CHC

LEADING

THE FUTURE OF NEW MATERIAL

DBC Design rules

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1 Material

1.01. Available ceramic types and thicknesses

Types	Thicknesses (mm)							
	0.25	0.32	0.38	0.5	0.635	0.76	0.89	1.0
96% Al_2O_3	√	√	△	√	△	√	√	√
96% Al_2O_3 HP	√	√	△					
ZTA	√	△	√					
AlN			√		√			√

Notes:

- Al_2O_3 other thicknesses on request.
- ZTA ZrO_2 toughened Al_2O_3

1.02. Copper thicknesses (OFH-Cu)

General characteristics and thickness of copper foil material

Item	Numerical value	Units
Copper content purity	≥99.99	%
Oxygen content	≤5	ppm
Electric conductivity	>58	MS/m
Tensile strength	≥320	N/mm^2
Elongation A50	2	%
Vickers hardness	105~120	HV

Copper foil thickness (mm)	0.127	0.2	0.25	0.3	0.4	0.5

2 DBC design features

2.01. Combinations

- Standard Mastercard dimension: 138x190.5±2mm

Al_2O_3

Thicknesses mm	Copper thicknesses (mm)				
	0.127	0.2	0.25	0.3	0.4
0.25	√	√	√	×	×
0.32	√	√	√	√	√
0.38	√	√	√	△	√
0.5	√	√	√	√	√
0.635	√	√	√	△	√
0.76	√	√	√	√	√
0.89	√	√	√	√	√
1.0	√	√	√	√	√

Al_2O_3 HP

Thicknesses mm	Copper thicknesses (mm)				
	0.127	0.2	0.25	0.3	0.4
0.25	√	√	√	×	×
0.32	√	√	√	√	√
0.38	√	√	√	△	√

ZTA

Thicknesses mm	Copper thicknesses (mm)				
	0.127	0.2	0.25	0.3	0.4
0.25	√	√	√	√	×
0.32	√	√	√	△	√
0.38	√	√	√	△	√

AIN

Thicknesses mm	Copper thicknesses (mm)				
	0.127	0.2	0.25	0.3	0.4
0.38	√	√	√	√	×
0.635	√	√	√	△	√
1.0	√	√	√	√	√

Note: √ available △ standard material combinations

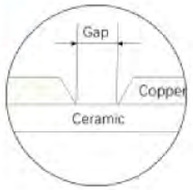
2.02. Layout design rules

- Max. usable Cu area: 127X178mm (standard)

Item	Copper thicknesses (mm)				
	0.127	0.20	0.25	0.30	0.4
Min. Conductor width (D)	0.40	0.40	0.50	0.50	0.60
Min. Spacing (d)	0.25	0.35	0.50	0.50	0.60
Min. Copper free perimeter (e)	0.25	0.30	0.30	0.30	0.40

Note:

All measurements are taken at ceramic and copper interface unless otherwise noted.



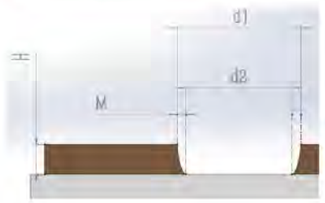
2.03. Tolerance

Item	Copper thicknesses (mm)				
	0.127	0.2	0.25	0.3	0.4
Thickness tolerance	±0.03				±0.03
Layout tolerance	±0.15				±0.2

Item	Ceramic thicknesses (mm)							
	0.25	0.32	0.38	0.5	0.635	0.76	0.89	1
Thickness tolerance		±0.04		±0.05	±0.07	±0.08	±0.09	±0.1
Laser hole tolerance	±0.15							

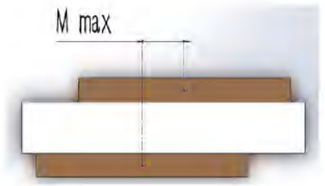
Item	Product tolerance (mm)
overall dimension	-0.05mm~+0.2mm
Total thickness tolerance	-10% ~ +7%

2.04. Etching properties



Etching factor	=H/M
	≥2

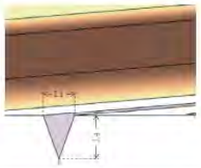
2.05. Mismatch copper pattern front/back



Item
Mismatch copper pattern front/back (center) Mmax≤0.15mm

2.06. Laser scribing and holes

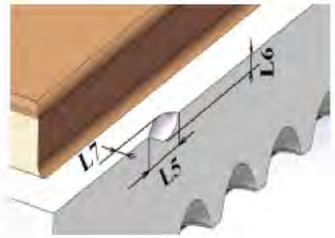
- Laser scribing

Type	Code name				Figure
	L1	L2	L3	L4	
	Typical value (mm)				
CO_2 laser	≤0.20	0	0.15±0.02	$\frac{\text{T-ceramic}}{2} \geq L4 \geq \frac{\text{T-ceramic}}{3}$ (T-ceramic < 0.635mm) $L4 \geq \frac{\text{T-ceramic}}{2}$ (T-ceramic≥0.635mm)	
Fiber laser	≤0.10	0	0.06±0.02	0.25*T-ceramic≥L4 ≥0.45*T-ceramic	
Pico laser	≤0.10	N/A	N/A	0.2*T-ceramic≥L4 ≥0.3*T-ceramic	

- Drilled holes

Type	Code name	Figure
	L8	
	Typical value (mm)	
drilled hole diameters	≥0.5mm	

2.07. Chipping at ceramic edge



Length (L5)	max. 1 x ceramic thickness
Width (L7)	max. 1/2 x copper free perimeter
Depth (L6)	max. 1/2 x ceramic thickness

2.08. Warpage

- The warapge value of single substrate cannot be guaranteed in advance due to the impact from various pattern design. Typical value shall be determined by both parties after sample delivery.

3 Additional

3.01. Ni/Ag/NIAG/ENIG/ENEPIG

Item	Thickness
Ni	3-7um（8% ±2% P）
Ag	0.1-0.6um
NiAg	Ni:3-7um（8% ±2% P）
	Ag:0.3-0.6um
ENIG	Ni:3-7um（8% ±2% P）
	Au:0.01-0.05um
ENEPIG	Ni:3-7um（8% ±2% P）
	Pd:0.05-0.18um ； Au:0.05-0.15um

Note:

Other surface treatments are available on request, such as partial electroless plating.

3.02. Surface roughness

Item	Value
Ra	≤ 3um
Rz	≤ 16 μm
Rmax	50um

Note:

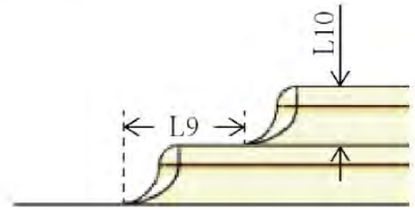
Customized roughness on request.

3.03. Solder mask

Min.	Location tolerance	Size tolerance	Condition
0.3mm @ Typical	±0.2mm	±0.1mm	Typical 288°C 10s Optional 350°C 60s
0.4mm @ Cu edge	±0.2mm	±0.2mm	

3.04. Half etching

Min.(L9)	Location tolerance	Size tolerance	Depth& tolerance (L10)
0.2mm@Typical 0.3mm@Cu edge	±0.1mm	±0.15mm	50%*Copper thicknesses &±0.05mm



3.05. Grinding

Item	Value
Ra	0.1um~1um

Note:

Customized roughness on request.

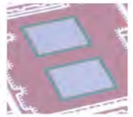
3.06. QR Code

QR Code Size	Size tolerance	Location tolerance	Depth	Condition
>2.5*2.5mm <5.0*5.0mm	±0.15mm	±0.15mm	5~20um	(Cu edge@>0.2mm)

4 Quality properties

4.01. Solderability

Standard



- Cu-surface: SnCu3In0.5-Preform
  > 95% Wetting
- Ni-surface: PbSn36Ag2-Preform
  > 95% Wetting
- with forming gas (10%H2, 90% N2) and vacuum

4.02. Wire bondability

Standard (pull-test)

- 300µm Aluminium wire AlH11
- shear speed 500µm/s
- shear height 10µm
- 1000cN<shear force<2000cN
- 50% Aluminium residue on DBC after shear test

4.03. Temperature cycle

ceramic	combination	(sigma0) cycles	condition
Al_2O_3	0.30/0.38/0.30	≥45*	-55°C, +150°C
Al_2O_3	0.30/0.635/0.30	≥60*	
ZTA	0.30/0.32/0.30	≥60*	
AlN	0.30/0.635/0.30	≥35*	

*dimple/with CHC Standard DBC layout.

4.04. Other physical properties

Physical properties	Al_2O_3	Al_2O_3 ZrO_2	AlN
Copper peeling strength (typical Cu @0.3mm)	>5.0N/mm @50mm/min	>6.0N/mm @50mm/min	>4.0N/mm @50mm/min
Application temperature	-55°C to +850°C depending on atmosphere (critical at H2 with >400°C)		
sigma0 Bending strength (blank ceramic)	≥400N/mm² ≥450N/mm²@HP	≥625N/mm²	≥350N/mm²
E-Modul (blank ceramic)	340Gpa 330Gpa@HP	310Gpa	320Gpa
Coefficient of linear thermal expansion (blank ceramic)	6.9 ppm/K @40°C – 400°C 7.8 ppm/K @40°C – 800°C	7.5 ppm/K @40°C – 400°C 8.4 ppm/K @40°C – 800°C	4.8 ppm/K @40°C – 400°C 5.4 ppm/K @40°C – 800°C
Thermal conductivity	22~24 W/mK @25°C	24~26 W/mK @25°C	170 ~180W/mK @20°C
Volume resistivity	$>10^{14}$Ωcm@25°C $>10^{10}$Ωcm@300°C	$>10^{14}$Ωcm@25°C $>10^{9}$Ωcm@300°C	$>10^{14}$Ωcm@25°C $>10^{10}$Ωcm@300°C
Dielectric constant	9.8±10%@1MHz	10.5±10%@1MHz	9.0±10%@1MHz
Dielectric loss	0.0003@23°C, 1MHz	0.0003@23°C, 1MHz	0.0005@23°C, 1MHz
Dielectric strength (DC)	>20kV/mm	>20kV/mm	>20kV/mm
Bulk density (blank ceramic)	≥3.70g/cm³	≥3.70g/cm³	≥3.25g/cm³
Fracture toughness (blank ceramic)	4.5MPa · $m^{1/2}$	6.8MPa · $m^{1/2}$	4.5MPa · $m^{1/2}$

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