Part Protected Embedded Modules

ATP Power Protector Technology in Networking Applications

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The networking industry requires dynamic embedded systems solutions with the flexibility of application specific designs, long-term durability, space constraint requirements, and data integrity. A common embedded SSD usage in networking applications includes boot up applications in which load time, constant/redundant read operations, and fast reliable back up become critical issues. Furthermore, the need for data integrity under adverse power conditions becomes one of the most important factors to consider during different applications for embedded SSD usages.

Embedded SSD's possess many of the same NAND management features as standard SSD's. These include flash management, with advanced data corruption mitigation, high reliability, and endurance with advanced wear leveling and write amplification reduction. Networking applications however require smaller format designs. Embedded modules are an ideal replacement for space-constrained applications as they are typically half the size of standard SSD's.

Power protection technologies have become prevalent in full size SSD form factors, but not in smaller embedded module configurations. Along with all of the benefits of standard SSD's, ATP branded embedded modules also come with Power Protector Technology. This added benefit is crucial during a sudden power down scenario.

Commands of NAND Flash Operations and The Impact During a Power Failure

Discussed below is a basic overview and risk assessment of the primary operations, which can be interrupted by sudden power down.

In "standby" mode, a power failure has no impact on the device and there is no data loss, the device will simply reset.

During a "read" command and under a power failure there is little impact on the data. In some SSDs, there is a low risk of a "read" failure where the controller may possibly need to program data to a reserve block. A power failure in this case has the same risk of a "program" command.

When the drive performs a "program" command, the likelihood of data corruption during a power failure increases significantly. During a "program" command, pages within the storage blocks are programmed in a sequential manner. During a power failure, the programmed pages become "unknown" or unusable, because the controller cannot recognize the state of the page and data is lost. A more severe case is if the controller link table is being programmed during the power failure. Without the link table, even with all data programmed

successfully to the NAND, it can become inaccessible and render the drive useless.

During an “erase” command of NAND flash operation, blocks of data may be erased in order to modify data on a single page. When a power failure occurs during the “erase” mode, multiple blocks of data also become “unknown”.

Table 1-1 Risk Assessment of Commands in Flash Operations

	Data Loss		Impact	Risk
Standby	**No**		**Reset device**	**Low**
Read	**Page/multi-plane/multi-channel**		**Read retry**	**Low**
Erase	**Block**		**Loss block data**	**High**
Program	**Data**	**Physical Page/multi-plane/multi-channel**	**Loss page data**	**High**
	FAT	**File allocation table**	**File system crash**	**Fatal**

Power Protector Technology

ATP Power Protector Technology guarantees reliable controller and lasting NAND flash operation with a back up power circuit during a power outage. The standalone design of Power Protector ensures a sufficient amount of backup power during any power abnormalities such as unstable voltages, and power outages during each command of the flash drive. During a power failure, Power Protector activates and the flash drive is able to draw reserve power from Power Protector’s solid state capacitors. This allows the drive to finish the last “program”

and “erase” commands, a critical feature which protect the page(s) or block(s) in mid transaction, in addition to the controller link table.

Power Protector is a stronger alternative to both battery and SuperCap solutions for back up power. Battery based solutions are not cost effective with short life spans and high costs of replacement. The hardware based design of Power Protector with its longer lifespan, support of wide temperature ranges, and low risk exceeds the performance and reliability of SuperCap based solutions.

TABLE 1-2 Power Protector vs. Other Solutions

Solution	Impact	Effectiveness	Risk	Lifetime	Wide Temp
POWER Protector	HW Design	Great	Low	> 5 Years	Yes
Battery	Size	Great	High	< 3 Years	No
SuperCap	Controller+ HW Design	Great	Degradation	< 2 Years	No

The high level of data integrity needed in networking applications is addressed by the backup power found in the ATP Power Protector Technology.

About ATP

ATP Electronics is a leading manufacturer of high performance, high quality and durable NAND flash memory solutions and DRAM memory modules. With over

twenty years of experience in service based memory products, ATP continues to focus on mission critical applications such as industrial, telecom, medical and enterprise computing where high levels of technical support, performance consistency and wide operating temperature ranges are required. ATP offers unique flash technologies such as Power Protector, Secure Erase and SMART Life Monitor and recently introduced the Elevated Temperature Burn In Testing system to screen for SMT related assembly issues and IC infant mortality. ATP also offers extensive supply chain support with controlled/fixed BOMs and long product life cycles, with components sourced from the Micron's Product Longevity Program with a guaranteed life cycle of up to ten years.

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