

# Application Notes - Reed Relays

## High Voltage Reed Relays

The principal function of a high voltage reed relay is to isolate as high a voltage as possible, Cynergy3 achieve this through the use of evacuated reed switches. These are available with Tungsten or Rhodium contacts, depending on the switching requirements of the applications. These relays are intended for use in DC or AC (50Hz to 60Hz) applications.

## RF Reed Relays

Cynergy3's range of RF reed relays are carefully designed to provide minimal RF signal loss and low contact resistance. This is achieved through the use of copper plated reed switches, with Rhodium contacts, packaged in carefully designed coil assemblies. These relays are designed for use in the HF band and are typically used in HF amplifiers and aerial tuning units (ATU's). The standard performance measure of an RF reed relay, adopted by Cynergy3, is Effective Series Resistance (ESR); this is because these relays are very often used in high "Q" circuits, which experience high currents throughout the frequency range, as found in certain ATU circuits.

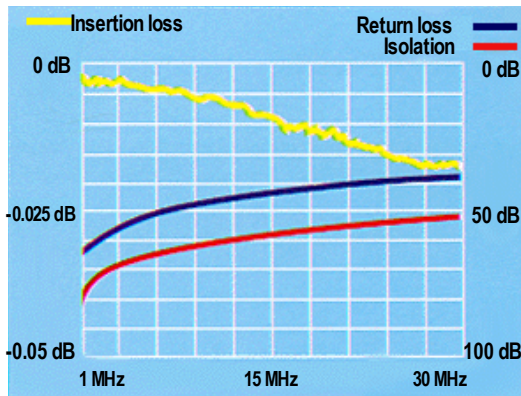


Figure 1 : Typical Parameters of Cynergy3 RF Reed Relay

## General

The following are some general guidelines, which should be considered when working and designing with Cynergy3's range of reed relays. It should be noted that all data is presented, throughout, at an assumed ambient temperature of 20°C, unless otherwise stated.

## COIL

### Coil Temperature Compensation

Coil resistance, as well as 'Must Operate' & 'Must Release' voltages, is quoted at 20°C, unless otherwise stated. It should be noted that these parameters will change at a rate of 0.4% per °C change in temperature.

### Coil Suppression

It is recommended that all relay coils be suppressed, by fitting a reverse biased diode across the relay coil; this is essential for latching relay types. Operate and release times for the relays are quoted with coil suppression fitted (unless otherwise stated).

### Coil: RF Screening

The benefit of RF screening is that it reduces the RF through losses (ESR) of the relay and extends the relay performance, at high frequencies and high ambient temperatures.

The RF reed relays offered by Cynergy3 have various screening options:

- Unscreened
- Partially Screened
- Fully Screened

Unscreened relays may be used in RF circuits where the highest currents occur at the lower frequency bands e.g. 2MHz.

Partially screened relays will offer extended current carry capability at elevated temperatures and frequencies up to 30MHz, over unscreened variants, due to lower ESR.

Fully screened relays offer the ultimate in low loss performance, resulting in the lowest ESR figures, significantly reducing the effects of RF coil heating, and maximising current carry performance at elevated temperatures and frequencies.

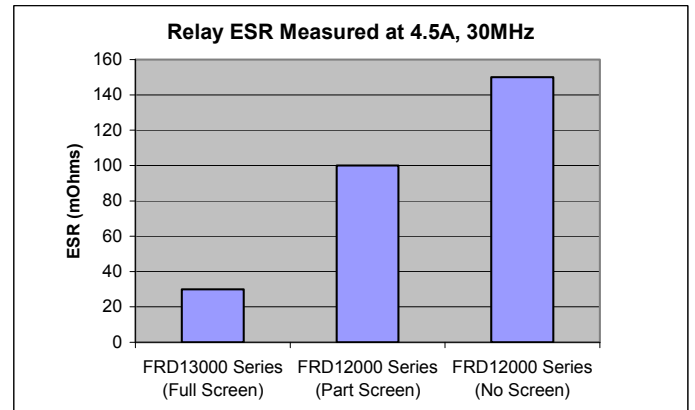


Figure 2: Effects of screening on ESR

## Coil: Magnetic Screening

A magnetic field is produced, when power is applied to the coil of a reed relay. Ferromagnetic screening can be used to contain this magnetic field, so allowing closer placement of reed relays on a PCB. It should be noted that many of the RF relays do not employ magnetic screening, as this can adversely affect the ESR; in this case refer to figure 3, for a suitable layout for RF relays without magnetic screening.

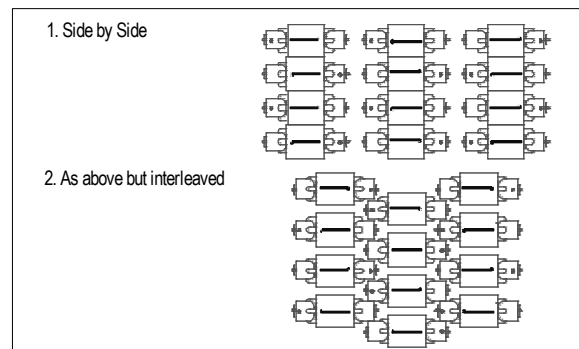


Figure 3 : Mounting Configurations to Minimise Magnetic Interference (Note Orientation)

Figure 4 shows a suitable arrangement for 'D' & 'S' type high voltage relays.

Note that the 'D' Series has magnetic screening fitted as standard.

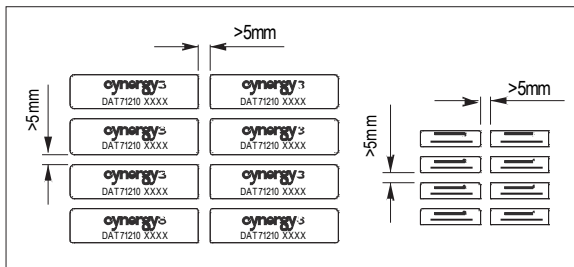


Figure 4 : Recommended Mounting for "S" and "D" Series High Voltage Reed Relays

## CONTACT

### Contact Arrangements

SPNO (FORM A): Normally open - energise to close contacts

SPNC (FORM B): Normally closed – energise to open contacts

Latching: Contact is bistable – energise "SET" coil to close contacts; energise "RESET" coil to open contacts.

### Contact Isolation Voltage

The isolation voltages quoted in the data are for DC or AC peak. The two may be considered directly equivalent, at mains frequency (i.e. 50 or 60Hz).

High voltage breakdown mechanisms at RF differ from those at DC. In general breakdown across the contacts occurs at a higher RF peak voltage than DC. Conversely, breakdown outside the switch (i.e. switch to coil or screen), caused by surface tracking, can occur more readily at high frequency than at DC. Verification of any particular voltage or frequency combination, within the HF band (1–30MHz), can be undertaken upon request.

### Contact Switching Power

The switching power, when quoted, will be for a resistive load. It should be noted that any combination of voltage and current can be switched, provided they do not exceed the stated switching maximums, for either parameter or the power rating of the contact. It should be noted that relays, used in a power switching application, will experience reduced operating life; it is recommended that sales be contacted for advice on specific applications.

### Contact Material – Rhodium vs Tungsten

Rhodium offers superior low contact resistance, which, coupled with Cynergy3's copper plated reed switch technology, enables Cynergy3 to produce very low loss RF reed relays, with exceptional current carry performance. Rhodium contacts are offered, in our 'D' series range, for high voltage applications, where low contact resistance and good current carry performance are required, provided the switching voltage is below 1000 volts DC or AC peak.

Tungsten contacts are used exclusively for our high voltage 'D' series range, where they are offered as high voltage switching contact able to switch voltages up to 10kV DC or AC peak at very low current. Tungsten is a good general purpose switching contact material but the higher contact resistance means it is not well suited for RF applications.

## PROCESSING & HANDLING

Cynergy3's reed relays are high performance products and the materials and methods of construction are significant factors

in achieving performance specifications. The following guidelines should therefore be followed when adopting assembly, soldering and cleaning processes.

### Handling:

Many of the RF reed relay designs are of open frame construction to achieve optimum RF performance, these designs need to be handled with due care to avoid damaging the exposed coil, contact and screen connections.

### Soldering:

Cynergy3 propose that either low residue fluxes are used in the soldering process (to eliminate the need for cleaning), or that the reed relays are fitted onto the PCB after the cleaning process has taken place. If a solder bath is employed the maximum immersion time recommended is 10 seconds at 250°C or 3 seconds at 350°C.

FRD12000/13000 Series: Electrical connections to the relay contacts on the FRD12000/13000 Series relays are made directly onto the reed switch leadout. Care must be taken when hand soldering to the contact terminals, as physical and thermal shocks can damage the glass to metal seals. It is recommended that a thermal shunt (Aluminium Clamp) be clamped to the reed switch lead out adjacent to the glass seal; this will reduce the chance of breakages due to thermal shocks. Alternatively relays may be warmed prior to soldering.

### Cleaning:

Cynergy3 relays are not hermetically sealed (unless stated otherwise) and as such are not suitable to aqueous cleaning solutions or processes. If after the soldering process the customer wishes to clean the PCB's containing Cynergy3 relays then the use of post operative cleaners such as IPA or HCFC based solvents with low pressure brush applicators is recommended. Please contact sales for further information on the suitability of various cleaning solutions.

## ENVIRONMENTAL ENDURANCE

Many of the designs manufactured by Cynergy3 Components Ltd are used in Military and Defence systems therefore many of the relay designs have been tested for Bump, Shock and Vibration endurance to the following standards:-

Bump Test: EN60068-2-29:1993 (Or Equivalent), 40g 6ms Pulse Duration

Shock Test: MIL-STD-202G (Or Equivalent), 100g 6ms Pulse Duration

Vibration Test: MIL-STD-202G (Or Equivalent), 20g 5-500-5Hz

Please contact sales for any particular requirements. Alternatively Cynergy3 can arrange product testing to other MIL, DEFSTAN or IEC standards with various third party test houses for specific applications.