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Automotive Relay Terminology Explanation and Users Guide

KKA

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Basic Terminology of Relays

Contact parameters

01 Contact type and code

Common contact types include normally open (H/NO), normally closed (D/NC), changeover (Z/CO), double-operated open (SH/2NO), and double-operated closed (SD/2NC). Their Chinese and international codes differ, so it is important to distinguish between them.

02 Contact resistance and voltage drop

Contact resistance refers to the total resistance of the contacts, springs, and leads, and is measured using the voltage drop method. The test current under a 1A load is 1A 6VDC. Contact voltage drop is the total voltage drop in the load circuit, such as 50mV (measured at 10A).

03 Contact material and load parameters

Contact materials commonly used include AgSnO□ . AgSnO□ has good anti-adhesion properties and low material transfer, making it suitable for various loads. The rated load of the contacts is expressed as a combination of voltage and current. Exceeding the maximum switching voltage/current limit will shorten the lifespan, and the maximum continuous current is affected by the ambient temperature.

Performance parameters

Insulation and electrical properties

Insulation resistance is measured by applying 500Vd.c between unconnected conductive parts and is expressed as "MΩ"; dielectric withstand voltage refers to the voltage when the leakage current is <1mA within a specified time, and is generally the AC effective value.

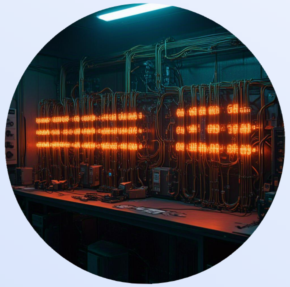
Time and environmental parameters

The operating time is the time from when voltage is applied to the coil to when the contacts switch; the release time is the time from when the coil is de-energized to when the contacts reset; and the bounce time is the time from when the contacts first switch on and off to when they finally stabilize. All of these times are measured in milliseconds. The ambient temperature range, coil temperature rise (in "K"), and humidity (%RH) directly affect the reliability of the relay.

Mechanical and structural properties

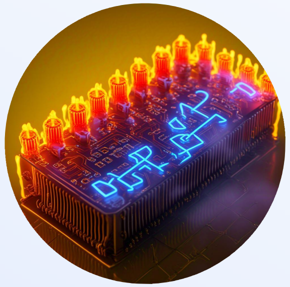
Impact is categorized into stability (acceleration m/s^2 and duration ms) and intensity; vibration is categorized into stability (acceleration m/s^2 and frequency Hz) and intensity; lead-out types include PCB, through-hole (ISO/280 series), and hard connection; packaging methods include open type, dust cover type, etc., and different packaging provides different protection performance.

Coil parameters



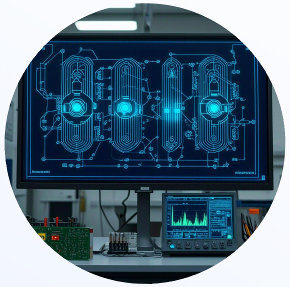
Basic electrical parameters

Rated coil power is the power consumption (W) when the rated voltage is applied. Rated voltage is the voltage required for normal operation (V). For polarized relays, attention must be paid to the voltage directionality. The operating voltage (maximum value) causes the relay to operate, and the release voltage (minimum value) causes the monostable relay to release.



Resistance and voltage limits

The coil resistance is a DC resistance (Ω), and the coil equivalent resistance is the lead resistance (Ω) after parallel connection of the anti-peak suppression element; the maximum allowable voltage is the maximum voltage that the coil can withstand within a certain time. Exceeding the limit will cause overheating and burnout.



Impact on relay operation

The coil parameters determine the relay's sensitivity and stability. For example, if the operating voltage is too high, it may not operate when the power supply fluctuates. If the coil resistance is out of tolerance, it will affect the power consumption. The maximum allowable voltage limit needs to be matched with the circuit design to avoid coil damage.

Order markings and outline drawings, etc.

Order marking information

The order markings include basic information such as product model, coil voltage, contact type, and packaging method. For example, in KKAV4-0121Z23, 012 indicates 12VDC, 1Z indicates a set of changeover contacts, and 23 indicates that the lead material is brass + copper.

Outline drawing and installation dimensions

The outline drawing shows the installation space dimensions, the wiring diagram shows the principle wiring method, and the mounting hole dimensions indicate the position and diameter of the lead-out end; the drawings are generally drawn using the first angle method, and the standard conditions are temperature 23℃±5℃, humidity 25%-75%RH, and atmospheric pressure 86kPa-106kPa.

Relay Types and Performance Curves

A monostable relay operates when its coil is energized and resets when the energizer is de-energized; a magnetic latching relay retains its state after energization and requires reverse energization or coil reset; the contact state of a polarized relay depends on the voltage polarity. Performance curves include the maximum load curve and the continuous coil voltage curve, reflecting the operating capability under different conditions.

02

Relay Selection Principles

Key Points for Contact Selection

Contact load: size and type matching

The voltage and current combination and type (resistive, inductive, capacitive, etc.) of the load need to be determined. For example, resistive loads include seat heaters, inductive loads include cooling fans, and capacitive loads include headlights and taillights. Different loads have a significant impact on contact materials and durability.

Contact type: Circuit function adaptation

Choose from normally open (H/NO), normally closed (D/NC), or changeover (Z/CO) forms according to circuit requirements. For example, a single changeover contact (1Z) is suitable for scenarios that require circuit switching, while a double-acting contact (SH/2NO) can meet the requirements of multi-load synchronous control.

Maximum continuous current and operating time

The switching frequency and duty cycle need to be considered to avoid exceeding the maximum continuous current allowed by the relay (the value varies under different ambient temperatures). For example, when switching high-current loads at high frequency for a long time, a current margin should be reserved to prevent overheating.

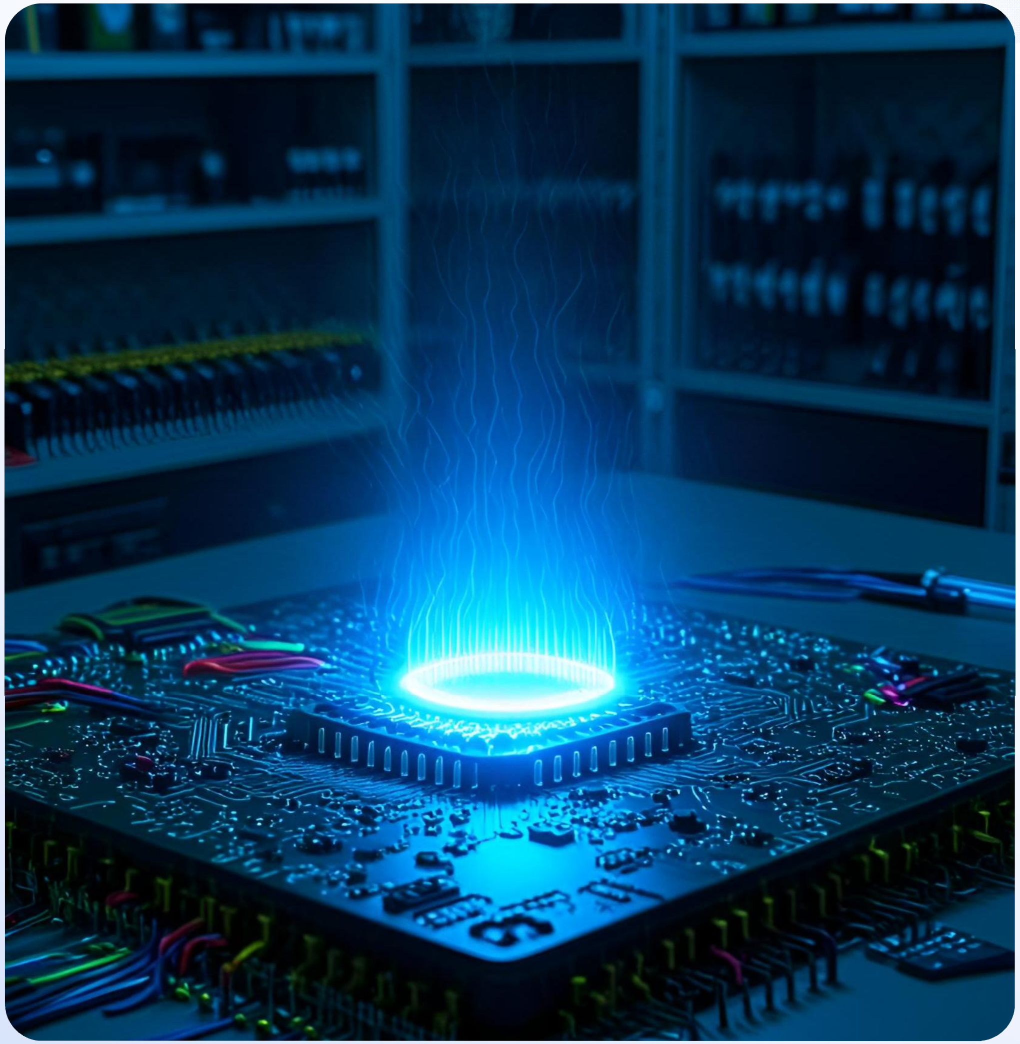
Electrical durability and contact material selection

Electrical durability is affected by load type and environmental factors. For example, AgSnO□ contacts have excellent anti-welding and material transfer properties, making them suitable for lamp loads and inductive loads; AgNi 0.15 contacts have good conductivity and are suitable for resistive loads; special AgSnO□ can be used for high-impact loads such as flash lamps.

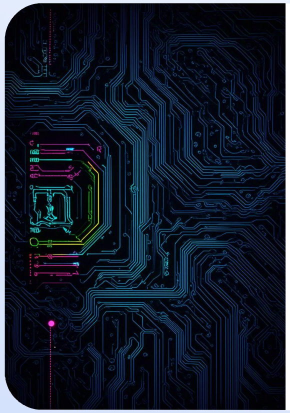
Key Points for Contact Selection

Contact resistance: Low resistance for reliable connection

Contact resistance must meet testing standards (e.g., measured at 1A 6VDC); excessive resistance may lead to abnormal voltage drop. For example, when used in high-precision control circuits, it is necessary to ensure that the contact resistance is stable within the range specified in the instruction manual (usually in mΩ).



Key points for coil selection



Rated voltage and power supply compatibility

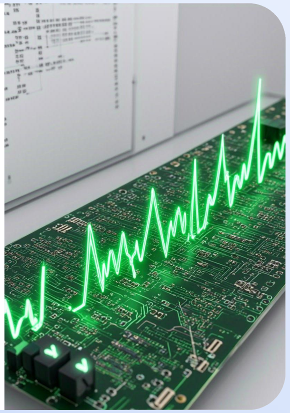
The circuit power supply voltage must be matched, such as 12VDC or 24VDC commonly used in automobiles. For polarized relays, pay attention to the voltage polarity. When the power supply fluctuates, ensure that the coil voltage is within ±10% of the rated value to avoid affecting the reliability of operation.

Coil resistance and power consumption control

The coil resistance determines the power consumption ($P=U^2/R$), and the appropriate coil should be selected based on the installation space and heat dissipation conditions. For example, in high-temperature environments, a low-power coil should be selected to avoid excessive temperature rise (coil temperature rise is usually expressed in Kelvin and must be ≤ the maximum value specified in the instruction manual).

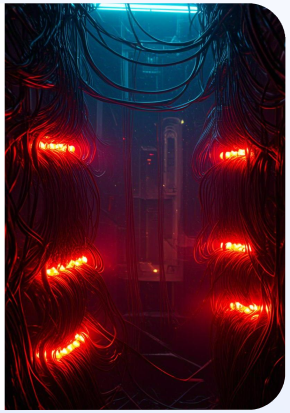
Operating and release voltages: Ensuring circuit stability

The operating voltage must be lower than the lower limit of the power supply voltage, and the release voltage must be higher than the lower limit of power supply fluctuation. For example, the operating voltage of a 12V relay is generally ≤7.2V (maximum value), and the release voltage is ≥1.2V (minimum value) to prevent malfunctions caused by power supply fluctuations.



Maximum permissible voltage and short-time overload

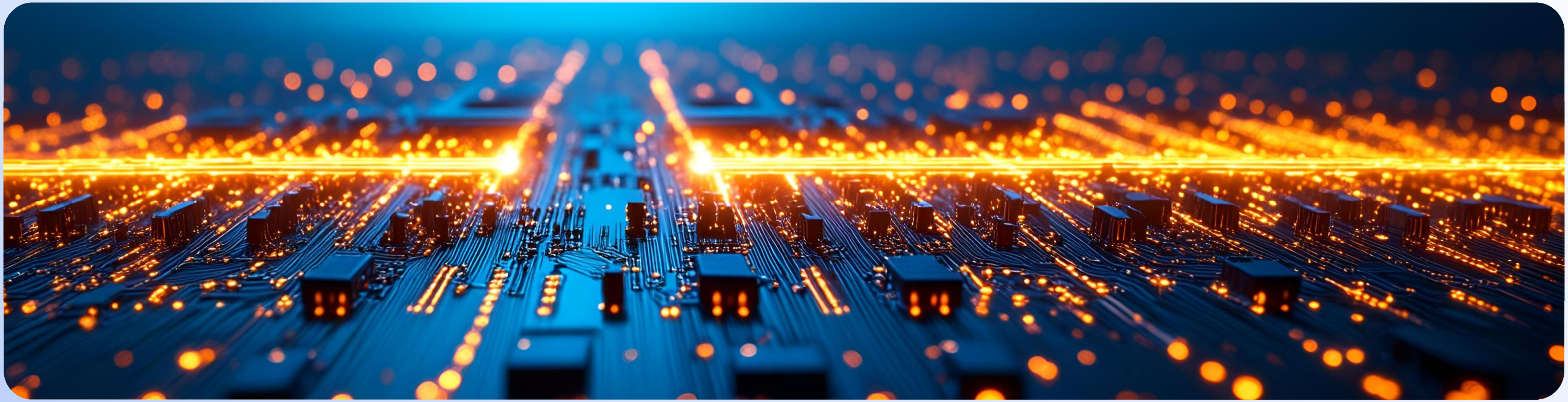
The maximum permissible voltage of the coil is the limit applied for a short period of time and must not be exceeded for an extended period, otherwise the coil will overheat and burn out. For example, a relay with a rated voltage of 12V may have a maximum permissible voltage of 16V (duration ≤ 1 minute).



Key points for coil selection

Coil reverse peak voltage: suppression and protection

When the coil is de-energized, a reverse peak voltage (up to several kV) is generated, which needs to be suppressed by a parallel diode, resistor, or varistor to avoid damaging the control components. For example, a parallel diode is recommended for PCB relays (as shown in the circuit of Figure 8(d)), and a parallel resistor is recommended for QC relays.



Key considerations for performance and environmental selection

Packaging method: Environmentally adaptable core

Open-type has no protection and is only suitable for clean environments; dust cover type and flux-proof type can prevent flux intrusion and are suitable for PCB soldering scenarios; encapsulated type has good dust and moisture protection and is suitable for humid and dusty environments such as forklifts and mines; sealed type can prevent harmful gases and is used in sulfide and organosilicon environments.

Dielectric withstand voltage and insulation resistance: Electrical safety assurance

The dielectric withstand voltage must meet the circuit insulation requirements (e.g., leakage current ≤1mA at 500V DC), and the insulation resistance is generally ≥100MΩ (500V DC). This is usually negligible for low-voltage automotive systems, but special verification is required in industrial high-voltage scenarios to prevent breakdown and short circuits.

Vibration and shock resistance: adaptable to mechanical environments

Vibration stability (e.g., 10-500Hz, $100m/s^2$) and impact strength (e.g., $1000m/s^2$, 6ms) must be matched to the usage scenario. For example, relays installed in the engine compartment need a higher vibration resistance rating to avoid failure caused by instantaneous contact disconnection.

Key considerations for performance and environmental selection

Ambient temperature and atmosphere: Coping with extreme conditions

The ambient temperature range must cover the usage scenario (e.g., -40℃ to 125℃). Derating is required at high temperatures. Sulfides (H_2S) and silicon vapors must be avoided in the atmosphere. Plastic sealing is recommended for humid environments, and additional protection is required for condensation environments.

External shape, installation and other selection criteria

External dimensions and installation clearance: Space adaptation

The installation space must be designed according to the maximum dimensions specified in the instruction manual, with sufficient clearance for heat dissipation and interference prevention. For example, PCB-type relays must match the mounting hole dimensions, and plug-in relays have lead widths of 2.8mm, 4.8mm, etc., which must be compatible with the socket.

Terminal type and installation method

PCB through-hole (THT) type is suitable for soldering and fixing, such as the HFKA series; plug-in type (ISO/280 series) such as Micro ISO is suitable for quick plugging and unplugging; hard-connect type (high current relay) requires bolt fixing. Installation methods include PCB soldering, socket insertion, screw connection, etc., with representative products such as HFV6 (plug-in type) and HFV12 (screw connection type).

Welding method: process compatibility

Recommended wave soldering temperature: (260±3)℃, time: (5±0.3)s; reflow soldering requires a high-temperature resistant model (such as HFKA-T), and ultrasonic cleaning is prohibited. For manual soldering, use a 30-60W soldering iron, with a soldering time ≤3s, and avoid coil breakage or contact sticking.

External shape, installation and other selection criteria

Security Certification and Special Needs

It must meet the certification requirements of the target market, such as UL, VDE, CQC, etc.; for special products (such as customized voltage and packaging), please contact the manufacturer. For example, relays that control the automotive steering system need to be designed with redundancy to improve the safety level.

03

Precautions for Using Relays

Precautions for contact usage

01 Avoid using the same relay to switch on and off different loads.

When switching on or off a large load, the contact debris generated can easily adhere to the contacts of a small load, leading to poor contact. Therefore, it is prohibited to use the same relay to control both large and small loads at the same time.

02 Limitations of two sets of contacts connected in parallel

Parallel connection of contacts can improve connection reliability, but it cannot increase load capacity because the two sets of contacts cannot operate in complete synchronization and cannot be used to expand load capacity.

03 Electrical durability degradation under high temperature conditions

High temperatures accelerate the wear of contact materials and significantly reduce electrical durability. In practical applications, lifespan needs to be verified under simulated high-temperature conditions, and high-temperature resistant packaging types should be given priority.

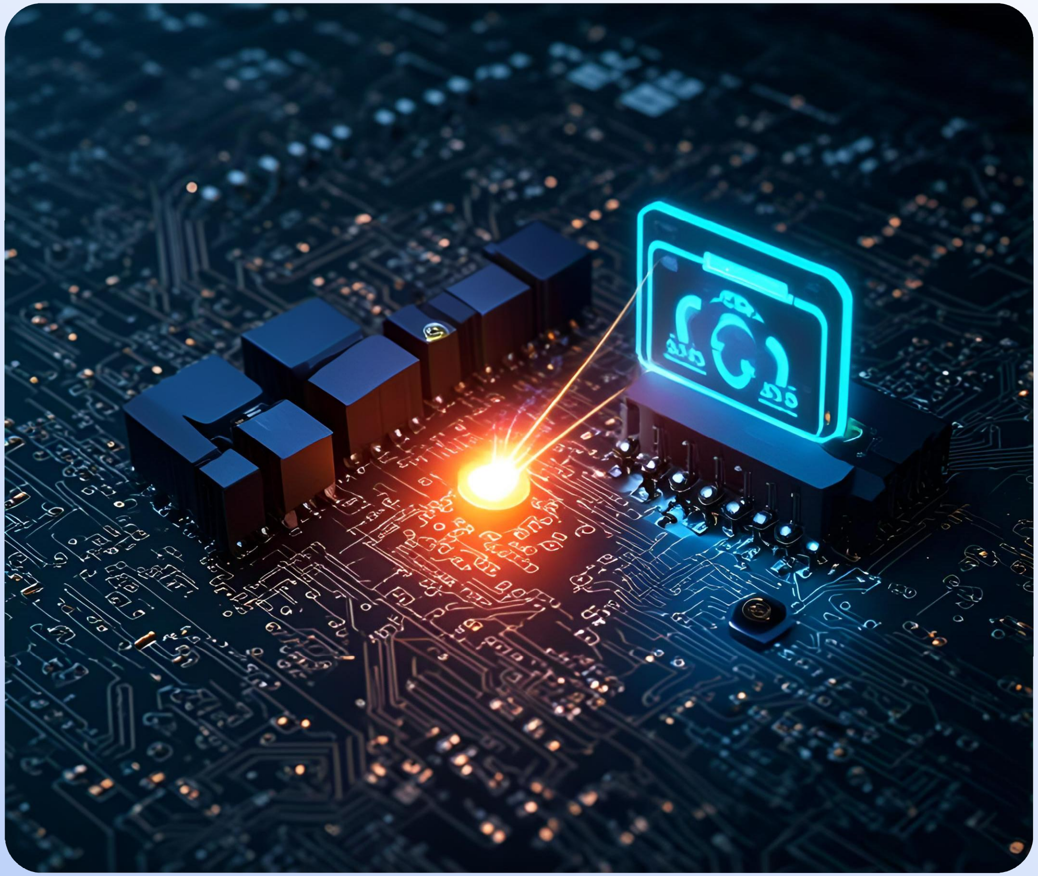
04 Wiring specifications for multiple sets of contacts and loads

Multiple sets of contacts should be connected to the same pole of the power supply, and the load should be connected to the other pole (as shown in Figure 4(a)) to avoid short circuits caused by voltage differences between the contacts. The incorrect wiring shown in Figure 4(b) is prohibited.

05 Preventing contact adhesion and arc short circuit

The contact gap is small, and short circuits caused by electric arcs must be avoided: ① The operation of the switching contacts needs to be set with an interval time (Figure 5(a)); ② It is forbidden to use two sets of switching contacts to directly control the forward and reverse rotation of the motor (Figure 5(d)). The circuit in Figure 5(c) is recommended and overcurrent should be limited.

Precautions for contact usage



Magnetic latching relay contact status management

The circuit is set to the default reset state upon leaving the factory. However, the state may change due to transportation or installation shocks. It needs to be calibrated to the required state upon power-on. Strong shocks may cause abnormal states, and the circuit needs to be designed with state monitoring and recovery mechanisms.

Contact protection measures

The hazards of inrush current and reverse voltage

When a load such as a motor or capacitor is connected, an inrush current several times the steady-state current is generated. When an inductive load is disconnected, a reverse voltage of hundreds to thousands of volts is generated. Both of these will aggravate contact wear and significantly shorten the lifespan.

Contact material transfer phenomenon and mitigation

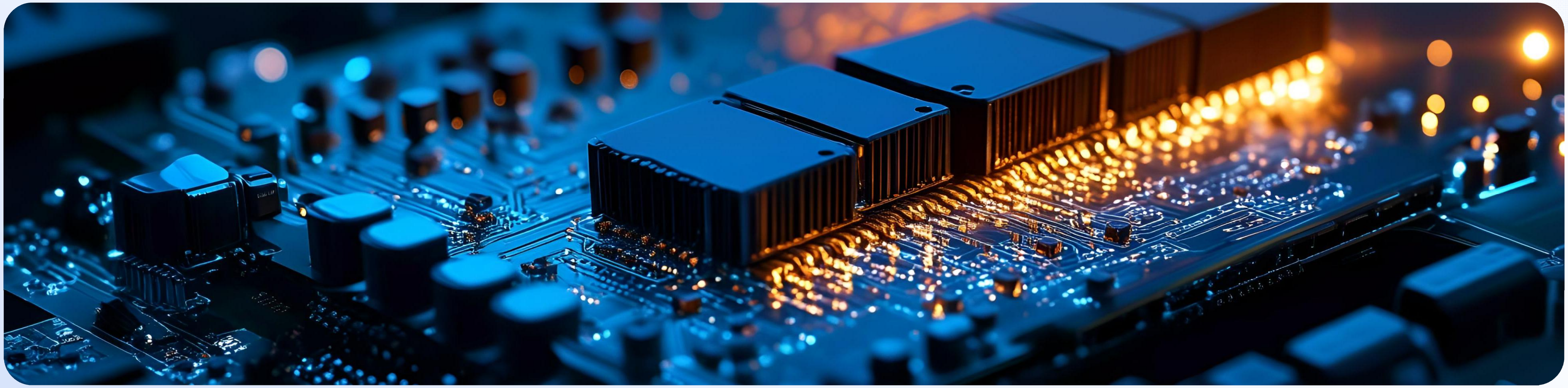
In DC circuits, unidirectional current flow or capacitive impact can cause unidirectional transfer of contact material (as shown in Figure 6), which can lead to unevenness and adhesion in severe cases. It is recommended to use AgSnO□ contact material or add a protective circuit to mitigate this.

Resistor + Capacitor (CR) Protection Circuit

Suitable for DC inductive loads, capacitor C (0.5~1μF for 1A) controls discharge, resistor R (0.5~1Ω for 1V) limits current, withstand voltage 200~300V; however, it will prolong the relay release time, and timer loads may malfunction.

Diode and diode + Zener diode protection

Connecting diodes in parallel can reduce reverse voltage; therefore, it is necessary to select models with a reverse breakdown voltage ≥ 10 times the circuit voltage and a forward current ≥ the maximum current. Connecting Zener diodes in series can speed up the release time; the Zener voltage should be close to the power supply voltage.



Contact protection measures

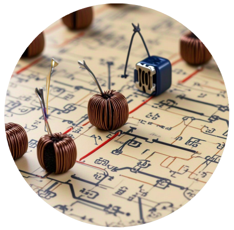
Varistor protection circuit characteristics

Suitable for AC/DC inductive loads, the limiting voltage Vc is more than 1.5 times the peak power supply voltage, which can effectively reduce overvoltage between contacts, but will prolong the load release time. It is necessary to pay attention to matching with the load type.

Installation distance requirements for protective components

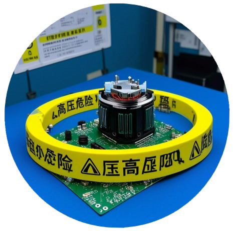
Protective components such as diodes, CRs, and varistors must be installed within 50cm of the load or contacts. If the distance is too far, the protection effect will be weakened and the arc and overvoltage cannot be effectively suppressed.

Coil Usage Precautions



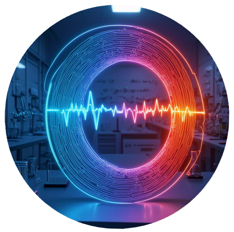
Coil voltage polarity matching with suppression element

Conventional relays do not require polarity differentiation, but relays with added suppression diodes must be wired strictly according to polarity. Reverse connection will cause the diode to short-circuit and break down, burning out the coil.



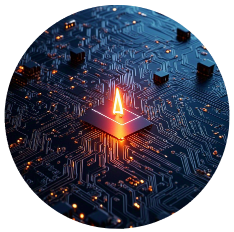
Maximum permissible voltage and continuous power-on limit

The maximum allowable voltage of the coil is the short-time withstand value and cannot be applied continuously, otherwise it will cause the insulation layer of the enameled wire to age and the coil to short-circuit and burn out. The continuous energizing time of the monostable relay should be ≤100ms and the duty cycle should be <50%.



The effect of coil temperature rise on operating voltage

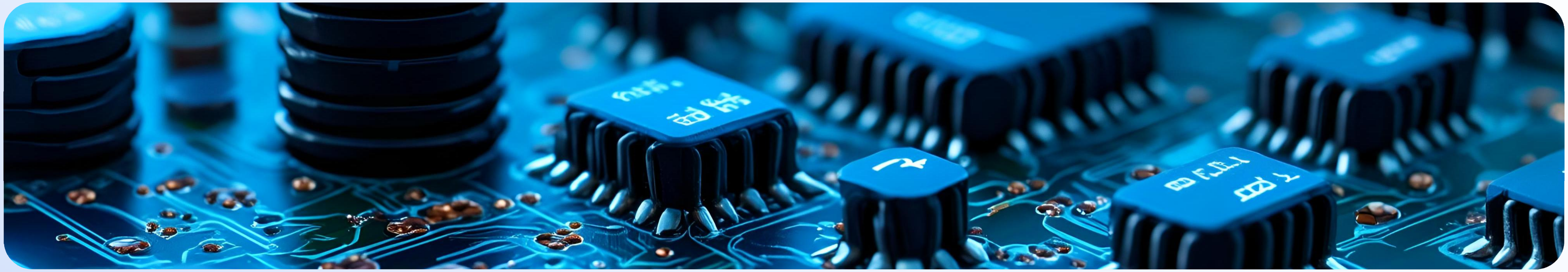
The temperature coefficient of resistance of copper wire is 0.4%/℃. Temperature rise leads to increased coil resistance and higher operating voltage. In environments above 23℃, it is necessary to verify whether the operating voltage exceeds the specifications at high temperatures, and derating should be applied if necessary. Note: The temperature rise is 100% when continuously energized, and approximately 50% when ON:OFF=1:1 (Table 12).



Coil reverse peak voltage suppression and circuit selection

When the coil is disconnected, a reverse peak voltage of several kV is generated. It is recommended that the QC relay use a coil parallel resistor, and the PCB relay use the circuit shown in Figure 8(d). The diode parallel connection (Figure 8(b)) has the best suppression effect, but the relay life is reduced the most, so it is not recommended.

Coil Usage Precautions



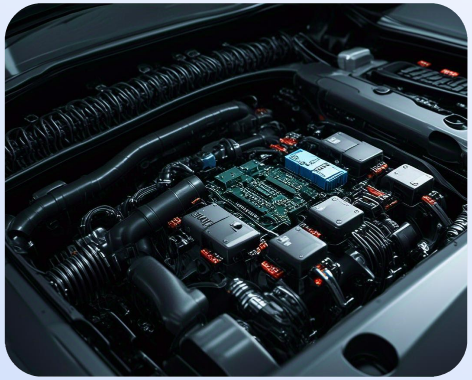
Pulse Width Modulation (PWM) Driver Specification

An excitation of 1 to 1.5 times the rated voltage must be applied for more than 100ms. The recommended frequency is ≥20kHz and the duty cycle is 50% to 70% (<50% requires technical confirmation). The coil must be connected in parallel with a freewheeling diode. The parameters need to be recalibrated when the supply voltage changes.

Magnetic latching relay coil voltage and pulse requirements

The rated voltage rectangular pulse with a pulse width of 50~100ms must be applied for the operation/reset. Long-term power supply (>1min) is prohibited. For dual-coil type, voltage must not be applied at the same time. For single-coil type, attention should be paid to the reverse excitation polarity.

Performance and Environmental Usage Considerations

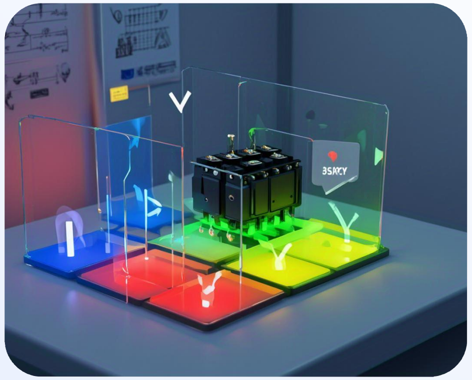


Vibration and shock protection measures

When installing relays and electromagnetic switches, which are impact sources, the opening and closing direction of the contacts and the direction of armature movement should be perpendicular to the impact direction, or a buffer sheet should be used for isolation to prevent the contacts from breaking instantly and causing malfunctions.

Transportation and storage environment control

Use, storage, and transportation must meet the following requirements: temperature 0~40℃, humidity 5%~85%RH, air pressure 86~106kPa (non-shaded area in Figure 12); avoid direct sunlight, violent vibration and heavy loads, and cushioning packaging must control vibration and impact within the allowable range.

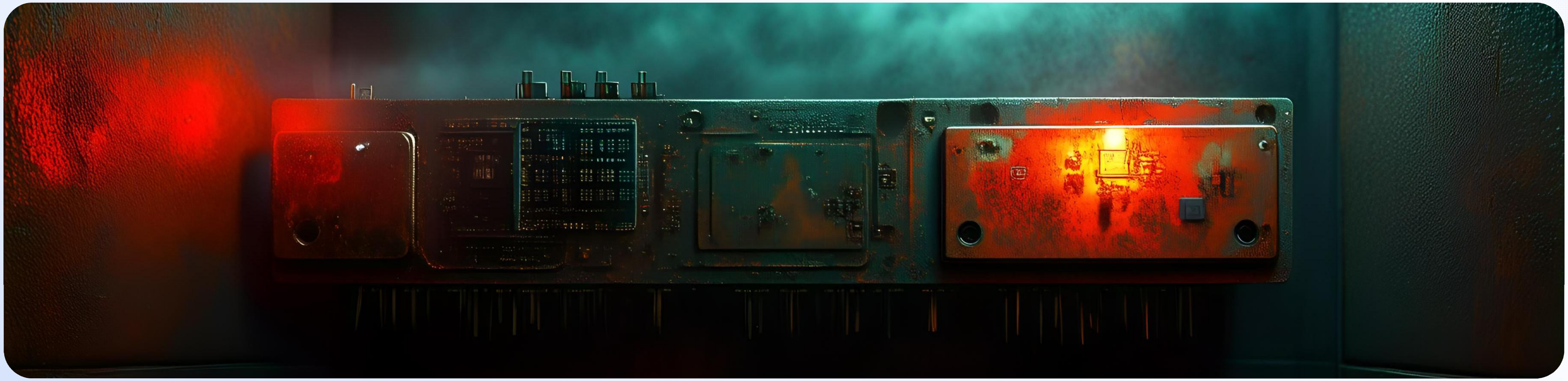


Adaptive selection for hazardous gas environments

① Silicon environment: Do not use any type of relay, as silicon volatiles will cause poor contact; ② Sulfide/nitrogen oxide gas: Sealed relays must be selected, and solder resist type/dust cover type are prohibited; ③ High humidity condensation environment: Plastic-encapsulated type is recommended and the corrosion resistance of the contacts must be verified.

External magnetic field and low temperature environment influence

External magnetic fields >800A/m may cause malfunctions and drift of magnetic latching relay parameters. Keep away from strong magnetic field sources. Prevent freezing below 0℃ to avoid moisture condensation causing moving parts to stick together. In low temperature and low humidity environments, pay attention to the brittleness of the plastic shell.



Performance and Environmental Usage Considerations

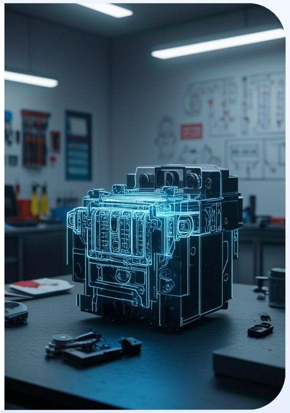
Aging risks in high temperature and high humidity environments

Prolonged exposure to high temperature and humidity can cause oxide film to form on the contacts and corrosion of metal parts, leading to unstable contact. Wave soldering relays stored for more than 6 months should have their terminal solderability tested. Non-soldering relays should have their electrical parameters tested after 12 months, and the maximum storage period should not exceed 36 months.

Precautions for installation and use

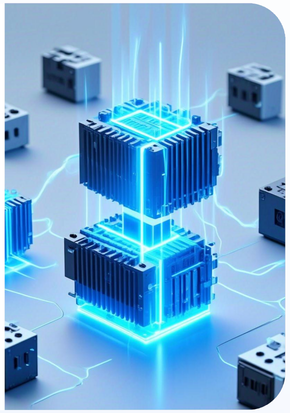
Installation direction and contact reliability optimization

Vibration and shock resistant installation: The contact action direction is perpendicular to the vibration direction; Contact reliability: The contact surface is vertical, reducing dust accumulation and splash adhesion, and improving long-term stability.



Close-range installation and heat dissipation spacing

When multiple relays are installed close together, heat interference can cause excessive temperature rise. Sufficient heat dissipation gaps must be reserved. When stacking relays, the ambient temperature must not exceed the product's upper limit. Low-power models should be selected first.

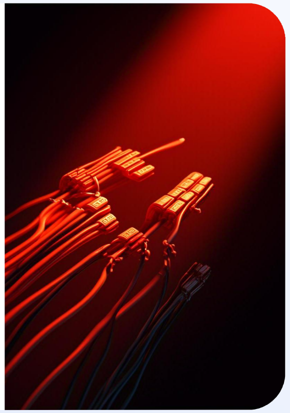


Insertion Terminal Installation and Removal Specifications

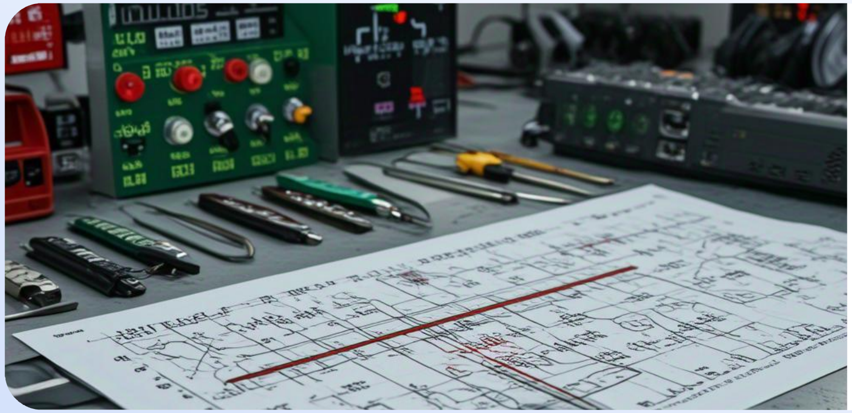
Before installation, confirm that the locking function of the female terminal matches the relay lead-out terminal; do not reuse the relay. When pulling out the relay, use a special tool to pull it out vertically (Figure 14(a)). Do not pull it out at an angle or pry it up (Figure 14(b)(c)) to avoid the terminal being misaligned.

Conductor Diameter Selection Standard

Select the conductor cross-sectional area according to the load current: 0.5mm² for below 3A, 0.75mm² for 3~6A, and 1.5mm² for 10~16A (Table 13). Too small a cross-sectional area will lead to excessive temperature rise and conductor burnout.

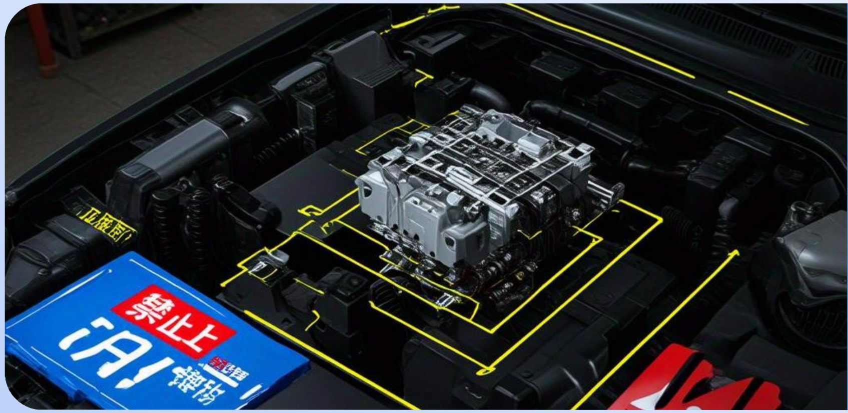


Precautions for installation and use



Through-hole (THT) relay soldering process

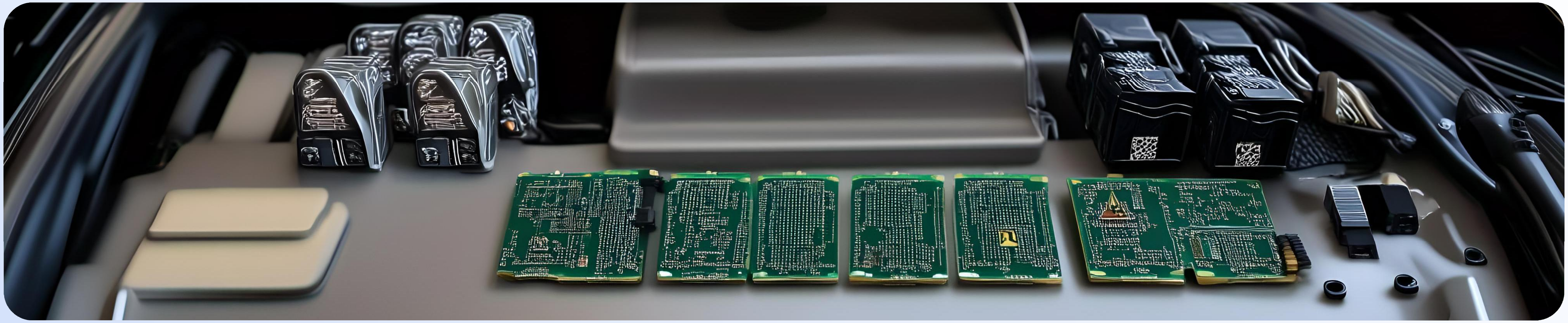
Wave soldering conditions: (260±3)℃, (5±0.3)s; Manual soldering: 30~60W soldering iron, 300~350℃, ≤3s; Repeated soldering is prohibited. When cleaning, the plastic-encapsulated type can use alcohol-based cleaning solution (below 40℃), while the dust cover type/solder resist type is prohibited from being cleaned.



PIP (Place In-Place) Relay Installation Requirements

Mechanical clamping force ≤ 9.8N, single-sided force area > 6mm²; cleaning or surface treatment is prohibited after welding. After reflow soldering of the plastic-encapsulated type, the outer shell may bulge slightly, and the plastic-encapsulation performance can no longer be guaranteed. Avoid secondary welding to prevent coil wire breakage.

Other usage precautions



Basic Safety Operating Procedures

Do not touch the terminals when the relay is in operation. The power must be disconnected before installation and maintenance. Wiring must be done in accordance with the instruction manual. Incorrect connection may cause malfunction, abnormal heating or even fire. If contact failure may endanger safety, a double protection device must be installed.

Long tubular packaging and transport protection

When using long tubular packaging, shaking and impact are prohibited. The stop plug must be pressed into the fixed relay (Figure 22). Avoid dropping during transportation. If the outer box is damaged, it must be opened for inspection. Damaged goods should be rejected. For secondary transportation, palletized containerization should be given priority (Figure 24).

Adverse feedback and redundancy design requirements

Disassembly is prohibited if any defects are found; the device must be returned to Hongfa for analysis. Relays that control driving safety functions (such as braking and steering) must employ a dual-relay redundancy design or other technical safeguards to prevent single-point failures from causing serious accidents.

PCB cutting and anti-static measures

When cutting PCB panels, they must be firmly fixed and the cutting time should be shortened to avoid vibration that could cause the coil to break. Epoxy resin dust generated during cutting may enter the relay, so dustproof encapsulation must be used. Do not break the PCB to prevent damage to the internal structure of the relay.

Other usage precautions

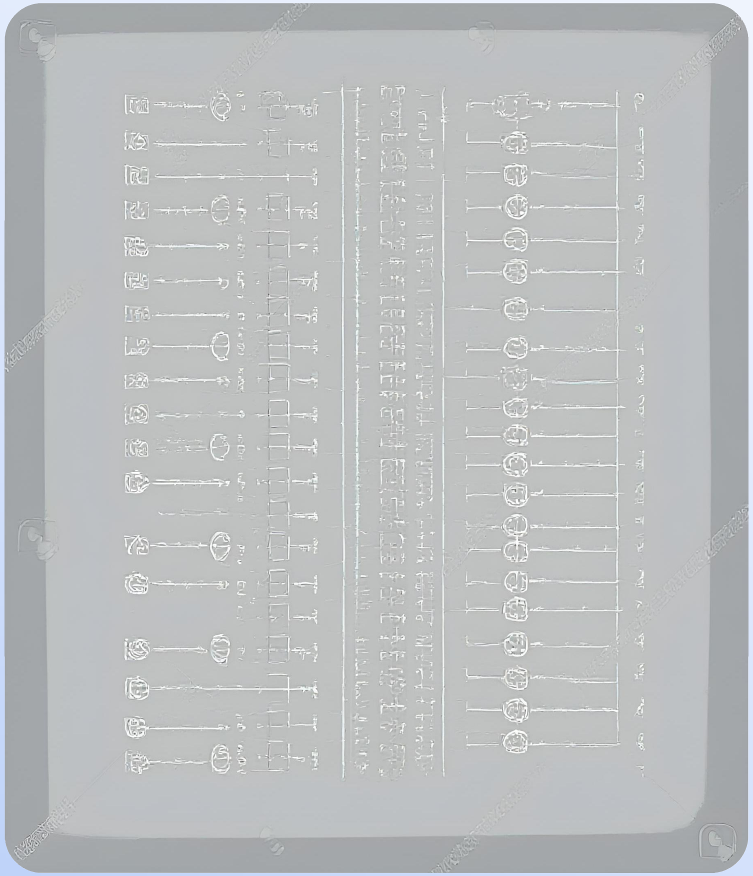
Packaging selection in special environments

For relays installed in humid and dusty environments such as forklifts and mines, or on the outside of electrical boxes, plastic-encapsulated relays must be used. For environments containing sulfides and nitrogen oxides, solder resist/dust cover types are prohibited; plastic-encapsulated relays must be used and their reliability verified in practice.

04

Order mark

Order mark composition



Relay model

This represents the basic type of relay, such as HFKA for standard type and HFKA-T for reflow soldering/high temperature resistant type.

Coil voltage

The coil voltage at which the relay operates normally is represented by a number, such as 012 representing 12VDC.

Contact form

This indicates the combination of contacts, such as 1Z representing a set of changeover contacts, 1H representing a set of normally open contacts, 2Z representing two sets of changeover contacts, and 2H representing two sets of normally open contacts.

Packaging method

This indicates the relay's package type; S indicates a plastic-encapsulated type, and no symbol indicates a solder resist type.

Coil types

Reflecting the characteristics of the coil, P indicates low operating voltage type, and no sign indicates standard type.

Contact materials

The material used for the indicator contact is T, which stands for $AgSnO_2$.

Order Marking Example

Model Number Analysis: KKAV4-0121Z

“ KKAV4 ” is the relay model, representing the standard type; “012” indicates that the coil voltage is 12VDC; “1Z” indicates that the contact type is a set of changeover contacts.

Packaging method and coil type

The absence of a packaging symbol in this example indicates that the packaging is solder resist type; the absence of a coil type symbol indicates that it is a standard coil.

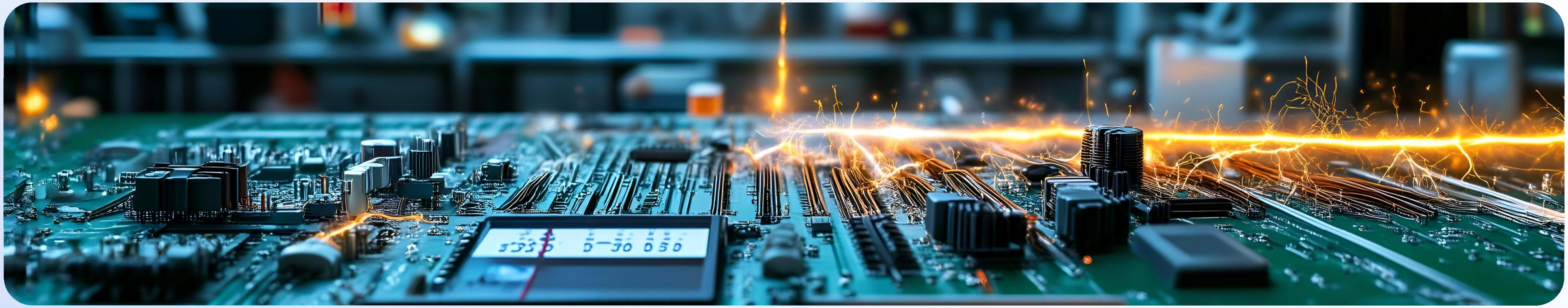
Contact materials and property numbers

If the contact material symbol is not clearly marked, please refer to the specific model instruction manual. The characteristic number "XXX" represents special customer requirements, and no symbol indicates a standard product.

05

Quick Reference Table for Relay Failure Causes

Reasons for relay failure



No voltage at the coil terminals

A broken power supply line, incorrect wiring or short circuit, or poor soldering of the leads can all cause no voltage at the coil terminals, preventing the relay from operating.

Insufficient voltage at the coil terminals

Low power supply voltage, excessively long power cord, or selection of relays with excessively high voltage specifications can all cause insufficient voltage at the coil terminals, preventing the relay from operating.

Coil not connected

Poor soldering or a broken coil wire can cause the coil to lose continuity, resulting in the relay malfunctioning.

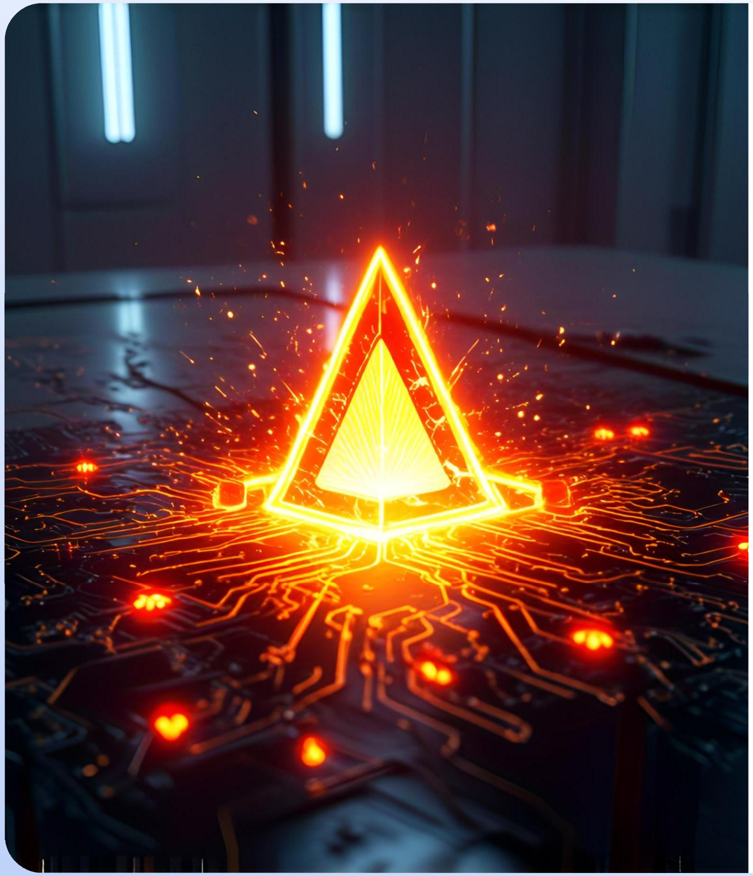
Relay fault

Relays may fail to operate if they are dropped, subjected to strong impacts, or have contact malfunctions.

Incorrect polarity of voltage at the coil terminals of the polarized relay

Impacts during transportation that alter the state or cause wiring errors can result in incorrect voltage polarity at the coil terminals of the polarized relay, causing the relay to fail to operate.

Reasons for relay failure to release



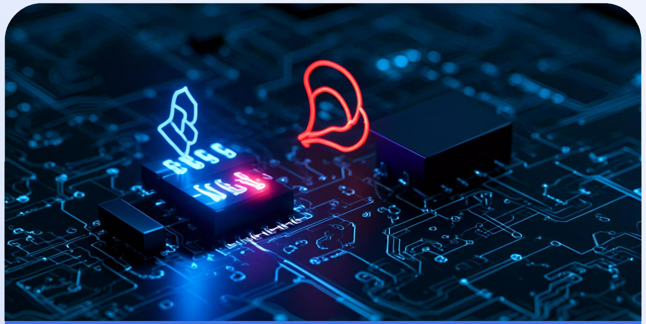
The residual voltage at the coil terminals is too high.

The presence of other energy storage components at the coil terminals, leakage current or bypass current in the coil, and excessive residual voltage in the semiconductor circuit can all lead to excessive residual voltage at the coil terminals, preventing the relay from releasing.

Relay fault

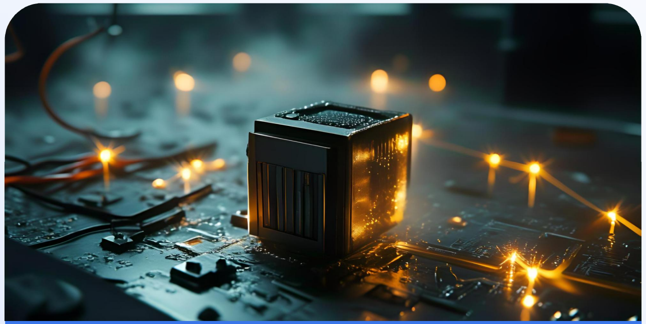
If a relay is dropped, subjected to a strong impact, or has a contact malfunction, it may fail to release.

Causes of relay malfunction



Unstable power supply

Excessive power supply ripple, insufficient voltage, or excessive coil resistance can lead to power supply instability and cause relays to operate erratically.



Unstable relay parameters

If a relay is dropped, subjected to a strong impact, or short-circuited between coil turns, the relay parameters will become unstable, leading to unstable operation.

Relay malfunction

Errors in the control program or excessive vibration in the operating environment can cause relays to malfunction, resulting in unstable operation.

Causes of contact bonding failure

01

Excessive current

Excessive load or surge current can cause excessive contact current, leading to sticking of NC or NO contacts.

02

Abnormal contact jitter

Significant external vibrations and unstable relay operation can cause abnormal contact jitter, resulting in contact sticking.

03

The relay operates at too high a frequency.

If the relay operates at too high a frequency, it will accelerate contact wear and easily lead to contact sticking.

04

The ambient temperature is too high

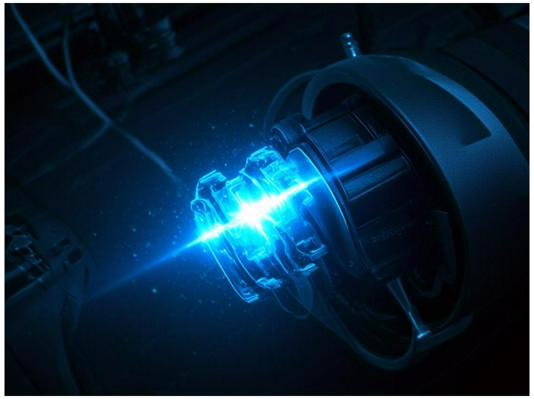
Excessively high ambient temperatures can affect contact performance and may cause contacts to stick together.

05

Used more times than expected lifespan

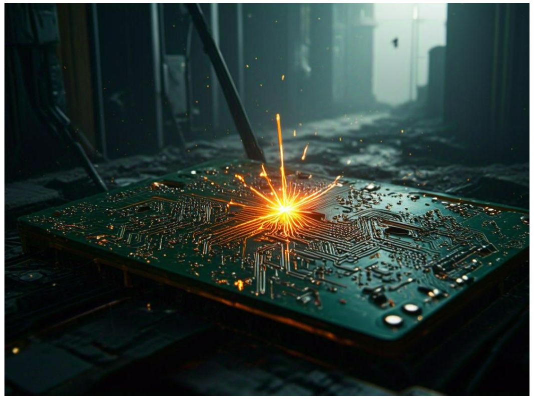
The relay has exceeded its expected lifespan, the contacts are aging, and it is prone to sticking.

Causes of contact failure



Excessive contact pressure drop

Poor welding, foreign objects between contacts, or harsh operating environments that cause contact oxidation or sulfidation can lead to excessive contact voltage drop, resulting in NO or NC contacts failing to close.



No current at the contact point

A broken load line, incorrect wiring or short circuit, or poor soldering of the leads can cause no current to flow to the contacts, resulting in the contacts not closing.

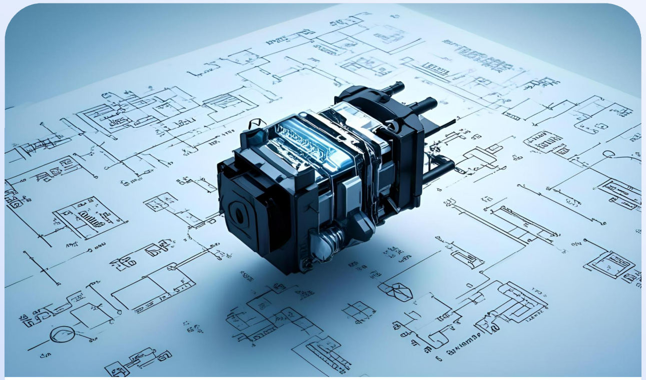
Used more times than expected lifespan

The relay has been used beyond its expected lifespan, and the contacts are severely worn, which may result in the NO or NC contacts not closing.

06

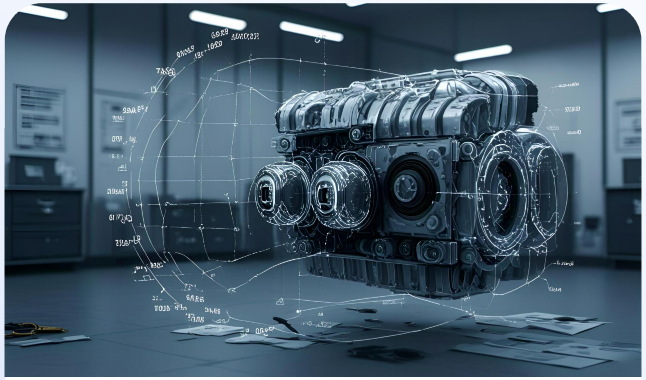
Summary of Relay Selection Principles

Must be determined and referenced items



Project must be determined

The core basis for selection includes contact load (size, type), contact form (normally open/normally closed/changeover, etc.), coil rated voltage (including direction), shape and installation (dimensions, lead-out form), which must be strictly matched with the actual working conditions.



Reference Projects

It covers electrical durability (number of cycles), contact materials (AgSnO□ , etc.), ambient temperature (-40℃~125℃), and vibration and shock resistance (acceleration, frequency), which affect long-term reliability and need to be evaluated in conjunction with the application scenario.

Comprehensive selection principles

It is necessary to simultaneously meet the hard requirements of the "must be determined" items and the optimization requirements of the "reference" items. Through the three-step method of load matching, environment adaptation, and parameter verification, it is ensured that the relay performance is fully compatible with the usage conditions.

07

Summary of Usage Precautions

Key Points to Note

Key points for contact usage

To avoid overloading, a relay of the corresponding specification should be selected for DC 24V loads; resistive/inductive/capacitive loads require matching contact materials, such as AgSnO□ which is suitable for multiple types of loads; parallel connection of two sets of contacts cannot increase the load capacity, and electrical durability under high temperature environments needs to be verified in practice.

Coil Safety Operation Procedures

The applied voltage should not exceed the maximum allowable value. The continuous energizing time of the monostable coil should be >100ms and the duty cycle <50%. The coil with the suppression diode must be strictly distinguished by polarity. The reverse peak voltage must be suppressed by RC, diode and other circuits. The recommended installation distance is <50cm.

Environmental adaptability requirements

The ambient temperature must be within the range specified in the instruction manual. For environments with humidity > 85%RH or containing sulfur, silicon, NOx, or other gases, the plastic-sealed type should be preferred. Avoid external magnetic fields above 800A/m. The direction of vibration and impact should be perpendicular to the direction of contact action. In low-temperature environments, prevent icing.

Key Points to Note

Installation and Welding Standards

Insert-type terminals must be matched with the female terminal locking structure. When pulling them out, use a special tool to operate vertically. The THT soldering temperature is (260±3)℃ and the time is (5±0.3)s. A special model must be selected for reflow soldering. The PCB must be firmly fixed during cutting to avoid vibration that could cause the coil to break.

08

Frequently Asked Questions

Typical problems and solutions

01

Contact adhesion or poor contact

If contact sticking or poor contact occurs, it is usually due to the load exceeding the rated value or the load type being incompatible. Solutions: Ensure the load does not exceed the contact's rated value; for inductive/capacitive loads, install a CR protection circuit (e.g., a 0.5-1μF capacitor + 0.5-1Ω resistor for a 1A load); and use anti-soldering contact materials such as AgSnO□ .

02

overheating or burning out of the coil

Coil overheating is usually caused by applying voltage exceeding the maximum allowable value or prolonged continuous energization. Solutions: Strictly control the coil voltage within the rated range, avoid prolonged continuous energization, and for applications requiring long-term operation, it is recommended to use a magnetic latching relay.

03

Relay malfunction or failure to release

Malfunctions may be caused by power fluctuations, vibration, or excessively high reverse peak voltage in the coil. Solutions include optimizing the power supply circuit, adding coil reverse peak suppression components (such as parallel diodes or resistors), and ensuring the installation direction is perpendicular to the vibration source to reduce interference.

Typical problems and solutions

Environmental factors lead to performance degradation

High temperatures, high humidity, and corrosive gases can easily cause contact oxidation and reduced insulation. Solutions: Use encapsulated relays in hot, humid, or dusty environments; avoid using open-type products in sulfur- or silicon-containing environments; and regularly clean foreign objects around the contacts.

THE END

Thanks