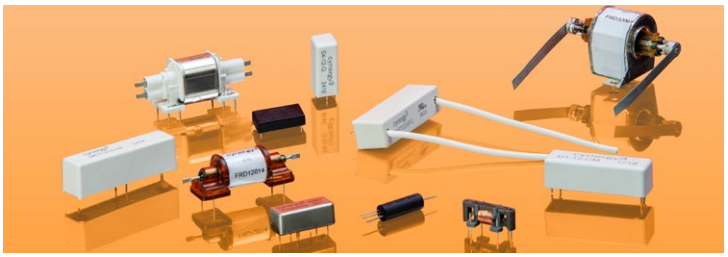
HOW TO SELECT THE CORRECT REED RELAY

A reed relay takes a reed switch contact and packages it in an actuation coil, with or without a cover, to form a reed relay. Why use a reed switch contact? Reed switches are compact hermetically sealed electrical contacts which benefit from no moving parts and fast switching times which outperform most electromechanical relays for actuation speed and mechanical reliability. Sensata | Cynergy3 has specialised in making vacuum reed switches over many years for both the radio frequency (RF) and high voltage reed relay markets.



Uses

Sensata | Cynergy3 reed relays provide a fast switching cost competitive way to provide high voltage isolation up to 15kVDC and switch and route power signals at RF up to 30MHz. The majority of high voltage reed switches manufactured end up in HF antenna tuning units, heart defibrillators and high voltage power supplies and ATE systems. In antenna tuners, the relays are used to select fixed value inductors or capacitors to tune the RF amplifier output to the antenna. Reed relays are ideal for the task as they can select the desired combinations of inductor and capacitor very quickly to allow the radio to frequency hop; a technique used by the majority of military radio manufacturers. In defibrillators, the relays are used to isolate and discharge the capacitor bank used to deliver shock pulses to the patient, in addition they can be used as part of the monitoring circuit to check the patient's heart rhythm. Reed relays have found use in many parts of the test and measurement market being used to route high voltage signals and charge/discharge and isolate different parts of test circuits and systems.

Function

Reed relays are typically available with nominal coil voltages of 5Vdc, 12Vdc or 24Vdc and there are Form A, Form B, Form C and Latching (Bi-Stable) contact switching actions to choose from.

Reed Switches: Reed switches were invented in 1936 by Walter B. Ellwood at Bell Telephone laboratories as switching devices to be used in automatic telephone exchanges. Since then telephone exchange technology has moved from the reed switch but the technology still endures in sensors and relays. Reed switches are comprised of two ferromagnetic reed blades hermetically sealed inside a glass capsule. The tips of the reed blades are coated with the desired contact material. Cynergy3 RF reed switches use sputtered Rhodium with additional copper plating to offer superior RF performance. There are also Tungsten contact reed switches which form the basis of many of the general-purpose high voltage reed relays.

Switching Action

Form A: Also referred to as Normally Open or Make Action contact; when the relay coil is energised the relay contacts will close. The majority of reed switches are Form A so this is the simplest relay type and suitable for general switching demands.

Form B: Also referred to as Normally Closed or Break Action contact; when the relay coil is energised the relay contacts will open. These relays usually use a magnet to bias the reed switch closed to obtain the desired switching action. Form B is often used in safety discharge circuits to discharge charged high voltage loads.

Form C: Also referred to as Changeover or Break Before Make action contacts; when the relay coil is energised the common (moveable) contact will break the normally closed contact and make with the normally open contact. Form C relays use special Form C reed switches and are desirable when a signal needs to be routed between three points - A to B or A to C.

Latching: Also referred to as Bi-Stable contacts; these relays usually have two coils named SET and RESET. When the SET coil is energised by a defined pulse the relay contacts will close, when the RESET coil is energised by a defined pulse the relay contacts will open. Latching contacts do not consume power to hold a given contact state therefore they are highly desirable for battery powered or low power consumption applications e.g. battery powered portable military radios.

Considerations

Switching: At the heart of the reed relay is the reed switch(es) contact(s). Reed switches, compared to most other switching devices, have very modest hot switching capabilities in terms of switching power, therefore the end user needs to be mindful of these limitations and design their circuit to work within these limitations. Indeed, some users elect to switch off or reduce the signal power when switching the relays to conserve the relay contacts. This technique is used in High Voltage Multiplexers in ATE systems and RF Antenna Tuning Units. In high voltage capacitive charging and discharging circuits a reed relay can be used provided that the switching voltage is not exceeded and the load RC time constant is kept to a couple of milliseconds or less. The peak charge discharge current should not exceed the maximum switching current of the relay but provided the time constant is short it is sometimes possible to switch higher instantaneous currents up to 1.3x the rated switching current. As with any switching device, Sensata | Cynergy3 advises end users to verify the selected relay is suitable for the intended switching load though by performing their own life test to ensure the circuit reliability performance criteria are met. Sensata | Cynergy3 has its own relay life testing equipment that can cater for most low to medium voltage DC and AC loads, however high voltage testing can be more difficult and sometimes requires relays to be tested in the actual circuit. Please consult our team for life testing requirements.

RF Reed Relays: RF reed relays are designed with copper plated Rhodium contact reed switches at their core to provide low and stable contact resistance from DC to 30MHz. RF reed relays will also be designed with low dielectric loss insulation materials because the physical structure of the relay will introduce unavoidable stray capacitance, it is important that this stray capacitance is kept as small as possible to reduce unwanted power loss through the relay as frequency increases. Therefore, it is important that circuit designers pay attention to the contact capacitance and the capacitance from contacts to coil and screen, as these capacitance paths will appear as a capacitive reactance. Therefore, as signal frequency increases the reactance of these paths will decrease meaning more of the signal power will be lost through these stray capacitance paths. Sensata | Cynergy3 RF Reed relays are designed for use in antenna tuning circuits primarily and therefore do not have a characteristic impedance matched to transmission line impedance. This is because antenna tuners do not have a characteristic impedance in the circuit itself.

Circuit Layout: Reed relays, as with any relay, use an electromagnetic coil and sometimes magnets to actuate the reed switch contacts. Both these devices produce a magnetic field around them to actuate the reed switch(es). These magnetic fields can interact with adjacent relays if multiple relays are mounted too close to one another, therefore careful consideration of the spacing and orientation of the relays needs to be taken.

Types

Reed relays are available in many different packages which are tailored for certain applications, ranging from simple thru hole PCB mountings through to panel mount options. There are also open frame relays which offer superior RF ESR performance with actuation coils with full RF screens to minimise losses, to fully encapsulated high voltage packages designed to survive being used in Military air-portable heart defibrillators used for medivac missions.

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