

VKP series

Compact, 40 Amp, Open or Sealed PC Board Relay For Automotive Applications

Features

- 40A continuous contact rating @ 85°C.
- 1 Form A and 1 Form C arrangements.
- PC board terminals.
- Available as open frame or sealed relay.
- Choice of AgNi 0.15 or AgSnO contacts.

Conditions

All parametric, environmental and life tests are performed according to EIA Standard RS-407-A at standard test conditions (23°C Ambient, 20-50% RH, 29.5 ± 1.0" Hg.) unless otherwise noted.

Contact Data

Arrangements: 1 Form A (SPST-NO) and 1 Form C (SPDT).
Material: AgNi 0.15 – Recommended for inductive loads.
 AgSnO – Recommended for high inrush, lamp and capacitive loads and applications prone to contact material transfer.
Max. Switching Rate: 20 operations per second with no contact load.
 6 operations per minute for rated life at rated load.
Max. Switching Voltage: 75VDC (1).
Max. Load Current (@ 14VDC Load Voltage):

Load		Form A (NO)	Form C	
			NO	NC
Max. Continuous Current	Open Frame	45A	45A	30A
	Sealed Cover	45A	45A	30A
Max. Break Current (1)		60A	60A	30A
Max. Make Current (2)				
AgNi 0.15		100A	100A	30A
AgSnO		180A	180A	30A

Max. Switching Power: 50-500 watts DC (voltage dependent) (1).
Min. Recommended Current: 1 amp @ 12VDC.
Initial Voltage Drop: 200 millivolts, maximum, for normally open contacts @ 40 amp contact load.
 250 millivolts, maximum, for normally closed contacts @ 20 amp contact load.
Expected Life: 10 million operations, mechanical; 100,000 operations at 40 amps, 14VDC, resistive load on normally open contact.

Initial Dielectric Strength

Between Contacts and Coil: 500V rms.

Coil Data

Voltage: 12 and 24VDC.
Resistance: See Coil Data table.
Nom. Power: 1.6 watts @ 23°C coil temp. and rated coil voltage.
Thermal Resistance: 45°C per actual coil watt in still air with no contact load current.

Coil Data (@ 23°C Coil Temperature)

Coil Designator	Rated Coil Voltage (VDC)	Coil Resistance ±10% (Ohms)	Coil Inductance (H) (Ref.)	Must-Operate Voltage (VDC)	Must-Release Voltage (VDC)	Allowable (3) Overdrive (VDC)	
						@ 23°C	@ 85°C
F	12	90	0.6	6.8	1.2	19.6	14.3
H	24	362	2.3	13.9	2.4	39.3	28.6

Operate Data

Must Operate and Must Release Voltage: See Coil Data table.
Initial Operate Time: 5 milliseconds, typical, with rated coil voltage applied.
Initial Release Time: 3 milliseconds, typical, with zero volts applied (for unsuppressed relays after having been energized at rated coil voltage).

Environmental Data

Temperature Range: **Storage:** -40°C to +155°C.
Operating: -40°C to +125°C (4).
Shock: 20g, 11 milliseconds, half sine wave pulse.
Vibration: (For NC contacts, NO contacts are significantly higher.)
 10-40 Hz., 1.27mm double amplitude.
 40-70 Hz., 5g's constant.
 70-100 Hz., 0.5mm double amplitude.
 100-500 Hz., 10g's constant.

Mechanical Data

Termination: Printed circuit terminals.
Enclosure: Sealed relay is suitable for immersion cleaning of PCB assembly or conformal coating. Relay may be vented after cleaning by cutting the vent projection from the corner of the relay after processing using a razor knife or equivalent.
Weight: 20g (0.7 oz.) approximately.

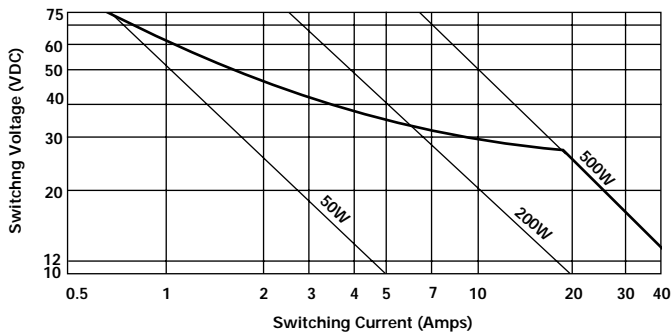
Abnormal Operation

Overload Current: Consult factory.
24V Jump Start: 24VDC for 5 minutes conducting rated contact current @ 23°C.
Drop Test: Capable of meeting specifications after a 1.0 meter drop onto concrete in final enclosure.
Flammability: UL94-HB or better, internal parts (meets FMVSS 302).

Notes

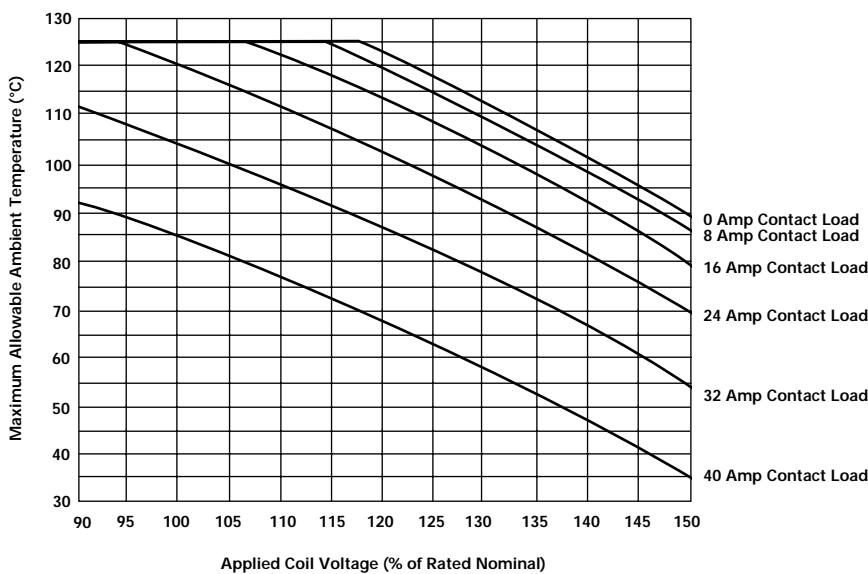
- (1) See Figure 1.
- (2) Inrush current for lamp load.
- (3) Allowable overdrive is rated at ambient temperature for 23°C or 85°C as stated with no load current flowing through the relay contacts and minimum coil resistance. Also see Figure 2 for maximum ambient temperature versus applied coil voltage.
- (4) See Figure 2.
- (5) Current and times are compatible with circuit protection by a typical automotive circuit breaker. Relay will make, carry and break the specified current.

Figure 1 – Limiting Curve for Power Load



Safe breaking, arc extinguished (normally open contact) for resistive loads.

Figure 2 – Ambient Temperature vs. Coil Voltage for Continuous Duty



Assumptions:

1. Thermal resistance = 40°C per watt.
2. Still air.
3. Nominal coil resistance.
4. Maximum mean coil temperature = 180°C.
5. Coil temperature rise due to load.
 - = 3.5°C @ 8 amps.
 - = 10°C @ 16 amps.
 - = 20°C @ 24 amps.
 - = 36°C @ 32 amps.
 - = 55°C @ 40 amps.
6. Thermal resistance and power dissipation based on coil resistance at 180°C.
7. Curves are based on 1.6 watts at 23°C.
8. When full lifetime is at high ambient and high load current, subtract 25°C from maximum allowable ambient temperature.
9. Data is for open relays.
10. Subtract 10°C from the maximum allowable ambient temperature for sealed version.

Ordering Information

Part Number	Contact Arrangement	Contact Material	Enclosure	Termination Footprint
VKP-11 * 42	1 Form A	AgNi 0.15	Open	U.S.A.
VKP-15 * 42	1 Form C	AgNi 0.15	Open	U.S.A.
VKP-11 * 52	1 Form A	AgSnO	Open	U.S.A.
VKP-15 * 52	1 Form C	AgSnO	Open	U.S.A.
VKP-31 * 42	1 Form A	AgNi 0.15	Immersion Cleanable Case	U.S.A.
VKP-35 * 42	1 Form C	AgNi 0.15	Immersion Cleanable Case	U.S.A.
VKP-31 * 52	1 Form A	AgSnO	Immersion Cleanable Case	U.S.A.
VKP-35 * 52	1 Form C	AgSnO	Immersion Cleanable Case	U.S.A.

*Standard Coil Voltages: F = 12VDC
H = 24VDC (Consult factory for availability)

Stock Items –The following items are normally maintained in stock for immediate delivery.

No items in this series are stocked.

New Relay for Flashing Lamp Applications

Features

- 30A flashing lamp rating up to 85°C.
- Long life for flashing lamp load applications.
- 1 Form A and 1 Form C arrangements.
- Available as open frame or sealed relay.
- Choice of standard or high current model.

Conditions

All parametric, environmental and life tests are performed according to EIA Standard RS-407-A at standard test conditions (23°C Ambient, 20-50% RH, 29.5 ± 1.0" Hg.) unless otherwise noted.

Contact Data

Arrangements: 1 Form A (SPST-NO) and 1 Form C (SPDT).

Material: PdCu/AgNi 0.15.

Max. Switching Rate: 20 operations per second with no contact load.
90 operations per minute for rated life at rated load.
270 operations per minute for passenger car lamp outage indication.

Max. Switching Voltage: 28VDC.

Max. Load Current (@ 14VDC Load Voltage):

Standard Current Types				
Load		Form A (NO)	Form C	
			NO	NC
Steady-State Flashing ⁽¹⁾	Open Frame	15A	15A	5A
	Sealed Cover	12A	12A	5A
Alternate Flashing ⁽²⁾	Open Frame	-	4A	4A
	Sealed Cover	-	4A	4A
Max. Make Current ⁽³⁾		120A	120A	30A
Max. Break Current		20A	20A	10A

High Current Types				
Load		Form A (NO)	Form C	
			NO	NC
Steady-State Flashing	Open Frame	30A	30A	10A
	Sealed Cover	25A	25A	10A
Alternate Flashing	Open Frame	-	8A	8A
	Sealed Cover	-	8A	8A
Max. Make Current ⁽³⁾		240A	240A	60A
Max. Break Current		30A	30A	20A

Min Recommended Current: 1 amp @ 12VDC.

Initial Voltage Drop: 100 millivolts, maximum, for normally open contacts @ 10A contact load.
200 millivolts, maximum, for normally closed contacts @ 10A contact load.

Expected Life: **Mechanical Life:** 10 million operations.
Electrical Life: (See application information.)

Electrical Isolation

Dielectric Strength (coil to contacts): 500 Vrms.

Coil Data (@ 23°C Coil Temperature)

Coil Designator	Rated Coil Voltage (VDC)	Coil Resistance ±10% (Ohms)	Coil Inductance (H) (Ref.)	Must-Operate Voltage (VDC)	Must-Release Voltage (VDC)	Allowable ⁽⁴⁾ Overdrive (VDC)	
						@ 23°C	@ 85°C
F	12	90	0.6	6.8	1.2	19.6	14.3
H	24	362	2.3	13.9	2.4	39.3	28.6

VKP series

PC Board Relay

Coil Data

Voltage: 12 and 24VDC.

Resistance: See Coil Data table.

Nom. Power: 1.6 watts @ 23°C coil temp. and rated coil voltage.

Thermal Resistance: 45°C per actual coil watt in still air with no contact load current.

Operate Data

Must Operate and Must Release Voltage: See Coil Data table.

Initial Operate Time: 5 milliseconds, typical, with rated coil voltage applied.

Initial Release Time: 3 milliseconds, typical, with zero volts applied (for unsuppressed relays after having been energized at rated coil voltage).

Environmental Data

Temperature Range: **Storage:**

Open Types: -40°C to +155°C.

Sealed Types: -40°C to +125°C.

Operating: -40°C to 125°C⁽⁴⁾.

Shock: 20g, 11 milliseconds, half sine wave pulse.

Vibration: (For NC contacts, NO contacts are significantly higher.)

10-40 Hz., 1.27mm double amplitude.

40-70 Hz., 5g's constant.

70-100 Hz., 0.5mm double amplitude.

100-500 Hz., 10g's constant.

Mechanical Data

Termination: Printed circuit terminals. (U.S.A. footprint style only)

Enclosure: Sealed relay is suitable for immersion cleaning of PCB assembly or conformal coating. Relay may be vented cutting the vent projection from the corner of the relay after processing using razor knife or equivalent.

Weight: 20g (0.7 oz.) approximately.

Abnormal Operation

Overload Current: Consult factory.

24V Jump Start: 24VDC for 5 minutes conducting rated contact current @ 23°C.

Drop Test: Capable of meeting specifications after a 1.0 meter drop onto concrete in final enclosure.

Flammability: UL94-HB or better (meets FMVSS 302).

Notes

- (1) Continuous On-Off cycling of a single set of lamps at 60 to 90 cycles per minute and approximately a 50% duty cycle.
- (2) Continuous cycling between two sets of lamps with one set switched by the N.O. contacts and the other by the N.C. contacts, at 60 to 90 cycles per minute and approximately a 50% duty cycle.
- (3) Inrush current for lamp load.
- (4) Allowable overdrive is rated at ambient temperature for 23°C or 85°C as stated with no load current flowing through the relay contacts and minimum coil resistance. Also see Figure 2 for maximum ambient temperature versus applied coil voltage.
- (5) Current and times are compatible with circuit protection by a typical automotive circuit breaker. Relay will make, carry and break the specified current.

Application Information

Load Polarity: VKP series relays for flashing lamp applications are constructed with Palladium-Copper movable contacts and fine grain silver stationary contacts. This causes the relay to be sensitive to the polarity of the load voltage. This type of VKP relay must be mechanized in the circuit such that the more positive connection is made to the movable contact (identified as terminal 4 in the wiring diagrams). Failure to do so will nullify the benefit of the Palladium Copper and will result in contact welding.

Typical Applications: VKP series relays for flashing lamp applications are typically used for turn signal, hazard warning, emergency vehicle, and security system applications. They may also be used for high in-rush current capacitive loads such as audio amplifiers. Use on inductive loads or loads with high continuous load currents should be avoided. The relay should also not be used for applications which do not have a significant make current as high contact voltage drop may result.

Standard Current Relays: VKP series relays for flashing lamp applications which are indicated as "standard current" units are generally suitable for passenger car and light truck applications for turn signal, hazard warning, or combination flashers (with or without normal trailering requirements) for 2 or 3 bulb turn signal systems. They are also generally suitable for security system applications for lamp flashing and for most audio amplifier applications.

High Current Relays: VKP series relays for flashing lamp applications which are designated as "high current" have larger contacts, a larger shunt connecting the movable contacts to the output terminals, and other performance enhancing characteristics to provide longer life and provide higher current carrying capacity. This type relay should be used for truck applications which have greater load current and in applications such as emergency vehicle lighting and service vehicle hazard warning lights which have very high cycle life requirements. The high current versions are also recommended for most alternating flasher applications, as this version has much improved performance of the normally closed contact. However, optimum life can be obtained for alternating applications by using two normally open relays and powering the coils alternately.

Electrical Life Test Information

Standard Current Relays: 3 bulb T/S (turn signal) system, combined turn signal and hazard warning with normal trailering (test requirements):

3 bulb	1.8 million operations
4 bulb	130 K operations
6 bulb	194 K operations
8 bulb	248 K operations
TOTAL	2.3 million operations

This application represent about the limit of the performance capability of the "standard current" types and is generally the limit of the industry requirement for passenger car applications.

Note: Bulb as used here is a 27 watt turn signal bulb, trade #1156. Testing includes operations at -40°C, 23°C, and 85°C.

High Current Relays: 3 bulb T/S system, combined turn signal and hazard warning with special trailering (test requirements):

3 bulb	2.1 million operations
6 bulb	194 K operations
7 bulb	259 K operations
14 bulb	497 K operations
TOTAL	3.0 million operations

This application represent about the limit of the performance capability of the "high current" types. It should be noted that the low current operations have very little affect on the total product life where as the 14 bulb (33 ampere) operations are extremely destructive. Units test on 14 bulb (only) loads can be expected to fail at less than 1 million operations.

Note: Bulb as used here is a 27 watt turn signal bulb, trade #1156. Testing includes operations at -40°C, 23°C, and 85°C.

Design Considerations: It should be noted that although the VKP series relays are capable of handling relatively high currents, when applying the product under high current and high ambient temperature conditions, providing adequate conductor volume is critical, as is the solder connection, particularly with respect to the normally open contact terminal. It may be necessary to use high temperature solder, a plated through hole PCB, or a copper lead frame type construction under these conditions to prevent failure of the solder joint.

Figure 2 – Ambient Temperature vs. Coil Voltage for Continuous Flashing at 50% Duty Cycle (Steady Current, Open Style)

Consult factory.

Ordering Information

Part Number	Contact Arrangement	Contact Material	Enclosure	Load Ratings
VKP-11 * 32	1 Form A	PdCu/AgNi 0.15	Open	Standard Current
VKP-11 * 62	1 Form A	PdCu/AgNi 0.15	Open	High Current
VKP-15 * 62	1 Form C	PdCu/AgNi 0.15	Open	High Current
VKP-31 * 32	1 Form A	PdCu/AgNi 0.15	Immersion Cleanable Case	Standard Current
VKP-31 * 62	1 Form A	PdCu/AgNi 0.15	Immersion Cleanable Case	High Current
VKP-35 * 62	1 Form C	PdCu/AgNi 0.15	Immersion Cleanable Case	High Current

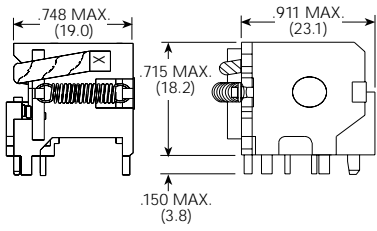
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H = 24VDC (Consult factory for availability)

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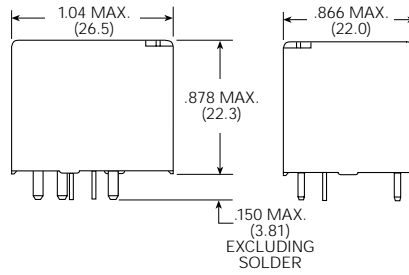
No items in this series are stocked.

Outline Dimensions

Open Model



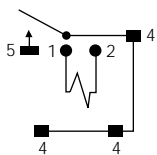
Sealed Model



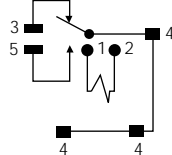
Wiring Diagrams (Bottom Views)

Open Models

1 Form A

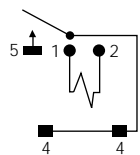


1 Form C

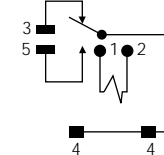


Sealed Models

1 Form A



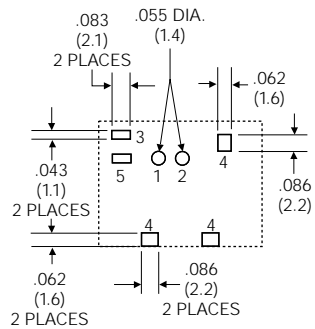
1 Form C



Suggested PC Board Layouts (Bottom Views)

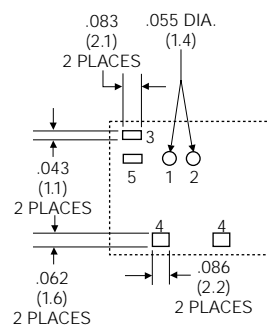
Open Model

Hole Size

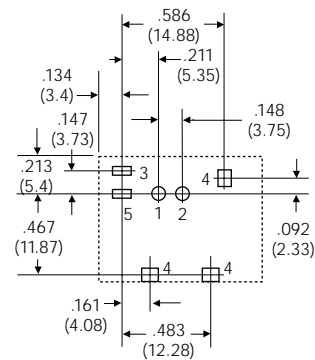


Sealed Model

Hole Size



Center-To-Center



Center-To-Center

