

HIGH VOLTAGE RELAYS SELECTION GUIDE

GIGAVAC

**We take pride in
knowing that our
technologies improve
safety, efficiency and
comfort for millions of
people every day**

For more than 100 years, we have provided a wide range of customized, sensor-rich solutions that address complex engineering requirements to help customers solve difficult challenges in many industries.

Our solutions help make products safer, cleaner, and more efficient and connected.

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Latching Bi-Stable Relays

GIGAVAC



High Voltage (HV) Relays from Sensata | Gigavac are critical components in electrical systems where the reliable switching of high-voltage circuits is required. These relays serve diverse industries, including power distribution, telecommunications, automotive, and medical equipment. They are essential in situations that demand high precision, longevity, and robust performance under extreme conditions.

HV relays are designed to handle significant power loads, offering efficient switching capabilities while ensuring electrical isolation. With a broad range of voltage and current ratings, coil configurations, and contact arrangements, Sensata's HV relays provide versatile solutions for both standard and custom applications. Whether switching high-power loads in industrial automation or protecting sensitive equipment in medical devices, these relays are designed to meet and exceed stringent performance requirements.

HIGH VOLTAGE RELAYS ARE IDEAL FOR A WIDE RANGE OF APPLICATIONS, INCLUDING:

Medical Devices and Equipment: MRI machines, defibrillators, and X-ray systems.

Power Management: Solar inverters, load switching systems, and grid management.

Test Equipment : Semiconductor test equipment, high voltage PSUs

Telecommunications: Signal routing and network protection.

Industrial Automation: Heavy machinery and factory control systems.

Sensata's team has decades of experience in handling high-voltage relay applications. Review the variety of application notes available on our website or reach out to our field application engineers to evaluate the best solution for your application.

CONSIDERATIONS FOR PRODUCT SELECTION

MAIN PARAMETERS

When choosing an HV relay, several factors need to be considered:

- **Voltage and Current Ratings:** Ensure that the relay meets the voltage and current requirements of your system.
- **Contact Configuration:** Choose between SPST, SPDT, DPDT or latching based on your switching needs.
- **Switching Speed:** Consider the required response time for your application.
- **Mounting Options:** Select the appropriate mounting style, such as flange, panel mounts or PCB.
- **Environmental Conditions:** Ensure the relay can operate in the specific temperature range and environmental conditions required.

RATINGS BY CONTACT FORM

Contact Form	SPST	SPDT	DPDT	Latching Bi-Stable
Voltage Ratings (kV)	5-75	6-70	10-25	17-75
Current (Amps)	10-150	10-50	10-150	10 - 50
Coil Voltage Options (V)	12, 26.5, 115	12, 26.5, 115	12, 26.5	12, 26.5, 115
Applications	Power distribution, industrial control	Telecom, automation	High power RF, control circuits	Low power consumption, secure switching

Descriptions:

- **SPST (Single Pole Single Throw):** Suitable for applications requiring straightforward ON/OFF switching with high power capabilities. Available with voltage ratings ranging from 5 kV to 75 kV and currents up to 150 Amps.
- **SPDT (Single Pole Double Throw):** Allows switching between two circuits, making it ideal for telecommunications and data routing. Rated for up to 70 kV and currents up to 50 Amps.
- **DPDT (Double Pole Double Throw):** For applications needing simultaneous switching of two independent circuits, often found in RF systems. Rated up to 25 kV and 150 Amps.
- **Latching Bi-Stable:** These relays maintain their state without continuous power, reducing energy consumption. Available up to 75 kV, providing versatile switching options for secure, energy-efficient operation.

MOUNTING OPTIONS AND ACCESSORIES

We offer a variety of mounting solutions to suit different applications:

- **PCB Mount:** Securely attaches circuit boards for compact, stable installations.
- **Standard Flange Mount:** For versatile and secure installations.
- **Threaded Panel Mount:** Provides a stable, secure fit in high-vibration environments.
- **Flying Leads:** Flexible, high-voltage connections for ease of use.



MATERIAL SPECIFICATIONS

Our HV relays are built using high-quality materials to ensure durability and performance:

- **Contacts:** Tungsten, Molybdenum/Tungsten for enhanced conductivity and longevity.
- **Housing:** Encapsulated designs using unglazed ceramics for robust insulation.
- **Terminals:** Solderable connections, with options for flying leads or threaded connections for flexible installation.

ACCESSORIES

- **Spare coils:** Replacement coils for maintaining operational efficiency and reducing downtime in electronic systems.

CUSTOM ENGINEERED SOLUTIONS

We offer custom-engineered solutions for clients with specific requirements that standard products may not meet. Our team can tailor HV relays to match particular operational, environmental, or mechanical conditions. From modified contact materials to custom housing designs, we ensure that our solutions align perfectly with your needs.

DIELECTRIC MATERIALS

Sensata is the established leader in the design and manufacture of sealed relays and contactors. Sealing is critical in preventing contamination from polluting the internal parts of any component.

The two dielectric materials used throughout our high-voltage product offering today are vacuum and gas.

Vacuum as a Dielectric

The styles of High Voltage Relays manufactured by Sensata were initially intended for use in high power RF circuits. The relays were to be as small as possible, have low RF losses, have good dielectric isolation at the rated RF voltage, and be able to operate at various altitudes and in harsh environments.

The dielectric strength of vacuum is about 8 times greater than air. And because there is no oxidation in a vacuum, low resistance copper contacts can be used, allowing the relay to carry significantly more current than traditional open-air relays.

These small vacuum relays quickly gained acceptance and new applications. Many of these applications required additional load switching capability. In order to accommodate the larger loads, relay designs were changed to include versions with harder contact materials such as molybdenum and tungsten.

Gas as a Dielectric

As High Voltage Relays became more popular, other applications developed which took advantage of the hard contact materials. These applications include high in-rush capacitive make and capacitive discharge such as those found in ESD test equipment, cable test equipment, heart defibrillators, and for applications where no high voltage is applied for long periods of time where low and or stable leakage current is needed. In High Voltage Relays a mixture of sulfur hexafluoride, SF6, and nitrogen is used, primarily because of the way the gas performs during switching. SF6 is an excellent insulator but once the switch is closed if the relay bounces the SF6 becomes easily ionized and carries the arc current. This makes the relay electronically 'bounceless' and dramatically reduces contact wear.

Sensata also provides custom gas mixes for special applications.

RELAY SCHEMATIC AND FORM

The following are industry accepted relay schematics and forms that Sensata uses for most of its relays.

Shown are:

- Single Pole Single Throw – Normally Open (SPST-NO) Form A
- Single Pole Single Throw – Normally Closed (SPST- NC) Form B
- Single Pole Double Throw (SPDT) Form C
- Double Pole Double Throw (DPST-NO) 2 Form C
- 4 Pole Double Throw (DPDT) 4 Form C
- Single Pole Single Throw (SPST) Latching Form P
- Single Pole Double Throw (SPDT) Latching Form R
- Single Pole Single Throw – Normally Open (SPST-NO) Double Make Form X
- Single Pole Single Throw – Normally Closed (SPST-NC) Double Break Form Y

High Voltage and Power Terminal designations are:

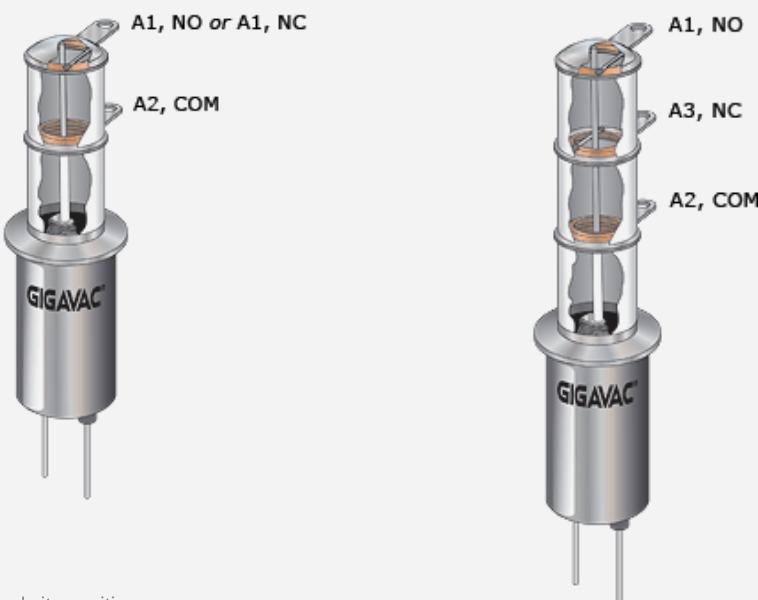
- Terminal 1 is Normally Open (NO)
- Terminal 2 is the moving contact (sometimes called Common)
- Terminal 3 is Normally Closed (NC)

Coil terminals designations are as follows (Coils of Sensata relays are not polarity sensitive unless otherwise noted):

- X for non-latching relays
- X and Y for Latching relays

For specific terminal locations on diaphragm style relays, refer to Figure 7 below

Fig. 7



Coil is not polarity sensitive

SPST-NO (make)	SPST-NC (break)	SPDT (break-make)
Form A	Form B	Form C
DPDT (break-make)	4PDT (break-make)	SPST (latching)
Form 2C	Form 4C	Form P
SPDT (latching)	SPST-NO (double-make)	SPST-NC (double-break)
Form R	Form X	Form Y

PRODUCT SERIES

SPST (SINGLE POLE SINGLE THROW)

SPST relays are the simplest type of relay configuration, consisting of a single input and a single output. They are often referred to as "On/Off" switches because they control a single circuit and can only be in two states: connected or disconnected. This configuration is ideal for straightforward switching tasks where high power capabilities are needed. SPST relays are commonly used in applications requiring robust, direct control over a circuit, such as industrial power systems, motor control, and lighting systems.

Key Features:

- Simple and efficient switching mechanism
- High current-carrying capacity
- Ideal for straightforward control tasks

Image						
Series Grouping	G41	G43	G47	G81	G3X	G71, G6X
Contact Form	A,B	A,B	A,B	A,B	X,Y	A,B
Isolation Voltage (kV)	5	10	10	10	25	25, 35, 40, 55, 75
Continuous Current (Amps)	30	25	25	10	15	10, 18
Operate Time (mS)	10	10	10	10	18	20
Release Time (mS)	10	10	10	10	20	15
Coil Voltage Options (Vdc)	12, 26.5, 115	12, 26.5, 115	12, 26.5, 115	12, 26.5, 115	12, 26.5, 115	12, 26.5, 115
Temperature Range (°C)	-55 to +125	-55 to +125	-55 to +125	-55 to +85	-55 to +125	-50 to +85
Approval/Standards	MIL-R-83725	MIL-R-83725	MIL-R-83725	MIL-R-83725	MIL-R-83725	MIL-R-83725
Mount Type Options	3-hole Flange, Std Flange	3-hole Flange, Std Flange	3-hole Flange, Std Flange	PC Board, Panel Mount	Through Panel	Threaded
Available Options	Meets MIL-R-83725	RF Efficient, High Power Handling	High Power Handling	PCB and Panel Mount Versions	Gas Dielectric, Hi-inrush	Compact design, HV wire leads, Flying Leads, Turret Terminal

SPDT (SINGLE POLE DOUBLE THROW)

SPDT relays (Changeover) allow a single input to be connected to one of two outputs. This configuration enables switching between two circuits, making it more versatile than SPST relays. SPDT relays are ideal for applications where alternate routing of signals or switching between two power sources is required, such as in telecommunications, automation systems, and automotive switching. With three connection terminals—Common (COM), Normally Open (NO), and Normally Closed (NC)—SPDT relays can alternate the connection between NO and NC contacts.

Key Features:

- Versatile switching between two circuits
- Ability to toggle connections between normally open and normally closed terminals
- Suitable for signal routing and control applications

Image									
Series Grouping	GH	G4X	G81C	GX, G1X	G9	G25	G5X	G71C, G6X	G60C
Contact Form	C (SPDT)	C (SPDT)	C (SPDT)	C (SPDT)	C (SPDT)	C (SPDT)	C (SPDT)	C (SPDT)	C (SPDT)
Isolation Voltage (kV)	5,10	6,11	11	17	22	27	30	30, 40, 55, 75	40
Continuous Current (Amps)	8,15,18,25	20, 25, 30	5 (PCB Pins), 10 (Flying Leads)	12, 30, 50	75	18	110, 150	10, 18	12
Operate Time (mS)	6	10	10	15	30	15	100	15, 20	15
Release Time (mS)	6	10	10	9	8	15	15	15	15
Coil Voltage Options (Vdc)	12, 26.5, 115	12, 26.5, 115	12, 26.5, 115	12, 26.5, 115	12, 26.5	12, 26.5, 115	12, 26.5	12, 26.5, 115	12, 26.5, 115
Temperature Range (°C)	-55 to +125	-55 to +125	-55 to +85	-55 to +125	-55 to +125	-55 to +125	-55 to +125	-50 to +85	-55 to +125
Approval/Standards	MIL-R-83725	MIL-R-83725	-	-	-	-	-	-	-
Mount Type Options	Any	3-Hole Flange, Std Flange	PCB Mounting	Solder Pot, Screw	Screw	Solder Pot, Screw	Through Panel, Flange	Threaded	Through Panel, Flange
Available Options	Solder, Threaded, Jam nut mounting, Mounting options in any axis, Short compact design, Solder connections, Tungsten Contacts	Solder, Turret Terminal, 3-Hole Flange, Std Flange	PCB, Flying Leads	Through Panel, Flange	Flange	Through Panel, Flange	Screw, Flange	Flying Leads, 12"/36"/72"	Solder, Screw

DPDT (DOUBLE POLE DOUBLE THROW)

DPDT relays are essentially two SPDT relays in one package, enabling two independent circuits to be switched simultaneously. This makes DPDT relays perfect for applications requiring the control of two separate circuits, such as in RF systems, dual-channel signal switching, and certain types of automation equipment. Each pole can switch between two terminals, providing more control and flexibility in complex systems.

Key Features:

- Dual circuit switching in a single unit reduces size
- Ability to control multiple lines or channels simultaneously
- Commonly used in RF applications and complex switching scenarios

Image				
Series Grouping	G12	GXSPD	G2X	G53
Contact Form	2C (DPDT)	2C (DPDT)	2C (DPDT)	2C (DPDT)
Isolation Voltage (kV)	10	17	23	25
Continuous Current (Amps)	10	12, 30, 50	30, 75	150
Operate Time (ms)	15	20	30	100
Release Time (ms)	9	8	10	15
Coil Voltage Options (V)	12, 26.5, 115	12, 26.5	12, 26.5	26.5
Temperature Range (°C)	-55 to +125	-55 to +125	-55 to +125	-55 to +125
Approval/Standards	-	-	-	-
Mount Type Options	Through Panel, Flange	Through Panel, Flange	Through Panel, Flange	Threaded
Available Options	Solder Tab, Through Panel	Solder Pot, Screw	Screw, Flange	Screw, Flange

LATCHING BI-STABLE RELAYS

Latching or Bi-Stable relays maintain their switched state without continuous power to the coil, making them energy-efficient compared to standard relays. They remain in their last position (either open or closed) until an external signal is provided to change the state. This feature is particularly useful in systems where energy savings are critical, such as battery-powered equipment, emergency lighting, and automated systems where relays need to retain their state in the event of a power failure.

Key Features:

- Maintains position without continuous power
- Reduces energy consumption, ideal for battery-powered devices
- Holds state even during power interruptions, ensuring reliability

Image			
Series Grouping	GX, G60	G13	GXL
Contact Form	C	2C	A,C
Isolation Voltage (kV)	17, 40	17	30, 40, 55, 75
Continuous Current (Amps)	12, 30, 50	10	10, 18
Latch Time (ms)	15	15	15, 20
Reset Time (ms)	9,15	9	15
Coil Voltage Options (V)	26.5	26.5	26.5
Temperature Range (°C)	-55 to +125	-55 to +85	-55 to +85
Approval/Standards	-	-	-
Mount Type Options	Through Panel, Flange	Through Panel, Flange	Through Panel, Flange
Available Options	Solder Pot, Screw	Flying Leads, Flange	Flying Leads, Threaded, 12"/36"/72"

SENSATA HIGH VOLTAGE RELAYS - FREQUENTLY ASKED QUESTIONS (FAQ)

Q1: What is the typical operational lifespan of Sensata's high-voltage relays?

A: The operational lifespan varies depending on the model and usage, but Sensata relays are designed for high durability with reliable switching cycles.

Q2: What are the recommended maintenance practices for Sensata high-voltage relays?

A: Regularly inspect for physical damage, ensure clean contacts, and follow proper soldering techniques to prevent ceramic seal damage.

Q3: How do I determine the most suitable relay for my application?

A: Consider voltage and current ratings, contact configurations, dielectric material (vacuum or gas), and environmental conditions relevant to your application.

Q4: Are there recommended mounting options for relays installed in high-vibration environments?

A: For high-vibration environments, flange or threaded panel mounting options provide secure and stable installation.

Q5: Do Sensata high-voltage relays come with detailed installation manuals?

A: Yes, detailed installation manuals and guidelines are provided to ensure proper mounting, soldering, and handling of relays.

Q6: What are the lead times for standard and custom-engineered relay orders?

A: Lead times vary based on order volume and customization, but standard relays generally have shorter delivery schedules compared to custom-engineered solutions.

Our distributors maintain inventory of standard models and can often deliver within 24 hours.

Q7: Can Sensata relays be stored for extended periods, and what are the storage requirements?

A: Yes, relays can be stored long-term under dry conditions with controlled temperature and humidity to maintain integrity.

Q8: What is the difference between vacuum and gas dielectric relays?

A: Vacuum relays offer superior dielectric strength and low resistance, while gas dielectric relays handle high in-rush currents and reduce contact wear.

Q9: Are spare parts or replacement components available for Sensata relays?

A: Yes, replacement coils are available for select relay models.



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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