



*Data Persistence at Speed*

# MRAM Solutions

Everspin – The MRAM Pioneer

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# Everspin: MRAM Technology Pioneer

Everspin is a Leading Provider of Non-volatile Memory Technology and Products to Mission-Critical Data Center, Industrial and Auto/Transportation Applications

- Origins in Motorola/Freescale
- Publicly traded : MRAM
- Independent since 2008
- Long-served tier-1 customers

600+

Well diversified customers

110M+

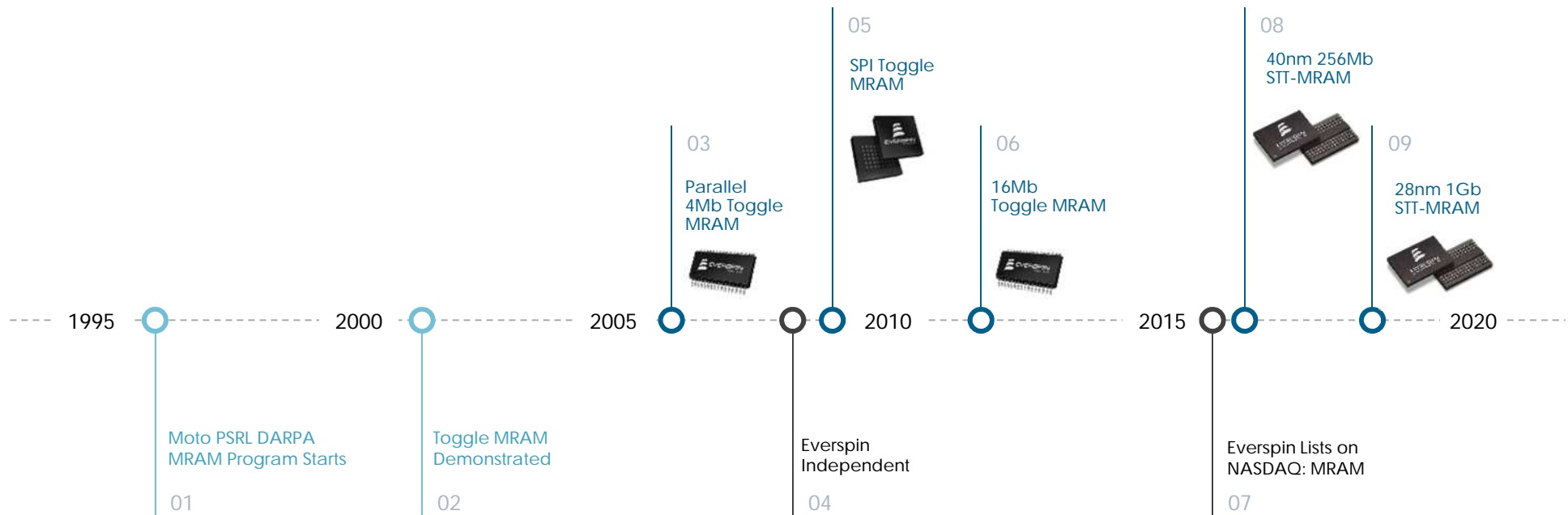
Units shipped

500+

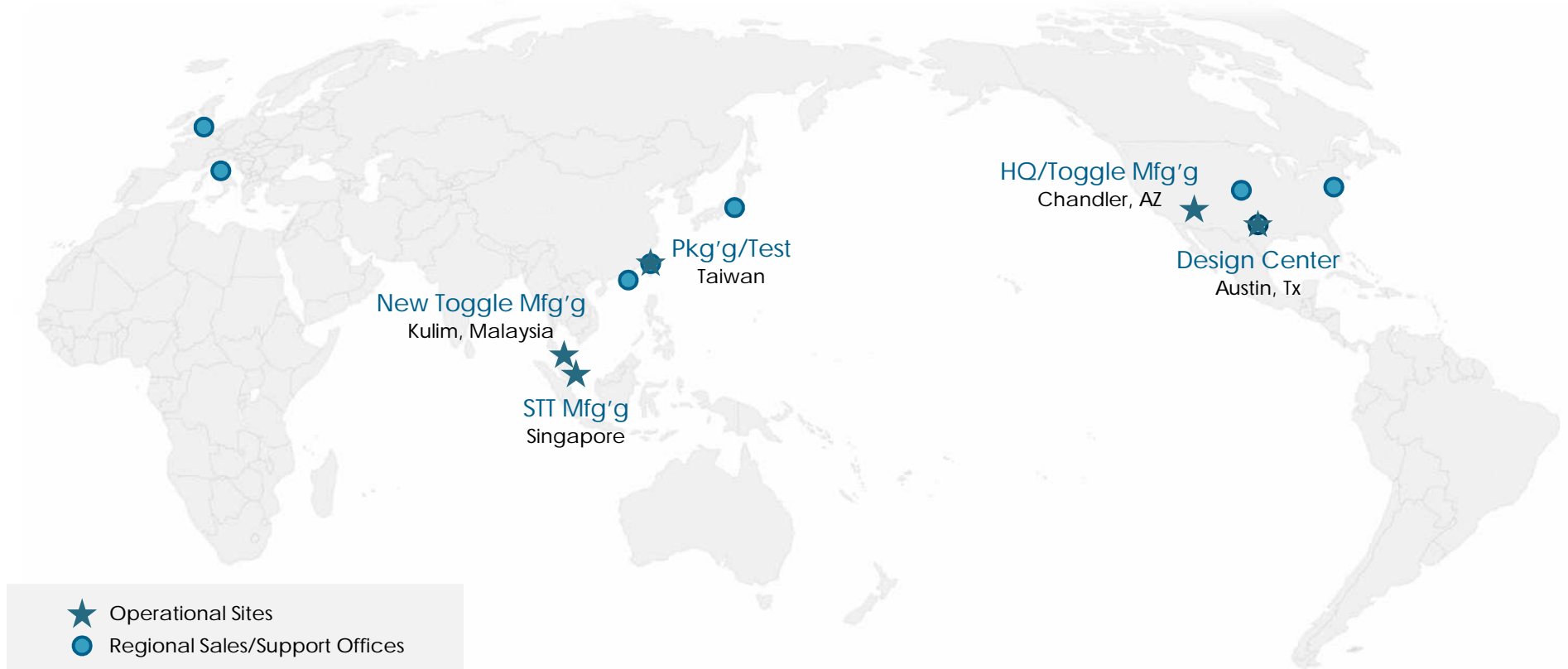
Patents and applications WW

Our products bring the unique benefits of MRAM to our customers where Performance, Persistence, Endurance and Reliability are critical

# MRAM Leadership Through Heritage of Innovation



## 5 Global Operation Sites & 8 Regional Offices



- ★ Operational Sites
- Regional Sales/Support Offices



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# Fab Partnership Expansion to Meet The Growing Demand



GLOBALFOUNDRIES®

## Strong Partnership With GF Continues for STT-MRAM

- 40nm 256Mb Discrete Mass Production,
- 28nm 1Gb Discrete Preproduction
- 22nm FDX Embedded
- Continue joint technology development for future





















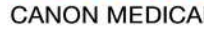













## GROWTH PLAN FOR TOGGLE

- Toggle expansion on track in collaboration with SilTerra
- Long-term Chandler operation continues

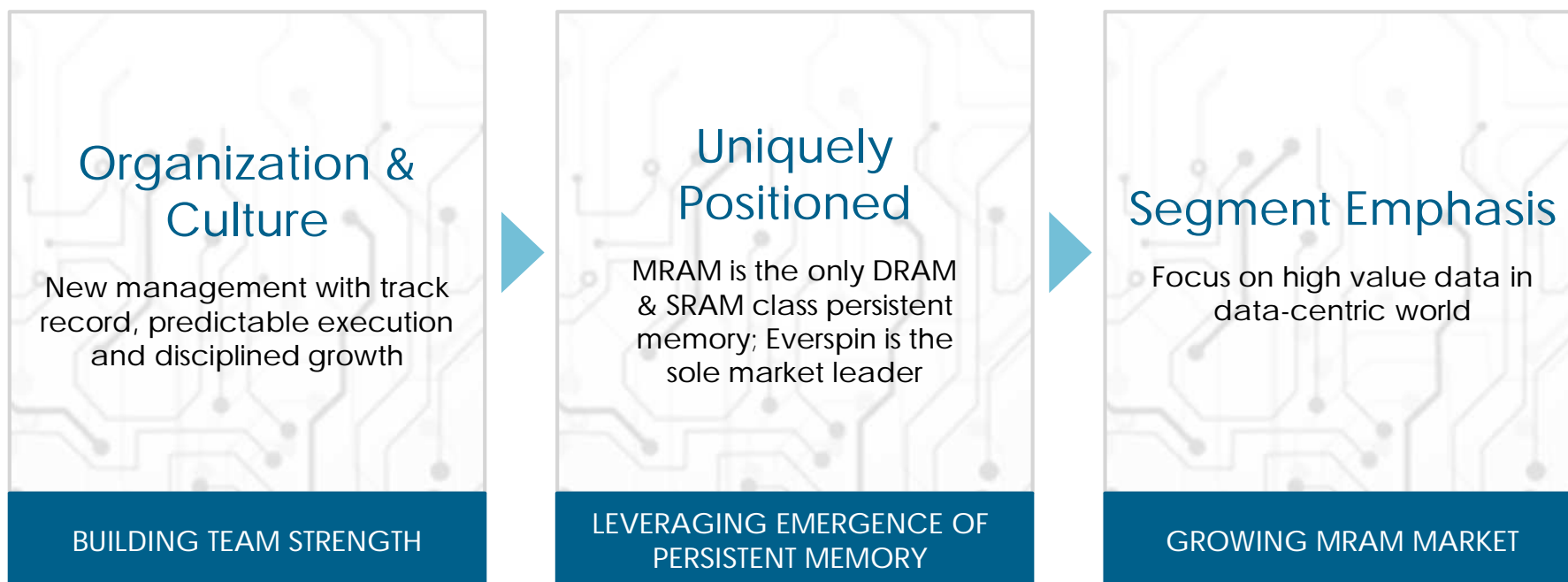


SILTERRA

# Diversified Top-Tier Customers in Significant Markets

INDUSTRIAL AUTOMATION	AEROSPACE/ TRANSPORT	GAMING	NETWORK/ INFRASTRUCTURE	ENTERPRISE
     	       	    <div>MEDICAL</div>    	    	      

# The Transformation of Everspin





# The Executive Team



Kevin Conley  
President & CEO



Jeff Winzeler  
Chief Financial Officer



Rizwan Ahmed  
VP, Marketing



Norm Armour  
VP, Operations



Sanjeev Aggarwal  
VP, Technology R&D



Tom Andre  
VP, Engineering



Angelo Ugge  
VP, Corp Bus. Dev.



Jim Everett  
VP, Human Resources



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# Our Strategic Focus

Investing across multiple horizons to drive sustained growth and leadership

## NEAR-TERM

Grow STT-MRAM  
Market for 256Mb

Strengthen Toggle  
MRAM Business

Qualify 1Gb STT-MRAM

Build Strength in Large  
Targeted Applications

## MID-TERM

Broaden STT-MRAM  
Product Family

Expand Toggle Supply

Expand STT-MRAM  
Market Penetration

Accelerate Growth into  
Adjacent Markets

## LONG-TERM

Innovate for Continued  
Market Leadership

Drive STT-MRAM Density

Higher density & Lower Bit  
Cost

Disrupt Mainstream Markets



Technology/Product

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# MRAM: Persistence, Performance, Endurance & Reliability



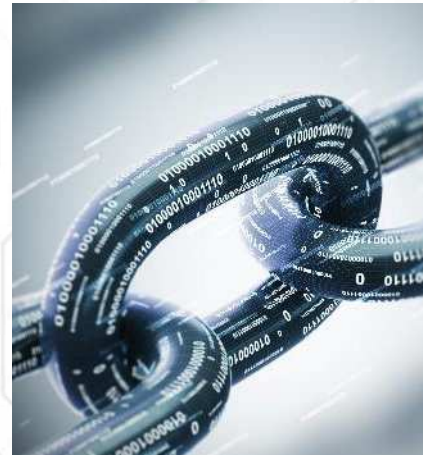
## PERSISTENCE

Maintains memory contents without requiring power



## PERFORMANCE

SRAM & DRAM-like performance with low latency



## ENDURANCE

Superior durability supports memory workloads without sophisticated management

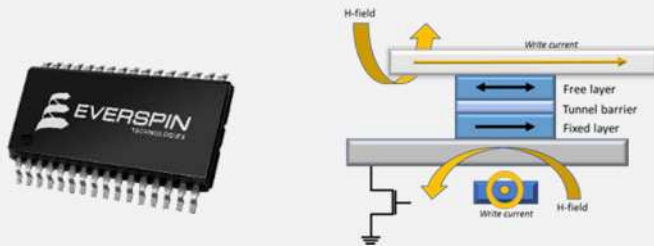


## RELIABILITY

Best in class robustness designed and tested for extreme conditions

# Product Technology Portfolio Overview

## 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



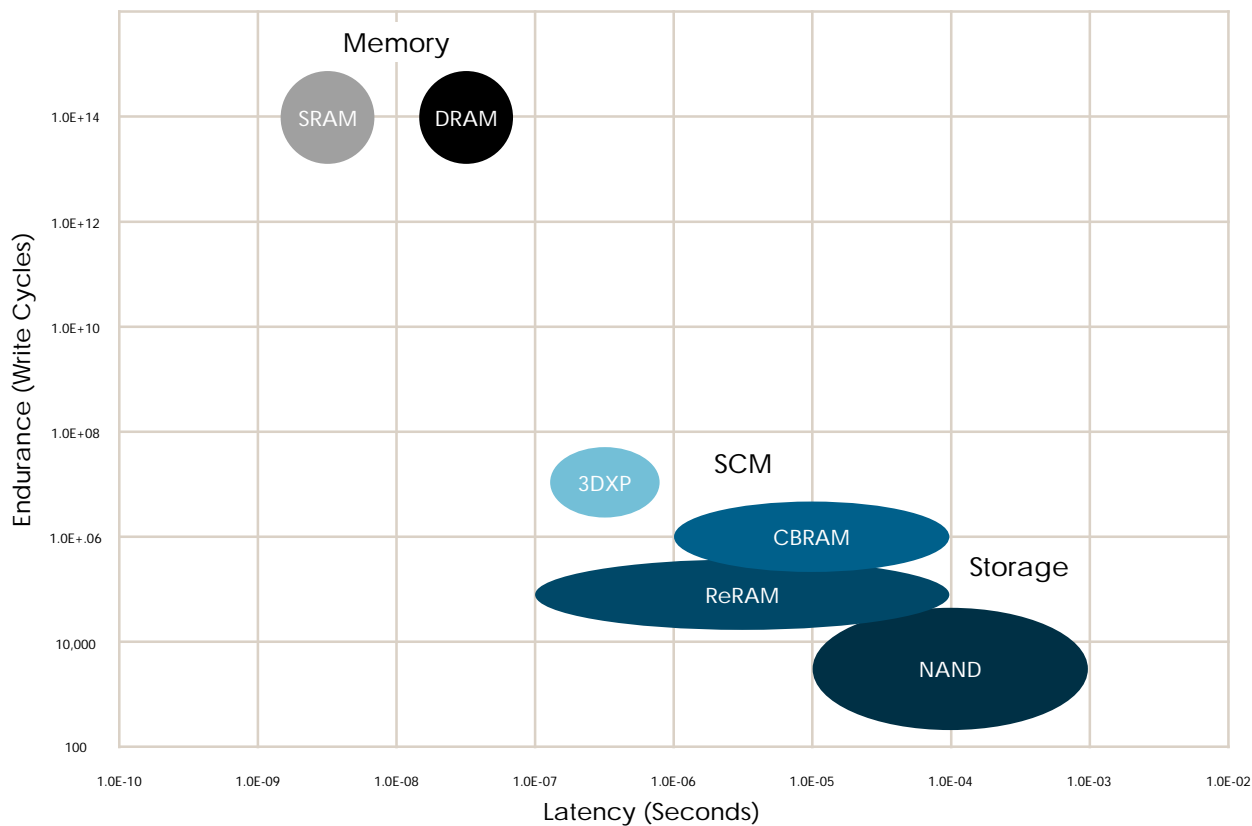
- DDR3 & DDR4 compatible
- Complementary to DRAM & Flash
- High performance NVM with high chip capacity
- Disruptive value as non-volatile write buffer
- New market growth driver

# Everspin Product Portfolio

Technology	Capacity	Interface	Package	2018	2019	2020
Toggle 	128kb	SPI	DFN	MP		
	256kb	Parallel, SPI	DFN, SOIC, BGA, TSOP2	MP		
	1Mb	Parallel, SPI, QSPI	DFN, BGA, TSOP2, SOIC	MP		
	4Mb	Parallel, SPI	DFN, BGA, TSOP2	MP		
	16Mb	Parallel	BGA, TSOP2	MP		
STT-MRAM 	256Mb	ST-DDR3	BGA	MP		
	1Gb	ST-DDR4	BGA	ES	CS	MP

MRAM products address a wide array of applications with long design life

# Legacy Discrete Memory Backdrop



**DRAM** is fast, but volatile and requires refresh cycle

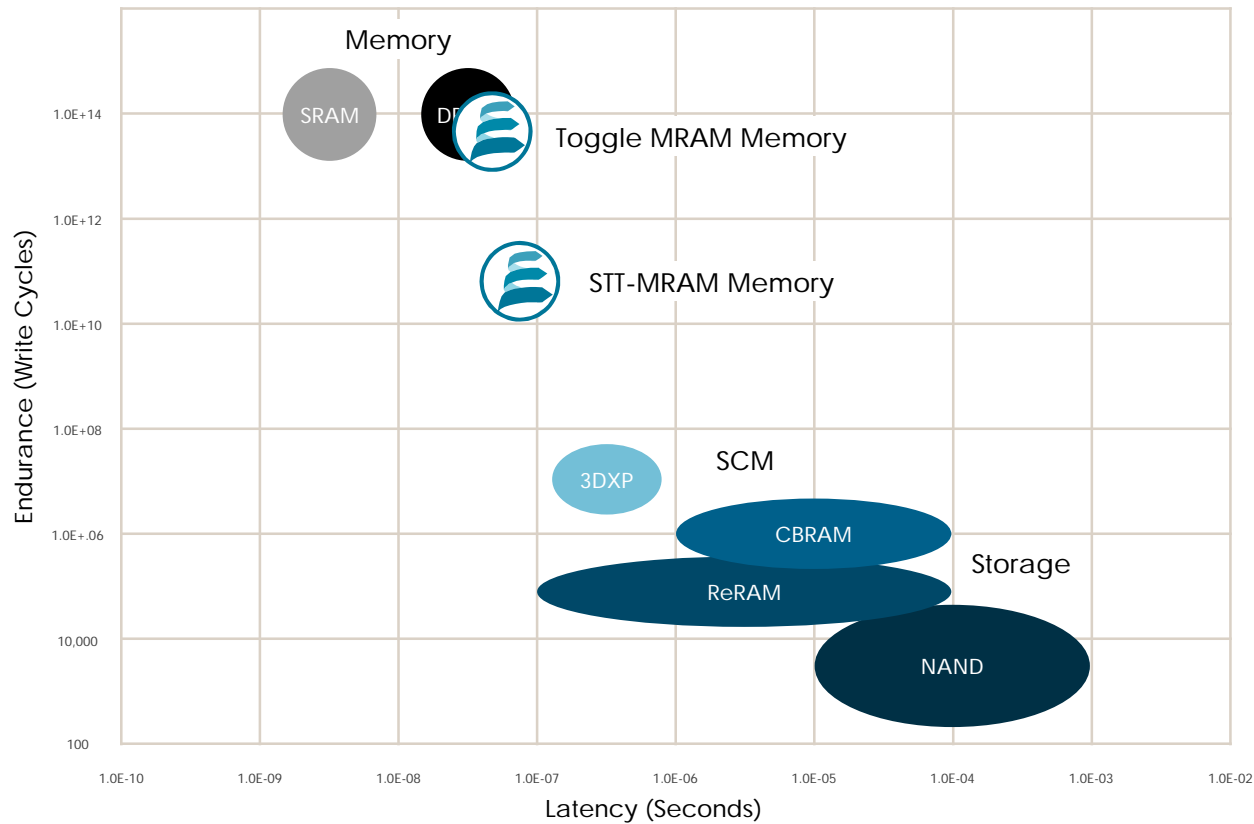
**SRAM** has lower density than DRAM and also volatile

Both require external batteries or capacitors to provide operating power

**SCM** (Storage Class Memory) is faster than NAND, but lower endurance than DRAM

**NAND** Flash is non-volatile, but high latency and low endurance

# MRAM Brings Native Persistence to Memory Workloads



MRAM COMBINES  
PERFORMANCE OF MEMORY  
WITH PERSISTENCE  
OF STORAGE

- Non-Volatile: Maintains memory without power
- Fast Read/Write Speeds: Similar to DRAM
- Superior Endurance: Survives memory workloads
- No Refresh





*Data Persistence at Speed*

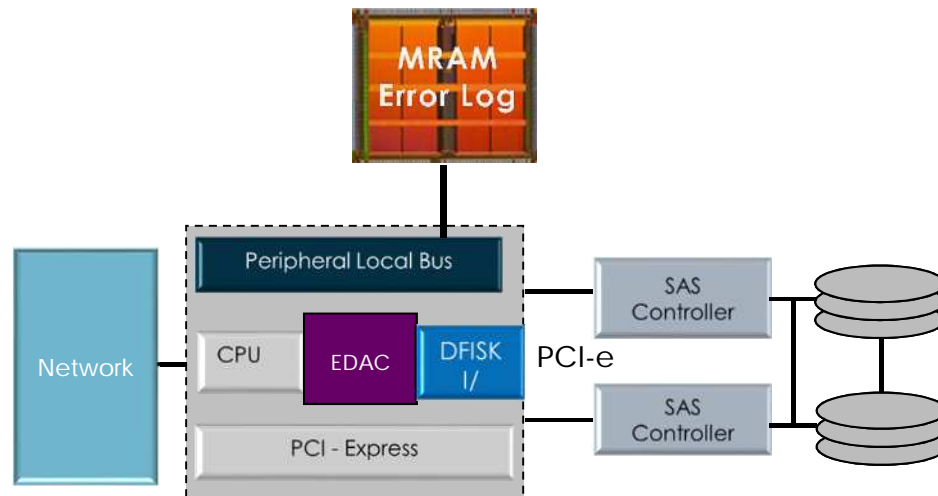
# A Sampling of MRAM Applications

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# RAID Log Journaling Made Persistent

## ► The Application

- Storage System Event / Error Logging
- Non-volatile memory stores Event maps used for predicting system failures
- Requires high endurance and power off storage and fast data recovery



## ► MRAM Improves Data Reliability

- Application requires high endurance of MRAM
- Immediate, nearly infinite reads and writes
- Fast start-up
- No stored charge liability
- Simplified architecture eliminates power fail hardening

# Electric Charging – Improved Accuracy and Data Retention



## The Application:

- Data logging to track charging currents to monitor battery health and ensure no overcharging



## ► MRAM Ensures Data Retention

- Persistent Memory ensures data retention / accuracy
- Ensures accuracy of data logging applications
- Monitors battery health / increases longevity

# Gaming Applications – Win for Data Validation



## The Application:

- Data logging - NA Gaming requires 3 separate non-volatile devices for winning validation

## ► MRAM Ensures Data Retention

- Persistent Memory ensures data retention / accuracy
- Ensures accuracy of data logging applications

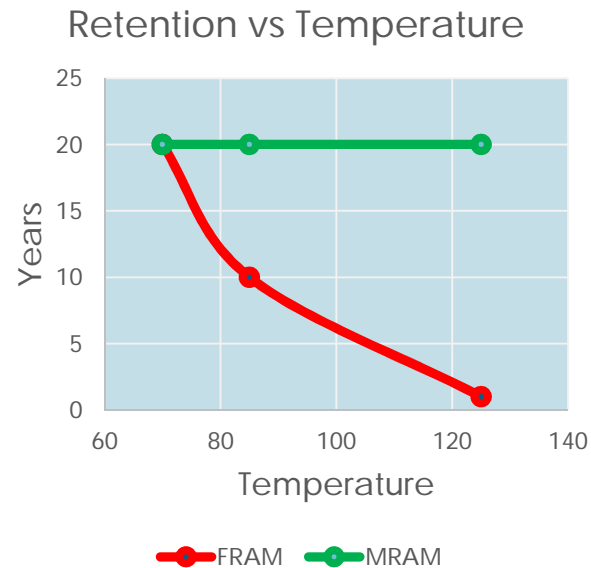


# Programmable Logic Controls and Industrial Automation



## The Application:

- Data logging for each step in the controller state for robotic manufacturing in case of power failure.
- Ensures accurate return to previous known process step



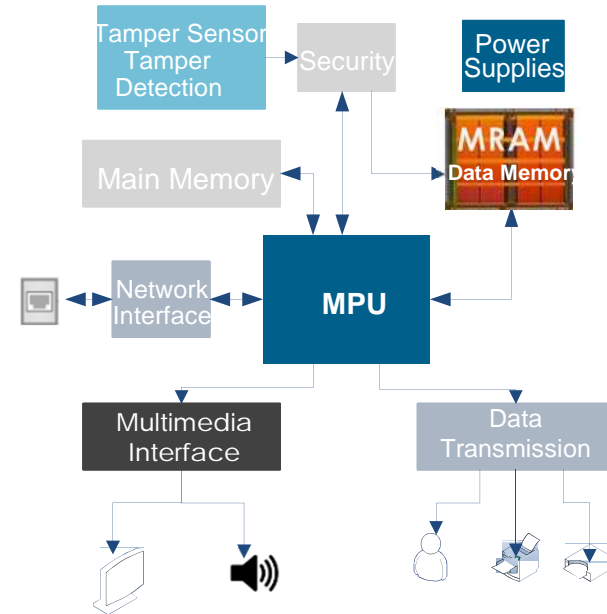
## ► MRAM Ensures Temperature Independence

- Retention is constant regardless of environment
- A single memory can be used for both PLC programs and critical data storage
- Write inhibit voltage – Data is not corrupted if there is a power loss

# Making the Point of Sale Even More Reliable

## ► The Application

- Point of Sale systems are found in cash registers, bill validator, and gaming machines
- Stored data must be maintained during brownouts, black outs, batch processing, maintenance shutdowns.
- Data is written continuously



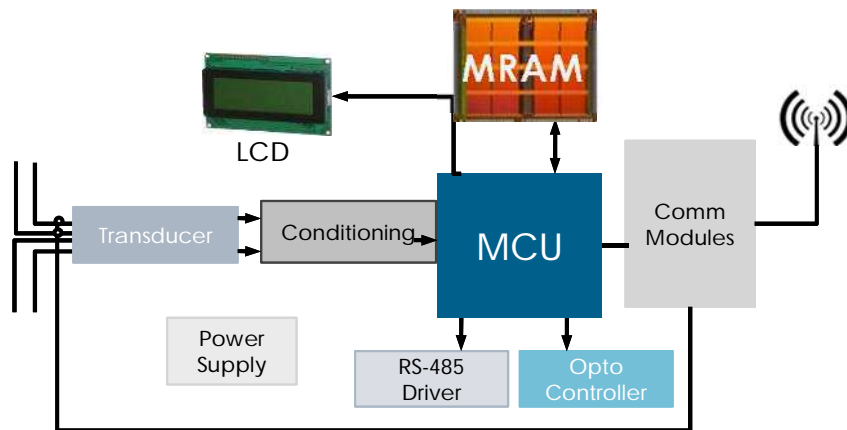
## ► MRAM Improves Data Reliability

- Store transaction data without battery or caps
- Best in class ( $10^{15}$ ) endurance write and read
- Financial data maintained reliably

# MRAM-Making Energy Management More Robust

## ► The Application

- Collect & store electric power use data, load profiles
- Data stored through power outages
- Time of use meters require high endurance data storage



## ► MRAM Improves Data Granularity

- Near Unlimited Endurance supports high resolution data logging
- Unrestricted data storage
- Application requires high endurance of MRAM
- Field reliability



# MRAM Advantages in Medical Applications



Insulin Pump



Dialysis Machines



Ultrasound / Imaging Systems



Patient Monitoring Systems

## The Application:

- Continuous data logging
- Power loss data protection
- Non-Volatile Durable data retention

## ► MRAM Ensures High Performance

- Virtually unlimited endurance with 20+ years of data retention
- Persistent data
- Sequential write
- No data corruption
- Immune to alpha particle induced soft errors

# MRAM for Event Recording (Black Box)



Automotive Event monitoring



Railway monitoring



Automotive airbags



Flight data recorders

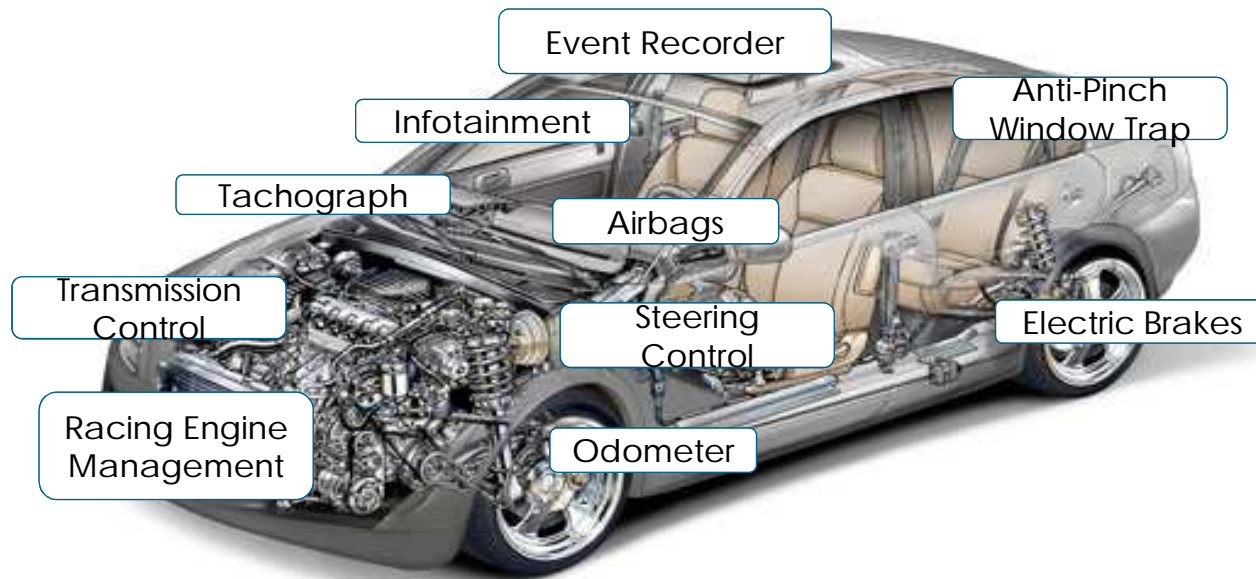
## The Application:

- Continuous monitoring and recording
- Instantly save critical data for traveler safety, ADAS, etc.

## ► MRAM Ensures Temperature Independence

- High data retention over full temperature range
- High endurance enables continuous data writing at high speed
- Event data is securely stored for review

# Automotive Applications for MRAM – Event Recording

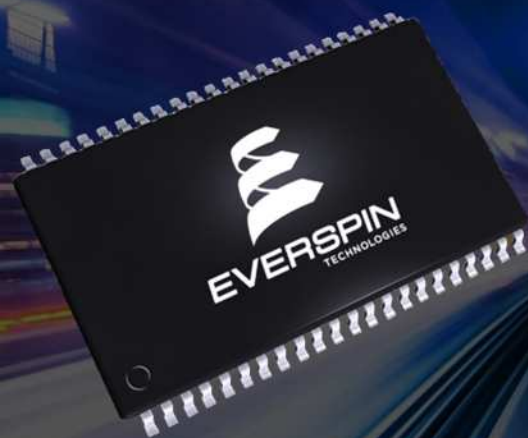


## The Application:

- Continuous monitoring and recording
- Instantly save event data for applications throughout the vehicle

## ► MRAM Ensures High Endurance

- High data retention over full temperature range
- High endurance enables continuous data writing at high speed
- Event data is securely stored for review



Thank you.

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