

## Toshiba And Western Digital Readyng 128-layer 3D NAND Flash

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higher write endurance. the increasing storage density of flash means that the endurance of the flash is decreasing. this means that nand flash manufacturers have to find a way to protect their flash chips. if a flash chip is subjected to a large number of writes, the flash itself can be damaged. over time the flash will fail. as the density of the flash increases, manufacturers will need to implement more complex wear leveling controls to protect the flash. this is a complex subject that alln covered in detail in the anandtech review of wd blue 3d nand ssds. nand flash size increases. nand flash manufacturers are moving to a planar format to achieve higher density and are now pushing to increase the size of the nand flash chips. intel is the first to release a 128-layer planar flash chip at 18 nm in size, and it was released in the anandtech review of wd blue 3d nand ssds. western digital is rumored to be releasing a 128-layer 3d nand flash as well, and the size of their flash chip is rumored to be around 16-gigabits per die. toshiba has announced a 128-layer 3d nand flash and the size of their flash chip is rumored to be around 32-gigabits per die. it is possible that toshiba and western digital will continue to use planar nand flash as their main nand flash, but it is also possible that they will use 3d nand flash instead. this is a complex subject, but if 3d nand flash becomes a reality, it is also likely that the size of the nand flash will be doubled to 128-gigabits per die. the 512gb wd black 3d nand drive takes sandisks 64-layer 15nm 3d tlc nand flash (i am surprised they did not use wd/toshibas 96-layer bics4 flash, but they may be saving that newer flash for nvme products ) and pairs it with a marvell 88ss1084 6-channel controller. limited by the sata 3 interface, the wd black ssd maxes out at 450 mb/s sequential reads and 420 mb/s sequential writes when hitting the slc cache. further, the 512gb drive offers up random 4k read and write performance of 75,000 and 67,000 iops respectively. we will have to wait for reviews to see how fast the sequential performance is after exhausting the cache, but it should not be too terrible as this is tlc nand rather than qlc. the tradeoff in higher cost from tlc is balanced by higher write speeds and write endurance (though at 512gb for consumer use, there is plenty of space to spread out writes even with qlc). speaking of write endurance, wd rates the black series ssd at 500 tbw. it should have at least a 3-year warranty as well, being part of the black lineup.

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unfortunately, toshiba and western digital haven't been very forthcoming about what their new 3d nand means for their end products. i think they're being quite cagey on this because the benefits of 3d nand are so obvious that it wouldn't make sense to heavily advertise them. also, toshiba and western digital may be worried about losing the current customers for their nand flash, and they may not be willing to push their ssd customers to adopt a new generation of nand until they're certain that the new nand is commercially viable. if toshiba and western digital can convince the ssd market to adopt their new 3d nand technology, it should allow them to continue to sell their nand in that market. but it also means that any ssd that toshiba and western digital use their 3d nand in may also use sk hynix and kioxia's 3d nand, and the different manufacturers may end up competing against each other. in 2017, toshiba announced an ultra-high-density nand flash storage solution for ssds. their solution used 1.2-1.4 um 2-bit/cell tlc to achieve densities of up to 1tb per die. their product also used vertical integration to reduce the overall cell size and increase the memory density. since then, toshiba has been quietly developing their own ssd controller for tlc nand. as of now, all of toshiba's tlc nand flash is used in enterprise ssds. but recently toshiba has begun selling consumer ssds with their own nand flash, though these drives have used rebranded memory from other vendors. these consumer ssds have been selling well, and toshiba has even begun to license their tlc nand to other vendors. it seems likely that toshiba's tlc nand will eventually be used in the next generation of consumer ssds, and they'll probably be using toshiba's own ssd controller. 5ec8ef588b

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