Life Beyond Flash: New Non-Volatile Memory Technologies

CBRAM®

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Adesto Technologies
CBRAM®: Technology Advantages Drive Growth

* T-Y. Liu (SanDisk) et al., “A 130.7mm² 2-Layer 32Gb ReRAM Memory Device in 24nm Technology”, ISSCC 2013
** Laith Altimime, IMEC, IMEC Press Conference, 11/2011
CBRAM®: High Growth Applications

- Battery-operated Wearable Electronics
- Ultra-Low Power Embedded Devices
- Low Power Smart Meters
- Energy-Harvesting Body Monitors
- Instant On Computers
- Fast NVM Memory for Mobile Electronics
- Fast, Energy-Saving Server Cache
- ~10ns to Write
- DRAM Speed
- Low Power
- Non-volatile Memory

Comparison of Technology

<table>
<thead>
<tr>
<th>Technology</th>
<th>CBRAM</th>
<th>ReRAM</th>
<th>FG Flash</th>
<th>MRAM</th>
<th>PCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMOS Compatibility</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Read Core Voltage (V)</td>
<td>0.35</td>
<td>0.32</td>
<td>0.5</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Write Core Voltage (V)</td>
<td>0.6</td>
<td>2.0</td>
<td>10</td>
<td>3.3</td>
<td>2.8</td>
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<tr>
<td>Read Energy/bit</td>
<td>50 nJ</td>
<td>75 nJ</td>
<td>500 nJ</td>
<td>100 nJ</td>
<td>500 nJ</td>
</tr>
<tr>
<td>Charge pumps needed for &lt;1 V SoC</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

~10ns to Write

Tp<10ns