Production Report

Double-Sided Embedded Copper Block Board (Type A1)

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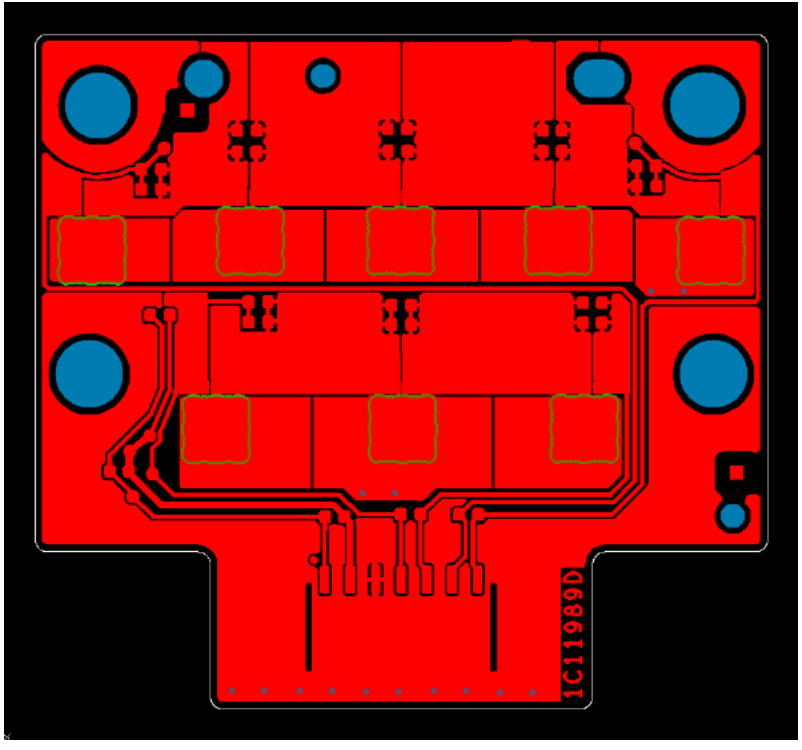
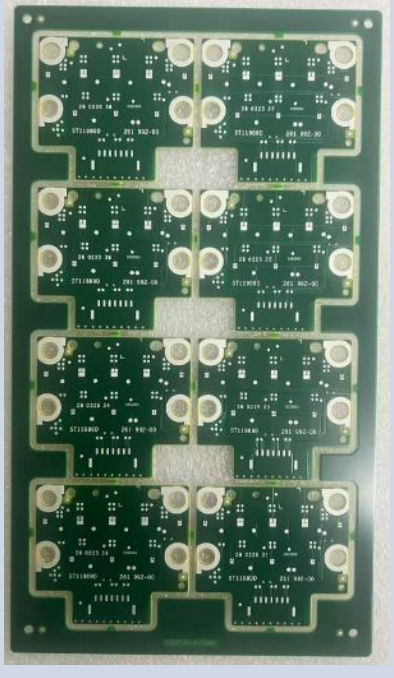
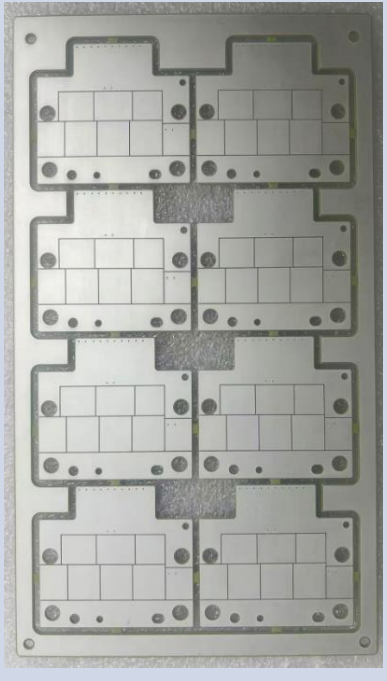
I. Product Basic Information Introduction & Showcase

1.1 Product Basic Information

Basic Product Information		
Product structure		Specification requirements
thickness	Finished Product	1.15mm±10%
Layer	Specification	2L
Size	Specification	Pcs Size：57.5*53mm Set Size：240*135mm Pnl Size：620*344mm
Material	Laminate	VT-481
	CORE	1.05mm 1/1oz（Copper Included）
	Silkscreen Ink	PSR-2000CE887M（Muted Green）
Hole Type	Via	Min 0.55mm
	Resin Plug	Yes（Resin-plugged hole with copper post）
Aspect Ratio	Specification	1.9：1
Finished Copper Thickness	Surface copper	≥52.9um
	Hole Copper	≥25um
Trace Width and Spacing	Outer Layer	0.3mm/0.3mm
Surface Finish	Immersion Tin	1.2±0.2um
Special Processes		1. Embedded Copper Block, Size:5*5mm； 2. Quantity:8/pcs，8pcs/set； 3. Resin-Filled Copper Block；



1.2 Finished Product Showcase

Top Side	Bottom Side
	

II. Key Challenges Identification & Capability Matching Analysis

2.1 Product Design vs. Factory Capability Analysis

Item	Product Requirements	Factory Capability	Match
Board Thickness	1.15mm+/-10%	Min0.4mm	Yes
Minimum Hole Diameter	0.55mm	min0.2mm	Yes
Hole Wall Copper Thickness	≥25um	≥25um	Yes
Trace Width/Spacing	0.3mm/0.3mm	0.076mm/0.076mm	Yes
Resin-Filled Holes (POFV)	Copper-Filled POFV	No Prior Experience	No
Solder Mask Thickness	Solder Mask Thickness at Trace Edge:5-55um Solder Mask Thickness at Trace Surface:10-55um	Solder Mask Thickness at Trace Edge > 5um Solder Mask Thickness at Trace Surface > 10um	Yes
Immersion Tin	Thickness:1.2+/-0.2um	0.8-1.4um	Yes

II. Key Challenges Identification & Capability Matching Analysis

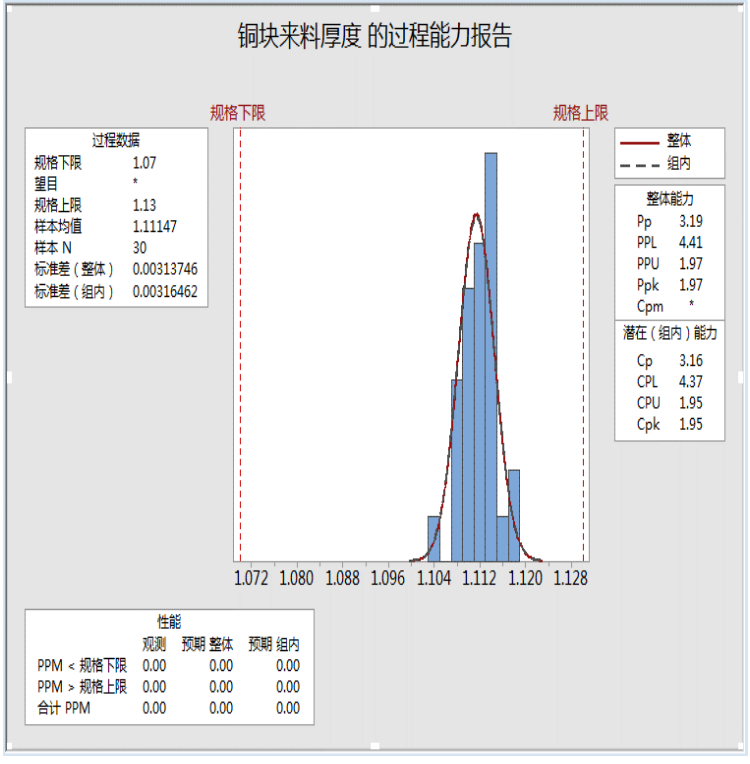
2.2 Key Challenge Control Plan

Critical and Challenging Projects	Process Control Scheme
Resin-Filled Copper Block	1. After milling FR-4 inner slots, apply pre-plating treatment to remove burrs before resin filling;
	2. Copper blocks require brown oxide treatment prior to insertion, using fixtures + tape masking for process control;
	3. For FR-4 inner slots, maintain 5mil single-side clearance from copper blocks with 1-2 protrusions (4×40mil) per edge;
	4. After milling FR-4 slots, apply heat-resistant brown tape to the bottom surface before placing copper blocks, then compress slightly and laser-drill vent holes;
	5. Vent holes should be designed at 0.1mm diameter, 0.45mm pitch, centered 0.08mm from copper block edges, with at least 1 hole per curved section;
	6. After laser drilling, perform 110℃×30min baking with vertical storage;
	7. Use vacuum stencil printing for resin filling, ensuring resin bleed-through at vent holes, with vertical storage during curing;
	8. After post-curing, remove bottom tape and perform ≤2 cycles of resin grinding, maintaining copper thickness while cleaning resin residue - manual touch-up permitted for localized areas.

III. Actual Product Processing Results

3.1 Copper Block Incoming Inspection -- Thickness

Item/Sample	Measured Values**mm**				
Copper Block Thickness	1.109	1. 114	1. 112	1. 112	1. 107
	1. 114	1. 111	1. 104	1. 114	1. 109
	1. 118	1. 110	1. 110	1. 117	1. 113
	1. 111	1. 113	1. 109	1. 112	1. 111
	1. 113	1. 109	1. 112	1. 108	1. 113
	1. 107	1. 116	1. 114	1. 114	1. 108
min	1. 104				
max	1. 118				
avg	1. 111				
R	0. 014				
Standard Specification	1. 10				
Tolerance	±0. 03				

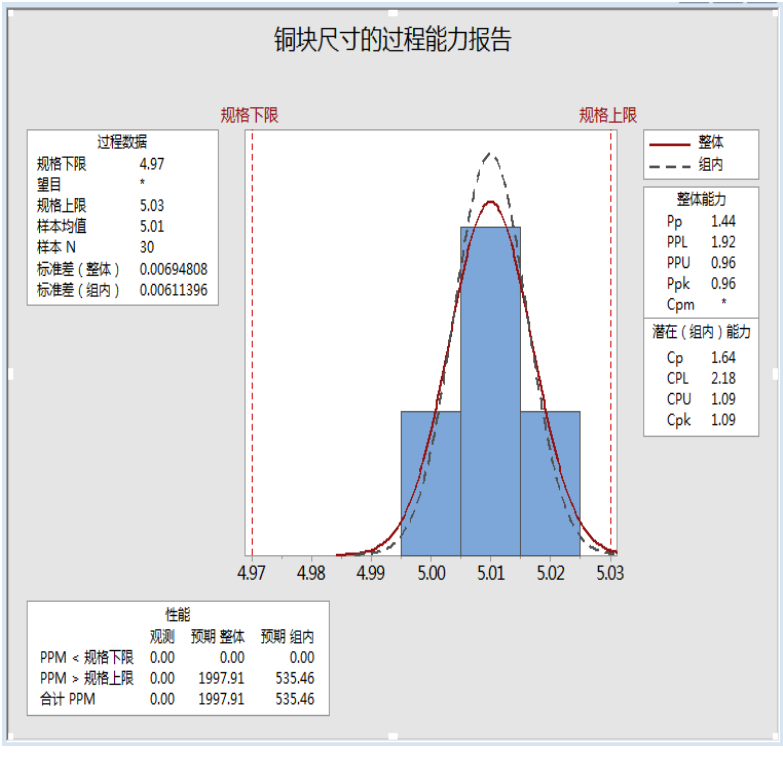


Note: Copper block incoming thickness is controllable within the required range, with a tendency towards the upper-middle range.

III. Actual Product Processing Results

3.1 Copper Block Incoming Inspection -- Dimensions

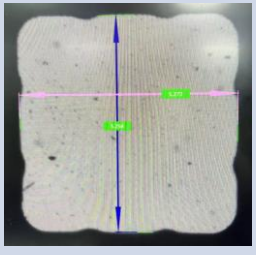
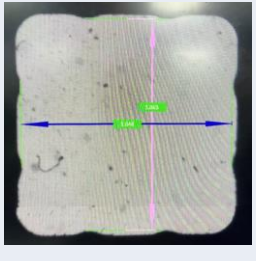
Item/Sample	Measured Values**mm**				
Copper Block Thickness	5.01	5.02	5.00	5.02	5.01
	5.01	5.01	5.01	5.02	5.00
	5.01	5.02	5.00	5.00	5.01
	5.01	5.01	5.02	5.00	5.02
	5.01	5.01	5.01	5.01	5.00
	5.02	5.00	5.01	5.01	5.01
min	5.00				
max	5.02				
avg	5.01				
R	0.02				
Standard Specification	5.00				
Tolerance	±0.03				



Note: Copper block incoming dimensions are controllable within the required range, with a tendency towards the upper-middle range.

III. Actual Product Processing Results

3.2 FR-4 Inner Slot Routing

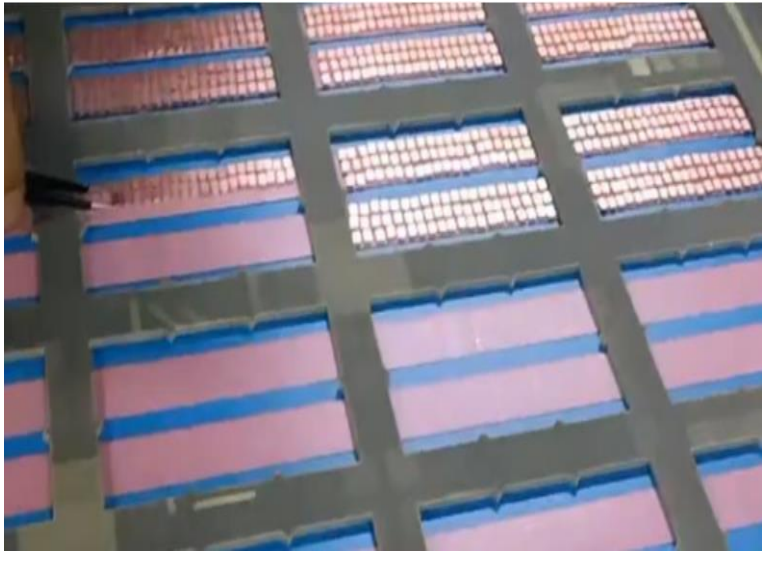
Item/Component	Specification(mm)	Tolerance (mm)	实测mm						图示
Square Slot Dimension	5.254	±0.075	5.273	5.254	5.259	5.26	5.268	5.319	 
Card Slot Dimension	5.05	±0.075	5.063	5.068	5.056	5.042	5.063	5.048	

Note: As copper block dimensions are controlled in the upper-middle range, the slot dimension lower control limit must exceed the maximum copper block size. Failure to do so will result in copper blocks failing to fit into the slots.

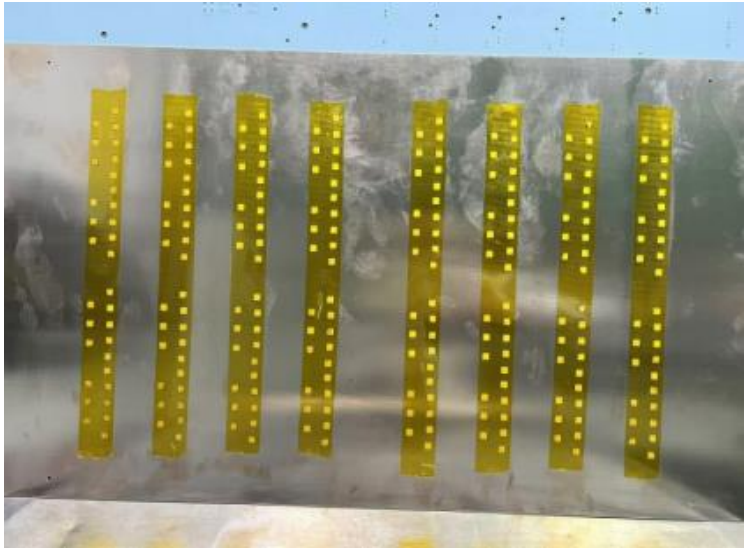
III. Actual Product Processing Results

3.3 Resin Filling of Copper Blocks

1) Prior to filling, copper blocks undergo brown oxide treatment. Treated blocks are then inserted into the slots. High-temperature-resistant brown tape is applied to the backside.



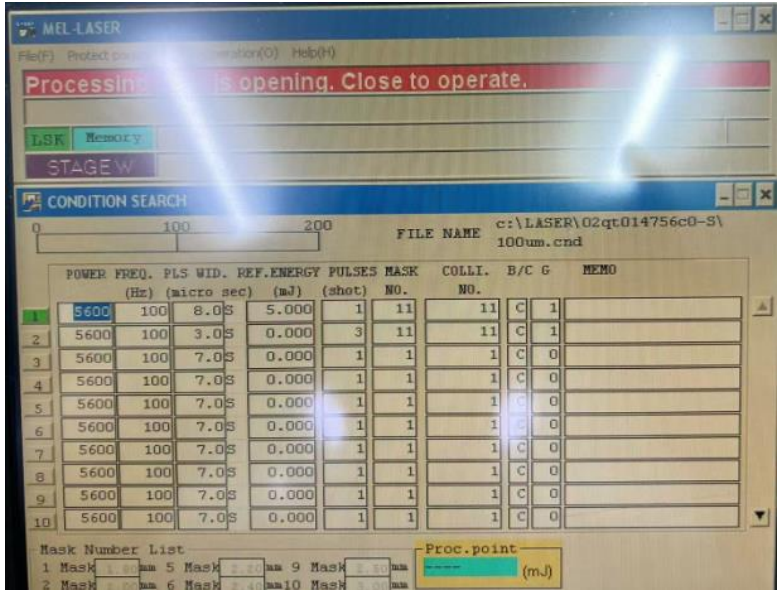
Copper Block Brown Oxide Fixture



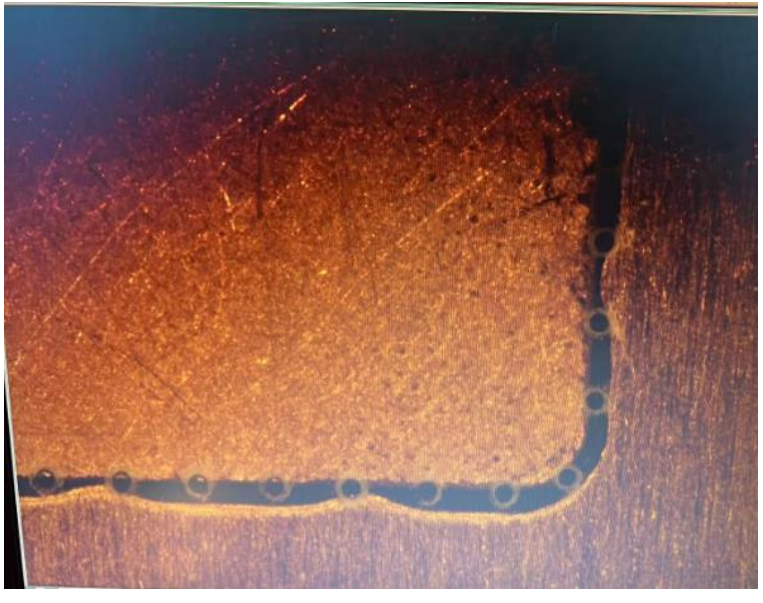
Tape Application Post Copper Block Insertion

3.3 Resin Filling of Copper Blocks

2) To facilitate resin filling into the gaps between the copper blocks and surrounding FR-4, laser-drilled vent holes are created in the tape after application.



Vent Hole Laser Parameters



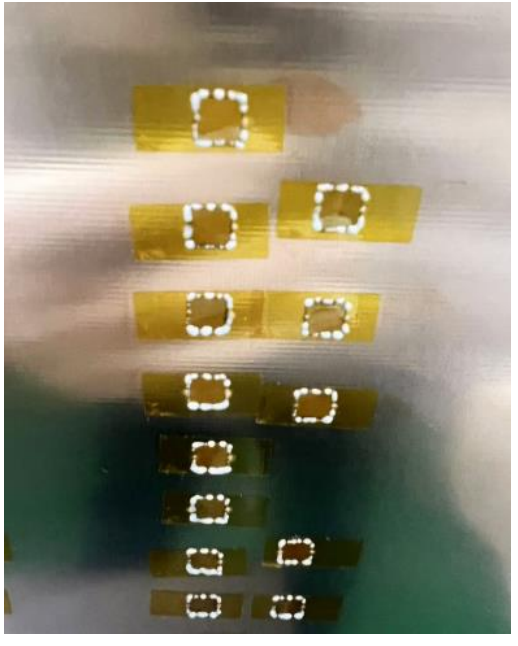
Vent Hole Effect Diagram

III. Actual Product Processing Results

3.3 Resin Filling of Copper Blocks

3) Screen-printed vacuum resin filling is performed (Shanrong IR-6P resin ink). Due to the small gap size, 4 filling passes are required at a speed of 30mm/s.

Resin Filling Parameters



Resin Bleed-Out Effect at Vent Holes

3.3 Resin Filling of Copper Blocks

4) After resin filling, panels must be placed flat in the oven (tape side down). Vertical placement is prohibited.

Stage/Step	Temperature (℃)	Time (min)
Stage 1	110	30
Stage 2	155	60

Note: Panel observation post-racking indicates horizontal placement risks panel warping due to copper block weight. Therefore, vertical racking is required.

III. Actual Product Processing Results

3.3 Resin Filling of Copper Blocks

5) Grinding is performed using sand belt + ceramic + non-woven abrasive brushes. Prior to grinding, the tape is removed. Tape removal pulls out resin beads formed at vent holes, creating pits which require re-filling and re-grinding.

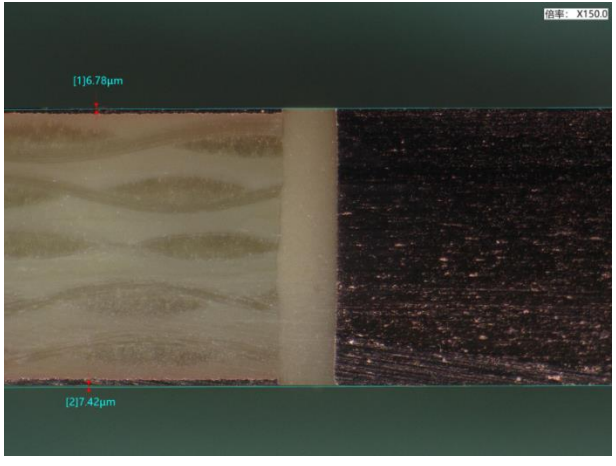
Post-Ceramic Grinding

Post Re-filling + Grinding

III. Actual Product Processing Results

3.3 Resin Filling of Copper Blocks

6) Flatness: Customer Requirement < 30μm



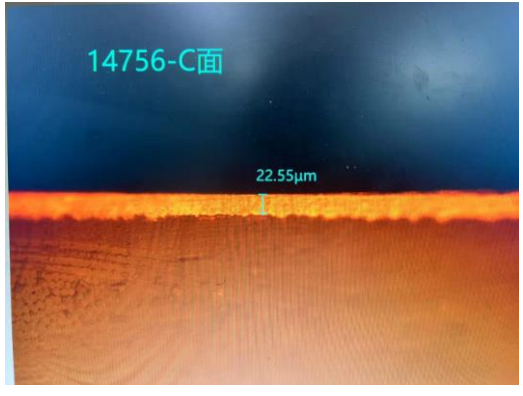
Note: Cross-section analysis post-grinding shows a height differential of approx. 6.78-7.42μm between the copper block and surrounding copper surface, meeting customer requirements.

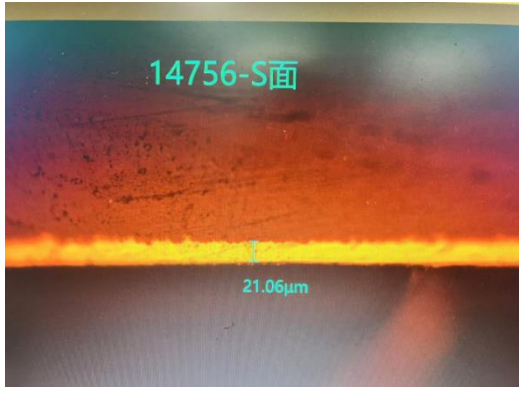
III. Actual Product Processing Results

3.3 Resin Filling of Copper Blocks

7) Copper Thickness Measurement

Serial Number	Substrate Copper Thickness (μm)	Measured Value (μm)						min	max	avg
1	35	23.60	22.97	23.67	23.47	22.48	22.88	21.99	25.7	23.6
2		22.37	22.31	23.38	24.98	22.60	24.26			
3		24.07	22.68	24.68	23.91	25.32	25.04			
4		24.55	25.23	24.03	25.70	24.45	25.17			
5		22.61	23.06	22.92	24.26	22.32	22.06			
6		23.57	23.64	24.44	23.94	21.99	22.11			





Notes:

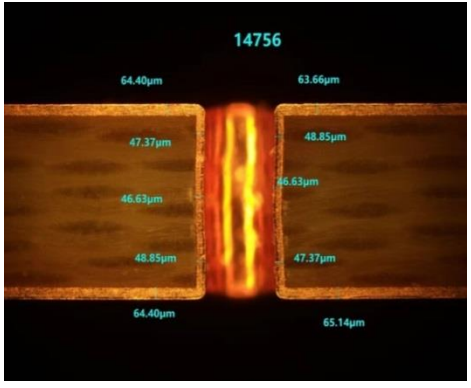
1. Post-grinding copper thickness measurement shows a variation of 9.3-13.0μm, averaging 11.4μm.
2. For similar future products, design copper thickness before resin grinding to 1oz.

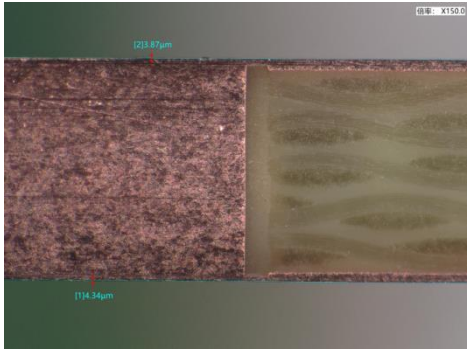
III. Actual Product Processing Results

3.4 Plating

Product Requirement: Final Surface Copper Thickness 52.9 - 87.9μm (Internal Plating Control: 58 - 70μm). Hole Copper Requirement: 25 - 55μm.

Index	Measured Value (μm) (CMI)						min	max	avg	Range
1	64.00	64.67	68.57	67.86	63.03	64.11	63.03	71.82	67.89	8.79
2	70.16	69.29	69.98	70.33	69.63	67.22				
3	66.39	67.22	68.08	68.61	67.50	67.66				
4	69.12	67.06	70.91	71.73	69.63	66.15				
5	65.80	65.23	70.64	71.45	63.31	65.68				
6	66.58	70.42	71.82	70.42	66.19	67.42				



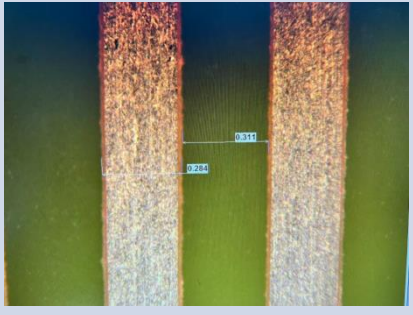
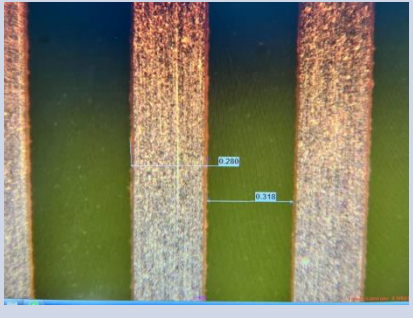


Notes:

1. Post-plating CMI measurement confirms surface copper thickness meets requirements.
2. Cross-section at copper block location shows a copper surface height differential of 4.34μm, meeting customer requirement (<30μm).

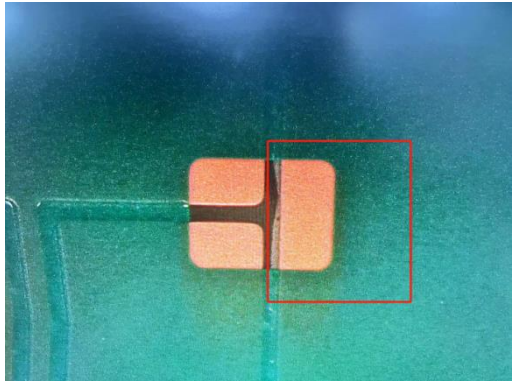
III. Actual Product Processing Results

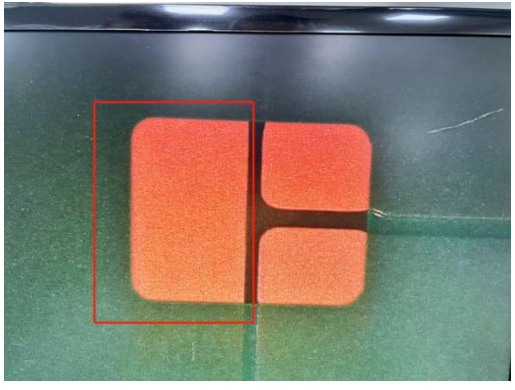
3.5 Circuit Imaging

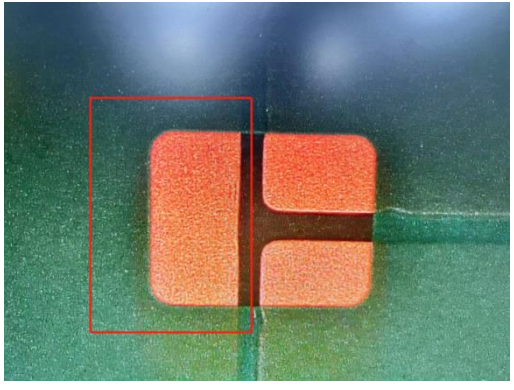
Item	Specification (mm)	Tolerance (mm)	Measured Value (mm)				Result	Illustration/Diagram
Line Width	0.3	±0.03	0.284	0.280	0.280	0.289	合格	
			0.278	0.273	0.282	0.275		
Line Spacing	0.3	±0.03	0.311	0.318	0.315	0.311	合格	
			0.318	0.323	0.315	0.322		
Min			0.273				/	
Max			0.323				/	
Avg			0.298				/	

3.6 Solder Mask

Finished solder mask effect at embedded copper block locations is shown below:







III. Actual Product Processing Results

3.7 FQC Yield Statistics

Product Yield Summary:

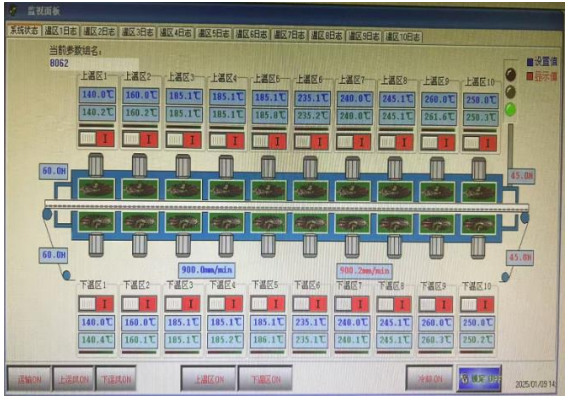
Process	Qualified Panel			Scrap Panel		Note
	PNL	SET	PCS	set	pcs	
Material Feeding	6	24	192	0	0	/
Drilling	3	12	96	12	96	Employee Drilled 3 Panels in Reverse
Outer Layer Circuitry	3	9	72	3	10	Scrap Reason: 8pcs/1set Sliced, 2pcs with Poor Resin Filled Holes
Final Quality Control	/	9	72	0	0	

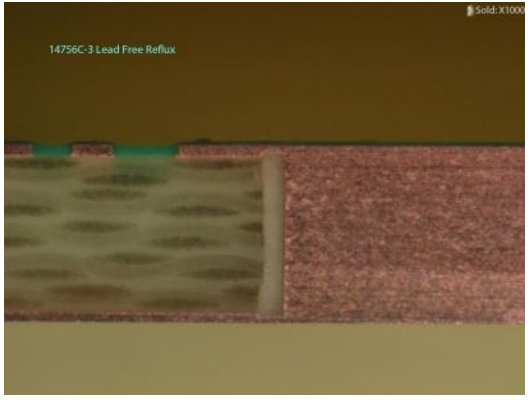
Summary: Based on process tracking results, excluding 3 PNLs scrapped due to drill reversal (human error), the panel (set) yield is 9/12 = 75%, and the unit (pcs) yield is 86/96 ≈ 89.6%.

III. Actual Product Processing Results

3.8 Reliability Testing

Test Instrument	Test Method	Test Condition	Test Standard	Inspection Item	Test Result			Judgment
Reflow Soldering Tester	Referenced IPC-TM-650 2.6.8 and Reflow Soldering Tester Manual	A: Select corresponding temperature profile, 8062 parameter profile; B: Routine pass three times	A: No delamination, blistering, or plate bursting anomalies; B: Sliced copper block position, quality meets requirements	Appearance	No blistering, delamination, or discoloration	No blistering, delamination, or discoloration	No blistering, delamination, or discoloration	Pass
				Slice	No corner cracking, fracture, or plate bursting	No corner cracking, fracture, or plate bursting	No corner cracking, fracture, or plate bursting	Pass





3.8 Reliability Testing

Resistance change measured at the exposed copper block pads after 3 lead-free reflow cycles:

Test Item		Resistance (mΩ)							
		Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8
Copper Block Resistance	Before IR	6.77	6.59	6.49	6.63	6.58	6.52	6.57	6.57
	Post-IR (3 Times)	6.55	6.36	6.42	6.53	6.54	6.39	6.07	6.60
Change Value		0.22	0.23	0.07	0.1	0.04	0.13	0.05	0.03
Change Rate (%)		3.25%	3.49%	1.08%	1.51%	0.61%	1.99%	0.76%	0.46%

IV. Product Production Summary

Preliminary conclusions based on this sample production run:

1. Copper block area reliability meets requirements: No delamination, blistering, or cracking observed.
2. Height differential between copper block and surrounding copper surface meets the <30μm requirement.
3. Other Engineering Design Recommendations:

1) Routing Slot Location Hole Drill File: Apply pre-scaling coefficient: +0.01% in both X and Y directions. Ensure the drill file includes panel ID holes at the board edge.

TGZ Data: Maintain scaling coefficient at 1:1 (no pre-stretch).

2) Optimize the original resin filling process to double-sided filling. Refer to the updated Control Plan for details.