Sensata Technologies

SENSATA | CYNERGY3 REED RELAYS SELECTION GUIDE

cynergy3™

Sensata | Cynergy3 Reed Relays are compact, hermetically sealed switch modules that offer exceptional performance for high voltage isolation from DC to 30MHz high-frequency RF switching applications. Each relay contains a magnetically actuated reed switch – a pair of ferromagnetic contacts sealed in a glass capsule – and an excitation coil. This simple construction results in fast switching speeds and high reliability that often outperform conventional electromechanical relays. Sensata's Cynergy3 line leverages proprietary reed switch technology (using specialty contact materials like copper, rhodium, and tungsten) to achieve precise, durable operation. The result is a family of relays that can provide up to 15 kV DC isolation and reliably switch delicate RF signals with very low contact resistance.

Reed relays offer several advantages in demanding applications. They feature extremely high insulation resistance, with low leakage Current even at high voltages. The sealed reed switch contacts are immune to dust, moisture, and other contaminants, ensuring stable performance over a long lifetime. Milliseconds switching speeds are achievable – reed switches switch much faster than larger armature-style relays – with no bouncing or complex moving parts. Additionally, their small size and coil power efficiency make them suitable for dense, power-sensitive designs. Sensata | Cynergy3 has developed both High Voltage (HV) reed relays and Radio Frequency (RF) (also called High Frequency, HF) reed relays to address a wide range of industry needs.

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APPLICATIONS

Reed relays are utilized across numerous industries that demand either high-voltage switching or RF signal routing (often both). Key application areas include:

Medical Devices: Used in life-saving equipment like cardiac defibrillators and electrosurgical generators to isolate and discharge high-voltage pulses safely. Also found in diagnostic and imaging systems (e.g. MRI, EEG) where, high-voltage DC to MHz signals must be switched with low leakage current.

Test & Measurement: Ideal for semiconductor testers, automated test equipment (ATE), insulation resistance testers, and high-voltage power supply test systems. Reed relays provide the fast, reliable switching needed to route high-voltage or small signals to various test points. Reed relays can be used in electrical insulation test instruments to safely discharge devices under test.

RF Communications: Employed in RF switching matrices, antenna tuning units, and radio transmit/receive selection circuits. For example, shortwave military and commercial radios use reed relays to rapidly select inductors/capacitors in antenna tuners (facilitating frequency hopping) due to their fast actuation speed and low insertion loss.

Industrial & Power Systems: Used in high voltage industrial powers supplies generating high voltages up to 15kV and outputs frequencies from DC to MHz. Reed relays have been used to provide isolation for grid tied solar panel inverters and EV battery chargers where there high voltage isolation makes them suited to insulation monitoring, pre-charging and high voltage interlock functions.

SELECTING A REED RELAY

When selecting a reed relay for a specific application engineers must evaluate several key parameters from the data sheet to ensure the device meets the needs of the application and application environment.

Contact configuration describes the switching action of the electrical contacts when the actuation coil(s) of the reed relay are energised with the required voltage.

Form A: Most reed switches are single pole single throw normally open contact devices [1 SPST N/O] or Form A configuration. In the deenergised state the reed switch contacts are open. When the actuation coil is energised then the reed switch contacts commutate from open-to-closed condition. De-energising the actuation coil cause the reed switch contacts to open.

Form B: Single pole single throw normally closed contact devices [1 SPST N/C]. In the deenergised state the reed switch contacts are closed. When the actuation coil is energised then the reed switch contacts commutate from closed-to-open condition. De-energising the actuation coil causes the reed switch contacts to close.

Form C: Single pole double throw normally break-before-make contact [1 SPDT]. In the deenergised state the common contact makes with the normally closed contact. When the actuation coil is energised then the common contact commutates from the normally closed contact to make with the normally open contact. De-energising the actuation coil causes the reed switch contacts to switch from the normally open contact to the normally closed contact.

Form L: Single pole single throw Bi-Stable contact devices [1 SPST Bi-Stable] or Latching contact. Bi-Stable or Latching contact relays hold their contact state in the de-energised condition. Pulse energising the SET coil will commutate the contact Open-to-Closed state. Pulse energising the RESET coil will commutate contacts from Closed-to-Open state.

Maximum switching power is the maximum power the reed switch contacts can switch reliably. It is typically stated in Watts DC resistive load. Any voltage or current switched, when multiplied together must not exceed the maximum switching power of the relay contact. Neither can the switched voltage or switched current exceed their maximum specified values. Lower switching power will typically result in higher endurance of the reed switch contacts.

Maximum switching voltage is the maximum load voltage the reed switch can switch. This voltage value must not be exceeded in general application, or the relay performance can be negatively impacted. Switching voltages greater than 30 Vdc will create an arc, arcing can lead to contact erosion and reduced lifespan of the switch contacts.

Maximum switching current is the maximum load current the reed switch can switch. This current value must not be exceeded in general application, or the relay performance can be negatively impacted.

Wetting current is the switching current required to ensure reliable contact operation typically a minimum switching current of 5mA will ensure reliable contact operation. For zero volts switching applications it is recommended the relay contacts periodically switch a suitable wetting current to maintain reliable contact operation.

Maximum carry current is the maximum current allowed when the contacts are already closed. The relay contacts must not open whilst carrying maximum carry current as this will result in damage to the relay and or equipment. Exceeding the maximum carry current can result in welded or sticking contacts.

Dielectric strength / isolation voltage is minimum voltage the relay can withstand. It is stated with respect to open reed switch contacts, between sets of reed switch contacts, from reed switch contacts to relay coil(s) with or without electrostatic screen circuits.

Insulation resistance is the resistance between electrically isolated parts of the relay. Typically measured at 500V dc.

Coil voltage Sensata | Cynergy3 reed relays are typically available with 5 Vdc, 12 Vdc and 24Vdc coil voltages. Ensure the drive circuit can provide the required coil power to actuate the relay across the expected operating temperature range. The drive circuit may also need to incorporate relay coil back EMF protection. For battery powered or low power consumption applications consider using latching contact Form L reed relays.

Environmental conditions should always be considered carefully. Operating temperature range, humidity, shock and vibration requirements need to be carefully considered. The simple structure of the reed switch and relatively low mass of reed relays can be an asset in vibration environments. However, users need to make sure the relays are mounted securely with adequate shock mounts on the PCBA.

RF REED RELAY CERTIFICATIONS AND STANDARDS

Sensata | Cynergy3 reed relays are manufactured and tested to adhere to industry standards and environmental compliance:

UL: Many of the high-voltage reed relays are UL recognised investigated under UL 508. Users can look for the "UL" mark in the product datasheets or consult UL file number E134514.

Compliance: Product declarations of conformity for RoHS, REACH and Conflict Minerals Reporting are available on request from support@sensata.com.

ISO 9001: Sensata Technologies operates ISO 9001 certified facilities, so the reed relays are produced under a documented quality management system. This ensures consistency in manufacturing, rigorous testing, and traceability of materials and processes. Customers can expect a high level of quality control, resulting in reliable field performance and low part-to-part variation.

Environmental testing: Some models have been tested for shock and vibration testing in accordance with military standard MIL-STD-202 for aerospace and defence applications.

PRODUCT FAMILIES

Sensata | Cynergy3 portfolio of reed relays can be categorized into two families based on their primary application focus: High Voltage (HV) Reed Relays and Radio Frequency (RF) Reed Relays. Both families share the fundamental reed technology and quality, but each is optimized for a different application.

HIGH VOLTAGE REED RELAYS (HV REED RELAYS)

High voltage reed relays are designed for high voltage operation from DC to 60Hz AC and can switch or isolate high-voltage circuits safely and reliably. They utilize special high-vacuum reed switches with durable contact materials to achieve standoff voltages in the kilovolt range. For example, Sensata's D series reed relays can provide 10 kV to 15 kV DC isolation by using encapsulated vacuum reed switches with either rhodium or tungsten plated contacts. These materials and construction allow the relay to withstand high potential differences with virtually zero leakage, which is critical in applications like defibrillators (to hold off the charging voltage until discharge) and high-voltage power supplies or HV test equipment.

High voltage reed relays are typically encapsulated in either Silicone RTV or Epoxy resin, terminal position is carefully observed to optimise clearance distances between terminations. The relay packages may provide external high-voltage connection options (such as flying lead outputs, solder turrets, or spade terminals) to ensure the high voltage is safely routed, some designs offer electromagnetic screening to help collocating relays together. Despite their high-voltage capability, these relays still offer relatively low contact resistance when closed, so they can carry currents of an ampere or more without excessive losses. However, the permissible switching current/voltage is limited by the contact's power rating – users must design within the relay's maximum switching power limits.

	Series / Type	Contact Form	Isolation Voltage (kV DC)	Max Switching Voltage (DC)	Max Carry Current (A)	Typical Lifetime (operations)
	**S Series (Mini HV Reed)**	SPST-NO (Form A)	5 kV	~100 V @ 0.1 A (10 W)	0.5 A (1 A max surge)	10^9 (dry switching); 10^8 at 10 W load
	**D Series (High Voltage)**	SPST-NO (Form A) (SPST-NC available in sub-series)	10 kV or 15 kV	~500 V @ 0.1 A (50 W)	2-3 A (steady state)	10^7 10^8 at full load; 10^9 no-load
	**DB Series (HV, Normally Closed)**	SPST-NC (Form B)	5 kV, 7.5 kV, or 10 kV (varies by model)	~200 V @ 0.05 A (10 W)	0.5 A	10^7 @ 10 W (NC contacts have slightly reduced life due to magnet bias)

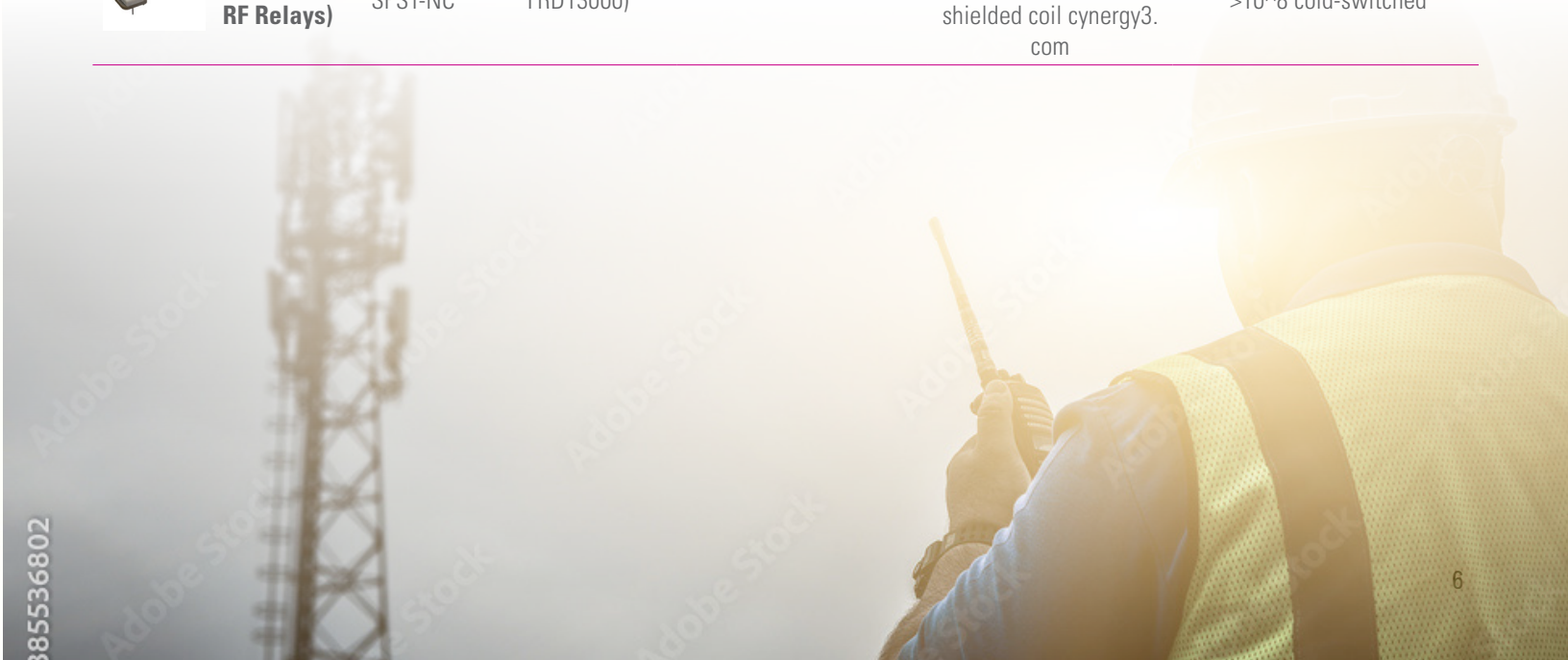
RF REED RELAYS (HIGH-FREQUENCY REED RELAYS)

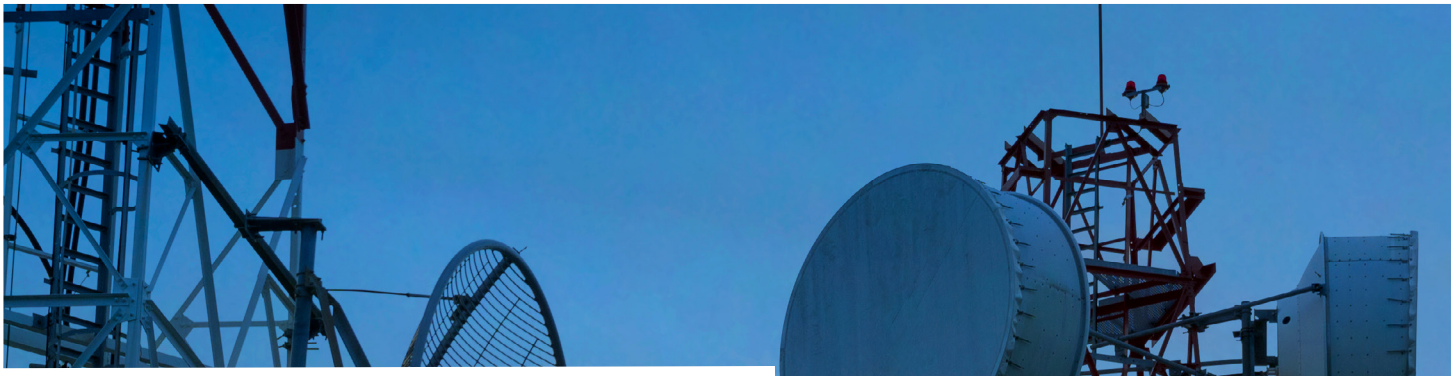
Radio Frequency (RF) reed relays share the same fast switching speeds of high voltage reed relays, but they are designed for high voltage operation from DC up to 30MHz [HF Band] radio frequencies. They typically use a Cynergy3 copper plated reed switch with rhodium contacts, the rhodium offers a durable low and stable contact resistance whilst the copper plating enhances the reed switch current carrying capabilities up to 30MHz. Most RF applications do not require the relays to hot switch or only hot switch the relays at low power to ensure long contact life.

RF Reed relays are constructed from electrical insulation materials with low dielectric constant and often incorporate geometry designed to minimise RF parasitic capacitance losses. Parasitic capacitance losses are further reduced by incorporating a partial or full electrostatic screen around the coil assembly, some designs may also incorporate an electromagnetic screen as well to help collocate reed relays near each other. Designs with a fully screened (electrostatic) coil assembly will exhibit the lowest RF losses as contact to coil capacitance will be minimised.

RF Reed relays are used in short wave radio communications circuits typically antenna couplers and harmonic filters. They are also utilised in radio frequency power generators such as those used for MRI scanners.

Series / Type	Contact Form	Isolation Voltage (DC)	Max Carry Current @ RF	RF Shielding	Typical Lifetime (operations)
 **4 & 6 Series (Mini RF Relays)**	SPST-NO (Form A)	~3.5 kV	3.5 A (4 Series) 4 A (6 Series) @ 30 MHz	4: Partial coil shield 6: Full shielding	10^7 10^8 (at rated RF load) >10^9 (cold switched low level)
 **FRS Series (High Current RF)**	SPST-NO (Form A)	2 kV (up to 3 kV on some models)	5 A @ 30 MHz (uses dual reeds in parallel)	Partial shielding (open-frame or covered options)	10^7 typical (at 5 A RF), higher at lower stress
 **FRD Series (HV RF Relays)**	SPST-NO or SPST-NC	8 kV (up to 9 kV on FRD13000)	6 A @ 30 MHz	FRD12000: Partial (open frame) FRD13000: Full shielded coil cynergy3.com	10^7 10^8 (rated load) >10^8 cold-switched





ABOUT US

Sensata Technologies is one of the world's leading suppliers of sensing, electrical protection, control and power management solutions with operations and business centers in twelve countries. Sensata's products improve safety, efficiency and comfort for millions of people every day in automotive, appliance, aircraft, industrial, military, heavy vehicle, heating, air-conditioning and ventilation, data, telecommunications, recreational vehicles and marine applications. For more information, please visit the Sensata website.

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