Flipping the Switch for Energy Conversion

By Nick Stephen
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Think back to early 2000s, when flipping a phone open was in style. The phone was the accessory that completed the look. Now, fast forward five to ten years where having a Motorola Razor is pretty much unheard of. A few weeks ago, I was cleaning out my old nightstand and I found a flip phone; it felt like I discovered a fossil from the Jurassic period.

Have you ever wondered how your old flip phone display turns on when you open and close it? You're probably thinking there's some kind of switch connected to the hinge of the phone or laptop to detect it opening and closing. If so, you are right for the most part, but if you really want to get technical, it is much more complex. A standard switch would be very unreliable for such applications. I'm sure some phone manufacturers know all about using unreliable parts in their phones. 😒

Since regular switches are unreliable, many phones and laptops use a reliable and inexpensive device called a reed switch.

IS THAT LIKE A LIGHT SWITCH?

Before we get into the reed switch, let's discuss a regular switch. Many circuits have a switch so that they can be turned on and off. When the switch is OFF, there is a gap in the circuit so the electrons are not able to flow. When the switch is ON, the gap closes, so electricity can flow and power a light or device. A simple ON/OFF switch is what you would typically have in a room to turn the light on and off.

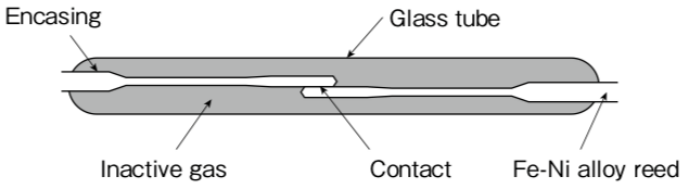
The proper name of an ON/OFF switch is a Single Pole Single Throw (SPST) switch. "Single Pole" means that only one "hot wire" can be connected to it. "Single Throw" means that when you flip the switch, it only connects to another wire, which in turn connects to the light or device.

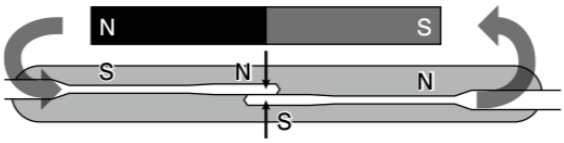
A regular switch has two electrical contacts that join when you flip your switch. A reed switch has two contacts made from ferromagnetic material. They are sealed inside a thin glass envelope to protect them. Reed switches come in two different types: "normally open" and "normally closed." These terms refer to the circuit. Therefore, normally open is when the switch is OFF, and normally closed is when the switch is ON. A reed switch works as both an electrical and a magnetic bridge, where magnetism and electricity flows through the switch.

NORMALLY OPEN VS. NORMALLY CLOSED

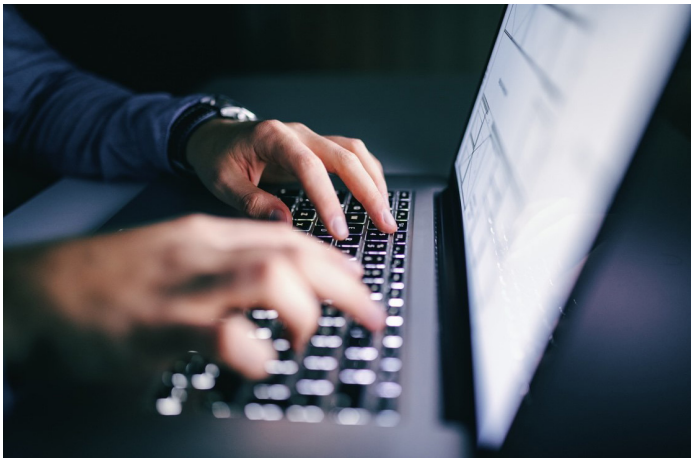
In a normally open application, the contacts are normally separated and when you bring a magnet up to the switch the two contacts become opposite magnetic poles, which causes the leads to attract and snap together.

In a normally closed reed switch, the contacts are normally snapped together, and when you bring a magnet near it, they snap open. When the magnet is taken away, it returns to its normally closed position.



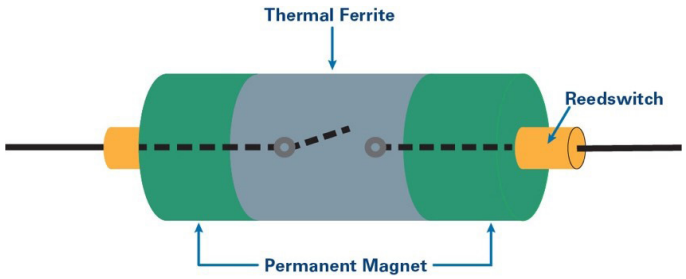


Now that you know about reed switches, we can link your knowledge to your flip phone or laptop. Each has a normally closed reed switch in the lower part of the device and a magnet in the upper part by the screen. When the device is open, the reed switch and magnet are far apart, which causes the contacts to be pushed together allowing power to flow. When the device is closed, the magnet meets the switch causing the contacts to be separated inside the switch.



IS IT A SENSOR? IS IT A SWITCH?

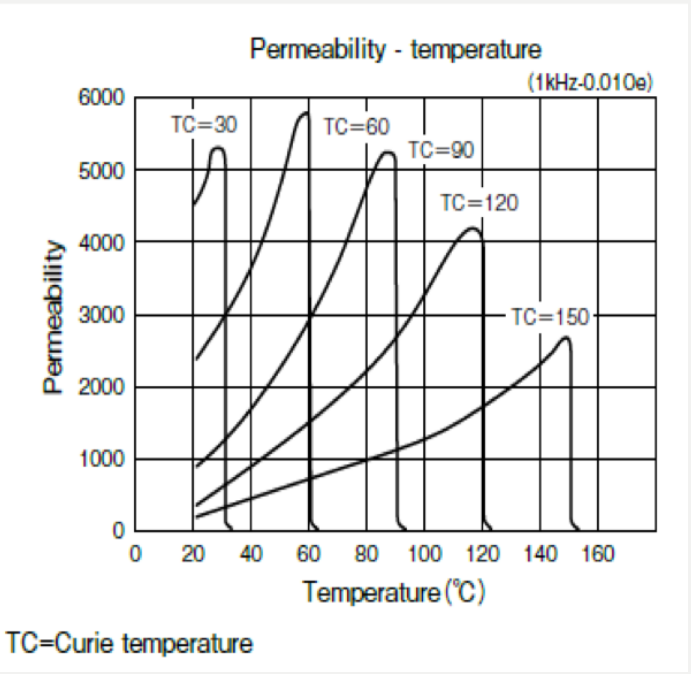
KEMET's thermal reed switch is a highly reliable, precise, temperature-sensitive switch ideal for energy conversion. Its unique, proprietary design features a magnet and a temperature-sensing, soft, ferromagnetic substance called Thermorite®. The material's magnetic flux density decreases as the temperature increases, turning it into a paramagnetic substance at the Curie temperature.



Now, you may wonder about this "Curie temperature". In the late 1800s, Pierre Curie, French physicist and husband of Nobel Prize winner Marie Curie, made a discovery. Curie himself was a pioneer in crystallography, magnetism, piezoelectricity, and radioactivity in his own right. This is interesting because KEMET also offers a lineup of piezoelectric devices. Click here to learn more. Thank you, Mr. Curie.

Anyway, Curie discovered that at a certain temperature, a permanent magnet will lose its magnetic properties. Curie eponymously called this temperature "The Curie Point." One way in which KEMET manipulates the Curie temperature of a material is to add a very controlled quantity of dopants.

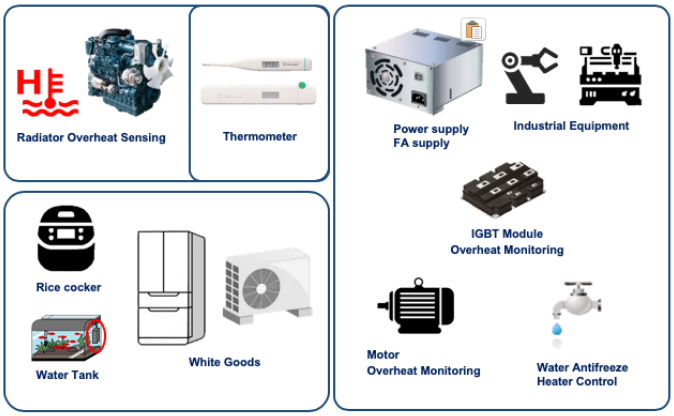
Careful control of particle size can also affect a material's Curie point. KEMET took advantage of such techniques and created a material whose Curie point can be precisely controlled and adjusted. That material, known as Thermorite®, is now used in creating a thermal switch that opens or closes when that very specific and tightly controlled temperature is reached.



TC=Curie temperature

WHERE CAN I USE IT?

Typical applications include temperature detection and overheat monitoring of electric appliances. Examples include heat-retention heater control for rice cookers, defrost for air conditioners and vending machines, roll heater temperature control for copying machines, and radiator water temperature detection for automotive electric fan control.



Overheat monitoring is a very common application, especially in industrial equipment. There are many factories with heavy machinery and other equipment that run 24/7 even without supervision. What if a piece of equipment overheats and there is no one around to control it? That would be catastrophic. KEMET's thermal reed switch will detect if equipment is overheating and it could send out an emergency alert, for example. If no one responds to the alert after a certain time, the reed switch can shut off the equipment. It can also be used in some automotive applications such as radiator overheating monitoring, alerting the driver when something is not right under the hood.

Thermal switches are used in restaurants and kitchens to monitor the temperature of the food that is being cooked. For example, if the rice cooker is equipped with a thermal reed switch, it can detect when the rice is perfectly cooked and it can maintain it at that temperature until it is ready to be served.

Due to the extremely simple circuit design, our thermal reed switches are basically plug and sense, so you don't need to be an advanced engineer to make use of this sensor. They are compact, light, and easy to handle with excellent environmental durability. We cover a wide range of operating temperatures ranging from −10°C to +130°C and have an excellent temperature accuracy of ±2.5°C.

IF IT'S NOT THERMORITE®, THEN IT'S THERMO-WRONG

At KEMET, we strive to provide our customers with the best products on the market. Our proprietary Thermorite® material, and the simple circuit design, is what makes our product a cut above the rest. Thermal reed switches are being used in every market you can think of and the use of these sensors will only increase as technology advances. Factory workers cannot carefully monitor every piece of equipment that is being operated in a factory. A chef cannot hover over every single working device in their kitchen. Sensor products are essential for safety measures.

As humans, it is part of our nature to make mistakes even when we try to take extra care in preventing them. There have been at least a few times where I've tried to fix something but ended up making it worse. According to a new workplace survey commissioned by Red Bull and Glassdoor, the leading jobs and recruiting community, nearly half (48 percent) of employed Americans are distracted by fatigue at work, causing them to make mistakes and even doze off. Sensor products are essential to reduce this percentage, especially in factory settings where mistakes can cause financial setbacks and compromise the safety of employees.

For more information on Thermal Reed Switches or to browse our library of products, be sure to visit Component Edge.

Interested in staying up to date on the newest technologies and trends? Join the KEMET Circuit today! Click here to subscibe.