

Advantages of Employing Reed Switches and Sensors in Automotive Designs





CONTENTS

- 03** More Facts and Features
- 04** Automotive Applications
- 05** Dependable Solutions Provider
- 05** Summary



From mechanical to solid-state technologies, there are many switching devices available today for all kinds of applications. However, unlike others, reed switch technology (Figure 1) is popular in all market segments, ranging from test and measurement to automotive, for two unique reasons: hermeticity and safety. Being hermetically sealed, it can exist or be used in almost any environment. Plus, it is simple in its structure to guarantee safety and reliability. To avoid cracking and poor seals, care is taken to ensure that the glass and metal used have exact linear thermal coefficients of expansion. In addition, whether sputtered or plated, the process of applying the contact material — usually rhodium or ruthenium — is carried out precisely in ultra clean environments, similar to semiconductor process technology. Like semiconductors, any foreign particles present in the manufacture will give rise to losses, quality and reliability problems.

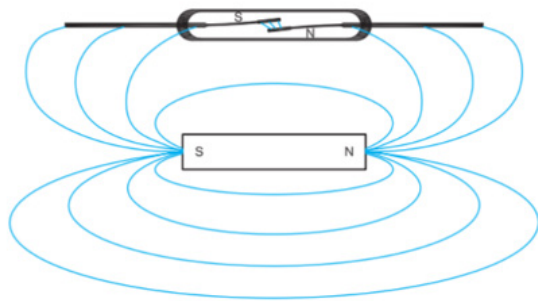


Figure 1 The basic operation of a reed switch under the influence of the magnetic field of a permanent magnet

More Facts and Features

Additionally, with shrinking spaces in systems, the reed switch has also shrunk in size from approximately 50 mm (2 inches) in length to 3.9 mm (0.15 inch) with time. In fact, the 3.9 mm long reed switch is the smallest in the world, designed to fit in very tight spaces, while maintaining a very narrow sensitivity range and fast operating time. In addition, the switch is carefully packaged so that no stress is induced on the elements, which is critical for proper operation and long life of the product, especially in automotives and electric vehicles (EVs) where the environment is harshest under the hood.

Some other features that lend themselves to automotive and EV applications include:

- Ability to switch voltage up to 10,000 V and current up to 5 A
- Ability to switch or carry as low as 10n V and 1 fA without signal loss
- Ability to switch or carry up to 7 GHz with minimal signal loss
- Isolation across the contacts up to 1015 Ω
- Typical contact resistance (on resistance) is 50 mΩ
- In its off state, it requires no power or circuitry
- Offers a latching feature
- Operation time in the range of 100 ms to 300 ms
- Capable of operating over extreme temperature ranges from -55°C to +200°C
- Ability to operate in all types of environments including air, water, vacuum, oil, fuels and dust-laden atmospheres
- Ability to withstand shocks of up to 200 Gs and vibration of 50 Hz to 2000 Hz at up to 30 g
- Offers long life. With no wearing parts, load switching under 5 V at 10 mA, it will operate well into billions of operations
- No power consumption, ideal for portable and battery-powered devices
- No switching noise

In addition, because it can be easily encased in a simple package with a sensing element, it can also be utilized as a low-cost sensor using a permanent magnet for actuation. In this sensor form, a permanent magnet plays an important role in opening and closing the switch contacts. Also, the methods used for actuation can vary, depending on the application. As a result, the reed switch can operate in a normally open, normally closed, change-over or latching mode. Simply bringing the magnet close to the reed blades or moving it away changes the state of the reed blades.

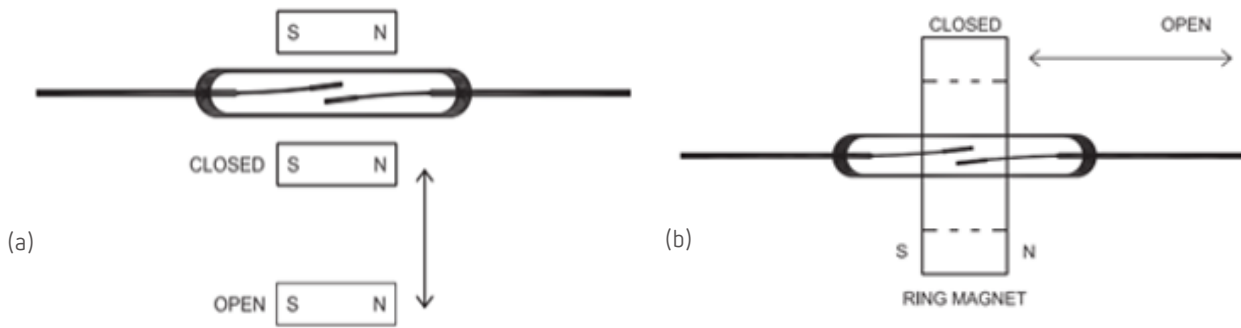


Figure 2 (a) Reed switch with a permanent magnet being moved in front-to-back motion. (b) A reed switch effectively passing through the center of a circular magnet for opening and closing contact points

This simple ON/OFF state control of the reed sensor opens a vast array of applications in the automotive world, such as seamlessly opening a door, flipping a switch for readouts on the dashboard, measuring fluid levels in

coolants, brakes and windshield, gauging tire pressure and emissions, tracking an object, adjusting a car thermostat, as well as supporting other applications like navigation, entertainment, convenience, communications and more.

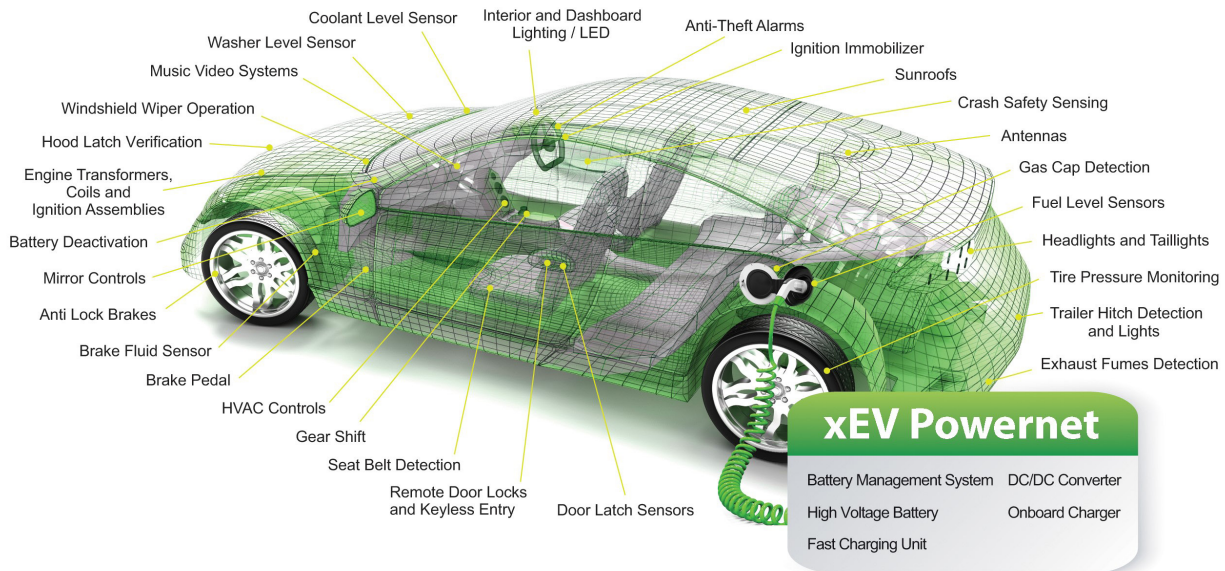


Figure 3 Automotive applications served by reed switches, relays and sensors

Automotive Applications

As a matter of fact, looking at a typical automobile (Figure 3), there are some 25+ key applications that reed switches and sensors are serving in a commercial auto today as shown in the list below. Each requirement is unique.

- Adaptable multi-level fluid sensor
- Battery control
- Brake fluid
- Brake pedal position
- Convertible roof position
- Coolant system fluid sensor
- Door lock
- Emission control
- End position control
- Fuel level multi-point
- Gas tank monitoring
- Gearshift sensor
- Harsh liquid
- Hood position
- Hot fluid multi-level
- Ignition sensor
- Immobilizer security antennas
- Level detection
- Planar transformers
- Power windows
- Removable tank
- Seat belt sensor
- Speedometer
- Windshield washer fluid
- Insulation measurement

Take, for example, the first application in the above list: the adaptable multi-level fluid sensor. Here, a liquid bath can comprise two or more different liquids with different densities and viscosities, while the temperatures can vary from -40°C for fluorinert (3M liquids) to 200°C for pressure-heated water and other special liquids. Meeting these extremes is no easy matter. It requires carefully designed and produced reed switches and sensors that can address these extremes along with multiple sensing points and multiple floats. Thus, allowing the auto maker to simultaneously measure and monitor different liquid levels.

Likewise, let us investigate the second application on this list: battery control. Before a completed vehicle is shipped to a customer, it sits in the warehouse for months. Here the connected battery could lose a lot of power via leakage currents that exist in car batteries if it is not deactivated prior to shipment to the customer. Consequently, auto makers have solved this leakage problem by using a magnetic reed sensor/switch. In this application, a magnet and a reed sensor are isolated with no physical contact. The reed sensor module is mounted beneath the car windshield while the magnet is manually positioned over the module to turn it off and deactivate the battery and stop the slow drain. The reed switch used in the reed sensor is hermetically sealed and is, therefore, not sensitive to rough, wet environments. Similarly, the magnet is also not affected by its environment, resulting in tens of millions of reliable switching operations performed using a magnet along with a reed sensor/switch.

For curiosity, let's explore the last title on this list: the insulation measurement. Since it features high dielectric strength and negligible leakage currents in the open state, reed switches offer outstanding capabilities for this kind of isolation measurement.

Compared to other competing switch/relay technologies with a similar size, used in isolation measurement, the reed switch/relay is capable of switching voltage levels from zero up to 400-1000 VDC, while providing not only a high dielectric strength between the coil and contact, but also high breakdown voltage across the open switch. This high voltage isolation combined with very high insulation resistance results in very low leakage current in the range of picoamperes. Consequently, reed relays and switches are popular in battery isolation systems, power inverters, and battery conditioning applications.

Dependable Solutions Provider

Because of its vast portfolio of reliable reed switches, relays and sensors tailored for a wide variety of automotive and transportation applications, Standex Detect can play a vital role in selecting the right and the best product for any automotive application in the above list, including any custom designs. From readouts on the dashboard to measurement of coolant, brakes, windshield, water in fuel, tire pressure, emissions and more, Standex Detect components can perform with safety and reliability, while consuming very little to no power, within automobiles, EVs, heavy-duty trucks, recreational vehicles, E-Bikes, and more. All its products meet international safety standards, and the company is certified to the automotive quality standards IATF 16949:2016 and ISO 9001:2015.

In short, selecting the right reed switch, relay or sensor for any automotive application is not a trivial task. Only an experienced engineer with knowledge of the products can select and guide you through this maze of products.

While several suppliers serve this market, only one stands out as a leader. With over 50 years of experience, Standex Detect is the world's largest manufacturer of reed switches (>700M/year) with >50% market share, and offers the most comprehensive listing of reed switches, relays and sensors that covers all sensing and switching requirements in the automotive world. For applications that need a custom solution, Standex Detect has the capability and experience to deliver a custom solution that is optimized for a customer's specific and unique task.

Summary

With a broad portfolio of reed switches, sensors and relays, combined with over 50 years of experience and knowledge in designing and producing these products for automotive applications, Standex Detect is a one-stop shop for any company, small or big, that is looking for the best, most reliable, and most cost-effective solution for any specific application in the automotive and EV space. Standex Detect is the preferred worldwide source for reed switch technology. Think of Standex Detect as your partner in solving your automotive problem.



A Standex **Electronics** Business