



# Virident FlashMAX PCIe Storage Class Memory



## Virident FlashMAX™ Storage Class Memory (SCM)

Virident incorporates specialized software and hardware that combine to implement Storage Class Memory (SCM) within the server. Virident's SCM architecture has been designed to tightly integrate different kinds of flash media, hardware and software to deliver memory-class performance with storage-class capacity and persistence. Virident's FlashMAX SCM devices and associated software deliver performance without compromise, along with HDD-like capacity in a very compact, universal form factor.

## Virident vFAS™

vFAS stands for Virident Flash-management with Adaptive Scheduling, which is the Virident software layer that delivers the most efficient access to flash media for applications. In addition to providing optimized access for peak performance, vFAS also includes many sophisticated techniques for ensuring that applications get a steady, sustained stream of data at all times. vFAS virtualizes the underlying flash media to present a standard block device interface to applications, without leveraging inefficient storage protocols or interconnects, resulting in unprecedented gains in application performance without any change to the application.

## Memory-like performance and Hard Disk Drive-like capacities

Virident's FlashMAX presents a traditional block storage volume to the host so that applications can easily access it without realizing that it is a different type of media. But that is where the similarity to a disk drive, and disk drive interfaces, ends. vFAS has been designed to treat flash media much more like an extension of memory, while maintaining a traditional block storage interface for applications. All of this is done without leveraging storage protocols, storage controllers, or storage interconnects. The result is access latencies under 20  $\mu$ s, which is closer to DRAM performance than storage. The results are clearly demonstrated by the ability of Virident's FlashMAX with vFAS to deliver over 1.4 Million IOPS in a single low-profile card – the only product in the market capable of doing so.

## Unconditional Performance

Virident's FlashMAX with vFAS delivers consistent performance across all application workloads, as well as when the device is fully utilized. FlashMAX with vFAS delivers application performance whether it is peak small block read

performance, where a single low profile card can deliver over 1.4 million IOPS, or sustained mixed read/write performance when the drive is nearly full. No other product on the market today can deliver this.

## Simplified Management

Unlike competing solutions, 100% of the capacity available on a FlashMAX card is available as a single host volume on the server without having to leverage 3rd party software RAID products to stripe across multiple drives. With FlashMAX, you can have a single volume presented to the operating system up to the formatted capacity, which is currently a maximum of 1.4 TB, depending on the FlashMAX product used.

## Flash-aware RAID

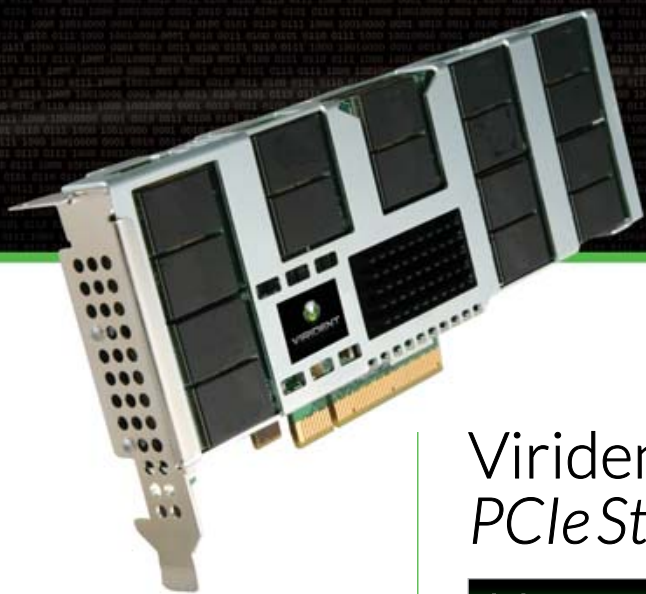
vFAS supports flash-aware RAID for enhanced reliability and data availability. This feature allows the discrete flash components included on the card to be isolated as separate slices to provide 7+1 RAID protection, implemented in a flash optimized manner. The flash modules on a card are spread across RAID groups, allowing for multiple failures to occur without disrupting an application's access to the data. This delivers continuity of operations in the event that there are failures with the flash media itself.

## Global and Local Wear Leveling

Virident FlashMAX with vFAS offers global wear leveling to maximize the lifetime of the flash media. Also, data is relocated to other parts of flash that are less-used whenever needed. FlashMAX's sophisticated wear leveling delivers maximum lifetime of the flash media.

## Virident FlashMAX SCM with vFAS

By leveraging Virident's FlashMAX SCM devices with vFAS, today's IT organizations can now realize unprecedented gains in application performance, along with unconditional performance over the entire lifecycle of the device. These benefits are revolutionizing the way leading IT organizations are thinking about their future server and storage architecture in order to maximize application performance.



## Virident FlashMAX PCIe Storage Class Memory

- High performance, enterprise class PCIe flash storage
- Uncompromised performance across a wide variety of workloads and over the lifetime of the product
- Over 2X performance as compared to other flash-based solutions
- Sustained, predictable random IOPS – Best in the Industry
- Over 1 Million IOPS from a single low profile card
- Enterprise-grade reliability and advanced end-to-end ECC
- Flash-aware RAID
- Dynamic, global wear-leveling
- Highest capacity and performance density in the industry for PCIe attached flash storage product

### FlashMAXSCMSpecifications

	MLC	SLC
<b>Capacity (GB)</b>	1000, 1400	300, 400, 800
<b>Form Factor</b>	Low Profile	Low Profile
<b>Read Performance</b>	1.3 GB/s (4 KB) 325 Thousand IOPS (4 KB) 1 Million IOPS (512 byte)	1.4 GB/s (4 KB) 340 Thousand IOPS (4 KB) 1.4 Million IOPS (512 byte)
<b>Write Performance</b>	600 MB/s	1100 MB/s
<b>Sustained Mixed Performance (75/25 r/w) at full capacity</b>	850 MB/s (4 KB) 220 Thousand IOPS (4 KB)	920 MB/s 235 Thousand IOPS (4 KB)
<b>Write Access Latency</b>	19 μs	16 μs
<b>Read Access Latency</b>	62 μs	47 μs

### Standards and Connectivity

<b>PCI Express 1.0/2.0</b>	Single slot, low profile, half height, half length
<b>Connectivity</b>	PCI Express electromechanical spec 1.0/2.0x8
<b>Application Interface</b>	Standard block device
<b>Platform Support</b>	Linux: RHEL 6/6.1, SLES 10/11, CentOS 5/6, Oracle EL 6, Debian 4/5/6, Ubuntu 8/9/10/11, Fedora Core Windows: 64-Bit Microsoft Server 2008 R2 SP1 (SLC)

### Environmental Specifications

	Min	Max
<b>Operating Temperature °C*</b>	0	50
<b>Non-operating Temperature °C</b>	-40	70
<b>Airflow (LFM)</b>	300	
<b>Humidity (%)</b>	5	95
<b>Weight (oz)</b>	5	7
<b>Power (w)</b>	0	24

\*Temperature derated 1°C per 1000ft elevation above sea level

### Agency Certification

<b>US/Canada</b>	UL 60950 1 & CSAC 22.2 FCC Part 15 Subpart B Section 15.109A/ANSI C63.4 (2003) ICES-003 Version 4, Class A Radiated & Conducted Emissions Class A EN 55022, Class A EN 55024 Immunity
<b>Europe</b>	2004/108/EC EMC Directive CE IEC 61000 Class A Mark
<b>Japan</b>	VCCI - V-2/2009.04