

Neutral (Maintain)

Industry Report
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[Semiconductor]

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Semiconductor

SEC begins 64-layer 3D NAND production

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Samsung Electronics (SEC) recently announced that it had begun volume producing 64-layer, 256Gb TLC 3D NAND. The company said its new 64-layer 3D NAND flash provided gains of more than 30% in productivity, speed, and energy efficiency compared to its existing 48-layer chip. The 64-layer 3D NAND is being produced initially at the company's Hwaseong fab, but later will be produced at its new fab in Pyeongtaek, which is set to be completed later this month. The new Pyeongtaek fab (Line 18) will go into full operation with the volume production of 64-layer 3D NAND.

Competitors are quickly catching up. SK Hynix is expected to have the upper floor of its M14 fab in Incheon ready for operation by the end of this month. The chipmaker will first use the facility to produce 48-layer 3D NAND flash memory, before starting mass production of 72-layer 3D NAND in 2H17. Meanwhile, Toshiba late last month unveiled its newest NVMe SSD, which is based on 64-layer TLC 3D NAND technology. The company is currently shipping samples to its customers and plans to start volume production in 3Q17.

Suppliers of related materials and equipment to benefit

The increased number of layers in 3D NAND, along with volume production and capacity ramp-ups across the industry, point to strong growth in NAND shipments in 2H17. We expect global NAND shipments to expand 12% QoQ in 3Q17 and 11% QoQ in 4Q17. This should benefit 3D NAND-related materials suppliers and, to a lesser extent, equipment makers. As the number of layers increases, so do the equipment and material requirements. More gas is needed to form gates, more etching equipment and gas to form channels and contacts, and much more metal deposition equipment and materials (tungsten, copper, etc.) to form word lines and bit lines. As the mainstream 3D NAND process moves to 64 layers and beyond, we expect related equipment and material input to increase, benefiting gas and materials suppliers like SK Materials.

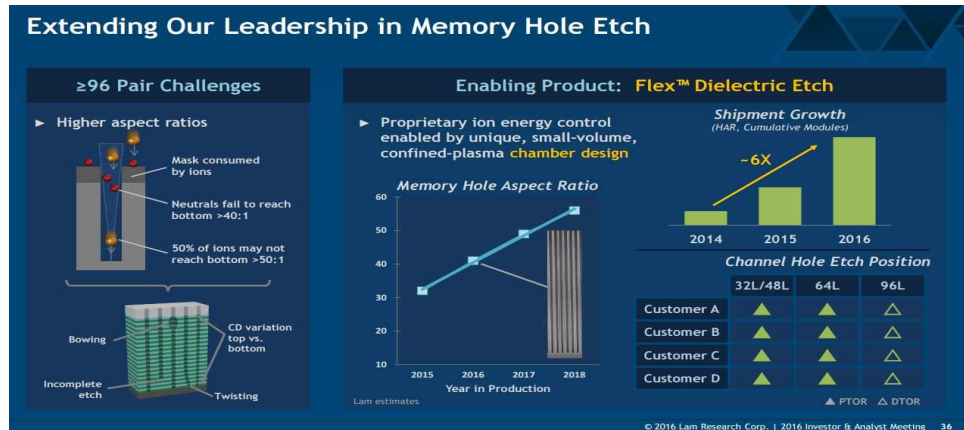
We also see a sharp rise in spending by SEC. Until 1H17, SEC maintained a wide lead over competitors in 3D NAND technology. But the technology gap has narrowed significantly, with rival companies set to mass produce 64-layer chips in 2H17. We think SEC will considerably ramp up spending to widen its lead again through scale effects. The company is likely to move up investments in the upper floor of its Pyeongtaek fab and the second phase of its Xi'an fab, which were originally slated for 2018. This should prove beneficial to equipment makers like Wonik IPS.

64-layer 3D NAND process: Greater material and equipment requirements

Significant Challenges in Scaling 3D NAND

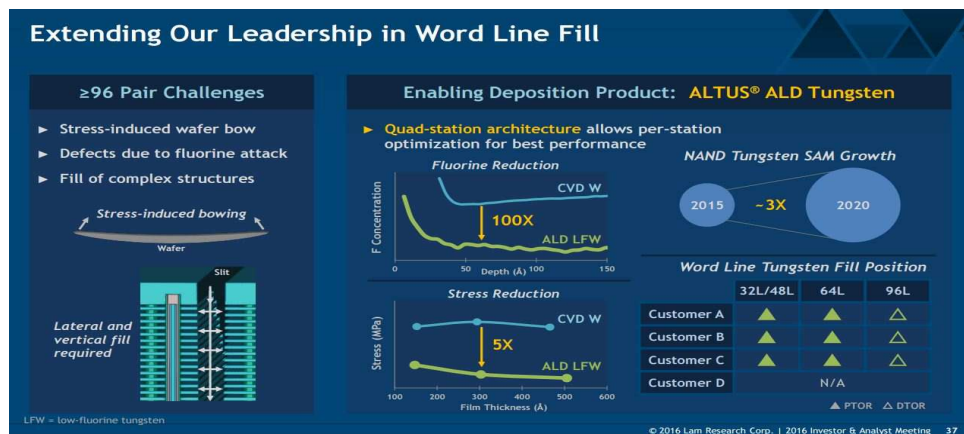


Figure 1. 64-layer 3D NAND process: Greater material and equipment requirements



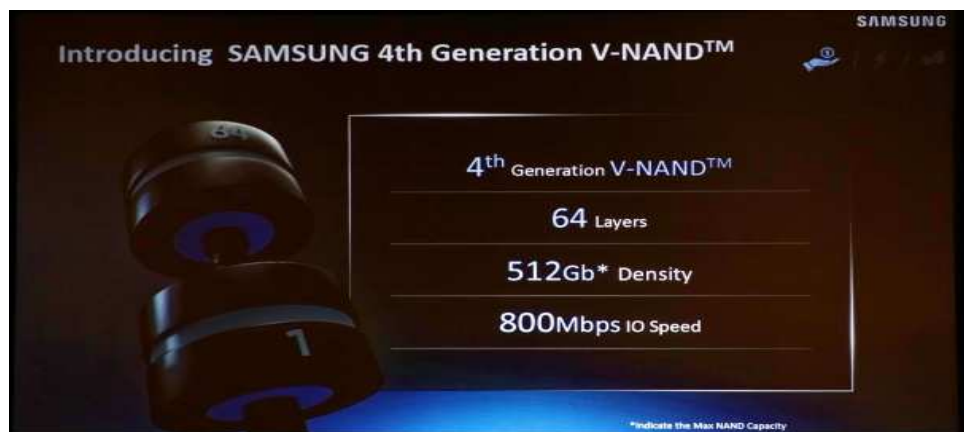
Source: Lam Research, Mirae Asset Daewoo Research

Figure 2. 64-layer 3D NAND process: Greater material and equipment requirements



Source: Lam Research, Mirae Asset Daewoo Research

Figure 3. SEC has begun 64-layer 3D NAND production



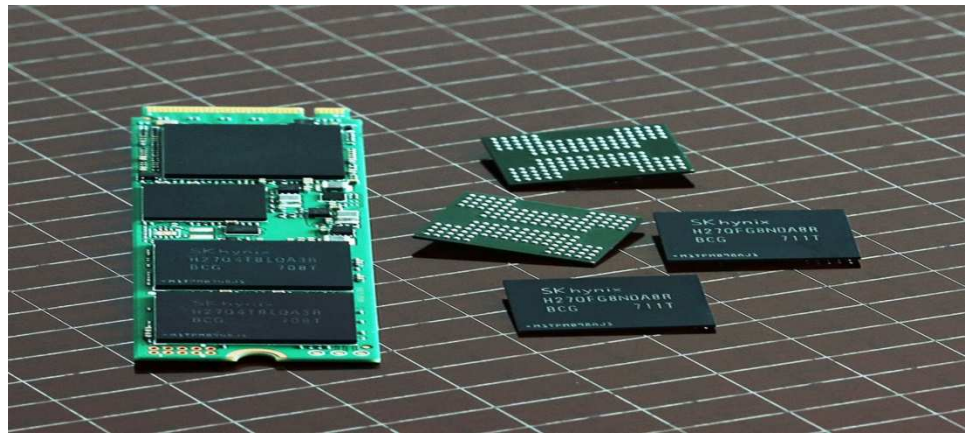
Source: SEC, Mirae Asset Daewoo Research

Figure 4. Toshiba has also begun volume producing 64-layer 3D NAND



Source: Toshiba, Mirae Asset Daewoo Research

Figure 5. Hynix plans to mass produce 72-layer 3D NAND in 2H17



Source: SK Hynix, Mirae Asset Daewoo Research

APPENDIX 1

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