

flash

Solid State Drives

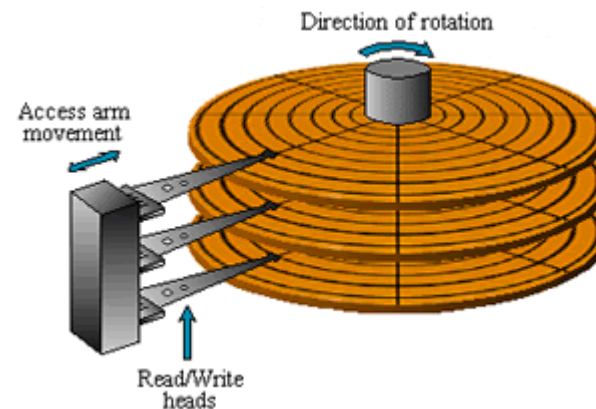
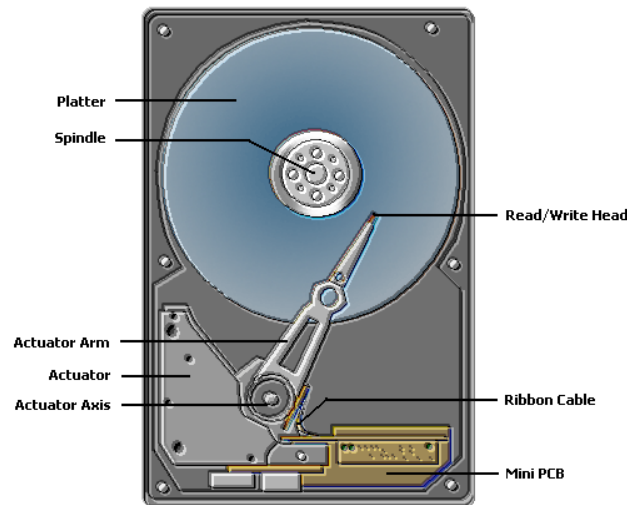
June 2009





Hard Disk Drive (HDD)

- Hard drives use round, rotating, flat disks (aka platters) which are coated with a magnetic substance that stores data. Reading and writing is done via a “head”, which resides on the end of a moving arm.
- HDD architecture is very similar to a phonograph
- HDDs were originally released in 1956 and have remained relatively unchanged since





HDD Form Factors and Interface

- **Form Factors**

- 3.5 inch – standard for desktops and servers
- 2.5 inch – standard for notebook computers and becoming more popular in server segment
- 1.8 inch – UMPC, GPS and IPODs, Zune...etc

- **Interface**

- IDE / EIDE aka PATA
- SATA / SATA2
- SCSI / SAS
- External connection via USB or eSATA

Drive Technologies

flash



<u>Interface</u>		<u># of Pins</u>	<u>Transfer Rate</u>
IDE/EIDE	40		100MB/s
SATA 1		7	1.5Gb/s
SATA II		7	3.0Gb/s
SAS		7	3.0Gb/s
SCSI Ultra 320		60 or 80	320MB/s
Fibre Channel		40	4Gb/s



What is SAS?

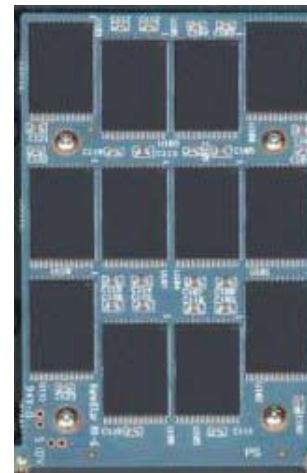
- **SAS = Serial Attached SCSI**
 - Increased data transfer performance by moving SCSI from parallel to serial bus.
 - Currently 3.0 Gb/s rate but will double to 6.0 Gb/s in the future.
 - SAS drives also are warranted for longer life and higher MTBF than standard HDDs
 - In the 2.5 inch form factor HDDs these are amongst the fastest drives available and a popular choice for enterprise market

What is SSD?

- SSD = Solid State Drive; has no moving parts
- SSDs can also be DRAM based, however KTC SSD is NAND Flash only
- Data is stored on NAND Flash in contrast to HDD which stores data on platters.
- KTC SSD is a SATA2 storage device
- KTC SSD is seen by the system as a standard hard drive



SSD



NAND



Key SSD Features

- **Performance**
 - Quicker boot times, apps load quicker
- **Solid Reliability**
 - No moving parts means no mechanical failures
- **Durability**
 - Shock and vibration proof
- **Low Power / Low Heat**
 - SSD's require less power than HDDs
 - Run cool and quiet, good for mobile and server
 - Power savings of SSD more apparent in network storage when comparing multiple drives than in a single drive notebook.



Usage Scenarios for SSD

- **Notebook and Netbooks (*SSDNow M and V*)**
 - Replace existing HDD, increases system performance and can extend the life of deployed notebooks.
- **Server (*SSDNow E and M*)**
 - Blades, benefit from low power / low heat of SSD
 - Database, provide high speed access to DB files
 - Transaction based servers / systems (OLTP: Ebay, banking)
- **External Storage (*SSDNow E and M*)**
 - Storage living outside of server (RAID BOX)
 - Huge performance gains and better performance per watt over HDD.
- **Desktop (*SSDNow E, M and V*)**
 - High end desktops and workstations
 - HTPC, Gaming
 - Nettop, Small Form Factor (systems are always on, need low power)
 - Industrial computers, kiosks, non-pc computer applications





Kingston's SSDNow Product Line

***SSDNow E Series:* uses Intel's 32GB and 64GB SSDs**

- Highest performance drive on the market
- Optimized for Server Environments

***SSDNow M Series:* uses Intel's 80GB and 160GB SSDs**

- Best used as a Hard Drive replacement for PCs
- Ideal for Power Users, Road Warriors, & Executives
- Optional Accessory Bundle which includes SSD and the following:
 - Acronis Cloning Software
 - 2.5" to 3.5" Bracket (For Desktop use)
 - Hard Drive Enclosure for cloning

***SSDNow V Series:* 64GB and 128GB Kingston labeled drives**

- Consumer grade SSD with high value in mind
- Optional Accessory Bundle as above



Kingston *SSDNow E Series*

- **Capacity:** 32GB and 64GB
- **Ultra Fast:** Up to 250MB/s Read; 170MB/s Write
- **Interface:** SATA2 (NCQ enabled)
- **Power:** 2.4W Active Power, 0.06W Idle Power
- **Impressive Performance:** 35,000 IOPS (4KB Read), 3,300 IOPS (4KB Write). Highest IOPS & endurance to replace many 15K RPM HDD's
- **Endurance:** 3.7TB/day for 5yrs minimum
- **Reliability:** 2 Million Hours MTBF
- **Architecture:** 10 Channel Architecture w/ 50nm SLC ONFI 1.0 NAND





Kingston *SSDNow M Series*

- **Capacity:** 80GB and 160GB
- **Fast:** Up to 250MB/s Read; 70MB/s Write
- **Interface:** SATA2 (NCQ enabled)
- **Power:** 0.150 W Active Power, 0.06W Idle Power
- **Rugged:** Operational Shock 1000G; Operational Vibration 2.17G. Vibration resistance and no moving parts make this drive able to handle extreme environments better than an HDD
- **Endurance:** 100GB/day for 5yrs minimum
- **Reliability:** 1.2 Million Hours MTBF
- **Architecture:** 10 Channel Architecture w/ 50nm MLC ONFI 1.0 NAND





Kingston SSDNow V Series

- **Capacity:** 64GB and 128GB
- **Fast:** up to 100MB/sec. read; 80MB/sec. write*
- **Interface:** SATA2
- **Supports S.M.A.R.T. :** Self-Monitoring, Analysis and Reporting Technology tells the user when a drive is about to fail
- **Convenient:** Bundle for Desktop and Notebooks (includes Migration Software)
- Released at Computex (4 June 2009) - available via ramped regional rollout to selected channels worldwide.





SSDNow Series with Kingston Reliability

- All drives come equipped with S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) to tell a user when a drive is about to fail.
- *SSDNow Series* is backed by a 3-year warranty and 24/7 tech support.
- All drives are also backed by legendary Kingston reliability and are eligible for our **KingstonCare** program.



SSD vs HDD

Feature	SSD	HDD
Reliability	No moving parts less chance for mechanical failures	Subject to mechanical failures
Performance	Near zero latency on seek means faster response times and better performance	Mechanical operation adds to seek times and limits response time
Durability	No moving parts makes SSD much more resistant to shock and vibration	Excessive shock and or vibration can cause mechanical failure
Power	Requires less power compared to HDD	More power required and higher performance HDDs will consume more power than consumer grade HDDs
Density	32-160GB, currently limited to NAND density	Up to 1 terabyte (One thousand GB) HDDs are available now

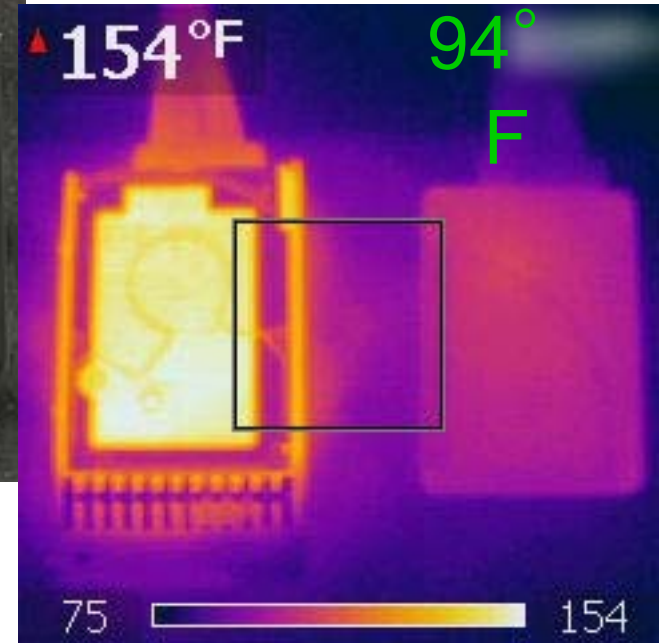
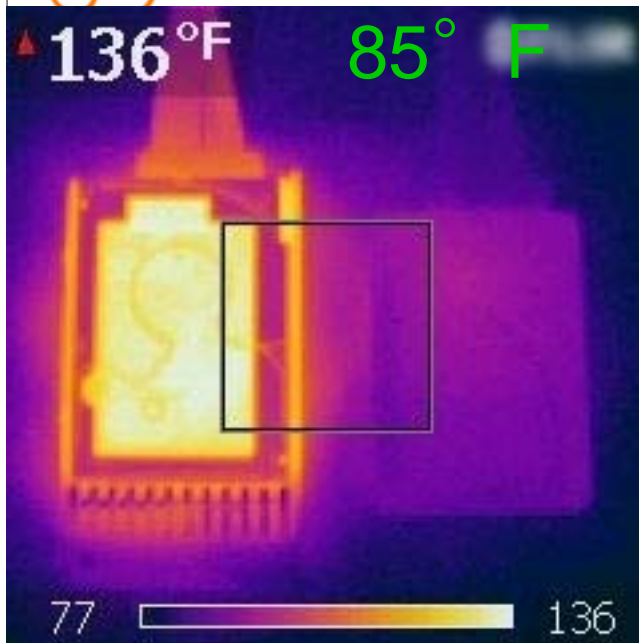
Power and Cooling Impact

Idle

15K RPM
HDD

E Series
SSD

Active Load



6.8W **0.5W**

59.6 kWh/year **4.4 kWh/year**

Idle Power

**Kingston SSDs:
Less Power,
Less Heat**

10.1W **0.9W**

88.5 kWh/year **7.9kWh/year**

Active Load Power



SSD's improve performance in *Data Centers*

Use Kingston E - Series SSD

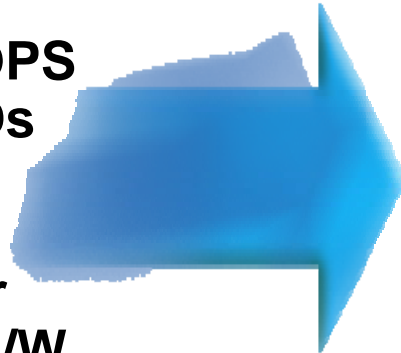
- **Consolidation of HDDs**
 - 1 SSD can replace many HDDs in terms of performance creating huge cost savings thanks to lower energy consumption and space reduction
 - Substantially improve performance by accessing data faster thanks to lower latency, higher IOPS and impressive Read/Write
 - Use less SSDs in “short-stroked”/high-performance environments
- **Improve levels of Endurance and Reliability**
 - Increase data cycles with the benefit of Wear Leveling and Write Amplification
 - Longer MTBF than HDD and a workload of up to 3.7TB/day for 5 years
- **Usage Models**
 - Hard Disk Drive Replacement; I/O intense applications
 - Tier 0 Storage
 - Caching, Swap Space
 - Application Acceleration
 - Boot Drive

Doing More With Less



HDD

- § 64,000 IOPS
- § 490 HDDs
- § 35 racks
- § 24 sq ft
- § 14 kW/hr
- § 4.6 IOPS/W
- § Mechanical failures



SSD

- § 120,000 IOPS
- § 8 SAS SSDs
- § 1 rack
- § 1 sq ft
- § 0.6 kW/hr
- § 200 IOPS/W
- § Silicon reliability

THE BOTTOM LINE.

Disk Drive BOM

8X

REDUCTION

Floor Space

24X

REDUCTION

Annual
Energy Costs

23X

REDUCTION

Comparing Data Center HDD vs Kingston SSD

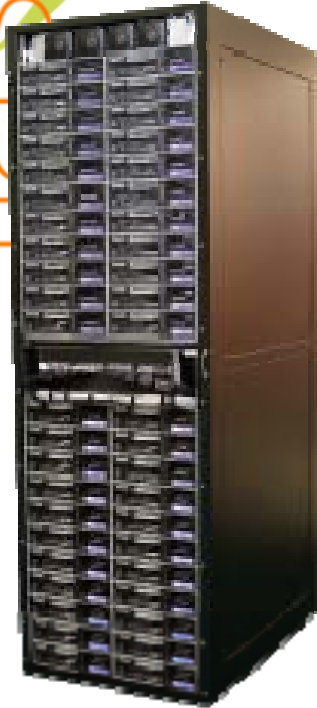
flash



10 & 15K RPM SAS HDD	Feature	Kingston E-Class SSD
~300	IOPS (4KB)	35,000 Read 3,300 Write
~100MB/sec. ~100MB/sec.	Peak Read Bandwidth Peak Write Bandwidth	250MB/sec. 170MB/sec.
~10-20W/1W	Power (Active/Idle)	2.4W/0.06W
< 300G	Durability	1000G
< 1,200,000 hours	Reliability / MTBF	< 2,000,000 hours

Source: Kingston, Intel.

What if we fill one rack with SSDs?



- 120 HDDs**
 - 36,000 IOPS
 - 12 GB/sec sustained BW
 - 1452 Watts
 - 8.8 TB
- Per HDD:
 - R/W 100MB/sec
 - 300 IOPS
 - 12.1W (active)



- 120 SSDs**
 - 4,200,000 IOPS
 - 36 GB/sec sustained BW
 - 288 Watts
 - 3.8 TB
- Per SSD:
 - Read 250MB/sec
 - Write 170MB/sec
 - 35,000 IOPS (Read)
 - 2.4W (active)

Read IOPS
115X
INCREASE

Sustained BW
3X
INCREASE

Energy Costs
5X
REDUCTION



SSD's improve *mobile* computing

Use Kingston M-Series SSD



- **Improve your laptop's performance.**
 - SSD improves system boot up, stand by time and shut downs while increasing overall laptop performance based on faster data transfers and quicker seek times.
- **Extend your laptop battery life.**
 - SSD can improve battery up to 13% (MobileMark 2007)
- **Don't scramble for lost data.**

In physically demanding environments, hard drives can fail; SSD is a safer bet to maintain data integrity

 - Ideal for Road Warriors and field reps.
 - Data recovery starts at \$300 and upwards of \$10K
- **Kingston service – We have you covered!**

flash

SSDnow M Series Bundle Kit



SATA Carrier - 3.5" Drive Bay





SSD's are more *Bang for your Buck!*

Use Kingston V-Series SSD



- **Companies looking mainly at reliability and endurance and can compromise a little on performance to meet pricing targets.**
 - Ideal for loaner pool/field laptops within organizations
 - SSD is over 8 times more Shock Resistant than leading HDDs
- **Consumer-Focused SSD**
 - Well suited for mass audiences including students, professionals, and more.
 - Optional Accessory Bundle will include brackets for Desktop use, cloning software, and hard drive enclosure that assists with imaging your original hard drive to your SSD. Afterward, the enclosure can be used with your hard drive for external storage.
- **Wide-Spread HDD Replacement is now affordable**
 - Improves system boot up, stand by time and shut downs while increasing overall laptop performance based on faster data transfers and quicker seek times.

flash

