ROBUST POWER LOSS PROTECTION

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FLEXXON POWER LOSS MECHANISM

By adding capacitor components (pFail protection circuit) on PCBA design, these capacitors ensure the required time for the SSD device to complete the flushing process after an unexpected power loss event occurs. These capacitors are charged when the SSD is powered on and acts like a UPS (uninterruptible power supply) for emergency power to the SSD to preserve data.

INTRODUCTION

Unexpected power loss has been a critical issue in the storage industry, regardless of SSD or HDD, in terms of data loss. In this document we will focus on how FLEXXON combats data loss in SSD. In most SSD devices, DRAM memory is usually used to reduce the performance gap between host interface and NAND flash memory. The SSD device uses a flushing process to store buffer data from DRAM memory into NAND flash memory, completely storing the data sent by host. However, because DRAM memory is volatile and cannot hold data without an external power supply, there is a possibility of losing cached data during the flushing process when an unexpected power loss incident occurs.

Preventing data loss when encountering sudden power loss is an important topic in the SSD industry, and FLEXXON's hardware power loss protection mechanism is the solution to preserve data in the event of unexpected power loss.

HOW DOES FLEXXON POWER LOSS PROTECTION WORK

Seen **Figure 1 & 2**, FLEXXON designed a SSD device with a hardware power loss protection mechanism (pFail protection circuit). It has a voltage drop detector, so when the SSD device detects the host power dropping, the SSD's pFail protection circuit will be triggered and begin providing power to the SSD. The SSD then will start to flush cached data from DRAM memory to NAND flash memory in order to preserve data integrity and prevent data loss.

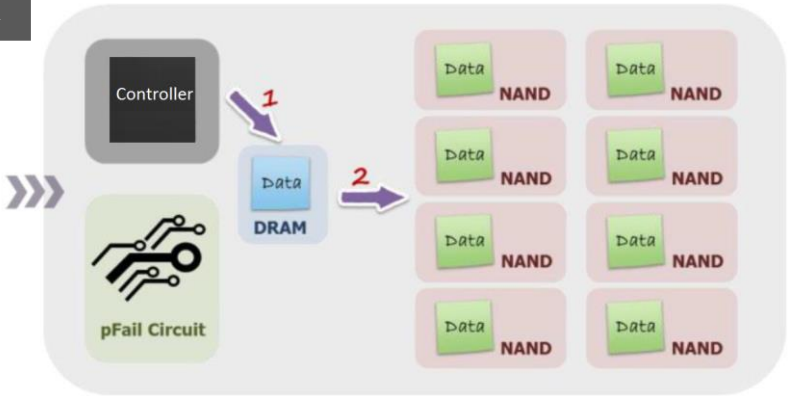

Figure 1 : Normal operation: The SSD is powered by the host power, and the pFail circuit is charged by the host power.

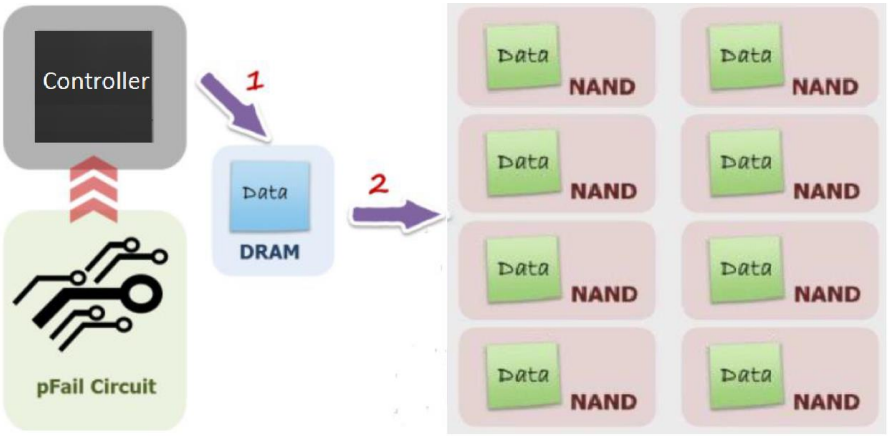

Figure 2. pFail protection mechanism

Unexpected Power Loss happens: When SSD detects the host power dropping, the pFail protection circuit starts to provide power to the SSD while it flushes cached data from DRAM to NAND.

Moreover, from **Figure 3**, it demonstrates the SSD flush cache trigger mechanism. When an event of unexpected power drop occurs, SSD firmware will detect the power drop incidence by GPIO, and all the internal activities of SSD will be suspended immediately, including garbage collection, wear-leveling, etc. After Stage 2, the cached data will be 4K aligned before flushing to NAND flash memory in order to fit the firmware data management structure. And then the SSD firmware will start to flush cached data stored in DRAM memory, including user data and firmware metadata, to NAND flash memory to complete flushing process while sudden power loss event.

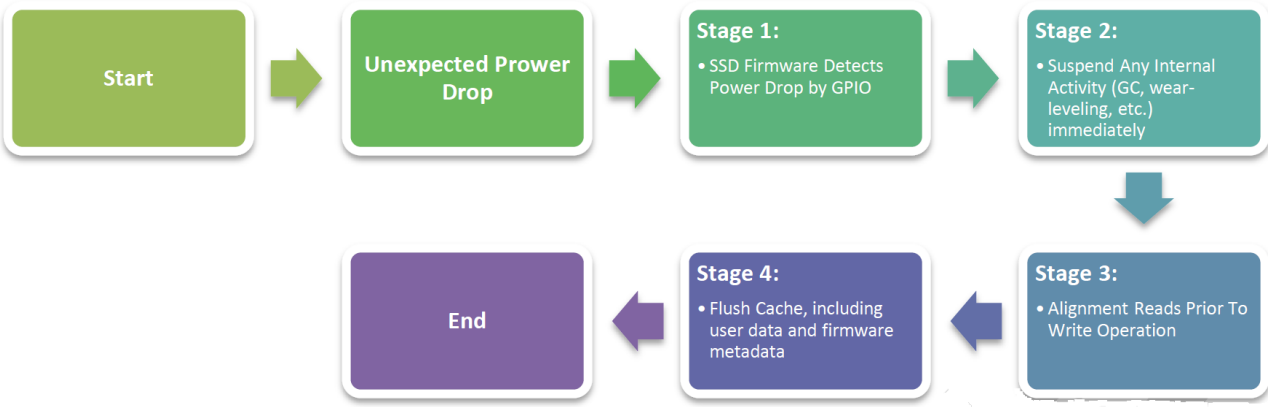

Figure 3. How SSD firmware mechanism handle unexpected power loss

Additionally, as shown in **Figure 4**, FLEXXON's pFail protection mechanism can provide a maximum of 25ms holdup time to flush 8MB cached data stored in DRAM memory in order to preserve data integrity and prevent data loss.

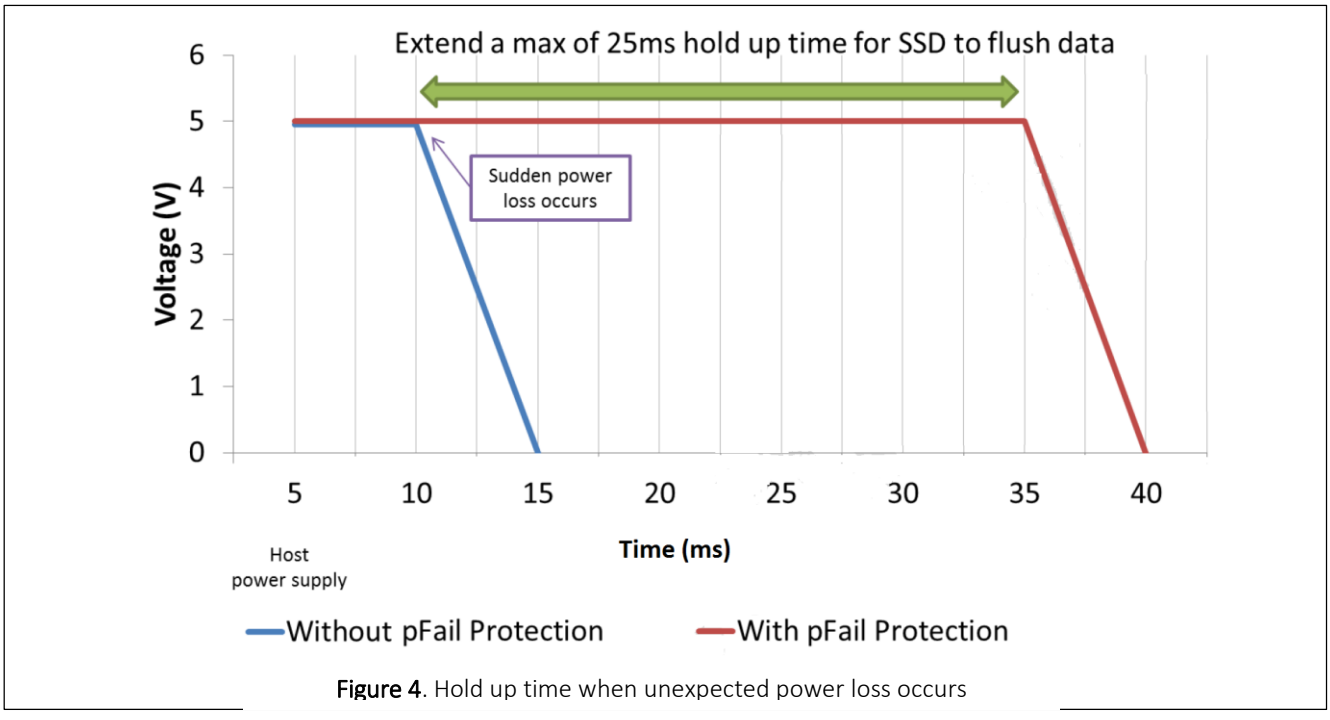

Figure 4. Hold up time when unexpected power loss occurs