3D X-DRAM™

World's First 3D NAND-like DRAM

August 2023

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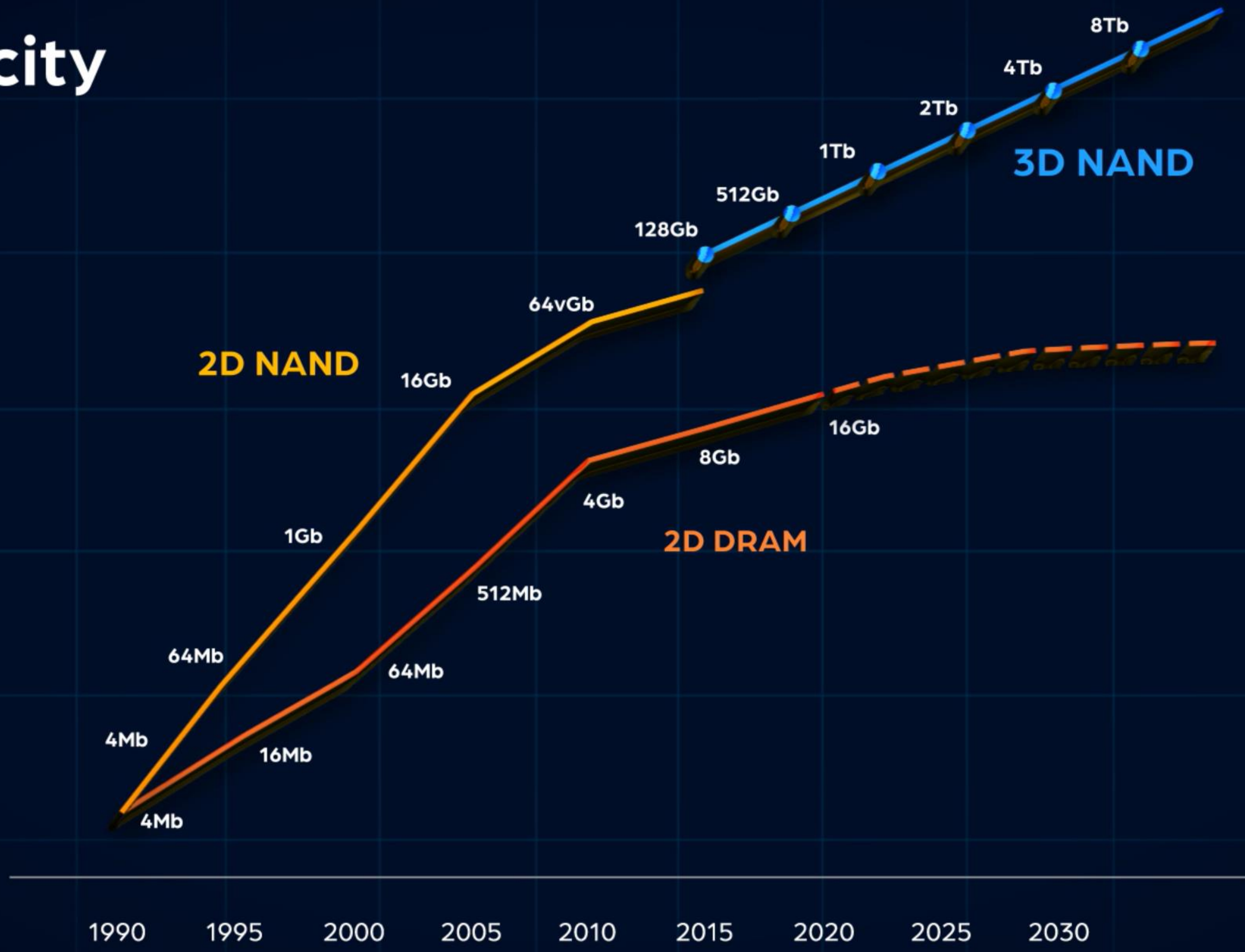
Presentation | 3D X-DRAM™ Technology

Capacity



2D DRAM

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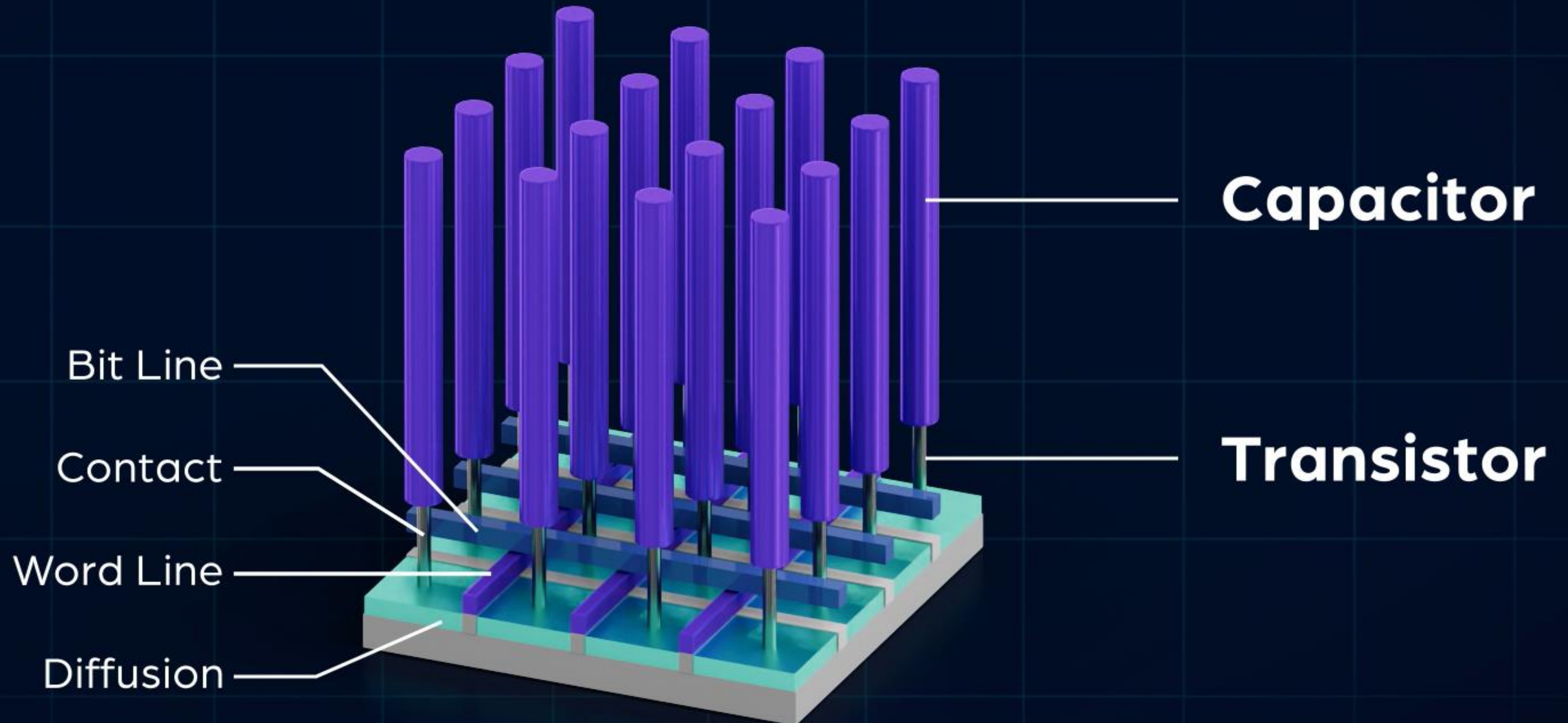
2D DRAM

2D DRAM

Not Scalable beyond 10 nm



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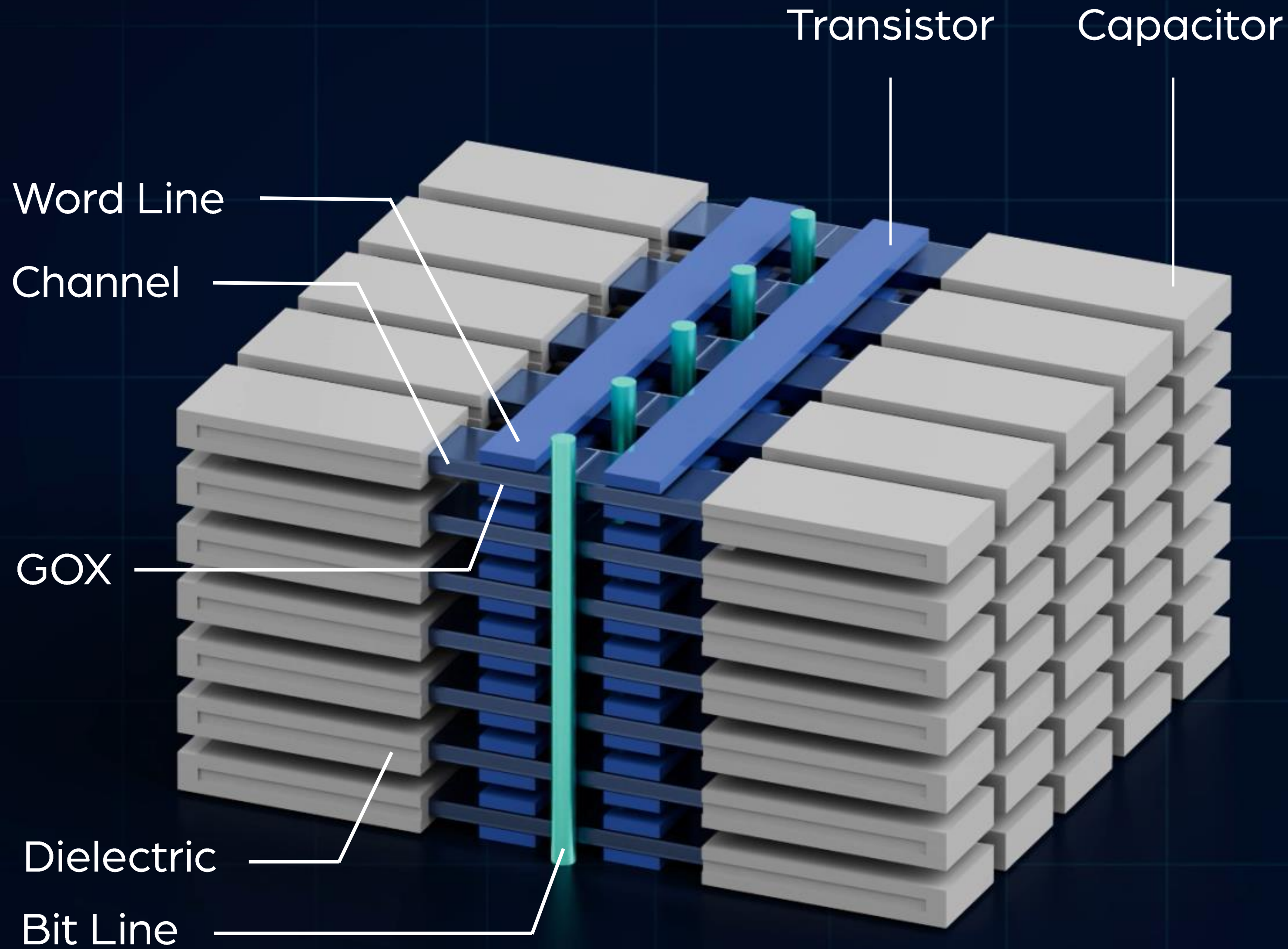
3D DRAM

3D DRAM



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Complicated

Large Cell Size

Process Challenge

Low Yield

3D X-DRAM™ Cell Structure

Based on Capacitor-less Floating Body Cell Technology

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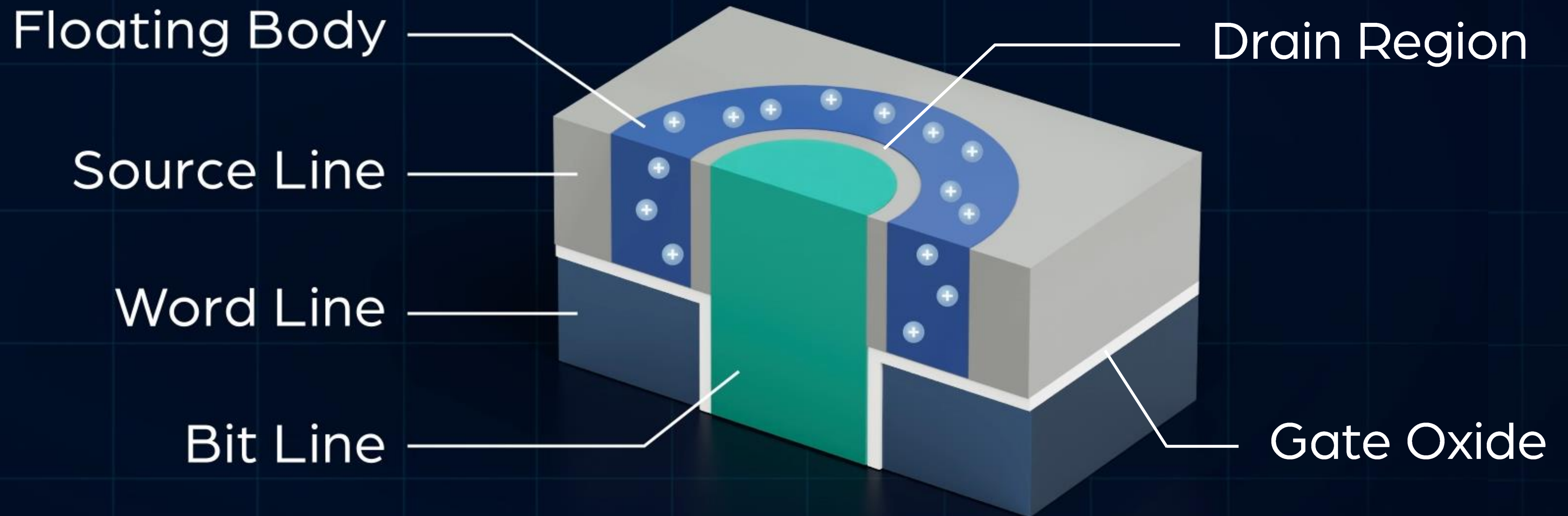
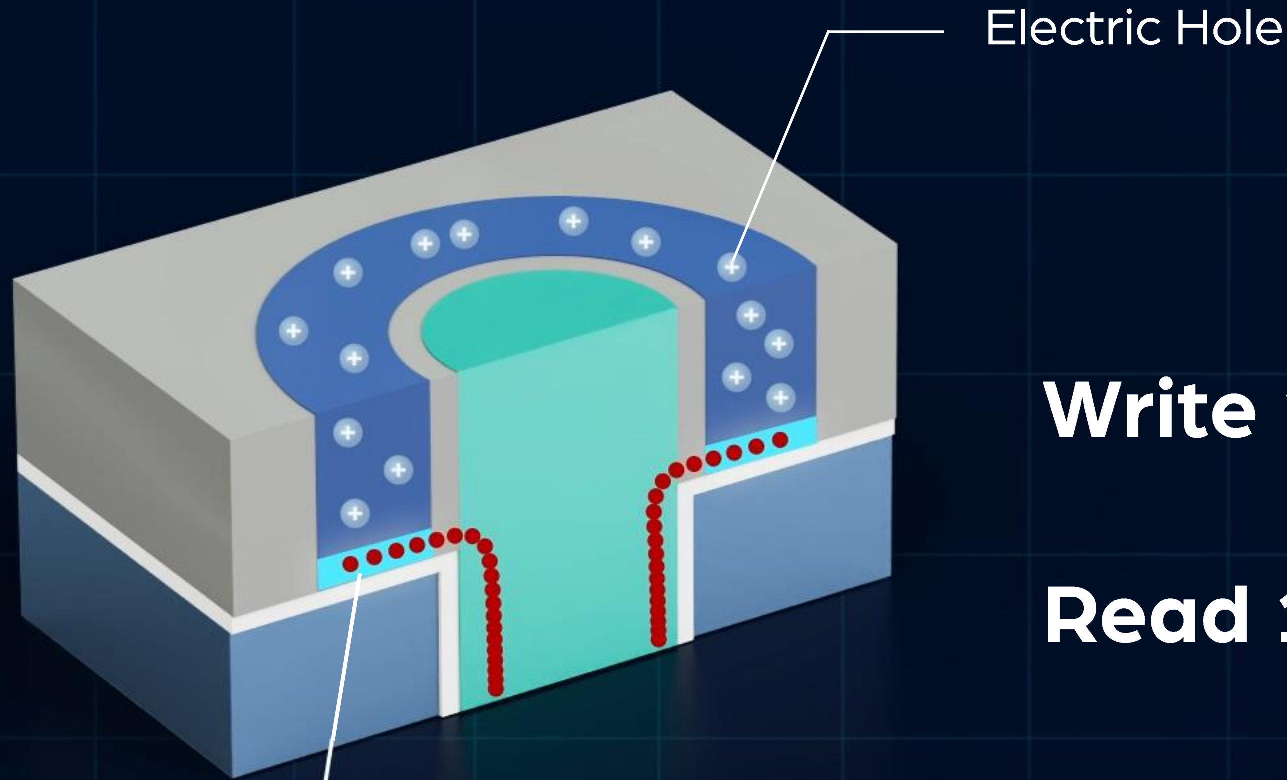


3D X-DRAM™ Operations



Write 1 > Impact Ionization

Read 1 > On cell

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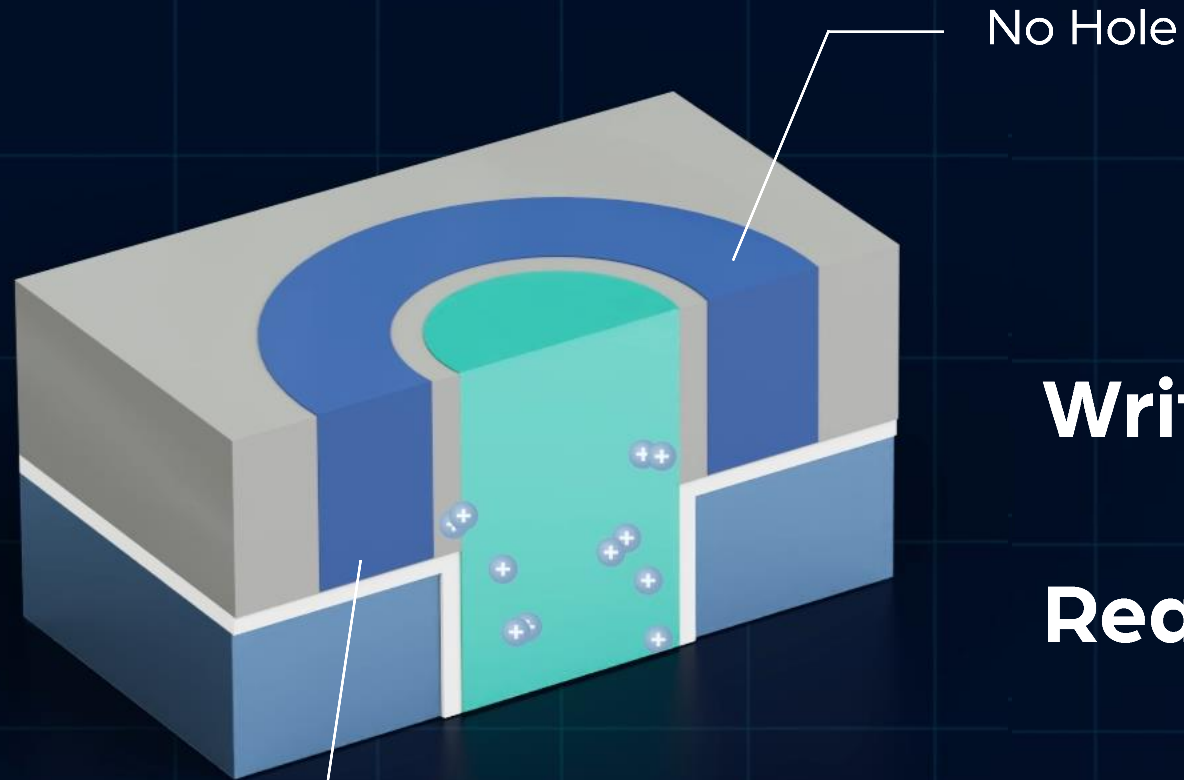
3D X-DRAM™
Operations



Write 0 > Forward Bias

Read 0 > Off cell

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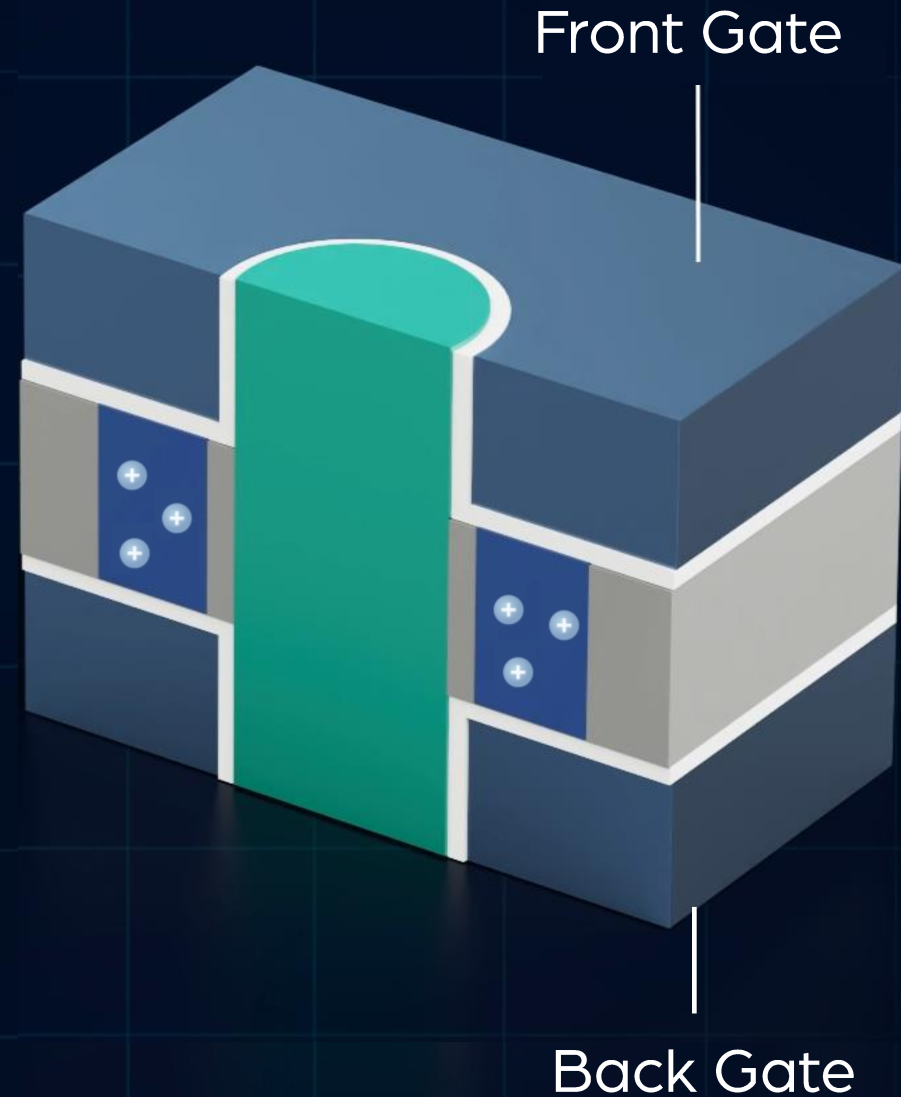
3D X-DRAM™ Performance

Non-destructive **Read**

Dual-Gate Structure

Increase Data Retention Time



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3D X-DRAM™ Array Structure

3D NAND-like Array

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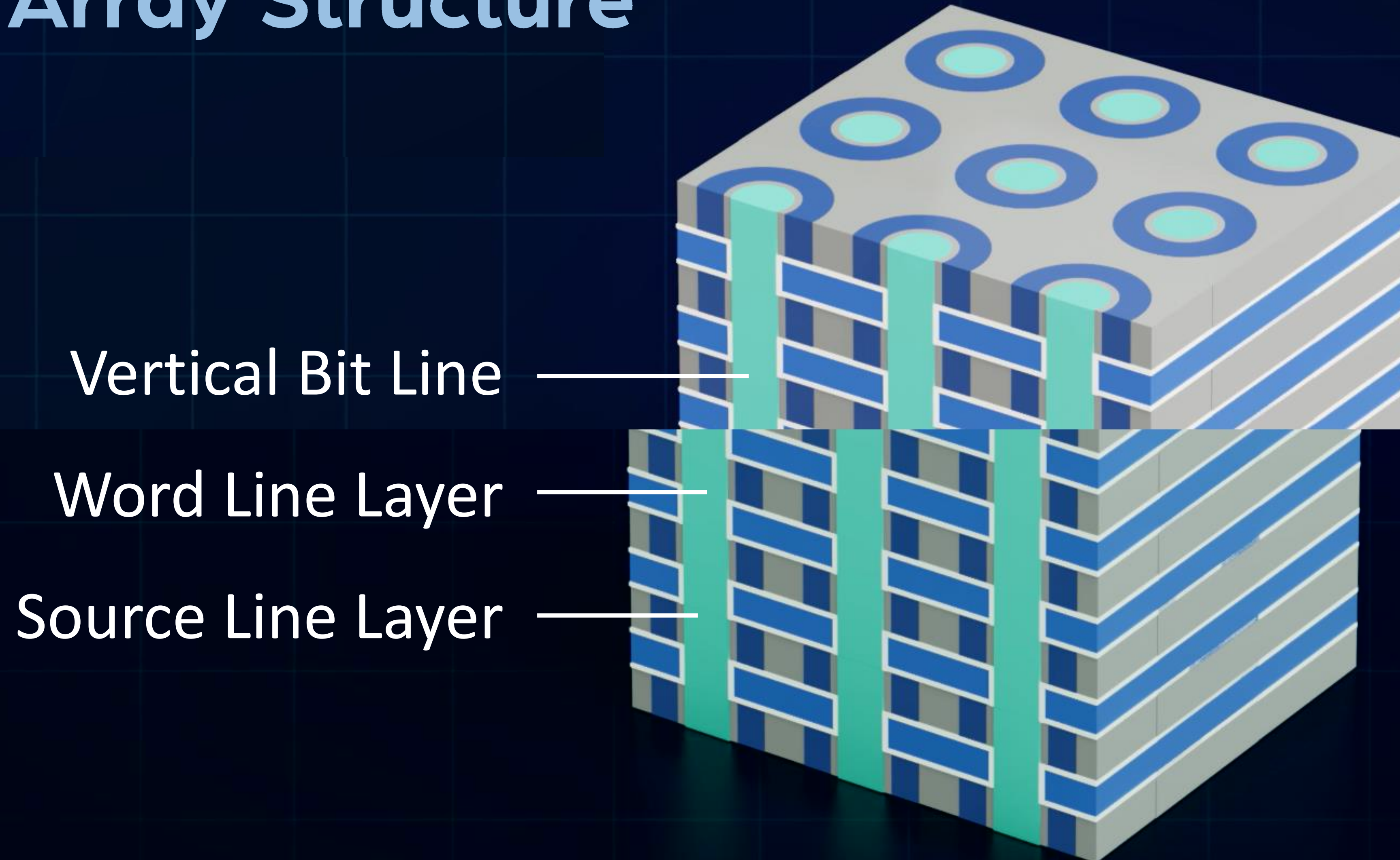
3D X-DRAM



3D X-DRAM™ Process Steps

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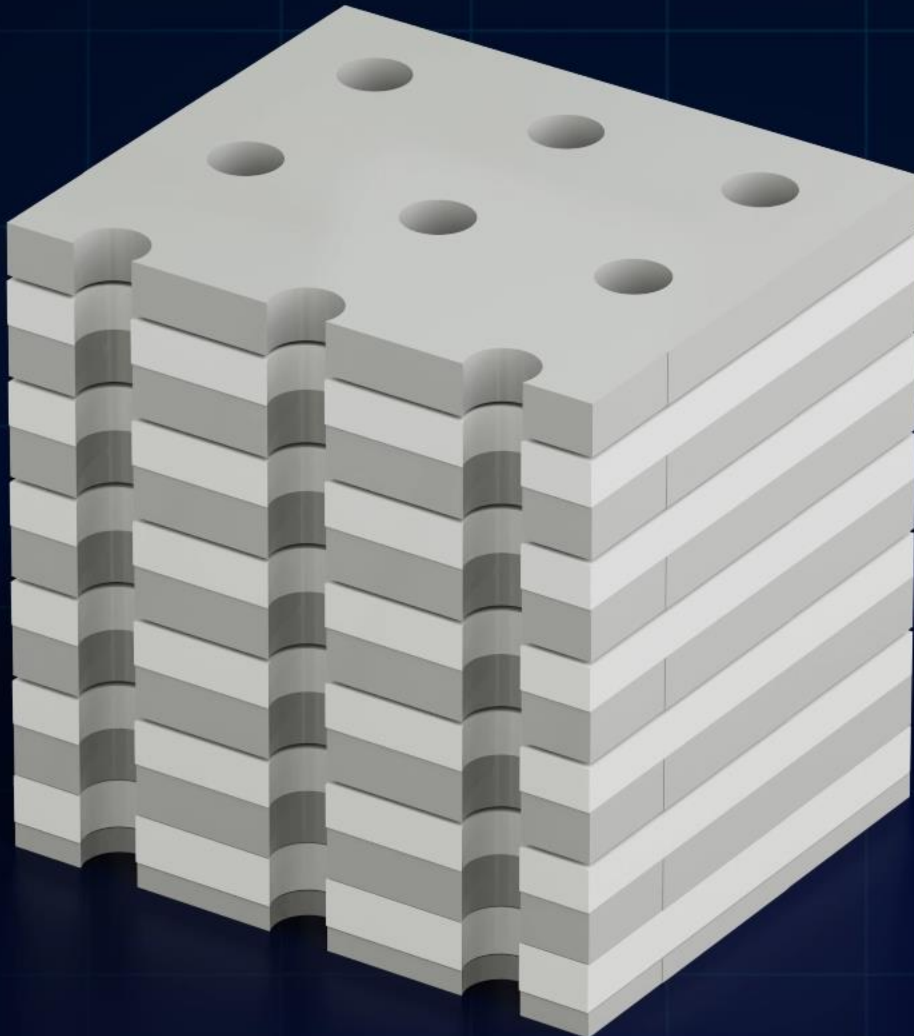

3D NAND-like Process

1 Deposit Multiple Layers

2 Deep Trench Bit Line Holes

3D X-DRAM

3D X-DRAM™ Process Steps

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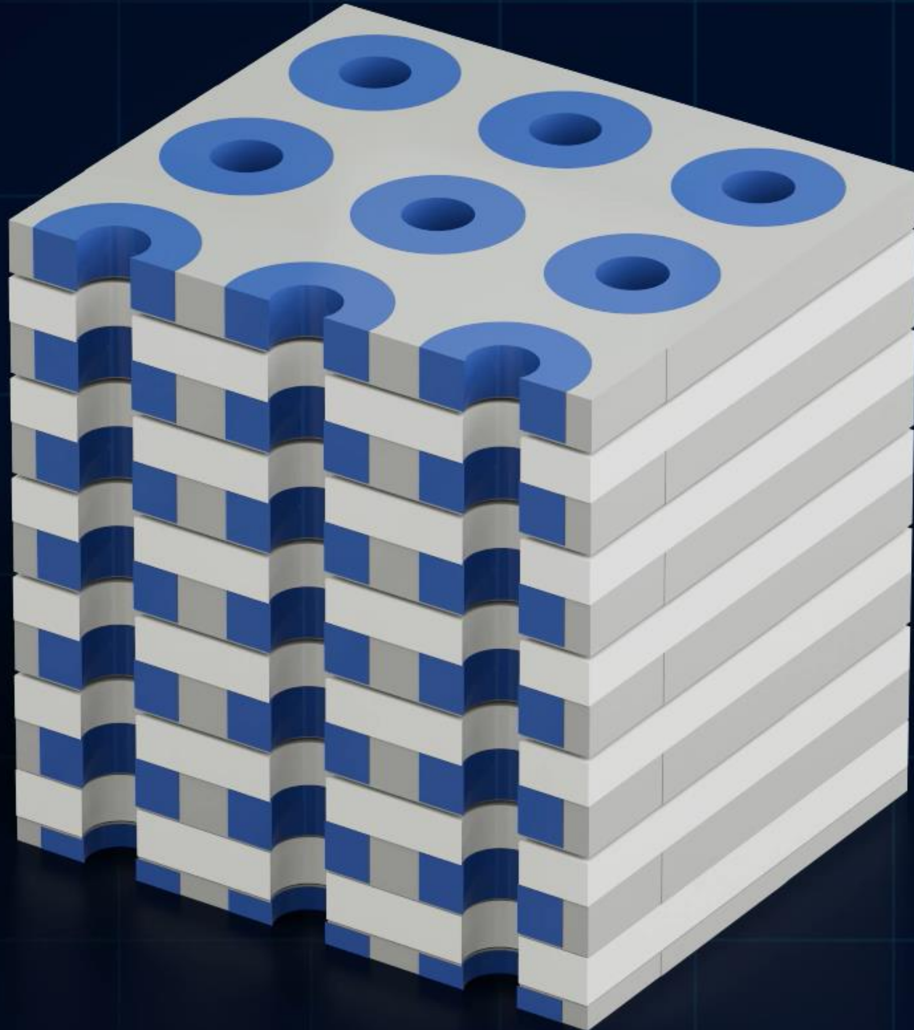

3D

NAND-like Process

1 Deposit Multiple Layers

2 Deep Trench Bit Line Holes

3 Plasma Doping for Floating Body

3D X-DRAM™ Process Steps

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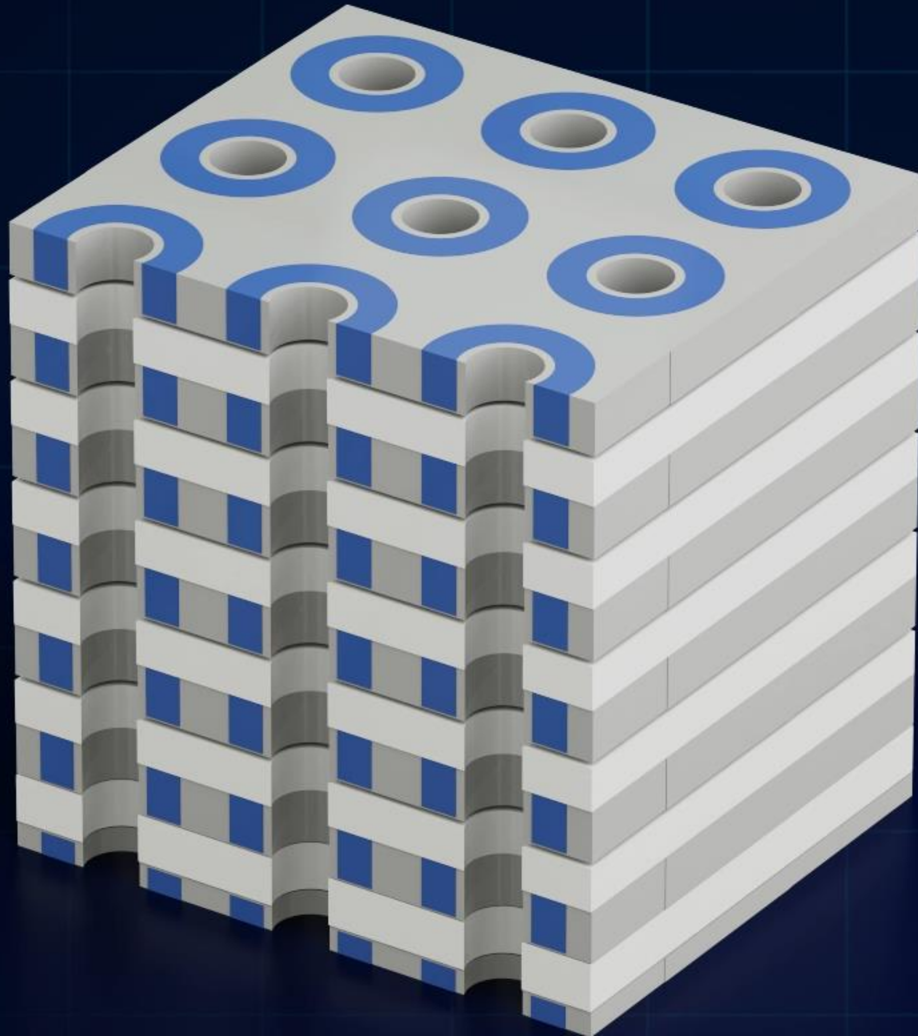

3D NAND-like Process

1 Deposit Multiple Layers

2 Deep Trench Bit Line Holes

3 Plasma Doping for Floating Body

4 Deposit Polysilicon Layer

3D X-DRAM™ Process Steps

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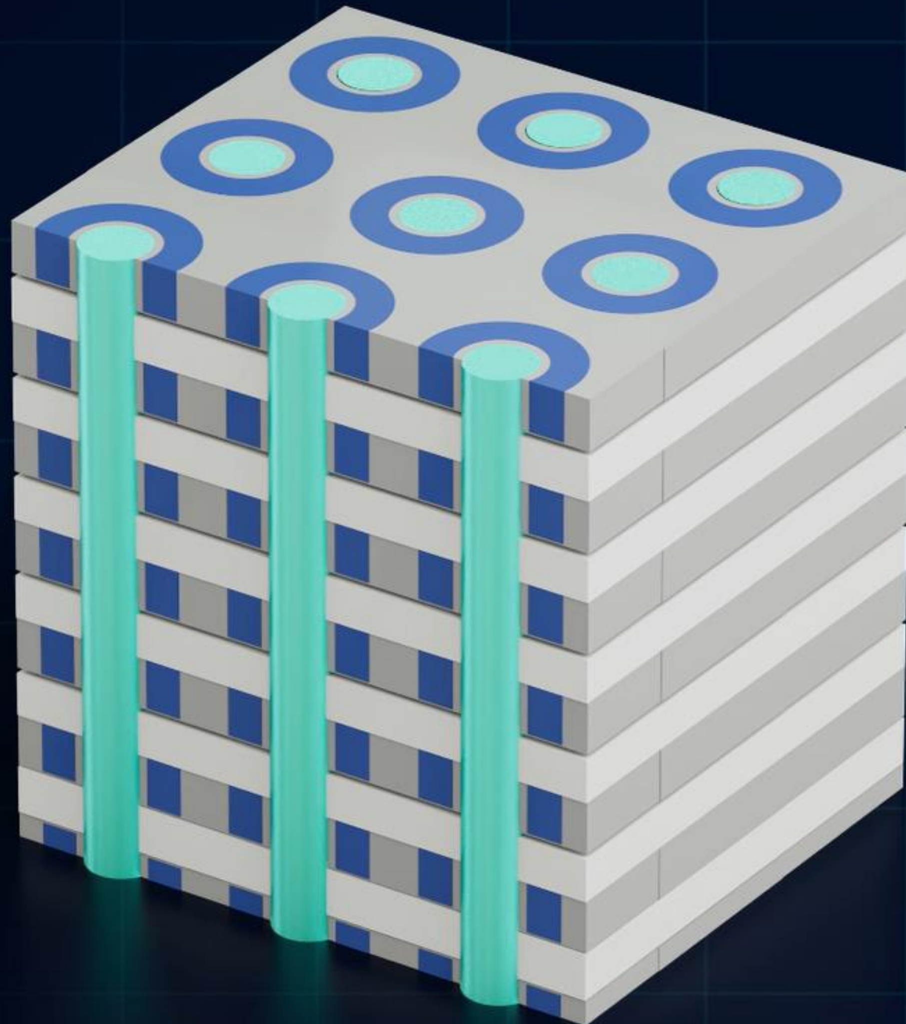

3D NAND-like Process

1 Deposit Multiple Layers

2 Deep Trench Bit Line Holes

3 Plasma Doping for Floating Body

4 Deposit Polysilicon Layer

5 Metal Fill Bit Line Hole

3D X-DRAM™ Process Steps

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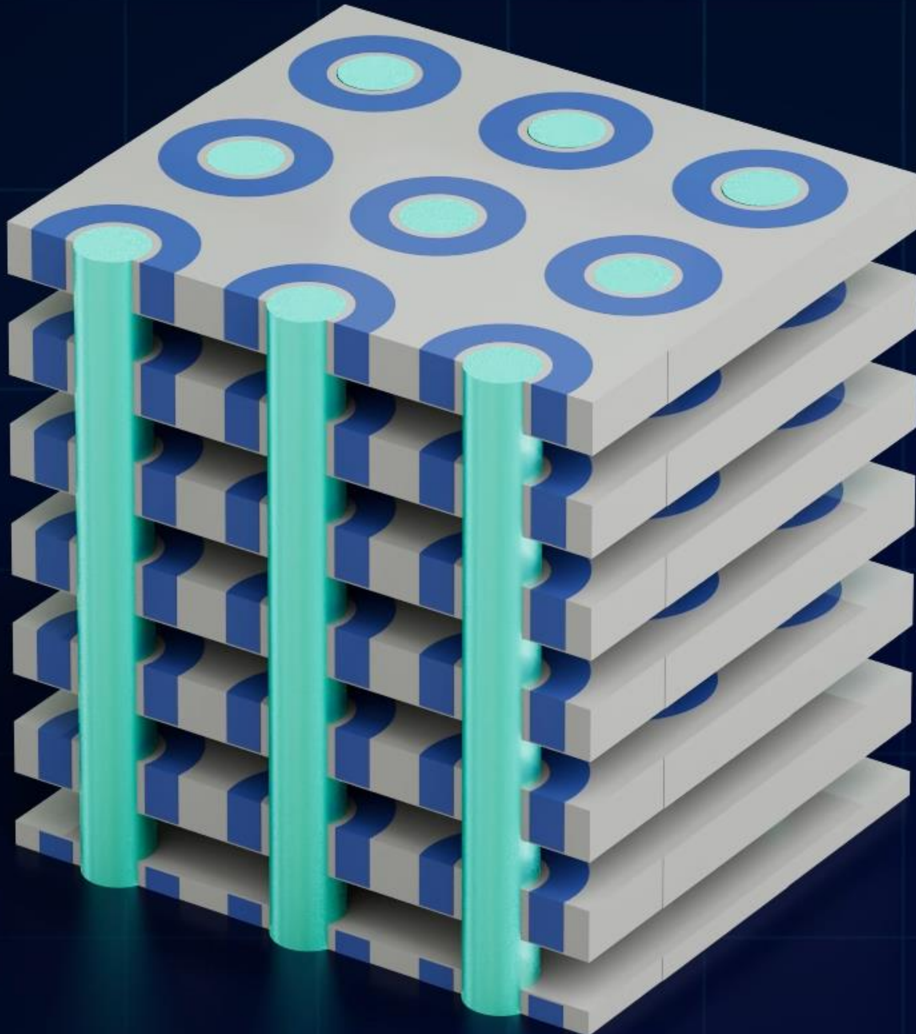

3D NAND-like Process

1 Deposit Multiple Layers

2 Deep Trench Bit Line Holes

3 Plasma Doping for Floating Body

4 Deposit Polysilicon Layer

5 Metal Fill Bit Line Hole

6 Wet Etch Nitride Layers

3D X-DRAM™ Process Steps

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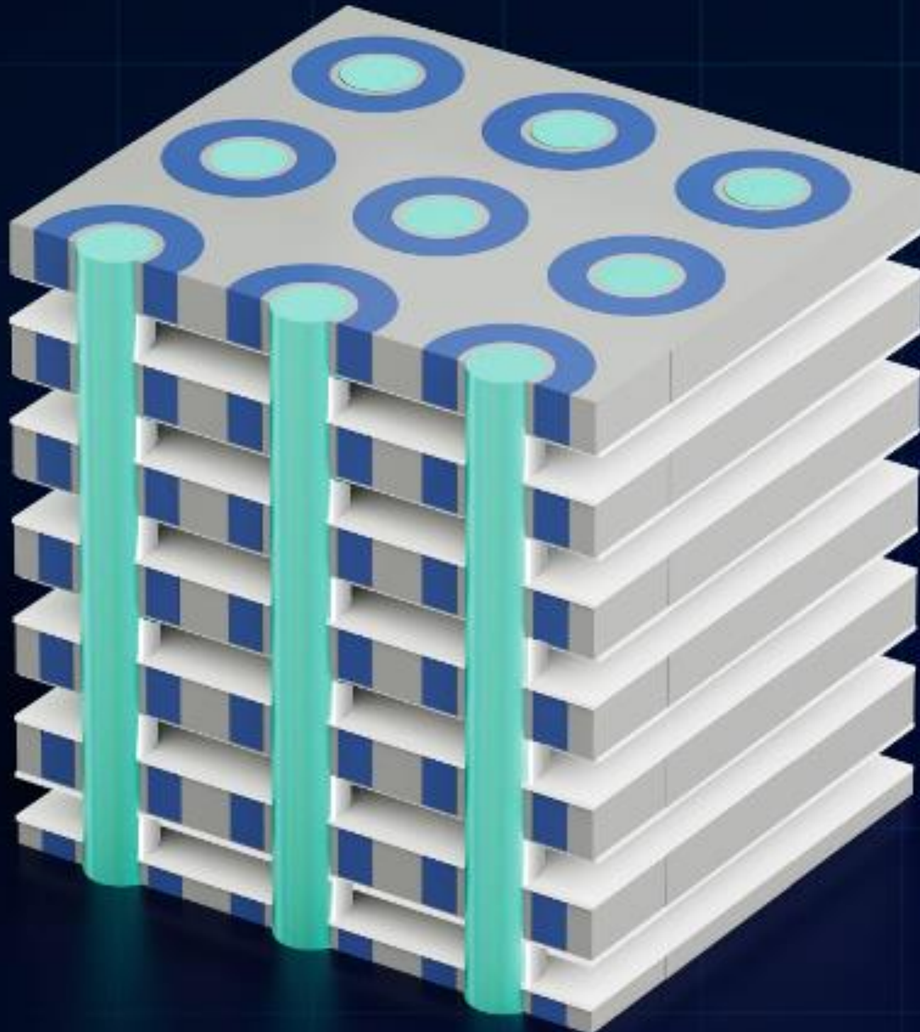

3D NAND-like Process

1 Deposit Multiple Layers
2 Deep Trench Bit Line Holes
3 Plasma Doping for Floating Body
4 Deposit Polysilicon Layer
5 Metal Fill Bit Line Hole
6 Wet Etch Nitride Layers
7 Deposit Gate Oxide Layer

3D X-DRAM™ Process Steps

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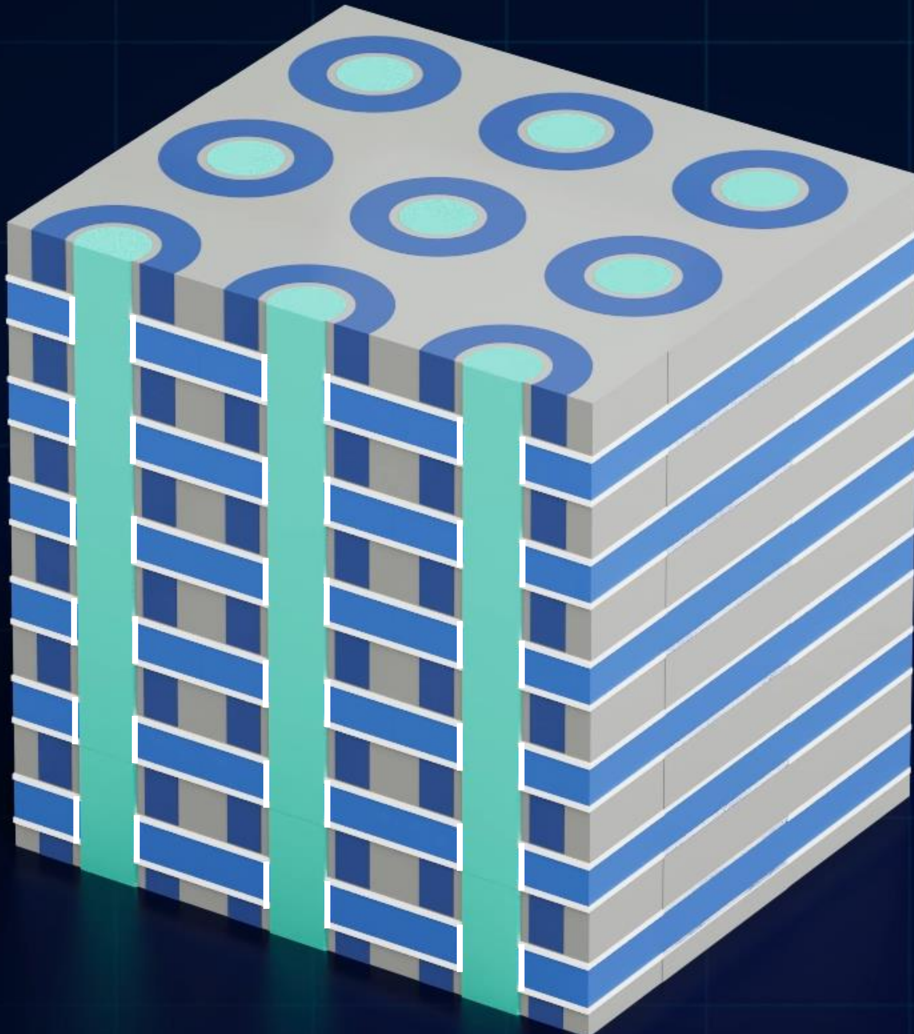
3D X-DRAM



3D NAND-like Process

1. Deposit Multiple Layers
2. Deep Trench Bit Line Holes
3. Plasma Doping for Floating Body
4. Deposit Polysilicon Layer
5. Metal Fill Bit Line Hole
6. Wet Etch Nitride Layers
7. Deposit Gate Oxide Layer
8. Deposit Metal Word Lines

3D X-DRAM

3D X–DRAM™ Process Advantages

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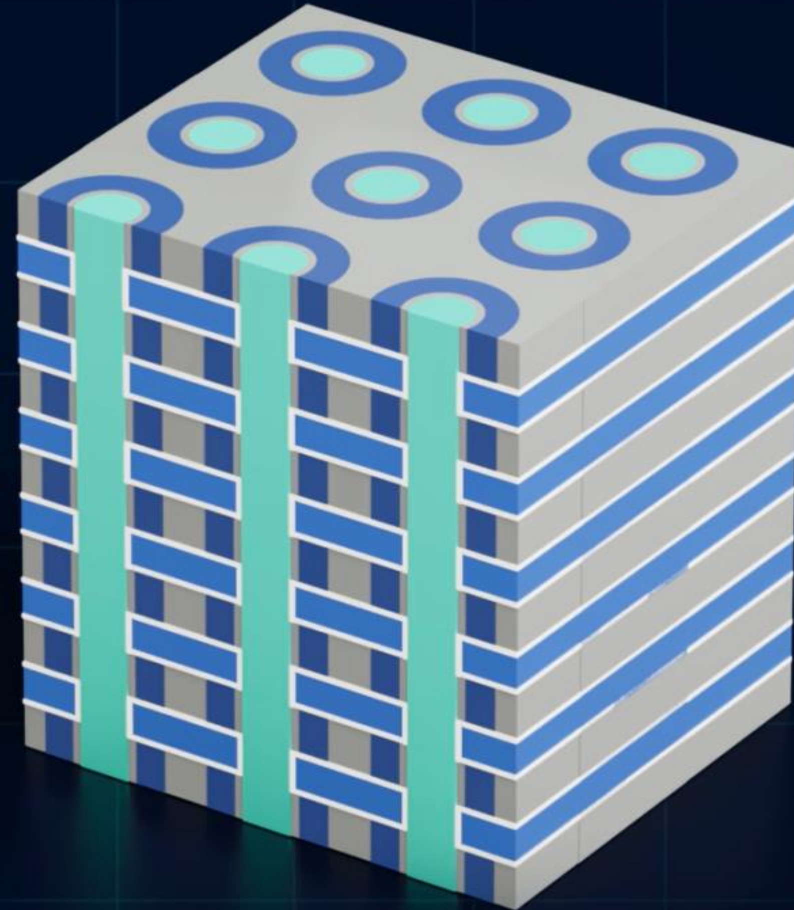
1 Bit Line Mask

8 Key Steps

– Self–Aligned



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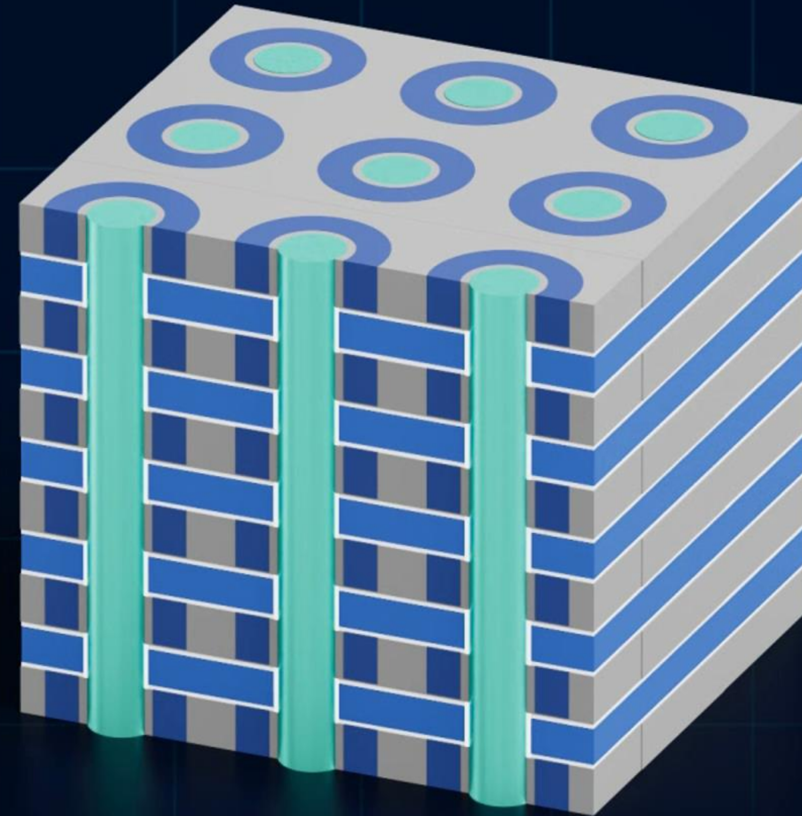
3D NAND

3D X-DRAM



Similar Processes

3D X-DRAM

3D X-DRAM™ Memory Density

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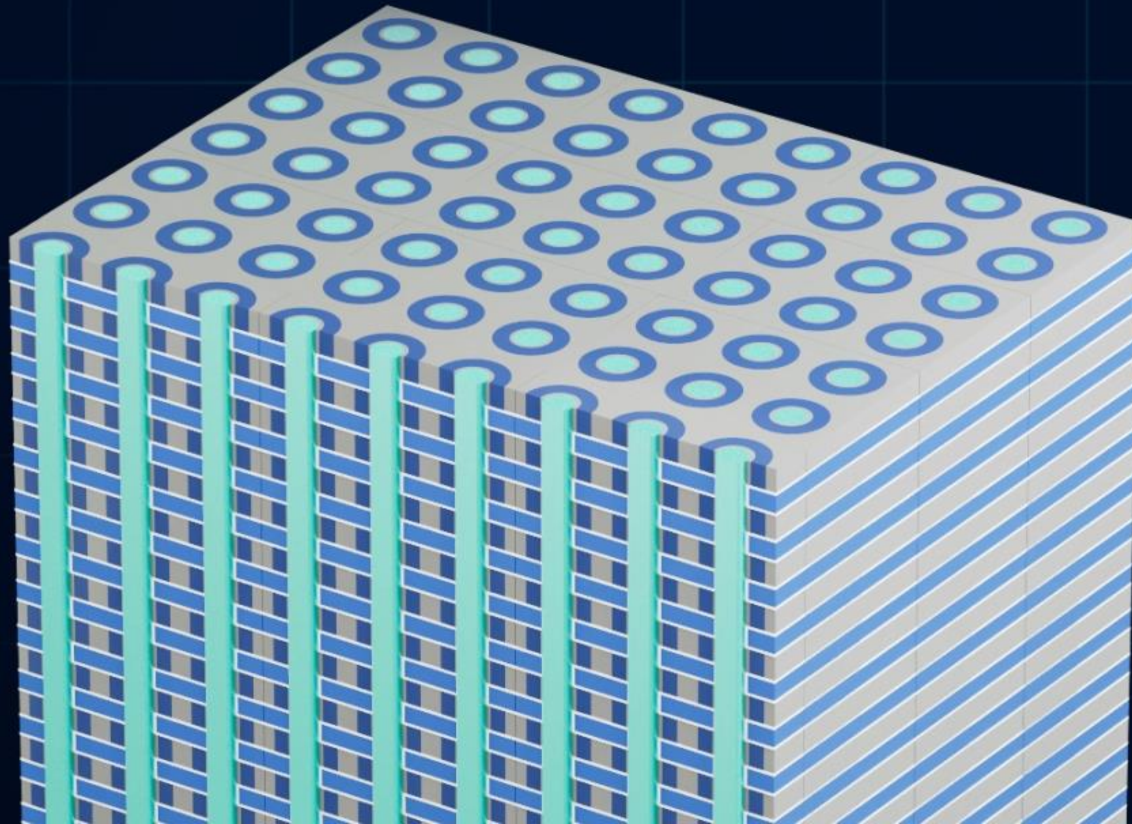


230 Layers

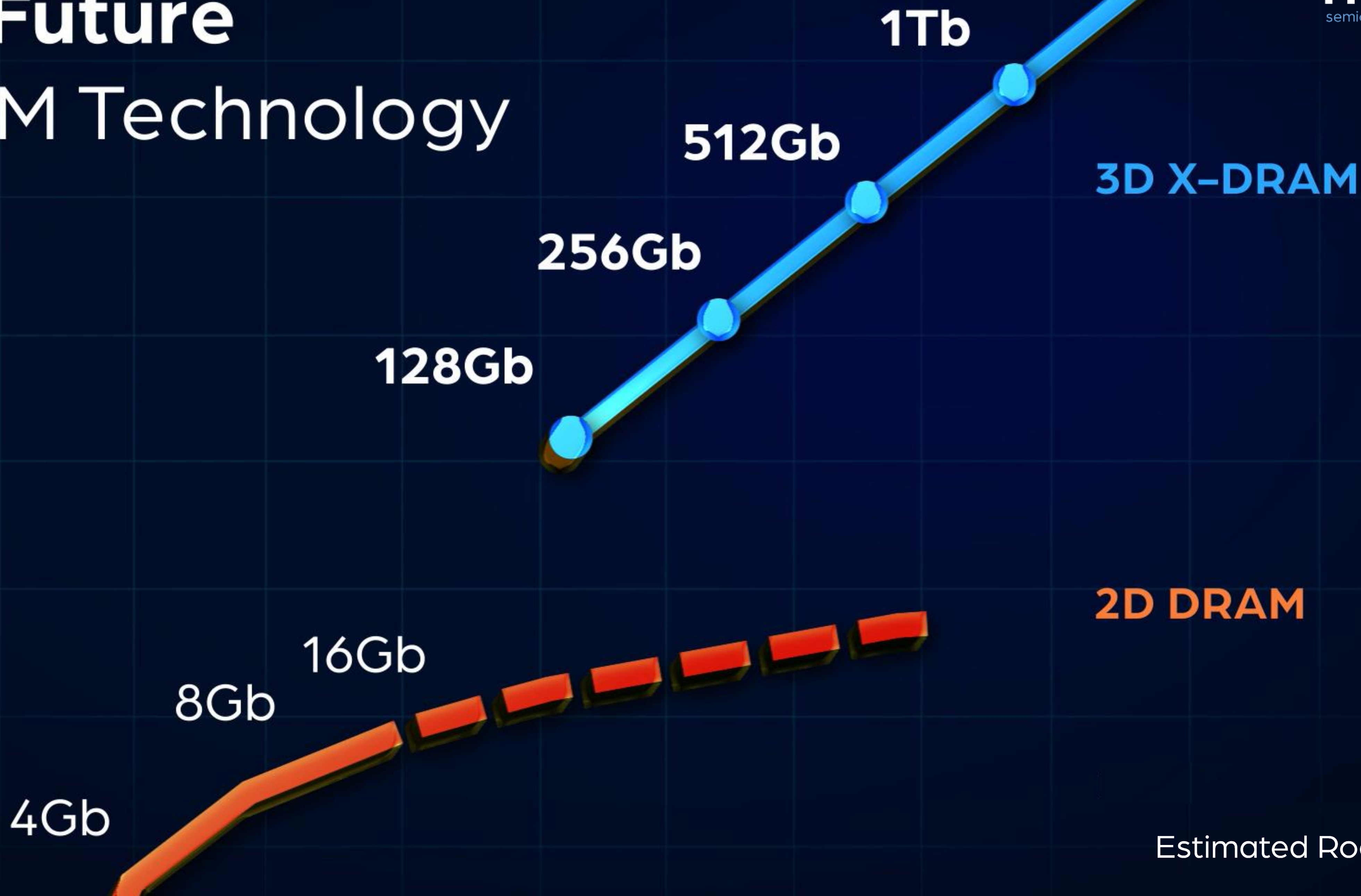
128 Gb

8X Density

Estimated Density

3D X-DRAM

The Future
DRAM Technology



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Estimated Roadmap

More Memory for AI Chip

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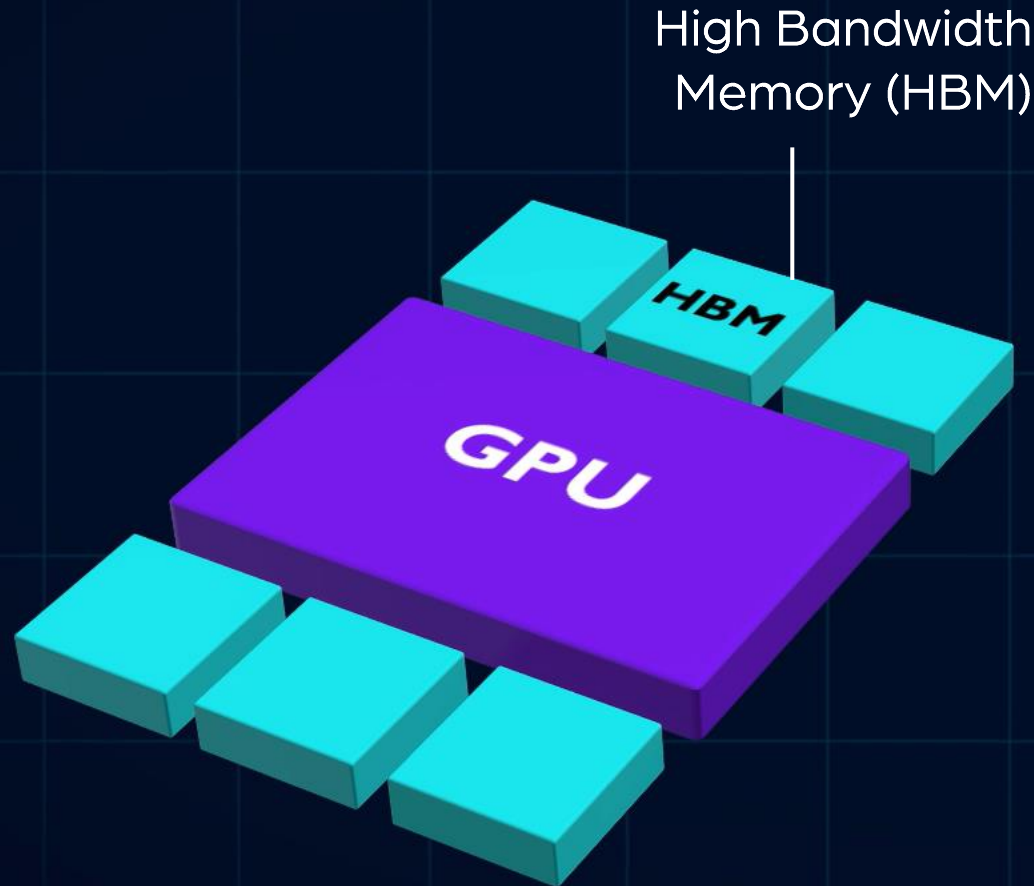
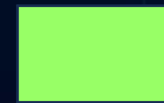


3D X-DRAM

1.5 TB

2D DRAM

192 GB



Estimated Capacity

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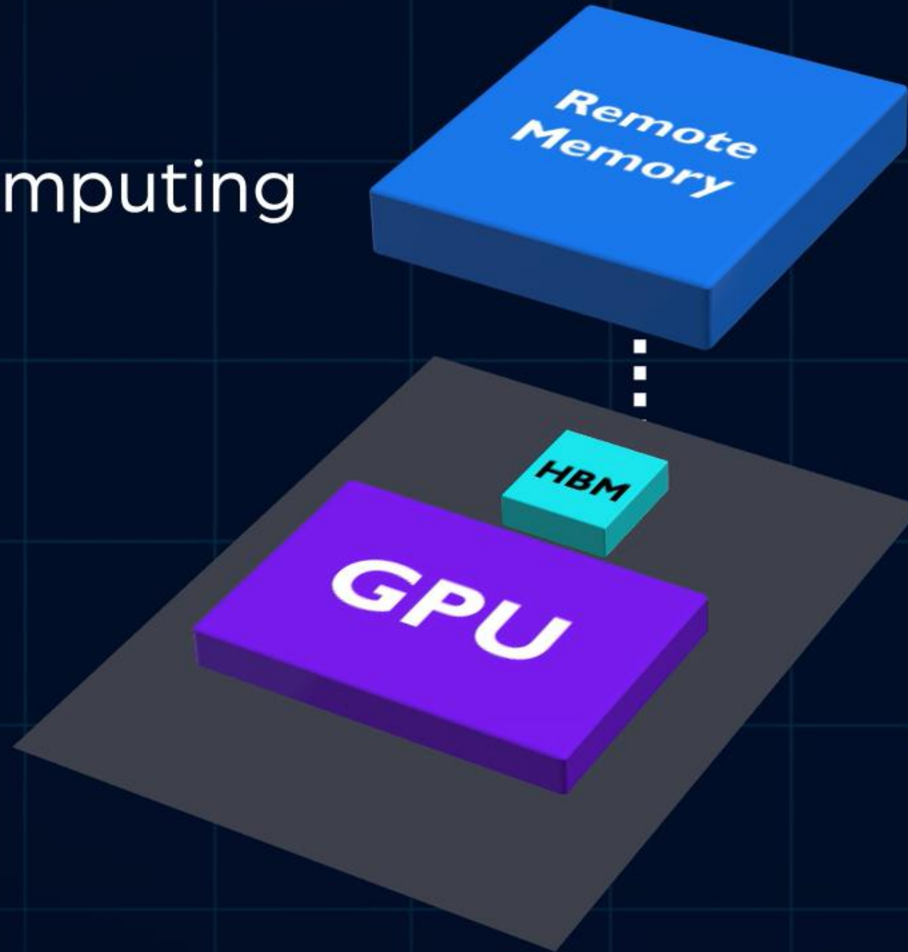
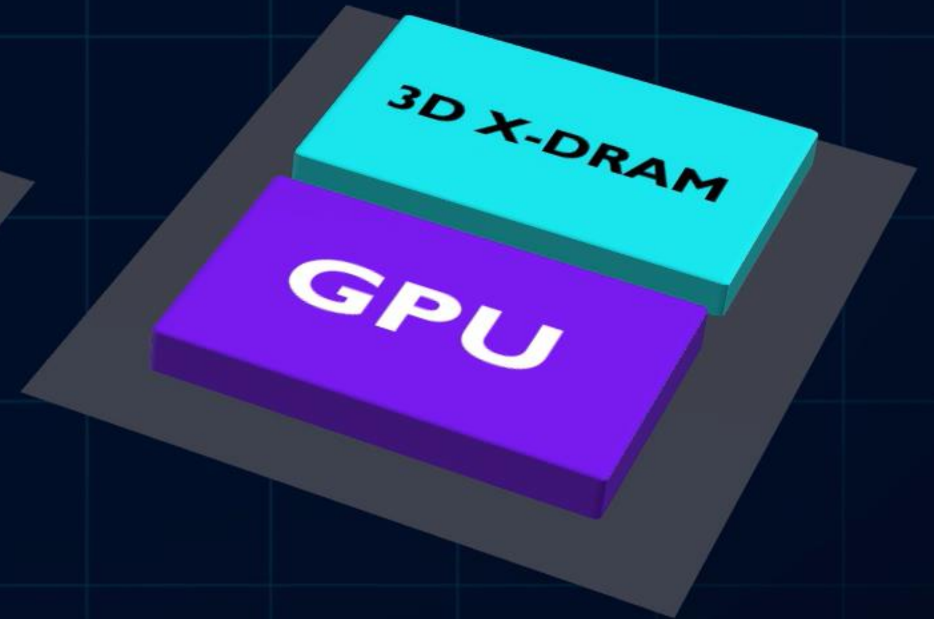
AI Revolution

Remote
Memory Computing



Local
Memory Computing



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Thank You

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