Application Bulletin AB-1—Glossary of Terms

A

AT-MRAM™
NVE's proprietary anti-tamper MRAM technology, which could help stem the tide of fraudulent use in ID tags, ATM cards, or smart cards.

Angstrom (Å)
One ten-billionth of a meter or one-tenth of a nanometer. Some spintronic critical dimensions are less than 50 Angstroms (approximately 14 atomic layers).

Anisotropic Magnetoresistance (AMR)
A change in the resistance in thin strips of ferromagnetic materials when exposed to a magnetic field. Lord Kelvin is credited with discovering the effect in the nineteenth century. The magnetic sensitivity of AMR sensors is much less than spintronic sensors. NVE has the capability to develop specialized AMR sensors, but is primarily focussed on spintronic technology.

Antiferromagnet
A material where the magnetic moments on each atom are opposite the adjacent atoms, so that the overall magnetic moment is always zero. Antiferromagnets are key spintronics building blocks and can be used to create "pinned" layers of permanent spin orientation or to store data.

Analog-to-Digital Convertor (A/D Convertor or ADC)
Devices commonly used to digitize sensors in industrial control systems. NVE offers unique four- and five-channel, 0.15"-wide single-chip spintronic couplers ideal for isolating serial ADC interfaces.

Aptamers
Protein-related molecules that bind to specific targets. Aptamers can be used in biosensor systems to detect biological materials using a sensor system containing a biological component. NVE has developed unique spintronic biosensors ideal for use with aptamers to detect disease-causing pathogens or naturally occuring protein markers.

B

Baud (Bd)
A measure of the speed of a network or transceiver in signaling events per second. NVE couplers can typically run at up to 150 megabaud—100 times faster than 1.5 megabit DSL.

BioMagnetICs
A Department of Defense acronym for "Bio-Magnetic Interfacing Concepts." The BioMagnetICs Program explored and demonstrated nanoscale magnetics for sensing at the cellular and ultimately single-molecule level. In 2004, NVE announced it had successfully demonstrated prototype a BioMagnetIC biosensor for laboratory-on-a-chip applications using its spintronic structures.

Bipolar
1. A sensor with opposite polarity magnetic operate point and release points. NVE offers bipolar magnetic switches with a negative (south) magnetic operate point and positive (north) release point. NVE also offers omnipolar digital magnetic switches.
2. A brain disorder that causes unusual shifts in mood, energy, activity levels, and the ability to carry out day-to-day tasks.

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Biosensor
A combination of "biologic" and "sensor," referring to a device to detect biological or chemical materials using a sensor system containing a biological component. NVE has developed unique spintronic biosensors.

Breakdown
Failure of an isolation barrier caused by high-voltage electrical stress.

C

CAN (Controller Area Network)
1. A network bus used for applications such as automotive system interconnects, vehicle diagnostics, and industrial control systems. NVE offers the world's smallest isolated CAN transceivers, and its IL712 and IL721 bidirectional couplers are ideal for isolating CAN busses.
2. Slang for termination of employment, as in: *engineers who use couplers other than NVE's risk being canned*.

Chase
1. The support area surrounding a cleanroom.
2. What NVE's competitors try to do to in vain to catch up to NVE's technology.

Classic MRAM
(also "conventional MRAM," "Field Induced Magnetic Switching MRAM," or "FIMS MRAM")
The classic or conventional MRAM design of an array of spin-dependent tunnel junctions with transistor facilitated reading. As distinguished from next-generation MRAM designs such as Magneto-Thermal MRAM, Vertical Transport MRAM, Current Perpendicular-to-Plane MRAM, and Spin-Momentum Transfer MRAM. NVE has intellectual property relating to classic MRAM as well as next-generation MRAM.

Cleanroom
A room that is maintained virtually free of particles; used in the production of semiconductors or nanotechnology.

Clearance
An isolation metric defined as the shortest distance through the air between conductive elements. Creepage is often a more important parameter in isolated systems. Clearance is always less than or equal to creepage.

Coupler
A device which transmits data between electronic systems. NVE makes spintronic couplers, which transmit information much faster than the fastest optical couplers. Couplers are also known as "isolators" because they electrically isolate the coupled systems.

Creepage
The shortest distance over the surface of an insulating material between conductive elements. Creepage is a critical dimension for isolation. NVE's unique True 8™ Isolators offer true eight millimeter creepage in a JEDEC-compliant wide-body package.

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Cryptokey
Data, usually stored in a memory, that determines the output of an encryption or decryption algorithm. Applications include military security and defenses against identity theft. Anti-tamper MRAM can be used for highly-secure cryptokeys.

Current Perpendicular-to-Plane (CPP) MRAM
An MRAM configuration where the write current is perpendicular to the storage layer, such as Vertical MRAM and spin-momentum MRAM. NVE has intellectual property relating to CPP MRAM.

D

DIP (Dual Inline Package; also PDIP for Plastic Dual Inline Package)
An electronic device package ubiquitous in the 1970s and 1980s. It is approximately 1/4-inch wide and has leads designed for holes through a circuit board. NVE offers DIP couplers as drop-in replacements for older optical couplers, and because their relatively large size allows them to better handle high voltages in some applications.

DeviceNet
A popular network for industrial control and factory automation based on the Controller Area Network standard. NVE offers the world's smallest isolated CAN transceivers, which are ideal for DeviceNet.

DRAM (Dynamic Random Access Memory)
The largest-capacity and most common type of conventional memory. MRAM may have the potential to match DRAM bit density but with higher speed and nonvolatility.

Die (pl. dice)
1. Small elements sliced from wafers which are bonded into electrical circuits or mounted in packages.
2. What the competition does when they see NVE parts.

E

Eden Prairie
The home of NVE Corporation got its name from the book Summer Rambles in the West. Author Elizabeth Fries Lummis Ellet visited the area in 1852; NVE was founded 137 years later. Eden Prairie was named the best place to live of America's small cities by *Money* Magazine in August 2010. Part of the Minneapolis-St. Paul metropolitan area, one of *Forbes*' 2010 "Best Places For Business." Eden Prairie is sometimes called "Silicon Prairie" because of its abundance of high technology firms.

Electromagnetic Compatibility (EMC)
The compatibility of an electronic device's generation of and susceptibility to unwanted electromagnetic fields in a particular environment. NVE couplers have an excellent EMC "footprint," meaning they generation very little electromagnetic energy and are not susceptible to electromagnetic fields encountered in application environments.

Electromagnetic Interference (EMI)
Electromagnetic fields that interfere with other electronics components or systems. Most NVE couplers have no carriers or clocks, so they generate very little EMI and have very little susceptibility to EMI from other electronics components or systems.

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Electron Spin
Electrons have two stable spins (up and down). Electron spin causes magnetism on the atomic level; spintronics encodes data in electron spin.

Embedded Memory
Memory combined with other electronics on the same integrated circuit, such as a cellphone on a chip. It is virtually impossible to embed the various types of conventional memory required for a total system together on one IC; however, MRAM replaces all the different memory types (DRAM, SRAM, Flash), and can be embedded.

Endurance Voltage (also "High-Voltage Endurance" and "Endurance Working Voltage")
A figure of merit for couplers defined as the maximum voltage that can be applied between the input and output of an electronic device indefinitely without damage. With their unique ceramic/polymer composite isolation barrier, NVE couplers have best-in-class endurance voltage.

F

Fab
1. A manufacturing fabrication plant or factory for semiconductor or analogous devices.
2. Archaic slang for "fabulous."

Ferromagnet
A material with the magnetic state of highly-ordered parallel electron spins.

Fieldbus
A popular network for industrial control and factory automation based on the Controller Area Network standard. NVE offers the world's smallest isolated CAN transceivers, which are ideal for Fieldbus.

FIT
1. Abbreviation for Failures In Time, usually expressed as the number of failures expected in one billion device-hours of operation. NVE devices have extremely low FIT. NVE isolator data, for example, show FIT of 2.6 per billion hours at 100°C, for a Mean Time Between Failures (MTBF) of 44,000 years.
2. What NVE gives the competition.

Flash Memory
The leading conventional nonvolatile memory. Used in cellphones for permanent storage. Versions are used in memory cards and sticks, but these are much too slow for program execution. MRAM has the potential to meet and exceed flash bit density but with unlimited life and much higher speed.

Foundry Wafer
Wafers containing conventional electronics. Many NVE products add spintronic layers to foundry wafers that contain electronics for housekeeping functions such as voltage regulation and signal conditioning.

Free Layer
A layer in SDT or GMR structures where the spin polarization of electrons can be switched, usually by magnetic energy. This is the layer where data is sensed or stored.

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G

Gauss
The metric cgs unit of magnetic flux density, named after German mathematician and physicist Carl Friedrich Gauss. A typical refrigerator magnet produces around 100 gauss. NVE has demonstrated sensors with approximately 0.0001 gauss sensitivity.

Geek
1. A person who is single-minded or accomplished in technical pursuits.
2. A character in NVE advertising and technical videos.

Giant Magnetoresistor (GMR)
A spintronic device that produces a large change in resistance of a conducting layer. "Giant" refers to its very large electrical signal. GMR is at the heart of NVE's sensors and couplers, and can also be used for a basic type of MRAM. In awarding the 2007 Nobel Prize in Physics for the discovery of GMR, the Nobel Committee said, "GMR can be considered one of the first real applications of the promising field of nanotechnology."

Gradiometer
A device that measures the change, or gradient, in magnetic field strength over a distance. NVE makes precise, single-chip gradiometers that can measure gradients from a fraction of a millimeter to several millimeters. Two devices can be used to measure the magnetic field gradient over almost any distance.

GT Sensor™
NVE's unique rotational sensors, which are sensitive enough to detect tiny magnetic field perturbations from small gear teeth.

H

Hall-effect Sensors
A semiconductor magnetic sensor based on the Hall effect, which was discovered in the 1800s. NVE spintronic magnetic sensors are smaller and more sensitive than Hall-effect sensors.

Hysteresis
The property of a magnetic material having different magnetizations depending on what magnetic fields it has seen and in what sequence. Hysteresis is the property which serves as the basis for storing data in MRAM and disk drives. For data retrieval sensing, however, hysteresis can cause errors and is undesirable.

I

I²C (Inter-Integrated Circuit) bus
A bidirectional serial bus often used to connect components in industrial control systems. NVE's unique bidirectional DC-correct IL612 spintronic coupler is ideal for isolating I²C busses.

ISM
An acronym for the industrial, scientific, and medical electronics market, which is a market well served by NVE products.

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ISO 9000
A family of standards for quality management systems maintained by the ISO (International Organization for Standardization). NVE has been ISO certified since 1997, and is currently certified under the latest standards amendment, ISO 9001:2008. ISO 9001:2008 provides a number of requirements to achieve customer satisfaction through consistent products and services. The scope of NVE's Quality Management System includes design, development and manufacture of semiconductor-based magnetic/semiconductor products, processes, systems, and services.

Implantable Cardioverter-Defibrillator (ICD)
A device, intended to be permanently implanted into the body, capable of recognizing dangerously abnormal heart rhythms and delivering high-voltage to correct the condition. NVE spintronic sensors are used for telemetry links with implanted ICDs (definition adapted from St. Jude Medical, Inc.).

***In vitro* Diagnostics (IVD)**
Reagents, instruments, and systems intended for use in the diagnosis of disease or other conditions, including a determination of the state of health, in order to cure, mitigate, treat, or prevent disease or its sequelae (definition from the FDA). NVE designs biosensors for clinical or point-of-care *in vitro* diagnostics.

Intrinsic Magnetism
The magnetism of elementary particles such as electrons, which is at the heart of spintronics. The magnetic moment of an electron is determined by its spin. Intrinsic magnetism is distinguished from magnetism caused by the motion of electric charges such as electric currents.

Intellectual Property (IP)
Patents, trademarks, copyrights, trade secrets, and other property that is created through the intellectual efforts of its creators. NVE intellectual property includes more than 100 patents worldwide either issued, pending or licensed from others.

Isolation
The electrical separation between the input and output and output of a device such as a coupler.

Isolation Voltage
A figure of merit in isolators and couplers, which is the maximum voltage that may be applied from input to output. NVE couplers have remarkable isolation voltages of 2,500 volts in devices as small as three millimeters square.

Isolator
See "coupler."

IsoLoop
NVE's registered trademark for spintronic couplers. Refers to a microscopic coil combined with GMR elements. The coil creates a small magnetic field that is picked up by the GMR elements transmitting data almost instantly.

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J
K

JEDEC ('jay-deck or 'jed-eck)
Formally known as the JEDEC Solid State Technology Association, formerly the Joint Electron Devices Engineering Council. An independent trade organization which issues industry standards such as standards for semiconductor packages. NVE provides a wide range of sensors and coupler in JEDEC-compliant packages. NVE also goes beyond JEDEC standards to meet industry needs such as the unique True 8 isolator package, which offers true eight millimeter creepage in a JEDEC-compliant package.

Jitter
1. A type of signal distortion and an important specification for couplers. Jitter is variation in the pulse edge position of a data stream that can cause errors. NVE couplers have jitter specifications ten times better than other types of couplers.
2. What engineers feel if they don't use NVE couplers.

L

Laboratory-on-a-Chip (LOC)
An ultra-miniature system to detect biological agents. NVE has stated a goal of providing spintronic biosensor elements for handheld devices that would provide biomedical test results in minutes rather than hours or days.

Loop Delay
A figure of merit for network transceiver such as Controller Area Networks, measuring the delay of a signal from a network input to the receiver output. NVE's IL41050 CAN transceivers provide best-in-class loop delay, which maximizes data rate over any given bus length.

M

MRAM (Magnetoresistive Random Access Memory)
A revolutionary memory which is fabricated with nanotechnology and which uses electron spin to store data. MRAM has been called the ideal memory because it may have the potential to combine the speed of SRAM, the density of DRAM, and the non-volatility of flash memory. Also called "Magnetic Random Access Memory."

MTBF
Abbreviation for Mean Time Between Failures, usually expressed in the years. NVE devices have extremely long MTBFs. NVE isolator reliability data, for example, show an MTBF of 44,000 years at 100°C.

Magnetic Tunnel Junction (MTJ)
See "spin-dependent tunnel junction."

Magnetometers
A device that measures magnetic field strength, often in gauss. NVE manufactures ultraminiature magnetometers for a wide range of applications.

Magneto-Thermal (also "Thermally Assisted" or "Thermomagnetic") MRAM
(abbreviated "M-T MRAM" or "T-A MRAM")
An MRAM design that uses a combination of magnetic fields and ultra-fast heating from electrical current pulses to reduce the energy required to write data. NVE has patents and know-how in this area.

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Mechatronics
The combination of mechanical and electronic systems, including robotics, industrial control, and factory automation. Mechanical systems include fluid power systems such as pneumatic cylinders; electronic systems include sensors, couplers, and control systems. NVE sensors and couplers enable faster, more precise mechatronics.

Memory
1. A device that stores information. Memories can be either volatile, meaning the data are lost when power is removed, or nonvolatile, where data are retained when power is removed. MRAM is nonvolatile.
2. A song from *Cats* sung by Grizabella the cat.

Micro-Small Outline Package (MSOP)
An industry-standard electronic device package designed to be automatically mounted onto a printed circuit board. An eight-pin MSOP is less than one-eighth inch square. NVE offers a number of MSOP sensors and couplers.

Minnesota
From a Dakota word meaning "sky-blue water." Much of the region was part of the Louisiana Purchase of 1803; NVE was founded 186 years later.

Monolithic
A device with all of its functions on a single die. Most complex integrated circuits such as microprocessors and memories are monolithic, but many couplers and sensors are not. NVE's unique monolithic spintronic couplers are therefore much smaller than optical or inductive couplers, which require multiple die.

N

Nano-beads
Tiny magnetic beads that serve as biological markers in proposed laboratory-on-a-chip systems. Nano-beads adhere to an immobilization surface when a targeted biological agent is present, and can be detected by spintronic biosensors.

Nanometer
One billionth of a meter. Some spintronic critical dimensions are less than five nanometers (approximately 14 atomic layers).

Nanooxide Layer (NOL)
A nanoscale layer in a spin valve that reduces resistance due to surface scattering, thereby increasing the percentage change in magnetoresistance of a spin valve.

Nanotechnology
Technology where dimensions of a few nanometers play a critical role. NVE uses nanoscale structures to create devices with unprecedented miniaturization, speed, and precision.

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Narrow Body
Shorthand for a 0.15-inch wide, typically 8 or 16 pin, semiconductor packages. NVE has a broad line of narrow-body isolators, including unique narrow-body isolated transceivers to minimize board space (see also "wide body").

Network
1. A network is a series of points or nodes interconnected by communication paths. NVE makes isolated transceivers for networks such as RS-422, RS-485, PROFIBUS, Controller Area Network, and DeviceNet.
2. The Network is a band with members of Green Day. The use of their songs "Transistors Gone Wild" and "Supermodel Robots" on NVE's telephone system background music may have helped popularize the band.

Nondestructive Evaluation (NDE; also Nondestructive Test or NDT)
Methods for testing in place critical components such as airframes, bridges, or building structures. NVE has developed spintronic sensors that can locate defects such as small cracks by detecting very small perturbations in magnetic fields.

Nonvolatile
A memory that retains data even when power is removed. MRAM is inherently nonvolatile.

Nonvolatile Electronics, Inc.
NVE's original name (see "nonvolatile" definition above). The company's name was formally changed to "NVE Corporation" when it became publicly-traded in 2000.

O

Oersted (Oe)
The metric cgs unit of magnetizing field strength, named after Danish philosopher and physicist Hans Christian Ørsted. One oersted equals exactly one gauss in a vacuum, and approximately one gauss in air. A typical refrigerator magnet generates a field strength of around 100 oersteds. NVE has demonstrated sensors that can detect approximately 0.0001 oersteds.

Omnipolar
Sensitivity to either magnetic polarity. Most NVE digital magnetic switches are omnipolar, that is they operate with either a north or south magnetic field and release when the field strength drops below a certain threshold. NVE also offers bipolar digital magnetic switches.

Optical Coupler (also optocoupler, opto-coupler, opto-isolator, optical isolator, or photocoupler)
A conventional coupler which uses the combination of a light-emitting diode and photo detector to transmit information. NVE couplers are faster and denser than optical couplers, and unlike optical couplers, which wear out, spintronic couplers last indefinitely.

P

Pacemaker
Q
A pulse generator which initiates the electrical impulses that control the heart rate. NVE spintronic sensors are used used for telemetry links with implanted pacemakers.

Paramagnet
The magnetic state of a material with randomly ordered electron spins.

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Partial Discharge
Electrical discharges in an isolators that do not completely bridge the isolation barrier. Such partial discharges degrade the isolation barrier. NVE's IsoLoop Isolators feature best-in-class partial discharge performance.

Passive Input
A unique isolator input configuration that eliminates the need to two power supplies. NVE's unique passive input isolators have a current-sensitive, resistive coil, like an LED input, but without the voltage drop.

Pinned Layer
A layer in SDT or GMR structures where the spin polarization of electrons is fixed, usually by applying a large magnetic field during the manufacture of the device.

PROFIBUS
A worldwide communication standard widely used in industrial automation networks. NVE makes transceivers that combine spintronics coupling with PROFIBUS network protocol functions in a single small package, including unique narrow-body packages.

Propagation Delay
The time for a digital signal to travel through a device, and a measure of speed often used in specifying couplers.

Propagation Delay Skew
The difference propagation delay between two or more channels. This is a critical specification for couplers in synchronous digital systems because skew can cause data to be clocked before it has settled. NVE IL700-Series Isolators have maximum propagation delay skew of six nanoseconds, which is five times better than the best optocouplers.

Physical Unclonable Function (PUF)
A function that is embodied in a physical structure and is easy to evaluate but hard to predict. Such functions can be components of anti-tamper systems. NVE has worked to develop spintronic PUFs.

Pulse Width Distortion
A type of signal distortion that can limit data transmission and an important specification for couplers. Pulse width distortion is the difference in propagation delay between a low-to-high signal and a high-to-low signal, expressed in time or as a percentage. NVE S-Series couplers have a typical pulse width distortion of a remarkable 300 picoseconds.

Quantum Mechanics
A science relating to the behavior of matter and energy at atomic and subatomic scales. The foundation of true nanotechnology, quantum mechanics typically cannot be observed on macroscopic scales, but can come into play at atomic nanoscales.

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R

Reed Switch
An electromechanical magnetic sensor with moving contacts ("reeds"), invented in the 1930s. Reed switches were also used as memories before the development of solid-state memory. NVE spintronic magnetic sensors often replace reed switches because they have no moving parts, are inherently more reliable, smaller, more precise in their magnetic switch points, and more sensitive.

RoHS (Restriction of Hazardous Substances)
A European Union regulation restricting certain hazardous materials in electronic devices. Virtually all NVE products are available in RoHS-compliant packages.

RS-422 (also known as TIA-422 or EIA-422)
An industry standard for a popular serial network protocol used for a variety of applications. NVE makes RS-422 transceivers that combine spintronics coupling with network protocol functions in a single small package.

RS-485 (also known as TIA-485 or EIA-485)
An industry standard for a network protocol used for factory automation and other applications. NVE makes RS-485 transceivers that combine spintronics coupling with network protocol functions in a single small package.

S

SRAM (Static Random Access Memory)
A conventional memory that is faster than DRAM but lower in density. Used for high-speed operations such as digital signal processing in cellphones and caches in computers. MRAM has the potential to match the speed of SRAM but with nonvolatility and much higher bit density.

Semiconductor
A substance such as silicon whose electrical conductivity is between that of a metal and an insulator. The term does not rigorously apply to NVE's spintronics because they are made primarily from metals (conductors), not semiconductors.

Sensitivity
The ratio of output signal to sensor input such as magnetic field strength.

Sensor
A device which acquires information such as position or speed. NVE makes ultra-precise spintronic sensors which acquire data such as the position of a robot arm.

Serial Peripheral Interface (SPI)
A four wire, bidirectional serial interface bus commonly used to network controllers to analog-to-digital convertors in industrial control systems. SPI busses are often isolated to reduce noise, and NVE offers unique four- and five-channel, 0.15"-wide, single-chip spintronic couplers ideal for SPI.

Silicon on Insulator (SOI)
A fabrication technique that uses pure crystal silicon and silicon oxide. NVE has a patent relating to MRAM incorporating SOI materials. The invention could allow smaller MRAM cells and lower power consumption by reducing the electrical current required to write data to the memory cells.

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Silicon Prairie
Several regions lay claim to the term, but Eden Prairie, Minnesota is sometimes called "Silicon Prairie" because of its abundance of high technology firms, including ADC Telecommunications; Digital River; Starkey Laboratories; Stratasys, Inc.; SurModics, Inc.; and NVE Corporation. In addition to technology, the city is home to Fortune 500 companies C.H. Robinson and Supervalu (because technologists need to eat).

Sink
1. An electrical output configuration that provides a low impedance path to ground ("pull-down") in the active state. NVE sensors and isolators offer sinking outputs as well as sourcing and CMOS, to address a wide range of applications.
2. A water basin fixed to a wall or floor. Use it to symbolically wash your hands of old sensor and isolator technology so you can redesign with NVE technology.
3. What will happen to your career if you use optocouplers.

Skew
A figure of merit in isolators defined as the worst-case difference in propagation delay between channels or devices. Because of their excellent channel matching, NVE isolators have best-in-class skew.

Smart Sensor
A sensors or sensor system that provides richer information than conventional sensors.

Solid State
Devices that have no moving parts. Includes semiconductors and spintronics.

Solid State Compass
Compasses that determine heading relative to magnetic north by using solid-state sensors to measure the angle of the earth's magnetic field. Spintronic compasses could enhance location-based services in cellphones and smartphones, and enable smaller, more precise, or more power-efficient navigation modules for consumer devices.

Spin-Dependent Tunnel (SDT) Junction
A nanotechnology-scale spintronic device that produces a large change in resistance through a normally insulating layer, depending on the predominant electron spin in a free layer. This allows spin to be sensed as electrical resistance for interface to conventional electronics. SDT devices use structures as thin as a few atomic layers. SDT devices are at the heart of MRAM, and in 2009 NVE introduced an SDT-based angle sensor, which was its first commercial product based on the technology. Also known as Magnetic Tunnel Junctions (MTJs) or Tunneling Magnetic Junctions (TMJs).

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Spin-Momentum Transfer
(also "Spin-Transfer," "Spin Injection," or "Spin Torque Transfer") MRAM
(abbreviated ST-MRAM, STT-MRAM, or SPRAM)
A method of changing the spin of electrons directly with an electrical current rather than an induced magnetic field. This method has the potential to significantly reduce MRAM write currents, especially with small lithographic feature sizes. NVE has a number of patents relating to spin-momentum transfer MRAM.

Spin Valve
A spintronic switch with two stable resistance states. Spin valves are used in many of NVE's products.

Spintronics (also "Spin Electronics"or "Quantum Spintronics")
NVE's enabling technology.
1. A nanotechnology which utilizes electron spin rather than electron charge to acquire, store and transmit information.
2. A new technological discipline which aims to exploit the subtle and mind-bendingly esoteric quantum properties of the electron to develop a new generation of electronic devices (courtesy www.worldwidewords.org).
3. A new technology exploiting quantum properties of electrons' spin for a new generation of electronic devices (Webster's New Millennium™ Dictionary of English, Preview Edition, v 0.9.6)

Sputter
1. A physical vapor deposition vacuum process used to deposit very thin films onto a wafer.
2. What the competition does when they try to talk about NVE products.

Superparamagnetism
The magnetic state of a material between highly ordered parallel spins (ferromagnetism) and randomly ordered spins (paramagnetism). Superparamagnetism occurs in ferromagnetic particles smaller than a critical value or at temperatures higher than a critical temperature. Superparamagnetism limits the density of conventional storage systems such as disk drives. A small applied field can order the spins in a superparamagnetic material, so the sensitivity to magnetic fields can be high and magnetic hysteresis is small. Thus, it may be used to improve the accuracy of spintronic sensing systems. NVE has patents relating to superparamagnetism.

Synthetic Antiferromagnet (SAF)
A spintronics building block using a multiple-element structure to form an antiferromagnet, which is a structure where the overall magnetic moment tends to zero.

T

TDFN Package
An acronym for a Thin, Dual-in-line, Flat, No-lead electronic device package designed to be automatically mounted onto a circuit board. Because they do not have leads, TDFN packages can be even smaller than Micro-Small Outline Packages. NVE offers several spintronic sensor products in TDFN packages.

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Tesla (T)
The International System of Units (SI) measure of magnetic flux density, named after Nikola Tesla, who has been called "the patron saint of modern electricity." Because one tesla represents a rather large magnetic field, sensitive devices such as NVE's magnetic sensors are often characterized in gauss instead (1 gauss = 0.0001 tesla).

Tie Bar
1. Metal tabs used to secure the in the package molding process. Tie bars result in exposed metal, which reduces creepage. NVE's True 8 isolator package has a unique tie bar design that allows true eight millimeter creepage in a JEDEC-compliant wide-body package, even allowing for a subtraction for the exposed tie bar width.
2. An anachronistic fashion accessory still occasionally worn by some engineering geeks.

Transceiver
Short for transmitter-receiver, a device that transmits and receives data such as in networks. NVE offers a family of ultra-miniature, high-speed, isolated transceivers that combine spintronics coupling with network protocol functions in a single small package.

True 8™
NVE's unique isolator package, which offers true eight millimeter creepage in a JEDEC-compliant wide-body package.

Tunnel Barrier
Structures in spin-dependent tunnel junctions that are so thin that electrons can "tunnel" through a normally insulating material, causing a resistance change. Spin-dependent tunnel barrier thicknesses are in the range of one to four nanometers (on the order of ten molecules).

Tunneling
1. A nanotechnology-scale phenomenon where under certain conditions electrons can "tunnel" through very thin normally insulating materials causing lower resistance than would be expected in bulk material.
2. A favorite activity of Minnesota's mascot, the gopher.

Tunneling Magnetic Junction (TMJ)
See "spin-dependent tunnel junction."

Tunneling Magnetoresistance (TMR)
The change in resistance between two stable states of a spin-dependent tunnel junction at room temperature (also sometimes used to refer to the tunnel junctions themselves). In 2005, NVE investigators reported a record for TMR junctions using aluminum oxide. Junctions with higher TMR could allow faster, more cost-effective MRAM.

U
V

ULLGA
An acronym for an Ultra Leadframe Land Grid Array electronic device package, which is designed to be automatically mounted onto a circuit board. NVE's smallest packaged sensors, which are 1.1 millimeters (less than 0.05 inches) square, use this type of package. These packages are smaller than the head of a pin.

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Vertical Transport MRAM (VMRAM)
A high-density type of MRAM that employs current perpendicular to the plane to switch spintronic memory elements. VMRAM could be applicable in general ultra-dense nonvolatile memory or as a hard disk replacement. NVE has designs and patents relating to VMRAM.

W
X
Y
Z

Wafer
A thin disk of silicon or ceramic. NVE builds spintronics structures on raw wafers or foundry wafers in its fabrication facility. Each wafer can include thousands of devices.

Wide Body
1. Shorthand for 0.3-inch wide, typically 16-pin, semiconductor packages such as NVE's unique True 8™ isolator package (see also "narrow body").
2. Crude slang for flight attendant who does not meet their airline's weight-proportional-to-height guideline.

Wire Bond
An connection of tiny wire (typically 0.001-inch diameter gold wire) between a die and its package or other electronics. Because NVE offers unique monolithic devices, they can be wire bonded into devices for maximum miniaturization.

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