



What is Intel® Smart Response Technology?



We store a lot of diverse types of content on our PCs: Movies, photos, music, documents—the list goes on. Intel® Smart Response Technology¹ enables either a dual drive (a lower-cost, small-capacity SSD used in conjunction with a low-cost, high-capacity hard disk drive) or a solid state hybrid drive (SSHD) to provide a high-performance, cost-effective storage solution. As a result, you can fast-track your favorites—faster access to applications and files that you use the most. Intel Smart Response Technology is also great for gaming enthusiasts—game launch times are faster^{2,3} than with a traditional hard disk drive (HDD).

Key Benefits

- Faster system startup, application performance and faster game loads^{2,4}
- Best performance per GB storage solution at affordable prices
- Lower power consumption than standard HDD
- Easy to set up and maintain

For HDD, Intel Smart Response Technology maximizes system storage I/O performance and power savings by implementing an intelligent cache policy that stores applications and files data blocks that will benefit most from caching onto the SSD. Intel Smart Response Technology differentiates between high-value data (application, user, and boot data) and low-value data, like that which may be caused by a virus scanner or other similar one-touch data. One-touch data, as the name suggests, is data that is accessed from the drive for a one time use only. This type of data typically does not benefit the user from caching, and therefore is not inserted into the cache. Purely sequential data streams (example: streaming a movie file from disk, or large file copies) do

not get a big boost from the SSD and may bypass the cache, since these often consist of a large amount of one-touch data unlikely to benefit from caching. Additionally, the bandwidth required for audio and video streams does not require SSD performance, so we intelligently choose not to cache and use up SSD capacity.

For SSHDs, Intel Smart Response Technology's caching policy provides priority hints to the SSHD's onboard cache manager of data through the **Hybrid Hinting** feature, notifying the drive which data would be best to store in the NAND cache instead of the rotational media.

The caching policy of Intel® Smart Response Technology adapts to facilitate faster cache warm-up by taking advantage of the well-known principles of data locality to keep a persistent working set of frequently accessed data blocks on the SSD and retaining that data across system shutdowns and reboots.

Acceleration Modes

Intel® Rapid Storage Technology⁵ user interface supports two modes of ac-

celeration for HDDs: Enhanced (write-through) and Maximized (write-back).

Enhanced mode (write-through) is the default mode of operation where acceleration is optimized for data protection. In this mode, all data is written to the SSD and HDD simultaneously. In the event the accelerated disk fails, there is no risk of data loss, because the data on the HDD is always synchronized with the data in the SSD. Since this mode is optimized for data protection, there is a performance impact since all writes slow down to HDD speeds. However the HDD and SSD pair may be physically separated without any special precautions to preserve data.

Maximized mode (write-back) enables acceleration optimized for input/output performance. This mode captures most host writes into the SSD first and updates the copy on the HDD during available system idle periods. This enables a considerable boost in write performance and also saves power. However, Intel® Smart Response caching must be disabled prior to HDD and SSD physical separation. If it is unlikely that the HDD and SSD may be physically separate or an SSHD is being used, then maximized

mode is recommended for best performance and responsiveness.

SSD Requirements

Intel Smart Response Technology requires a PCIe* or SATA based SSD in conjunction with a traditional HDD or a SSHD.

Discrete SSD Cache Requirements

Any SATA SSD can be used as a cache provided it has a minimum capacity of 16GB. The system SATA controller must be set to RAID mode via the system BIOS and the SSD attached to an internal PCIe or SATA port of the computer.

There is no support for Intel Smart Response Technology in AHCI mode. Please refer to the platform specific design guides for PCIe and SATA supported lanes.

SSHD Requirements

Intel Smart Response Technology supports SSHDs with a minimum capacity of 8GB that are compliant with the SATA-IO Hybrid Information Feature. The system controller must be set to RAID mode via the system BIOS and the SSHD attached to an internal SATA port of the computer. There is no support for Intel Smart Response Technology in AHCI mode.

Other Features

Power-Up In Standby (PUI) support for Intel® Smart Connect Technology⁶ reduces HDD drive spin up, lowers system power consumption, and improves battery life and reliability with disk spin suppression during motion. When Intel® Smart Connect Technology wakes the system up to download fresh data, Intel Smart Response Technology powers up the SSD and keeps the HDD spun down. A PUIS-enabled HDD is required to support this feature.

System Requirements

CPU	Intel® Core™ processor
CHIPSET	Intel® 6 Series Chipset: Z68, HM67, QM67 Intel® 7 Series Chipset: H77, Q77, Z77, HM77, QS77, UM77 Intel® 8 Series Chipset: H87, Q87, Z87, HM87, QM87, Premium Intel® 9 Series Chipset: H97, Z97
CHIPSET CONTROLLER MODE	RAID (AHCI mode supported for Hybrid Hinting with SSHDs only)
STORAGE INTERFACE TYPE	SATA or PCIe
STORAGE CAPACITY	SSDs: Minimum capacity of 16GB SSHDs: Minimum capacity of 8GB
RST VERSION	Discrete SSD Cache: RST10.5 or later SSHD: RST12.5 or later

For more information, visit the Intel Web site: www.intel.com/responsiveness

1 Requires a select Intel® processor, enabled chipset, Intel Rapid Storage Technology software, and a properly configured hybrid drive or dual drive (HDD + small SSD). Depending on system configuration, your results may vary. Contact your system manufacturer or visit www.intel.com/responsiveness for more information.

2 (FTC DISCLAIMER) Software and workloads used in performance tests may have been optimized for performance only on Intel® microprocessors. Performance tests, such as SYSmark® and MobileMark®, are measured using specific computer systems, components, software, operations, and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products.

3 Game Loads Workload: Application and Level load times for mainstream games such as Battlefield® 3 and Call of Duty®: Modern Warfare 3.

System Configuration: (Desktop) Comparing 2nd generation Intel® Core™ i7-2600K Processor (8T4C, 8MB cache, up to 3.8GHz), Intel® Desktop Board DZ68DB, Memory 4 GB (2x2 GB) Corsair® DDR3-1333, EVGA® GTX 580, Driver:8.17.12.8562 (vendor package 285.62) (BIOS: DBZ6810H.86A.0014.2011.0413.1049, Chipset INF 9.3.0.1019 with the following disk options: 1) Hitachi® ST31000528AS Barracuda®, 1TB, 7200rpm, with Intel RST 10.6.0.1002 2) Intel SSD 311 series, 20GB SRT Cache, Intel RST 10.6.0.1002 3) Intel SSD 510 series, 250GB, Intel RST 10.6.0.1002.

4 I/O Performance Workload: PCMark® 7 – storage score and PCMark® Vantage HDD score System Configuration: (Desktop) Comparing pre-production 3rd generation Intel® Core™ i7-3770K Processor (8T4C, 8MB cache, up to 3.9GHz), Intel® Desktop Board DZ77GA-70K, Memory 8 GB (2x4GB) Samsung® DDR3-1600, Intel® HD Graphics 4000, Driver: 8.15.10.2616 (BIOS: GAZ7710H.86A.1868.R06.1201060946, Chipset INF 9.3.0.1019 with the following disk options: 1) Seagate® ST31000528AS Barracuda®, 1TB, 7200rpm, with Intel RST 11.0.0.1032 2) Intel SSD 311 series, 20GB SRT Cache, Intel RST 11.0.0.1032 with Seagate® ST31000528AS Barracuda®, 1TB, 7200rpm.

5 Requires a select Intel® processor, Intel® software and BIOS update, and Intel® Solid-State Drive (SSD). Depending on system configuration, your results may vary. Contact your system manufacturer for more information.

6 Requires a select Intel® processor, Intel® software and BIOS update, Intel® wireless adapter, and Internet connectivity. Solid state memory or drive equivalent may be required. Depending on system configuration, your results may vary. Contact your system manufacturer for more information.

INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL® PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER, AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

Intel may make changes to specifications and product descriptions at any time, without notice. Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The information here is subject to change without notice. Do not finalize a design with this information. The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request. Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order. Copies of documents which have an order number and are referenced in this document, or other Intel literature, may be obtained by calling 1-800-548-4725, or by visiting Intel's Web Site <http://www.intel.com>.

