

Winspower CERAMIC SUBSTRATES

AMB technology

Design Rules



Key features

Great heat conductivity and temperature resistance for high performance and high temperature applications

High insulation voltage

High heat spreading

Adjusted coefficient of thermal expansion between chip and substrate

Good thermal shock resistance

1. Material properties

1.1 Ceramic properties

Material		Si ₃ N ₄	AlN
Bending strength	MPa	> 600	> 350
Thermal conductivity (@ 20°C)	W/m·K	≥ 80	170
Coefficient of thermal expansion (20°C - 500°C)	10 ⁻⁶ /K	2.6	4.6
Dielectric constant (@1MHz)		9.0	9.0
Dielectric loss (@1MHz)	10 ⁻³	0.2	0.2
Breakdown voltage	kV/mm	>15	>15
E-moduls	GPa	300	320
Density	g/cm ³	3.22	3.3

1.2 Copper properties

Purity	%	99.99
O ₂ content		OFHC
Electrical conductivity	MS/m	58 (20 °C)

1.3 Ceramic thicknesses

	Si ₃ N ₄	AlN
0.25 mm	☒	
0.32 mm	☒	
0.38 mm		☒
0.63 mm		☒
1.0 mm		☒

* other thicknesses on request

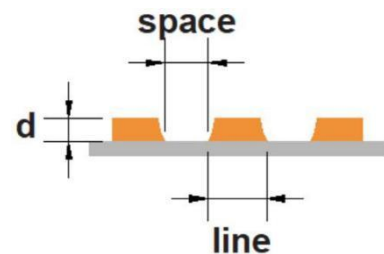
1.4 Copper thicknesses

0.127mm	0.2 mm	0.25 mm	0.3 mm	0.4 mm	0.5 mm	0.8 mm
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2. Geometric properties

2.1 Pattern min. Width/spacing dimension

Thickness Cu d [mm]	Min.Space [mm]	Min. Line [mm]
0.127	0.20	0.20
0.20	0.35	0.35
0.25	0.40	0.4
0.30	0.50	0.5
0.40	0.60	0.60
0.50	0.80	0.80
0.80	1.0	1.0



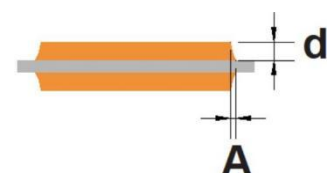
2.2 Ceramic edge perimeter

Thickness Cu d [mm]	Min. Cu free area [mm]
0.10 - 0.25	0.20
0.30 - 0.60	0.30
0.80	0.50



2.3 Etching factor

Thickness Cud[mm]	Etching factor
0.10 - 1.00	$F=d/A > 2$

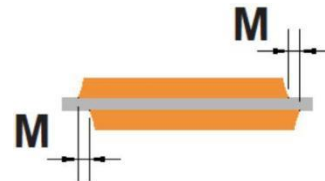


2.4 Etching tolerance

Thickness Cu	d [mm]	Tolerance length & width T [mm]
	0.10 - 0.15	± 0.10
	0.20 - 0.40	± 0.15
	0.50 - 0.80	± 0.20

2.5 Misalignment copper pattern front/back

$$M < 0.2\text{mm}$$



2.6 Dimensions & tolerances

Single parts dimensions	Single parts dimensional tolerances
10mm*10mm—127mm*178mm	± 0.15mm (thickness < 0.635mm)
	± 0.20mm (for Si3N4 thickness = 0.635mm)
* Others on request	

2.7 Tolerance of total thickness (ceramic + copper)

Total thickness	+7%/-10%
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3. Surface properties

3.1 Surface roughness

$$R_{\max} = 50 \mu\text{m} ; R_a \leq 1.5 \mu\text{m} ; R_z \leq 10 \mu\text{m}$$

*Lower roughness on request

3.2 surface finish

Bare copper	-
Anti-oxidation	-
Electroless Ni	2-8 μm (6-10% P content)
Electroless NiAu	Au:0.01-0.1 μm ; Ni:2-8 μm
Electroless Ag	Ag:0.1-0.6 μm

3.3 Solder stop

Pattern width	$\geq 0.20\text{mm}$
Mismatch solder stop line (center) to layout (center)	$\pm 0.20\text{mm}$
Min. spacing between solder stop pattern	$\geq 0.20\text{mm}$
Min. Distance from solder stop edge to copper edge	≥ 0
Temperature resistance	$\leq 288^{\circ}\text{C} / 30\text{sec}$ $\leq 320^{\circ}\text{C} / 10\text{sec}$

4. Product properties

Peeling strength	$> 10\text{N/mm}$ (50 mm/min)
Solderability	$> 95\%$ Solder preforms Sn / Ag 3.5/ Cu0.5+Ni,Ge 100% H ₂
Application temperature	$-55^{\circ}\text{C} \sim +650^{\circ}\text{C}$ depending on time and atmosphere
Wire bonding	Shearing strength $\geq 1000\text{gf}$ Aluminium Residue after shearing $\geq 50\%$ Condition: Al wire 300um ; Shear speed 500um/s ; Shear height $\leq 30\text{um}$
Thermal shock	$> 60\text{cycles}$ @ AlN thickness 0.635mm; Copper thickness $\leq 0.3\text{mm}$ $> 3000\text{cycles}$ @ Si ₃ N ₄ All available combinations Condition: $-55^{\circ}\text{C} \sim +150^{\circ}\text{C}$, hot/cold chamber system, 15min at min/max. Transfer time $< 10\text{s}$

Warpage behavior depends on specific layout, single part size and material combination and can only be specified after initial sample preparation