

# TLC is the New MLC

*Kevin Kilbuck*

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# Agenda

- TLC in the past
- TLC in the present
- TLC in the future



# TLC in the Past – Planar NAND Scaling Makes Each Generation Worse

- Slow
- Unreliable
- Limited to consumer applications



# TLC in the Present – 3D NAND Technology Enables MLC-like Capability

- Closer to MLC speed
- Closer to MLC reliability
- NAND management solutions emerging to enable more applications



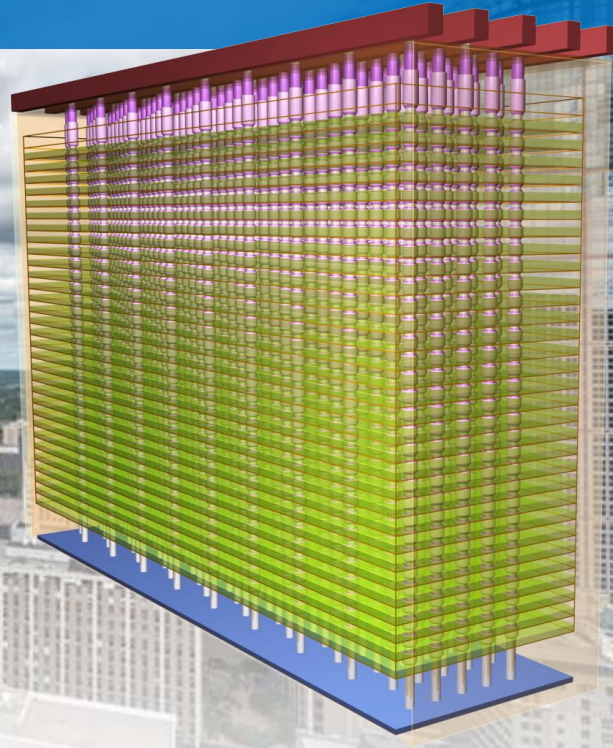
# What is 3D NAND?

Planar NAND is like a single-story building—  
The only way to increase capacity and lower  
cost/GB is to shrink in the X-Y direction



# What is 3D NAND?

3D NAND cells are built vertically – like a skyscraper



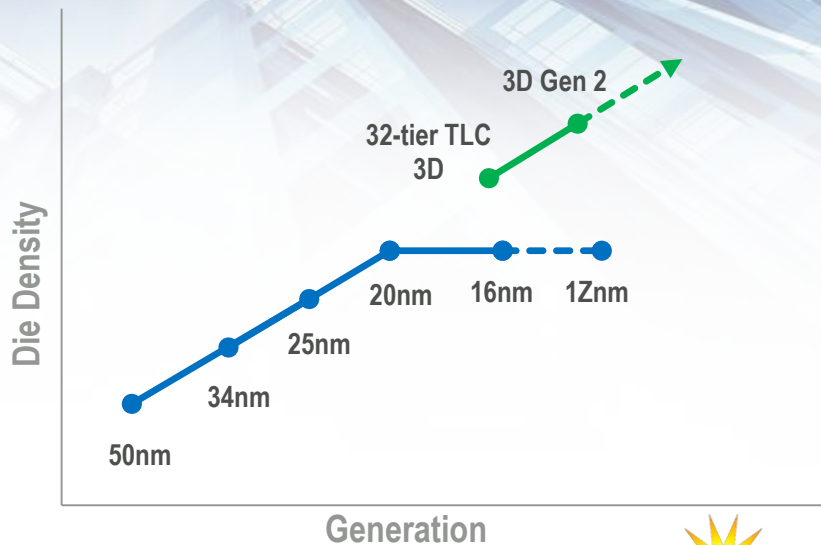
# What is 3D NAND?

3D NAND capacity increases and cost/GB reductions come from adding more layers and X-Y dimensions can remain constant and greatly relaxed from today's planar NAND



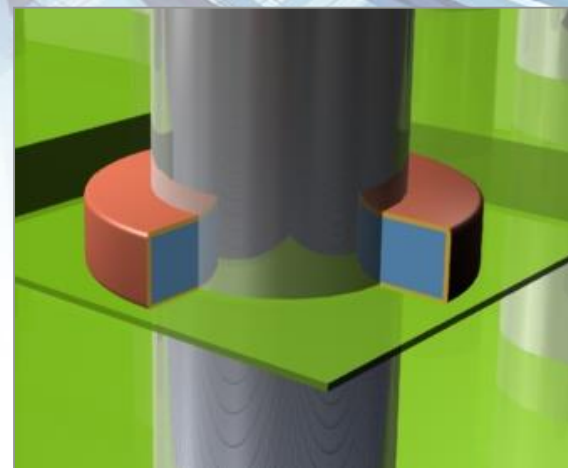
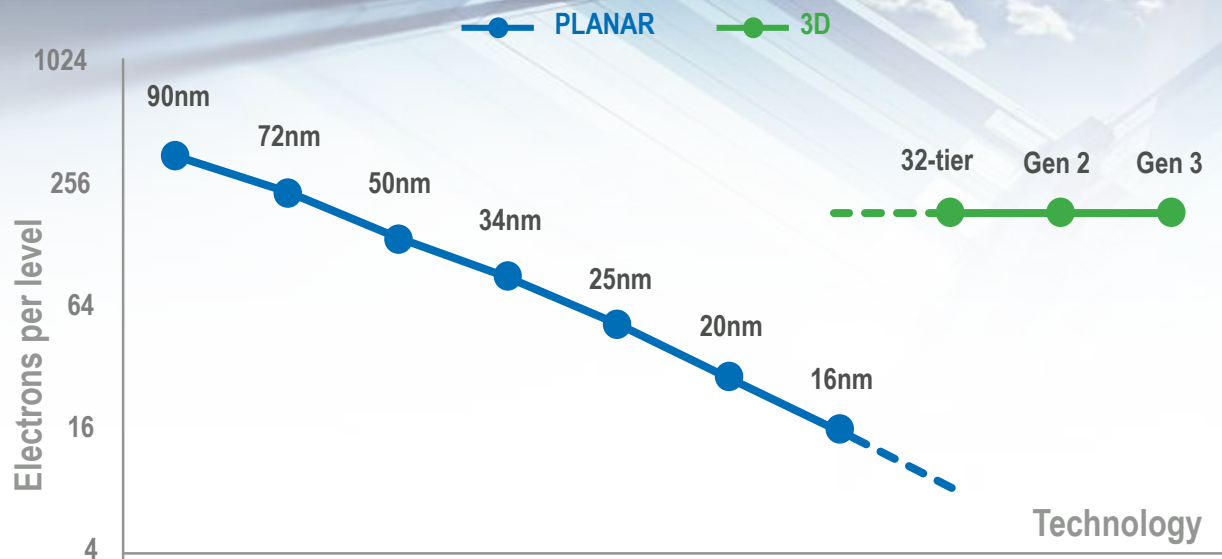
# Why is 3D Necessary?

- Planar NAND scaling limitations below 20nm mean minimal density increases and cost/GB reduction
- 3D NAND gets us back on the prior “scaling curve”





# Performance and Reliability



3D NAND enables improved and consistent performance and reliability

# TLC in the Future – Call to Action

- NAND suppliers need to develop/specify products with emerging applications in mind, such as TLC in enterprise
- Controller/system capability needs to improve to enable 3D TLC to be used in more applications, including enterprise
- End users need to define realistic requirements

and...

→ TLC will be the new MLC



# Q&A



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