

Failure Analysis Report

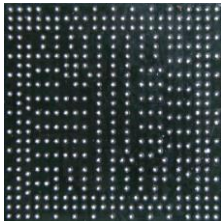
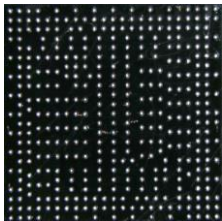
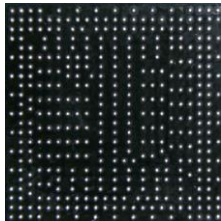
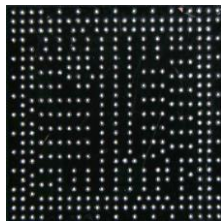
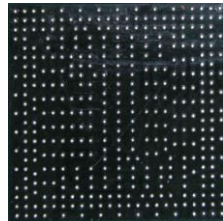
TO: FOXCONN		Due Date: 2024-08-26																								
ATTN:		Open Date: 2024-08-13																								
FROM: Amlogic		CC:																								
☒ AMLOGIC FA NO. : FAZ240806																										
SUBJECT: S905X2-B																										
DISCIPLINE 1	INTERNAL MEMBER	EXTERNAL MEMBER																								
USE TEAM APPROACH:	Member: CQE team, FAE team, test team, Sales team, Software team, etc.	Member: NA																								
DISCIPLINE 2	ISSUE DESCRIPTION																									
Customer: FOXCONN Device: S905X2-B Qty: 5ea																										
Problem description: The customer returned 5 pcs S905X2-B chip for failure analysis. They reported "USB failure" Detail information of chip was as follows:																										
<table><tr><th>No.</th><th>Lot No.</th><th>Date Code</th><th>Defect symptom</th></tr><tr><td>#1</td><td>PVY049.00</td><td>E22313N05117</td><td>USB failure</td></tr><tr><td>#2</td><td>PRK086.00</td><td>E22221N00803</td><td>USB failure</td></tr><tr><td>#3</td><td>PGM446.00</td><td>E22149N11406</td><td>USB failure</td></tr><tr><td>#4</td><td>P2XK63.0008</td><td>E22334D01104</td><td>USB failure</td></tr><tr><td>#5</td><td>PRK086.00</td><td>E22221N00711</td><td>USB failure</td></tr></table>			No.	Lot No.	Date Code	Defect symptom	#1	PVY049.00	E22313N05117	USB failure	#2	PRK086.00	E22221N00803	USB failure	#3	PGM446.00	E22149N11406	USB failure	#4	P2XK63.0008	E22334D01104	USB failure	#5	PRK086.00	E22221N00711	USB failure
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DISCIPLINE 3	Containment Action																									
Perform analysis for suspect chips which were returned by customer to find root cause.																										
DISCIPLINE 4	Issue Investigation																									

FA analysis was as follows :

1. External Visual Examination

The external condition of the unit was inspected by stereo microscope.

No obvious crack or warpage etc was observed.

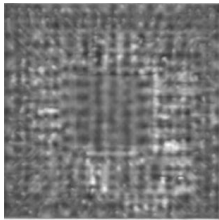
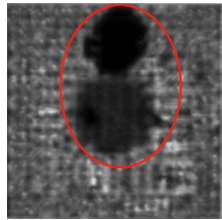
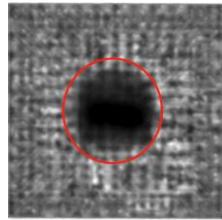
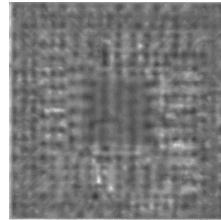
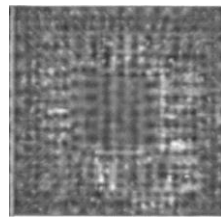
No.	#1	#2	#3	#4	#5
Top					
Bottom					

2. Scanning Acoustic Microscopy Inspection

The internal condition of the unit was inspected by scanning acoustic microscopy.

Chip #1 ,#4,#5 was not observed crack or delamination.

Chip #2,#3 were observed delamination.

No.	#1	#2	#3	#4	#5
SAT					

3. Socket board Testing

The unit was tested by a special socket board, the test result was as follows:

NO.	Test result
#1	Measured impedance abnormal from USBOTG_B pins to ground.
#2	Measured impedance abnormal from USBOTG_B pins to ground.
#3	Measured impedance abnormal from USBOTG_B pins to ground.
#4	No bootup
#5	Measured impedance abnormal from USBOTG_B pins to ground.

#4 Serial data was as below:

```
Normal-Com3 - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
Normal-Com3 x
ddr scramble enable
2D training succeed
auto size-- 6553DDR cs0 size: 2048MB
DDR cs1 size: 0MB
DMC_DDR_CTRL: 0040002CDOR size: 2048MB
cs0 DataBus test pass
cs0 AddrBus test pass
pre test bdlr_100_average==452 bdlr_100_min==452 bdlr_100_max==452 bdlr_100_cur==452
aft test bdlr_100_average==452 bdlr_100_min==452 bdlr_100_max==452 bdlr_100_cur==452
100bdlr_step_size ps== 452
result report
boot times 0Enable ddr reg access
00000000
emmc switch 3 ok
BL2: rpm counter: 0x00000000
00000000
emmc switch 0 ok
Load FIP HDR from eMMC, src: 0x00010200, des: 0x01700000, size: 0x00004000, part: 0
Load BL3X from eMMC, src: 0x0006c200, des: 0x0175c000, size: 0x000c4000, part: 0
BL33 CHK: 0xffffffff ADDR 01795800
Load FIP HDR from eMMC, src: 0x00010200, des: 0x01700000, size: 0x00004000, part: 1
00000000
emmc switch 1 ok
Load BL3X from eMMC, src: 0x0006c200, des: 0x0175c000, size: 0x000c4000, part: 1
BL33 CHK: 0xffffffff ADDR 01795800
Load FIP HDR from eMMC, src: 0x00010200, des: 0x01700000, size: 0x00004000, part: 2
00000000
emmc switch 2 ok
Load BL3X from eMMC, src: 0x0006c200, des: 0x0175c000, size: 0x000c4000, part: 2
BL33 CHK: 0xffffffff ADDR 01795800
reset...
```

4. Automatic Test Equipment Testing

The unit was tested by automatic test equipment, the test result was as follows:

NO.	FT Test result
#1	Open/Short failed
#2	Open/Short failed
#3	Open/Short failed
#4	Function failed, there was not observed O/S pins
#5	Open/Short failed

Partial data was as below:

#1

```
----- Test Name: OS_PassFail[1]: FAILED -----
OS_PassFail[1]: FAILED
Executed Testmethod G12A.tml.RDI_Open_Short_Global_PF on Site 1: FAILED
----- Test Name: USBOTG_B_DM_GND_Limit_mV@USBOTG_B_DM[1]: FAILED -----
USBOTG_B_DM_GND_Limit_mV@USBOTG_B_DM[1]: FAILED
----- Test Name: USBOTG_B_DP_GND_Limit_mV@USBOTG_B_DP[1]: FAILED -----
USBOTG_B_DP_GND_Limit_mV@USBOTG_B_DP[1]: FAILED
----- Test Name: USBOTG_B_DM_VDD_Limit_mV@USBOTG_B_DM[1]: FAILED -----
USBOTG_B_DM_VDD_Limit_mV@USBOTG_B_DM[1]: FAILED
----- Test Name: USBOTG_B_DP_VDD_Limit_mV@USBOTG_B_DP[1]: FAILED -----
USBOTG_B_DP_VDD_Limit_mV@USBOTG_B_DP[1]: FAILED
: Executed Testmethod G12A.tml.RDI_Open_ShortIZE on Site 1: FAILED
: Site 1 has FAILED. Binned to bin_215(2)
```

#2

```
----- Test Name: OS_PassFail[1]: FAILED -----
OS_PassFail[1]: FAILED (null) FAILED 0.000000
Executed Testmethod G12A_tml.RDI_Open_Short_Global_PF on Site 2: FAILED
----- Test Name: gpioA_14_GND_Limit_mV@gpioA_14[1]: FAILED -----
gpioA_14_GND_Limit_mV@gpioA_14[1]: FAILED (null) FAILED -58.494441 mV
----- Test Name: USBOTG_B_DP_GND_Limit_mV@USBOTG_B_DP[1]: FAILED -----
USBOTG_B_DP_GND_Limit_mV@USBOTG_B_DP[1]: FAILED (null) FAILED -30.270563 mV
----- Test Name: gpioA_14_VDD_Limit_mV@gpioA_14[1]: FAILED -----
gpioA_14_VDD_Limit_mV@gpioA_14[1]: FAILED (null) FAILED 59.393920 mV
----- Test Name: USBOTG_B_DM_VDD_Limit_mV@USBOTG_B_DM[1]: FAILED -----
USBOTG_B_DM_VDD_Limit_mV@USBOTG_B_DM[1]: FAILED (null) FAILED 1976.350546 mV
----- Test Name: USBOTG_B_DP_VDD_Limit_mV@USBOTG_B_DP[1]: FAILED -----
USBOTG_B_DP_VDD_Limit_mV@USBOTG_B_DP[1]: FAILED (null) FAILED 1.724693 mV
: Executed Testmethod G12A_tml.RDI_Open_ShortIZE on Site 2: FAILED
: Site 2 has FAILED. Binned to bin 215(2)
```

#3

```
----- Test Name: OS_PassFail[1]: FAILED -----
OS_PassFail[1]: FAILED (null) FAILED 0.000000
Executed Testmethod G12A_tml.RDI_Open_Short_Global_PF on Site 3: FAILED
----- Test Name: USBOTG_B_DM_GND_Limit_mV@USBOTG_B_DM[1]: FAILED -----
USBOTG_B_DM_GND_Limit_mV@USBOTG_B_DM[1]: FAILED (null) FAILED -99999000.000000 mV
----- Test Name: USBOTG_B_DP_GND_Limit_mV@USBOTG_B_DP[1]: FAILED -----
USBOTG_B_DP_GND_Limit_mV@USBOTG_B_DP[1]: FAILED (null) FAILED -23.214864 mV
----- Test Name: USBOTG_B_DM_VDD_Limit_mV@USBOTG_B_DM[1]: FAILED -----
USBOTG_B_DM_VDD_Limit_mV@USBOTG_B_DM[1]: FAILED (null) FAILED 99999000.000000 mV
----- Test Name: USBOTG_B_DP_VDD_Limit_mV@USBOTG_B_DP[1]: FAILED -----
USBOTG_B_DP_VDD_Limit_mV@USBOTG_B_DP[1]: FAILED (null) FAILED 0.990901 mV
: Executed Testmethod G12A_tml.RDI_Open_ShortIZE on Site 3: FAILED
: Site 3 has FAILED. Binned to bin 215(2)
```

#4

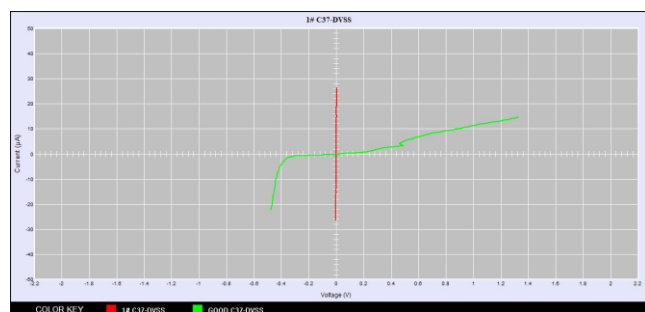
```
#4.log
Line 211: Site 4 has FAILED. Binned to bin 801(8)
Line 245: Site 4 has FAILED. Binned to bin 810(8)
Line 273: Site 4 has FAILED. Binned to bin 814(8)
Line 328: Site 4 has FAILED. Binned to bin 806(8)
Line 356: Site 4 has FAILED. Binned to bin 803(8)
Line 7849: Site 4 has FAILED. Binned to bin 448(4)
Line 8059: Site 4 has FAILED. Binned to bin 451(4)
Line 8144: Site 4 has FAILED. Binned to bin 414(4)
Line 8166: Site 4 has FAILED. Binned to bin 415(4)
Line 8335: Site 4 has FAILED. Binned to bin 455(4)
Line 8652: Site 4 has FAILED. Binned to bin 425(4)
Line 8818: Site 4 has FAILED. Binned to bin 432(4)
Line 8840: Site 4 has FAILED. Binned to bin 433(4)
Line 8943: Site 4 has FAILED. Binned to bin 435(4)
Line 8965: Site 4 has FAILED. Binned to bin 436(4)
Line 9177: Site 4 has FAILED. Binned to bin 438(4)
Line 9199: Site 4 has FAILED. Binned to bin 439(4)
Line 10863: Site 4 has FAILED. Binned to bin 802(8)
Line 10891: Site 4 has FAILED. Binned to bin 805(8)
Line 10919: Site 4 has FAILED. Binned to bin 809(8)
Line 10947: Site 4 has FAILED. Binned to bin 804(8)
Line 11002: Site 4 has FAILED. Binned to bin 813(8)
Line 11073: Site 4 has FAILED. Binned to bin 1108(11)
Line 11102: Site 4 has FAILED. Binned to bin 1109(11)
Line 11131: Site 4 has FAILED. Binned to bin 1108(11)
Line 11160: Site 4 has FAILED. Binned to bin 1109(11)
```

#5

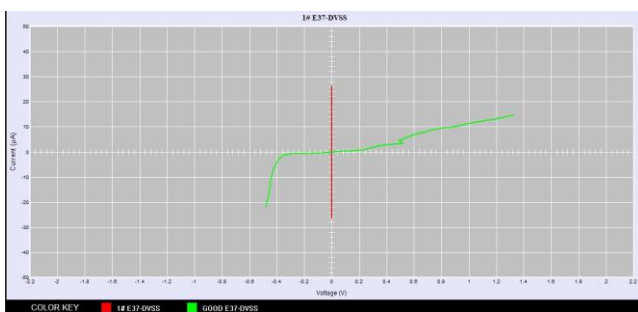
```
----- Test Name: USBOTG_B_DM_GND_Limit_mV@USBOTG_B_DM[1]: FAILED -----
USBOTG_B_DM_GND_Limit_mV@USBOTG_B_DM[1]: FAILED (null) FAILED -99999000.000000 mV
----- Test Name: USBOTG_B_DP_GND_Limit_mV@USBOTG_B_DP[1]: FAILED -----
USBOTG_B_DP_GND_Limit_mV@USBOTG_B_DP[1]: FAILED (null) FAILED -99999000.000000 mV
----- Test Name: HCSL_REXT_VDD_Limit_mV@HCSL_REXT[1]: FAILED -----
HCSL_REXT_VDD_Limit_mV@HCSL_REXT[1]: FAILED (null) FAILED 998.658657 mV
----- Test Name: PCIE_REXT_VDD_Limit_mV@PCIE_REXT[1]: FAILED -----
PCIE_REXT_VDD_Limit_mV@PCIE_REXT[1]: FAILED (null) FAILED 1038.320780 mV
----- Test Name: USBOTG_B_DM_VDD_Limit_mV@USBOTG_B_DM[1]: FAILED -----
USBOTG_B_DM_VDD_Limit_mV@USBOTG_B_DM[1]: FAILED (null) FAILED 99999000.000000 mV
----- Test Name: USBOTG_B_DP_VDD_Limit_mV@USBOTG_B_DP[1]: FAILED -----
USBOTG_B_DP_VDD_Limit_mV@USBOTG_B_DP[1]: FAILED (null) FAILED 99999000.000000 mV
Executed Testmethod G12A_tml.RDI_Open_ShortIZE on Site 5: FAILED
Site 5 has FAILED. Binned to bin 215(2)
```

The chip test result was as follows:

#1 USBOTG_B_DM(C37)-Gnd Short



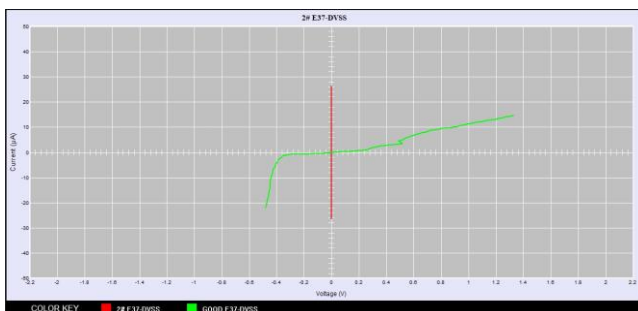
#1 USBOTG_B_DP(E37)-Gnd Short



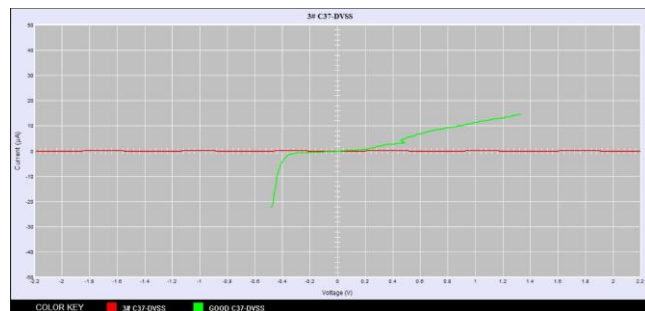
#2 USBOTG_B_DM(C37)-Gnd Leakage



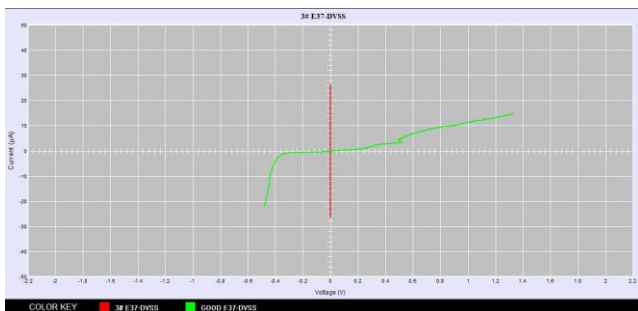
#2 USBOTG_B_DP(E37)-Gnd Short



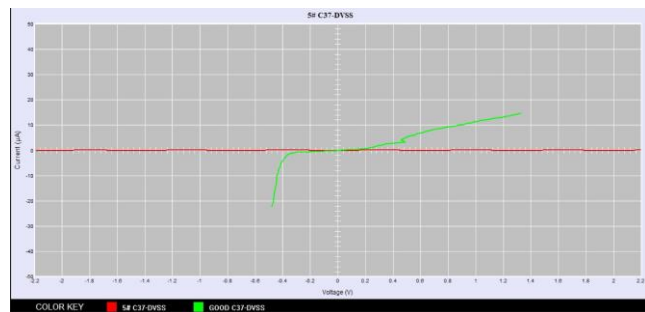
#3 USBOTG_B_DM(C37)-Gnd Open



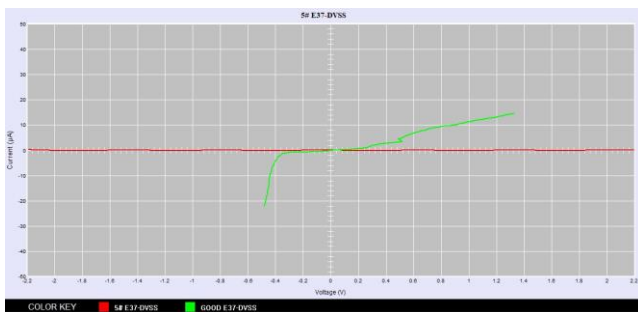
#3 USBOTG_B_DP(E37)-Gnd Short



#5 USBOTG_B_DM(C37)-Gnd Open



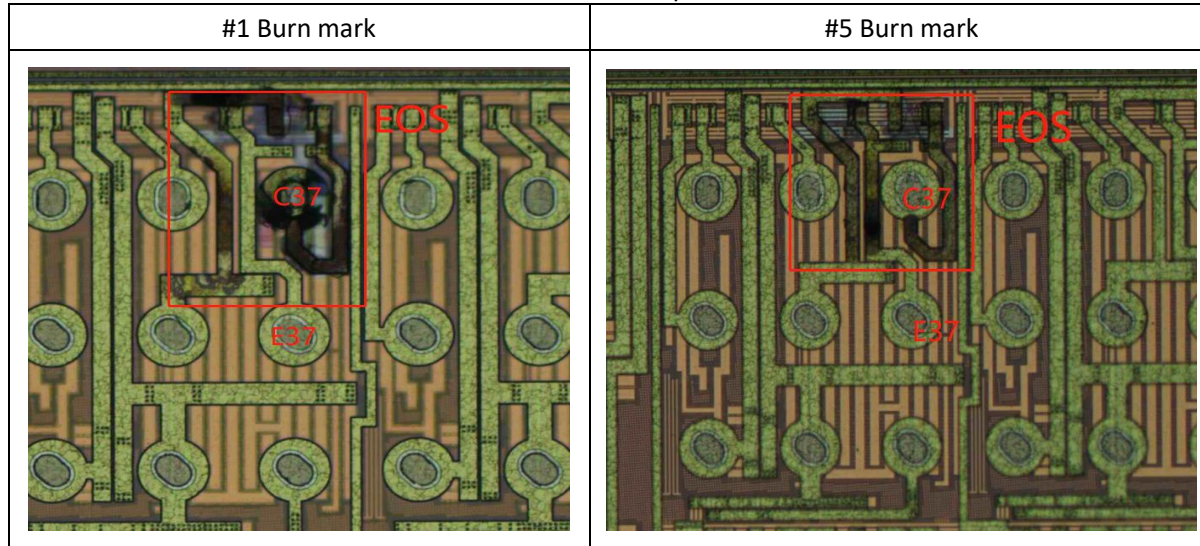
#5 USBOTG_B_DP(E37)-Gnd Open



6. De-cap Test

De-cap result was as follows:

There was observed burn mark on the die surface of the chip.



FA Summary:

No.	Issue description	Visual inspection	SAT	FT	SKT	IV	De-cap
#1	USB failure	Normal	Normal	Open/Short	Failed	Short	Burn mark
#2	USB failure	Normal	Delamination	Open/Short	Failed	Short	NA
#3	USB failure	Normal	Delamination	Open/Short	Failed	Open/Short	NA
#4	USB failure	Normal	Normal	Function failed	No bootup	NA	NA
#5	USB failure	Normal	Normal	Open/Short	Failed	Open	Burn mark

DISCIPLINE 5

Root Cause

As a result of FA summary:

1. All chips passed visual inspection.
2. All chips passed SAT except chip #2 and chip #3. The chip #2 and #3 were observed delamination.
3. Measured impedance abnormal from USBOTG_B pins (C37/E37) to ground on the socket board except chip #4.
4. All chips failed FT with Open/Short and were observed USBOTG_B pins O/S through the IV-Curve test except chip #4.
The chip #4 failed function item and no observed O/S pins.
5. The chip #1 and #5 were observed burn mark on the die surface due to EOS.

Failure Analysis Report

Based on FA result, the returned chips were observed Pins Open/Short due to EOS except chip #4.
The chip #4 was damaged by external stress factor(s) that are beyond the self-protection capabilities of the SoC.
The chips went through 100% FT before shipment and the failed chips can be screened by FT.

DISCIPLINE 6**Verification of Corrective Action**

NA

DISCIPLINE 7**Preventive Action**

NA

DISCIPLINE 8**Final Approval**

Appreciated team members' cooperation.