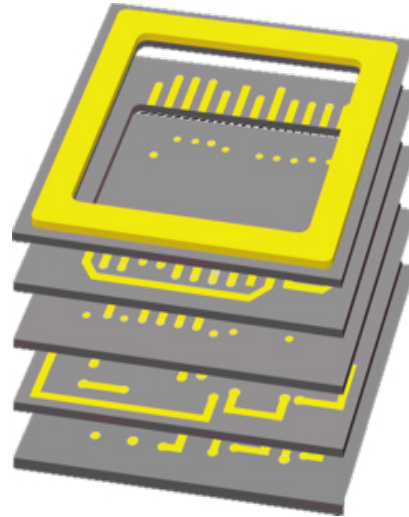
FEATURES

- ▶ High thermal conductivity
- ▶ AuSn pre-solder available
- ▶ Open-tooled design available

WHAT CAN KYOCERA'S CERAMICS DO?

METALIZATION & LAMINATION

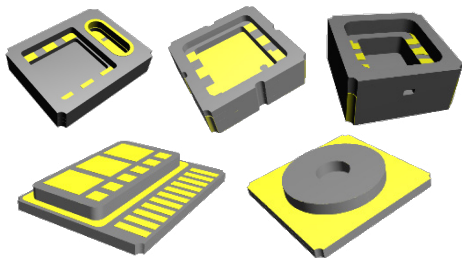
High density routing with vertical connection by metal via:



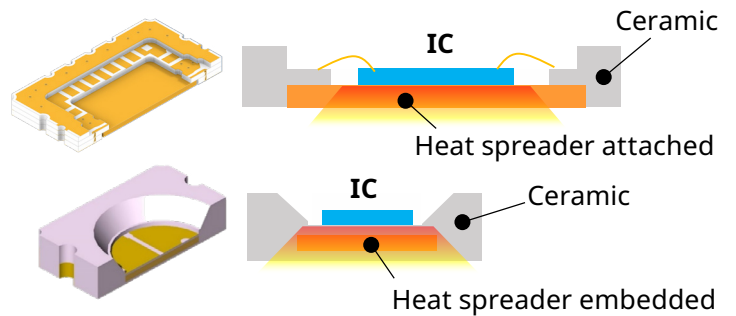
VARIOUS MATERIAL PROPERTIES

- ▶ High CTE material (close to PCB)
CTE: 11.7 ppm/K
- ▶ Low CTE material (close to silicon)
CTE: 3.4 ppm/K
- ▶ High heat dissipation material
Thermal conductivity: 150 W/mK
- ▶ High robustness material
Flexural strength: 740 MPa

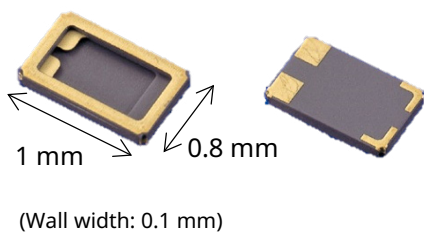
STRUCTURE FLEXIBILITY



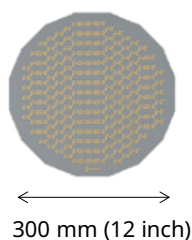
CERAMICS + METAL ATTACHMENT



ULTRA SMALL SIZE CAVITY PACKAGE



VERY LARGE SIZE SUBSTRATE



THIN FILM METAL ON CERAMICS



- ▶ Thin film metal on AlN
- ▶ AuSn pre-solder available
- ▶ Thick Cu option enable high current