

Test Report

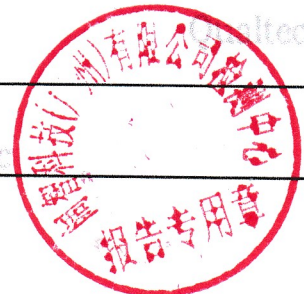
Sample Name : PCB

Submission Unit : Victory Giant Technology(HuiZhou)Co.,Ltd

Report NO. : REP220300400038

Contract NO. : KZ22030040

Total pages : 33pages



TO: Victory Giant Technology(HuiZhou)Co.,Ltd

ADD: Hangcheng Technology Park, Xinqiao Village, Danshui Subdistrict, Huiyang District, Huizhou, Guangdong

Report No. :	REP220300400038
Release Date :	March 9, 2022
Testing Centre of Guangzhou Qualtec Co.,Ltd	
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Test Report

1. Test title:	Burning plate short circuit analysis				
2.Sample acceptance date:	2022-03-01	3. Test date	Start: 2022-03-02 End: 2022-03-08		
4. Sample information:	PCBA 1PCS				
5. Sample source:	Customer's Samples				
6. Test requirements:	NO.	Test Items	Test Method	Use of Equipment	Remarks
	1	Surface observation	/	SN-10H LV100D-U	/
	2	X-Ray	/	XD7500VR Phoenix xlaminer	/
	3	Thermal imaging observation	GB/T 28706-2012	T530	/
	4	Resistance measurement	/	289C	/
	6	Microsectioning	IPC-TM-650 2.1.1	L-5020	/
	7	Sectional Morphology Observation	JY/T 010-1996	JSM-6010LA	/
	8	Analysis of elements in section	GB/T 17359-2012	JSM-6010LA	/
7.Environment conditions:	Temperature: 17 ~ 25 °C Humidity: 40 ~ 70 %RH				
8. Test results:	8.1、Observe the burned positions of the TOP surface and BOTTOM surface of the sample. The burned areas on the top surface have blackened to varying degrees and have no obvious characteristics; There is obvious blackening between the associated networks on the BOTTOM surface (near the via position of network A). 8.2、X-ray observation was conducted on the sample burn loss position, and no obvious abnormal phenomenon was found between A/B network. See P8。 8.3、Thermal infared imaging observation was carried out on the burned position, With 0.3A current applied to A/B network, the thermal infared imaging				

Qualtec	viewer found the heated short point between the networks. See P9.
Qualtec	8.4、According to the thermal imaging picture of the top surface of the burning position, it is found that the hot spot is located in the via area of network A, indicating that the short point is located in the via area of network A。 See P10.
Qualtec	8.5、according to the thermal imaging picture of the bottom surface of the burning position, it is found that the hot spot is located in the via area of network A, indicating that the short-circuit point is located in the via area of network A. See P11.
Qualtec	8.6、Compared with the actual picture of PCB layers, combined with the appearance characteristics of burn loss, thermal imaging observation results and PCB graphic structure, it is speculated that the short-circuit point of A/B network is located between the hole position of A network and the inner layer position of B network. See P12.
Qualtec	8.7、The surface observation of the sample TOP surface and BOTTOM surface after removing the solder ink was carried out, and it was found that the substrate between network A and network B was blackened, and the copper in the outer layer was relatively intact, and no copper melting was found. See P13.
Qualtec	8.8、The resistance value before and after the solder mask ink was measured at the burned position of the sample. The resistance value before removing the solder mask ink was 3.71Ω , and the resistance value after removing the solder mask ink was 0.61Ω , indicating that the short circuit point still exists after removing the solder mask ink. See P14.
Qualtec	8.9、Thermal imaging observation was carried out on the sample burning position after the removal of solder blocking ink, and 0.9A current was applied to A/B network to make the short-circuit point between networks heat up, and thermal imager was used to observe; On the next page. See P15.
Qualtec	8.10、Thermal imaging observation after the removal of solder blocking ink on the TOP surface of the burned position showed that the hot spot was still located in the hole area of NETWORK A, indicating that the short circuit point was located in the hole area of network A. See P16.
Qualtec	8.11、Thermal imaging observation after the removal of solder blocking ink on the BOTTOM surface of the burned position showed that the hot spot was still located in the hole area of NETWORK A, indicating that the short circuit point was located in the hole area of network A. See P17.
Qualtec	8.12、Measure the resistance value of the burned position of the sample after plane grinding, and the measured resistance value is 6.46Ω . After grinding off the L1 layer, the short-circuit point still exists. See P18.
Qualtec	8.13、After the thermal imaging observation of the BOT surface of the burned-out position of the sample was carried out, it was found that the hot spot was still located in the via area of the A network. After grinding off L1 layer, the short circuit in the via area of the A network still existed. See P19.
Qualtec	8.14、X-Ray observation of the burnt-out position of the sample after plane grinding, and it is found that there are suspected that there were suspected metal debris in the of L2 dielectric layer. See 20.
Qualtec	8.15、Surface observation after plane grinding was carried out on the burned-out position, and it was found that there was residual copper phenomenon at position 1, position 2, and position 4 of the base material between the A

Qualtec	network and the B network. See P21.
Qualtec	8.16、SEM observation was made on the surface of the burnt loss position after plane grinding, and it was found that there was copper residue in the base material position between NETWORK A and network B. See P22.
Qualtec	8.17、Observe the burned position after plane grinding. The outline of the burned position is similar to that of the inner copper. See P23.
Qualtec	8.18、measure the resistance value of the burned position of the sample after plane grinding. After grinding off the L4 layer, the short-circuit point still exists, and the measured resistance value is 28.75 Ω . See P24.
Qualtec	8.19、After plane grinding of the sample burning position, the resistance value between position 1 ~ position 12 and network B was measured respectively. The resistance value of position 3 was the lowest, 187.19 ω . After grinding off L3 layer, the short circuit point still existed, and L1/L4 layers were all ground off, indicating that the short circuit point was located in L2 layer, and position 4 had the most serious burning loss. See P25.
Qualtec	8.20、the metallographic observation of the section after removing the solder resist ink at the burned position shows that the substrate at the core plate position is carbonized, and there is copper melting at the carbonized position of the core plate substrate. Continue on the next page. See P26.
Qualtec	8.21、the metallographic observation of the section after removing the solder resist ink at the burned position shows that there are cracks and residual copper on the core plate, and there is copper melting at the carbonized position of the core plate substrate. See P27.
Qualtec	8.22、SEM observation of the section after removing the solder resist ink at the burned position shows that the substrate at the core plate position is carbonized, and there is copper melting at the carbonized position of the core plate substrate. Continue on the next page. See P28.
Qualtec	8.23、SEM observation of the section after removing the solder resist ink at the burned position shows that the core plate has penetrating cracking and residual copper. See P29.
Qualtec	8.24、EDS analysis of the section of the burned position after the removal of welding ink, C, O, Si, Cu, Br elements were detected in the copper melting position, and C, O, Si, Ca, Br elements were detected in the carbonization position of the base material. See P30.
Qualtec	8.25、EDS analysis of the section of the burned position after the removal of welding ink, C, O, Si, Ca, Cu, Br elements were detected in the copper melting position, and C, O, Si, Ca, N, Cu, Br elements were detected in the carbonization position of the base material. See P31.
Qualtec	8.26、Description: EDS analysis of the cross-section after removing the solder mask thick film at the burn-out position, C, N, O, Si, Ca, Cu, Br elements were detected at the residual copper position, and C, O, Si, Ca were detected at the carbonization position of the substrate, Br element. See P32.
Qualtec	8.27、Inspection after micro sectioning with same pattern of others location, without found abnormal, space between innerlayer and PTH was 222.033 ~ 233.359 μm (meet the requirements), roughness is 5.638 μm and wicking is 69.815 μm . See P33.

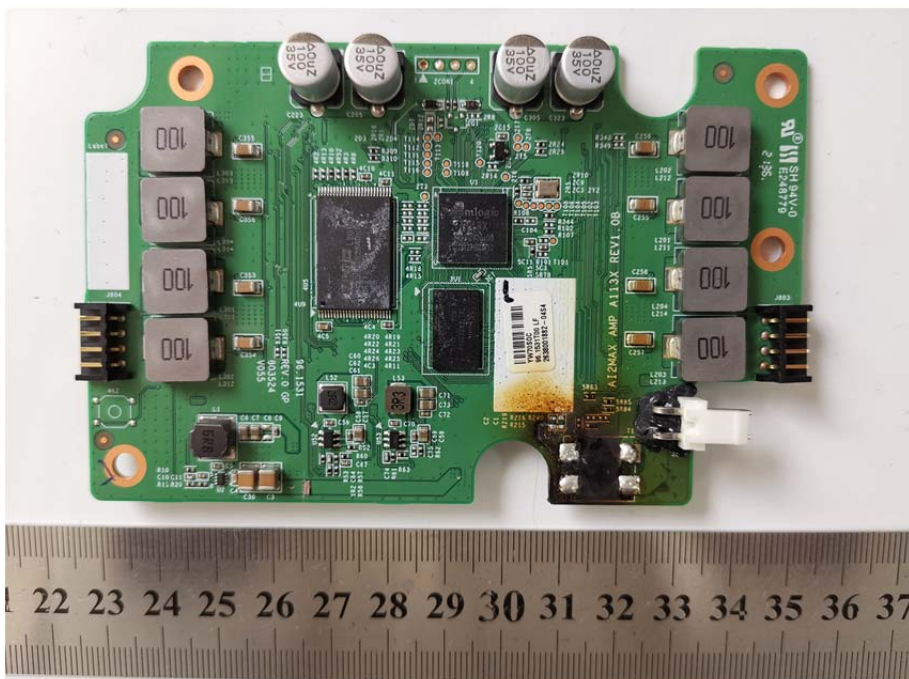
9. analysis:	Based on the analysis, it is speculated that the main reasons for this failure are as follows: 1、nspection the specimen with X-ray detection and thermal image, combined with the appearance characteristics of burn area, PCB stack-up and pattern, so we're speculated that the short area of A/B network is located between the PTH of A network and the inner layer of B network. 2、 After dissolve solder mask, visual inspection the specimen and take resistance measurement, found out the external copper was intact and without fusion, the resistance is 3.71Ω before dissolve solder mask and 0.61Ω after, so we can be determined that the short failure point still exist. Then applied 0.9A current to A/B network for heat the short area, thermal image showed the fail point locate PTH of A network. 3、 ake resistance measurement after horizontal grind, the short failure point still exist even if removal L1/L4/L3, so the failure location at L2. X-ray observation showed that there were suspected metal debris in the of L2 dielectric layer. After SEM inspection, found there was residual copper between the A network and B network. 4、 With vertical cross section and SEM inspection, found dielectric layer carbide after burning and there was fusion copper inside. EDS detected copper element at dielectric layer. 5、 Inspection after micro sectioning with same pattern of others location, without found abnormal, space between innerlayer and PTH was 222.033 ~ 233.359μm(meet the requirements), roughness is 5.638μm and wicking is 69.815μm. After FA, we're speculated that the cause of this failure is that conductive material contains copper between the PTH of A network and GND of B network in L2 dielectric layer, which leads to A/B network short failure, thus causing this burning board issue.				
10. proposal:	Recommendations: 1. Confirm the quality of the inner layer pattern after etching. 2. Check the cleanliness of the surface before the PCB lamination process.				
11. Notes: Nothing.					
12 .Tester date	刘红全 March 9, 2022	Auditor date	新连峰 March 9, 2022	Approver Date	哈斯格司乐吐 March 9, 2022

Statement:

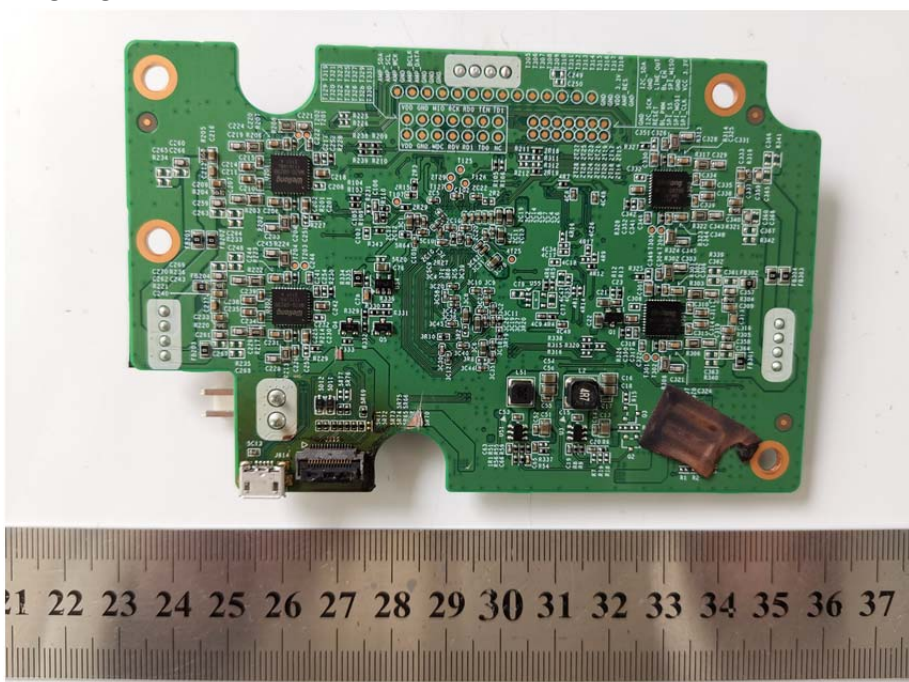
- ①. The test report is invalid without the signature of the approver and the special seal of the "Test Center" report. The test results in this report are only responsible for the tested samples.
- ②. Without the permission of the testing center, the contents of the report shall not be reproduced (except full-text reproducing); if necessary, an application shall be submitted to the testing center in formal written form.

Overall appearance picture

TOP



BOTTOM



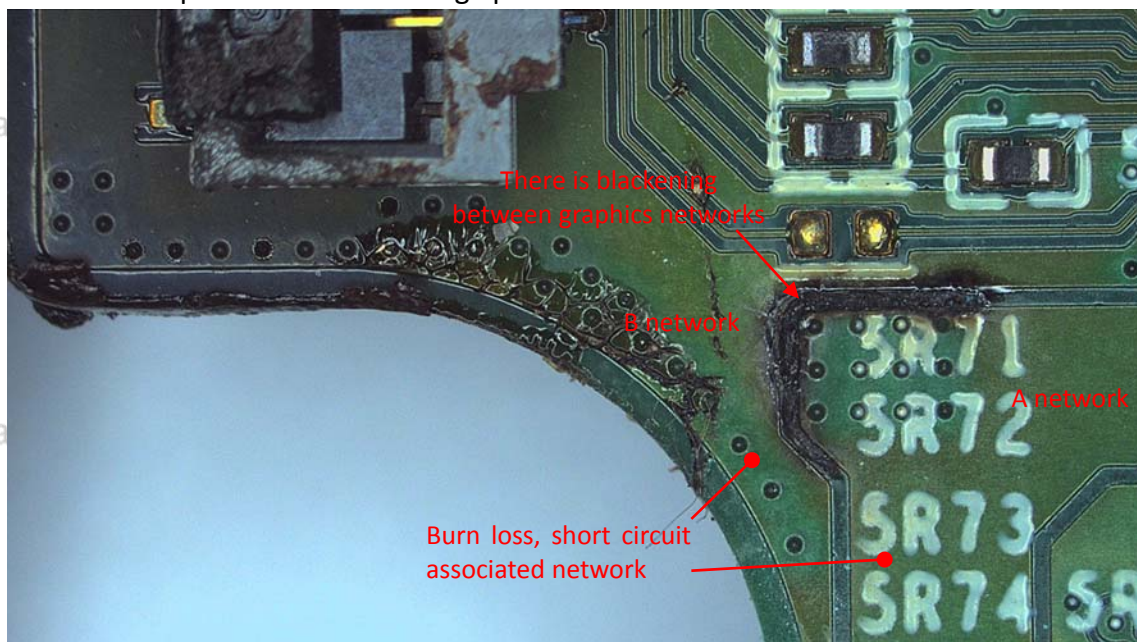
Description : Sample appearance picture.

Surface observation at burning position

Observation picture of burn damage position on TOP surface



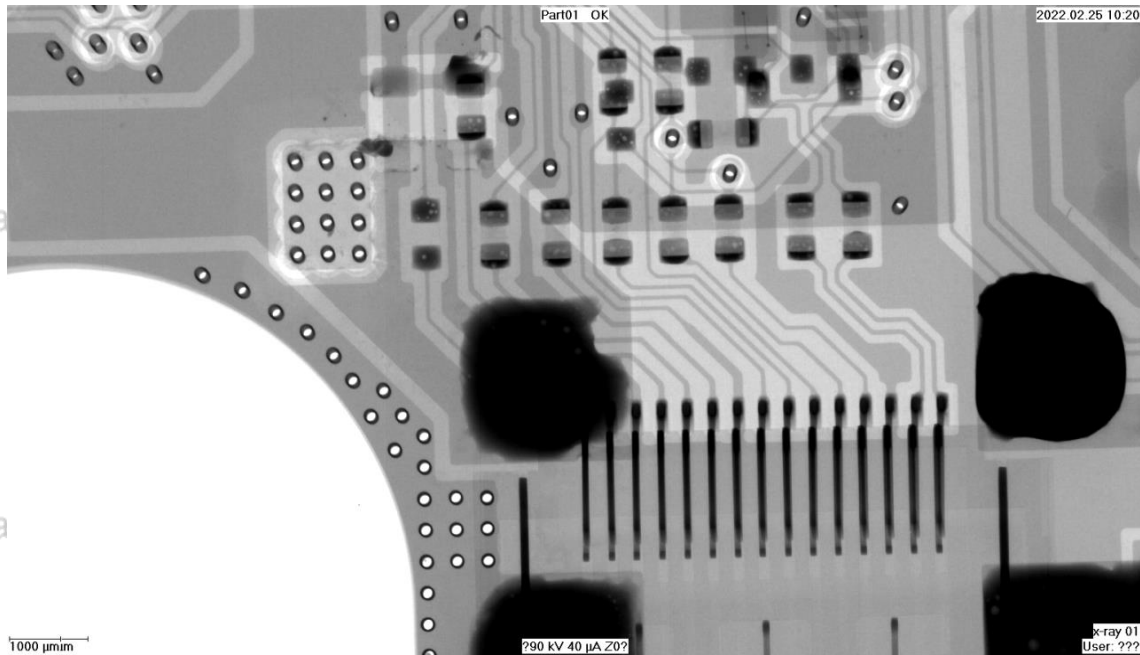
Observation picture of burn damage position on Bottom surface



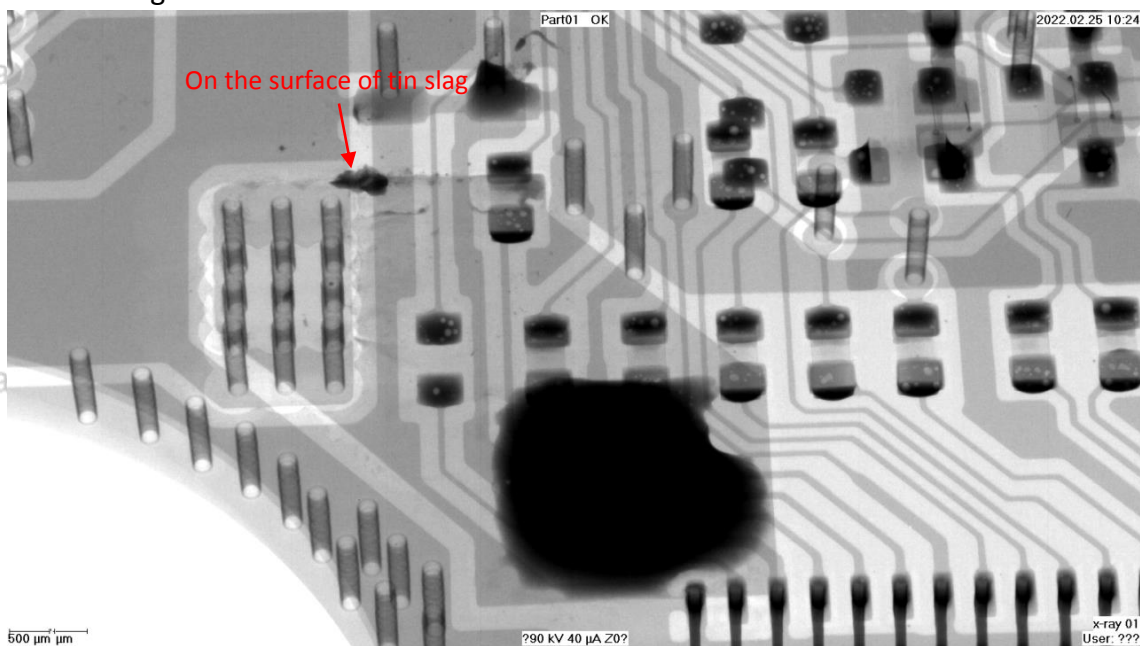
Description : Observe the burned positions of the TOP surface and BOTTOM surface of the sample. The burned areas on the top surface have blackened to varying degrees and have no obvious characteristics; There is obvious blackening between the associated networks on the BOTTOM surface (near the via position of network A).

X-ray observation of burn loss position

Vertical observation



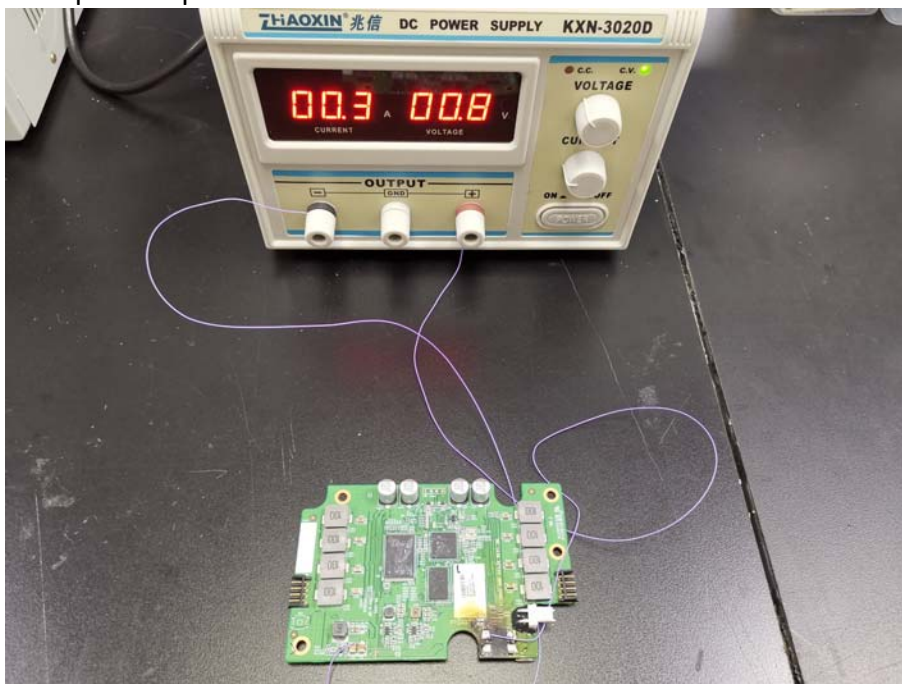
Tilt 30 degrees for observation



Description : X-ray observation was conducted on the sample burn loss position, and no obvious abnormal phenomenon was found between A/B network.

Thermal imaging observation

Test process picture

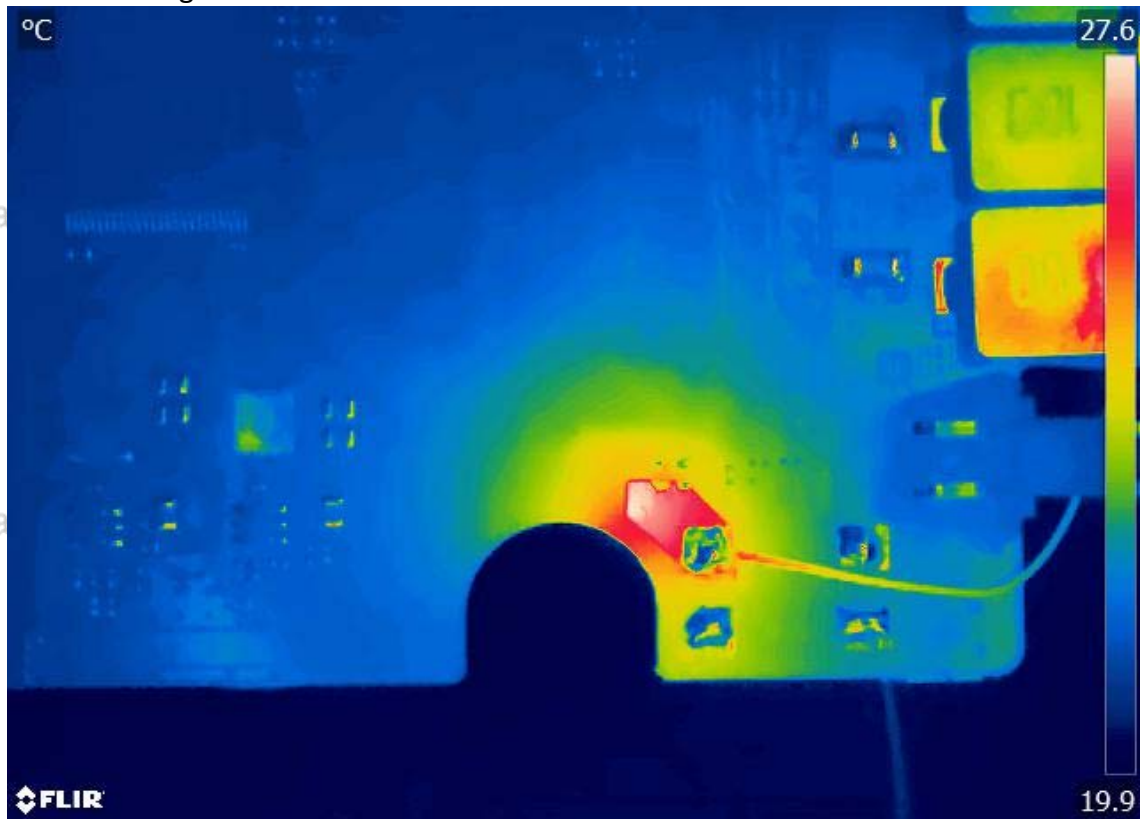


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Description : Thermal imaging observation was carried out on the sample burning loss position, and 0.3A current was applied to A/B network to make the short-circuit point between the networks heated, and thermal imager was used to observe; On the next page to continue.

Thermal imaging observation

Thermal image of TOP surface



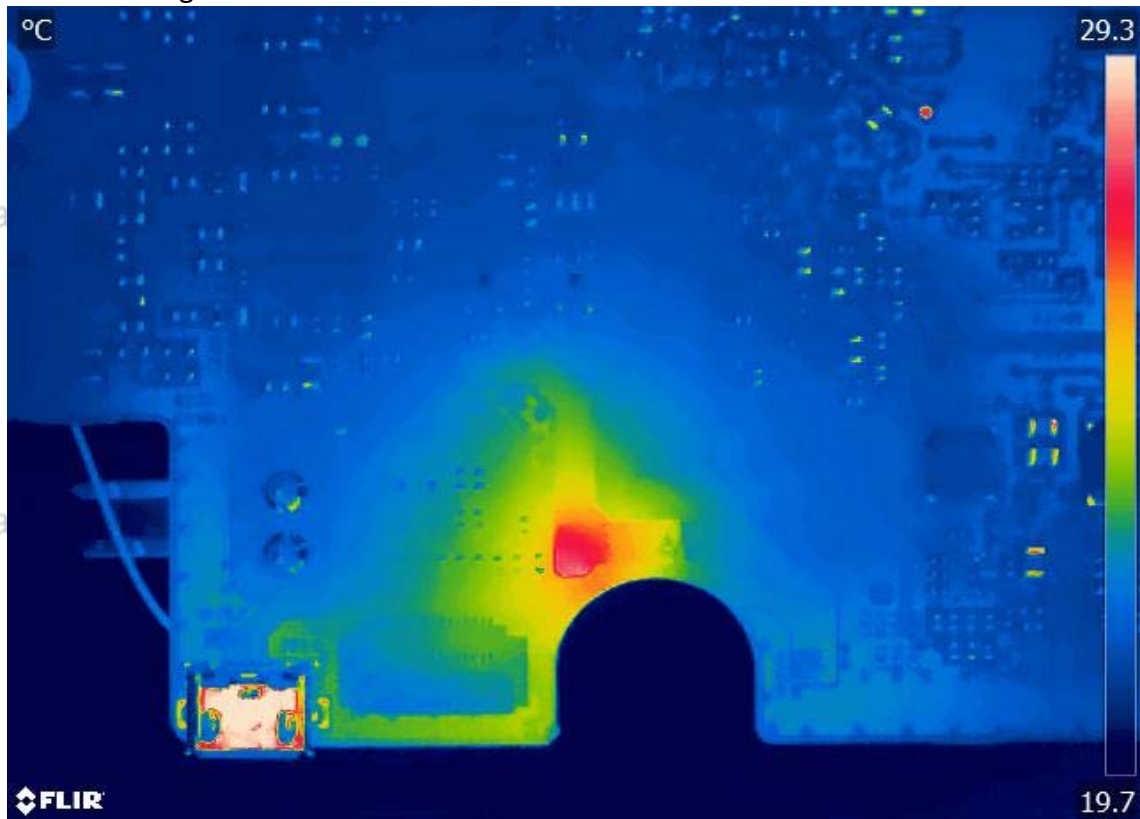
Corresponding object picture



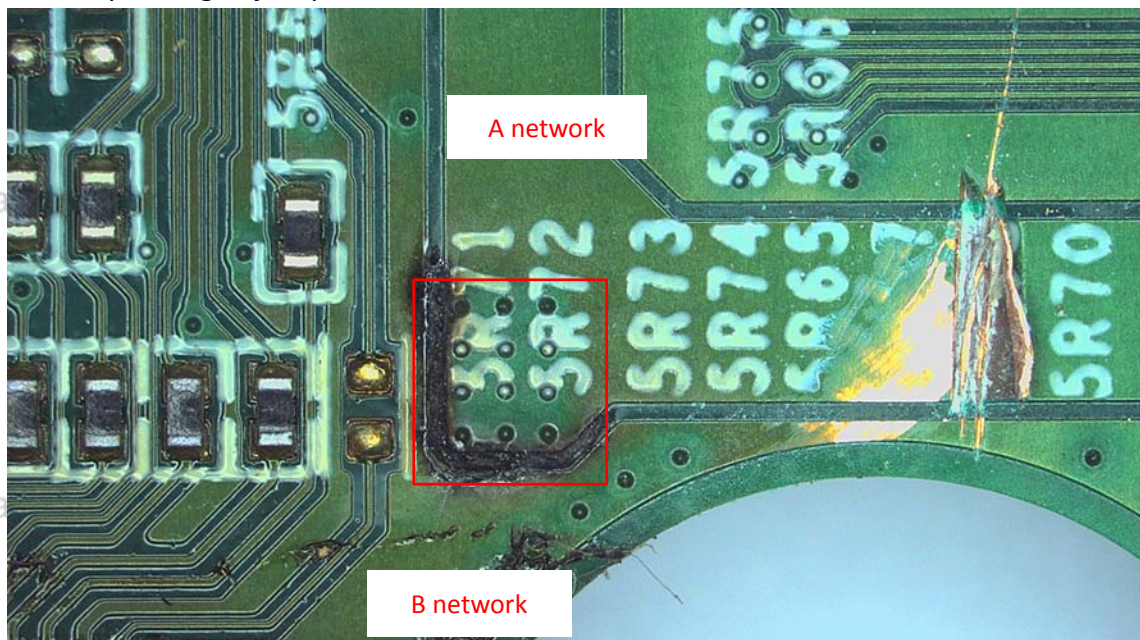
Description : according to the thermal imaging picture of the top surface of the burning position, it is found that the hot spot is located in the via area of network A, indicating that the short-circuit point is located in the via area of network A.

Thermal imaging observation

Thermal image of Bottom surface



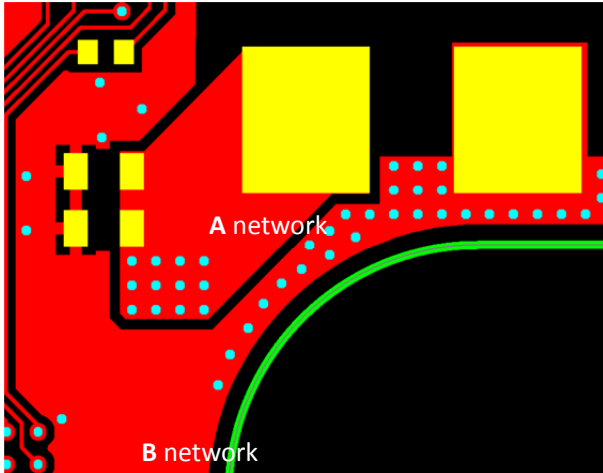
Corresponding object picture



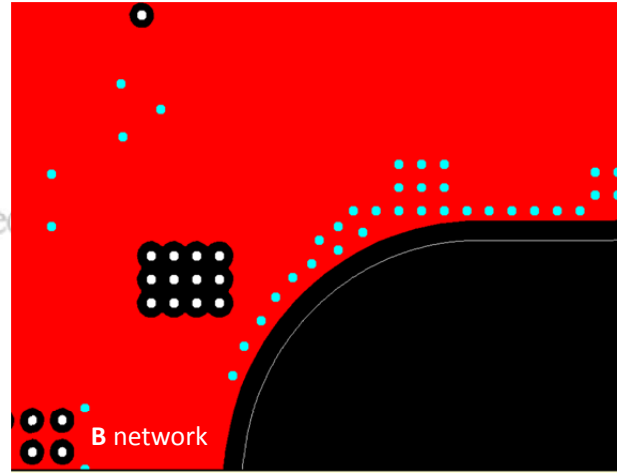
Description : according to the thermal imaging picture of the bottom surface of the burning position, it is found that the hot spot is located in the via area of network A, indicating that the short-circuit point is located in the via area of network A.

Comparison between PCB layer graphics and physical drawings

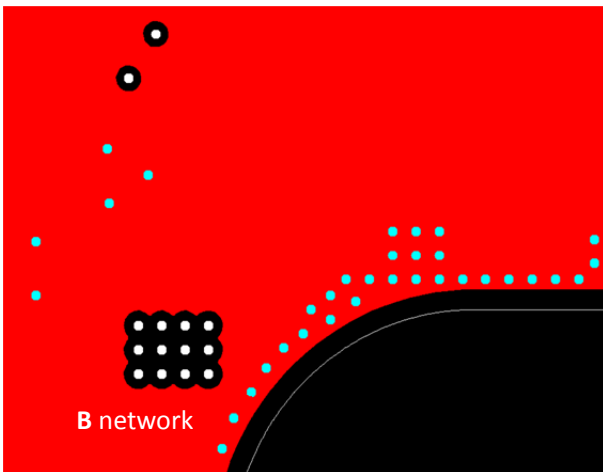
The TOP layer of graphics



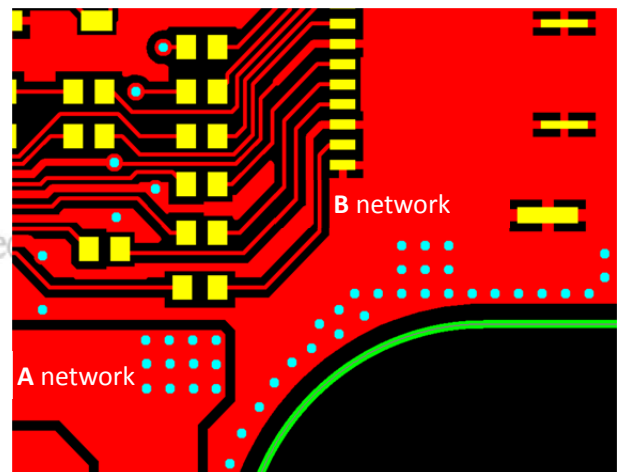
L2 layer graphics



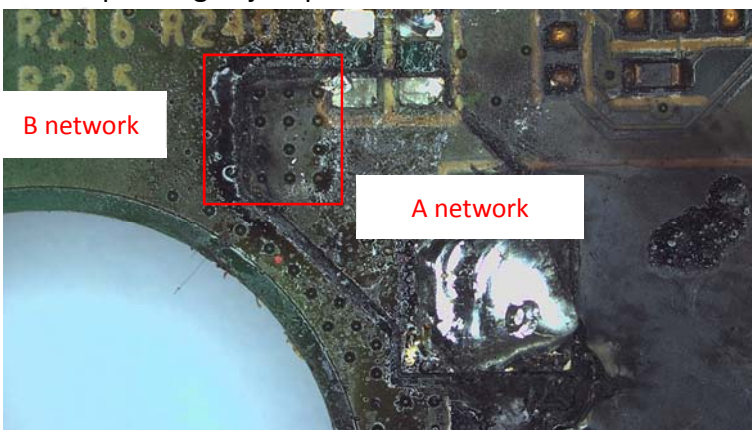
L3 layer graphics



The BOTTOM layer of graphics



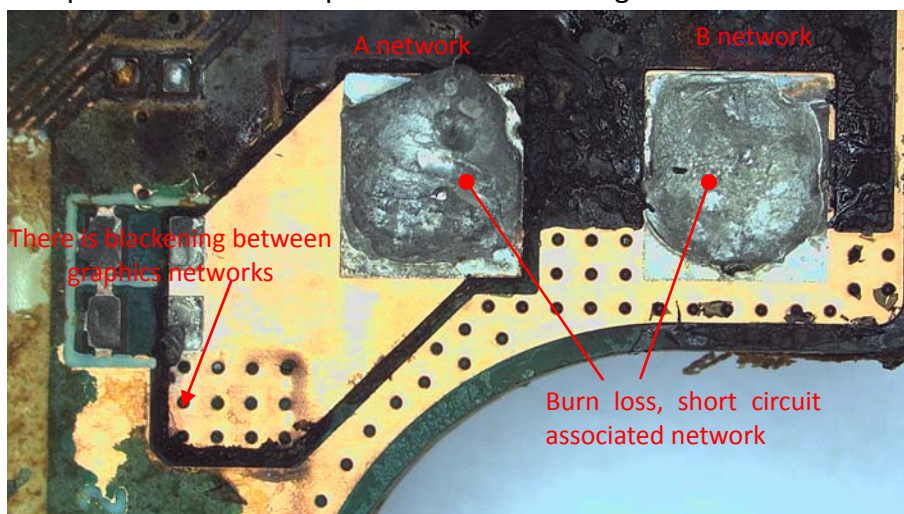
Corresponding object picture



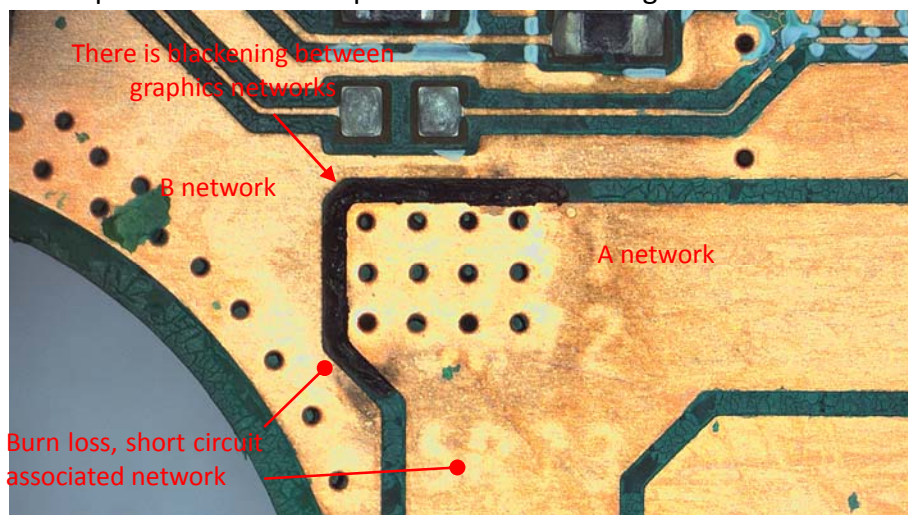
Description : Compared with the actual picture of PCB layers, combined with the appearance characteristics of burn loss, thermal imaging observation results and PCB graphic structure, it is speculated that the short-circuit point of A/B network is located between the hole position of A network and the inner layer position of B network.

Surface observation after removing solder mask ink at burned position

Observation picture of burn loss position after removing Solder mask on TOP surface



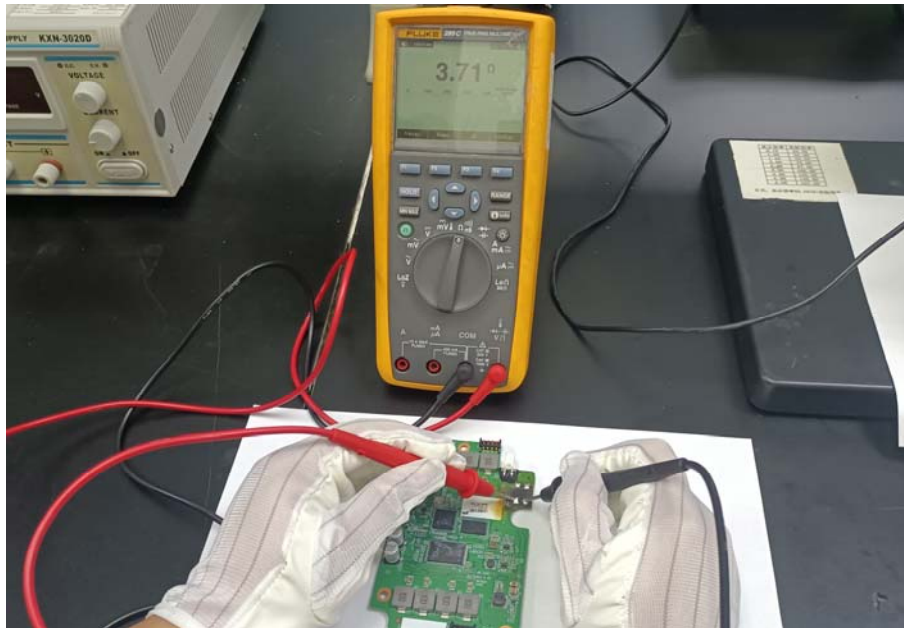
Observation picture of burn loss position after removing Solder mask on BOTTOM surface



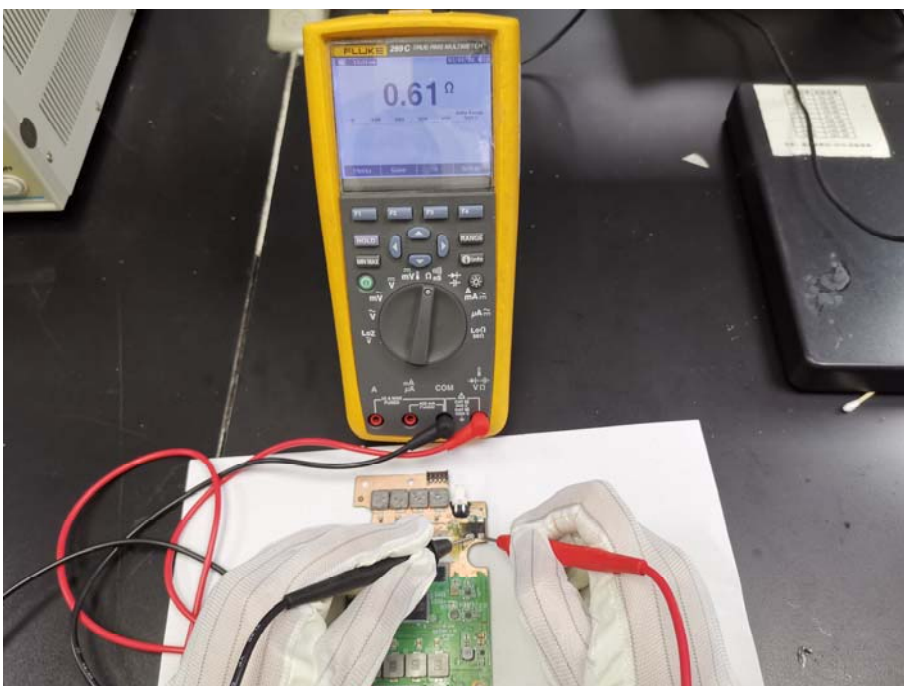
Description :The surface observation of the sample TOP surface and BOTTOM surface after removing the solder ink was carried out, and it was found that the substrate between network A and network B was blackened, and the copper in the outer layer was relatively intact, and no copper melting was found.

Comparison of resistance measurement before and after removing solder ink

Resistance test picture before removing solder ink



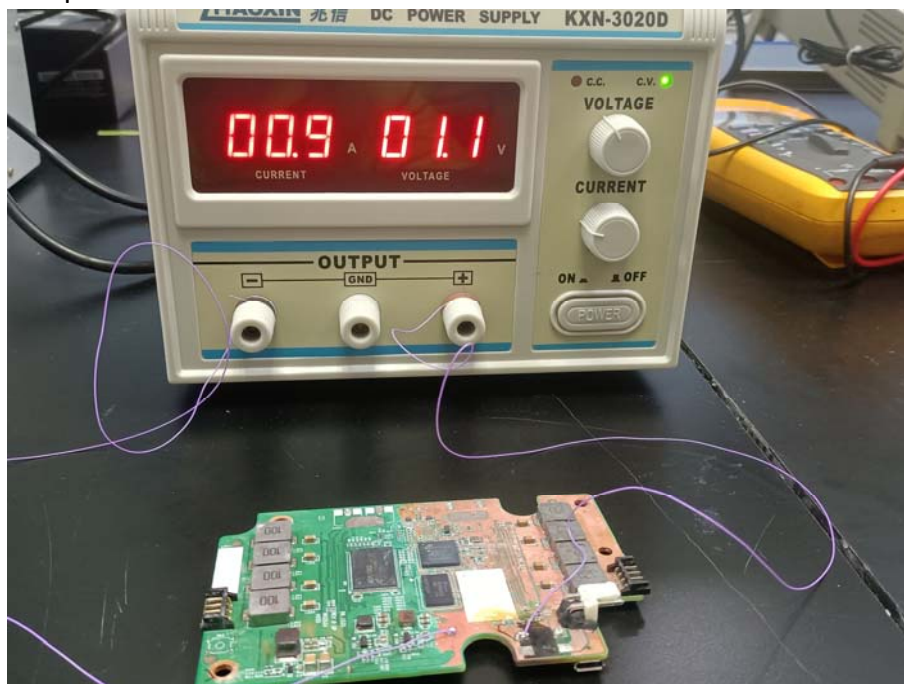
Resistance test picture after removing solder ink



Description : The resistance value before and after the solder mask ink was measured at the burned position of the sample. The resistance value before removing the solder mask ink was 3.71Ω , and the resistance value after removing the solder mask ink was 0.61Ω , indicating that the short circuit point still exists after removing the solder mask ink.

Thermal imaging observation after removal of solder blocking ink

Test picture

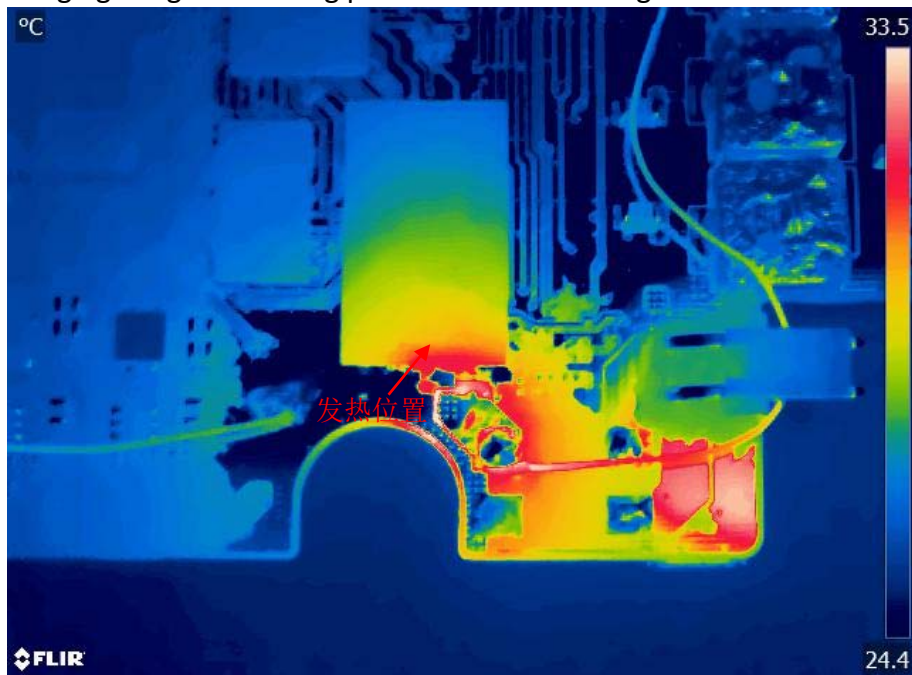


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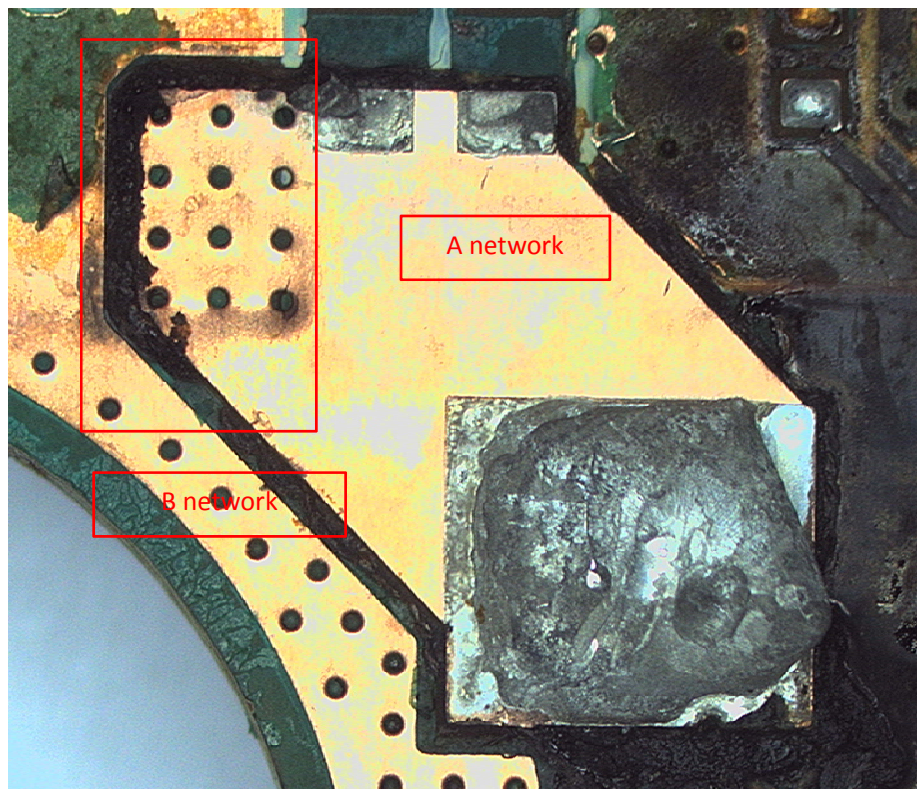
Description :Thermal imaging observation was carried out on the sample burning position after the removal of solder blocking ink, and 0.9A current was applied to A/B network to make the short-circuit point between networks heat up, and thermal imager was used to observe; On the next page.

Thermal imaging observation after removing solder resist ink

Thermal imaging image of burning position after removing solder resist ink on TOP surface



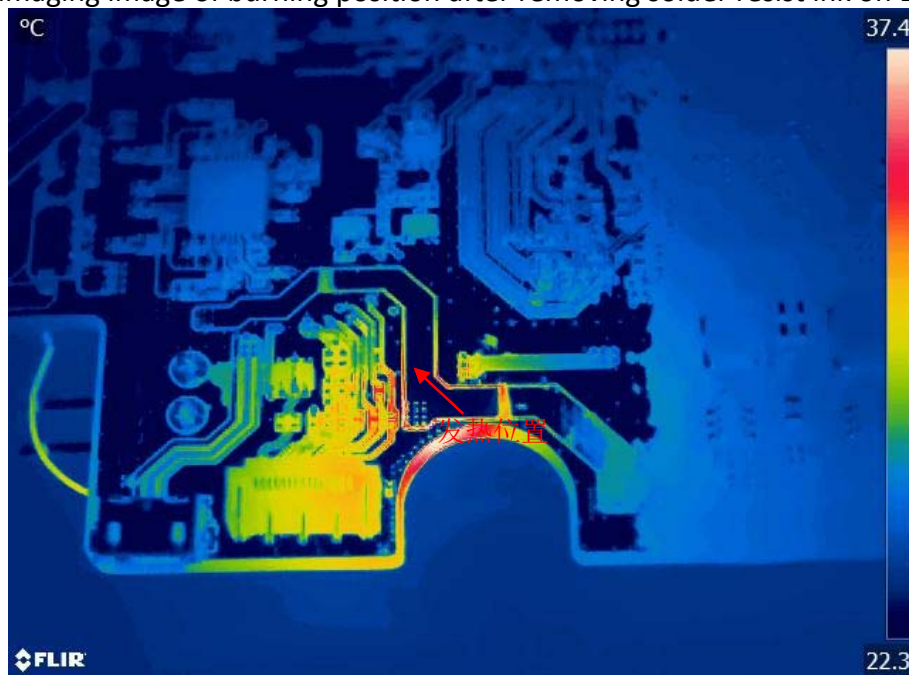
Corresponding object picture



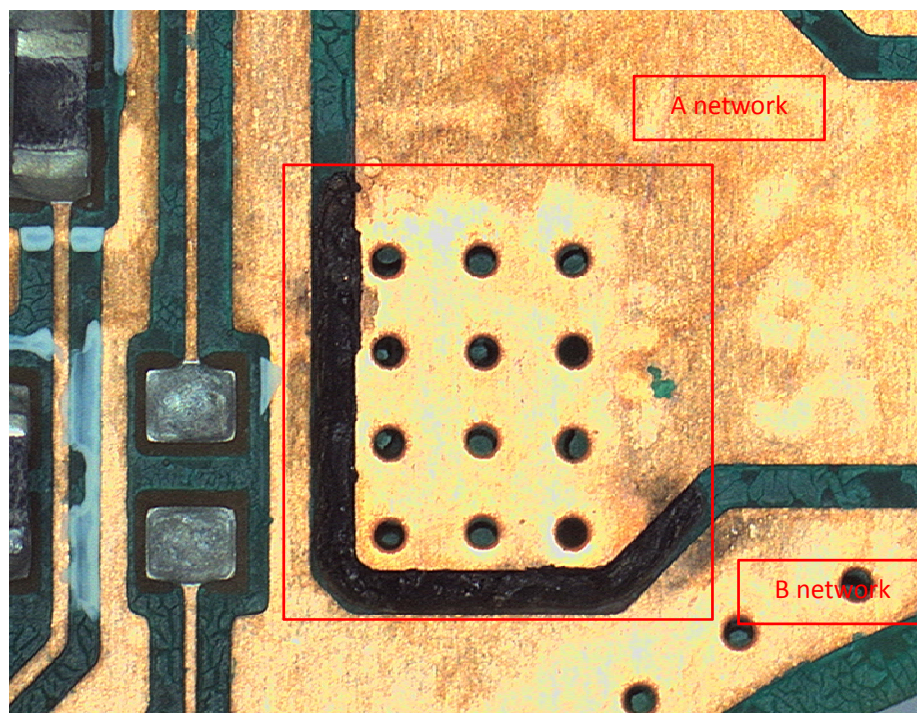
Description :Thermal imaging observation after the removal of solder blocking ink on the TOP surface of the burned position showed that the hot spot was still located in the hole area of NETWORK A, indicating that the short circuit point was located in the hole area of network A.

Thermal imaging observation after removing solder resist ink

Thermal imaging image of burning position after removing solder resist ink on BOTTOM surface



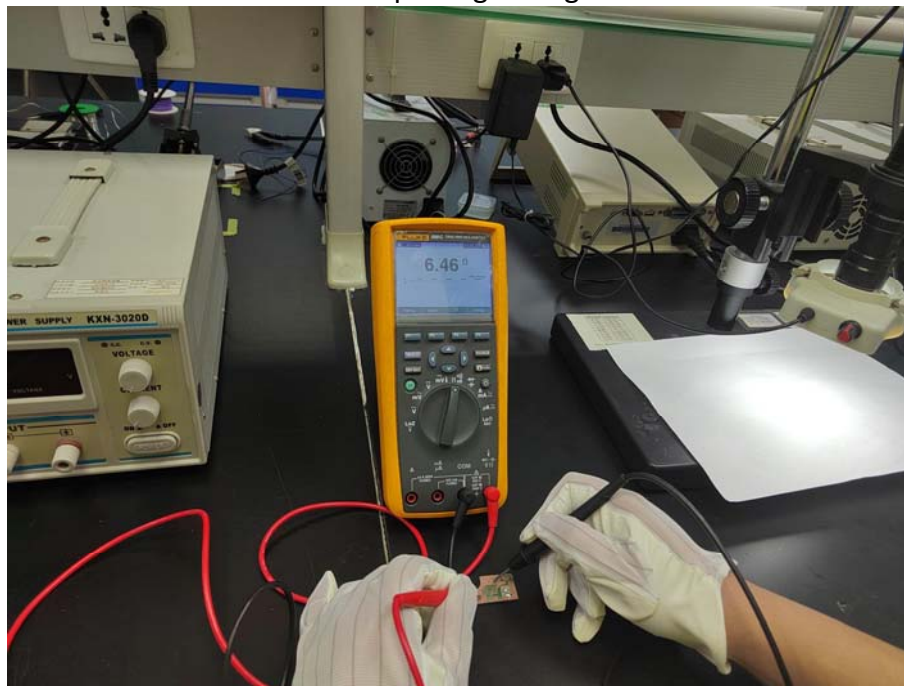
Corresponding object picture



Description :Thermal imaging observation after the removal of solder blocking ink on the BOTTOM surface of the burned position showed that the hot spot was still located in the hole area of NETWORK A, indicating that the short circuit point was located in the hole area of network A.

Measurement of resistance value after plane grinding

Picture of resistance test after plane grinding

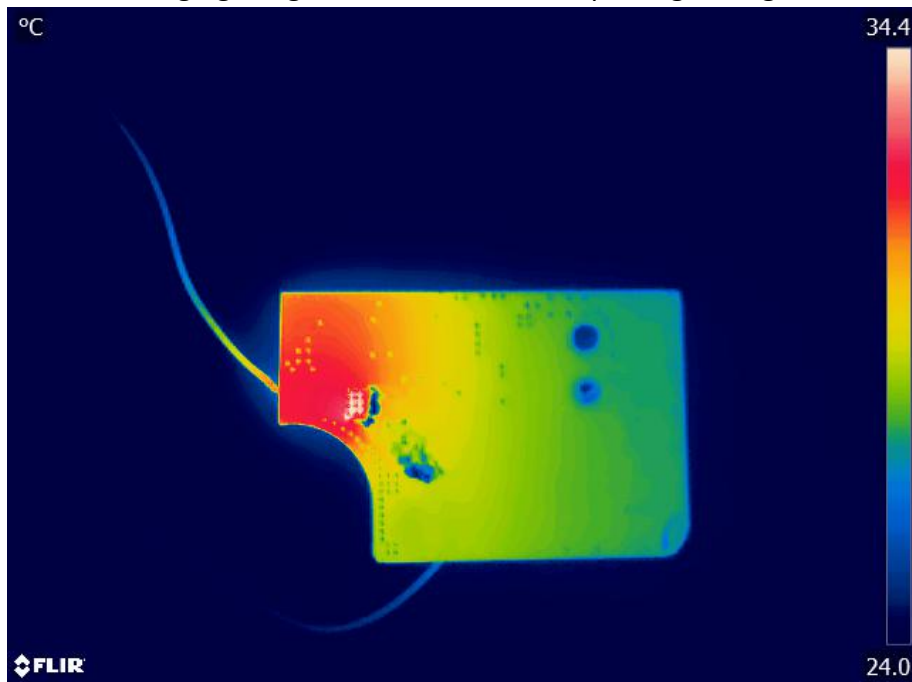


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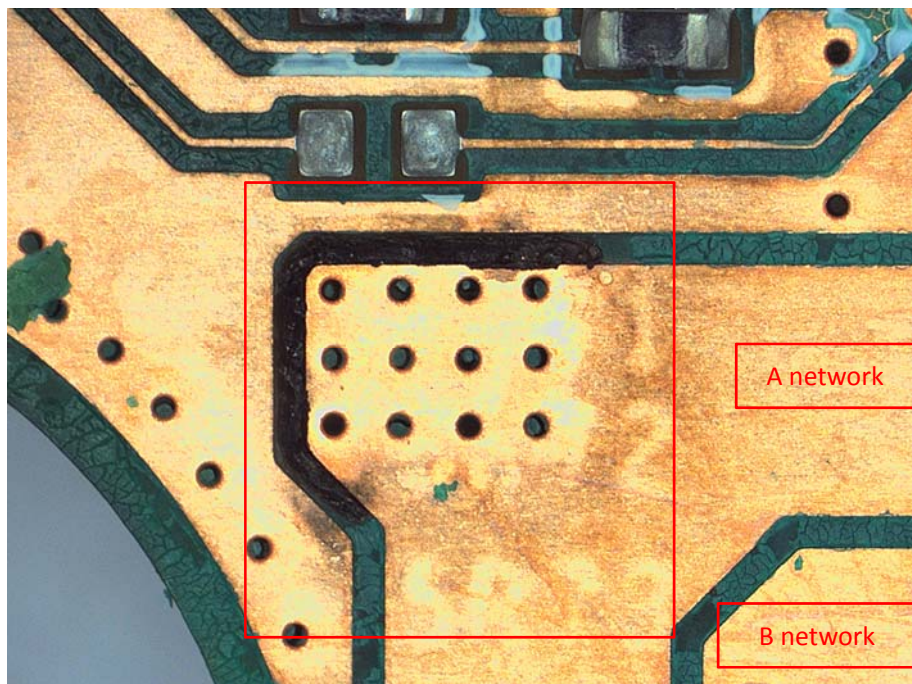
Description : Measure the resistance value of the burned position of the sample after plane grinding, and the measured resistance value is 6.46 Ω. After grinding off the L1 layer, the short-circuit point still exists.

Thermal imaging observation after plane grinding of burn loss position

Thermal imaging image of BOT surface after plane grinding



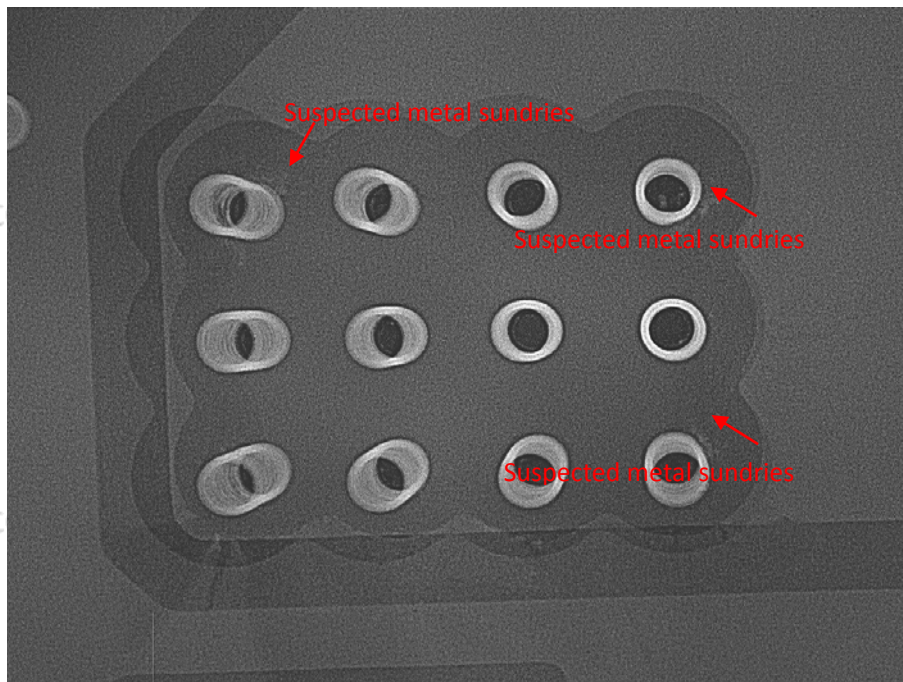
Corresponding object picture



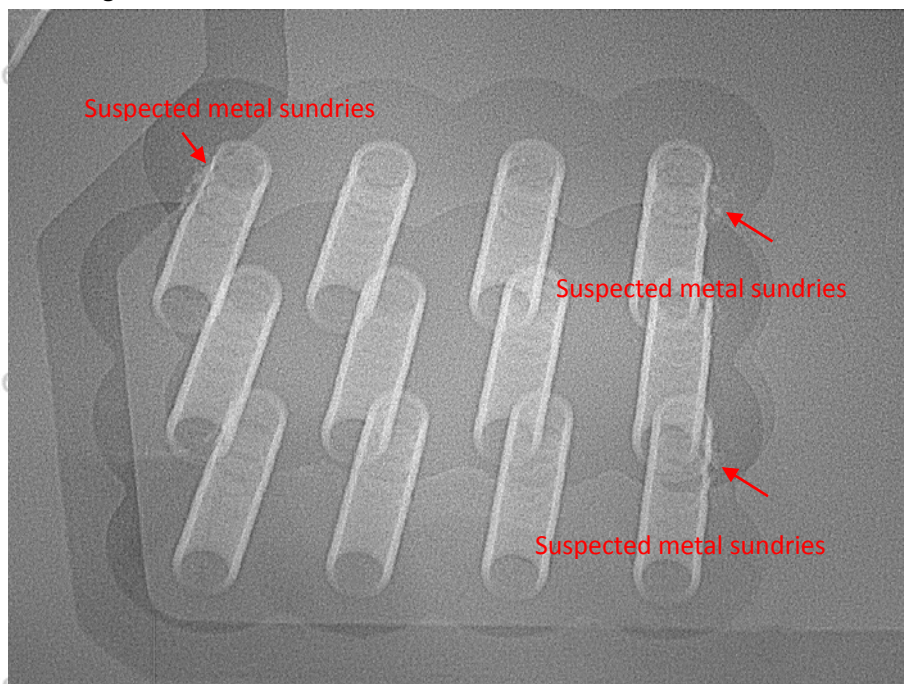
Description : After the thermal imaging observation of the BOT surface of the burned-out position of the sample was carried out, it was found that the hot spot was still located in the via area of the A network. After grinding off L1 layer , the short circuit in the via area of the A network still existed.

X-ray observation after plane grinding of burning position

Vertical observation



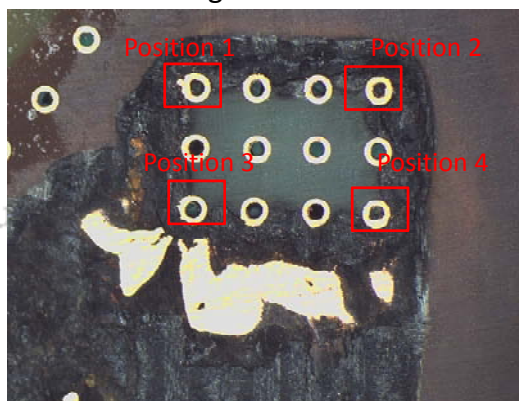
Tilt 30 degrees observation



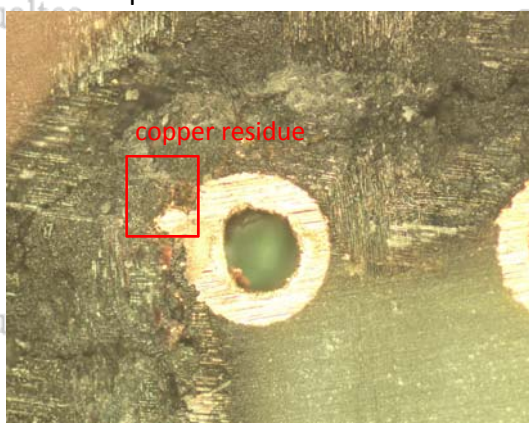
Description: X-Ray observation of the burnt-out position of the sample after plane grinding, and it is found that there are suspected that there were suspected metal debris in the of L2 dielectric layer.

Surface observation after plane grinding of burn loss position

Observation diagram



Observe picture 1



Observe picture 2



Observe picture 3



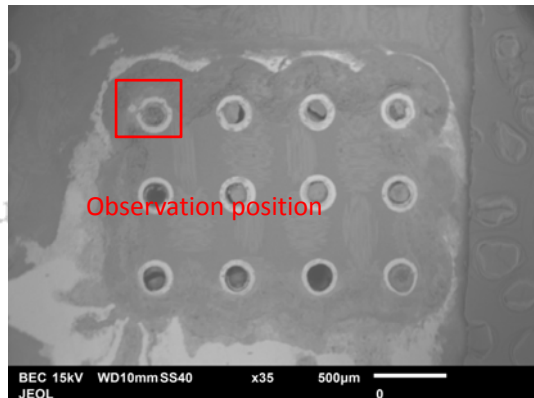
Observe picture 4



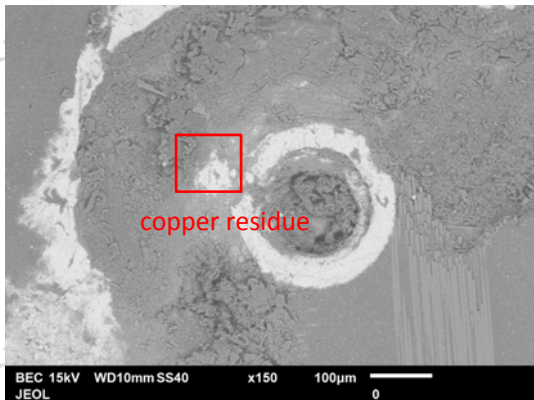
Description: Surface observation after plane grinding was carried out on the burned-out position, and it was found that there was residual copper phenomenon at position 1, position 2, and position 4 of the base material between the A network and the B network.

Surface morphology observation after plane lapping

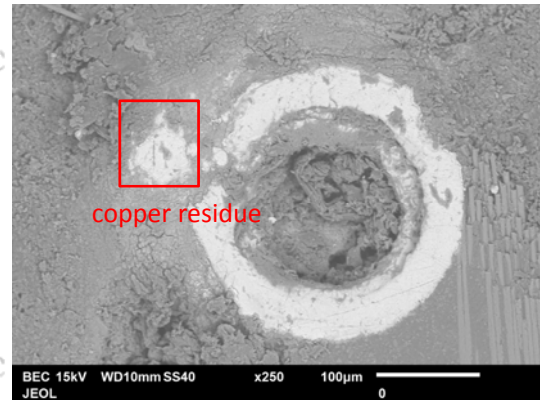
Surface morphology observation



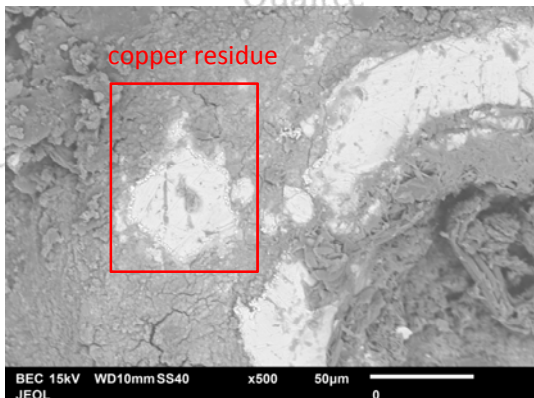
magnification



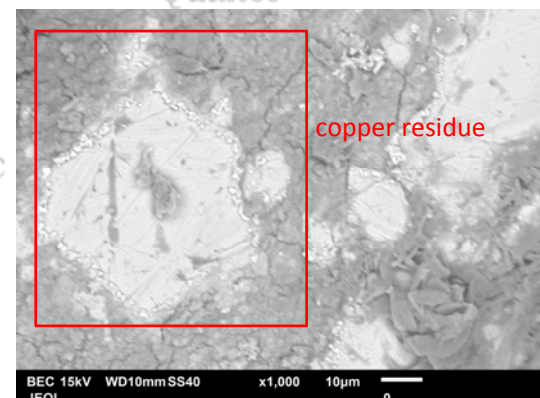
magnification



magnification



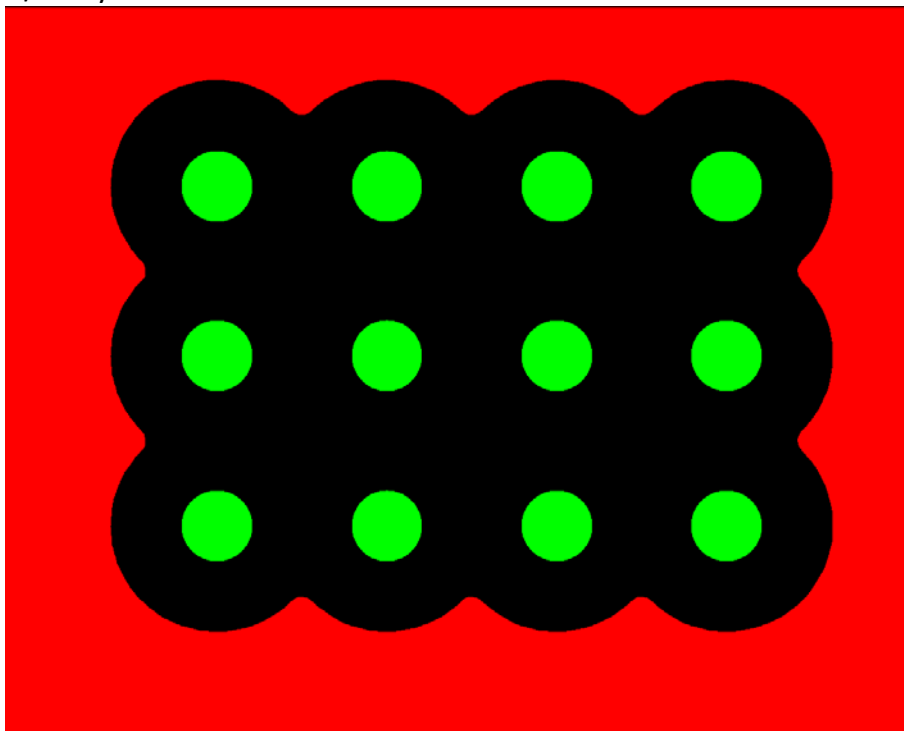
magnification



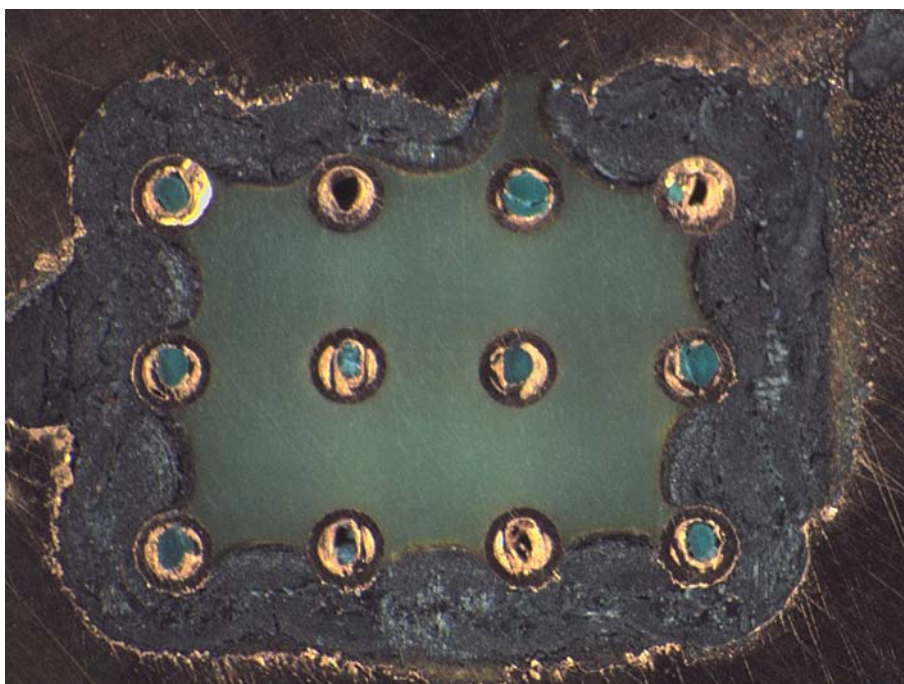
Description: SEM observation was made on the surface of the burnt loss position after plane grinding, and it was found that there was copper residue in the base material position between NETWORK A and network B.

Observation after plane grinding

L2/L3 layer A network via hole area



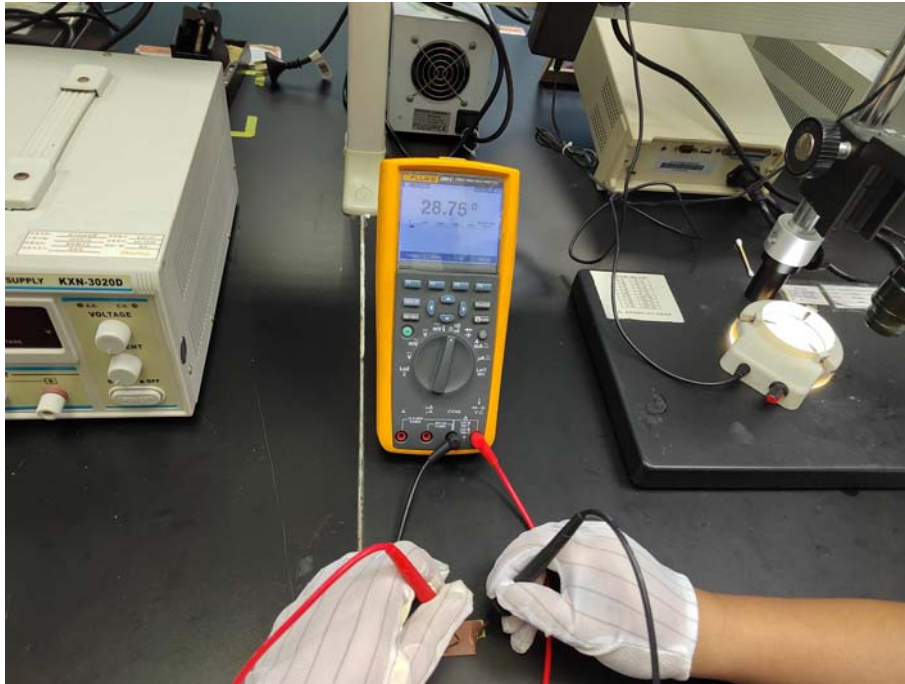
L3 floor



Description: Observe the burned position after plane grinding. The outline of the burned position is similar to that of the inner copper.

Resistance measurement after plane grinding of burning position

Resistance measurement picture

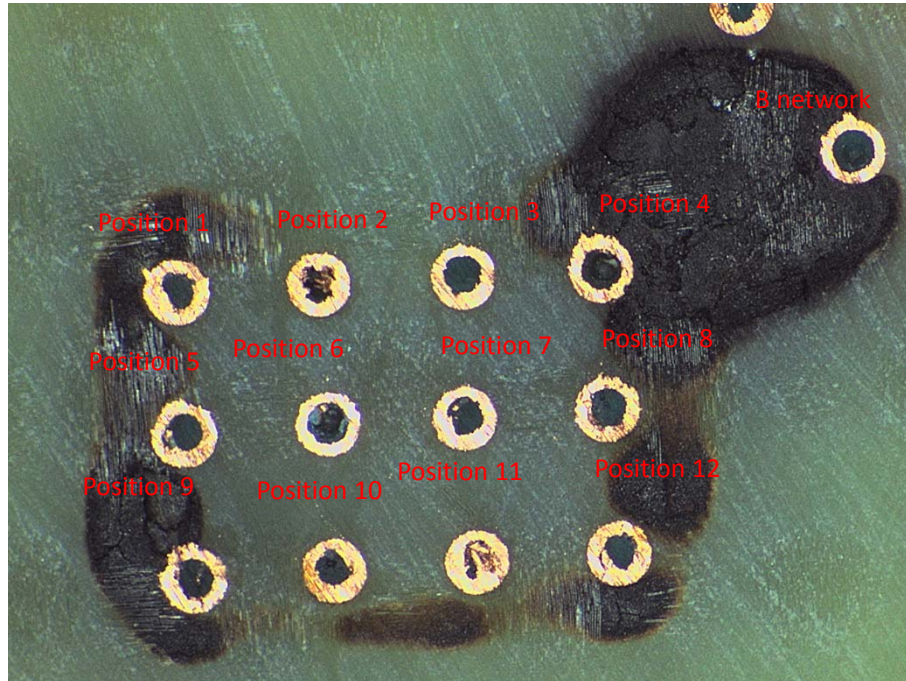


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Description:measure the resistance value of the burned position of the sample after plane grinding. After grinding off the L4 layer, the short-circuit point still exists, and the measured resistance value is 28.75 Ω.

Observation and resistance measurement after plane grinding

Observation after grinding copper foil of L3 layer



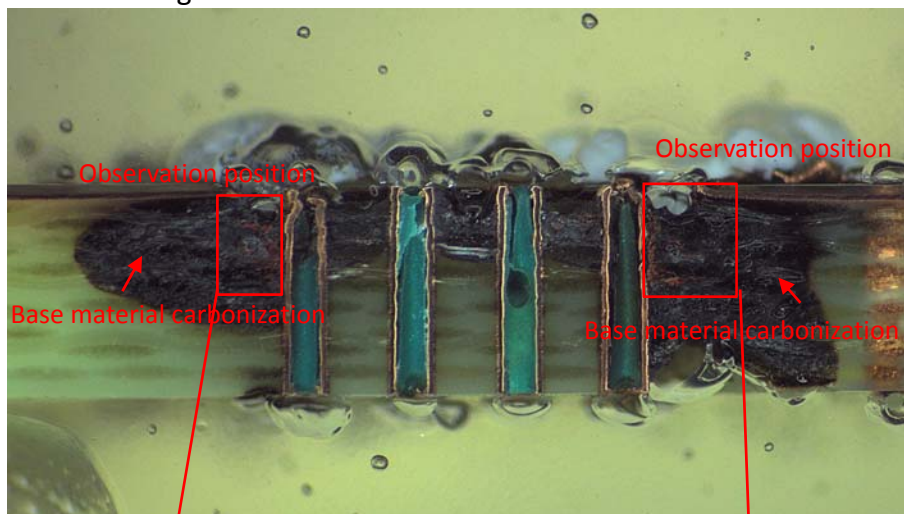
test results:

test location	Test result
Position 1	8.426KΩ
Position 2	411.05Ω
Position 3	187.19Ω
Position 4	1.0945KΩ
Position 5	61.49KΩ
Position 6	29.441MΩ
Position 7	67.4MΩ
Position 8	0.932KΩ
Position 9	4.1661KΩ
Position 10	17.892KΩ
Position 11	0.504KΩ
Position 12	1.8188KΩ

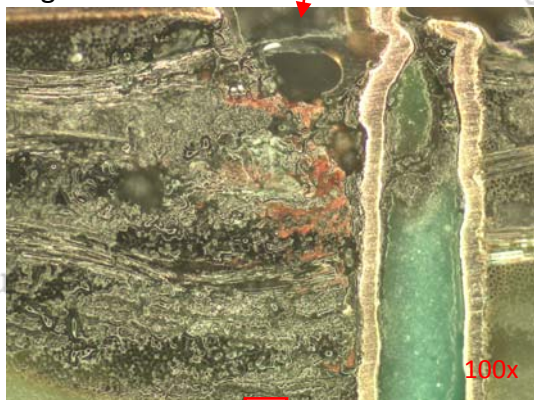
Description: After plane grinding of the sample burning position, the resistance value between position 1 ~ position 12 and network B was measured respectively. The resistance value of position 3 was the lowest, 187.19 Ω. After grinding off L3 layer, the short circuit point still existed, and L1/L4 layers were all ground off, indicating that the short circuit point was located in L2 layer, and position 4 had the most serious burning loss.

Metallographic observation of section after removal of solder blocking ink

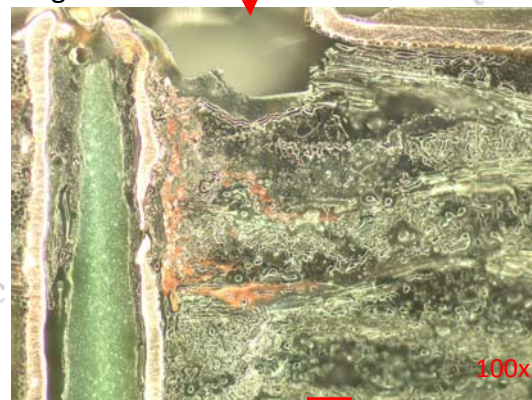
Schematic diagram of section observation



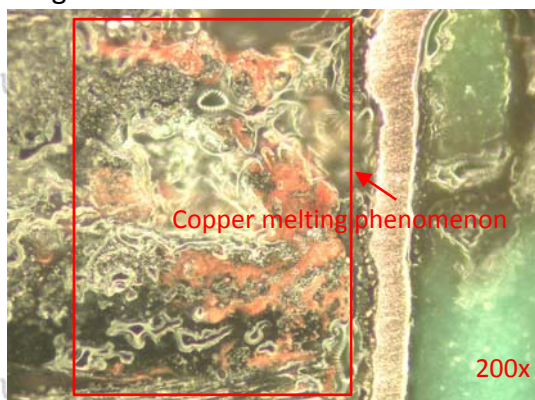
magnification



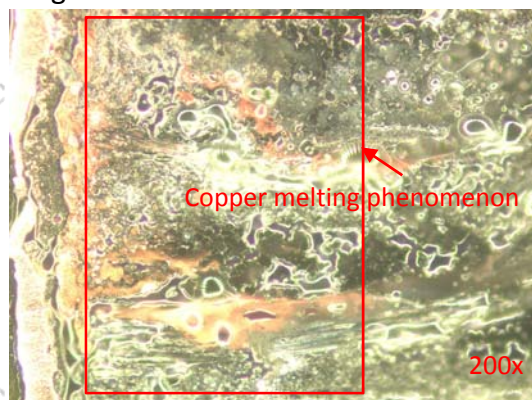
magnification



magnification



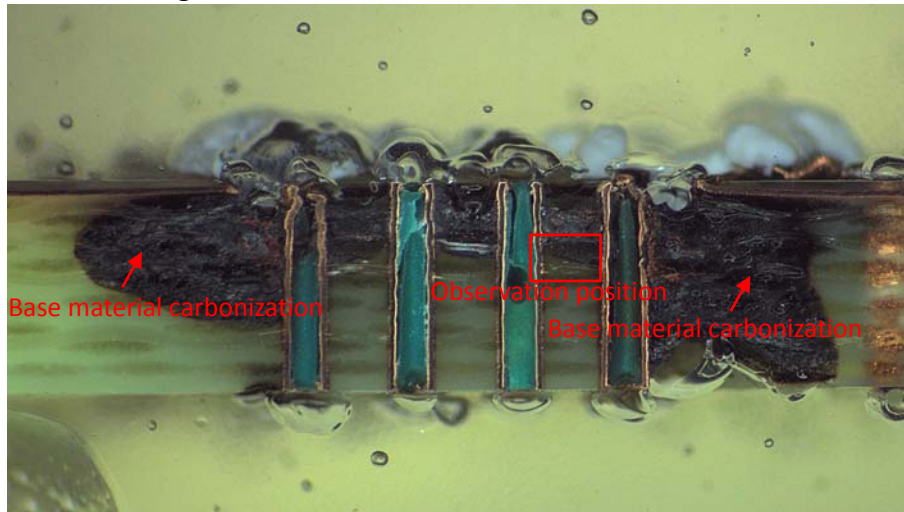
magnification



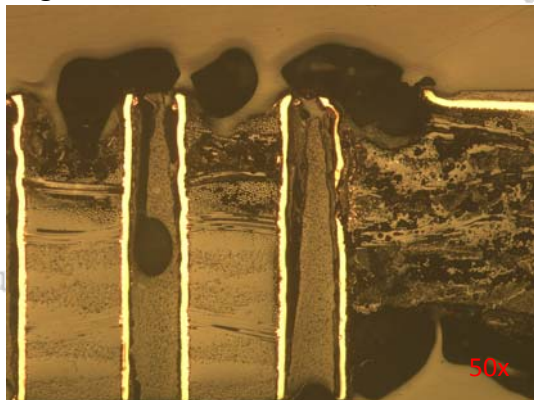
Description: the metallographic observation of the section after removing the solder resist ink at the burned position shows that the substrate at the core plate position is carbonized, and there is copper melting at the carbonized position of the core plate substrate. Continue on the next page.

Metallographic observation of section after removal of solder blocking ink

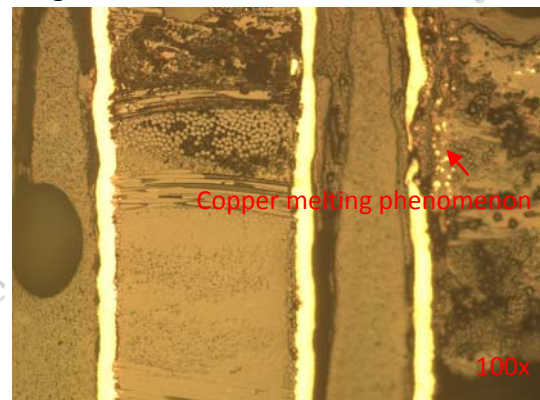
Schematic diagram of section observation



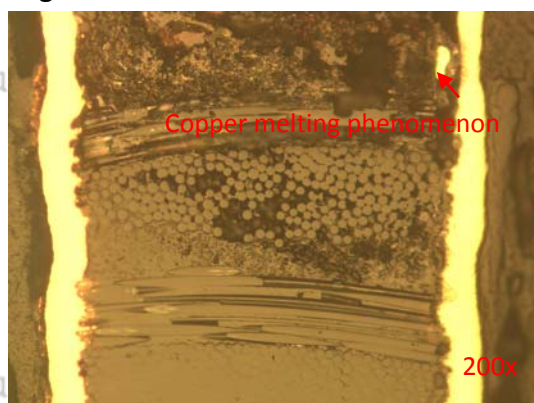
magnification



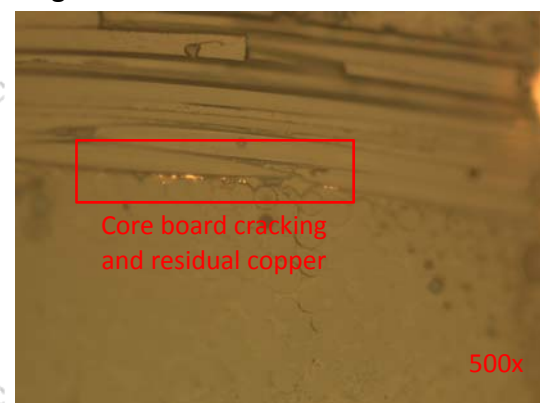
magnification



magnification



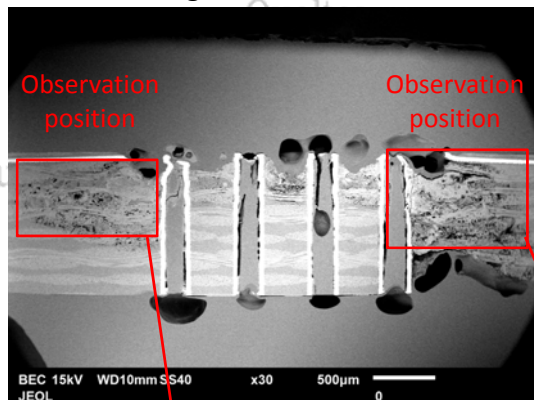
magnification



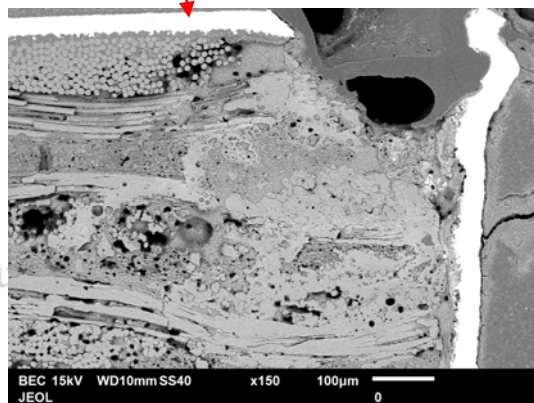
Description: the metallographic observation of the section after removing the solder resist ink at the burned position shows that there are cracks and residual copper on the core plate, and there is copper melting at the carbonized position of the core plate substrate.

Observation of cross-sectional morphology after removing solder mask ink

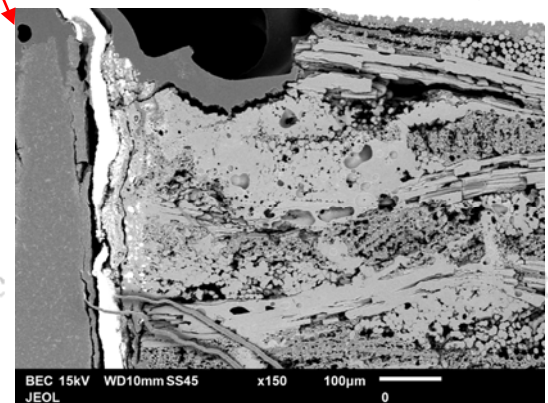
Schematic diagram of section observation



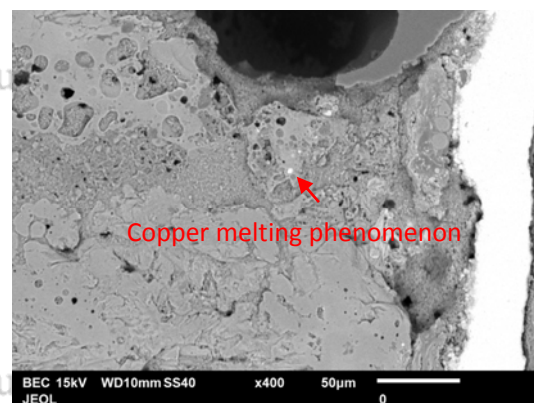
magnification



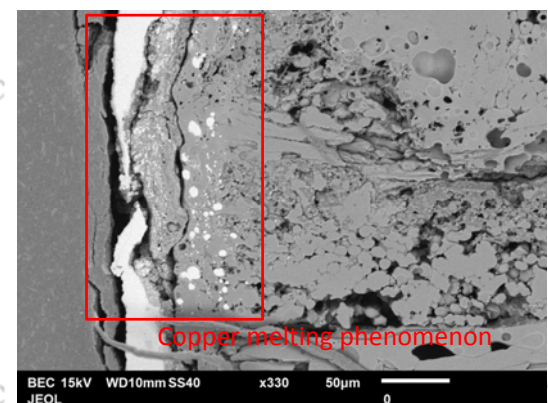
magnification



magnification



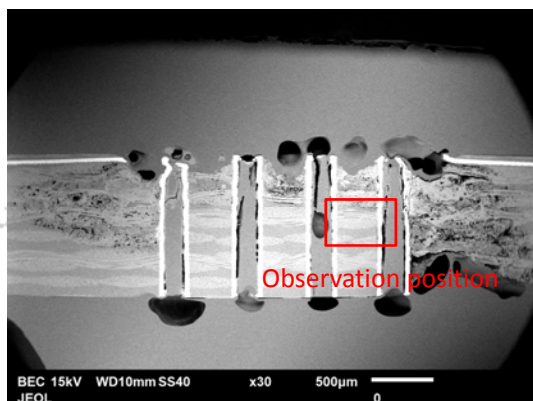
magnification



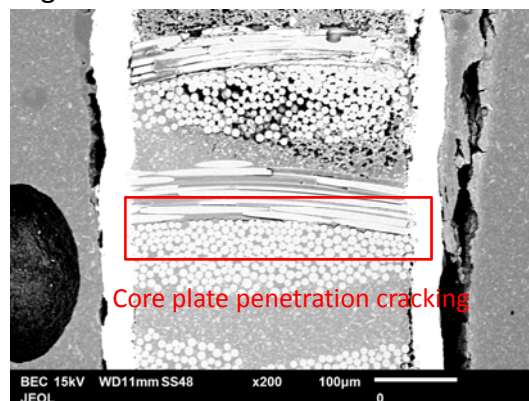
Description: SEM observation of the section after removing the solder resist ink at the burned position shows that the substrate at the core plate position is carbonized, and there is copper melting at the carbonized position of the core plate substrate. Continue on the next page.

Observation of cross-sectional morphology after removing solder mask ink

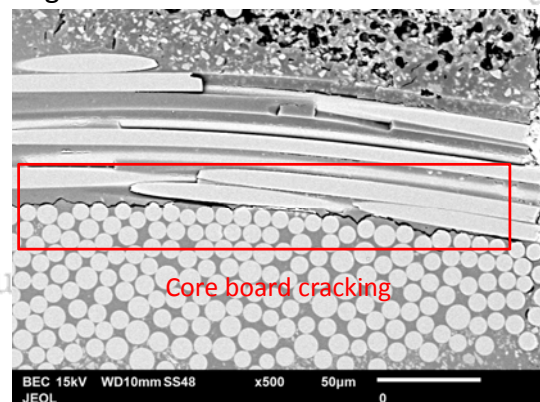
SEM observation of section



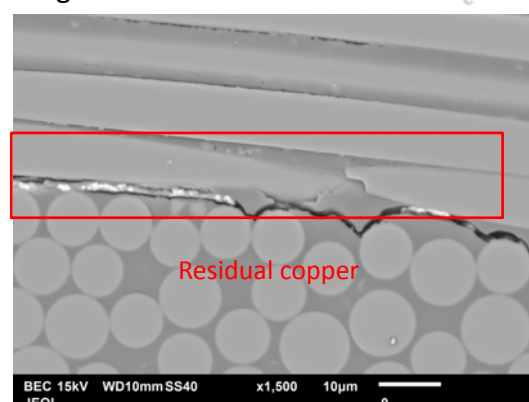
magnification



magnification



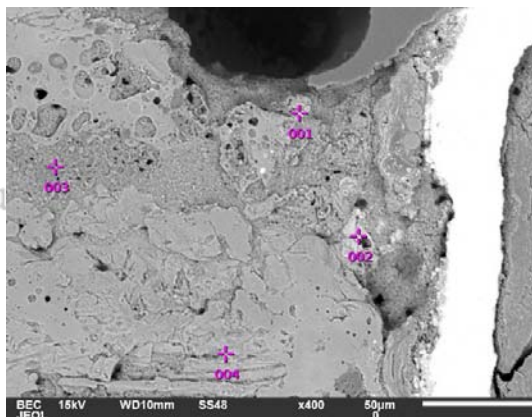
magnification



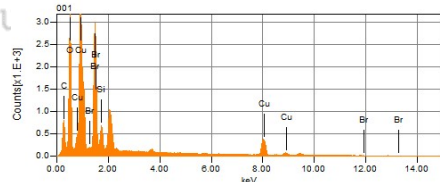
Description: SEM observation of the section after removing the solder resist ink at the burned position shows that the core plate has penetrating cracking and residual copper.

Elemental composition analysis of cross section after removal of solder blocking ink

Section element composition analysis

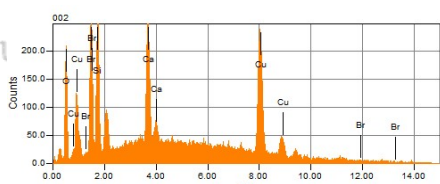


001 (Copper melting position)



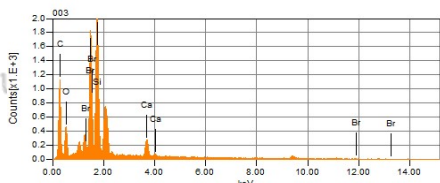
元素	mass%	Atom%
C	17.93	39.37
O	23.19	38.23
Si	1.84	1.73
Cu	21.65	8.99
Br	35.39	11.68
Total	100.00	100.00

002 (Copper melting position)



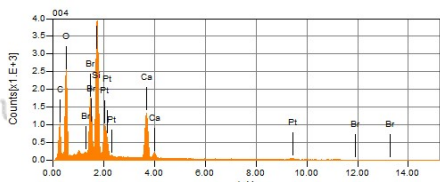
元素	mass%	Atom%
O	6.18	19.66
Si	5.12	9.28
Ca	7.24	9.21
Cu	60.34	48.38
Br	21.12	13.47
Total	100.00	100.00

003 (Base material carbonization)



元素	mass%	Atom%
C	46.59	73.27
O	8.85	10.45
Si	11.71	7.88
Ca	2.71	1.28
Br	30.13	7.12
Total	100.00	100.00

004 (Base material carbonization)

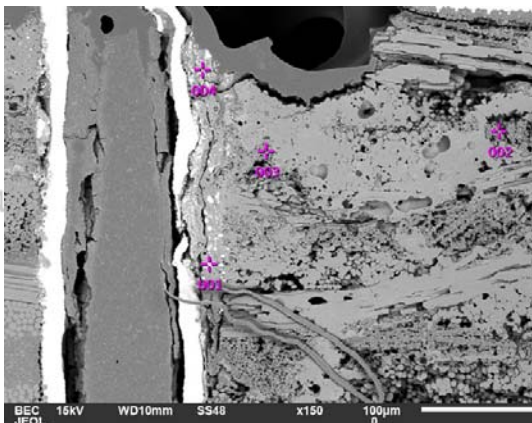


元素	mass%	Atom%
C	20.95	40.78
O	25.00	36.54
Si	12.04	10.02
Ca	9.29	5.42
Br	19.23	5.63
Pt	13.51	1.62
Total	100.00	100.00

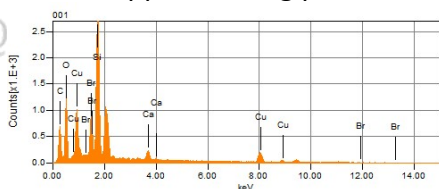
Description: EDS analysis of the section of the burned position after the removal of welding ink, C, O, Si, Cu, Br elements were detected in the copper melting position, and C, O, Si, Ca, Br elements were detected in the carbonization position of the base material.

Elemental composition analysis of cross section after removal of solder blocking ink

Section element composition analysis

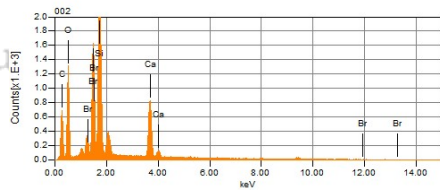


001 (Copper melting position)



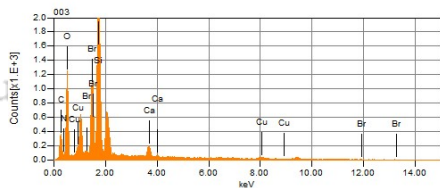
元素	mass%	Atom%
C	28.53	51.49
O	16.99	23.02
Si	17.78	13.72
Ca	1.99	1.07
Cu	18.35	6.26
Br	16.38	4.44
Total	100.00	100.00

002 (Base material carbonization)



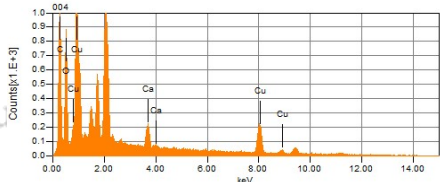
元素	mass%	Atom%
C	27.39	48.20
O	21.56	28.48
Si	15.32	11.53
Ca	8.87	4.68
Br	26.87	7.11
Total	100.00	100.00

003 (Base material carbonization)



元素	mass%	Atom%
C	21.99	38.92
N	3.20	4.85
O	23.04	30.62
Si	22.48	17.02
Ca	2.34	1.24
Cu	2.68	0.90
Br	24.28	6.46
Total	100.00	100.00

004 (Copper melting position)

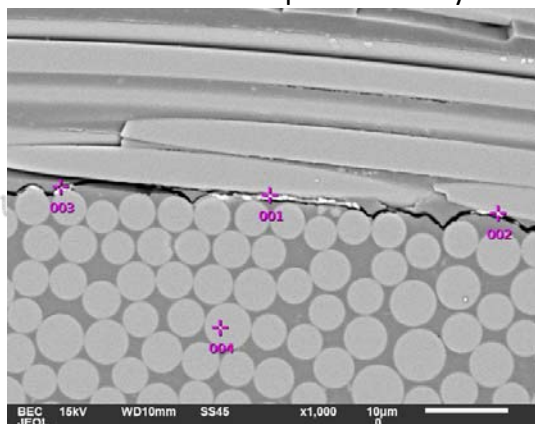


元素	mass%	Atom%
C	39.31	63.10
O	19.87	23.94
Ca	3.20	1.54
Cu	37.62	11.41
Total	100.00	100.00

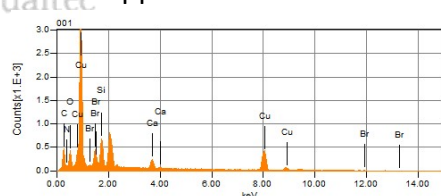
Description: EDS analysis of the section of the burned position after the removal of welding ink, C, O, Si, Ca, Cu, Br elements were detected in the copper melting position, and C, O, Si, Ca, N, Cu, Br elements were detected in the carbonization position of the base material.

Elemental composition analysis of cross section after removal of solder blocking ink

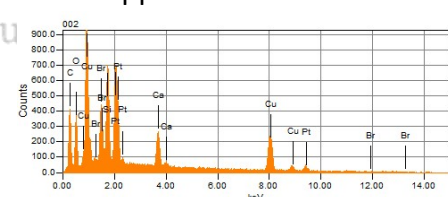
Section element composition analysis



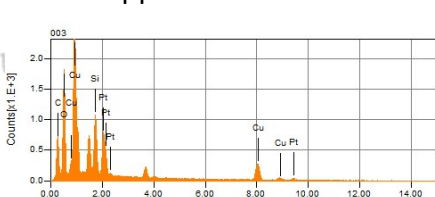
001 (copper residue location)



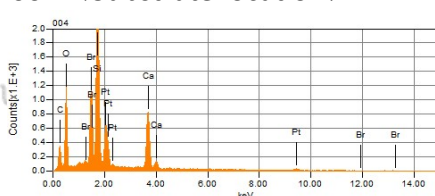
002 (copper residue location)



003 (copper residue location)



004 (Substrate location)



元素	mass%	Atom%
C	18.54	45.37
N	4.20	8.81
O	5.55	10.20
Si	4.73	4.96
Ca	2.57	1.89
Cu	53.66	24.82
Br	10.74	3.95
Total	100.00	100.00

元素	mass%	Atom%
C	19.27	52.64
O	6.53	13.40
Si	4.84	5.65
Ca	3.61	2.95
Cu	32.37	16.71
Br	12.55	5.15
Pt	20.84	3.50
Total	100.00	100.00

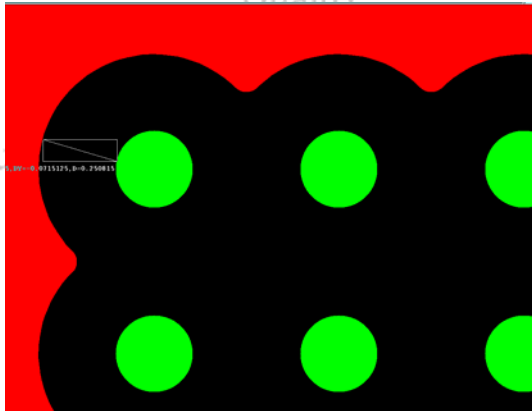
元素	mass%	Atom%
C	22.27	45.36
O	23.10	35.32
Si	5.74	5.00
Cu	31.54	12.15
Pt	17.35	2.18
Total	100.00	100.00

元素	mass%	Atom%
C	14.83	33.16
O	20.31	34.10
Si	17.06	16.31
Ca	10.50	7.04
Br	21.45	7.21
Pt	15.86	2.18
Total	100.00	100.00

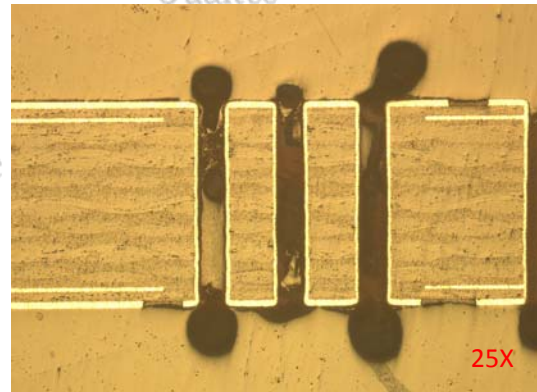
Description: EDS analysis of the cross-section after removing the solder mask thick film at the burn-out position, C, N, O, Si, Ca, Cu, Br elements were detected at the residual copper position, and C, O, Si, Ca were detected at the carbonization position of the substrate, Br element.

Metallographic observation of sections at similar positions of failure network structure

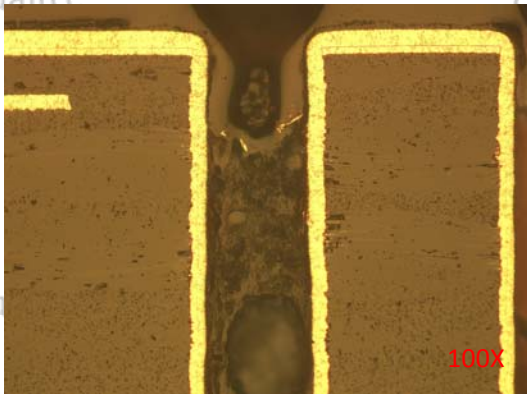
Schematic



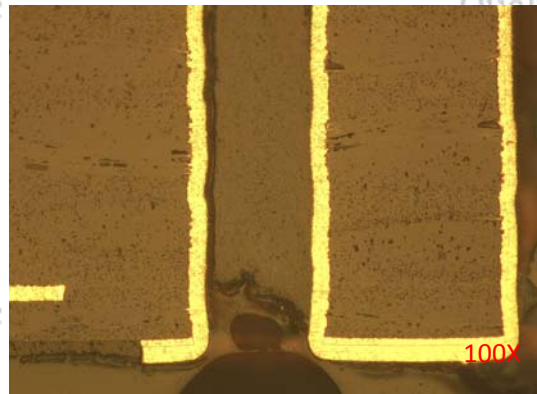
Metallographic observation of section



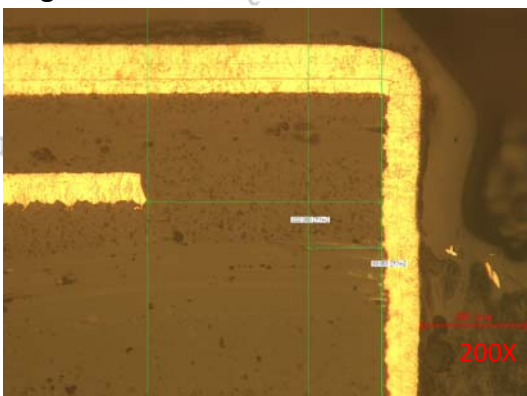
magnification



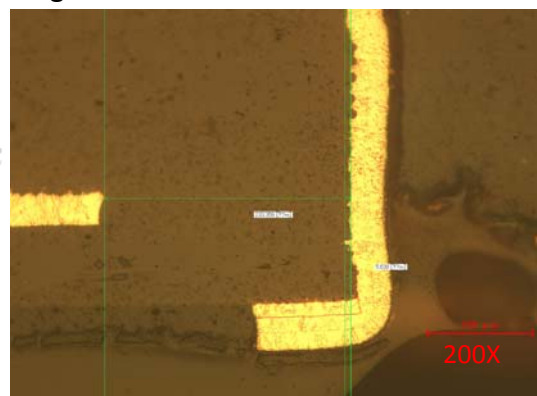
magnification



magnification



magnification



Description: Inspection after micro sectioning with same pattern of others location, without found abnormal, space between innerlayer and PTH was 222.033~233.359 μ m(meet the requirements), roughness is 5.638 μ m and wicking is 69.815 μ m.