FAILURE ANALYSIS REPORT

TEXAS INSTRUMENTS

TI Information - Selective Disclosure

Device Analysis Services

FA405534-1

Customer:	ARROW CORPORATE XLR8 T1	**Assy Site:**	QAB
Customer Tracking ID:		**Fab Site:**	MH8
Customer Part ID:		**Technology:**	LBC7
Customer Contact:	Rachel	**Analyst:**	Stephen Holman
Device Type:	TPS54622RHLR	**TI Contact:**	Kris Ganesan Pillai
		Qty Submitted:	2
Flow Type:	Customer Return	**Date Submitted:**	07/29/2014
Reviewer:	Michael Foley	**Approval:**	Michael Foley

Summary

Failure Analysis	Results
Customer Reported Failure Mode	TPS54622RHL has no output. The IV curve of the EN-GND is abnormal.
TI Failure Description	Unit 1 & 2, EN is electrically open. Unit 1, VIN leakage to GND.
What effect does the defect or damage cause?	Thermal damage in the EN circuitry caused the EN to have a resistive open, and the VIN leakage to GND.
Where and what is the defect/damage?	Thermal damage is in the EN circuitry.
Did the identified physical defect/damage explain the TI reported failure mode?	The thermal damage in the VIN circuitry does explain EN having a resistive open, and the VIN leakage to GND.

TI Unit #	Cust. Unit #	Lot Trace Code	Symbolization	Wafer Fab Lot #
1		24C4G4I	54622	2047015
2		24C4G4I	54622	2047015

- **Customer Reported Problem Description:**

  TPS54622RHL has no output. The IV curve of the EN-GND is abnormal.

- **TI Problem Description**

  Unit 1 & 2, EN is electrically open.
  Unit 1 has VIN leakage to GND.

- **Package Analysis**

  - **External Package Examination:**

    External visual examination showed no abnormalities that would contribute to device failure (see Figure 1).

  - **X-Ray Analysis**

    Internal x-ray examination did not reveal any obvious evidence of damage or defect (see Figure 2).

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

    Scanning Acoustic Microscopy examination revealed delamination on the lead frame not related to device failure (see Figure 3).

- **Electrical Characterization**

  Pin to pin curve tracer analysis of the returned units revealed anomalous characteristics when compared to a standard unit. Unit 1 and Unit 2 exhibited a resistive open between device pin EN (Pin 10) and all other pins. Unit 2 additionally exhibited a resistive leakage between device pin VIN (Pin 6) and GND (Pins 2 and 3) (see Figure 4 and Figure 5).

- **Decapsulation:**

  Unit 1 and Unit 2 were chemically decapsulated and cleaned for internal optical inspection.

- **Internal Optical Inspection:**

  Internal visual examination revealed obvious thermal damage to the EN (Pin 10) circuitry (see Figure 6).

- **Failure Isolation:**

  Failure isolation was achieved through decapsulation, deprocessing, and visual inspection.

- **Deprocessing and Visual:**

  Unit 1 and Unit 2 were deprocessed removing the copper metal layer to expose thermal damage to the EN (Pin 10) circuitry (see Figure 7 and Figure 8).

- **Physical Mechanism ID:**

  Thermal damage was identified by metal flash-over.

- **Conclusion:**

  The failure of two TPS54622RHLR was confirmed. Unit 1 and Unit 2 exhibited a resistive open between device pin EN and all other pins. Unit 2 additionally exhibited a resistive leakage between device pin VIN and GND. Internal visual examination revealed obvious thermal damage to the EN circuitry. Damage of this nature is typically caused by an applied electrical overstress (EOS) event.

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.

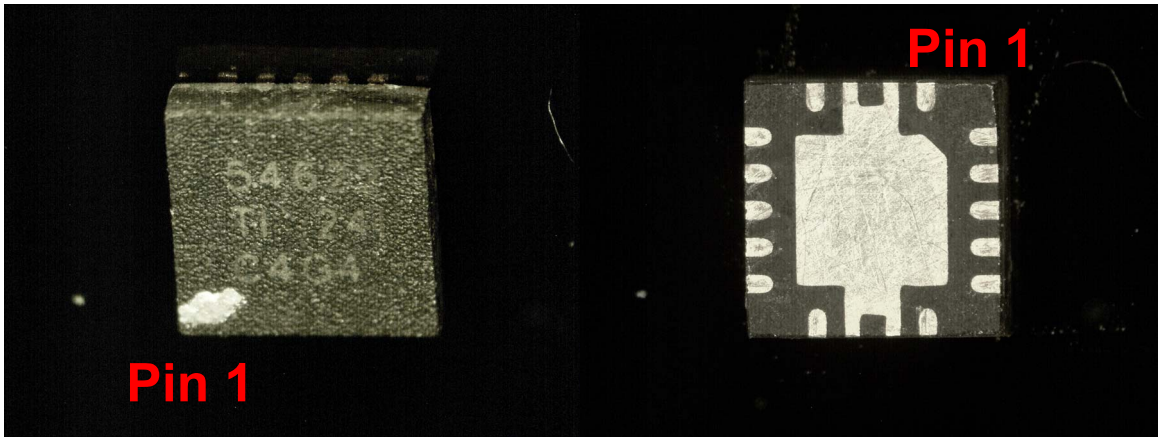

Figure 1: Unit 2 as received, representative of Unit 1. Top view is on the left. Bottom view is on the right. No obvious evidence of damage or defect.

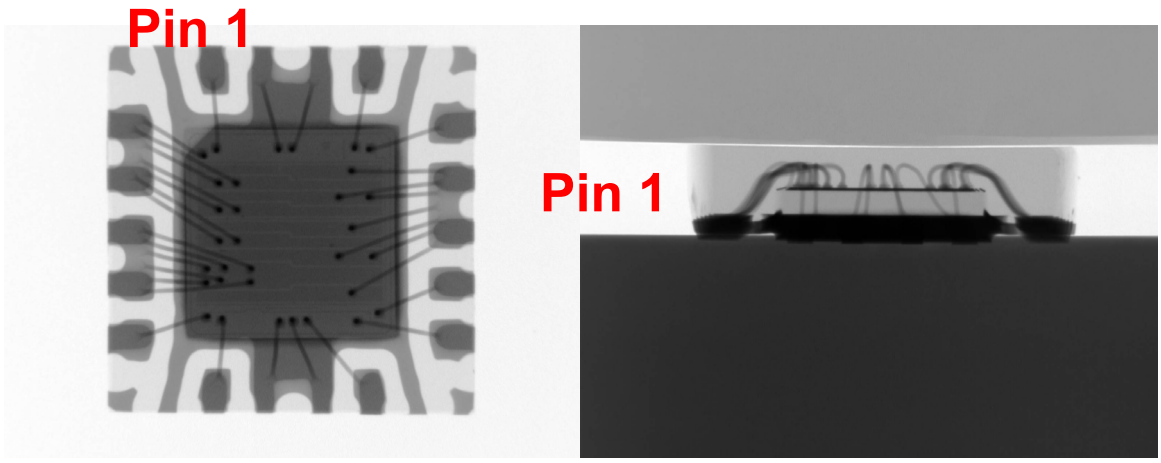

Figure 2: X-ray of Unit 2 as received, representative of Unit 1. Top view is on the left. Edge view is on the right. No obvious evidence of damage or defect.

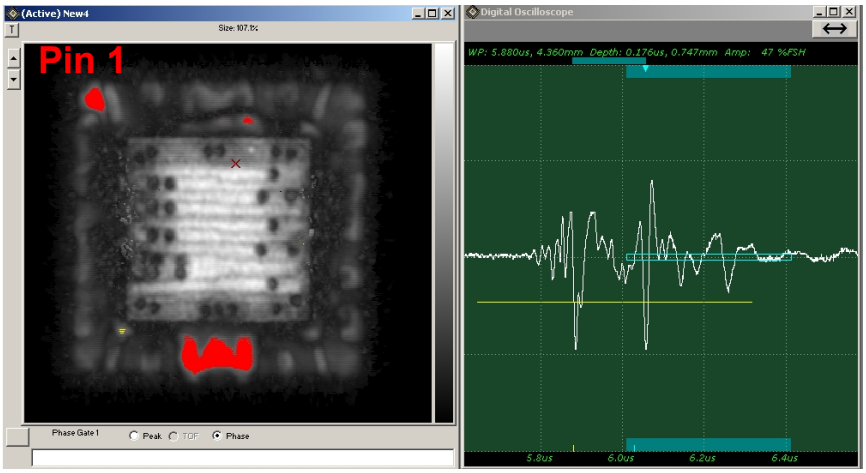

Figure 3: Unit 2 SAM analysis, representative of Unit 1, analysis revealed delamination on the lead frame not related to device failure.

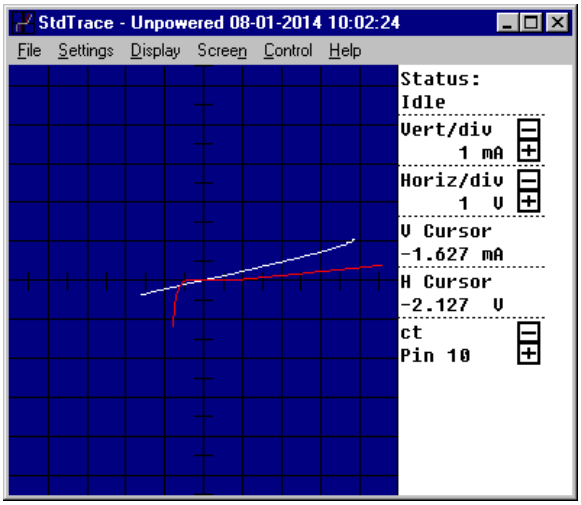

Figure 4: Unit 1 and Unit 2, EN (Pin 10) referenced to all other pins. White is returned units. Red is good unit.

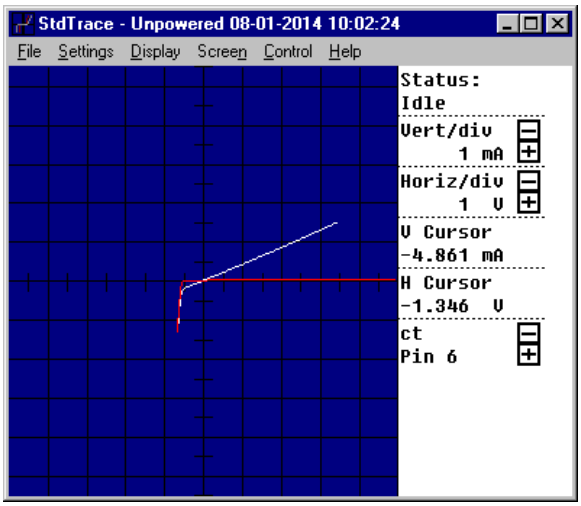

Figure 5: Unit 2, VIN (Pin 6) referenced to GND (Pins 2 and 3). White is returned unit. Red is good unit.

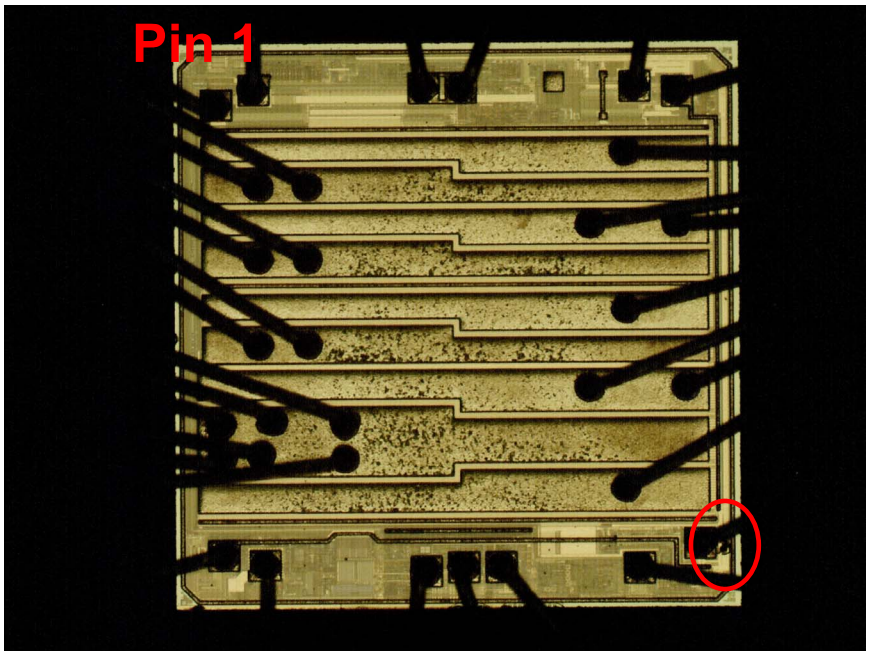

Figure 6: Unit 2 as decapsulated, representative of Unit 1. Circled is the area of thermal damage to the EN (Pin 10) circuitry.

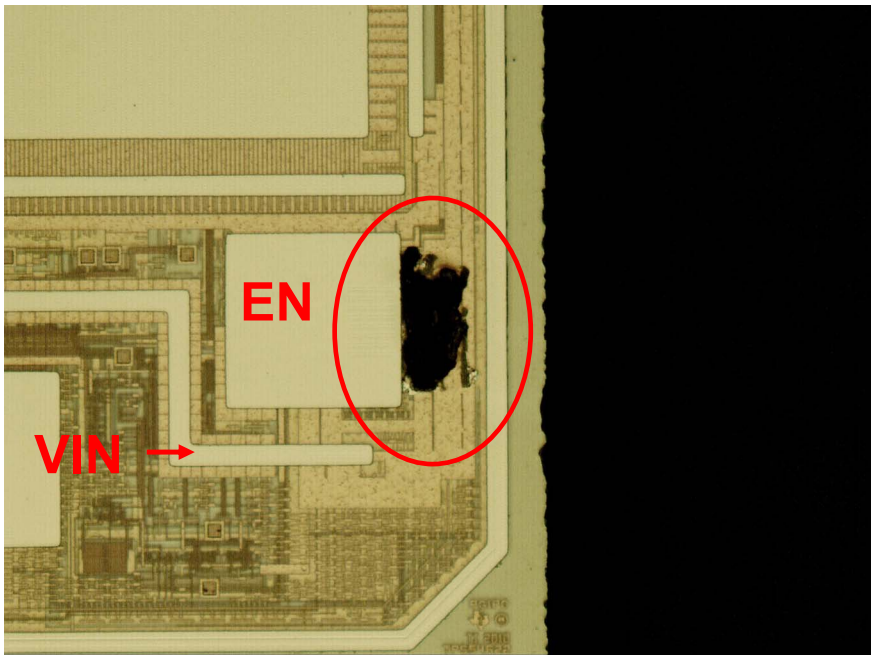

Figure 7: Unit 1 as deprocessed with copper metal layer removed, close-up of the thermal damage to the EN (Pin 10) circuitry.

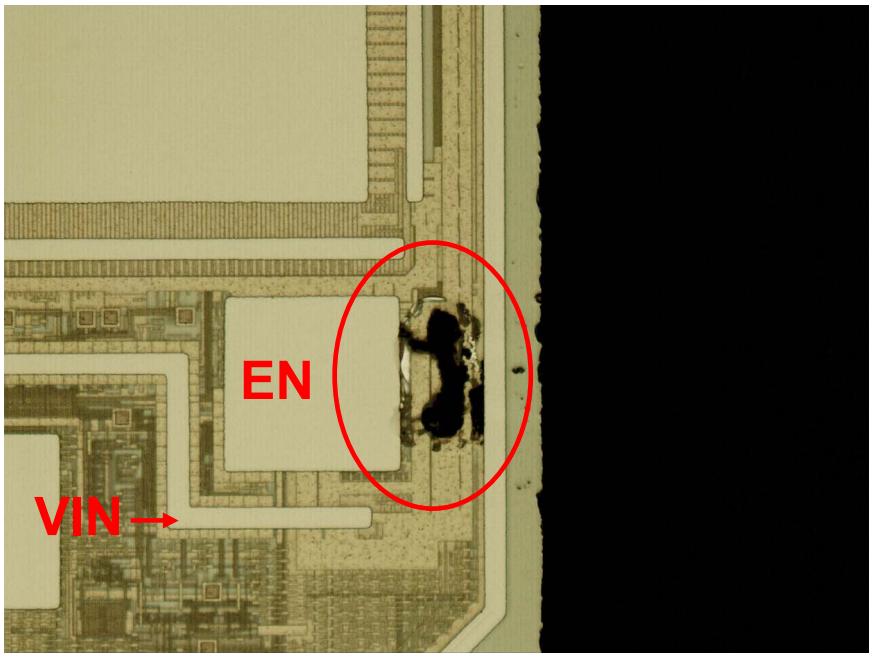

Figure 8: Unit 2 as deprocessed with copper metal layer removed, close-up of the thermal damage to the EN (Pin 10) circuitry.