Failure Analysis Report

TEXAS INSTRUMENTS

TI Information - Selective Disclosure

Device Analysis Services

FA QEM-CCR-2002-00903
ACTION-0390444

Customer:	NEOPHOTONICS	**Assy Site:**	MLA
Customer Tracking ID:	5370020909,	**Fab Site:**	TID
Customer Part ID:		**Technology:**	ASL3C
Customer Contact:	Xiaoxi Zhang	**Analyst:**	June Zhu
Device Type:	TS3A5018PWR	**TI Contact:**	Sophia Fei
		Qty Submitted:	1
Flow Type:	Customer Return	**Date Submitted:**	2020-03-06
Reviewer:	Shengzhuan Huang	**Approval:**	Shengzhuan Huang

Summary

Failure Analysis	Results
Customer Reported Failure Mode	Issue type: Electrical | Issue type details: this is an electrical switch and there are 4 channel switches in this chip. we found channel I doesn't work when we enable switch while other 3 channel work. | Other details: 1) check solder quality, it is ok. 2) no abnormal were found when conduct X-Ray solder inspection checking 3) when connect EN signal to low, it is excepted that pin2 should connect to pin4, pin5 connect to pin7, pin11 to pin 9, pin14 to pin12. Other 3 parts are connect to excepted pin except pin2, pin2 doesn't connect pin4. 4) swap test (A-B-A) we found defect follow suspected chip 5) check the impedance of pin, pin2 is not different from other pins. Normal pin's impedance to GND is about 7M, but pin2 to GND is up to 40M..
TI Failure Description	Open failure was observed at pin1,2,10.
What effect does the defect or damage cause?	Open failure was observed at pin1,2,10.
Where and what is the defect/damage?	EIPD (Electrical Induced Physical Damage) and crack was observed at wedge.
Did the identified physical defect/damage explain the TI reported failure mode?	Yes.

TI Unit #	Cust. Unit #	Lot Trace Code	Symbolization	Wafer Fab Lot #	Assembly Lot #
1	1000020850	86ALGTK		8116153	8583518ML8

- **Customer Reported Problem Description:**

  Issue type: Electrical | Issue type details: this is an electrical switch and there are 4 channel switches in this chip. we found channel I doesn't work when we enable switch while other 3 channel work. | Other details: 1) check solder quality, it is ok.
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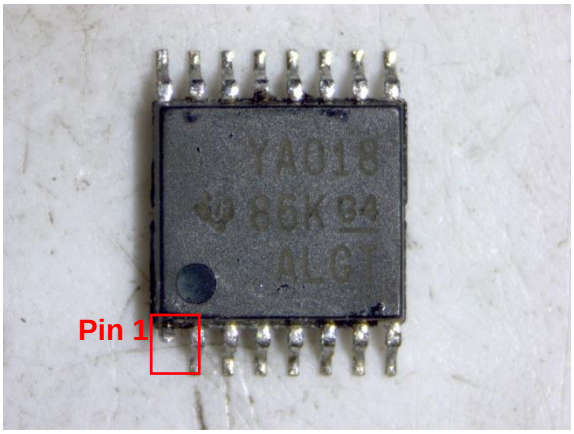
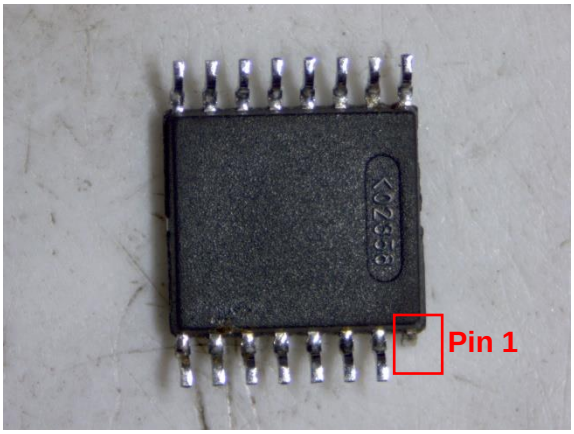
- **TI Problem Description:**

  Open failure was observed at pin1,2,10.

- **Package Analysis:**

  - **External Package Examination:**

    Optical inspection was performed on returned units. Bent lead was observed at pin1.

<table>
<tr><td> 
</td><td> 
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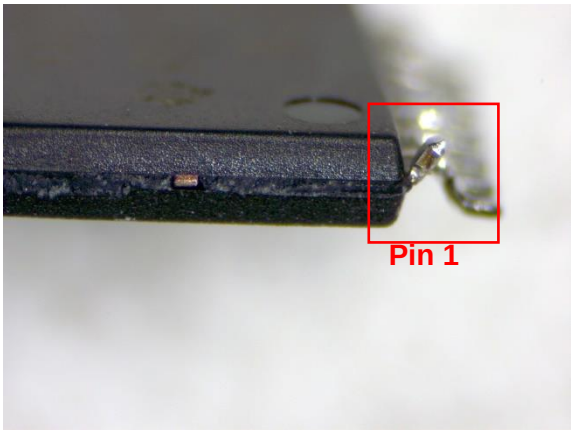
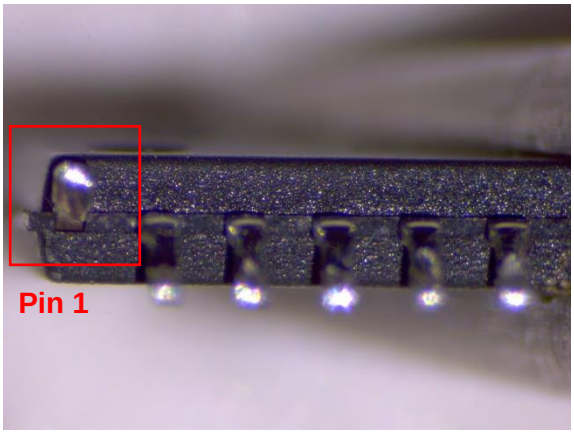
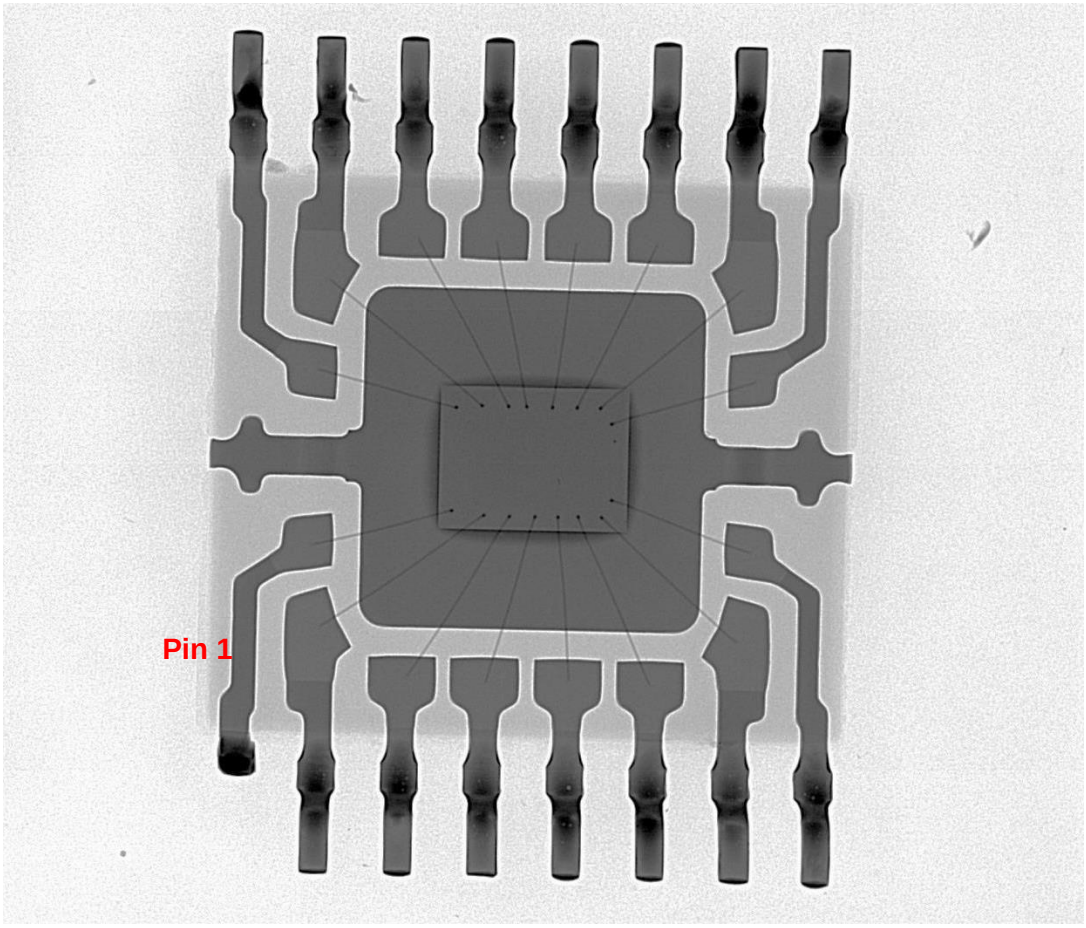
<tr><td>Unit #1 Top view</td><td>Unit #1 Bottom view</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Unit #1 Pin1</td><td>Unit #1 Pin1</td></tr>
</table>

Fig.1: Optical view of the returned unit.

- **X-Ray Analysis:**

  The returned unit#1 was inspected by X-ray. No anomaly was observed.

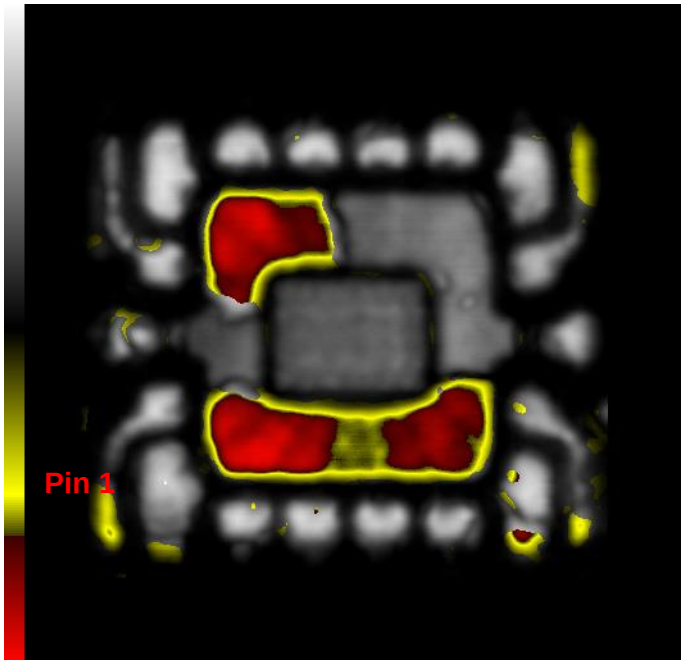


Unit #1 Top View

Fig.2: X-ray view of the returned unit.

- **Scanning Acoustic Microscopy (SAM):**

  Scanning acoustic microscopy inspection was performed on the returned units. No delamination was observed on die surface.

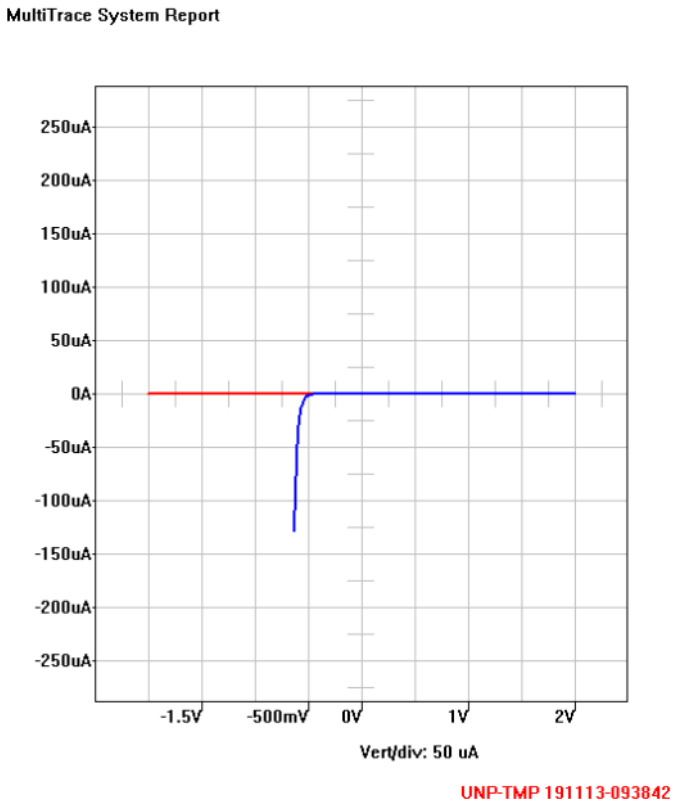


Unit #1 Waveform

Fig.3: CSAM view of the returned unit.

- **Electrical Characterization:**

  Curve trace analysis was performed on the returned units. Open failure was observed at pin1,2,10. Blue curve represents correlation unit. Red curve represents returned units.



Unit#1 Pin1,2,10 to GND

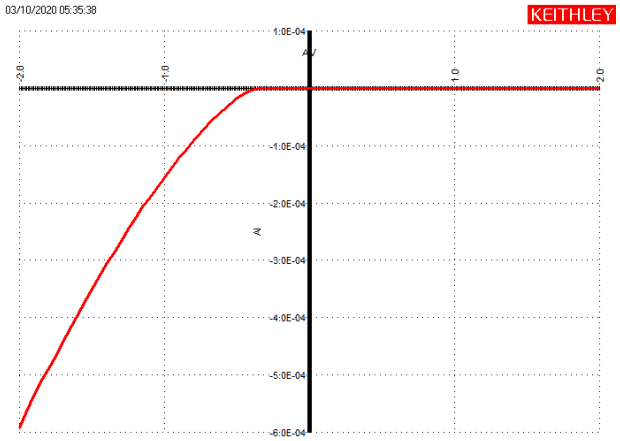
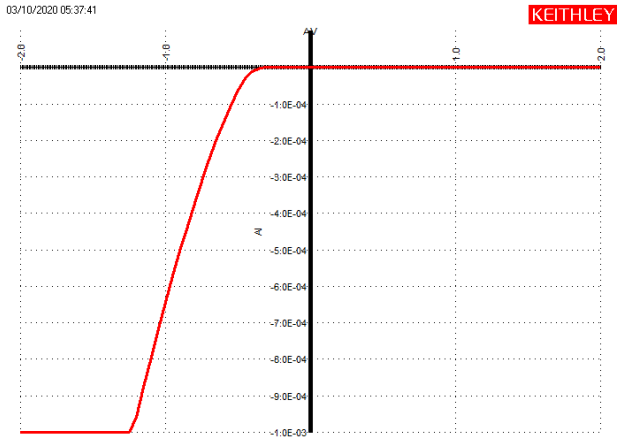
Fig.4: CT of the returned unit.

- **Decapsulation:**

  Returned unit was de-capped with laser and Cu wire was exposed.

- **CT recheck:**

  Curve trace analysis was performed on Cu wire. No open failure was observed. Damage suspect to be at wedge of pin1,2,10.

<table>
<tr><td> 
</td><td> 
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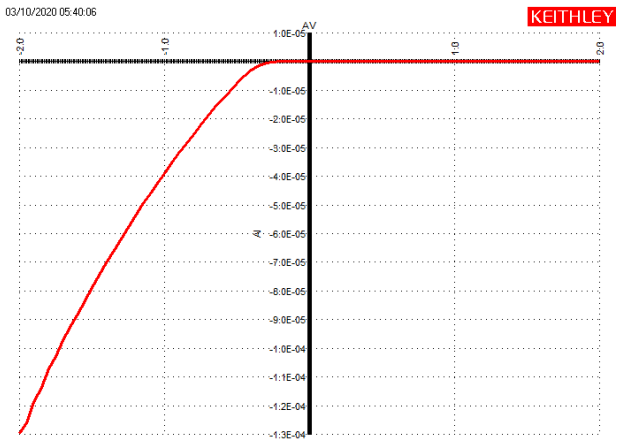
<tr><td>Unit#1 Pin1 to GND</td><td>Unit#1 Pin2 to GND</td></tr>
<tr><td> 
</td><td></td></tr>
<tr><td>Unit#1 Pin10 to GND</td><td></td></tr>
</table>

Fig.5: CT recheck on exposed wire.

- **Decapsulation:**

  Returned unit was de-capped at pin1 wedge with laser and mixed acid.

- **Internal Optical Inspection:**

  EIPD was observed on wedge.

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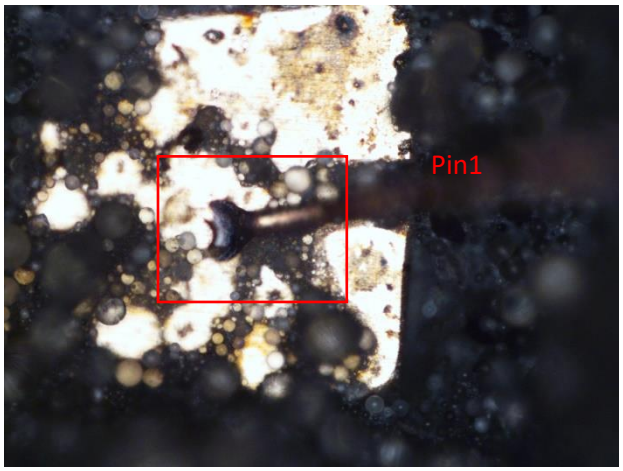
<tr><td> 
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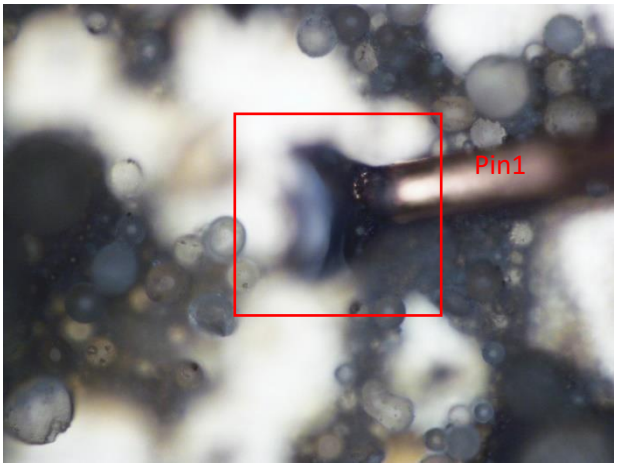
</td></tr>
<tr><td>Unit #1. Pin1</td><td>Unit #1. EIPD at wedge</td></tr>
<tr><td></td><td> 
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<tr><td></td><td>Unit #1. EIPD at wedge</td></tr>
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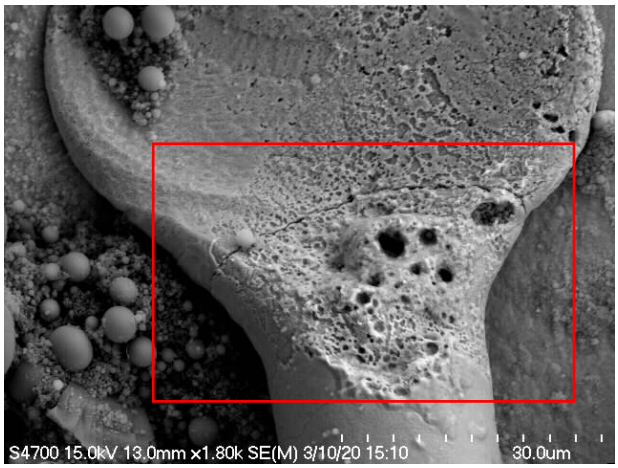
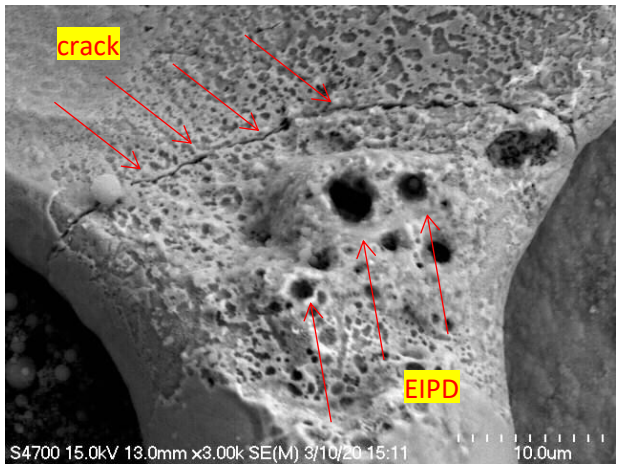


Unit #1. SEM image



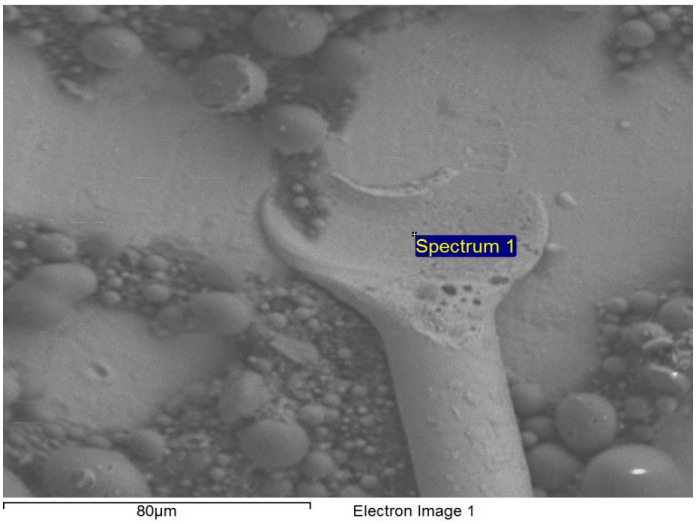
Unit #1. SEM image

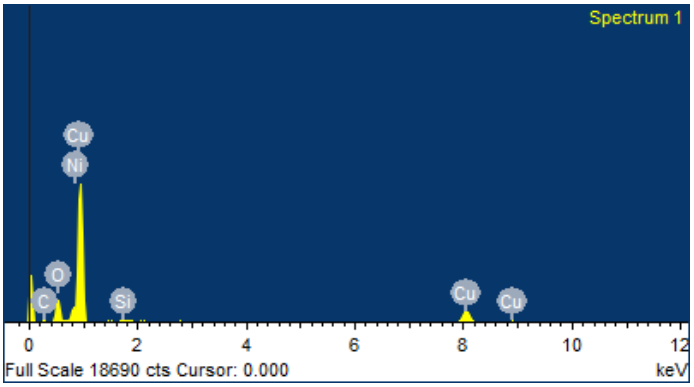
Fig.6: Optical image of the returned unit#1 after de-capsulation.

- **EDX analysis:**

  Unit#1 was submitted to EDX analysis. No abnormal element was detected.

Element	Weight%	Atomic%
C K	4.83	15.73
O K	13.68	33.49
Si K	0.67	0.93
Ni K	0.91	0.60
Cu L	79.91	49.24
Totals	100.00	





- **Conclusion:**

  Curve trace analysis showed open failure on unit #1.

  PFA showed EIPD and crack at wedge of fail pin1.

  The damage is typically indicative of electrical induced physical damage (EIPD).

Note 1: Due to digital image capture, the magnification is not calibrated nor is the aspect ratio maintained. Not all tools provide a means recorded in the image for calibrating the measurements. When a calibration marker is supplied in the image, the measurements may be calibrated in the direction of the marker.