EVERSPIN® TECHNOLOGIES

Toggle MRAM

Magnetoresistive Random Access Memory

Persistence - Performance - Endurance - Reliability

High Endurance, Non-volatility Ideal for RAID Applications

High Performance, Unlimited Endurance for Industrial and Human Machine Interface Applications

Foremost Reliability Requirements for Medical, Point-of-sale, and Gaming Systems

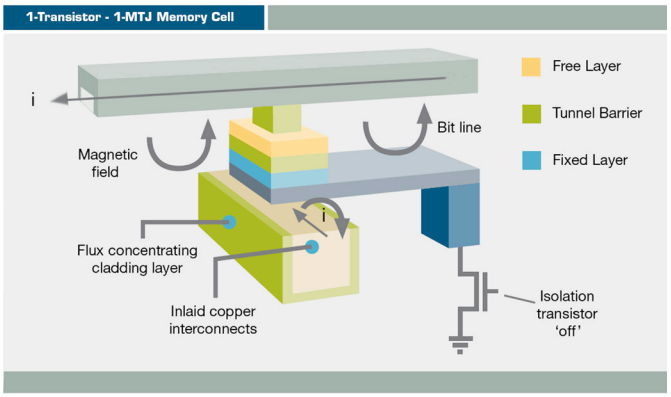
Performance and Reliability in Demanding Transportation, Military, and Aerospace Applications

Everspin's State-of-the-Art MRAM Technology

How Everspin's Patented MRAM Memory Technology Works

Everspin MRAM is Integrated with Standard CMOS Processing

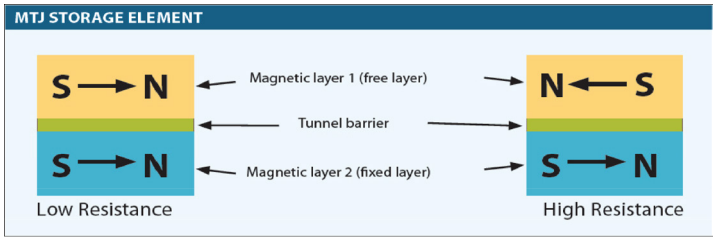
Everspin MRAM is based on magnetic storage elements integrated with CMOS processing. Each storage element uses a magnetic tunnel junction (MTJ) device for a memory cell.



The Magnetic Tunnel Junction Storage Element

The magnetic tunnel junction (MTJ) storage element is composed of a fixed magnetic layer, a thin dielectric tunnel barrier and a free magnetic layer. When a bias is applied to the MTJ, electrons that are spin polarized by the magnetic layers traverse the dielectric barrier through a process known as tunneling.

The MTJ device has a low resistance when the magnetic moment of the free layer is parallel to the fixed layer and a high resistance when the free layer moment is oriented anti-parallel to the fixed layer moment. This change in resistance with the magnetic state of the device is an effect known as magnetoresistance, hence the name "magnetoresistive" RAM.



Everspin MRAM Technology is Reliable

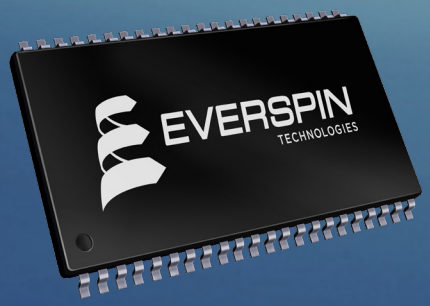
Unlike most other semiconductor memory technologies, the data is stored as a magnetic state rather than a charge, and sensed by measuring the resistance without disturbing the magnetic state. Using a magnetic state for storage has two main benefits. First, the magnetic polarization does not leak away over time like charge does, so the information is stored even when the power is turned off. Second, switching the magnetic polarization between the two states does not involve actual movement of electrons or atoms, and thus no known wear-out mechanism exists.

...and what you can do with it...

- **Eliminate backup batteries and capacitors**
- **Non-volatile working memory**
- **Real-time data collection and backup**
- **AEC-Q100 qualified options**
- **Retain data on power fail**
- **Extend system life and reliability**

MRAM Worldwide

Designers Select Everspin MRAM Whenever Fast Write, Non-Volatile Data Management is Critical



Selected Case Studies Using Everspin MRAM

RAID-on-Chip Journal Memory

Dell Computer selected Everspin MRAM because MRAM fast Write and non-volatility supports enhanced data center fault recovery without requiring wear leveling or ECC overhead. This reduced system downtime and lowered their total cost of ownership.

See a full Case Study under Applications/ RAID on our web site.

Direct Logic 205 PLC

Koyo Electronics Industries' new Direct Logic 205 PLC utilizes a 1Mb Everspin MRAM, which enables data integrity and reliability in harsh environments, and instant event save in the event of a power loss - without the need for a battery.

See a full Case Study under Applications/ Factory Automation on our web site.

Industrial Grade Memory Module

The **Advantech** PCM-23 memory module is an optional extended memory used to store critical data in an event log. For their non-volatile memory requirement, Advantech chose an Everspin 16Mb MRAM because it provides two megabytes of non-volatile, reliable data storage, with 20 years of data retention.

See a full Case Study under Applications/Industrial Computing on our web site.

Engine Control Module

BMW Motorsport selected Everspin's 4Mb MRAM in the AEC-Q100 Grade 1 qualified option for their 1000RR Superbike because it was rugged enough to operate within the very high temperature environments encountered in a motorcycle race, fast enough to read or write data in real time during a race, yet always be non-volatile.

See a full Case Study under Applications/Automotive on our web site.

Applications Taking Advantage of Everspin MRAM

Transportation	**Battery Management**	**Industrial Computing**
Network & Infrastructure	**Medical**	**Factory Automation**
Smart Meters	**Enterprise RAID**	**Gaming**
Internet of Things	**Military / Aerospace**	**Point of Sale**

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Everspin MRAM Product Selector

Parallel Interface						
Density	**I/O**	**Grade**	**V_{DD}**	**Temperature**	**Packages**	**Data Sheet**
256Kb	x8	Commercial and Industrial	3.3	0 to +70 C, -40 to +85 C	44-TSOP2, 48-BGA	MR256A08B
		Commercial	3.3 / 1.8	0 to +70 C	48-BGA	MR256D08B
		Commercial	2.7 / 1.65	0 to +70 C	48-BGA	MR256DL08B
1 Mb	x8	Commercial and Industrial	3.3	0 to +70 C, - 40 to +85 C	44-TSOP2, 48-BGA	MR0A08B
		Commercial	3.3 / 1.8	0 to +70 C	48-BGA	MR0D08B
		Commercial	2.7 / 1.65	0 to +70 C	48-BGA	MR0DL08B
	x16	Commercial and Industrial	3.3	0 to +70 C, - 40 to +85 C	44-TSOP2, 48-BGA	MR0A16A
		Extended	3.3	- 40 to +105 C	44-TSOP2, 48-BGA	
		AEC-Q100 Grade 1	3.3	- 40 to +125 C	44-TSOP2	
2 Mb	x16	Commercial and Industrial	3.3	0 to +70 C, - 40 to +85 C	44-TSOP2, 48-BGA	MR1A16A
		Extended	3.3	- 40 to +105 C	44-TSOP2, 48-BGA	
		AEC-Q100 Grade 1	3.3	- 40 to +125 C	44-TSOP2	
4 Mb	x8	Commercial and Industrial	3.3	0 to +70 C, - 40 to +85 C	44-TSOP2, 48-BGA	MR2A08A
		AEC-Q100 Grade 1	3.3	- 40 to +125 C	44-TSOP2	
	x16	Commercial and Industrial	3.3	0 to +70 C, - 40 to +85 C	44-TSOP2, 48-BGA	MR2A16A
		Extended	3.3	- 40 to +105 C	44-TSOP2, 48-BGA	
		AEC-Q100 Grade 1	3.3	- 40 to +125 C	44-TSOP2	
8 Mb	x16	Commercial and Industrial	3.3	0 to +70 C, - 40 to +85 C	54-TSOP2, 48-BGA	MR3A16A
		Automotive	3.3	- 40 to +125 C	54-TSOP2	MR3A16AUYS45
16Mb	x8	Commercial and Industrial	3.3	0 to +70 C, - 40 to +85 C	44-TSOP2, 48-BGA	MR4A08B
		Automotive	3.3	- 40 to +125 C	44-TSOP2	MR4A08BUYS45
	x16	Commercial and Industrial	3.3	0 to +70 C, - 40 to +85 C	54-TSOP2, 48-BGA	MR4A16B
		Automotive	3.3	- 40 to +125 C	54-TSOP2	MR4A16BUYS45
32 Mb	x16	Commercial and Industrial	3.3	0 to +70 C, - 40 to +85 C	54-TSOP2, 48-BGA	MR5A16A
		Automotive	3.3	- 40 to +125 C	54-TSOP2, 48-BGA	MR5A16AUYS45

Serial SPI Interface						
Density	**Speed**	**Grade**	**V_{DD}**	**Temperature**	**Package**	**Data Sheet**
128Kb	40 MHz	Industrial	3.3	- 40 to +85 C	8-DFN	MR25H128A
		AEC-Q100 Grade 3	3.3	- 40 to +85 C	8-DFN	
		AEC-Q100 Grade 1	3.3	- 40 to +125 C	8-DFN	
256Kb	40 MHz	Industrial	3.3	- 40 to +85 C	8-DFN	MR25H256
		AEC-Q100 Grade 1	3.3	- 40 to +125 C	8-DFN	
		Industrial	3.3	- 40 to +85 C	8-DFN	MR25H256A
		AEC-Q100 Grade 3	3.3	- 40 to +85 C	8-DFN	
		AEC-Q100 Grade 1	3.3	- 40 to +125 C	8-DFN	
1Mb	40 MHz	Industrial	3.3	- 40 to +85 C	8-DFN	MR25H10
		AEC-Q100 Grade 1	3.3	- 40 to +125 C	8-DFN	
	Quad SPI 104 MHz	Commercial	3.3 / 1.8	0 to +70 C	16-SOIC, 24-BGA	MR10Q010
		Industrial	3.3 / 1.8	- 40 to +85 C	16-SOIC, 24-BGA	
4Mb	50 MHz	Industrial	3.3	- 40 to +85 C	8-DFN	MR25H40
	40 MHz	Industrial	3.3	- 40 to +85 C	8-DFN	
		Extended	3.3	- 40 to +105 C	8-DFN	
		AEC-Q100 Grade 1	3.3	- 40 to +125 C	8-DFN	

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