DRAM-less SSD – The New Trend for Embedded System

Phison Electronics Corp.

Michael Wu
General Manager, American Business Div.
Michael_wu@phison.com
Embedded System are Everywhere

- Industrial / Semi-Industrial
- Military / Defense
- Aviation / Automation / Automobile
- Medical / Tele-communication

Example Applications:
Typical Storage Form Factor of Choice

1-32GB

- Automotive, medical devices,
- Booting, data logging, preloaded contents

32GB – 256GB+

- IPC, Panel PC, Thin Client
- POS, STB, Digital Signage
- Feature-rich O/S, compute power, larger transactional data
Different Application, Different Focus Driven

<table>
<thead>
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<th>Client SSD</th>
<th>Gamer SSD</th>
<th>Embedded SSD</th>
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<tbody>
<tr>
<td>Cost Driven</td>
<td>★ ★ ★</td>
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<td>Reliability Driven</td>
<td>★</td>
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<td>Power Driven</td>
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<td>Performance Driven</td>
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Problem Statement:

Why is DRAM needed in SSD Design?
Short Answer: Performance boost
DRAM-less SSD Design has lower power consumption.

Examples of Power budget of SSD in Portable Devices

- In the portable device category, power consumption are key to long usage life.
- The major contribution of the power consumption still comes from screen, however, SSD can take up as much as 10% of the power budget of SSD.
- DRAM-less SSD design shows 3X lower power when in active and 1.5X lower when in idle.

DRAM-less design shows power advantages.
DRAM-less SSD Design is more Reliable

- The risk of data loss is great concern for embedded devices.
- On SSD design with external DRAM, the in-flight data will be loss during the event of SPL.
- This is the motivation behind PLP circuit of SSD w/ DRAM design.

DRAM’s inflight data at risk during the sudden power loss.
DRAM-less SSD Design saves Cost

- On a 32/64GB, $1 added cost of DRAM contribute to up to 5-7% of the SSD BOM cost
- In semi-industrial SSD market, this is the entire margin of the product.
- Every penny counts – DRAM-less SSD design wins.

<table>
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<th>DRAM Density</th>
<th>Added Cost</th>
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<tbody>
<tr>
<td>256MB</td>
<td>$1</td>
</tr>
<tr>
<td>512MB</td>
<td>$2</td>
</tr>
<tr>
<td>1GB</td>
<td>$4</td>
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</table>

Added Cost of DRAM component in SSD BOM.
DRAM-less SSD Design saves Size

- DRAM-less SSD has enabled small form factor designs.
- M.2 2242 easily fits 2 NANDs without external DRAM.
- BGA SSD perfect candidate for DRAM-less SSD controller – less stacking complexity.
Key Takeaway

- SSD w/ DRAM
- Size
- Reliable
- Power
- Cost
- Performance

DRAM-less SSD

But, still 10-20 times faster than HDD
Some Facts on Phison... 60 seconds?
Phison SSD Market Segments

Market Leadership

- In-house SATA III, PCIe Gen 3 IP
- Process node 40nm & 28nm
- S10 & E7 for enabling hyperscale
Phison SSD Solution Line-Ups

- **Client SSD**
  - PHISON PS3110-S10
  - PHISON PS3111-S11
  - DRAM-less

- **Embedded SSD**
  - PHISON PS3110-S10
  - PHISON PS3111-S11
  - DRAM-less

- **Hyperscale SSD**
  - PHISON PS3110-S10
  - PHISON PS5007-E7
For more information on Phison SSD solution, please visit us at Booth #712 & #714.
THANK YOU FOR YOUR TIME & ATTENTION!