

# Data Compression in the Intel® Solid-State Drive 520 Series

On-board data compression engine helps increase performance and endurance in the Intel® SSD 520 Series.



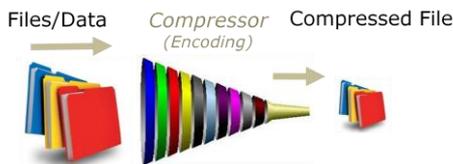
Utilizing a unique hardware and firmware architecture, the Intel® Solid-State Drive 520 Series (Intel® SSD 520 Series) implements on-board data compression, a feature that helps increase performance and endurance by automatically compressing data sent to the SSD.

## What is Data Compression?

Data compression in a storage drive is the process of encoding information in such a way that the resulting data requires less space to be stored on the NAND (the storage component of the Intel SSD 520 Series). The amount of data that can be compressed depends on the type of data.

In the Intel SSD 520 Series, data compression occurs automatically. The SSD uses *lossless data compression* to ensure the original data is preserved and completely reconstructed when accessed.

Figure 1. Data Compression



## Advantages of Data Compression

Writing to the NAND requires time and is usually the bottleneck of SSD performance. With data compression, less data is written to the NAND, and therefore, effective write speed improves – resulting in better performance.

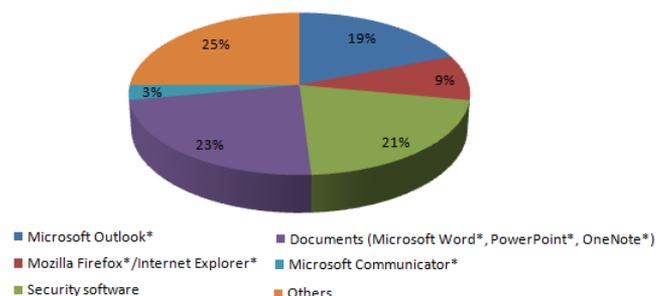
Additionally, because fewer bits are written to the NAND as compared to an SSD that does not use data compression, the NAND is exercised less. This increases the relative endurance of the SSD, as more lifetime host writes can be performed before the NAND wears out.

## What Data is Compressible?

Whether or not a file can be compressed depends on the file type. Various types of files have redundancy in the pattern of data and can be compressed to some degree. Typically, files that can be compressed include system files relating to the operating system, application files and associated user files, and PC utilities and games. Files that typically cannot be compressed include software-encrypted files and image files such as pictures, videos, and DVD movies.

A study of a sample of office users shows a significant amount of data in user drives is compressible. The study shows a typical office user writes Microsoft Outlook\* files and documents such as Microsoft Word\*, Microsoft PowerPoint\*, and Microsoft OneNote\* more than 40% of the time as compared to other file types, as shown in Figure 2. Security software (such as virus scan), Internet usage, and instant messaging (IM)-type software such as Microsoft Communicator\* comprise approximately another 30% of the activity.

Figure 2. Drive Usage of a Typical Office User<sup>1</sup>



1. Source: Intel labs data.

A closer look at the compression rates of these different file types shows that 75% of the file types observed can be typically compressed 60% or more.

Table 1. Typical Compression Rates<sup>1</sup>

File Type	Typical Compression
Microsoft Outlook*	60%
Microsoft documents	85%
Mozilla Firefox* or Internet Explorer*	80%
Microsoft Communicator*	70%
Security software	95%

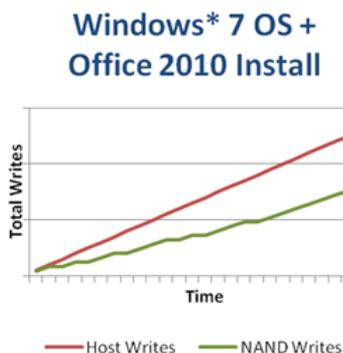
1. Source: Intel labs data. Data shown is for illustration purposes only and is not a true representation of the Intel SSD 520 Series.

## Improved Drive Writes

Data compression decreases the number of writes to the NAND on an SSD.

For example, Figure 3 shows that with data compression, an installation of Microsoft Windows\* 7 and Microsoft Office 2010 results in only about half the number of writes to the NAND as host data was sent.

Figure 3. Compression Benefits with Amount of NAND Data Written<sup>2</sup>



2. Source: Intel labs data.

This decrease in NAND writes directly affects the lifetime drive writes the SSD can support. Additionally, reducing the amount of bits stored on the NAND in general reduces the amount of data clutter on the SSD and improves drive efficiency in maintaining its health through *garbage collection* (the SSD controller process of cleaning up and managing NAND for optimal health).

## Improved Performance

With a significant amount of user data being compressible, performance benefits can be substantial. Table 2 shows performance benefits of data compression with the 240 GB Intel SSD 520 Series.

Table 2. Intel SSD 520 Series Performance<sup>3</sup>

Performance Specification	Incompressible Data	Compressible Data
Sequential Write Bandwidth (Mbp/s)	235	520
Sequential Read Bandwidth (Mbp/s)	550	550
Random Write (IOPS)	16,500	60,000
Random Read (IOPS)	46,000	50,000

3. Source: Intel® Solid-State Drive 520 Series Product Specification; Random reads based on 4KB Queue Depth 32

Sequential and random write performance is improved in the Intel SSD 520 Series with data compression. In addition, random read performance – where read operations can be bottlenecked due to controller limitations – shows improvement.

## Conclusion

Typical user data is compressible, and the Intel SSD 520 Series is the right drive to take advantage of optimizing performance and endurance with data compression.

Solid-State Computing Starts with Intel Inside.® For more information, visit [www.intel.com/go/ssd](http://www.intel.com/go/ssd)

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.

UNLESS OTHERWISE AGREED IN WRITING BY INTEL, THE INTEL PRODUCTS ARE NOT DESIGNED NOR INTENDED FOR ANY APPLICATION IN WHICH THE FAILURE OF THE INTEL PRODUCT COULD CREATE A SITUATION WHERE PERSONAL INJURY OR DEATH MAY OCCUR.

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 go to: <http://www.intel.com/design/literature.htm>

Intel and the Intel logo are trademarks of Intel Corporation in the U.S. and other countries.

\*Other names and brands may be claimed as the property of others.

Copyright © 2012 Intel Corporation. All rights reserved.

Printed in USA

♻️ Please Recycle 326483 -001US

