COTO TECHNOLOGY®

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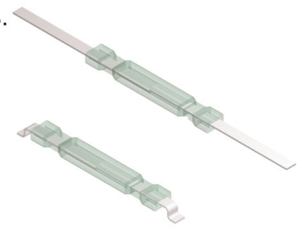
FR2S/FR

DYAD Switch

DESCRIPTION

Coto Technology's FR dry reed switch series is ideally suited for small switching signal applications. This switch has sputtered ruthenium contacts and an extraordinary seal strength, achieved by a patented laser sealing of the glass. In low level or dry switching enviroments, the FR reed switch typically provides > 1 billion operations.



FEATURES

- •Small size
- •SMT-compatible
- •Easily formed leads
- •Sputtered ruthenium contacts
- •Hermetically sealed contacts
- •Fast switching speed - up to 500Hz
- •Wide range of available magnetic sensitivities
- •Rectangular glass for superior pick and place performance
- •Lead-free Tin plating
- •UL Recognized under UL File BP6039
- •RoHS Compliant Pb

APPLICATIONS

- •Security
  - -proximity sensing
  - -smoke alarms
- •Automotive
  - -level sensor
  - -lamp current sensor
- •Relays

SPECIFICATIONS

Parameters	Conditions	Min	Typ	Max	Units
Contact Ratings					
Operate ampere turns range	+/-1.5 NI	10		30	NI
Release ampere turns range	+/-1.5 NI	5		30	NI
Switching Voltage	Max DC/PeakAC Resistive			200	VDC
Switching Current	Max DC/PeakAC Resistive			0.5	Amps
Carry Current	Max DC/PeakAC Resistive			1.5	Amps
Contact Rating	Max DC/PeakAC Resistive			10	VA
Life Expectancy	1V, 10mA Signal Level		1000		$x10^6$ Ops
	10V, 10mA Low Level		500		$x10^6$ Ops
	50V, 100mA Telecom Load		2		$x10^6$ Ops
	100V, 100mA Rated Loads		2		$x10^6$ Ops
Static Contact Resistance	50mV, 10mA		80	150	mOhms
Contact Material			Ru		
Switch Specifications					
Insulation Resistance	100V, 25°C, 40% RH	10^9	10^{11}		Ohms
Capacitance	Across Open Contacts		0.3		pF
Dielectric Strength	Between Contacts	250	300		VDC/Peak AC
Operate Time, including bounce	At nominal coil voltage, 10Hz Square Wave			0.5	ms
Release Time	Zener-Diode Suppression			0.2	ms
Enviromental Ratings					
Storage Temperature		-40		+125	°C
Operating Temperature		-40		+125	°C
Soldering Temperature				+260	°C
Vibration Resistance				20	Gs
Shock Resistance	11+/-1ms, 1/2 sine wave			100	Gs
Weight			0.13		grams/unit

ORDERING INFORMATION

A complete part number is represented by the digits below

FR2S XX XX

Series
S = straight switch
Blank = SMT

Minimum Operate Value (NI)

Maximum Operate Value (NI)

Surface Mount
Refer to operating characteristics
table for a complete part number.

DYAD

Part #	Operate Range (NI)[1]
FR2S1015	10 to 15
FE2S1020	10 to 20
FR2S1030	10 to 30
FR2S1520	15 to 20
FR2S1525	15 to 25
FR2S2025	20 to 25

[1] Tolerance = +/-1.5NI

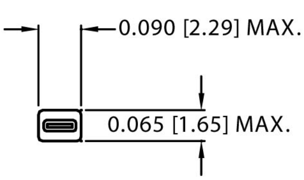
DYAD Surface Mount

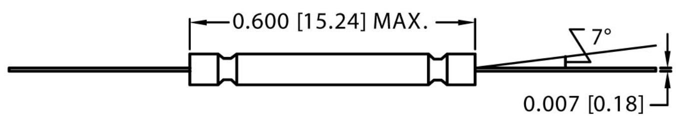
Part #	Operate Range (NI)[1,2,3]
FR2024	10 to 15
FR2259	10 to 20
FR2282	10 to 30
FR2025	15 to 20
FR2249	15 to 25
FR2026	20 to 25

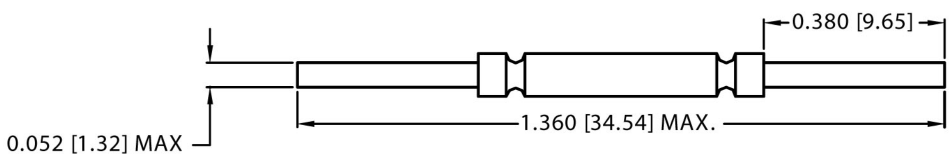
[1] Tolerance = +/-1.5NI
[2] Full Blade Sensitivity
[3] Surface Mount switches are packaged 3,000 parts per reel

MECHANICAL DIMENSIONS

Dimensions in inches [mm]







MECHANICAL DIMENSIONS

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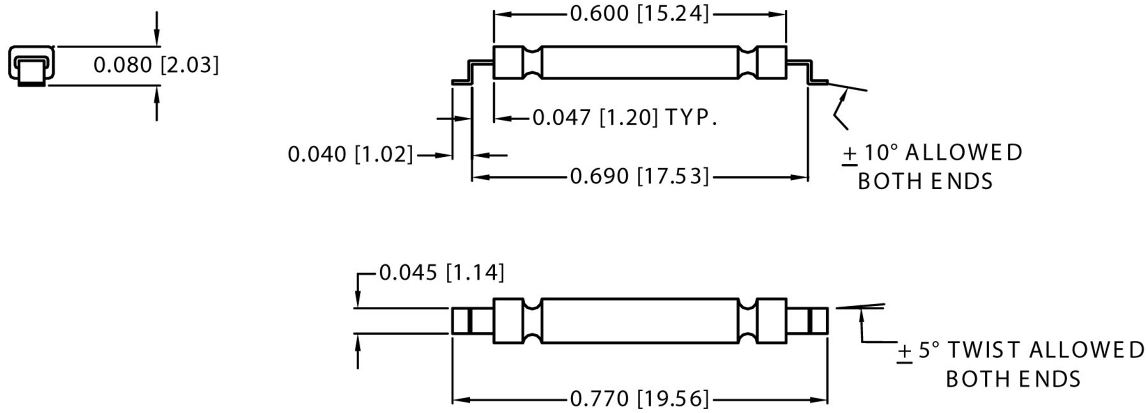


Reed Switches

WHAT IS A REED SWITCH?

The basic reed switch consists of a pair of low reluctance ferromagnetic reeds, which overlap at their free ends — the contact area. The reeds are hermetically sealed in a narrow glass tube to protect the contact area from contamination by external effects of dust, moisture, oils, etc. When a magnetic field is brought in proximity to the reeds, the extreme ends assume opposite magnetic polarity. When the magnetic field is strong enough (typically 300-3000 gauss), the overlapping ends attract and are brought together, completing an electrical circuit. When the field is removed, the reeds separate, by their own spring tension, back to their original, normally open position.

The principal advantages of a reed switch include:

- Hermetically sealed contacts
- Low resistance when contacts are closed (approximately 50 mΩ)
- High isolation resistance when contacts are open (typically 10^{12} Ω)
- Complete isolation between input and output
- Long life where needed; predictability when only occasional actuation is required

ENHANCEMENTS TO REED TECHNOLOGY

Since the invention of glass-enclosed contacts in the late 1950s, the technique for producing them has remained the same — so much that there are commonly identified issues with using reeds.

CP Clare Corporation has addressed each of these issues. The DYAD is not just another reed switch. Immediate improvements in end-product reliability, production yields, and switching characteristics at low level loads (12V, 10-30mA) can be experienced with this switch.

Advantages specific to the Clare DYAD reed switch include:

- Flexible leads can be bent or formed without special fixturing and without breaking or stressing the switch.
- Flat reed design provides a larger surface area for weld, solder or crimp joints, resulting in stronger, more reliable connections.
- Flat glass/flat blade allows the designer to define the orientation of the reeds, increasing the switch ability to absorb shocks or vibrations.
- Flat leads provide the capability for surface mounting; it is compatible with vapor phase and reflow soldering processes.
- A Ruthenium contact exhibits less wear, provides stable contact resistance throughout life, and exhibits virtually no tendency to cold weld or stick.

APPLICATION FOR REED SWITCHES

Over the past three decades, billions of reeds have been used in thousands of applications. The current trend in the design of automobiles, security systems, consumer goods and business machines calls for more sophisticated electronic controls. The large degree of electronic design effort has also brought with it a need for higher levels of reliability. This increases the need for a reliable, low-cost sensor to measure various parameters such as speed, position, direction and current or temperature changes. The reed switch is an economical non-contact switching alternative to the push switch, microswitch and solid state switch. And where load-switching requirements are microamps or milliamps, the reed switch is an ideal solution.

Magnetic sensitivity

This rating specifies the amount of magnetism used to close the switch. Switches are ordered based on their full-length operate sensitivity, expressed in Ampere Turns (NI or AT). At CP Clare, this is done based on a NARM 1 coil:

Standard Test Coil

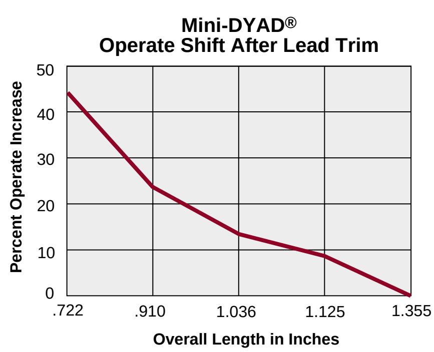
The magnetic force (expressed in NI, AT or Ampere Turns) required to cause the reed switch contacts to close is called the pull-in or operate value.

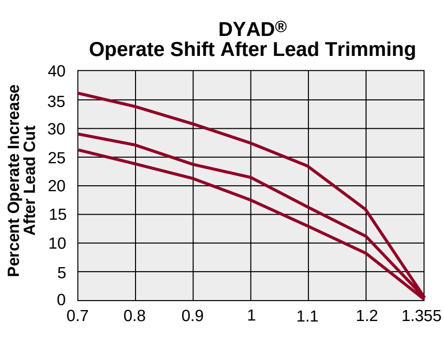
Coil definition	EIA/NARM I Standard
Wire size	AWG 46
Number of turns	5000 ± 5 turns
Coil resistance	1200 Ohms ± 10%
Recommended mounting conditions	Vertical, with the coil magnetic field opposing the local earth's magnetic field

The reed switch shall be placed in the test coil with the gap centered in the core of the coil winding.
Test leads and their clips must be non-magnetic.
The longitudinal axis of the test coil and the test switch shall be vertical.

Length vs. magnetic sensitivity

The leads of a reed switch are the "antennae" that pick up the flux of the magnetic field. The full-length switch is the most sensitive. As a switch is cut shorter, it becomes less sensitive.





Coil Actuation

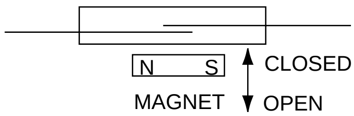
The operation of a reed switch via an electromagnetic coil provides the designer with a method of actuation from a remote source. This is a very simple method of actuation.

When the reed switch is placed inside or close to a coil of wire and a current is passed through the coil, each lead of the reed switch becomes strongly magnetized. One end of the reed switch will become a north pole and the other a south pole. Because the reed blades overlap in the center of the glass housing, with a few thousandths of an inch separating the overlapping ends, each lead will have a north and south pole. The overlapping reed blades come together (close) when the electrical current generates sufficient magnetic flux in the coil. When the current to the coil is turned off, the reed blades return to their open condition.

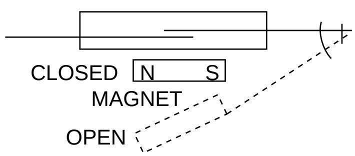
The efficiency of the reed switch actuation is largely dependent upon the coil. The size, shape, wire type, and the number of turns of wire on the coil determine its efficiency. In addition, the proximity of the switch to the coil determines the efficiency of the coil (ie, if the switch is placed inside or very close to the coil, the coil requires little current to actuate the switch. The farther the switch is from the coil, the more magnetic flux the coil must generate to cause switch closure). A single coil can actuate two or more switches.

Permanent Magnet Actuation

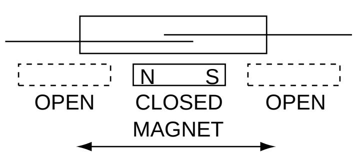
A permanent magnet is the most common means of operating the reed switch. As with a coil, a magnet and switch must be positioned within a specific proximity of each other to actuate the reed switch. This distance is related to the sensitivity of the switch and the strength of the magnet. For the normally open reed switch, when the magnetic field is close enough, the contacts will close; when the magnetic field is taken away, the contacts will open. There are many ways to use a permanent magnet to actuate the reed switch. We have addressed the most popular techniques in the following figures.



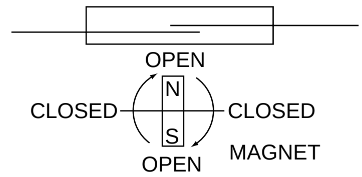
1) As the magnet moves closer to the switch, the switch is activated. Figure PMA1 shows that as you get closer with the poles centered over the contact gap, you will close the switch. As you move away, the field reduces by the square of the distance, and the switch will open. This type of movement is typical of many proximity applications, such as alarm or telecom systems.



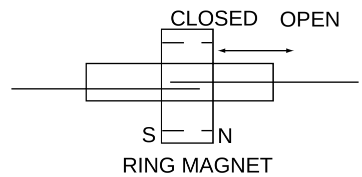
2) In this application, the magnet may swing away from the switch. As the distance decreases, the switch closes. This is typical of a security or safety door contact application. If you imagine the magnet rotating at a larger radius than the switch, the effect is the same. When the switch and the magnet are end-to-end, the switch is closed. This is commonly found in level sensors and security applications.



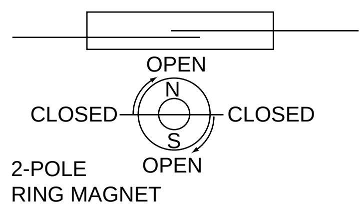
3) In this motion, the magnet moves parallel to the switch. When centered, the switch is closed; when moved slightly to either side, the switch will open. If movement continues away from the gap, closure will again occur. Graph (PMA1 from p.51) shows how the field strength varies by distance. This type of actuation is very common in automotive and industrial level detectors. Note: the on/off characteristics vary greatly by turning the magnet 90°, as shown in figure PMA2.



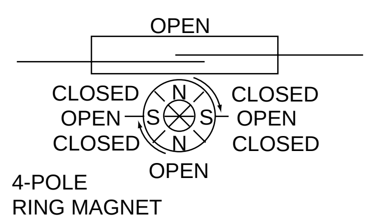
4) This extends the application to rotation of the magnet. As the magnet makes one full revolution, the switch will close twice when the poles of the magnet are parallel with the switch. This could be used for metering of counting the cycles of a rotating shaft.



5) This is a ring magnet with poles at the faces. As the ring is moved to the center of the gap, the switch closes. At either end, the switch is open. This can be used effectively in a level control or a deceleration sensor.



6) The ring magnet, when attached to a rotating device, can be used to activate the switch to act as a counter. This is similar to the rotating bar application in that when the magnet poles are parallel to the switch, the switch is closed. For each revolution, the switch closes twice.



7) Taking application 6 one step further, higher resolution can be found by going to a 4-pole ring magnet. This would yield 4 closures per revolution.