

Power Failure Protection

White Paper for Industrial SD/MicroSD

May 26, 2016

Version 1.0

Data Protection Mechanism

The data correctness and reliability of flash memory are very important for industrial products. Flash memory may be stored customers' data and production records, if data error or loss happened, it will be a serious problem for industrial applications. More probability of data loss situations would be happened when suddenly power failure. It is necessary for Industrial SSD drives/cards design with Data Protection Mechanism.

NAND Flash Architecture and Normal Procedures

A NAND Flash memory array consists of multiple Blocks, a Block consists of multiple Pages, and a Page consists of multiple Columns. The program unit in the NAND Flash memory is Page, the erase unit in the NAND Flash is Block.

The data content of the Page of the NAND Flash memory must be trusted and ensure the Block of the NAND Flash memory is valid or blank.

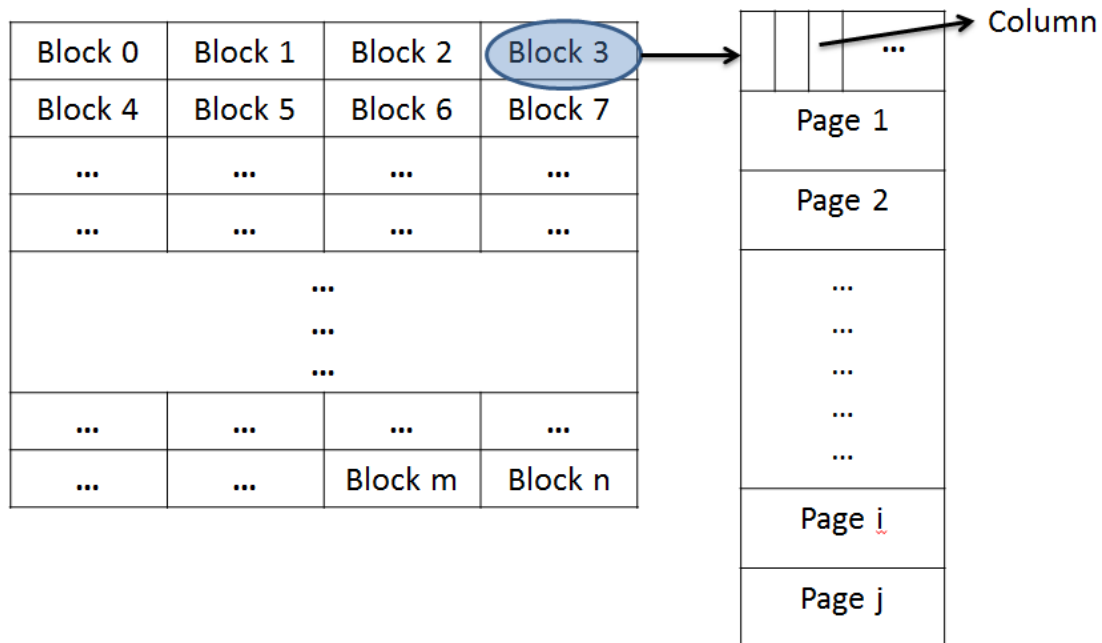


Figure1. The brief architecture of NAND Flash

A typical write procedure will require two individual Blocks to store user data and system information. The user data will be stored in the User Data Block, and the System Table Block will keep the tracks of the physical Flash Pages with respect to the host-side LBA (Logical Block Addresses). Flash controller needs to ensure the user data Block and System Table Block to be correct during the normal procedure.

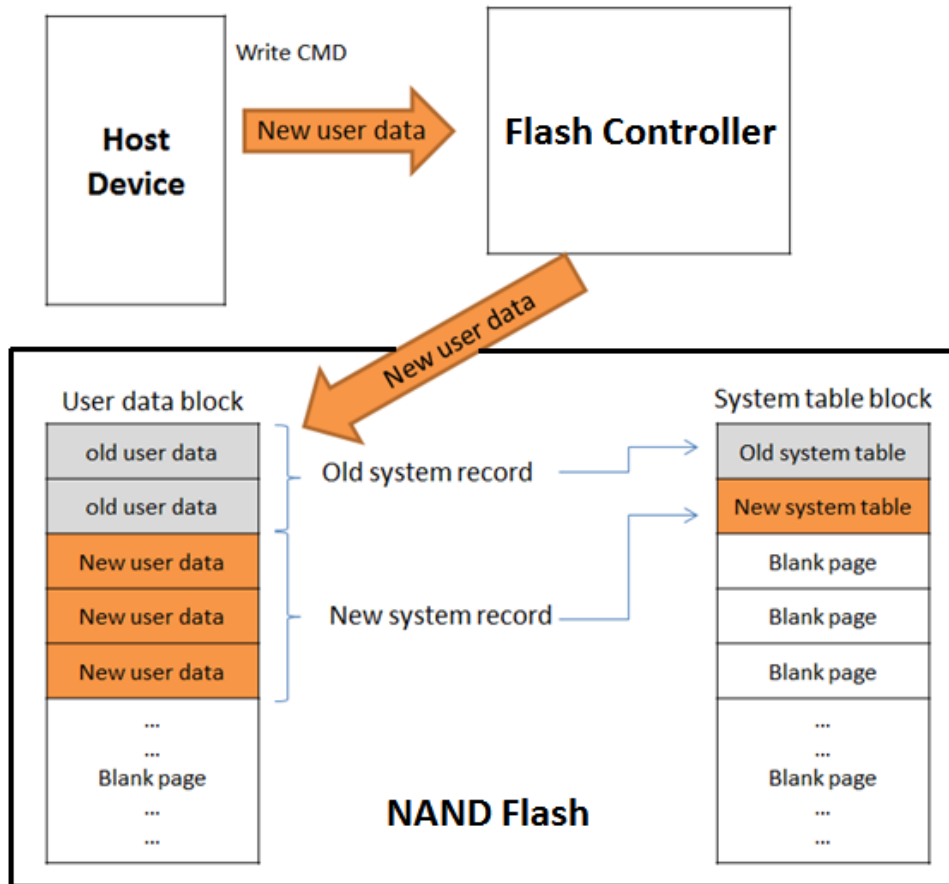


Figure2. The data stream from Host to device

Power Failure Protection

Apacer industrial SD and MicroSD cards provide the complete data protection mechanism during every abnormal power shutdown situation, such as power failure at programming data, updating system tables, erasing blocks, etc. The mechanism can maintain the data correctness and increase the reliability of the data stored in the NAND Flash memory.

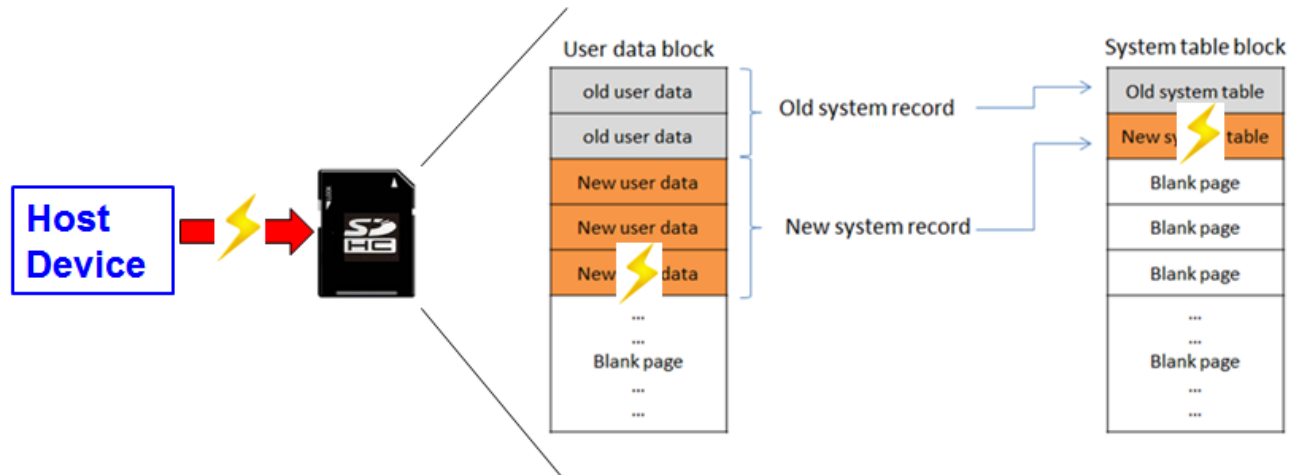


Figure3. Power failure protection diagram

Abnormal power shutdown occur during data program

If the abnormal power shutdown occurs during the data programming, it may cause the page data becoming uncorrectable. After that, the Flash controller will detect and discard the uncorrectable data pages and rebuild the user data, then update the system table.

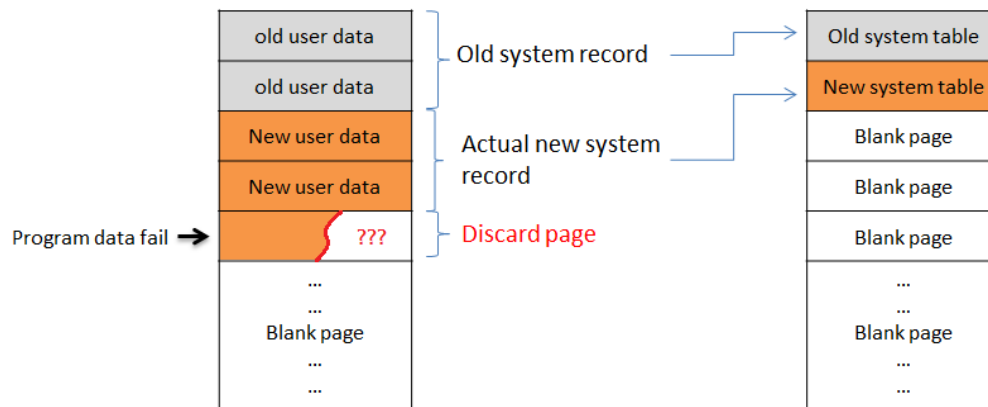


Figure4. Abnormal power shutdown occur during data program

Abnormal power shutdown occur during system table update

If the abnormal power shutdown occurs during the system table updating, it will cause the Page data becoming uncorrectable and the new user data might be lost. After that, the Flash controller will rebuild the user data and update the system table.

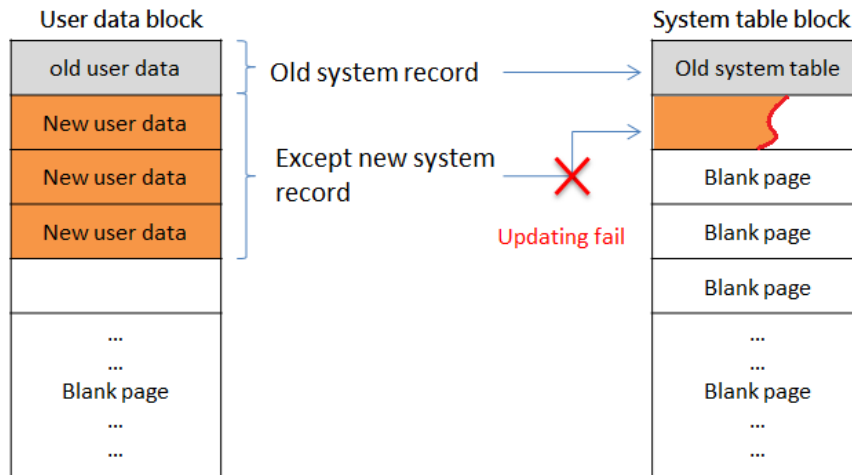


Figure5. Abnormal power shutdown occur during system table update

Abnormal power shutdown occur during block erase

Sometimes controller needs erase the dirty Blocks for reusing. If the abnormal power shutdown occurs during the Block erase procedure, it may cause the wrong Block erasure and the dirty blocks could not be reused. In this situation, controller will scan out the dirty Blocks and erase the dirty Blocks again.

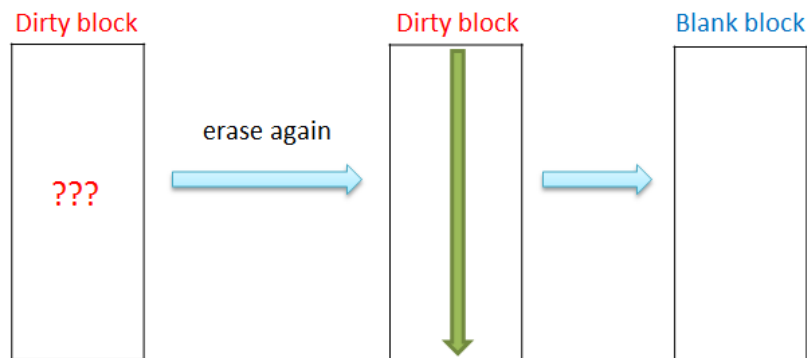


Figure6. Abnormal power shutdown occur during block erase

Revision History

Revision	Date	Description	Remark
1.0	05/26/2016	Official release	

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