# PERSISTENT MEMORY JANUARY 24, 2019 | SANTA CLARA, CA Driving the MRAM Revolution

Kevin Conley CEO, Everspin Technologies

#### MRAM In Datacenter Core Enables Data Persistence At Speed





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## MRAM Enables Critical Data Persistence At Speed In Edge Applications





## MRAM is Deployed in Various Mission-Critical End Points





<sup>1</sup>Cisco Visual Networking Index, June 2017

## MRAM: Persistence, Performance, Endurance & Reliability





#### PERSISTENCE

Maintains memory contents without requiring power

#### PERFORMANCE

SRAM & DRAM-like performance with low latency



#### ENDURANCE

Superior durability supports memory workloads without sophisticated management



#### RELIABILITY

Best-in-class robustness designed and tested for extreme conditions

## A Variety of Persistent MRAM Technologies



#### Toggle MRAM as Persistent SRAM



- Standard SPI and Parallel I/F
- Replacement for nvSRAM, FRAM, BBSRAM and NOR Flash
- Robust operating reliability across extended temperature
- Steadily growing long-term market value

#### STT-MRAM As Persistent DRAM



- DDR3 & DDR4 compatible
- Complementary to DRAM & Flash
- High performance NVM with high chip capacity
- Disruptive value as non-volatile write buffer
- New market growth driver

## Legacy Discrete Memory Backdrop





## MRAM Brings Native Persistence to Memory Workloads



**MRAM COMBINES** PERFORMANCE OF MEMORY WITH PERSISTENCE **OF STORAGE** Non-Volatile: Maintains memory without power East Read/Write Speeds: Similar to DRAM Superior Endurance: Survives memory workloads High Data Retention 

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#### World's First Pre-Production 1Gb STT-MRAM



Everspin Ships the World's First Pre-Production 28 nm 1 Gb STT-MRAM Customer Samples

Next generation product family expands portfolio of non-volatile persistent memory solutions.

#### January 08, 2019 07:00 AM Eastern Standard Time

CHANDER, Arz.-<u>HEUSNEESS WIRE</u>)-Eversal's Technologies, Inc. (NASDAC: MFAM), the world's leading developer and mainfacturer of Magnetonesistive RAM (MFAM), today announces that is commenced shipment of pre-production customer samples of its 26 mm 1-Gapati (Gb) Signi Terque Transfer Magnetonesistive Random Access Memory (STT-MFAM) product in December 2018. This achievement follows Everspin's successful commercialization of 16-40 pm 265 Mb STT-MFAM and builds upon months of close work with customers and manufacturing patients to mature this product technology. These are the world's list 1 Gb STT-MFAM parts that meric customer specifications for endurance, performance and reliability in persistent write buffer applications.

"We now lock forward to working with oustomers to oring the next generation of STT-MRAVenabled products to market." Everpin's STF-MRAM devices enable enterprise infrastructure providers to increase the reliability and performance of systems where high performance data persistence is critical by delivering protection against power loss without the use of supercapacitors or batteries.

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\*Our team is proud to reach this significant milestone of shipping preproduction 1 Gb parts, further establishing STT-MRAM's presence in the

memory product landscape. It represents years of Everspin focus on driving the NRAM neolution and is a testament to our strong partnership with GLOBALFOUNDRIES<sup>1</sup>, said Kevin Coniey, Everspin's President and CEO. "We now look forward to working with outporters to bring the rest generation of STT-MRAM-enabled products to market."

Eversals<sup>15</sup> 1 Gb product family includes both -bot and 18-bit DDP4 compatible (ST-DDP4) interface versions of the device and are available in a similar BGA package to Everspin's existing portificie of 258 Mb parts, providing a four-fact increase in density in the same shysical seaso. Production ramp for the 1-Gb products is scheduled to begin in the second half of 2019.

#### About Everspin Technologies

Headquartered in Chandler, Arizona, Everspin Technologies, Inc. is the worldwide leader in the design, volume production and distribution of Wagnetanesistive RMAI (MRAM) into markets and applications where data persistence, performance, and endurance are paramount. Serving applications across the data center, industrial, and transportation markets, Everspin has built the strongest and tasket-growing foundation of IMRAM users in the world. For mare information, visit www.everspin.com.

- 28nm technology from GLOBALFOUNDRIES JDA
- Shipped in December 2018
- Full performance & reliability specs
- Production ramp 2H 2019





## **STT-MRAM** in Enterprise Storage

In Partnership With:







## **STT-MRAM** in Server Storage Accelerator

In Partnership With:





\*FinTech Logging White Paper available at:

https://www.everspin.com/files/accelerating-fintech-applications-lossless-and-ultra-low-latency-synchronous-logging-using

## **STT-MRAM** in Fabric Accelerators



STT-MRAM Bypass Assist Option

#### **Higher Performance With Bypass Assist**

- Acts as power loss protected write burst data buffer on the fabric/network controller card for offload engines
- Providing at point persistent write data completion
- Eliminates the multi-microseconds latency path before data can be committed to a persistent device

## Provide bigger working persistent memory region

#### Enables product differentiation

## **Toggle MRAM** in RAID Controller Journal Memory

#### No Stored Charge Liability

## X X

Simplified Architecture Eliminates Power Fail Hardening



**Solid Reliability** 





## Toggle MRAM in Gaming Machine Data Log

#### **MRAM Ensures Data Retention**

Persistent Memory ensures data retention

Ensures accuracy of data logging applications  $\checkmark$ 

#### No Stored Charge Liability

#### **Extended Temperature Operation**



#### **Solid Reliability**





- Expanding discrete MRAM adoption in data center storage and networking applications
- Growth of discrete MRAM in mission critical applications in gaming, industrial, transportation and medical endpoints
- Embedded MRAM penetration in SOCs for consumer, industrial, and transportation endpoints



GLOBALFOUNDRIES



- MRAM meets persistent data needs from the data center to the edge
- MRAM is the key technology for tomorrow's need for a universal memory that delivers persistence at speed with high endurance and reliability
- Everspin Technologies is the memory pioneer driving the MRAM revolution

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