



**Toshiba Memory Europe Unveils 1TB Single Package PCIe Gen3 x4L SSDs
with 96-Layer 3D Flash Memory**

New BG4 Series Doubles Capacity and Delivers Industry-Leading Random Read Speeds^[1]

Düsseldorf, Germany, 9 January 2019 – Toshiba Memory Europe announced the introduction of the fourth generation of its single package ball grid array (BGA) solid state drive (SSD) BG4 series at [CES 2019](#). Toshiba Memory's new line-up of ultra-compact NVMe™ SSDs places both the flash and an all-new controller into one package, bringing design flexibility to ultra-thin PC notebooks, embedded systems and server boot in data centers.

“The BGA form factor SSD enables larger amounts of flash to be added to smaller and thinner devices, and extends battery life to improve the mobile experience,” said Jeff Janukowicz, research vice president, Solid State Drives and Enabling Technologies at IDC. “NVMe™ BGA solutions, such as the new TOSHIBA BG4 series, provide OEMs with a better-than-SATA storage option that boosts

demand for client SSD units. In fact, we expect this demand to increase at a 2017-2022 CAGR of 14 percent.”

Toshiba Memory has long been at the forefront of delivering SSDs that enable smaller, thinner, lighter, and more power efficient mobile designs. The company was the first to develop a [single package PCIe® SSD](#), and the introduction of the fourth generation BG series represents another pioneering achievement as the densest client SSD by volumetric measurements^[2]. Utilizing Toshiba Memory’s innovative 96-layer [BiCS FLASH™](#) 3D memory, BG4 increases the maximum capacity from 512GB to 1024GB (approximately 1TB)^[3] and provides a slim 1.3mm profile for capacities up to 512GB^[4]. Furthermore, the BG4 series doubles the PCIe Gen3 lane count from 2 to 4, delivering more performance in the same power envelope when compared to the prior generation product.

Performance improvements^[5] over the BG3 series include:

- Up to 2,250 MB/s sequential read (50 percent improvement) and up to 1,700 MB/s sequential write performance^[6] (70 percent improvement)
- Up to 380,000 random read IOPS (153 percent improvement) and 190,000 random write IOPS^[7] (90 percent improvement)

“The BG4 is set to rapidly replace SATA SSDs in notebooks and PCs,” said Paul Rowan, vice president of the SSD business unit of Toshiba Memory Europe. “Not only because of its performance that exceeds client SATA drives up to 4 times^[8], but also because of its reduced power consumption and compact footprint.”

Compared to BG3 series, BG4 SSDs feature a power-saving solution that improves power efficiency up to 20 percent in read and 7 percent in write^[9] and provides a low-power state^[10] as low as 5mW. The BG4 also improved its Host Memory Buffer (HMB) technology by increasing the accelerated read access range and optimizing background flash management. Additionally, BG4 includes new enhanced reliability features to protect against host DRAM failures when using the HMB feature.

Paul Rowan continues: “Toshiba Memory understands our customers’ needs to gain competitive advantage. The BG4 series, as a result, offers enhanced user-experience through an increase in storage capacity, significantly improved performance while prioritising power efficiency.

Providing essential options for today’s mobile devices, Toshiba Memory’s new single package SSD is available in capacities of 128GB, 256GB, 512GB, and 1024GB (approximately 1TB), in either surface-mount BGA M.2 1620 (16 x 20mm) or removable M.2 2230 (22 x 30mm) module. Pyrite drive (version 1.00) or self-encrypting drive (TCG Opal version 2.01) models^[11] are also available.

Toshiba Memory offers the industry's broadest SSD portfolio, including a wide array of client SSDs. The BG4 series is currently sampling to select OEM customers, with general sample availability expected later in the second calendar quarter of 2019. During CES, Toshiba Memory America, Inc. will showcase the BG4 series in its private demo suite at the Venetian® Resort from January 8 – 11.

For more information, please visit <https://business.toshiba-memory.com/en-emea/>

Notes:

PCIe is a registered trademark of PCI-SIG.

NVMe is a trademark of NVM Express, Inc.

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[1] Toshiba Memory Corporation survey, as of January 9, 2019

[2] Toshiba Memory Corporation survey, in the segment of single package SSDs, as of January 9, 2019

[3] Definition of capacity: Toshiba Memory Corporation defines a gigabyte (GB) as 1,000,000,000 bytes and a terabyte (TB) as 1,000,000,000,000 bytes. A computer operating system, however, reports storage capacity using powers of 2 for the definition of 1GB = 2³⁰ bytes = 1,073,741,824 bytes, 1TB = 2⁴⁰ bytes = 1,099,511,627,776 bytes and therefore shows less storage capacity. Available storage capacity (including examples of various media files) will vary based on file size, formatting, settings, software and operating system, such as Microsoft® Operating System and/or pre-installed software applications, or media content. Actual formatted capacity may vary.

[4] The thickness of the 128GB, 256GB and 512GB single package models is 1.3 mm, and the thickness of the 1024GB single package model is 1.5 mm.

[5] Based on the best performance of BG4 series (BG4 1024GB model) vs. BG3 series (BG3 512GB model) under Toshiba Memory Corporation test conditions.

[6] Toshiba Memory Corporation survey based on sequential read and write speeds of 128KiB units, using BG4 1024GB models under Toshiba Memory Corporation test conditions. Read and write speed may vary, depending on the host device, read and write conditions, and file size. Toshiba Memory Corporation defines a megabyte (MB) as 1,000,000 bytes and a kibibyte (KiB) as 2¹⁰ bytes, or 1,024 bytes. The sequential read and write performance mentioned herein are reference data, and may vary with the BG4 product data in the datasheet.

[7] Toshiba Memory Corporation survey based on random read and write speeds of 4KiB units, using BG4 1024GB models under Toshiba Memory Corporation test conditions. Read and write speed may vary, depending on the host device, read and write conditions, and file size. IOPS is Input Output Per Second (or the number of I/O operations per second) and Toshiba Memory Corporation defines a kibibyte (KiB) as 2^{10} bytes, or 1,024 bytes. The random read and write performance mentioned herein are reference data, and may vary with the BG4 product data in the datasheet.

[8] Based on the best sequential performance of BG4 1024GB model vs. the theoretical maximum bandwidth of SATA 6Gbit/s SSD

[9] Based on a power/performance ratio of BG4 PCIe Gen3x4 lanes model vs. BG3 PCIe Gen3x2 lanes model under Toshiba Memory Corporation test conditions.

[10] Toshiba Memory Corporation survey under the test conditions of link power management state L1.2 in non-operation power state.

[11] Availability of the self-encrypting drive (SED) model line-up may vary by region.

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About Toshiba Memory Europe GmbH

We, Toshiba Memory Europe GmbH, are the European business of Toshiba Memory Corporation. Our company offers a broad product line of flash memory products, including SD Cards, USB flash drives, and embedded memory components, in addition to solid state drives (SSD). Our company maintains offices in Germany, France, Spain, Sweden and the United Kingdom. President is Masaru Takeuchi.

For more information on the full range of our memory and SSD products please visit:

<https://business.toshiba-memory.com/en-emea/top.html>

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