

Electronic Ceramic Substrates

Advanced Materials

High Thermal Conductivity Electronic Ceramic Substrates

Highlights

- Ideal for applications where significant amounts of heat must be continuously dissipated.
- Less-toxic alternative to other ceramic products used in the past.
- Available in a variety of sizes, thicknesses and surface conditions including plain, polished, or with either full coverage or patterned metallization.
- Excellent electrical and mechanical properties
- Silicon Nitride is best suited to applications where repetitive thermal cycling of the circuit/package is present.

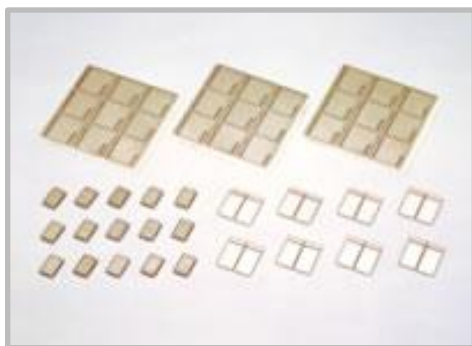
Description

Ceramic Substrates

Toshiba offers Aluminum Nitride and Silicon Nitride high thermal conductivity ceramic substrates for use with high power, hybrid microelectronic circuits and power modules. These advanced ceramic products offer a broad range of thermal, mechanical and physical properties and are a less-toxic alternative to other substrate materials used in the past. They can be safely processed and machined in house without the need for special environmental equipment to ensure employee health safety. Both materials are available in a variety of sizes, thicknesses and surface conditions including plain, polished, or with either full coverage or patterned metallization. These ceramic substrates are ideally suited for use as platforms for high power density electronic circuits or as single or multiple chip heat sinks, where significant amounts of heat must be continuously dissipated to ensure proper circuit function, improve reliability and extend mean time between failures. Both materials have thermal expansion coefficients that are close to those of the most commonly used semiconductor components which results in lower interfacial stress between chip and substrate with thermal cycling and improved circuit function reliability.

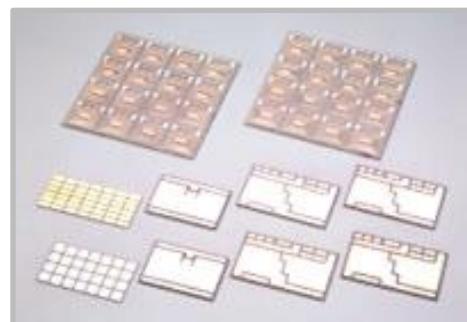
Aluminum Nitride

Toshiba Aluminum Nitride substrates are available in three different levels of thermal conductivity: 170, 200 and 230



Co-fired Tungsten Metalized ALN

Watt/meter Kelvin. Each grade is available with surfaces that are either plain as fired (<63uin Ra), plain honed (<32uin Ra), plain polished (<2uin Ra) or metalized with either co-fired thick-film printed tungsten or braze attached copper. The metalized surfaces are typically nickel plated and can be supplied either with full face coverage or patterned coverage to customer specification if they are to serve as part of a electrically conducting circuit.



Copper Clad ALN and SN Substrates

Silicon Nitride

Toshiba Silicon Nitride substrates, with a thermal conductivity rating of 90 Watts/meter Kelvin, at first glance, appear inferior to Aluminum Nitride grades from the standpoint of heat dissipation. However, Silicon Nitride substrates, due to their far superior mechanical properties, can provide thermal resistance levels comparable to Aluminum Nitride. This is because Silicon Nitride substrates have twice the strength and fracture toughness of Aluminum Nitride substrates, which enable the circuit/package designer to use Silicon Nitride substrates that can be half as thick as Aluminum Nitride substrates. These same impressive mechanical properties also make Silicon Nitride substrates an excellent choice in applications where severe, repetitive thermal cycling of the circuit/package is present.

High Thermal Conductivity Substrates

Typical Room Temperature Properties of Toshiba Aluminum Nitride and Silicon Nitride Ceramic Substrate Materials

Material	Density (gm/cc)	Thermal Conductivity (W/mK)	Thermal Expansion (ppm/°C)	Volume Resistivity (ohm-cm)	Dielectric Constant (1MHz)	Dielectric Strength (kv/mm)	Bending Strength (Mpa)	Young's Modulus (Gpa)	Fracture Toughness (MPa·m ^{1/2})
ALN170	3.3	170	4.6	10 ¹⁴	8.8	14	350	320	3
ALN200	3.3	200	4.6	10 ¹⁴	8.8	14	330	320	3
ALN230	3.3	230	4.6	10 ¹⁴	8.8	14	330	320	3
SN90	3.2	90	3.4	10 ¹⁴	9	14	650	290	6.5

Standard Plain Surface ALN and SN Substrate Sizes and Specifications

	Type	Size	Thickness	Camber	Surface Roughness
ALN170	AS FIRED	≤ 4.50" X 4.50"	≤ 0.100"	< 0.0028"/inch	< 63u inch Ra
	HONED/LAPPED	≤ 4.50" X 4.50"	≤ 0.100"	< 0.002"/inch	< 32u inch Ra
	POLISHED	≤ 4.50" X 4.50"	≤ 0.100"	< 0.001"/inch	< 2u inch Ra
ALN200	AS FIRED	≤ 4.50" X 4.50"	≤ 0.070"	< 0.0028"/inch	< 63u inch Ra
	HONED/LAPPED	≤ 4.50" X 4.50"	≤ 0.070"	< 0.002"/inch	< 32u inch Ra
	POLISHED	≤ 4.50" X 4.50"	≤ 0.070"	< 0.001"/inch	< 2u inch Ra
ALN230	AS FIRED	≤ 4.00" X 4.00"	≤ 0.032"	< 0.0028"/inch	< 63u inch Ra
	HONED/LAPPED	≤ 4.00" X 4.00"	≤ 0.032"	< 0.002"/inch	< 32u inch Ra
	POLISHED	≤ 4.00" X 4.00"	≤ 0.032"	< 0.001"/inch	< 2u inch Ra
SN90	HONED/LAPPED	≤ 4.00" X 4.00"	≤ 0.032"	< 0.002"/inch	< 32u inch Ra
	POLISHED	≤ 4.00" X 4.00"	≤ 0.032"	< 0.001"/inch	< 2u inch Ra

Plain aluminum nitride substrates are kept in stock in a variety of sizes in the United States for immediate shipment in response to short lead-time customer requirements. Additional sizes and thicknesses of plain surface and metalized substrates are available typically in 6 to 8 weeks. Please contact us to discuss your application and to determine which type of Toshiba ceramic substrate is best for your application.

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