SanDisk®

Failure Analysis & Corrective Action Report
Preliminary

RMA Number: SDUS0124

Device: SDSA5JK-064G,Met6-QFN,4x2D64GbMA02X2,52LGA,Asus U

Date: 12/22/2011   **Author:** Katie Nguyen   **Owner:** Arthur Wong

Customer Information:

Name: ASUStek

Contacts	Name	Email Addresses
Technical Contact	Kravany Asaf	asaf.kravany@sandisk.com
Technical Contact	Holther Michael	michael.holther@sandisk.com

Customer Failure Environment

Type of Failure:	**Nature of Test:**	**Failure Description:**
Other		Other

Failing Temperature:	**DOS Image:**	**Does Good Unit Pass Test:**
Unknown	Unknown	Yes

Parts Received Date:
12/14/2011

Problem Description:

Customer Issue Description:
Units #1,2,3,4,7,8,9 are SDSA5JK-128G
Units #5,6 are SDSD5JK-064G
Units #1 to #6 were checked by Sankit burn-in WRC test and got failed results.
Units #7 to #9 passed the check, provided just for double confirm.

Device Details

Device Marking	Qty	Mfg. Date	Capacity	Technology Code
113935308266	1	Work Week 39, 2011	128GB	20854
113944313787	1	Work Week 39, 2011	128GB	20854
114544300652	1	Work Week 45, 2011	128GB	20854
113944317946	1	Work Week 39, 2011	128GB	20854
113345300009	1	Work Week 33, 2011	64GB	20854
114439309336	1	Work Week 44, 2011	64GB	20854
113944310137	1	Work Week 39, 2011	128GB	20854
113935305499	1	Work Week 39, 2011	128GB	20854
113935310478	1	Work Week 39, 2011	128GB	20854

Summary/Abstract:

Six units are confirmed to be fully functional, two units are still under investigation, and one unit failed due to a random memory defect. This defect would be caught by the production test process that was waived by the customer during the production of this lot.

Team Members:

Arthur Wong	CQE
Katie Nguyen	FA Analyst
Harini Elayavalli	Firmware Engineering
Abhijeet Manohar	Memory System Engineering
Harlee Carter	System Design Engineering

Define Root Cause:

System Serial #	Device Markings	Device Stage	Failure Category	Failure Sub Category	Failure Description
1	113935308266	MP	Memory	Word Line Short	A memory defect leading to data corruption.
2 6	113944313787 114439309336	MP	Under Investigation	Under Investigation	TBD
3 4 5 7 8 9	114544300652 113944317946 113345300009 113935305499 113935310478 113944310137	MP	NTF	NTF	No trouble can be found.

Failure Remarks:
Unit 1:
Upon arrival the unit was visually inspected with no obvious external abnormalities found.

At the application level, the unit was found to be able to link with a standard SATA host. In addition, the unit was recognized by BIOS and normal functional operations were successful. The unit was also recognized on a by a Windows XP operating system and the full capacity of the drive was seen through the Windows Device Manager. Logical read testing was performed on the entire user area found multiple Logical Block Addresses (LBAs) with read errors.

At diagnostic level, the internal error log of the unit was found to contain several entries indicating uncorrectable ECC (UECC) errors were encountered during operation. The UECC reported by the error log matched the failing LBAs from the logical read test. Analysis of the physical locations indicated by the error log confirmed the data was in an improper condition and was the cause of the read errors.

The unit was then transferred to the firmware engineering team for analysis of the failure. Here the firmware team was able to identify the cause of the failure: Corruption in a written block which caused an unrecoverable error condition.

The unit was then transferred to the memory systems team for additional analysis. Here it was confirmed that the corruption was due to UECC in one particular location, preventing the data written at this location from being read properly. Analysis of the physical location with UECC found that a word line within this block was corrupted. Program or erase operations in this block were found to fail when attempting to program or erase the corrupted word line.

The unit was then passed to the memory device team, where it confirmed that the word line failure was due to a short. This failure mode is due to a latent defect in the memory.

The unit was confirmed to have a production test stamp indicating it passed the initial production test flow. An analysis of the test history in this device found that it did not complete the full test flow at the customer request. As a result, the failure rate is within the value predicted by SanDisk as a result of skipping this test flow.

Unit 4, 8, 9:
Upon arrival the units were visually inspected with no obvious external abnormalities found.

At the application level, the units were found to be able to link with a standard SATA host. In addition, the units were recognized by BIOS and normal functional operations were successful. The units were also recognized on a by a Windows XP operating system and the full capacity of each of the drives was seen through the Windows Device Manager.

The units were found to be fully functional after the following tests:
- → All firmware files and parameters were found to be correct and passed all low-level format diagnostics.
- → The units had no entries in their internal error logs, indicating no errors occurred during operation.
- → Logical read testing of the entire data areas passed with no issue.
- → The units were able to format with Windows. Files were copied to the units, read back and deleted with no issue.

The units went through the card-level production test which resulted in a passing status. To ensure the units had no other issues, they were subjected to a write/read/compare test where the entire capacity was cycled for 24 hours with no failures. The units were then transferred to System Engineering group for further investigation. Here, they were put through a battery of tests including running test using on the ASUS Ux21E host for 12 hours with no errors encountered.

Unit 3:
Upon arrival the unit was visually inspected with no obvious external abnormalities found.

At the application level, the unit was found to be able to link with a standard SATA host. In addition, the unit was recognized by BIOS and normal functional operations were successful. The unit was also recognized on a by a Windows XP operating system and the full capacity of the drive was seen through the Windows Device Manager. In addition, logical read testing was performed on the unit at 25°C and 70°C with no errors found.

At diagnostic level, the internal error log of the unit was found to contain an entry indicating a read error was encountered during operation. However, examination the location reported by the error log found no issues. In addition, an examination of the firmware file system and control blocks found no abnormality.

The unit was transferred to System Engineering group for further investigation. Here, it was put through a battery of tests including running test using on the ASUS Ux21E host for 12 hours with no errors encountered. Then the unit went through the card-level production test which resulted in a passing status. To ensure the unit had no other issues, it was subjected to a write/read/compare test where the entire capacity was cycled for 24 hours with no failures.

Unit 5 & 7:
Upon arrival the units were visually inspected with no obvious external abnormalities found.

At the application level, the units were found to be able to link with a standard SATA host. In addition, the units were recognized by BIOS and normal functional operations were successful. The units were also recognized on a by a Windows XP operating system and the full capacity of each of the drives was seen through the Windows Device Manager. In addition, logical read testing was performed on the unit at 25°C and 70°C with no errors found.

At diagnostic level, the internal error logs of the units were found to contain an entries indicating an erase error was encountered during operation. Examining the location reported by the error log found the erase failure was handled

properly by firmware on each unit. In addition, an examination of the firmware file system and control blocks found no abnormality.

The units were transferred to System Engineering group for further investigation. Here, they were put through a battery of tests including running test using on the ASUS Ux21E host for 12 hours with no errors encountered. Then the units went through the card-level production test which resulted in a passing status. To ensure the units had no other issues, they were subjected to a write/read/compare test where their entire capacity was cycled for 24 hours with no failures.

Unit 2:
Upon arrival the unit was visually inspected with no obvious external abnormalities found.

At the application level, the unit was found to be able to link with a standard SATA host. In addition, the unit was recognized by BIOS and normal functional operations were successful. The unit was also recognized on a by a Windows XP operating system and the full capacity of the drive was seen through the Windows Device Manager. The SMART attributes of the device were extracted and found to contain indications of errors when reading the device ID.

At diagnostic level, the internal error log of the unit was found to contain an entry indicating errors were encountered during operation. The unit was then transferred to the System Engineering team for additional analysis which it still ongoing.

Unit 6:
Upon arrival the unit was visually inspected with no obvious external abnormalities found.

At the application level, the unit was found to be able to link with a standard SATA host. In addition, the unit was recognized by BIOS and normal functional operations were successful. However, the unit was unrecognized on a by a Windows XP operating. In addition, the SMART attributes were not able to be extracted from the device.

The unit was then transferred to the System Engineering team for additional analysis which it still on-going.

Root Cause Remarks:
Unit 1: Based on the analysis above, the unit failed due to a defective data block in the memory which caused corruption on a word line. The failure would have been caught if it went through the write/read/compare cycle test in production which was waived by customer.

Unit 3, 4, 5, 7, 8, 9: Based on the analysis above, SanDisk was not able to confirm any failure on the devices. The units themselves are fully functional and are therefore considered No Trouble Found (NTF).

Unit 2 & 6: Root cause of the failure has not been determined yet since investigation is still on-going.

Implement Corrective Actions:

Corrective Actions	Implementation Date
Units #1, 3, 4, 5, 7, 8, 9: Corrective action cannot be generated for these units.	N/A
Units 2 & 6: The root cause is still under investigation.	TBD