

TC

覆铜衬板规格书

Specification for Copper Clad Substrate

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1 材料介绍 Material

1.1. 瓷片 Ceramic

项目 Items	单位 Unit	氮化铝 AlN	氮化硅 Si ₃ N ₄	氧化铝 Al ₂ O ₃	氧化锆 ZTA
密度(典型值) Density	g/cm ³	3.25	3.20	3.75	3.95
粗糙度 Roughness (Ra)	μm	≤0.6	≤0.7	≤0.6	≤0.6
抗弯强度 Bending Strength	MPa	≥480	≥700	≥450	≥600
线膨胀系数 (25-400℃)(典型值) Coefficient of Thermal Expansion	10 ⁻⁶ /K	3.8-4.5	2.6	6.9	7.5
热传导率(25℃) Thermal Conductivity	W/(m·K)	≥170	≥80	≥24	≥26
介电常数(典型值) Dielectric Constant	1MHz	≤13	7.8	9.8	10.2
介电损耗(典型值) Dielectric Loss	1MHz	3*10 ⁻⁴	2*10 ⁻⁴	2*10 ⁻⁴	2*10 ⁻⁴
体阻抗(25℃) Volume Resistivity	Ω*cm	≥10 ¹⁴	≥10 ¹⁴	≥10 ¹⁴	≥10 ¹⁴
绝缘耐压(AC) Dielectric Strength	kV/mm	≥15	≥20	≥20	≥20

1.2. 铜箔 Copper

项目 Items	单位 Unit	压延铜箔 Copper
纯度(Cu) Purity	%	≥99.99 (TU00) ≥99.97 (TU0)
含氧量 O ₂ Content	ppm	≤5 (TU00) ≤10 (TU0)
密度 Density	g/cm ³	≥8.93
粗糙度 Roughness (Ra)	μm	≤0.6
维氏硬度 Vickers Hardness	Hv	70~125
热传导率(20℃) Thermal Conductivity	W/(m*K)	≥394
线膨胀系数(20℃-300℃) Coefficient of Thermal Expansion	10 ⁻⁶ /K	≤17.7
导电率 Electric Conductivity	%IACS	≥101 (TU00) ≥100 (TU0)

1.3. 物料厚度组合 Material Thickness Combination

		铜箔 Copper Thickness						
		0.15mm	0.2mm	0.25mm	0.30mm	0.4mm	0.50mm	0.80mm
瓷片 Ceramic Thickness	0.25mm	Si ₃ N ₄	Si ₃ N ₄	Si ₃ N ₄	Si ₃ N ₄	Si ₃ N ₄	Si ₃ N ₄	—
	0.32mm	Si ₃ N ₄ ZTA	Si ₃ N ₄ ZTA	Si ₃ N ₄ ZTA	Si ₃ N ₄ ZTA	Si ₃ N ₄	Si ₃ N ₄	Si ₃ N ₄
	0.38mm	AlN Al ₂ O ₃	AlN Al ₂ O ₃	AlN Al ₂ O ₃	AlN Al ₂ O ₃	Al ₂ O ₃	—	—
	0.50mm	Al ₂ O ₃	Al ₂ O ₃	Al ₂ O ₃	Al ₂ O ₃	—	—	—
	0.63mm	AlN Al ₂ O ₃	AlN Al ₂ O ₃	AlN Al ₂ O ₃	AlN Al ₂ O ₃	—	—	—
	1.00mm	Al ₂ O ₃	Al ₂ O ₃	Al ₂ O ₃	AlN Al ₂ O ₃	—	—	—

注：上表为常规物料组合，我司不限于常规物料组合，如有特殊需求，可与我司联系。

Note: The above table is the conventional material combination, our company is not limited to the conventional material combination, if you have special needs, you can contact our company.

1.4. 铜箔厚度公差 Thickness Tolerance

原材料铜厚标准		
铜厚(T) Cu Thickness	公差 Tolerance	示意图 Diagram
0.15mm	±0.01mm	
0.2mm	±0.012mm	
0.25mm	±0.012mm	
0.3mm	±0.012mm	
0.4mm	±0.015mm	
0.5mm	±0.015mm	
0.8mm	±0.015mm	

2 覆铜衬板 Copper Clad Substrate

2.1. 耐温特性 Temperature Resistance Characteristics

项目 Items	氮化铝 AlN	氮化硅 Si ₃ N ₄	氧化铝 Al ₂ O ₃	氧化锆 ZTA
铜层 Copper	410±10℃, 5min			
化学镀层 Electroless Plating	410±10℃, 5min			
阻焊层 Solder Mask	320℃, 10s			

2.2. 电气特性 Electrical Characteristics

项目 Items	氮化铝 AlN	氮化硅 Si ₃ N ₄	氧化铝 Al ₂ O ₃	氧化锆 ZTA
绝缘电阻 Insulation Resistance	≥10MΩ (DC≤1000V)			
绝缘耐压 Dielectric Strength	AC 7kV, 3s	AC 4.3kV, 3s	AC 3.0kV, 3s	
局部放电 Partial Discharge	<10pC	—	—	—

2.3. 温度循环 Thermal Shock Cycle

项目 Items	氮化铝 AlN	氮化硅 Si ₃ N ₄	氧化铝 Al ₂ O ₃	氧化锆 ZTA
温度冲击 Thermal Shock(cycles)	>500	>3000	>50	>150

冷热冲击箱测试条件: -40℃~150℃/-55℃~150℃;

Test Conditions for Thermal Shock Chamber: -40° C to 150° C / -55° C to 150° C;

停留时间: 高低温各停留 30min;

Dwell Time: 30 minutes at both high and low temperatures;

测试选用: Test Selection:

1、测试图形为我司标准图形, 不同图形的设计会影响测试结果;

The test pattern will be our standard design, as different designs can affect the test results;

2、可接受客户定制图案进行测试;

Custom patterns from customers are acceptable for testing;

失效模式判定: Failure Mode Determination:

1、外观: 铜层与瓷片分离;

Appearance: Separation of the copper layer from the ceramic substrate;

2、空洞率: 空洞率超过标准;

Voids: Void rate exceeds the standard;

3、耐压: 产品耐压测试发生击穿;

Dielectric Strength: Breakdown occurs during dielectric strength testing.

2.4. 其它物理特性 Other Physical Properties

项目 Items	单位 Unit	氮化铝 AlN	氮化硅 Si ₃ N ₄	氧化铝 Al ₂ O ₃	氧化锆 ZTA
表面粗糙度 Surface Roughness	μ m	Ra≤1.5 μ m, Rz≤10 μ m, Rmax≤50 μ m		Ra≤3 μ m, Rz≤16 μ m, Rmax≤50 μ m	
剥离强度 Peeling Strength	N/mm	≥9.0 (50mm/min)	≥10.0 (50mm/min)	≥6.0 (50mm/min)	≥6.0 (50mm/min)
绑线强度 Wire-bonding Strength	g	≥1000(铝线 Aluminium Wire: 300um)			
焊接润湿性 Solder Wettability	%	≥95 (240℃, 90s, SAC305)			
空洞率 (超声扫描) Void Content (C-SAM)	—	≤1%	≤1%	≤5%	≤5%

2.5. 交付样式 Delivery Form

项目 Items	氮化铝 AlN	氮化硅 Si ₃ N ₄	氧化铝 Al ₂ O ₃	氧化锆 ZTA
母板 Master Card	127*178mm			
单颗 Single Parts	根据客户需求 According to customer requirements			

2.6. 环保认证 Environmental Certification

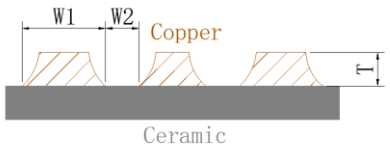
RoHS、REACH 已认证。

RoHS and REACH have been certified.

3 设计特性 Design Features

3.1. 铜层 Copper Layer Design

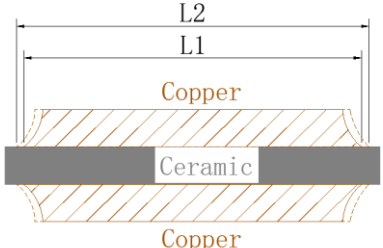
3.1.1. 线宽线距 Line Width Line Spacing

铜厚(T) Thickness Cu	尺寸(W1/W2) Size	示意图 Diagram
0.15mm	0.3mm /0.3mm	
0.2mm	0.35mm/0.35mm	
0.25mm	0.4mm /0.4mm	
0.3mm	0.5mm /0.5mm	
0.4mm	0.6mm /0.6mm	
0.5mm	0.7mm/0.7mm	
0.8mm	1.0mm /1.0mm	

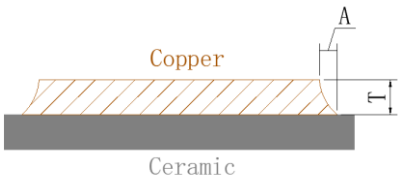
所有隔离间隙应具有相同的尺寸。同一基板上不同尺寸的隔离间隙可能导致更高的蚀刻公差。

All isolation gaps should have the same dimensions. Different sizes of isolation gaps on the same substrate may lead to higher etching tolerances.

3.1.2. 蚀刻公差 Etching Tolerance

铜厚(T) Cu Thickness	公差(L=L1-L2) Tolerance	示意图 Diagram
0.15mm	±0.1mm	
0.2mm	±0.1mm	
0.25mm	±0.15mm	
0.3mm	±0.15mm	
0.4mm	±0.2mm	
0.5mm	±0.2mm	
0.8mm	±0.25mm	

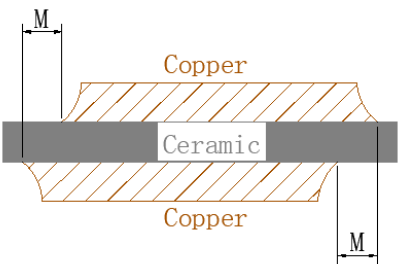
3.1.3. 蚀刻因子 Etching Factor

铜厚(T) Cu Thickness	蚀刻因子 E(T/A) Etching Factor	示意图 Diagram
$\leq 0.4\text{mm}$	A 面: ≥ 3 B 面: ≥ 2	
$> 0.4\text{mm}$	A 面: ≥ 2.5 B 面: ≥ 2	

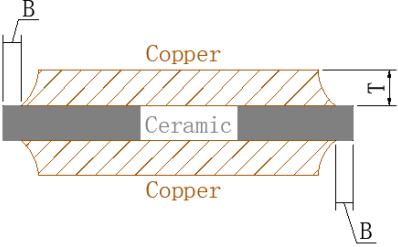
注：一般试制过程中，蚀刻因子 ≤ 5 。

Note: In the general trial production process, the etching factor is ≤ 5 .

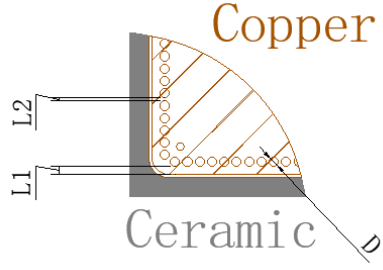
3.1.4. 正背面铜箔对位公差 Mismatch Copper Pattern Front/Back

铜厚(T) Cu Thickness	对位公差(M) Tolerance for Alignment	示意图 Diagram
$0.15 \sim 0.8\text{mm}$	$\leq 0.15\text{mm}$	

3.1.5. 铜自由区 Copper Free Area

铜厚(T) Cu Thickness	铜自由区(B) Copper Free Area B	示意图 Diagram
0.15mm	$\geq 0.2\text{mm}$	
0.2mm	$\geq 0.2\text{mm}$	
0.25mm	$\geq 0.25\text{mm}$	
0.3mm	$\geq 0.3\text{mm}$	
0.4mm	$\geq 0.4\text{mm}$	
0.5mm	$\geq 0.45\text{mm}$	
0.8mm	$\geq 0.5\text{mm}$	

3.1.6. 钉孔 Dimple

铜厚 Thickness Cu	孔径 D	间距 L1	间距 L2	示意图 Diagram
0.15mm	0.25mm	0.2mm	0.2mm	
0.2mm	0.45mm	0.2mm	0.2mm	
0.25mm	0.6mm	0.2mm	0.2mm	
0.3mm	0.6mm	0.2mm	0.2mm	
0.4mm	0.8mm	0.3mm	0.3mm	
0.5mm	1.0mm	0.35mm	0.35mm	
0.8mm	1.6mm	0.5mm	0.4mm	

注: Note:

1、 我司钉孔管控上层。

Our nail hole control upper layer.

2、 钉孔实际尺寸形状, 建议客户以首次试样为准。

The actual size and shape of the nail holes are recommended to the customer based on the first sample.

3、 上表为钉孔蚀刻到底所需最小尺寸与间距, 如需蚀刻不到底, 可与我司联系, 适当调整最小所需钉孔孔径大小。

The table above is the minimum size and spacing required for nail hole etching. If you need to etch not to the end, you can contact our company to adjust the minimum required nail hole aperture.

3.2. 铜层表面处理 Copper Surface Treatment

项目 Items	厚度 Thickness
Ni	2.5~7.5 μm
Ni-Au	Ni: 2.5~7.5 μm Au: 0.05~0.15 μm
Ni-Pd-Au	Ni: 2.5~7.5 μm Pd: 0.03~0.1 μm Au: 0.05~0.15 μm
Ag	0.1~1 μm

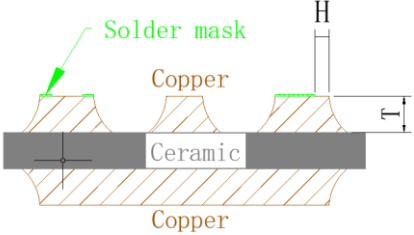
3.3. 粗化 Coarsening

项目 Items	参数 parameter
表面算术平均高度 (Sa) Surface Arithmetic Mean Height	0.1–0.65 μm
表面展开比 (Sdr) Surface Development Ratio	0.8 –2.74

优势：提高产品可靠性与性能，拥有更好的散热性能。

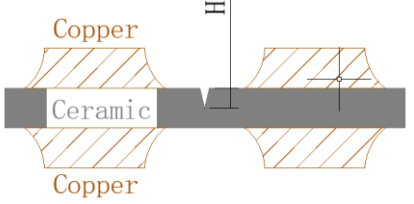
Advantages: Improving product reliability and performance, and having better heat dissipation performance.

3.4. 阻焊 Solder Mask

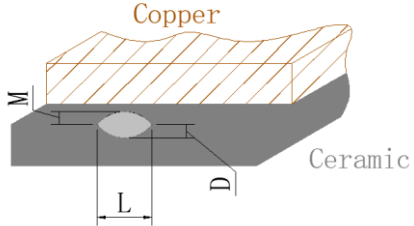
项目 Items	尺寸 Size	示意图 Diagram
线宽/线距 Line Width, Line Space	$\geq 0.2\text{mm}$	
位置公差 Tolerance	$\pm 0.15\text{mm}$	
厚度 Thickness	5~30 μm	
阻焊与铜边间距 (参考铜上部) Solder Resistance and Copper Edge Spacing (Refer to copper upper surface)	$T \leq 0.3, H \geq 0\text{mm}$ $T > 0.3, H \geq 0.1\text{mm}$	

3.5. 激光切割 Laser Cutting

3.5.1. 划线 Scribing

项目 Items	尺寸 Size	示意图 Diagram
深度 (H) Depth	$(40 \pm 10\%) \times \text{ceramic thickness}$	

3.5.2. 陶瓷崩边 Chip-off at Ceramic Edge

项目 Items	尺寸 Size	示意图 Diagram
长度 Length	$\leq 1 \times \text{ceramic thickness}$	
宽度 Width	$\leq 1/2 \times \text{ceramic thickness}$	
深度 Depth	$\leq 1/2 \times \text{ceramic thickness}$	

3.6. 其它设计特性 Other Design Features

项目 Items	单位 Unit	尺寸 Size	
母板尺寸公差 Master Card Dimension Tolerances	mm	(长&宽)* $\pm 1\%$	
单颗尺寸公差 Single Parts Dimension Tolerance	mm	$\pm 0.1 / +0.2 - 0.05 \text{mm}$	
翘曲度 Warpage	—	以首次试样为准 The first sample shall prevail	
总厚 Total Thickness Tolerance	mm	$\pm 0.1 \text{mm (DBC\&ALN)}$	$\pm 7\% (\text{Si}_3\text{N}_4)$
瓷片 Ceramic Thickness Tolerance	mm	$\pm 0.05 \text{(DBC)}$	$\leq 10\% * \text{ceramic thickness (AMB)}$
最大利用面积 Max Usable Area	mm	127*178	

外发文件