DRIVES WITH INTEGRITY
THE INTEL SSD ADVANTAGE

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INTEGRITY.

“Firm adherence to a code of especially moral or artistic values”  

“The quality or state of being complete or undivided”  

Webster.com
DRIVES WITH INTEGRITY. THE BUILDING BLOCKS

SOLUTION
- LASTING INTEGRITY
- RELIABLY EFFECTIVE PERFORMANCE
- PLATFORM CONFIDENCE

FOUNDATION
- UNCOMPROMISING SUPPLY CHAIN QUALITY
- COMPLETE PRODUCT LIFE CYCLE SUPPORT
- INNOVATION LEADERSHIP
Proven End-to-End data protection

Demonstrated $10^{-17}$ UBER$^1$

≥100X more reliable preventing Silent Data Corruption (SDC)$^2$

Reliability that goes beyond

Actual AFR$^3$ consistently better than 0.44% goal

Better than JEDEC data retention and UBER$^{16}$

>2M PLI cycles and self-test delivers trusted protection from data loss.

Select competitor drives do not conduct a self-test$^4$
Validated on a massive scale

- 1000s of drives
- 1000s of configurations
- >5000 workloads
- >1M power cycles

Tested beyond JEDEC standard

≤11% performance degradation over the product life\(^5\)

Up to 90% IOPs consistency on all product lines\(^6\)

See footnotes and disclaimers in backup
PLATFORM CONFIDENCE.
SOLUTION LEVEL DESIGN, DEVELOPMENT, VALIDATION

Complete in-house design of data center solutions

- CPU
- Chipset NIC
- Media Controller FW
- SSD

Intel

Others

In-house design
Out-source design

Better together platform features

- 2.3X more database transactions with Intel® Cache Acceleration Software
- Improve RAID performance and latency with Intel® Rapid Storage Technology enterprise

Up to 1 more year in extended platform-level validation

See footnotes and disclaimers in backup
UNCOMPROMISING SUPPLY CHAIN QUALITY.
CONSISTENCY. QUALITY. CONFIDENCE

95% delivery to commit

Relentless focus on quality, delivering <100 DPM

Ranked #4 overall, #1 semiconductor in Gartner* 2015 Supply Chain Ranking

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**COMPLETE PRODUCT LIFE CYCLE SUPPORT.**

**LAUNCH-READY. PLATFORM-EXPERT.**

**ECOSYSTEM**

>2000 engineers engage ISVs and open source communities developing, optimizing preferred solutions

Preferred **solutions tuned** and ready for scale at launch

**DESIGN-IN**

>500 resources dedicated to OEM design-in support

Support scaled though >10,000 Intel channel partners

**POST-SALES**

Our customers rate Intel post-sales support as world-class

Worldwide phone, chat, email, online community support in 11 languages

Platform-wide expertise

See footnotes and disclaimers in backup
INNOVATION LEADERSHIP.
BREAKTHROUGH INNOVATIONS. GROWTH OPPORTUNITIES.

~1000 researchers in Intel labs.

Leader in memory technology innovation

PCI interface  SATA interface  PCIe interface  NVMe protocol  3D XPoint™ Technology

Disruptive technologies that drive growth opportunities

3D NAND Technology  3D XPoint™ Technology
REASONS TO CARE.
DISRUPTIONS ARE COSTLY

Silent Data Corruption is more costly than perceived

11 drives per 1000 can experience SDC in a year\(^{17}\)

Data center downtime cost $7.9K/min. on average\(^{13}\)

Actual cases demonstrate the impact

- **NETFLIX**
  - 55 distribution centers down for 3 days
  - [http://www.pcmag.com/article2/0,2817,2328778,00.asp](http://www.pcmag.com/article2/0,2817,2328778,00.asp)

- **Amazon**
  - S3 cloud service down for 36 hours
  - [http://cloudsecurity.org/blog/2008/06/25/a-question-of-integrity-to-md5-or-not-to-md5.html](http://cloudsecurity.org/blog/2008/06/25/a-question-of-integrity-to-md5-or-not-to-md5.html)

- **Facebook**
  - 10-15% photos not available for 48 hours

HDDs fail \(~50X\) more often than Intel SSDs\(^{14}\)

Reasons to care.

Disruptions are costly

- Silent Data Corruption is more costly than perceived

- Data center downtime cost $7.9K/min. on average

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REASONS TO CARE.
QUALITY OF SERVICE. CONFIDENCE.

Deliver consistent QoS

Reliably consistent performance through product life improves QoS

Massive validation helps ensure products perform as expected

Confidently grow business

Platform-ready and optimized from day 1

Proven supply chain quality delivers the right product at the right time

Rapid response to support calls from platform experts
DRIVES WITH INTEGRITY

- Uncompromised **data integrity** and **drive reliability** designed in
- Reliable, consistent **performance where it matters**
- Uncompromising **supply chain quality**
- **Platform-expert** product life cycle **support**
- Technology and **platform connectivity leadership**

LOOK INTO THE INTEL ADVANTAGE
One page version
DRIVES WITH INTEGRITY. THE INTEL DATA CENTER SSD ADVANTAGE.

**Lasting integrity**
- ≥100X more reliable preventing Silent Data Corruption²
- >2M PLI cycles and self-test delivers trusted protection from data loss

**Reliably effective performance**
- Validated on a massive scale
- ≤11% performance degradation over the product life⁵

**Platform confidence**
- Complete in-house design of data center solutions
- Up to 1 more year in extended platform-level validation

**Uncompromising supply chain quality**
- 95% delivery to commit⁸
- <100 DPM factory quality⁹
- #4 overall, #1 semiconductor Gartner® 2015 Supply Chain Ranking¹⁰

**Complete product life cycle support**
- >2000 engineers optimizing top ISV solutions¹¹
- >500 dedicated OEM design-in resources¹¹
- Platform-expert post-sales support

**Innovation leadership**
- ~1000 researchers in Intel labs
- Memory technology innovation leader

See footnotes and disclaimers in backup
FOOTNOTES AND DISCLAIMERS


2. **Silent Data Corruption.** Source – Intel. Test performed on Intel® SSD S3x00 drives, Samsung PM853T and SM843T, Micron P400e, Seagate 600 Pro and SanDisk Lightening drives. Drives were exposed to increasing amounts of radiation. After a drive “hang”, a power cycle was performed to determine whether the drive would re-boot. If a drive re-booted it was read, and data was compared to the tester’s master copy of the up-to-date data that the drive was expected to contain based on writes the drive had acknowledged as completed prior to the “hang” event. If the drive returned data that differed from the expected data, it was recorded as failing for silent errors. The annual rate of silent errors was projected from the rate during accelerated testing divided by the acceleration of the beam (see JEDEC standard JESD89A).


4. **PLI:** Source – Intel. Intel® Datacenter Drives provide robust Power Loss Imminent (PLI) circuitry that helps to protect inflight data in the event of power loss. Intel drives monitor the health of the PLI circuitry via a Self Cap Test using SMART attributes. Samsung PM853T and SM843T drives were checked for capabilities and flags. No PLI monitoring capabilities (e.g. SMART Attributes) were listed in the Samsung drive specification sheet. Additionally, the drives were tested by powering off a drive and removing one electrolytic (or any other type) capacitor. The drives were then powered up to recollect SMART attribute data to determine if the cap test detected the removal of the capacitor. The Samsung drives did not detect capacitor removal.


6. **IOPS consistency.** Source – Intel. Measured performance of Intel® SSD DC53710 and DC P3700 on 4K Mixed (70/30) workload. Device measured using Iometer. Quality of Service measured using 4 KB (4,096 bytes) transfer size on a random workload on a full Logical Block Address (LBA) span of the drive once the workload has reached steady state but including all background activities required for normal operation and data reliability. Based on Random 4KB QD=1, 32 workloads, measured as the time taken for 99.9999999999 percentile of commands to finish the round-trip from host to drive and back to host.


8. **Delivery to commit.** Source – Intel. Actual measurement of percent shipments for all Intel SSD products that arrive on committed delivery date.
Drives with Integrity.

FOOTNOTES AND DISCLAIMERS


11. ISV enabling, OEM design-in support. Source – Intel Software and Solutions Group, Intel Non-volatile Memory Solutions Group, Intel Influencer Sales Group, Intel Direct and Channel Sales.


