



ReThink Persistent Memory with 3D ReRAM

Faster Access to Big Data

CrossBar Resistive RAM (ReRAM) high-density memory IP cores are an ideal choice for high-density, low-latency memory applications such as data center storage, mobile computing, consumer electronics and artificial intelligence. They offer high density, low latency, high performance and low power in a non-volatile memory solution.

CrossBar is enabling a new class of persistent memory solutions for read-intensive applications that benefit from the superior characteristics of CrossBar's 3D ReRAM technologies.

Supported densities are from 64Gbits (8GBytes) or custom sizes, enabling 128GB NVDIMM to 1TB NV-DIMM with 8 chips per package. At system level, NV-DIMM read performance achieves 25.6 GB/s – 64 IOs – 250ns random read latency while consuming less than 1W active reads.

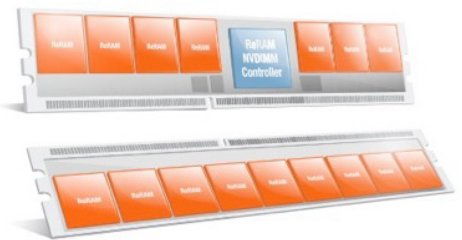
Depending on the business model, the IP cores can be provided to customers as hard macros that can be integrated into SoC or used as stand-alone memory chips.

In addition to utilizing CrossBar's high-density ReRAM technology described above for non-volatile memory applications, this technology can also be used for creating secure cryptographic keys embedded in the semiconductor. These keys are called physical unclonable functions (PUF) keys which are random and unique for every fabricated semiconductor and virtually impossible to reverse engineer or duplicate. The same ReRAM cell technology can be utilized for both memory and cryptographic keys.

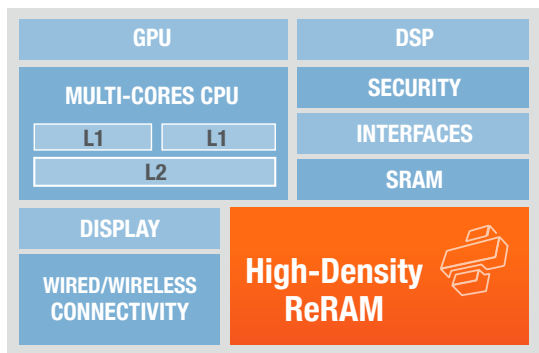
HIGH-DENSITY MEMORY KEY FACTS

- Non-volatile: no current drawn during inactivity
- Low energy: 68mA active read current – 3.7pJ/bit
- Lower cost than DRAM \$/GB
- DRAM read equivalent performance – 3.2GB/s - 8 IOs
- 200ns random read latency at chip level

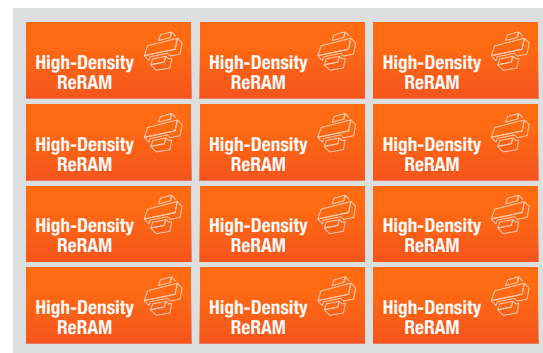
TARGETED APPLICATIONS



SOC with Embedded ReRAM



Persistent ReRAM Memory Chip



Embedded Persistent Memory Array & Stand-Alone Chip



High-Density Memory

64 Gbit 3D ReRAM

2x and 1x nm process nodes.

Features

- **Device Parameters**
 - 2x nm and 1x nm CMOS
 - 64Gb, 2 Layers
- **Interface**
 - 3.2GB/s Throughput
 - 1.66GHz Clock Frequency
 - 8-bit Data Bus
- **Memory Organization**
 - 64Gb Total Device Size
 - 64B Page Size
 - 16 banks
 - 64 Tiles per Bank
- **Read Operation**
 - 200ns Page Read Latency
 - 3.2GB/s Max Read Throughput
- **Write Operation**
 - 2us Page Write Latency
- **Status Register**
 - Ready/Bust State
 - Pass/Fail Condition
 - Write-protect Status
- **Ready/Bust (R/B#) Output indicator**
- **Supply Voltage**
 - VDD = 1.2V
 - VPP = 2.5V
- **Write Protection to Prevent Inadvertent Writes**
- **Data Integrity**
 - 10 Year Retention at 85°C (post 10K cycles)
 - 1M Write Cycles
- **Power Consumption**
 - 100mW Read Power with ICC = 68mA for Continuous Read
- **Operating Junction Temperature**
 - Industrial -40°C to +85°C (ambient)

Product Description

CrossBar Resistive RAM (ReRAM) high-density memory provides a cost-effective solution for applications requiring high density, high performance, low power, non-volatile data storage.

CrossBar 3D ReRAM high-density memory devices include a high bandwidth bus interface running at 1.6 MHz DDR providing maximum of 3.2 GB/s throughput. The 64Gb ReRAM memory array consists of 16 banks with each bank further comprising of 64 tiles. Each tile is 64Mb and provides 8-bit of data hence the 64 tiles creating page size of 64 bytes. The 16 banks of ReRAM are required to provide the 64Gb density as well as achieving the maximum throughput of 3.2GB/s.