# Integrating Solid State Storage and DRAM onto Standard Memory Module Form Factor (SSDDR)

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# Agenda

- The Need to Integrate SSD & DRAM onto a Module
- Today's Technologies make SSDDR Possible
- A Bright Future for SSDDR
- The Road Ahead for SSDDR Applications

# The Need to Integrate SSD & DRAM onto a Module

VOLATILE

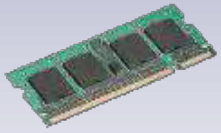
NON VOLATILE

Random Access memory (RAM)

Hard drive - SSD

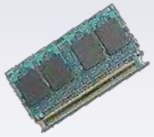
DESKTOP

LAPTOP



SODIMM

Flash Module



Micro-DIMM

Discrete NAND

DRAM on Board

TABLET

NETBOOK

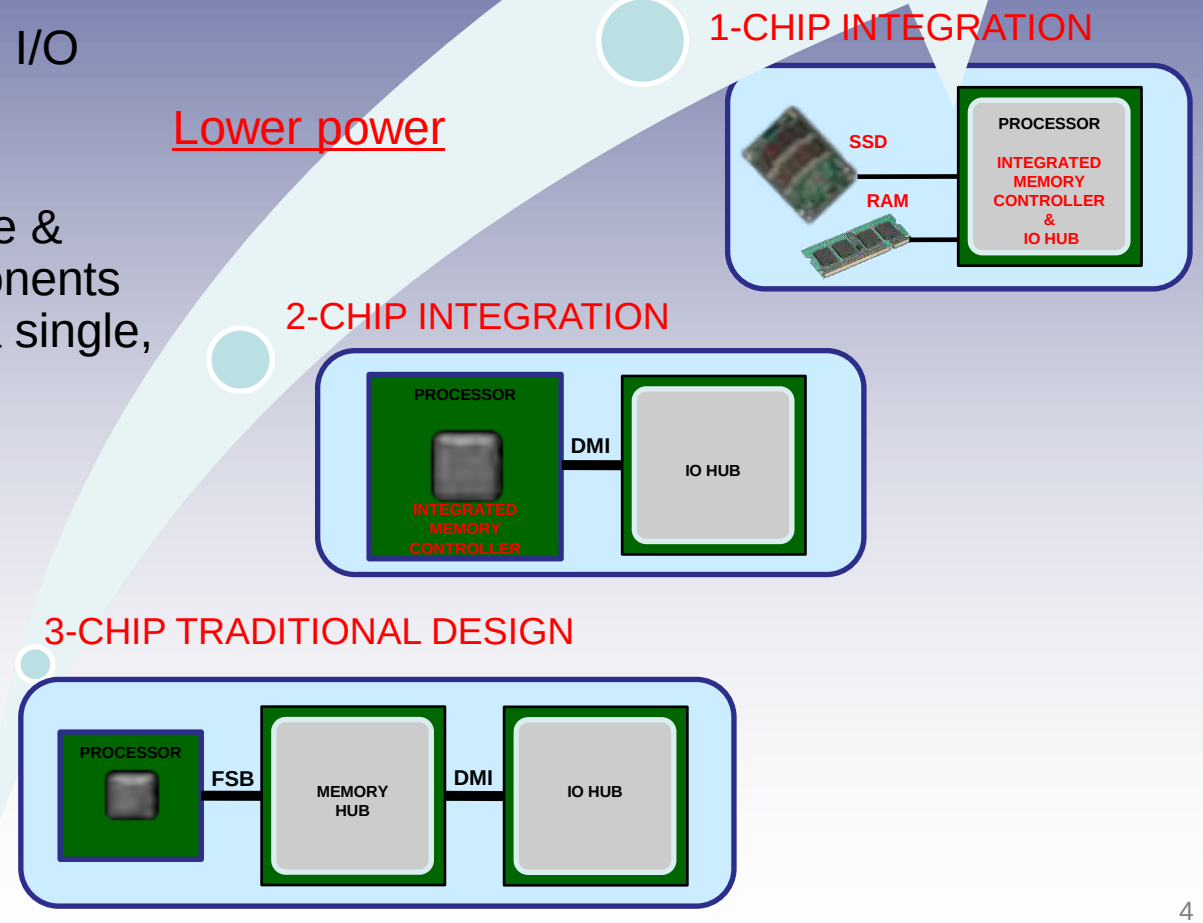
- Today's computer:
  - Smaller
  - Lighter
  - Higher performance
  - Lower cost
- Volatile & non-volatile subcomponents have also been reduced in size to smaller form factor

# The Need to Integrate SSD & DRAM onto a Module

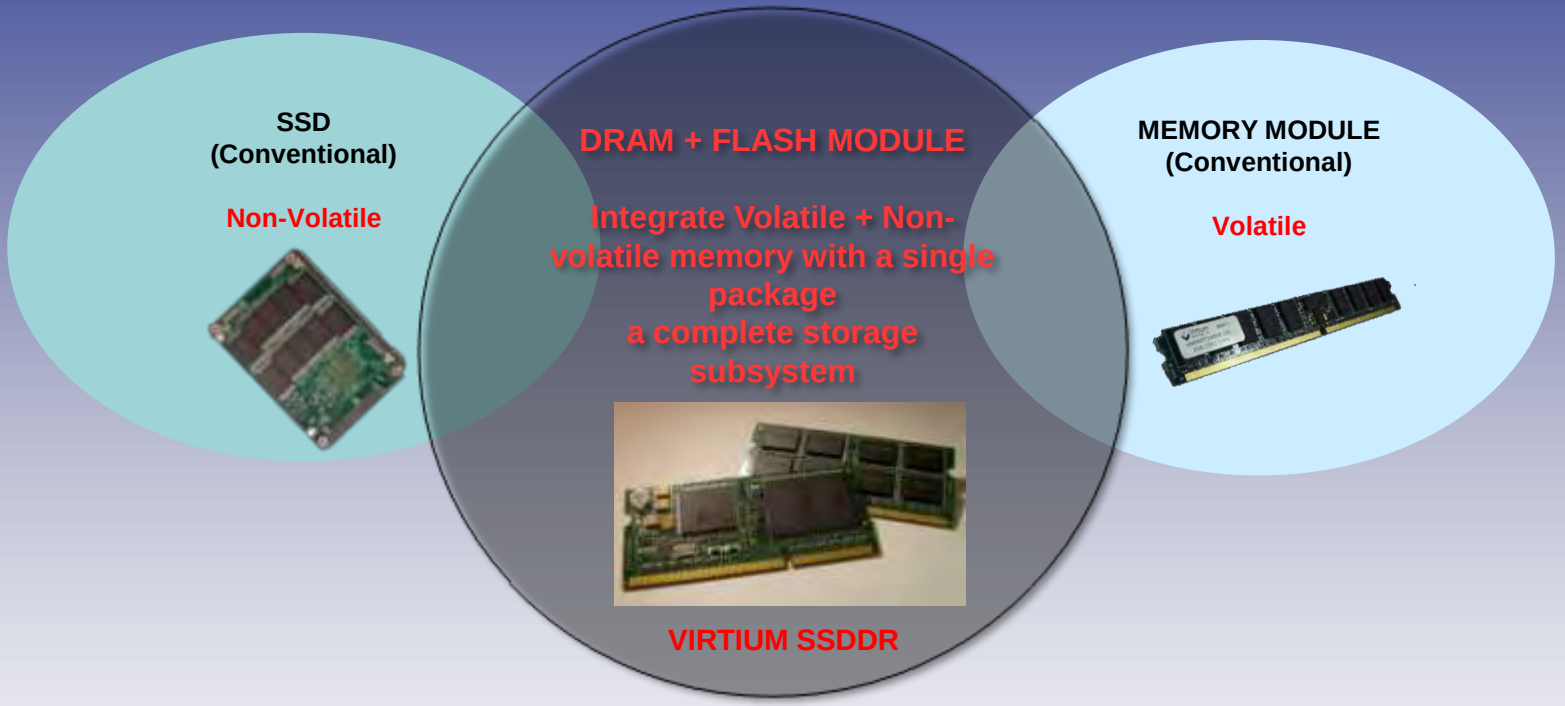
- Future potential: single chip, single package – a complete processor integrating memory controller and I/O controller
- A need to scale volatile & non-volatile subcomponents (SSD & DRAM) onto a single, small form factor

Increase overall system performance

Lower power



# The Need to Integrate SSD & DRAM onto a Module

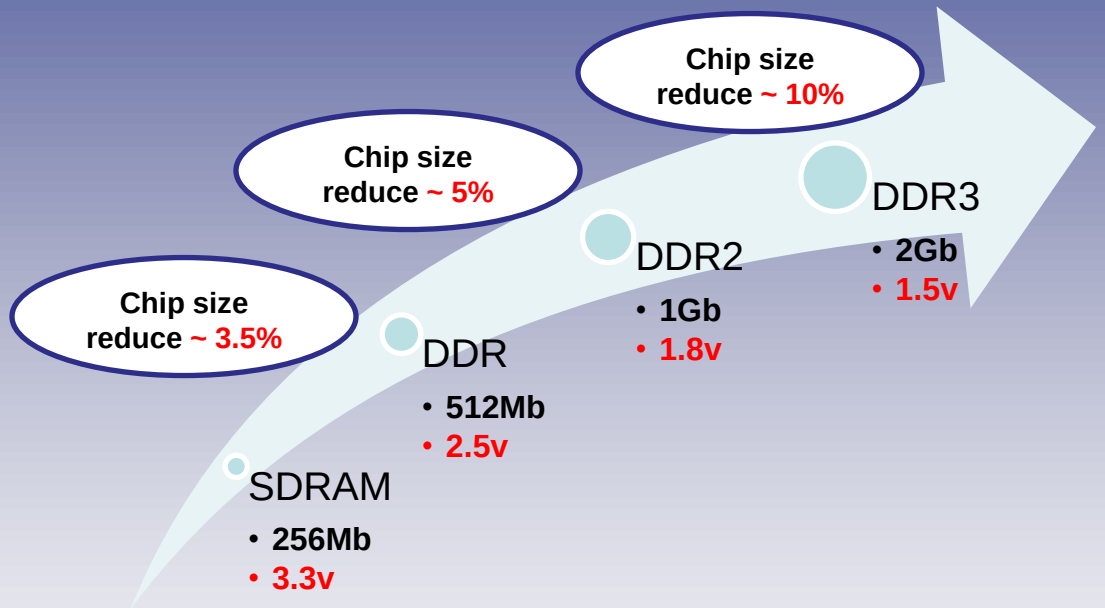



Integrate volatile & non-volatile to:

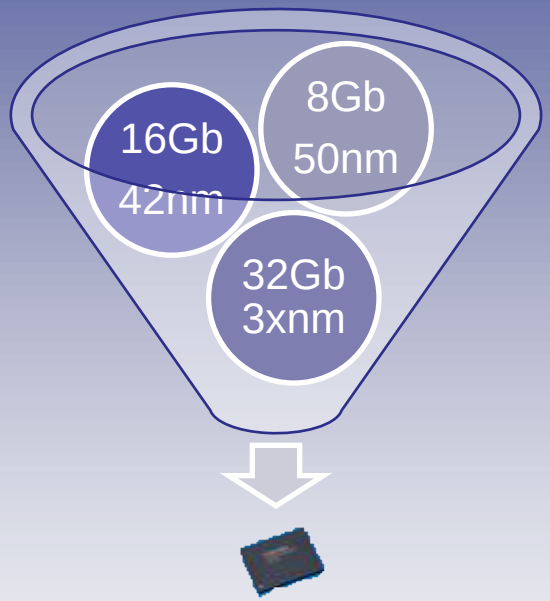
- Save cost
- Increase overall system performance, lower the power consumption
- Scale to smaller form factor and lighter weight

# Today's technologies make SSDDR Possible - Components

- DRAM technology trends:




- NAND flash technology trends

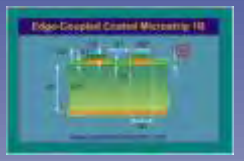



- Smaller DRAM & Flash components make the integration possible in a small form factor i.e. SODIMM
- Low power consumption components help to reduce design complexity i.e. reduce number of power supply input pins and consolidate two different voltage technologies into a single voltage supply

# Today's technologies make SSDDR Possible – PCB Technology

Memory Module stack-up & Impedance requirement

SSD stack-up & Impedance requirement



8 layers stack-up (SODIMM)

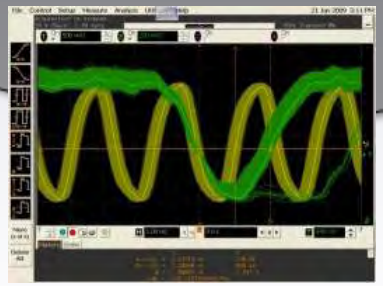
- Single end 0.1mm width
  - Outer layer 60 ohms +/- 10%
  - Inner layer 55 ohms +/- 10%
- Differential 0.1mm width
  - 88 ohms +/- 10%

Mixed signal PCB technology enables the integration of these two technologies

- Combine onto a 40 mil thick – 10 layers PCB
- Maintain signal integrity and crosstalk between mix and match signals

4 layers stack-up

- Single end 0.1mm width
  - 50 ohms +/- 10%
- Differential 0.1mm width
  - 100 ohms +/- 5%

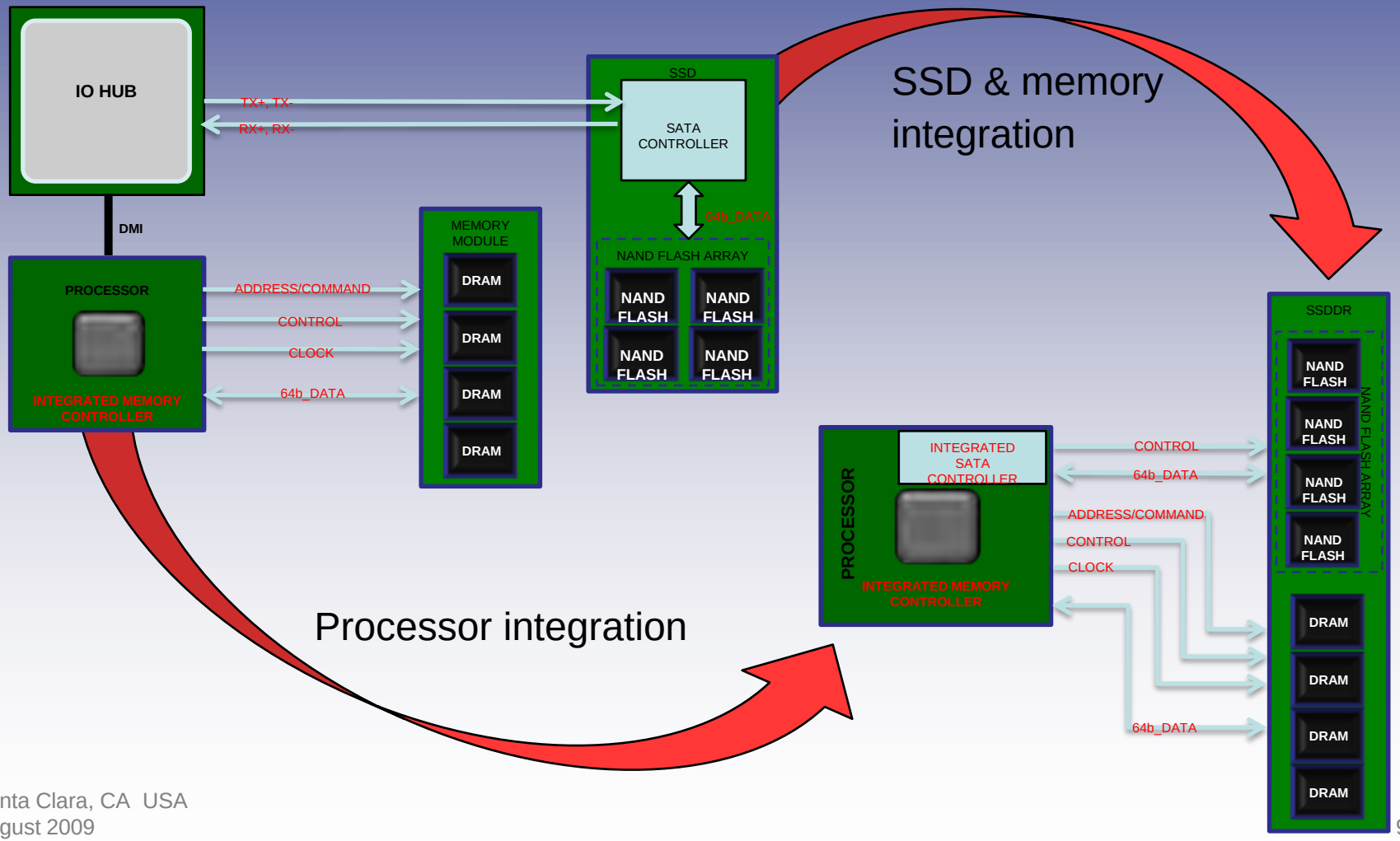


| | | | | Tolerance | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Substrate 1 Height | H1 | 5.0000 | +/- | 0.0000 | 5.0000 | 5.0000 |
| Substrate 1 Dielectric | Er1 | 4.2000 | +/- | 0.0000 | 4.2000 | 4.2000 |
| Lower Trace Width | W1 | 8.0000 | +/- | 0.0000 | 8.0000 | 8.0000 |
| Upper Trace Width | W2 | 7.5000 | +/- | 0.0000 | 7.5000 | 7.5000 |
| Trace Separation | S1 | 14.0000 | +/- | 0.0000 | 14.0000 | 14.0000 |
| Trace Thickness | T1 | 1.3000 | +/- | 0.0000 | 1.3000 | 1.3000 |
| Coating Above Substrate | C1 | 0.4000 | +/- | 0.0000 | 0.4000 | 0.4000 |
| Coating Above Trace | C2 | 0.4000 | +/- | 0.0000 | 0.4000 | 0.4000 |
| Coating Between Traces | C3 | 0.4000 | +/- | 0.0000 | 0.4000 | 0.4000 |
| Coating Dielectric | CEr | 4.2000 | +/- | 0.0000 | 4.2000 | 4.2000 |

# Today's technologies make SSDDR Possible

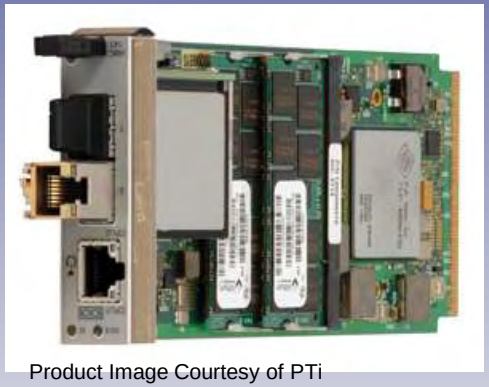
- SSDDR Video

# A Bright Future for SSDDR

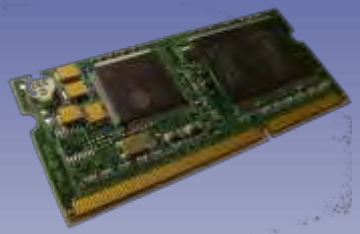


# The Road Ahead for SSDDR Applications

- SSDDR in use



Product Image Courtesy of PTi



Product Image Courtesy of Kontron

Benefits of integrating Solid State Storage and DRAM onto Standard Memory Module Form Factor:

- Smaller
- Lighter
- Higher performance
- Lower cost


# Q&A