Automotive Relays and Switching Modules

Tyco Electronics

Driver
Information

Powertrain
Systems

THE 5 APPLICATION AREAS

Convenience

Safety & Security Systems

Body & Chassis Systems

INNOVATIVE TECHNOLOGIES

Tyco Electronics is the world's largest passive electronic components manufacturer and a world leader in cutting-edge wireless technologies. The company has facilities located in over 50 countries, serving customers in the aerospace, automotive, computer, communications, consumer electronics, industrial and power industries. The global automotive division follows the globalization goals of our customers, speeds up the integration of new technologies and enables our customers access to our vast product portfolio and services.

TERMINALS & CONNECTORS

Tyco Electronics offers a broad range of high quality terminals and connectors. Our electrical and electronic interconnection products and solutions are used to electrically and mechanically join wires and cables, printed circuit boards, integrated circuit packages and batteries. Our continually expanding capabilities include new copper and fiber-optic connectors, wires, cables and cable management systems that are designed to meet automotive industry demands. The AMP brand encompasses the broadest range of connectors in the world, including high-density, high-speed designs for leading-edge communications equipment.

LITERATURE NO. 1308092-2

CABLE ASSEMBLY SYSTEMS

Tyco Electronics is your partner for special cable assemblies. Tyco Electronics offers research and development capabilities, prototyping, samples as well as manufacturing facilities for special cable assemblies. This includes overmold technology, semi- and fully-automatic manufacturing, testing equipment and appliances for handling of high volume production.

LITERATURE NO. 1654288-2

MECHATRONICS

A variety of technical products is designed today by integrating mechanical components and electronic hardware into one packaging unit thus creating true mechatronic solutions. Mechatronic applications offer amazing and versatile potentials related to functionality, cost, space requirements and quality. Tyco Electronics contributes to those applications with its wide range of innovative and cost-effective product and process technologies.
Advanced stamping, injection molding and assembly techniques are applied along with highly selective surface plating methods.

LITERATURE NO. 1308091-2

SENSOR TECHNOLOGY

Contactless measuring eliminates interference effects, wear and tear, and provides increased reliability. Tyco Electronics, one of the largest technology providers for the automobile industry, offers contactless sensors for a variety of applications. As sensor manufacturer and processing partner, Tyco Electronics also provides project planning support for new sensor applications, assistance in the selection of the appropriate sensor technology for the respective application, and assistance with defining the corresponding mechanical, electrical and magnetic interface. Tyco Electronics has a broad electromechanical portfolio that includes robust housing technologies, connector systems, and temperature stable designs based on foil and cable networks. This combination of technologies and experience ensures that reliable and cost effective sensor solutions are available for all application types.

LITERATURE NO. 1308086-2

RELAYS AND SWITCHING MODULES

Automotive technology and integrated systems continue to develop rapidly with electric and electronic systems in today's vehicles playing an increasingly important role for traffic safety and travelling comfort. Automotive Relays and Switching Modules (AR & SM) of Tyco Electronics' Global Automotive Division offer a wide range of the most important components for such systems and is the world's no. 1 player in this industry sector. It is our intent to bring closer to you our total competencies in development, production and related technologies as well as our unique application support thus ensuring the competitive edge for mutual business growth on a worldwide scale.

LITERATURE NO. 1308085-2

POWER DISTRIBUTION SYSTEMS

The extensive net of electrical and electronic loads requires the next evolution of complex powernet structures including intelligent control and distribution systems.

Modules with intelligent technology combinations for power distribution units with integrated switching and protection functions together with a maximum of flexibility and modularity at highest package density tuned 100 % on customers needs, that's what Tyco Electronics is working on.

LITERATURE NO. 1308087-2

INDUCTIVE SYSTEMS

The Global Automotive Division is your source for interconnection and wireless technologies for automotive, truck and off-highway OEMs and Tier 1 suppliers. With the design competency center in Oostkamp (Belgium), and strategic production centers in Evora (Portugal), Bangalore (India), Shenzhen (China), and Oostkamp (Belgium), Tyco Electronics Inductive Systems is ready to offer you any LF-application component required in the automotive branches.

The Inductive Systems groups focus is on the customer requirement in order to design to the exact demand. This is achieved by high-technological, intelligent and cost-efficient engineering. In order to be a leader in design, Tyco Electronics Inductive Systems has a vast product portfolio, which consists out of antennas, actuators and integrated modules. Next to that, several specific applications are designed.

LITERATURE NO. 1308089-2

ALTERNATIVE POWER SYSTEMS
COMPONENTS FOR HYBRID AND FUELCELL TECHNOLOGY

Tyco Electronics is a leader in next-generation transportation technologies and products for hybrid and electric vehicles. The Global Automotive Division is your source for high voltage power distribution, high current contacts, high voltage connectors and cables, high voltage relays, sensors and temperature protection devices for hybrid and other alternative powered vehicles.

LITERATURE NO. 1308093-2

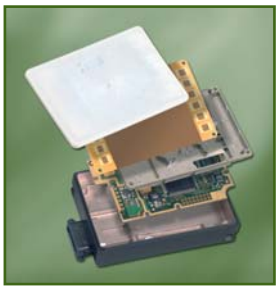
HIGH SPEED DATA NETWORKING

High speed data networking within the automobile is becoming more predominant. What was till now restricted to the high end of the market utilizing system such as the MOST® network, high speed data transmission based on optical fibers, now with the introduction of iPOD's, display screens and cameras results in the need for high speed networking throughout all platforms.

MOST® IS A TRADEMARK

LITERATURE NO. 1308084-2

WIRELESS TECHNOLOGIES
RADAR SENSORS & ANTENNAS FOR TELEMATICS



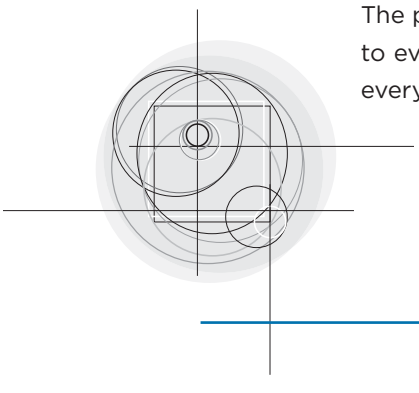
Tyco Electronics is a world leading supplier of radar technology for the automotive industries. In cooperation with system integrators and OEMs, Tyco Electronics developed 24 GHz high resolution short range radar sensors in Ultra Wide Band technology and 77 GHz Adaptive Cruise Control radar front ends suitable for driver assistance applications, which enable advanced active and passive safety systems.

Tyco Electronics develops, produces and supplies antennas for the automotive industries. Single to Quad band antennas are available in state of the art planar and dipole technologies. All telematic frequency bands for satellite radio, navigation, emergency positioning and cellular mobile communications are covered.

LITERATURE NO. 1308090-2

TYCO ELECTRONICS.
OUR COMMITMENT. YOUR ADVANTAGE.

Tyco Electronics' businesses operate in thousands of different areas of industry. The products and services we deliver all have one thing in common. They are vital to everyday living. Individuals and companies worldwide have critical needs. And every minute of every day, we satisfy them.



Tyco Electronics

TYCO ELECTRONICS "TECHNOLOGY PORTFOLIO"

- Connector Systems/ Electromechanical Components
- Relays
- Wireless Products
- Sensors
- Fiber Optic Products
- Wire & Cable
- Application Tooling
- Antennas, GPS Antennas, Integrated Antenna Systems
- Circuit Protection Devices
- Tubing & Harnessing Products
- Touch Screen Displays
- Power Systems
- Resistors & Inductors
- Battery Connectors & Assemblies
- Heat Sinks & Thermal Solutions
- Switches and Knobs
- Identification Labeling Products
- Racks & Panels
- Smart Cards/Leadframes

TYCO ELECTRONICS "AT YOUR SERVICE"

Tyco Electronics Online

The Tyco Electronics website is an innovative and interactive source for application information, product updates and technical solutions.
Our step-by-step software makes our website intuitive and user-friendly to better serve you!
Please contact us at:
www.tycoelectronics.com/automotive

Internet Homepage

www.tycoelectronics.com
www.tycoelectronics.com/automotive

Electronic Internet Catalog

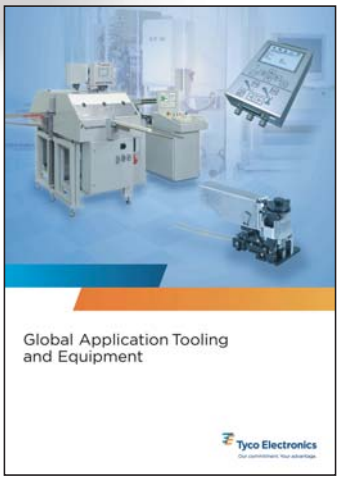
www.catalog.tycoelectronics.com

Product Information Center (PIC)

You can rely on Tyco Electronics PIC Team to provide you support for answers to your general information or technical questions in an efficient and effective manner.
To reach our PIC staff, please contact your local Tyco Electronics organization.

Product and Machine Literature

Tyco Electronics offers a variety of product specific catalogs, brochures and high impact flyers to help better serve you!
For more information on literature for Tyco Electronics' Global Automotive Division, please contact your local Tyco Electronics Organization or go to www.tycoelectronics.com/automotive



TYCO ELECTRONICS LTD.

Tyco Electronics Ltd. is a leading global provider of engineered electronic components, network solutions and wireless systems, to customers in more than 150 countries. We design, manufacture and market products for customers in industries from automotive, appliances and aerospace and defense to telecommunications, computers and consumer electronics. With over 8,000 engineers and worldwide manufacturing, sales and customer service capabilities, Tyco Electronics' commitment is our customers' advantage. More information on Tyco Electronics can be found at www.tycoelectronics.com.

GLOBAL AUTOMOTIVE DIVISION

Tyco Electronics offers a broad range of high quality electronic component products. We provide solutions for OEM applications, utility and energy, outside plant and premise networking installations and more. Products from well-known brands include connectors and interconnection systems, terminal blocks, relays, electronic modules, circuit protection devices, fiber optic components, wires and cables, switches, wireless components, sensors, touch screens and application tooling. We also provide products to insulate, protect, hold, bundle and identify electrical harnesses.

AUTOMOTIVE RELAYS AND SWITCHING MODULES

Automotive technology has developed at an amazing pace over the past couple of years. Today's vehicles feature a multitude of intelligent systems, dramatically increasing all aspects of safety and comfort of driving. Navigation systems with interactive traffic condition interface have become common even in mid-size cars. Passive and active safety systems such as antiskid brake/traction control, belt tensioners, airbags are taken for granted meanwhile. Today, in high-spec cars, the value of the electric and electronic content reaches almost a quarter of the total vehicle value. The length of the wiring can reach several thousands of meters with as many connection systems between different harnesses, ECU's and actuators. In all these systems, the reliable switching of lights, motors, heaters, ECU's has become a function that is critical for the overall reliability of the vehicle. Since decades, Tyco Electronics' automotive relays have provided the state-of-the-art solution to satisfy the industry's constantly growing requirements in this area.

With innovative solutions in design and process and with completely new features such as latching relays, low noise relays and ultra-miniaturized double relays, we provide the switching technology for the latest generation of electronic functions in the car.
The Star Point Relay – with a triple bridging make contact specially designed to switch the star point of 3-phase motors – represents a key component in the safety concept of electric power steering systems.

At the same time, uncompromised quality, based on a strict zero defects philosophy, have become an integral part of all business processes from the first design ideas to mass production. This ensures highest reliability of the electrical systems in the vehicle and for the car owner, customer satisfaction becomes reality.

This catalog is intended to give you an overview of our complete range of automotive relays with all relevant technical data. However, as every relay application is different and includes individual requirements, we encourage you to contact your Tyco Electronics representative with your specific application details. For your convenience we have included a questionnaire on page 33 of this catalog. Our team of experienced Application Engineers will be pleased to develop the "made to measure" solution optimized for your needs, and in close cooperation with your experts.

Introduction

As a further novelty of this edition the Application Recommendations were extended and are now called Application Notes. This section now includes:

- The completely reworked Relay Glossary,
- Information on Processing Relays on a PCB,
- Details about Automotive Applications,
- Important hints about Diagnostics of Relays,
- Our revised Application Questionnaire,
- An explanation of the V23### Relay Description and
- References to our Application Notes in the eCatalog.

To facilitate the ordering process, the Ordering Information tables display both the V23### Relay Description and the Tyco Electronics Part Number. For order processing, only the Tyco Electronics Part Number in the format 1-1234567-1 is relevant, whereas V23### Relay Description contains useful information about the relay type in coded form – see explanation on page 34. In addition, at the end of the catalog, all order numbers are listed in a numerical index sorted according to the Tyco Electronics Part Number giving an overview and enabling a quick find.

The Contact Data contains a minimum recommended current value for each relay. Should you wish to apply relays below the mentioned current limit please contact our Application Specialists and refer to the new chapter Application Notes (pages 16 ff).

Furthermore in order to enable a meaningful comparison, we completed the Limiting Continuous Current given at ambient temperatures of 23°C, 85°C respectively 105°C or 125°C next to the Rated Current values at 85°C displayed in previous catalogs.

Further highlights of this issue are:

The Overview of Special Featured Products containing short form information about relays developed using special technologies such as Latching and Through-Hole-Reflow (Pin-in-Paste) technology and relays for special application fields such as 24 V.

The AWG Conversion Table that is useful when selecting the right connector for plug-in relays.

Tyco Electronics Relay Experts in our Global Technology Centers and our Application Specialists in Berlin are glad to advise you to find the “made to measure” solution for your automotive applications.

We have also improved our web site; please do not hesitate to visit us at:

www.tycoelectronics.com
the address for Tyco Electronics or

http://relays.tycoelectronics.com/appnotes/
the address for our Application Notes online or

http://relays.tycoelectronics.com/telectronics.asp
the address for our Datasheets or

http://catalog.tycoelectronics.com/TE/bin/TE.Connect?C=15355&M=FEAT&LG=1&I=13
the address for our online catalog available to you 24 hours a day wherever you are.

For further information concerning individual products, please contact us in our Worldwide Companies listed at the end of this catalog. Our customer service will be glad to help you.

Attention

All products shown in this catalog carry the former logotype Tyco independently of specific customer requests.

This revision replaces all former issues and is the only current valid catalog. This especially applies to contents and revisions of technical standards and guidelines referred to in this catalog.

All specifications subject to change.
Consult Tyco Electronics for latest specifications.

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Table of Contents

INTRODUCTION

PLUG-IN RELAYS

Micro ISO Relays

Mini ISO Relays

Maxi ISO Relays

Micro 280 Relays

Mini 280 Relays

PCB RELAYS

Single Relays

Twin Relays

Axicom Relays for Automotive Applications PCB – Twin Relays

Table of Contents

	Page	
Plug-In Relays		
Micro ISO Relays		
Micro Relay A	36	✓
Micro Relay Latching	42	✓
Micro Relay Low Noise	47	✓
Mini ISO Relays		
Power Relay F4/VF4	52	✓
Shrouded Power Relay F4 A	59	✓
VF4 A (Standard, Shrouded and Weatherproof)	64	✓
Power Relay B	71	✓
Mini Relay Latching	76	✓
Maxi ISO Relays		
Power Relay F7/VF7	81	✓
Shrouded Power Relay F7 A	87	✓
Micro 280 Relays		
VJ28	92	✓
VH28 Half Width	96	✓
Mini 280 Relays		✓
VF28	100	✓
PCB Relays		
Single Relays		
Single Nano Relay (THT – THR)	106	✓
Micro Relay K (THT – THR)	111	✓
Micro Relay K SMD (Standard – Open Vent Hole)	118	✓
Micro Relay K Latching	123	✓
Mini Relay K (Open – Sealed)	128	✓
Power Relay PK2 (THT – THR)	134	✓
Power Relay PK2 Latching	139	✓
Power Relay K (Open – Sealed)	144	✓
Power Relay K-S	151	✓
VKP (Open – Sealed)	156	✓

THE PRODUCTS

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	Page	
PCB Relays		
Twin Relays		
Nano Relay (THT – THR)	162	✓
Double Micro Relay K (THT – THR)	167	✓
Double Micro Relay K SMD (Standard – Open Vent Hole)	173	✓
Double Mini Relay DMR	178	✓
Axicom Relays for Automotive Applications/PCB – Twin Relays		
IM Relay	183	
P2 Relay	184	
High Current Solutions		
High Current Devices		
Star Point Relay SPR	186	✓
High Current Relay 75	190	✓
High Current Relay 150	194	✓
Battery Disconnect Switch BDS-A	199	✓
Application Specific Switching Solutions		
Basic Module Relays		
Power Module F4/F7 and Base	204	✓
Application Specific Modules		
Wiper Module	216	✓
Cooling Fan Module	217	✓
Power Management Module	218	✓
Accessories		
Connectors Production Europe		
Connectors for Micro ISO Relays	226	✓
Connectors for Mini ISO Relays	229	✓
Production Production North America		
Connectors for Micro ISO Relays	232	✓
Connectors for Mini ISO Relays	233	✓
Connectors for Mini (Shrouded)/Maxi ISO Relays	234	✓
Connectors for Mini 280 Relays	235	✓

THE PRODUCTS

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Glossary

Technical relay terms are used differently. Depending on the relay application and the relay supplier you will face a variety of terms. For this catalog, we preferred technical terms according to IEC/EN 60 255 Part 1-00.

A

Ambient temperature
Temperature in the direct environment of the relay. Potting can hamper heat transport and consequently lead to a derating of the relay parameters (e.g. continuous current and switching capability).

Arc
Plasma current flow between opening relay contacts. An arc is enabled by the electric power of the load circuit (turn off spark) ionizing the gas between the contacts. The stability of the arc depends on various parameters such as → contact material, air pressure, → contact gap, etc. An arc locally produces high temperature causing contact erosion. In cases of strong erosion, → spark suppression becomes necessary.

Caution
If a relay that is not especially designed for 42 V applications has to switch off a 42 V load, depending on the conditions (→ contact gap, → load limit curve) an arc of infinite duration could occur. Due to the high power consumption in the arc the relay will be destroyed.

B

Bistable relay
Same as → latching relay.

Bounce time
The time from the first to the last closing or opening of a relay contact.

Break contact, Form B
→ NC contact. The break contact is closed in the → release (rest) state of a → monostable relay and opens (breaks) when the armature moves to the core (→ operate state). See also table 1.

C

Capacitive load
Switching on a capacitive load results in high inrush current. Lamp loads show similar behavior.

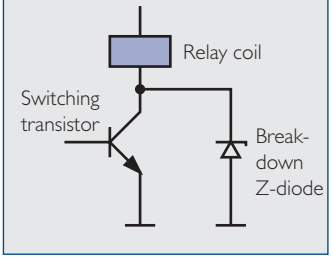
Changeover contact, Form C
Contact configuration with → make and → break contact. Changing the switch position opens the closed contact first and then closes the formerly open contact. See also table 1.

Coil resistance
Electrical resistance of the energized coil not including a parallel device for → coil suppression.

Coil suppression circuit
Circuit to reduce the inductive switch off voltage peak of the relay coil (EMC protection, → switch off voltage peak). Note that most of the circuits reduce the armature release speed, which can decrease the relay lifetime, especially valid for diodes in parallel to the coil. From the various solutions, the use of a Zener diode is particularly suitable (see fig. 1). Further information is available on request.

Class of protection
Ratings for example defined in IEC 529, indicating how completely a cover, seal, etc. protects against water, humidity, dust, direct contact etc. See also protection class.

Fig. 1



Coating
Protection of → PCB and electrical components by applying lacquers on the surfaces. For further details please see item 7 in the “Processing Information”.

Contact
Made out of → contact material and part of the → contact set where the electrical load circuit is opened or closed.

Contact carrier
Conductive metal part of the relay where the → contact is applied to.

Contact configuration, Form A, B, C
Configuration of the relay switch (→ make, → break or → changeover contact). According to the application, various contact configurations are used (see table 1). Contacts which are moved by the armature system are called → movable contacts, and non moving contacts → stationary contacts.

Contact erosion
Material loss at the contact surfaces, for example due to material evaporation by an → arc.

Contact force
Force between closed contact surfaces.

Contact gap
Gap between the contact surfaces of an open contact pair.

Most Common Contact Configurations

Denominations	Form	Abbreviations/Symbols NARM Abbreviation	Symbol of Circuit Element
Make contact Double contact make (bifurcated)	1 Form A 1 Form A (Double contact make)	SPST-NO SPST-NO DM	
Break contact	1 Form B	SPST-NC	
Make and break or Changeover contact	1 Form C	SPDT	
Double make contact on armature	1 Form U	SPST-NO DM	
Double break contact	1 Form V	SPST-NC DB	
Double make contact	1 Form X	SPST-NO DM	
Triple make contact	Form 3	–	

[1] 1 Form A
[2] 1 Form A (Double contact make)

Table 1

Contact material
For relays a variety of contact materials are in use. They operate under a wide range of loads in terms of voltage and current. Inductive loads can cause high switch off voltages and strong → arcs, capacitors create inrush current peaks. Arcs and improper → coil suppression can reduce the lifetime of a contact. So far, no universal contact material is known, that can be used on all load types with optimum performance. Contact manufacturers, relay developers, and users have established the following criteria to describe a contact:

- Electrical resistance
- Resistance to contact erosion
- Resistance to material transfer
- Resistance to welding

These criteria can be used to classify the most important contact materials according to their performance as shown in table 2 on the next page.

The table lists the major contact materials for automotive use. As the load rating for a contact depends on the used relay design as well (contact force etc.), the specification of one relay type cannot simply be transferred to others.

Contact/relay resistance (voltage drop)
Electrical resistance between the relay load terminals while the respective contact is closed. The resistance can be obtained out of the ratio of the voltage drop across the relay and the load current (Ohm's law). Surface layers (→ fritting) can result in non-linear contact – resistances and increased voltage drops (see chapter Diagnostics of Relays).

Contact set
All contacts in a relay.

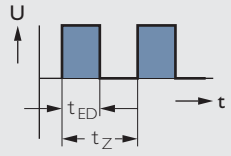
Contact Materials

Switching function current range	Load type inside vehicle	Best-suited contact material
Switching and carrying currents 0.5 A < I < 10 A at 12 V	In low power applications	AgNi0.15 or $AgSnO_2$
Periodical switching and approx. 10^6 operations 1 A < I < 10 A at ≥ 12 V	Long-life indicator switches	$AgSnO_2$
Switching and carrying of I > 10 A capacitive load	Lamps, Capacitors	$AgSnO_2$
Switching and carrying of I > 10 A resistive and inductive load	Motors, Valves	AgNi0.15 or $AgSnO_2$
Switching high inrush of I > 100 A	Lamp (e.g. H4), Spark plugs, Short circuit	$AgSnO_2$ in special cases: AgNi20 or Tungsten pre-contact

Table 2

Cycle time
Sum of make and break (i. e.: on and off) time of a contact pair (fig. 2).

Fig. 2 t_{ED} = Make time, t_Z = Cycle time



$$r = \frac{t_{ED}}{t_Z} \cdot 100\ (\%)$$

D

Double break contact, Form V
Two break contact configuration, with two electrically connected → movable contacts which operate simultaneously. See also table 1.

Double contact
Double contact configuration, where two → movable contacts are connected in series and operate simultaneously. In a bridge configuration, the load current flows from one → stationary contact via the bridge to a second stationary contact. See also table 1.

Double contact make or bifurcated contact, Form A (Double contact make)
Contact type with two contact studs per contact spring. Both contacts work in parallel. This is used for redundancy and/or reduction of contact resistance. See also table 1.

Double make contact, Form U
Two make contact configuration, with two electrically connected → movable contacts which operate simultaneously. As special version → main contact with pre-contact. See also table 1.

Double make contact, Form X
Two make contact configuration with two electrically connected movable contacts operating simultaneously. There is no external connection to the armature.

Drop test
Relays are dropped from a specified height onto a solid ground. This simulates the resistance to bad handling e.g. fall from a table. However we recommend to scrap dropped relays.

Dry switching
The relay contact switches no or a very small electrical load (< 1 mA, < 100 mV). See also chapter Diagnostics of Relays.

Dustproof
Covered but non sealed relay, featuring protection class IP54 according to IEC 529 → protection class.

Duty cycle
The ratio between the switch on time and total cycle time during periodical switching (see fig. 2). 50% duty cycle means the switch on time is equal to the switch off time.

E

Electrical endurance
Number of load switching operations a relay can perform without failure. The lifetime varies with the load. If not stated otherwise, the reference values shown in this data book apply for resistive or inductive loads with suitable spark suppression.

ELV
Abbreviation for End-of-Life Vehicles.

Environmental endurance
Generic term for the relay endurance under different climatic conditions. Appropriate test conditions are classified in IEC 68.

Energization, energizing value
A current driven through the relay coil to generate a magnetic field to move the armature. The energizing value is the product of the coil current and the number of wire turns of the coil.

Glossary

F

Faston blade
Flat male terminal of a plug-in relay.

Faston blade identification numbers for ISO relays
Coil and load faston blades of an ISO relay can be numbered according to two different standards. However, the terminals have the same location and function. The respective numbers are:

1 or 86 for the first coil pin;
2 or 85 for the second coil pin;
3 or 30 for the common load pin;
4 or 87a for the NC load pin;
5 or 87 for the NO load pin.

Fritting
See → Icing.

Fritting
Electrical breakdown which can occur under special conditions (voltage, current) whenever thin contact films prevent electrical conductivity between closed contacts. Fritting is a process which generates (A-fritting) and/or widens (B-fritting) a conducting current path through such a semi-conducting film on a contact surface. During A-fritting, electrons are injected into the undamaged film. The electron current alters the condition of the film producing a "conductive channel". During the following B-fritting, the current widens the channel increasing the conductivity (R. Holm, Electric Contacts, 4th edition, 1967, Springer-Verlag, Berlin/Heidelberg/New York). Please also refer to chapter Diagnostics of Relays.

H

H-bridge
The H-bridge or motor-reverse circuit is used to operate a motor in two directions (e.g. door lock, steering lock, power window, seat adjustment. See chapter Automotive Applications.

I

Icing
Under very special environmental conditions and temperatures below 0°C temporary relay switching failures can occur (also defined in the Standard DIN 25424 as "secondary fail"). Moisture condenses on the surface of the cold contact and forms a thin layer of ice, causing a temporary interruption of the electrical contact.

Immersion cleanable/sealed relays
Relays which are sealed against the penetration of specified → PCB cleaners or lacquers → protection class and refer to chapter Processing Information.

Inductive load
Life expectancy strongly depends on the inductance of the load circuit.

Industrial atmosphere
Atmosphere carrying dust and certain industrial exhaust gases (sulfur, chlorine and nitrogen compounds at certain humidity levels).

J

Jump start
Short relay use at higher system voltages (like car start after flat battery).

L

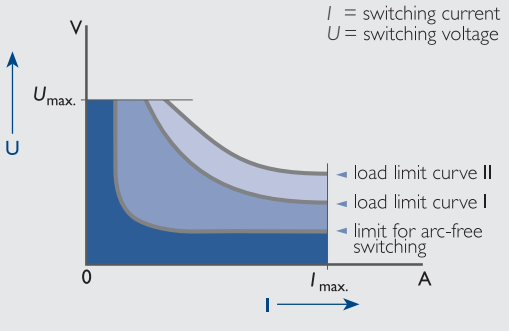
Latching relay
In a latching relay, after the coil input voltage is disconnected, the contacts remain in the last reached switching position. Tyco Electronics delivers latching relays in reset contact position. However in order to eliminate influences due to e.g. transport and processing the customer is advised to check the set/reset contact position and, if necessary, to set/reset the relay into the required position. Latching relays only require a short set respectively reset impulse. A permanent coil power supply after setting/resetting the relay is neither necessary nor allowed: maximal pulse durations depend on the relay family, for details please refer to the respective datasheets. Hence the distinguishing characteristic of monostable relays in respect to a fail safe behavior is the fact that the predefined contact rest position will be reached at break down of the power supply. This behavior cannot be shown by latching relays due to the bistable working principle they are based on. Therefore latching relays should not be used in applications that are rated according to ISO/TS 16949 7.5.3 Product Identification and Traceability.

Leadfree
See chapter Processing Information.

Limiting continuous current
The highest current (effective value for AC loads) a relay can carry under specified conditions without exceeding its specified upper limit temperature. Please note that this is not the current that can be switched with any load over the specified lifetime.

Load dump
Short relay use at overvoltage (disconnection of the battery during running engine).

Fig. 3



Load limit curves
Switching limit for DC voltage and resistive loads (see fig. 3). The load limit curves were measured with low-inductive resistors, verified for 1000 switching events. The load limit curves depend on the relay design (contact gap, contact material, armature release speed, etc.). → Contact erosion and relay lifetime vary with different voltage/current values.

Load limit curve (I)
The switch off arc of all NO loads below this load limit curve extinguishes during the → transit time of the moving contact. This limit is important for → change over relays, when the → stationary NC and NO contacts are at different voltage levels, e. g. in a motor reverse application. For currents up to 100 A the load limit curve has a falling characteristic i. e. for higher currents the voltage drop across the contacts becomes lower. If a relay that is not especially designed for 24 V or 42 V loads, depending on the conditions, (→ contact gap) an arc of infinite duration could occur. In a motor reverse circuit the arc will then shortcut the battery. The current will only be determined by the resistance of the arc and could rise to several hundreds of Amps. Due to the high power consumption in the arc the relay will be destroyed.

Load limit curve (II)
The switch off arc of the NO loads below this curve extinguishes within 10 ms (the relay is already in → release position).

Load limit curve for arc-free switching
Load voltage/current combinations below this load limit curve in general cause no arc at all.

M

Make contact, Form A
→ NO contact. Contact is open in the → release (rest) state of a → monostable relay and closes (makes) when the relay coil is energized (→ operate state). See also table 1.

Main contact with pre-contact, Form U
Double make (Form U) contact with two decoupled points of contact on the movable springs. The forward contact highly resistant to burn-up, e.g. tungsten, switches the current. The main contact highly conductive, e.g. fine grain silver, conducts the current. The forward contact makes before the main contact does and opens at last.

Maximum continuous thermal load at 23°C
Maximum coil power consumption of a relay at continuous load operation at room temperature where the relay does not exceed the specified upper limit temperature.

Maximum operate voltage (or must operate voltage)
Voltage at → room ambient temperature (RT) a relay must → operate at. To guarantee proper function of all relays, the applied coil voltage in the car must be above this specified operating voltage. Please note that the actual operate voltage of an individual relay, the maximum operate voltage and the car system value are sometimes all called operate voltage.

Maximum voltage U_{max} or V_{max}
Maximum coil voltage at → RT, at which the coil reaches the specified → upper limit temperature without contact load (→ maximum continuous thermal load at 23°C).

Maximum switching power
Maximum permissible power switched by the relay contacts, i.e. the product of the switching current and switching voltage.

Mechanical endurance
Number of load free relay switching operations without failure.

Mechanical stress resistance
Characterization of the mechanical stress a relay can withstand during installation or use. The stress resistance is defined in terms of vibration, shock, drop tests, etc.

Minimum recommended voltage
Minimum load voltage to ensure an adequate contact cleaning (see also “fritting”).

Minimum voltage U_{min} or V_{min}
Minimum coil voltage at → RT where a relay is still able to operate.

Minimum release voltage (must release voltage)
Voltage at → RT a relay must → release at.
To guarantee proper function of all relays, the limit in the car must be below this specified release voltage. Please note that the release voltage of an individual relay, the guaranteed minimum (must) release voltage and the car system value are sometimes all called release voltage.

Monostable and non polarized relay
Monostable: Relay which returns to a defined release state after the coil is de-energized. Non polarized: the relay coil works independently of the polarity of the applied voltage.

Moveable contact
Moving contact during switching operation. Moveable contact is mounted on the armature/spring system.

N

NC contact (normally closed)
→ Same as break contact. The break contact is closed in the → release (rest) state of a → monostable relay and opens (breaks) when the armature moves to the core (→ operate state).

Nip-off pin
Removable locking pin of a relay cover ventilation hole. Due to the used plastic materials, an open vent hole is usually not needed for our relays. However, certain extreme ambient/load conditions can generate noxious gases (diffusion, arc ionization) or over-pressure (during SMD soldering) inside a relay, making a gas exchange with the atmosphere desirable.

NO contact (normally open)
→ Same as make contact. Contact is open in the → release (rest) state of a → monostable relay and closes (makes) when the relay coil is energized (→ operate state).

Nominal values (power consumption, voltage)
See → rated values.

Non-operating current/voltage
Coil current/voltage at which an individual relay does not operate.

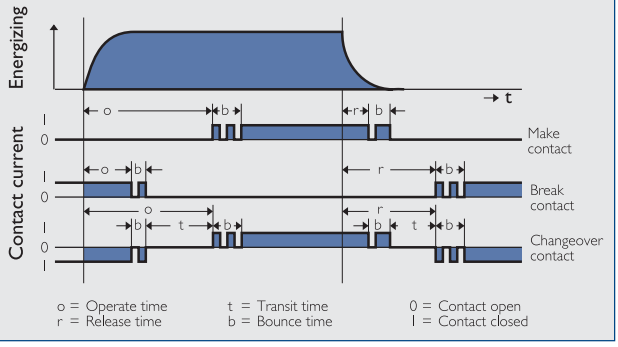
Non-release current/voltage
Coil current/voltage at which a → monostable relay does not release.

O

Operate
Relay switching process from the release state (→ NC closed) to the operate state (→ NO closed).

Operate state
Switch position of an energized → monostable relay.

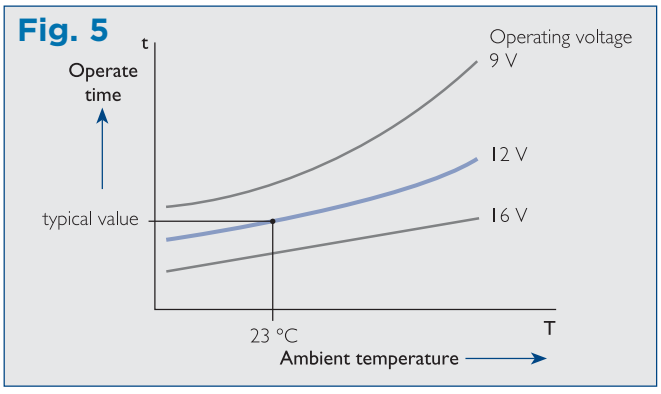
Fig. 4



The times given in this catalog are for 12 V coil voltage and RT, without any devices in parallel to the relay coil.

Operate time
Time from energizing the relay coil till the first break of the → NC contact or the first make of the → NO contact. See → relay time characteristics, fig. 4. The operate time is given as a typical value within each section "coil data" in this databook. As the coil resistance depends on the ambient temperature, the operate time varies with the operate voltage and the ambient temperature. For principal behavior see fig. 5.

Fig. 5



Overload current
This test is done to make sure, that our relays withstand overload conditions, e.g. withstand short circuit conditions until the fuse opens. Current and time are compatible to circuit protection by a typical automotive fuse according to ISO 8820-3 (2002) as shown in the table below. Relay will carry the specified currents at 23°C (I_{rated} = rated current as given in contact data section for each relay).

Test Current in A	Operating time in seconds Minimum	Maximum
6.00 * I_{rated}	0.02 s	0.20 s
3.50 * I_{rated}	0.08 s	0.50 s
2.00 * I_{rated}	0.25 s	5.00 s
1.35 * I_{rated}	0.75 s	1800 s
1.10 * I_{rated}	100 h	No requirement

Table 3

Operate current/voltage/power
Coil current/voltage/power at which a relay operates.

Operation
In tests, a whole switching cycle including energizing and de-energizing of the relay coil.

P

PCB
Common abbreviation for printed circuit board.

PIP
Abbreviation for → pin-in-paste

Pin-in-paste (PIP)
Insertion technology for → THR components on a → PCB. The terminals of the component are inserted into printed circuit board holes pre-filled with solder paste.

Polarity reverse
See → H-bridge.
Also see chapter Automotive Applications.

Protection class
According to IEC 529 standard following classification can be carried out for our relays.

Class IP67: Our so called "sealed" relays.

IP6X: Dust-tight. No ingress of dust.

IPX7: Protected against the effects of immersion. Ingress of water in a harmful quantity is not possible when the enclosure is immersed in water under defined conditions of pressure and time.

Class IP54: Non sealed relays which are protected against flux by their base plate and cover.
IP5X: Dust protected. Ingress of dust is not totally prevented, but dust does not enter in sufficient quantity to interfere with satisfactory operation of equipment.

IPX4: Protected against splashing water. Water splashed against the enclosure from any direction shall have no harmful effect.

In addition we classify the following types:

- Flux tight type (open relay without cover)
- Sealed type open vent hole (on top of cover)
- Sealed type tight washable
- Hermetic type

Also refer to Processing Information for → PCB Relays.

Pull-in voltage
Synonym for operate voltage.

R

Rated current
Defined as limiting continuous current at 85°C.

Rated power
Power consumption of the relay coil with → rated coil resistance at rated voltage and → at room ambient temperature.

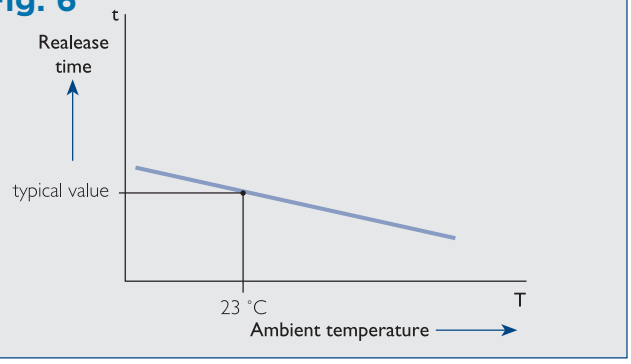
Rated values (voltage, current, resistance, etc.)
Standard values, the relay is designed for. Values are used to classify relays.

Relay time characteristics
Due to the inertia of a magnetic coil and the limited speed of the armature movement, we distinguish various characteristic relay times as shown in fig. 4.

Release
Switching process of a relay from the → operate state (→ NO closed) to the release state (NO opened or → NC closed).

Release current/voltage
Coil current/voltage at which a → monostable relay releases. Please note that the release voltage of an individual relay, the guaranteed minimum (must) release voltage of a relay type and the car system value are sometimes all called release voltage.

Fig. 6



Release state (normal position)
Switch position of a → monostable, non energized relay.

Release time (drop time)
Time interval between de-energizing the coil of a → monostable relay and the first break of the → NO contact or the first make of the → NC contact.
The release time is given as a typical value within each section "coil data" in this catalog. As the coil resistance depends on the ambient temperature, the release time varies with the ambient temperature. The influence of the operating voltage can be neglected. For principal behavior see fig. 8. The release time also depends on → coil suppression circuit.

Reset current/voltage
Coil current/voltage at which a → latching relay switches back to the reset position (generally the same value as for the operating voltage).

RoHS
Abbreviation for Restriction of Hazardous Substances.

Room ambient temperature (RT)
A standardized value for the → ambient temperature. In this data book room ambient temperature means 23°C ±3°C.

RT
Abbreviation for room ambient temperature.

S

Sealed relay
Relays which are sealed against the penetration of specified → PCB cleaners or lacquers → protection class and refer to chapter Processing Information for PCB Relays.

Shock resistance
The ability of a relay to operate properly during or after mechanical shock acceleration.

Silicone atmosphere
Silicone and its derivatives are not allowed in the material of any relay subcomponent.

Materials containing silicone or its derivatives cannot be used in any form in or near to the processing and packaging of subcomponents and the final relay assembly.

Silicone atmosphere can diffuse through the relay housing and cause contact failures. Substances containing silicone are for example grease and hand cream.

Single contact
Contact configuration with a single → stationary/ → movable contact pair on the make and/or the break side (compare → twin or double contacts).

Single/double pole (single throw version)
A single pole (single throw) relay connects one common line (movable contact) to one load line (stationary contact). A double pole relay switches two, electrically not connected common lines with two electrically independent load lines (like two separate make relays).

Single/double throw (single pole version)
A single throw (single pole) relay connects one common line (movable contact) to one load line (stationary contact). A double throw (single pole) relay switches one common line between two → stationary contacts, for example between a → NO contact and a → NC contact (→ changeover relay or form C).

Spark suppression
Reduction of the → arc energy between → movable and → stationary contact during switching.

Stationary contact
Non movable contact, mounted on a → contact carrier which is directly connected to a relay pin/faston blade.

Steady state current limit
See → limiting continuous current.

Storage
Relays should be stored in a clean area within the specified temperature limits. Extreme humidity and condensation can cause corrosion of the metal parts in and outside of the relay. Solderability is best within a storageperiode of up to 6 months under 15 to 35°C; 25 to 75% relative humidity, according to IEC 68. SMT relays have to be dried before the soldering process to prevent damage caused by evaporating humidity absorbed in the plastic. This is done in the preheating zone of the SMD oven. Temporarily increased contact resistance caused by the formation of oxides and other layers during a longer storage period, is typical for most contact materials.

The growth of such layers depends on the ambient atmosphere and is more rapid at high temperature. Special attention is required if relays are tested or used with low contact loads after extended storage periods. See also “Diagnostics of Relays” in the Application Notes.

Surface mounted device (SMD)
See surface mount technology (SMT).

Surface mounted technology (SMT)
An assembly process where electrical connection of components → (surface mount device) is made to the surface of a conductive pattern of a PCB without component terminal holes. SMT soldering should be carried out according to the recommendations of CECC 00802 and IPC/JEDEC J-STD-020C if not stated otherwise in the respective datasheet.

Switching current
Current switched by the relay contact.

Switching rate
Number of → operations (contact closings and openings) per second. The rated “maximum switching rate” is measured for load free switching at → room ambient temperature and no → coil suppression device parallel to the coil.

Switching voltage
Voltage between the relay contacts before closing or after opening the contacts.

Switch off voltage peak of the relay coil
Induced voltage peak caused by the collapsing magnetic field of a de-energizing relay coil. The product of the coil current and the resistance* of the device parallel to the coil approximately gives the amplitude of the switch off voltage.

* In case of a 36 V rated coil the use of a 60 V Varistor or Zener diode is recommended.

T

Test voltage/dielectric test voltage/dielectric strength
Voltage applied during dielectric (high voltage) tests between intentionally not electrically connected parts of the relay.

Thermal resistance
Relay parameter measured in Kelvin per Watt, which relates the consumed power with the respective temperature increase in thermal equilibrium.

Without load and parallel resistor, the thermal resistance of a coil multiplied with its power consumption (at the actual coil temperature) gives the temperature increase of the coil above ambient temperature.

Through-hole technology (THT)
An assembly process for mounting components where terminals are passed through supported (plated through) or unsupported (bare) holes in an interconnection substrate. Normally, traditional wave soldering is used with THT components.

Through-hole reflow (THR)
An assembly process, where THT components are soldered in a reflow process instead of traditional wave soldering. See also → pin-in-paste and for details see chapter Processing Information.

Transit time
The movement time of the armature after opening of one contact set (e.g. NC) before closing of the other (e.g. NO) of a → changeover relay (→ relay time characteristics, fig. 4).

Triple make contact, Form 3
Three make contacts configuration (new form) with three electrically connected movable contacts operating simultaneously. There is no external connection to the armature. See also table 1.

V

Vent hole open (open vent hole)
Reflow solderable relays as well as THR and SMD relays are provided with an open vent hole on top of the cover.

Vibration resistance
The ability of a relay to maintain the operating state during mechanical vibration.

Voltage drop/voltage mV drop
See → contact/relay resistance.

W

WEEE
Abbreviation of Waste Electric and Electronic Equipment.

Important Facts about Processing PCB Relays

Our relays can be processed in commercial soldering and washing installations (if classified as washable). They cover the following regulations:

Flux tight type relays; open relays without cover:

- Solderability according to IEC 68 2-20, Test Ta, method 1, aging 3: 4 hours at 155°C, dewetting
- Resistance to soldering heat according to IEC 68 2-20, test Tb, test method 1A

Sealed type open vent hole relays:

- Solderability according to IEC 68 2-58; dewetting
- Resistance to soldering heat according to IEC 68 2-58

Sealed type washable relays:

- Such relays are capable of being automatically soldered and subsequently undergoing a washing process to remove flux residues without allowing the ingress of flux or washing solvents
- Sealing complies to IEC 68 2-17; Test Qc: method 2, the relay will withstand a bubble test at 70°C for 1 min
- See also item 6. Chemical Cleaning

1. Assembly on the PCB

Relays are high precision components that are sensitive to mechanical stress and abusive handling. Care must be taken when handling the relay during all stages of production. Do not exert any pressure on the pins. After assembling the relays onto the PCB the relay pins must not be bent for attachment. Bending the pins may affect the relay parameters and on immersion the sealing maybe damaged for cleanable relays. If attachment is necessary before soldering, we recommend an external arrangement such as a pressure plate or similar.

2. Fluxing Open and Dustproof Relays

Fluxer must not penetrate into the relay. It could deposit impurities onto open relays and system failures would occur. When using open or dustproof relays the fluxer should merely touch the bottom of the PCB. It should be set in a way that it cannot flood onto the top of the PCB. This is particularly critical if multilayer PCB are used and there are unused holes under the body of the unsealed relay. If there is any doubt about the fluxing process, sealed type washable or hermetic type relays should be used.

Recommended flux (with non corrosive residue): type F-SW 32 to 34 to EN 29454-1 (ISO 9454-1).

3. Preheating

The preheating temperature for drying the flux should not exceed 100°C on top of the PCB.

Note: Flux which has not completely dried might "explode" when immersed in the soldering wave and may get inside an open relay. This could create solder balls generating short circuits on the PCB.

4. Processing on Soldering Lines

- SnPb processing

Fig. 4.1, 4.2 and 4.3 show the maximum permissible temperatures at the terminals according to CECC 00802 and IPC/JEDEC J-STD-020C.

Fig. 4.1

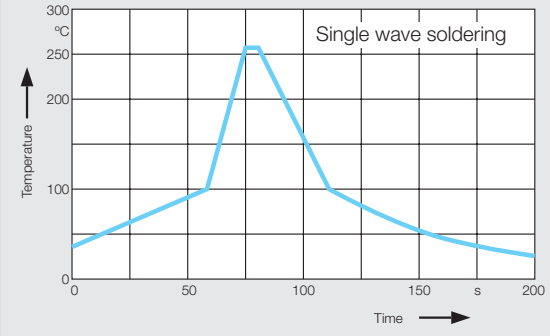


Fig. 4.2

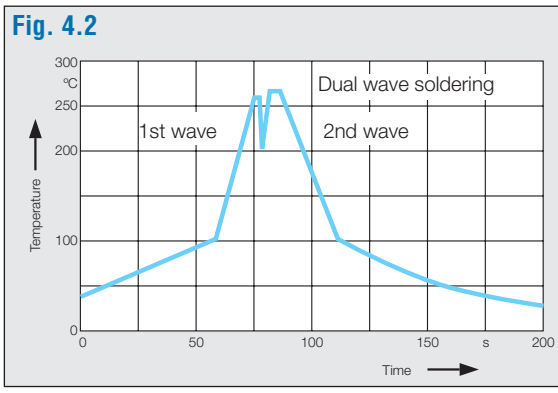
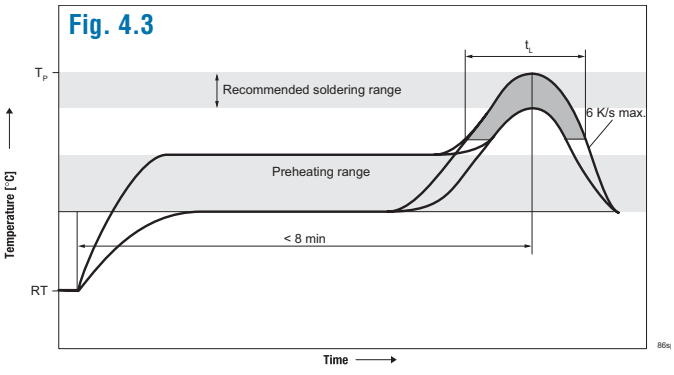


Fig. 4.3



For SnPb Eutectic Process we recommend a maximum peak temperature Tp < 225°C. For Pb-free processing we recommend a maximum temperature Tp < 245°C. These soldering temperature profiles indicate the Pad/Pin temperature.

In some cases the ambient temperature may be greatly increased on top of the relay component. In this case the component temperature should not exceed 260°C. Check for specific mounting conditions. In addition the time, parameter t_L in fig. 4.3, should be below 150 s.

- **Leadfree processing**
  The components are ELV/RoHS/WEEE compliant. Processing of relays under leadfree conditions may have impact on relay parameters. We recommend that leadfree processes should be carried out using SnAgCu-solder. For further information please refer to the IPC/JEDEC J-STD-020C.

5. Cooling Post Soldering

After flow soldering, the assemblies should be cooled in order to reduce thermal stress and to minimize the pressure difference between inside and outside of the relay. Do not cool down by using cold liquids or aerosols. If not performing as prescribed, the relay sealing could break, cleaning fluid with dissolved flux might be sucked inside the relay. Ingress of liquids into the relay can lead to failures in operation.

6. Chemical Cleaning

In modern PCB assembly, less and less cleaning is used.

Note: If the recommended flux is used, there is no need to wash the PCB. This helps the environment. If cleaning is necessary, certain precautions have to be taken.

- **Flux tight type relays/**
  relays with open vent hole (THR)
  Only the base of the PCB (soldering side) should be cleaned to prevent penetration of solvent and dissolved flux into the relay. Any other cleaning method involving potential contamination of unsealed relays should be avoided. Acidic fluxes are not suitable for open relays due to the risk of corrosion, especially inside the coil.
- **Sealed type washable/hermetic relays**
  Only sealed relays should be washed carefully to remove flux residues without allowing the ingress of flux or washing solvents. Nevertheless the PCB should be allowed to cool prior to the washing process to avoid damaging of the seal due to thermal shock or pressure differential.

  When using high pressure cleaning processes, special care has to be taken to avoid any ingress into the relay. Liquids under high pressure can damage the seal of the relay. Modern cleaning equipment uses water or alkaline solutions, which are more environment-friendly than chlorofluorocarbons (CFC). If other cleaning solvents are used, ensure that the chemicals are suitable for the relay.
  The use of unsuitable solvents can cause cracking or discoloring of the plastic parts. Suitable solvents include isopropyl alcohol (alcohol-based solvents), water with wetting agents. Unsuitable solvents are e.g. acetone, ethyl acetate, aqueous alkalines, phenolic combinations, thinner-based solvents, chlorosenebased solvents, trichlene-based solvents and chlorine. Fluor-based cleaning solvents like Freon are prohibited nowadays.

7. Protective Coating of Assembled PCB

Do not coat flux type relays. Sealed type open vent hole could only be partly coated.

For varnishing of assembled PCB, we recommend one-component lacquers (epoxy-based). If using a polyurethane based lacquer, check if the solvent damages the relay.

We recommend the usage of a selective coating technology to make sure that the area between relay bottom and board is free of lacquer.

If not possible, make sure that the varnish is cured under constant or increasing process temperature. The coating lacquer temperature should not be lower than the relay temperature.

A further possibility is to mount the relay after coating.

Do not allow de-varnishing of PCB for repair.
If unavoidable the relay has to be replaced in addition by a new one.

We recommend a drying oven temperature of 70°C. The temperature should not exceed the maximum temperature range specified in the datasheets.

8. Hand Soldering

For hand soldering please refer to the following standard: ANSI/J-STD-001.

Temperature of soldering iron 300 to 350°C.
Soldering time < 2 s.

9. Silicone

Silicone and its derivatives are not allowed in the material of any relay subcomponent. Materials containing silicone or its derivatives cannot be used in any form in or near to the processing and packaging of subcomponents and the final relay assembly.

Contamination can occur with

- Volatile silicones
- Silicone aerosols
- Silicone fluids

The volatility of silicone materials depends on temperature, molecular weight and structure. Arcing, i.e. by switching relays or rotating motors, degrades silicone species into siliceous compounds that deposit as an insulating abrasive layer on the contact surface. This layer generates either contact resistance increase in relays or failure in electrical motors due to abrasion of the collector. It must be pointed out that all silicone-based materials before and after cure have a certain percentage of silicone volatiles.

In standard materials, this varies from 0.5 to 3%, but it can be even more in some very low viscosity conformal coatings (“The use of silicon materials in close proximity of electrical motors and mechanical relays”; e-Drive Magazine Dec. 2005/Jan. 2006; Vol. 6, Is. 6).

In addition silicone aerosols and volatile silicones can diffuse through the relay housing. Substances containing silicone are for example grease and hand cream.

Typical Automotive Applications

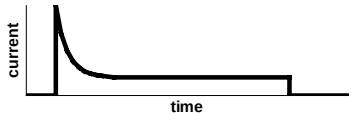
Load	Application examples	Typical current curve
Resistive Loads	- Heatings (rear window heating, seat heating glow plug, air/water preheating)	
Capacitive Loads	- Lamps (front and rear beam, fog lights, flasher) - Filter capacitors in electronic modules (engine management module, ABS module)	
Inductive Loads	- Solenoids (vales, clutches, relay coils) - Motors and pumps (power window, central lock, cooling fan)	

Table 1

Introduction

The range of applications can be classified into resistive loads, capacitive loads and inductive loads. The current curve of resistive loads is specified by the load voltage and load resistance. Capacitive loads have a high inrush current and a low steady current. Therefore lamps are counted to the capacitive loads, because the cold filament has a significantly lower resistance, than the hot filament. Inductive loads are characterized by an exponential current increase and a remarkable switch off arc, induced by the demagnetization of the magnetic circuit of the load. Power supply relays (clamp relays) can switch or feed a mixture of different loads.

The circuit design of resistive and capacitive loads is usually a simple switch on and switch off. Motor load circuits are often more complex. The most typical circuits are described hereafter.

Short-Circuit Brake

The short-circuit brake is used, wherever an electric motor must be braked (e.g. wiper). The short-circuit brake transforms the rotational energy of the motor into electrical energy. The short-circuit brake can be critical at higher load voltages. If the switch-off arc does not extinguish during the transition time of the movable contact, the arc creates a direct shortage of the power source. Particularly in 24 V systems, the resulting extremely high arc current could cause almost instantly severe damage to the contacts and could destroy the entire relay.

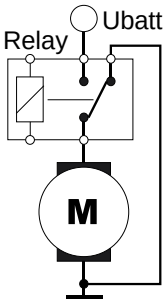


Fig. 1 Short-circuit brake

Motor-Reverse Circuit (H-Bridge)

The H-bridge is used to operate a motor in two directions (e.g. door lock, steering lock, power window, seat adjustment, etc.). The operation time is typically very short compared to the thermal time constant of the relay (e.g. door lock < 1 s, power window < 10 s). This means, H-bridge relays must be designed for high current-switching-capability, but not for high current-carrying-capability. Higher load voltages can be critical, due to possible short-circuit-arcs (see also short-circuit brake).

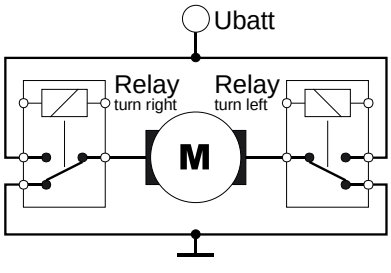


Fig. 2 H-bridge

Wiper Circuits

To stop the wiper in the correct position, a short-circuit brake is used. This can be done either by an internal slipring (usually used for rear wiper) or with the normally closed contact of the relay (usually used for front wiper). This requires a high switching capability of the N/C-contact, especially in combination with intermittent wipe function or rain sensor control. Dual speed wipers have two windings, which are commuted by a second relay. There are also wiper systems without mechanical gear, which are electrically reversed with a H-bridge circuit.

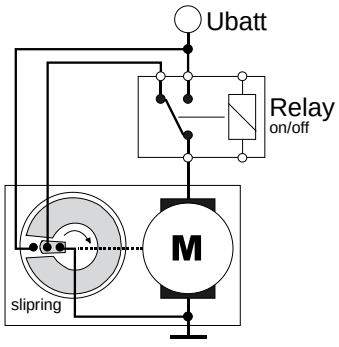


Fig. 3 Standard front slipring

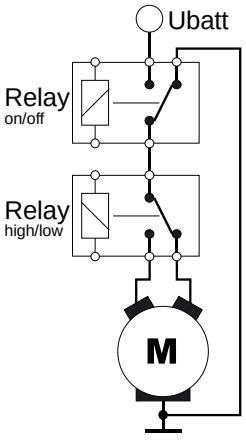


Fig. 4 Wiper with internal wiper-circuit

Cooling Fan Circuits

Depending on the size of the engine, either one or two fans are used to cool the engine. There are different possibilities to control the speed of the fans. Single fan systems are usually controlled by one or more serial resistors. The disadvantage is the electrical power loss of the resistors. Double fan systems are normally controlled by switching them either in series (low speed) or in parallel (high speed). If more speed steps are needed, additional serial resistors are used.

A more sophisticated method is a PWM-controlled brushless motor. In commercial vehicles the cooling fan is mostly driven directly by the motor shaft.

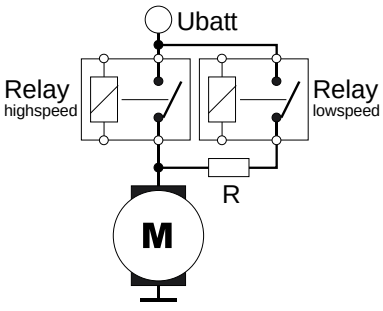


Fig. 5 Single fan circuit

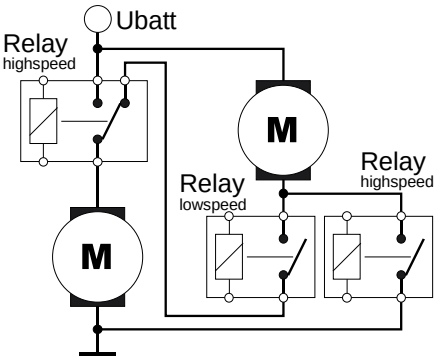


Fig. 6 Double fan circuit

Coil Suppression Circuits

The disconnection of the relay coil generates a transient voltage peak, which is only limited by the parasitic inductivity and capacity of the electrical system. In most of the cases it is necessary to suppress the transient voltage peak to typically 60 V – 100 V for the protection of the relay driver or the vehicle electrical system. Any voltage suppression of the relay coil influences the dynamics of the electro-mechanical system and can reduce the lifetime.

The best protection method for the driver is a diode in parallel to the relay coil. But this method has the worst influence on lifetime of the relay. Typical suppression methods are a resistor in parallel to the coil (preferably as internal component in plug-in relays) or a Zener diode in parallel to the relay driver (preferably for PCB relays).

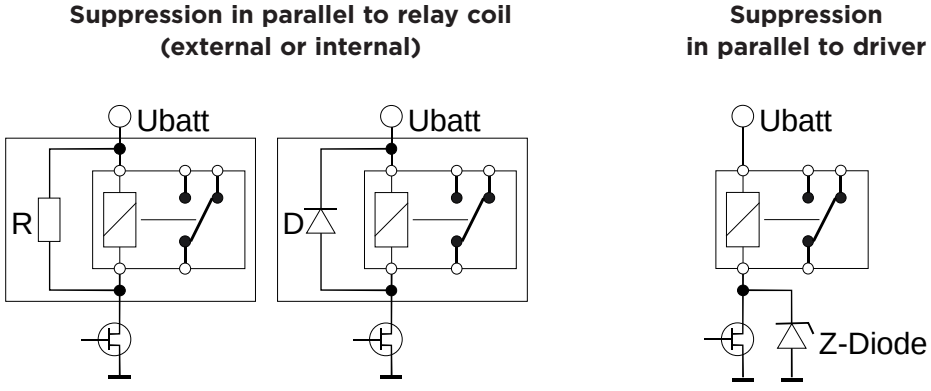


Fig. 7 Coil suppression circuits

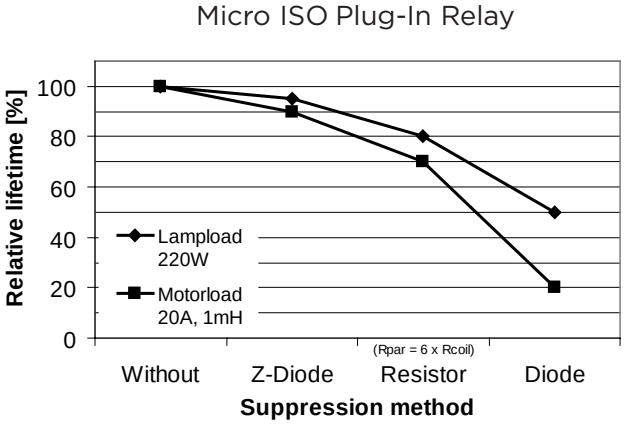


Fig. 8 Influence of coil suppression on the lifetime

Introduction

With the increase of electronic circuits and safety requirements in cars, more and more switching contacts are monitored by diagnostic routines. Similar routines are used by the system suppliers before, during and after the assembly processes (In-Circuit and End-Of-Line tests) as well.

Automotive relays are originally designed to switch real automotive applications (e.g. motors, lights, heating, etc.) with a load voltage of 12 V (or 24 V or 42 V) and load currents above 1 A. Lower diagnostic current and voltage levels can result in wrong interpretations of the state of the relay contact.

This paper explains the technical background of the relay contact system, coil system and dynamic behavior and gives recommendations for applicable diagnostic routines.

Contact System

The most common contact materials for automotive relays are fine grain silver (AgNi0.15) and silver tin oxide ($AgSnO_2$). Both materials are affected by sulfidation and oxidation. These layers of oxides, sulfides and other compounds will be formed on the surface of metal-contacts by absorption of gas molecules from the ambient atmosphere within a very short time. The layers will increase the contact resistance. The resistance of such layers depends on the thickness of the layer, effective contact area and the specific resistance of the contact material/layer. To get a reliable electric contact these layers have to be destroyed. This can be done by mechanical, electrical or thermal destruction.

A mechanical destruction requires high contact forces. With the very high degree of miniaturization of automotive relays, those contact forces cannot be safely achieved, especially for normally-closed contacts.

An electrical destruction requires a specific breakdown voltage and current. This destruction process is called A-fritting.

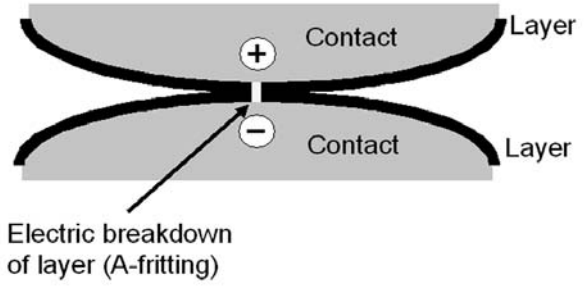


Fig. 1 Contact layers

The breakdown voltage depends on the thickness and specific resistance of the layer and can reach theoretically some hundred volts. In the practice of automotive relays the breakdown voltage can be up to 3 V. A current of min. 10 mA is needed to start the A-fritting.

After the electrical breakdown a small current is forced through very thin channels in the layer. The resulting local high current density heats the conducting channels up quickly, destroying the layers, until finally (within a few ms) a metal to metal bridge is established. This process is called B-fritting. The B-fritting voltage depends again on the thickness and specific resistance of the layer and can reach in the practice of automotive relays up to 300 mV.

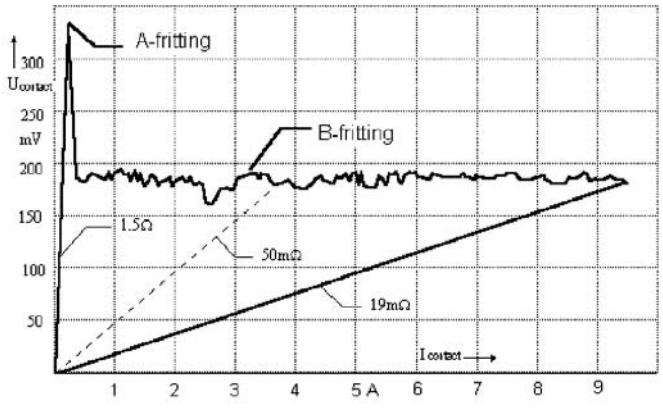


Fig. 2 Fritting of a relay contact

A thermal destruction requires high temperatures, which will only be generated by high contact currents or electric arcs (disconnecting inductive loads). The thermal destruction can only take place, after an electrical destruction.

Coil System and Dynamic Behavior

Automotive relay coils are designed for DC-voltages. The switching times (i.e. operate time or switch-on time and release time or switch-off time) are usually in the low millisecond-range. The operate time depends on the applied coil voltage. Fig. 3 shows the relation of the operate time and coil voltage, related to the actual pull-in voltage. The nominal voltage in the displayed case is 170% of the actual pull-in voltage at an ambient temperature of 23°C (e.g. 7 V pull-in voltage at 12 V nominal voltage). Higher coil temperatures increase the pull-in voltage and subsequently increase the operate time at the same applied coil voltage. Including possible contact bouncing, the operate time can be three times as high as the typical values shown in the datasheets.

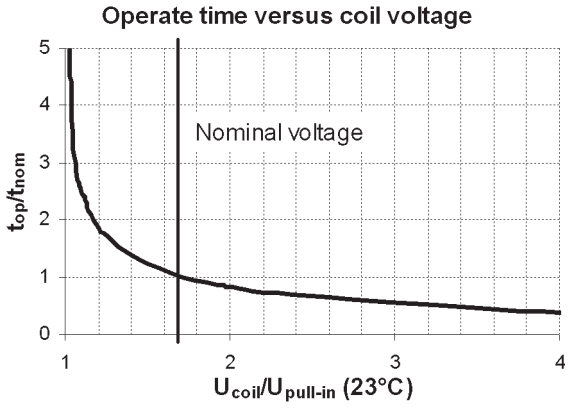


Fig. 3 Operate time

The release time depends mainly only on the used coil suppression. A low ohmic device (e.g. a diode) in parallel to the relay coil can increase the release time by a factor of up to 4 compared to the typical values shown in the datasheets.

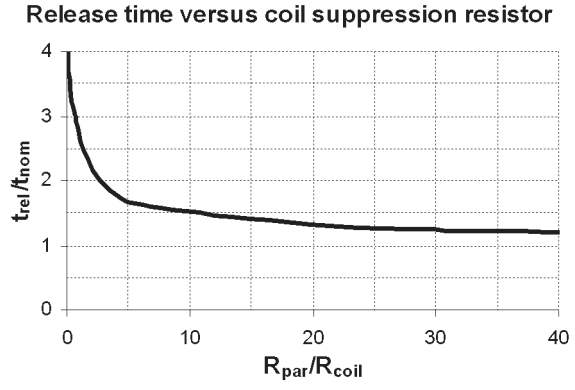


Fig. 4 Release time

Coil Resistance

The inductivity of automotive relay coils can exceed (in the unsaturated range) 1 H. This results in time constants tau between 1 to 50 ms for the exponential inductive current increase (jump response). If the ohmic coil resistance is measured with a 4-pole measurement, the resistance value will be wrong, if it is measured during the inductive current increase after switch on.

Recommendations for Diagnostic Routines

A contact diagnostic routine must:

Take into account, that the contact resistance may be non-linear. Due to the explained fritting phenomena, the contact resistance can be non-linear. This means, that the contact resistance, measured at low voltage and current levels (e.g. standard multimeter) can be significantly higher than the contact resistance under real conditions (e.g. supplying a 100 W load). **We recommend to perform the diagnostic routine with the real application and real board net voltage connected.**

Supply a sufficient voltage and current to force the A-fritting. If the diagnostic routine cannot be performed with real application and voltage, the measurement voltage level must secure an electrical breakdown of possible layers. **We recommend a voltage level of min. 5 V and current of min. 100 mA.**

Accept, that the voltage drop can be 300 mV. The B-fritting is a physical phenomenon, which can occur on all silver based contacts. For signal-applications, special signal relays are available. **We recommend to set the diagnostic threshold voltage to 500 mV per relay contact (important for H-bridges or serial contact arrangements).**

Regard the maximum possible switching times. If the status of the contact has to be changed for the diagnostic routine (energize or de-energize relay), the routine must wait until the intended contact status is reached. Depending on ambient conditions (temperature, voltage levels, coil circuits) the times can be significantly longer than the specified typical times. **We recommend a delay time of min. 10 times of the typical switching times.**

A coil diagnostic routine must:

Secure, that the status of the contact does not change during the diagnostic. If the coil driver is monitored by a watchdog routine, the energizing/de-energizing time of the coil must not result in an unintended closing or opening of the contacts. **We recommend times of max. 0.5 ms.**

Remarks

1. During the lifetime of the car, the relay parameters can alter due to ageing processes like contact erosion, fretting corrosion and relaxation. Moreover the environmental requirements (temperature, vibration etc.) in the car are higher than in IC- or EOL-tests. Therefore we recommend for diagnostic routines in the car a higher threshold voltage (approx. 3 V) and higher delay times (min. 15 times of the typical switching times).
2. Most of the applications, switched by relays, are not safety related. If a potential relay failure is detected, we recommend to not block any further activation of the relay but to write the occurrence into the error memory.

Application Questionnaire

To ensure the selection of the best suitable relay type for your application, we strongly recommend to complete below questionnaire and consult your local Tyco Electronics representative or our application support.

Company: _____
Name: _____
Department: _____
Address: _____
Phone: _____
Email: _____

1. General Information

Application: _____ Relay type: _____
_____ Contact arrangement: NC ❑ NO ❑ C/O ❑

2. Wiring Diagram/Sketch (Please use separate sheet if needed)

3. Driving (Control) Circuit

Minimum coil resistance (23°C) _____ Ω
Pull-in voltage at 23°C [1] _____ V
Pull-in voltage at max. temperature [1] _____ V
Maximum vehicle voltage _____ V

Vehicle electrical system: 12 V ❑ 24 V ❑ other: ___ V
Further requirements for operate and release voltage:
_____
_____

[1] Coil temperature

Duty cycle Energized time: _____s De-energized time: _____s
Ambient temp. range Minimum: _____°C Maximum: _____°C

Relay coil suppression None ❑ Parallel resistor ❑ Diode type ❑ Others ❑

4. Load Description

Inductive load ❑ _____ mH Resistive load ❑ Lamp load ❑ Others ❑ (detailed description please)

N/O (make contact) Max. make current ___ A Max. break current ___ A Max. cont. current ___ A
N/C (break contact) Max. make current ___ A Max. break current ___ A Max. cont. current ___ A

Dry Switching (currents < 1 A) Yes ❑ [2] No ❑ Unknown ❑ [2]
Switching status diagnostics intended Yes ❑ [2] No ❑ Unknown ❑ [2]

[2] Contact Tyco Electronics representative for important guidelines about dry switching and diagnostic routines.

Spark suppression components _____
Required number of switching cycles _____

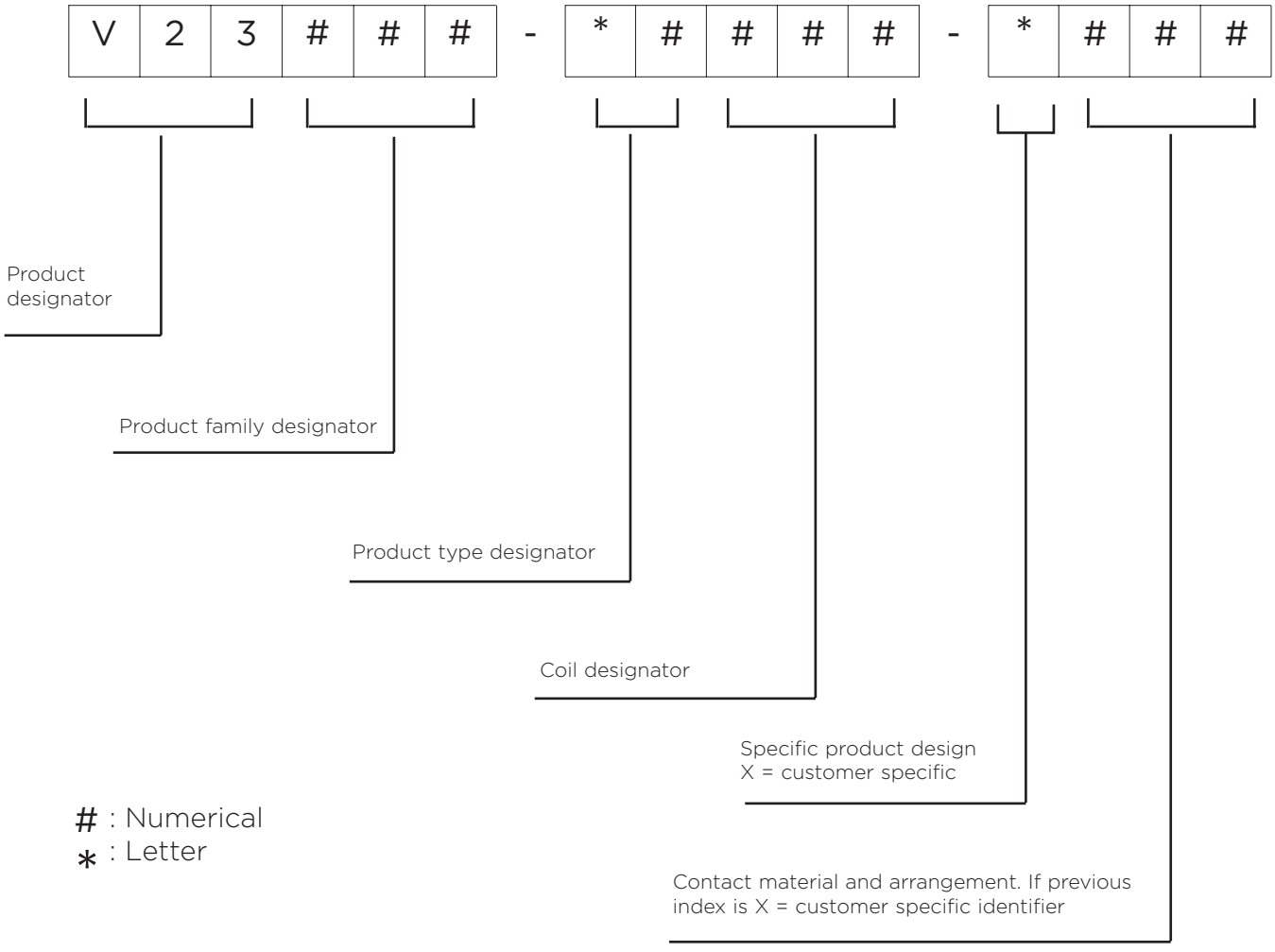
5. Miscellaneous

Dimensions in mm L _____ W _____ H _____ Footprint _____
Approvals _____
Others _____
_____
_____

6. Quantity

Volume in	1st year	2nd year	3rd year	4th year
Pieces				

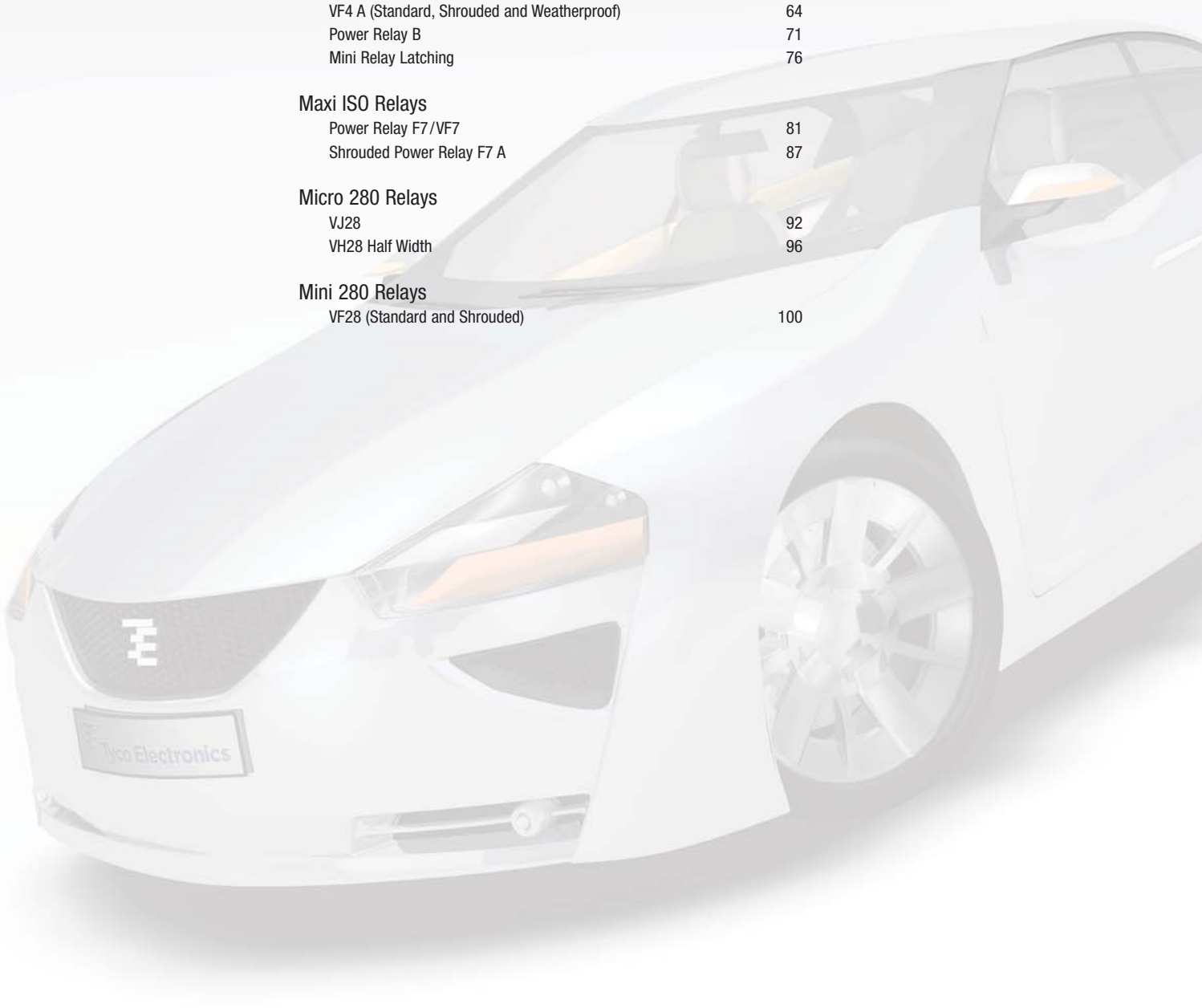
Description Explanation



Example

Relay Description	V23072-A1061-A303	V23086-C1021-A502
Relay Family	Mini Relay K	Micro Relay K
Relay Type	Open version	Sealed version
Coil Designator	12 V	12 V
Design	Standard version	Standard version
Contact Material and Arrangement	AgNi0.15, CO	$AgSnO_2$, NO

Technical Information



Micro Relay A

Features

- Limiting continuous current 25 A at 85°C
- High current version with limiting continuous current 30 A at 85°C
- Pin assignment according to ISO 7588 part 3

Customized Versions on Request

- 24 V versions with special contact gap
- Integrated components (e.g. diode)
- Customized marking
- Special covers (e.g. notches, release features, brackets)

- For latching version refer to Micro Relay Latching
- For low noise version refer to Micro Relay Low Noise
- For high current version refer to Ordering Information page 41

Typical Applications

Cross carline up to 25 A for example:

- ABS control
- Blower fans
- Cooling fan
- Door control
- Door lock
- Fuel pump
- Heated front screen
- Immobilizer
- Interior lights
- Seat control
- Seatbelt pretensioner
- Sun roof
- Trunk lock
- Valves
- Window lifter
- Wiper control

Please contact Tyco Electronics for relay application support.

074_3D03

Design

- ELV/RoHS/WEEE compliant
- Dustproof; protection class IP54 to IEC 529 (EN 60 529)

Weight

Approx. 16 – 20 g (0.5 – 0.7 oz.)

Nominal Voltage

12 V or 24 V

Terminals

Quick connect terminals similar to ISO 8092-1, coil and break 4.8 x 0.8 mm, load 6.3 x 0.8 mm; surfaces tin plated

Accessories

Connectors see page 226 ff

Conditions

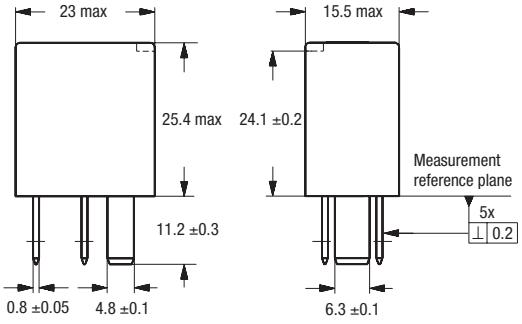
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

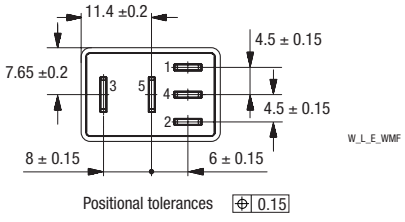
Micro Relay A

Dimensional Drawing

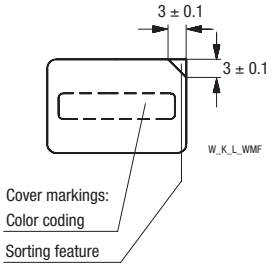


Quick connect terminal similar to ISO 8092-1

View of the Terminals (bottom view)



Cover Marking



Only available for Micro Relay A on request

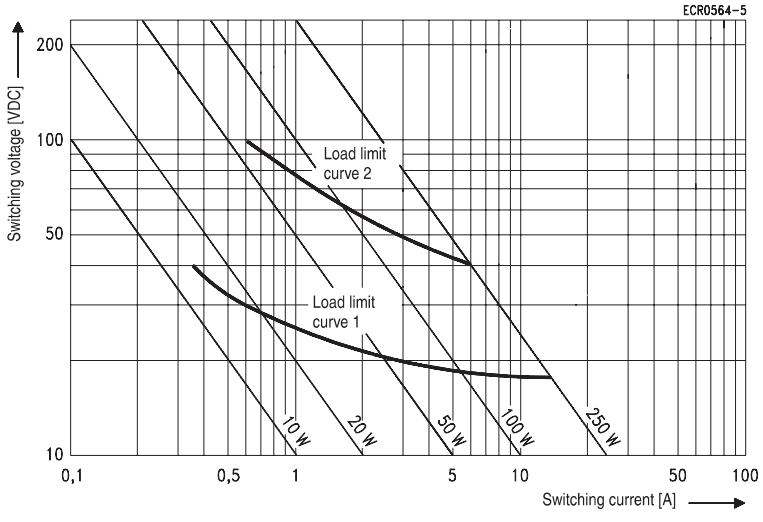
Micro Relay A

Contact Data

Contact configuration	1 Make contact/ 1 Form A			1 Changeover contact/ 1 Form C	
Circuit symbol					
Rated voltage	12 V		24 V	12 V	24 V
Rated current	Standard	High current			
	25 A	30 A	15 A	15/25 A	10/15 A
Limiting continuous current				NC/NO	
23°C	30 A	35 A	30 A	20/30 A	
85°C	25 A	30 A	25 A	15/25 A	
125°C	10 A	15 A	10 A	8/10 A	
Contact material	Silver based				
Max. switching voltage/power	See load limit curve				
Max. switching current [1]				NC/NO	NC/NO
On [2]	120 A	120 A	120 A	40/120 A	20/120 A
Off	30 A	30 A	20 A	15/30 A	10/20 A
Min. recommended load [3]	1 A at 5 V				
Voltage drop at 10 A (initial)					
NO contact	Typ. 15 mV, 200 mV max.			Typ. 15 mV, 200 mV max.	
NC contact				Typ. 20 mV, 250 mV max.	
Mechanical endurance (without load)	Typ. 10^7 operations				
Electrical endurance (example of resistive load, further information on request)	> 1 x 10^5 operations		> 1 x 10^5 operations 15 A, 28 V	> 1 x 10^5 operations 25 A, 14 V (NO contact) > 1 x 10^5 operations 10 A, 28 V (NC contact)	> 1 x 10^5 operations 15 A, 28 V (NO contact)
	25 A, 14 V	30 A, 14 V			
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)				

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V or 27 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve



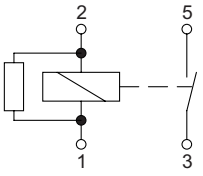
Load limit curve 1 ≙ arc extinguishes, during transit time (changeover contact)

Load limit curve 2 ≙ safe shutdown, no stationary arc (make contact)

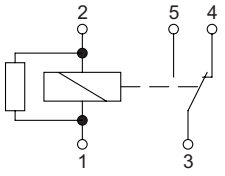
Micro Relay A

Circuit Diagram

AR
1 Make contact/1 Form A
with Resistor



CR
1 Changeover contact/1 Form C
with Resistor

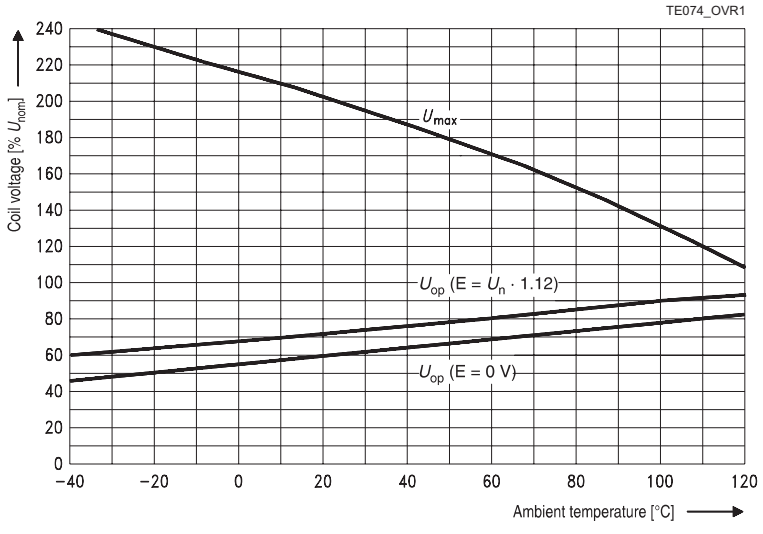


Coil Data

Available for nominal voltages	12 V / 24 V		
Nominal power consumption at nominal voltage with suppression resistor	Micro A 12 V 1.4 W	Micro A 12 V high current 1.1 W	Micro A 24 V 1.6 W
Test voltage winding/contact	500 VAC_{rms}		
Ambient temperature range	–40 to +125°C		
Max. switching rate without contact loading	20 Hz		
Operate time at nominal voltage	Typ. 5 ms		
Release time at nominal voltage	Typ. 3 ms		

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Micro Relay A

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	150 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1)]
Resistance to bending, force applied to side	10 N [1)]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures.

1) Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

Environmental Conditions

Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation	EN ISO 6988		6 cycles	Storage 8/16 h
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat				
cyclic	IEC 68-2-30	Db, Variant 1	6 cycles	Upper air temperature 55°C
constant	IEC 68-2-3	Ca	56 days	
Corrosive gas	IEC 68-2-42	10 ±2 cm^3/m^3 SO_2	10 days	
	IEC 68-2-43	1 ±0.3 cm^3/m^3 H_2S	10 days	
Vibration resistance	IEC 68-2-6 (sine sweep)		10 - 500 Hz min. 5 g	No change in the switching state > 10 µs Valid for NC contacts, NO contact values significantly higher
Shock resistance	IEC 68-2-27 (half sine form single pulses)		min. 20 g 11 ms	
Load dump	ISO 7637-1 (12 V)	Test pulse 5	Vs = +86.5 V	
	ISO 7637-2 (24 V)	Test pulse 5	Vs = +200 V	
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1)]			
Overload current [2)]	34 A, 1800 s 50 A, 5 s 87.5 A, 0.5 s 150 A, 0.1 s			

1) FMVSS: Federal Motor Vehicle Safety Standard.
2) Current and time are compatible with circuit protection by a typical 25 A automotive fuse. Relay will make, carry and break the specified current.

Micro Relay A

Ordering Information

Part Numbers (see table below for coil data)			Circuit/Contact Arrangement	Contact Material	Enclosure	Coil Suppression	Terminals
Relay Description	**Equivalent to**	**Part Number**					
12 V Plug-In Relays [1]							
V23074-A1001-A402	VFM-11F41-S01	1393292-5	AR/1 Form A	$AgSnO_2$	Dust cover	Resistor 680 Ω	Quick connect
V23074-A1001-A403	VFM-15F41-S01	8-1393292-4	CR/1 Form C	$AgSnO_2$	Dust cover	Resistor 680 Ω	Quick connect
High current version [1]							
V23074-H1005-A502		2-1414971-4	AR/1 Form A	$AgSnO_2$	Dust cover	Resistor 680 Ω	Quick connect
24 V Plug-In Relays [1]							
V23074-A1002-A402			AR/1 Form A	$AgSnO_2$	Dust cover	Resistor 1800 Ω	Quick connect
V23074-A1002-A403			CR/1 Form C	$AgSnO_2$	Dust cover	Resistor 1800 Ω	Quick connect

[1] Versions with diode or varistor in parallel to the coil on request. Versions with special labels or color shapes on request

Coil Versions

Coil Data for Micro A (with Resistor)	Rated Coil Voltage (V)	Coil Resistance [2] ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V)	
					at 23°C	at 85°C
V23074-**001-****	12	105	7.2	1.6	24	18
V23074-**002-****	24	354	14.4	3.6	45	33
V23074-**005-****	12	127	7.2	1.6	24	18

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] Including parallel resistor.

Standard Delivery Packs (orders in multiples of delivery pack)

Micro A: 480 pieces

Micro Relay Latching

Features

- Magnetically latched ISO plug-in relay
- Two coils with set and reset function
- Pin assignment according to ISO 7588 part 3
- Plug-in terminals

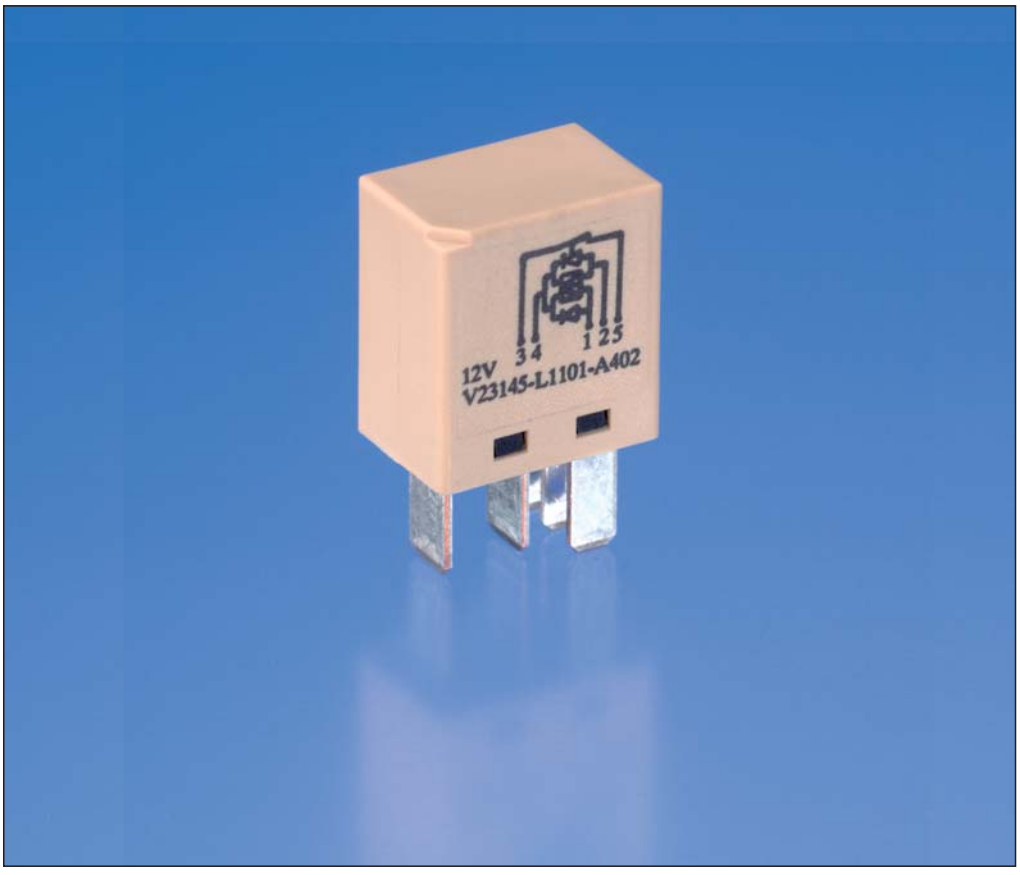
Customized Versions on Request

- Special marking
- Special covers (e.g. notches, release features, brackets)

Typical Applications

- Active power management
- Disconnection of power outlets
- Security systems

Please contact Tyco Electronics for relay application support.



145L_3D2

Design

- ELV/RoHS/WEEE compliant
- Dustproof; protection class IP54 to IEC 529 (EN 60 529)

Weight

Approx. 15 g (0.5 oz.)

Nominal Voltage

12 V

Terminals

Quick connect terminals similar to ISO 8092-1, coil and break 4.8 x 0.8 mm, load terminals 6.3 x 0.8 mm; surfaces tin plated

Accessories

Connectors see page 226 ff

Conditions

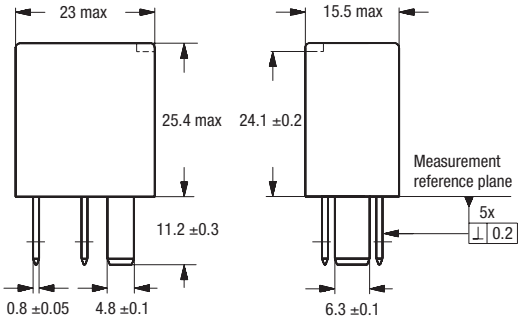
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

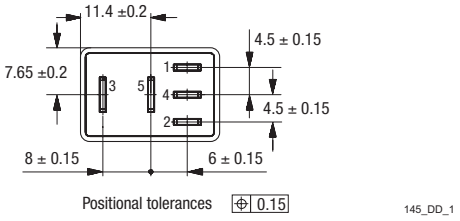
Micro Relay Latching

Dimensional Drawing



Quick connect terminal similar to ISO 8092-1

View of the Terminals (bottom view)

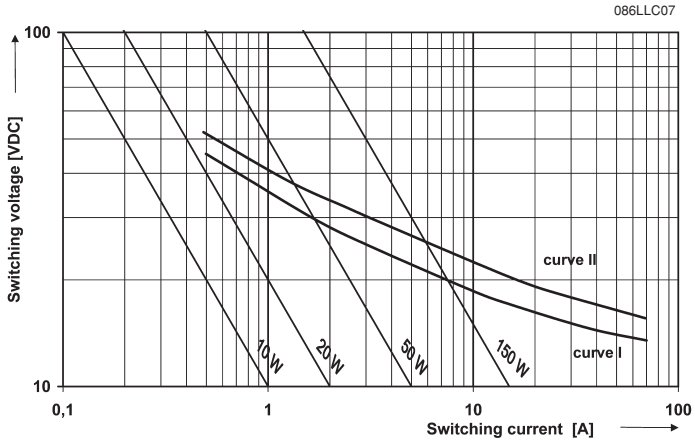


Contact Data

Typical areas of application	Resistive, inductive and capacitive loads
Contact configuration	1 Make contact/ 1 Form A
Circuit symbol (see also Pin assignment)	
Rated voltage	12 V
Rated current	20 A
Limiting continuous current	
23°C	25 A
85°C	20 A
125°C	8 A
Contact material	Silver based
Max. switching voltage/power	See load limit curve
Max. switching current [1]	
On [2]	50 A
Off	30 A
Min. recommended load [3]	1 A at 5 V
Voltage drop at 10 A (initial)	
NO contact	Typ. 50 mV, 300 mV max.
Mechanical endurance (without load)	Typ. 10^6 operations
Electrical endurance example at cyclic temperature –40/+23°C/+85°C and 14 V	> 1 x 10^5 operations 20 A resistive > 1 x 10^5 operations 25 A inductive (L=0.6 mH)
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)

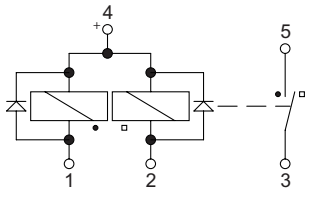
[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve



Circuit Diagram

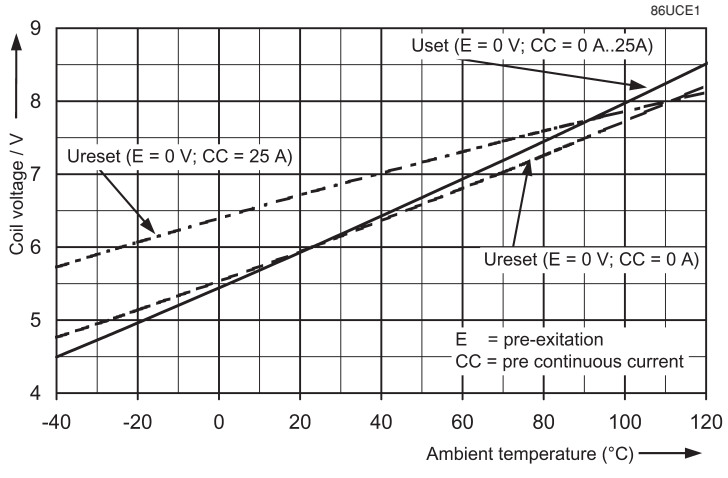
AS
1 Make contact/1 Form A
with Diodes



Coil Data

Available for nominal voltages	12 V			
Polarity for energizing/deenergizing contact	Set		Reset	
	+ Pin 4	– Pin 1	+ Pin 4	– Pin 2
Min. and max. set pulse width	5 ms < pulse width < 1 s			
Test voltage winding/contact	500 VAC_{rms}			
Ambient temperature range	–40 to +125°C			
Operate time at nominal voltage	Typ. 1.5 ms			
Release time at nominal voltage	Typ. 1.5 ms			

Operating Voltage Range



Micro Relay Latching

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	150 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1]
Resistance to bending, force applied to side	10 N [1]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures.

[1] Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

Environmental Conditions

Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation	EN ISO 6988		6 cycles	Storage 8/16 h
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat				
cyclic	IEC 68-2-30	Db, Variant 1	6 cycles	Upper air temperature 55°C
constant	IEC 68-2-3	Ca	56 days	
Corrosive gas	IEC 68-2-42	10 ±2 cm^3/m^3 SO_2	10 days	
	IEC 68-2-43	1 ±0.3 cm^3/m^3 H_2S	10 days	
Vibration resistance	IEC 68-2-6 (sine sweep)		10 - 500 Hz min. 10 g	No change in the switching state > 10 µs
Shock resistance	IEC 68-2-27 (half sine form single pulses)		min. 30 g 6 ms	
Load dump	ISO 7637-1 (12 V)	Test pulse 5	Vs = +86.5 V	
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			
Overload current [2]	27 A, 1800 s 40 A, 5 s 70 A, 0.5 s 120 A, 0.1 s			

[1] FMVSS: Federal Motor Vehicle Safety Standard.
[2] Current and time are compatible with circuit protection by a typical 20 A automotive fuse. Relay will make, carry and break the specified current.

Micro Relay Latching

Ordering Information

Part Numbers (see table below for coil data)		Circuit/Contact Arrangement	Contact Material	Enclosure	Terminals
Relay Description	Part Number				
V23145-L1101-A402	On request	AS/1 Form A	Silver based	Dust cover	Quick connect

Coil Versions

Coil Data for Micro Latching	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)		Must Pulse Voltage (V)		Allowable Overdrive [1] Voltage (V)			
						at 23°C		at 85°C	
		Set	Reset	Set	Reset	Set	Reset	Set	Reset
V23145-L1101-A402	12	75	75	6	6	28	18; 28 [2] [3]	28	18; 28 [2] [3]

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] Overvoltage according to ISO 16750-2 functional status C. In case of a reset latch pulse up to 28 V the contact may reclose, but will not remain closed (no latching function).
[3] The delay between driving impulses at cyclic energizing at T_{Amb} = 85°C must be at least 10 s.

Standard Delivery Packs (orders in multiples of delivery pack)

Micro Latching: On request

Micro Relay Low Noise

Features

- Noise level below 50 dB(A)
- Limiting continuous current 20 A
- Pin assignment according to ISO 7588 part 3
- Plug-in terminals

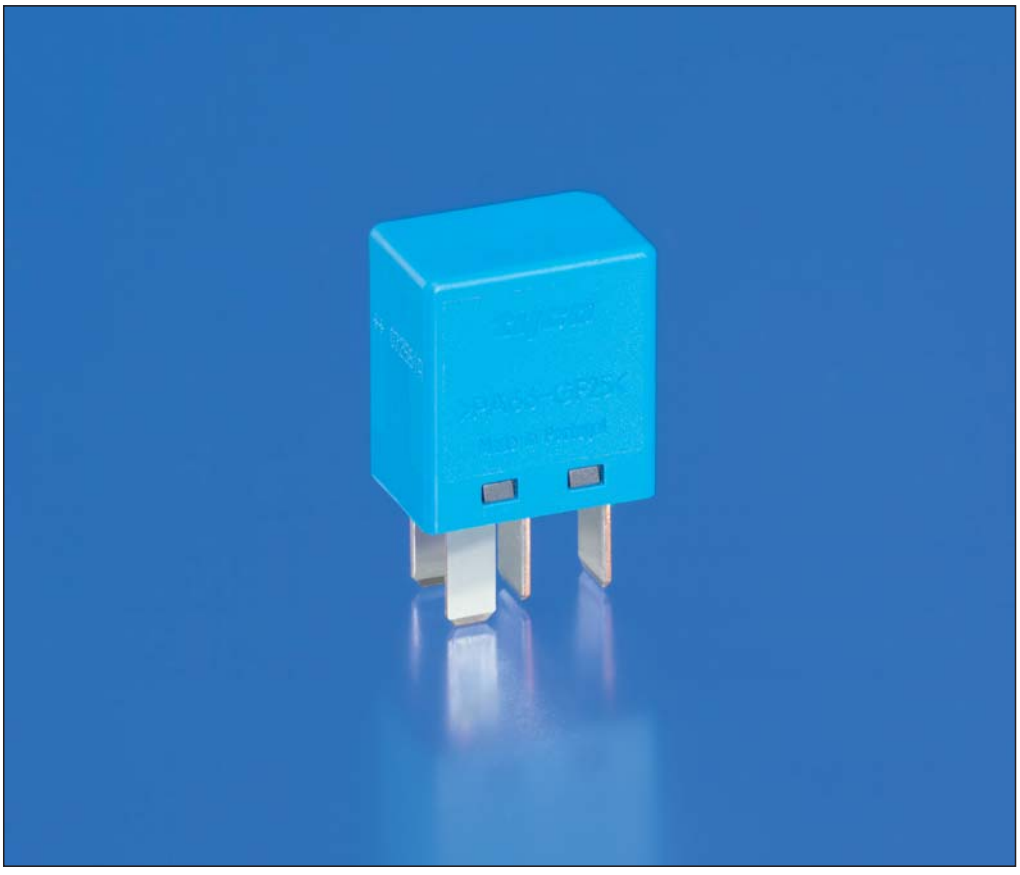
Customized Versions on Request

- Special marking
- Special covers (e.g. notches, release features, brackets)

Typical Applications

Cross carline up to 20 A
for example:
- Front and rear wiper
- Air condition
- Interior fan

Please contact Tyco Electronics for relay application support.



145_3D03

Design

- ELV/RoHS/WEEE compliant
- Dustproof; protection class IP54 to IEC 529 (EN 60 529)

Weight

Approx. 15 g (0.5 oz.)

Nominal Voltage

12 V

Terminals

Quick connect terminals similar to ISO 8092-1, coil and break 4.8 x 0.8 mm, load terminals 6.3 x 0.8 mm; surfaces tin plated

Accessories

Connectors see page 226 ff

Conditions

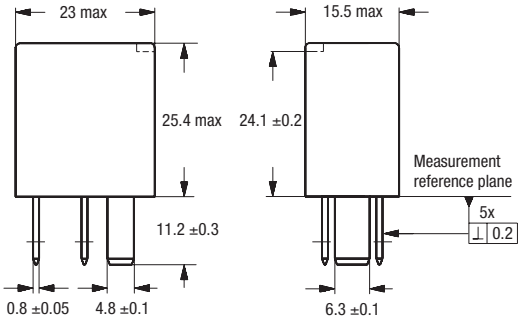
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

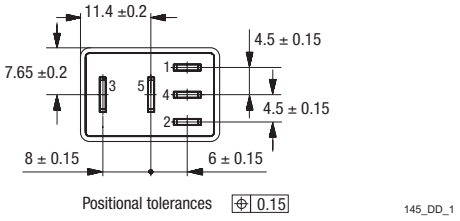
Micro Relay Low Noise

Dimensional Drawing



Quick connect terminal similar to ISO 8092-1

View of the Terminals (bottom view)



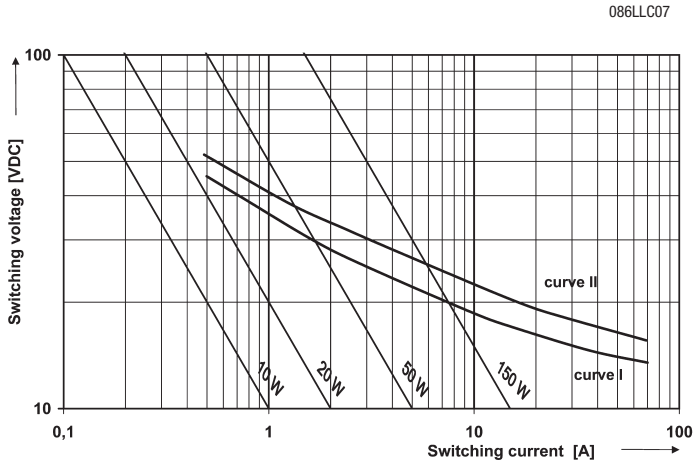
Contact Data

Typical areas of application		Wiper
Contact configuration	1 Make contact/ 1 Form A	1 Changeover contact/ 1 Form C
Circuit symbol		
Rated voltage	12 V	12 V
Rated current	15 A	15/25 A
Limiting continuous current		NC/NO
23°C	20 A	15/20 A
85°C	15 A	10/15 A
125°C	8 A	5/8 A
Contact material	Silver based	
Max. switching voltage/power	See load limit curve	
Max. switching current [1]		
On [2]	100 A	40 A
Off	30 A	30 A
Min. recommended load [3]	1 A at 5 V	
Voltage drop at 10 A (initial)		
NO contact	Typ. 15 mV, 300 mV max.	Typ. 50 mV, 300 mV max.
NC contact		Typ. 50 mV, 300 mV max.
Mechanical endurance (without load)	Typ. 10^6 operations	
Electrical endurance example at cyclic temperature –40/+23°C/+85°C and 14 V	> 1 x 10^5 operations 15 A resistive > 1 x 10^5 operations 120 W lamp (+ on terminal 5)	> 1 x 10^5 operations front wiper (20 a inrush, 8 A steady, 1.1 mH)
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)	

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Micro Relay Low Noise

Load Limit Curve

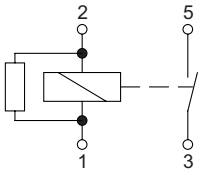


Load limit curve 1 ≙ arc extinguishes during transit time

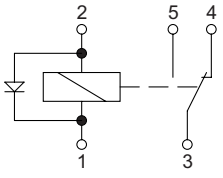
Load limit curve 2 ≙ safe shutdown, no stationary arc

Circuit Diagram

AR
1 Make contact/1 Form A
with Resistor



CD
1 Changeover contact/1 Form C
with Diode



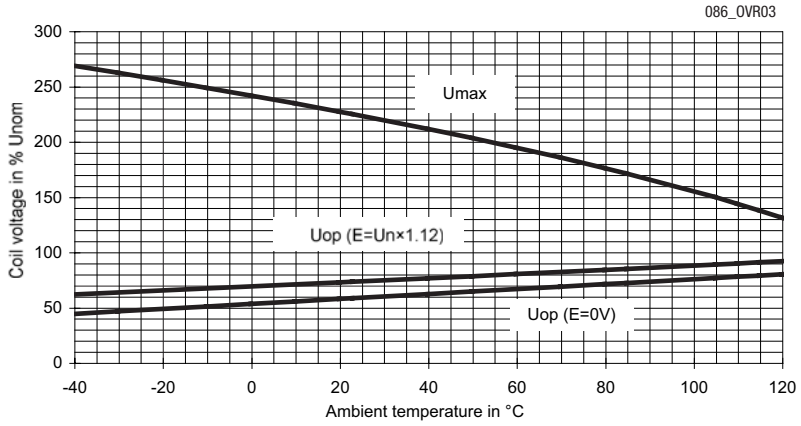
Coil Data

Available for nominal voltages	12 V	
Nominal power consumption at nominal voltage with suppression resistor	Form A/Make 0.9 W	Form C/Changeover 0.6 W
Test voltage winding/contact	500 VAC_{rms}	
Ambient temperature range	–40 to +85°C	
Operate time at nominal voltage	Typ. 3 ms	
Release time at nominal voltage	Typ. 2 ms	Typ. 4 ms

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Micro Relay Low Noise

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	150 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1)]
Resistance to bending, force applied to side	10 N [1)]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures.

1) Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

Environmental Conditions

Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Noise emission	Leq measured at 10 cm distance, 0.5 s/0.5 s cycling, freely suspended in anechoic chamber		< 50 dB (A)	
Climatic cycling with condensation	EN ISO 6988		6 cycles	Storage 8/16 h
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat cyclic constant	 IEC 68-2-30 IEC 68-2-3	 Db Ca	 6 cycles	 Upper air temperature 55°C 56 days
Corrosive gas	IEC 68-2-42 IEC 68-2-43	10 ±2 cm^3/m^3 SO_2 1 ±0.3 cm^3/m^3 H_2S	10 days 10 days	
Vibration resistance	IEC 68-2-6 (sine sweep)		10 - 500 Hz min. 5 g	No change in the switching state > 10 µs Valid for NC contacts, NO contact values significantly higher
Shock resistance	IEC 68-2-27 (half sine form single pulses)		min. 20 g 11 ms	
Load dump	ISO 7637-1 (12 V)	Test pulse 5	Vs = +86.5 V	
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1)]			
Overload current [2)]	27 A, 1800 s 40 A, 5 s 70 A, 0.5 s 120 A, 0.1 s			

1) FMVSS: Federal Motor Vehicle Safety Standard.
2) Current and time are compatible with circuit protection by a typical 20 A automotive fuse. Relay will make, carry and break the specified current.

Micro Relay Low Noise

Ordering Information

Part Numbers (see table below for coil data)		Circuit/Contact Arrangement	Contact Material	Enclosure	Terminals
Relay Description	Part Number				
V23145-B1101-A402	3-1414773-5	AR/1 Form A	Silver based	Dust cover	Quick connect
V23145-A1101-A403	On request	CD/1 Form C	Silver based	Dust cover	Quick connect

Coil Versions

Coil Data for Micro LN	Rated Coil Voltage (V)	Coil Resistance [2] ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V)	
					at 23°C	at 85°C
V23145-B1101-A402	12	181	7.2	1.4	25	19
V23145-A1101-A403	12	254	7.2	1.4	25	19

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (orders in multiples of delivery pack)

Micro LN: 240 pieces

Power Relay F4/VF4

Features

- Limiting continuous current 40 A at 85°C
- Pin assignment similar to ISO 7588 part 1
- Plug-in or PCB terminals
- Also available for 42 V applications

Customized Versions on Request

- 24 V versions with contact gap > 0.8 mm
- Integrated components (e.g. resistor, diode)
- Customized marking/color
- Special covers (e.g. notches, release features, brackets)
- Various contact arrangements and materials

- For latching (bistable) version refer to Mini Relay Latching
- For shrouded/weatherproof dust cover versions refer to Shrouded Power Relay F4 A and VF4 A

Typical Applications

Cross carline up to 40 A
for example:

- ABS control
- Blower fans
- Car alarm
- Cooling fan
- Electric Power Steering
- Energy management
- Engine control
- Fuel pump
- Heated front screen
- Ignition
- Immobilizer
- Lamps front, rear, fog light
- Main switch/supply relay
- Seatbelt pretensioner
- Trunk lock
- Valves
- Window lifter
- Wiper control

Please contact Tyco Electronics for relay application support.

134_3Dco_1

Design

- ELV/RoHS/WEEE compliant
- Dustproof: protection class IP54 to IEC 529 (EN 60 529)
- Sealed: protection class IP67 to IEC 529 (EN 60 529)

Weight

Approx. 35 g (1.2 oz.)

Nominal Voltage

12 V or 24 V; other nominal voltages available on request

Terminals

Quick connect terminals similar to ISO 8092-1, coil and load 6.3 x 0.8 mm; surfaces tin plated or PCB terminals

Accessories

Connectors see page 229 ff

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

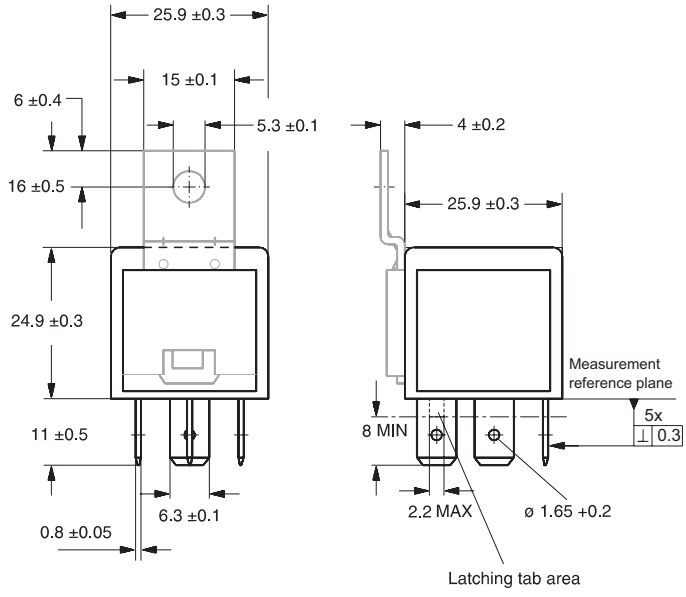
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

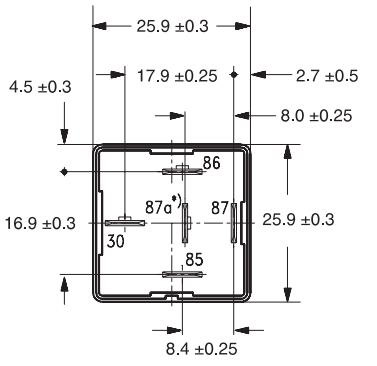
Power Relay F4/VF4

Dimensional Drawing

Power Relay F4/VF4 with Quick Connect Terminals

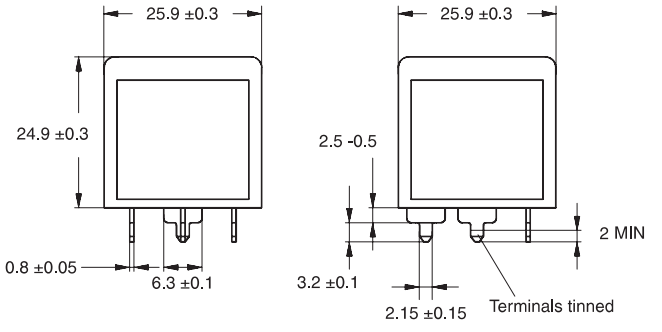


View of the Terminals (bottom view)



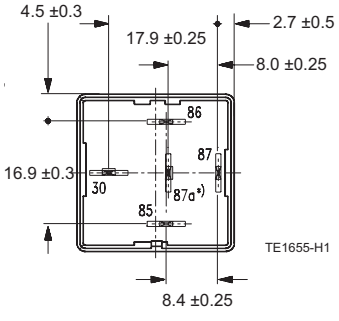
*) For the make contact (2 x 87),
pin 87a = 87
For the double make contact,
pin 87a = 87b

Power Relay F4/VF4 with PCB Terminals

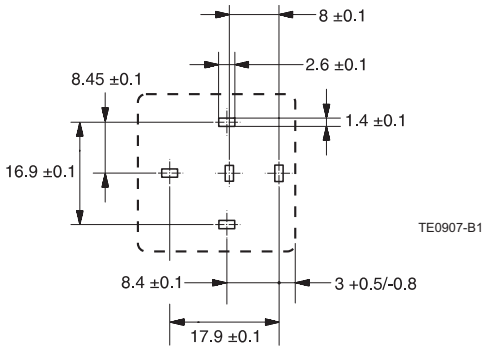


View of the Terminals (bottom view)

*) For the make contact (2 x 87),
pin 87a = 87
For the double make contact,
pin 87a = 87b

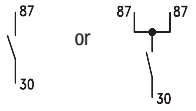
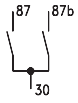


Mounting Holes (bottom view)



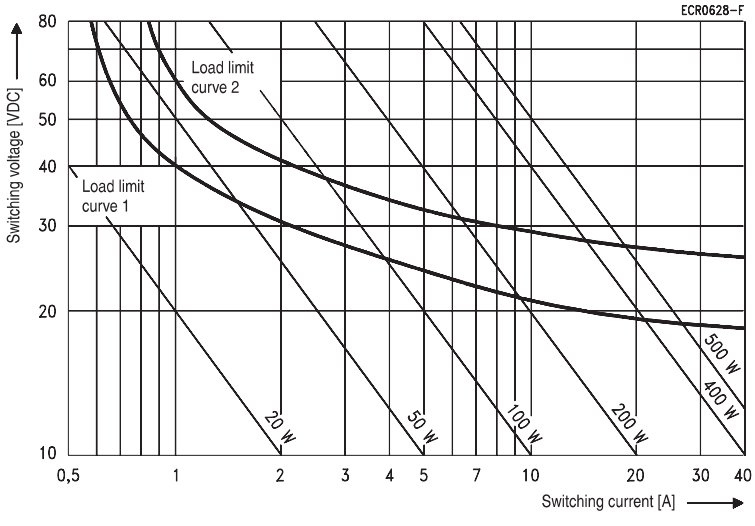
Power Relay F4/VF4

Contact Data

Contact configuration	1 Make contact/ 1 Form A or 1 Form A (2 x 87)		1 Double make contact/ 1 Form U		1 Changeover contact/ 1 Form C		
Circuit symbol (see also Pin assignment)							
Rated voltage	12 V	24 V	12 V	24 V	12 V	24 V	24 V [3]
Rated current	40 A	20 A	2 x 25 A	2 x 15 A	30/40 A	15/20 A	20/30 A
Limiting continuous current					NC/NO		
23°C	60 A		2 x 32 A		45/60 A		
85°C	40 A		2 x 35 A		30/40 A		
125°C	17 A		2 x 11 A		12/17 A		
Contact material	Silver based						
Max. switching voltage/power	See load limit curve						
Max. switching current [1]					NC/NO	NC/NO	NC/NO
On [2]	120 A	120 A	2 x 100 A	2 x 100 A	45/120 A	45/120 A	45/120 A
Off	60 A	20 A	2 x 40 A	2 x 15 A	40/60 A	15/20 A	20/30 A
Min. recommended load [4]	1 A at 5 V						
Voltage drop at 10 A (initial)							
NO contact	Typ. 15 mV, 200 mV max.		Typ. 2 x 15 mV, 200 mV max.		Typ. 15 mV, 200 mV max.		
NC contact					Typ. 20 mV, 250 mV max.		
Mechanical endurance (without load)	> 10^7 operations						
Electrical endurance (example of resistive load without component in parallel to the coil)	> 2 x 10^5 operations 40 A, 14 V	> 1 x 10^5 operations 20 A, 28 V	> 2 x 10^5 operations 2 x 25 A, 14 V	> 1 x 10^5 operations 2 x 15 A, 28 V	> 2 x 10^5 operations 40 A, 14 V (NO contact)	> 1 x 10^5 operations 20 A, 28 V (NO contact)	> 1 x 10^5 operations 30 A, 28 V (NO contact)
							> 5 x 10^5 operations 10 A, 28 V (NC contact)
Max switching rate at nominal load	6 operations per minute (0.1 Hz)						

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 14 V for 12 V or 28 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] Special high performance 24 V version with contact gap > 0.8 mm, part number V23134-A0056-X432/-X433 (see ordering information).
[4] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve



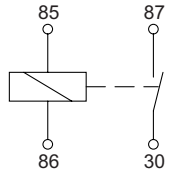
Load limit curve 1 ≙ arc extinguishes during transit time (changeover contact)

Load limit curve 2 ≙ safe shutdown, no stationary arc (make contact)

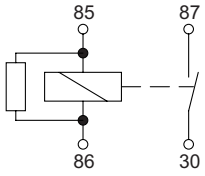
Power Relay F4/VF4

Circuit Diagram

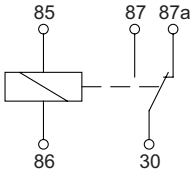
A0
1 Make contact/1 Form A



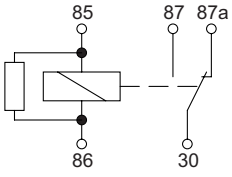
AR
1 Make contact/1 Form A
with Resistor



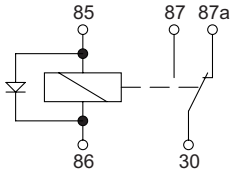
C0
1 Changeover contact/1 Form C



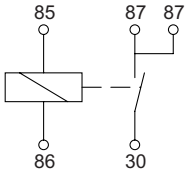
CR
1 Changeover contact/1 Form C
with Resistor



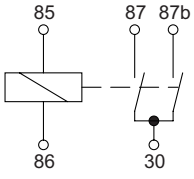
CD
1 Changeover contact/1 Form C
with Diode



D0
1 Make contact/1 Form A (2 x 87)



U0
1 Double make contact/1 Form U



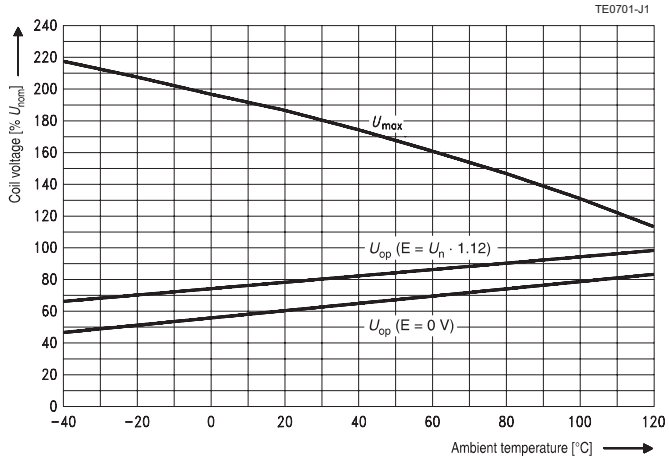
Coil Data

Available for nominal voltages	12 V / 24 V
Nominal power consumption of the unsuppressed coil at nominal voltage	1.6 W
Nominal power consumption at nominal voltage with suppression resistor	1.8 W / 2.1 W (standard/high performance 24 V)
Test voltage winding/contact	500 VAC_{rms}
Ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 7 ms
Release time at nominal voltage [1)]	Typ. 2 ms

1) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Power Relay F4 / VF4

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	150 N
Push force	150 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1]
Resistance to bending, force applied to side	10 N [1]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures

[1] Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

Environmental Conditions

Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation	EN ISO 6988		6 cycles	Storage 8/16 h
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat				
cyclic	IEC 68-2-30	Db, Variant 1	6 cycles	Upper air temperature 55°C
constant	IEC 68-2-3	Ca	56 days	
Corrosive gas	IEC 68-2-42	10 ±2 cm^3/m^3 SO_2	10 days	
	IEC 68-2-43	1 ±0.3 cm^3/m^3 H_2S	10 days	
Vibration resistance	IEC 68-2-6 (sine sweep)		10 - 500 Hz min. 5 g	No change in the switching state > 10 µs Valid for NC contacts, NO contact values significantly higher
Shock resistance	IEC 68-2-27 (half sine form single pulses)		min. 20 g 11 ms	
Load dump	ISO 7637-1 (12 V)	Test pulse 5	Vs = +86.5 V	
	ISO 7637-2 (24 V)	Test pulse 5	Vs = +200 V	
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			
Overload current for relays with rated currents as shown in contact data table [2]	1.35 x Rated current 1800 s 2.00 x Rated current 5 s 3.50 x Rated current 0.5 s 6.00 x Rated current 0.1 s			

[1] FMVSS: Federal Motor Vehicle Safety Standard.
[2] Current and time are compatible with circuit protection by a typical automotive fuse. Relay will make, carry and break the specified current.

Power Relay F4/VF4

Ordering Information

Part Numbers (see table below for coil data)			Circuit/Contact	Contact	Enclosure	Coil	Bracket
Relay Description	Internal Reference	Part Number	Arrangement	Material		Suppression	
6 V Plug-In Relays							
VF4-45D11	V23134-A1051-X826	7-1393305-2	C0/1 Form C	Silver based	Dust cover		Yes
12 V Plug-In Relays							
V23134-A0052-C643		2-1393302-2	C0/1 Form C	Silver based	Dust cover		
V23134-A0052-X205		3-1393302-6	CD/1 Form C	Silver based	Dust cover	Diode (cathode at 86)	
V23134-A0052-X278		4-1393302-1	CR/1 Form C	Silver based	Dust cover	Resistor 560 Ω	
V23134-A1052-C643		5-1393302-8	C0/1 Form C	Silver based	Dust cover		Yes
VF4-45F11-C05	V23134-A1052-X828	7-1393305-5	CR/1 Form C	Silver based	Sealed	Resistor 680 Ω	Yes
V23134-B0052-C642		7-1393302-5	A0/1 Form A	Silver based	Dust cover		
V23134-B0052-X270		1-1414099-0	AR/1 Form A	Silver based	Dust cover	Resistor 680 Ω	
V23134-B1052-C642		3-1393303-4	A0/1 Form A	Silver based	Dust cover		Yes
VF4-41F11-S01	V23134-B1052-X824	6-1393305-9	AR/1 Form A	Silver based	Dust cover	Resistor 680 Ω	Yes
V23134-C0052-C642		3-1393303-9	D0/1 Form A (2 x 87)	Silver based	Dust cover		
V23134-C1052-C642		4-1393303-7	D0/1 Form A (2 x 87)	Silver based	Dust cover		Yes
V23134-M0052-C642		5-1393304-6	U0/1 Form U	Silver based	Dust cover		
V23134-M1052-C642		7-1393304-1	U0/1 Form U	Silver based	Dust cover		Yes
12 V PCB Relays							
V23134-A0052-G243		2-1393302-3	C0/1 Form C	Silver based	Dust cover		
VF4-15F13	V23134-A0052-X811	1393302-6	C0/1 Form C	Silver based	Dust cover		
VF4-15F13-C01	V23134-A0052-X812	4-1393305-5	C0/1 Form C	Silver based	Sealed		
VF4-15F13-C05	V23134-A0052-X813	4-1393305-7	CR/1 Form C	Silver based	Sealed	Resistor 680 Ω	
V23134-B0052-G242		7-1393302-7	A0/1 Form A	Silver based	Dust cover		
VF4-11F13	V23134-B0052-X801	2-1393305-1	A0/1 Form A	Silver based	Dust cover		
VF4-11F13-C01	V23134-B0052-X802	2-1393305-2	A0/1 Form A	Silver based	Sealed		
V23134-C0052-G242		4-1393303-0	D0/1 Form A (2 x 87)	Silver based	Dust cover		
V23134-M0052-G242		5-1393304-7	U0/1 Form U	Silver based	Dust cover		
24 V Plug-In Relays							
V23134-A0053-C643		5-1393302-1	C0/1 Form C	Silver based	Dust cover		
V23134-A0056-X432 [1)]		1-1414167-0	CD/1 Form C	Silver based	Dust cover	Diode (cathode at 86)	
V23134-A0056-X433 [1)]		1-1414168-0	CR/1 Form C	Silver based	Dust cover	Resistor 1200 kΩ	
VF4-15H11-C05	V23134-A0064-X816	5-1393305-3	CR/1 Form C	Silver based	Sealed	Resistor 2700 kΩ	
V23134-A1053-C643		6-1393302-3	C0/1 Form C	Silver based	Dust cover		Yes
VF4-45H11-C05	V23134-A1064-X829	1432219-1	CR/1 Form C	Silver based	Sealed	Resistor 2700 kΩ	Yes
VF4-15H11-S05	V23134-A1064-X830	8-1393305-4	CD/1 Form C	Silver based	Dust cover	Diode (cathode at 86)	Yes
V23134-B0053-C642		1393303-9	A0/1 Form A	Silver based	Dust cover		
VF4-41H11	V23134-B1064-X825	7-1393305-0	A0/1 Form A	Silver based	Dust cover		Yes
VF4-41H11-S08	V23134-A1064-X831	7-1393305-1	AR/1 Form A	Silver based	Dust cover	Resistor 2700 kΩ	Yes
V23134-B1053-C642		3-1393303-7	A0/1 Form A	Silver based	Dust cover		Yes
V23134-C0053-C642		4-1393303-4	D0/1 Form A (2 x 87)	Silver based	Dust cover		
V23134-C1053-C642		5-1393303-0	D0/1 Form A (2 x 87)	Silver based	Dust cover		Yes
V23134-M0053-C642		6-1393304-7	U0/1 Form U	Silver based	Dust cover		
V23134-M1053-C642		7-1393304-4	U0/1 Form U	Silver based	Dust cover		Yes
24 V PCB Relays							
V23134-A0053-G243		5-1393302-2	C0/1 Form C	Silver based	Dust cover		
VF4-11H13	V23134-B0064-X804	2-1393305-6	A0/1 Form A	Silver based	Dust cover		
VF4-15H13	V23134-A0064-X819	1393302-8	C0/1 Form C	Silver based	Dust cover		
VF4-15H13-C01	V23134-A0064-X820	5-1393305-9	C0/1 Form C	Silver based	Sealed		
V23134-B0053-G242		1-1393303-0	A0/1 Form A	Silver based	Dust cover		
V23134-C0053-G242		4-1393303-5	D0/1 Form A (2 x 87)	Silver based	Dust cover		
V23134-M0053-G242		6-1393304-8	U0/1 Form U	Silver based	Dust cover		

[1)] Special feature: contact gap > 0.8 mm.

Power Relay F4/VF4

Coil Versions

Coil Data for Power F4/VF4	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive[1] Voltage (V)	
					at 23°C	at 85°C
VF4-**D**-**	6	22	3.6	0.6	11	8
VF4-**F**-**	12	90	7.2	1.2	22	17
V23134-**052-****	12	90	7.2	1.6	22	17
VF4-**H**-**	24	360	14.4	2.4	40	30
V23134-**053-****	24	324	14.4	3.2	41	32
V23134-**056-****	24	268	16.0	4.0	38	29
V23134-**064-****	24	360	14.4	2.4	40	30

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (orders in multiples of delivery pack)

Power F4	Quick connect version:	315 pieces
	Quick connect with bracket:	200 pieces
	PCB version:	200 pieces
VF4-1, VF4-4		300 pieces

Shrouded Power Relay F4 A

Features

- Limiting continuous current 40 A at 85°C
- Pin assignment according to ISO 7588 part 1
- Bracket

Customized Versions on Request

- Integrated components (e.g. diode)
- Customized marking

Typical Applications

- ABS control
- Blower fans
- Cooling fan
- Energy management
- Engine control
- Fuel pump
- Heated front screen
- Ignition
- Lamps front, rear, fog light
- Main switch/supply relay
- Wiper control

Please contact Tyco Electronics for relay application support.

136_3D03

Design

- ELV/RoHS/WEEE compliant
- Shrouded: protection class IP67 to IEC 529 (EN 60 529) if used with special connector

Weight

Approx. 60 g (2.1 oz.)

Nominal Voltage

12 V or 24 V; other nominal voltages available on request

Terminals

Quick connect terminals similar to ISO 8092-1, coil and load 6.3 x 0.8 mm; surfaces tin plated

Accessories

Fitting connectors see table Ordering Information

Conditions

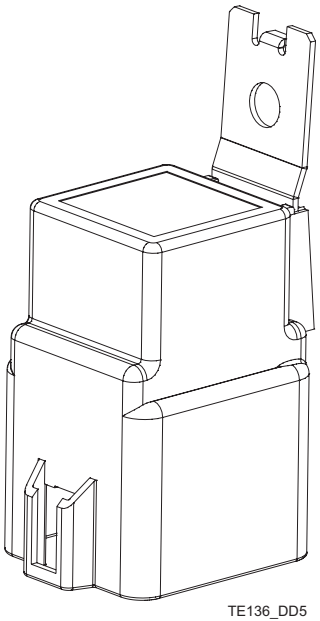
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

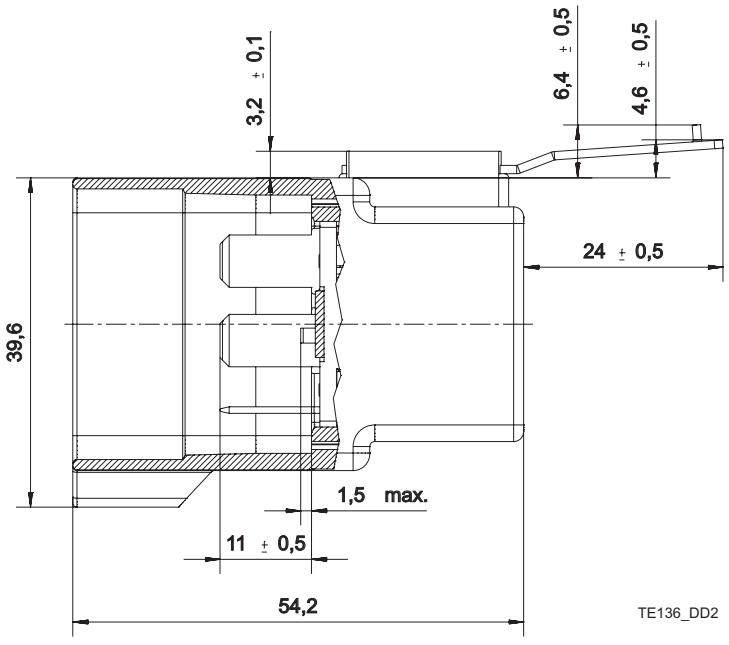
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

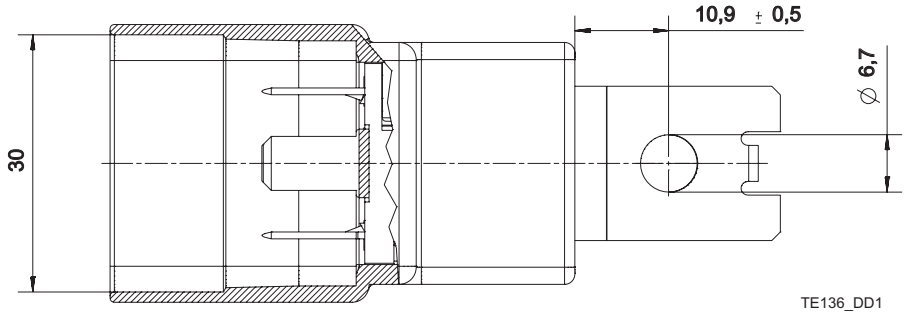
Shrouded Power Relay F4 A

Dimensional Drawing


TE136_DD5

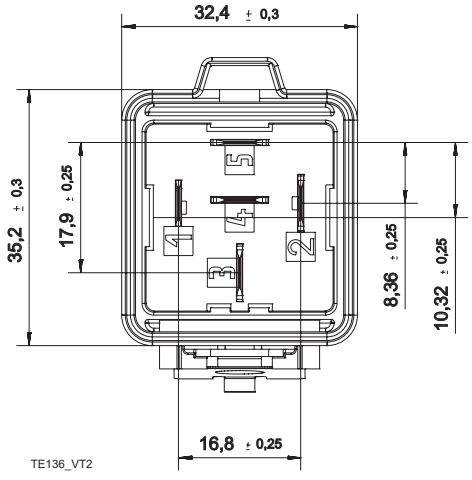


TE136_DD2

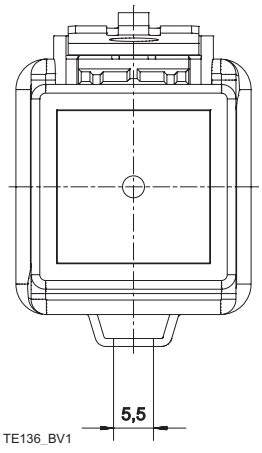


TE136_DD1

View of the Terminals (bottom view)

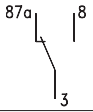


TE136_VT2



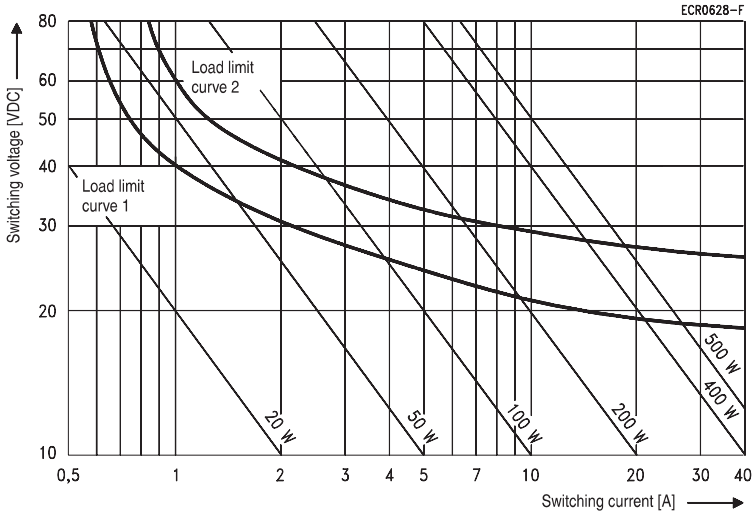
TE136_BV1

Shrouded Power Relay F4 A

Contact Data		
Contact configuration	1 Make contact/ 1 Form A	1 Changeover contact/ 1 Form C
Circuit symbol		
Rated voltage	12 V	12 V
Rated current	40 A	40/40 A
Limiting continuous current [1]		NC/NO
23°C	60 A	45/60 A
85°C	40 A	30/40 A
125°C	17 A	12/17 A
Contact material	Silver based	
Max. switching voltage/power	See load limit curve	
Max. switching current [2]		NC/NO
On	120 A	45/120 A
Off	60 A	40/60 A
Min. recommended load [3]	1 A at 12 V	
Voltage drop A (initial)		
NO contact	Typ. 15 mV, 300 mV max.	Typ. 15 mV, 300 mV max.
NC contact		Typ. 25 mV, 300 mV max.
Mechanical endurance (without load)	Typ. 10^7 operations	
Electrical endurance (example of resistive load, further information on request)	> 2 x 10^5 operations 40 A on NO	> 1 x 10^5 operations 40 A on NO
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)	

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V or 27 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve



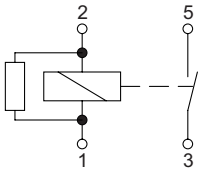
Load limit curve 1 ≙ arc extinguishes during transit time (changeover contact)

Load limit curve 2 ≙ safe shutdown, no stationary arc (make contact)

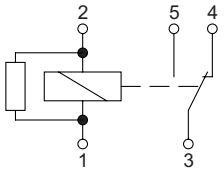
Shrouded Power Relay F4 A

Circuit Diagram

AR
1 Make contact/1 Form A
with Resistor



CR
1 Changeover contact/1 Form C
with Resistor



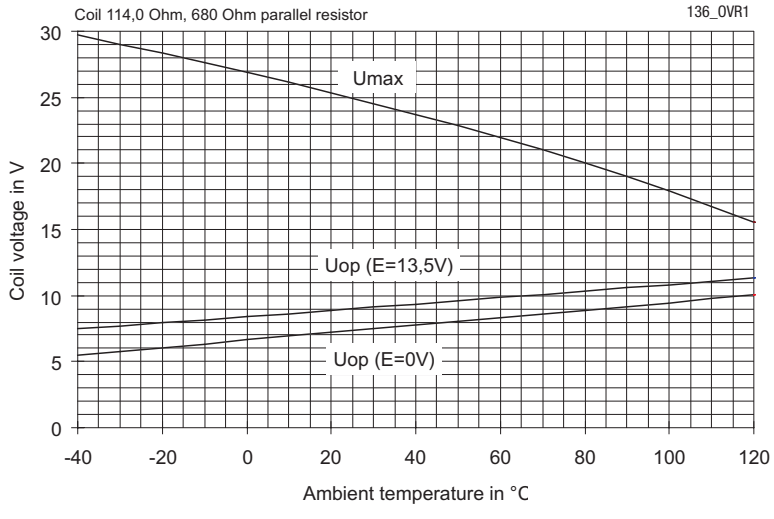
Coil Data

Available for nominal voltages	12 V
Nominal power consumption at nominal voltage with suppression resistor	1.5 W
Test voltage winding/contact	500 VAC_{rms}
Ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 8.5 ms
Release time at nominal voltage [1)]	Typ. 4 ms

1) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	200 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N

Shrouded Power Relay F4 A

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation	EN ISO 6988		6 cycles	Storage 8/16 h
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat cyclic constant	 IEC 68-2-30 IEC 68-2-3	 Db, Variant 1 Ca	 6 cycles 56 days	 Upper air temperature 55°C
Corrosive gas	IEC 68-2-42 IEC 68-2-43	10 ±2 cm^3/m^3 SO_2 1 ±0.3 cm^3/m^3 H_2S	10 days 10 days	
Vibration resistance	IEC 68-2-6 (sine sweep)		10 - 500 Hz min. 5 g	No change in the switching state > 10 µs Valid for NC contacts, NO contact values significantly higher
Shock resistance	IEC 68-2-27 (half sine form single pulses)		min. 20 g 11 ms	
Load dump	ISO 7637-1 (12 V) ISO 7637-2 (24 V)	Test pulse 5 Test pulse 5	Vs = +86.5 V Vs = +200 V	
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			
Overload current for relays with rated currents as shown in contact data table [2]	1.35 x Rated current 1800 s 2.00 x Rated current 5 s 3.50 x Rated current 0.5 s 6.00 x Rated current 0.1 s			
Protection class	IEC 529 (EN 60 529)	IP67 if used with special connector		

[1] FMVSS: Federal Motor Vehicle Safety Standard.
[2] Current and time are compatible with circuit protection by a typical automotive fuse. Relay will make, carry and break the specified current.

Ordering Information

Part Numbers (see table below for coil data)		Circuit/Contact Arrangement	Contact Material	Enclosure	Coil Suppression	Fitting Connectors FCI Order Number
Relay Description	Part Number					
V23136-B1001-X051	1-1414121-0	AR/1 Form A	Silver based	Shrouded cover	Resistor 680 Ω	6 043 01 01
V23136-A1001-X057	1-1414552-0	CR/1 Form C	Silver based	Shrouded cover	Resistor 680 Ω	6 043 01 41

Coil Versions

Coil Data for Shrouded Power F4 A	Rated Coil Voltage (V)	Coil Resistance [2] ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V)	
					at 23°C	at 85°C
V23136-**001-****	12	96	7.2	1.6	24	18

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] Resistance measured between terminals 1 and 2.

Standard Delivery Packs (orders in multiples of delivery pack)

Shrouded Power F4 A: 108 pieces

VF4 A (Standard, Shrouded and Weatherproof)

Features

- Limiting continuous current 40 A
- Pin assignment according to ISO 7588 part 1
- Plug-in terminals

Customized Versions on Request

- Integrated components (e.g. resistor, diode)
- Customized marking
- Special covers (e.g. brackets, shrouded)

- For latching (bistable) version refer to Mini Relay Latching

Typical Applications

Cross carline up to 40 A
for example:

- ABS control
- Blower fans
- Car alarm
- Cooling fan
- Electric Power Steering
- Energy management
- Engine control
- Fuel pump
- Heated front screen
- Ignition
- Immobilizer
- Lamps front, rear, fog light
- Main switch/supply relay
- Seatbelt pretensioner
- Trunk lock
- Valves
- Window lifter
- Wiper control

Please contact Tyco Electronics for relay application support.

VF4_3D1

Design

- ELV compliant
- Dustproof; protection class IP54 to IEC 529 (EN 60 529)
- Sealed: protection class IP67 to IEC 529 (EN 60 529)
- Shrouded: protection class IP67 to IEC 529 (EN 60 529) if used with special connector

Weight

Approx. 35 g (1.2 oz.)

Nominal Voltage

12 V or 24 V

Terminals

Quick connect terminals similar to ISO 8092-1, coil and load 6.3 x 0.8 mm; surfaces tin plated

Accessories

Connectors see page 233 ff

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

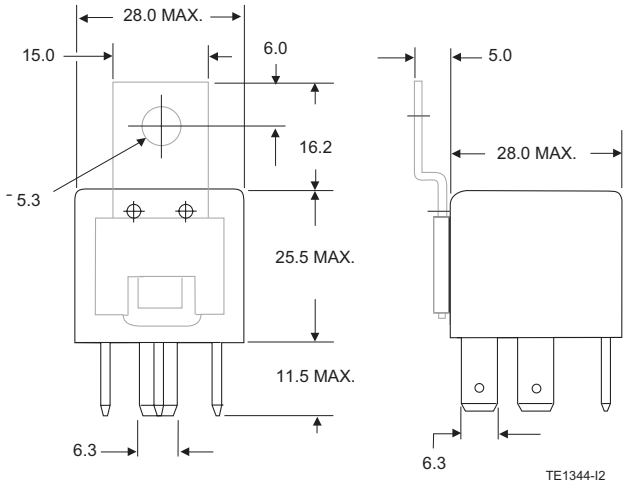
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

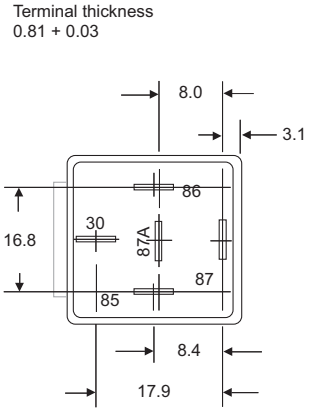
VF4 A (Standard, Shrouded and Weatherproof)

Dimensional Drawing

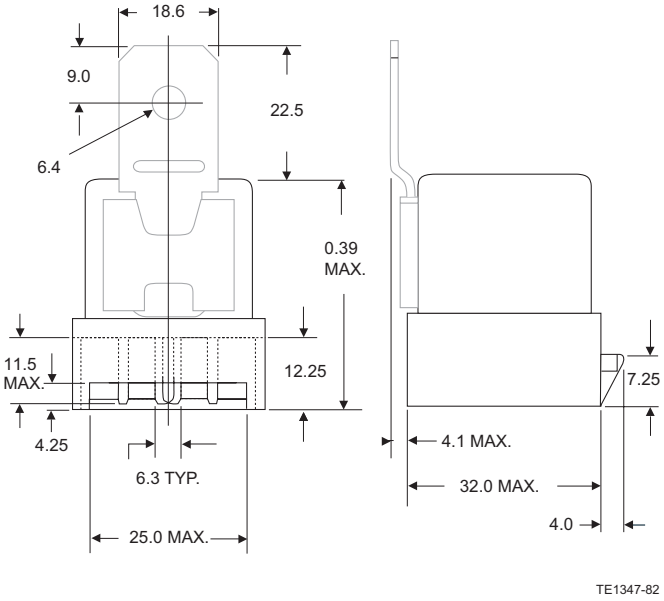
VF4 A with Dust Cover
VF4-1** (without bracket) and VF4-4**** (with bracket)**



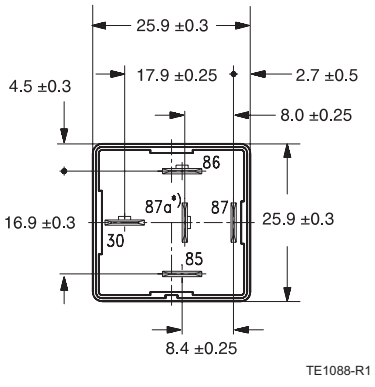
View of the Terminals (bottom view)

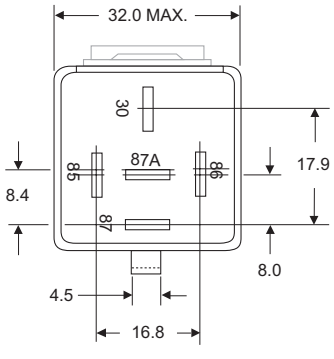


VF4 A with Shrouded Dust Cover
VF4-2** (without bracket) and VF4-5**** (with bracket)**



View of the Terminals (bottom view)

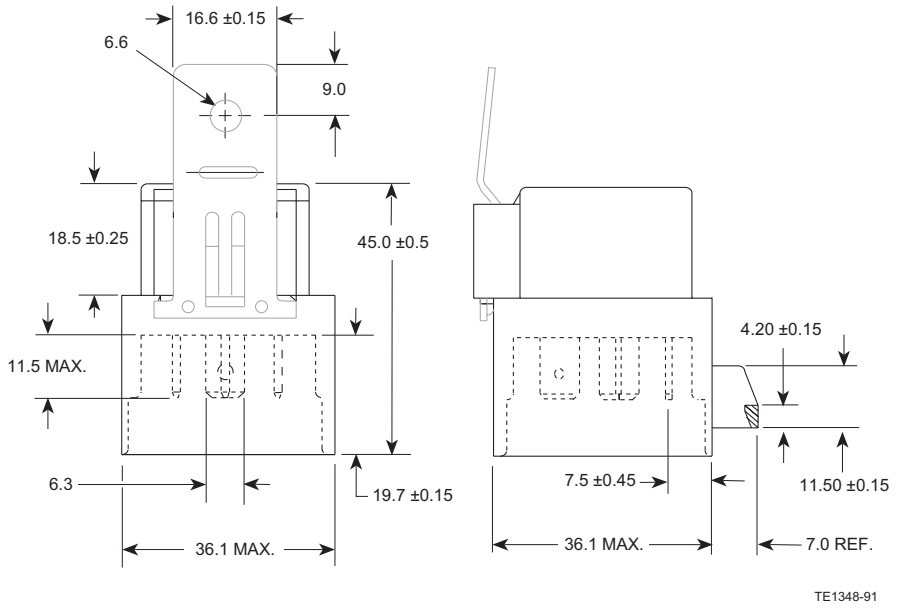




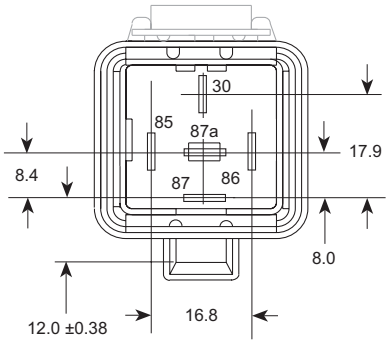
VF4 A (Standard, Shrouded and Weatherproof)

Dimensional Drawing

VF4 A with Weatherproof Cover
VF4-3** (without bracket) and VF4-6**** (with bracket)**



View of the Terminals (bottom view)

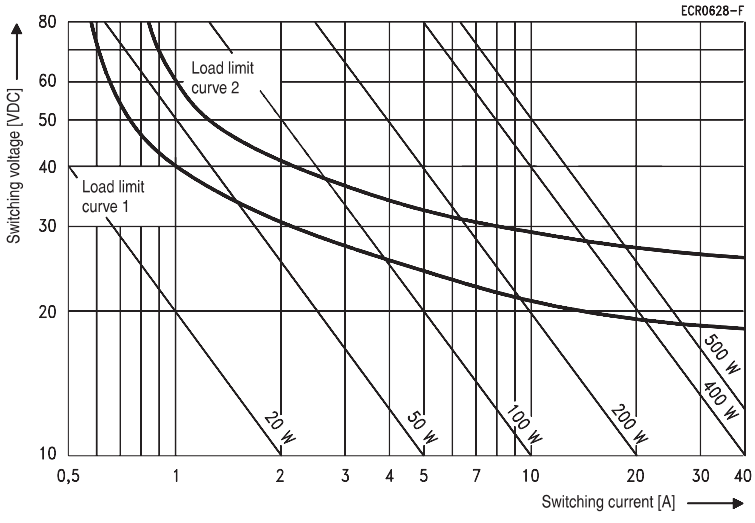


VF4 A (Standard, Shrouded and Weatherproof)

Contact Data	
Contact configuration	1 Changeover contact/ 1 Form C
Circuit symbol	
Rated voltage	12 V
Rated current	20/14 A
Limiting continuous current	NC/NO
23°C	45/60 A
85°C	30/40 A
125°C	12/17 A
Contact material	Silver based
Max. switching voltage/power	See load limit curve
Max. switching current [1]	NC/NO
On [2]	45/120 A
Off	40/60 A
Min. recommended load [3]	1 A at 12 V/0.5 at 24 V
Voltage drop (initial)	
NO contact	Typ. 60 mV, 200 mV max. at 40 A
NC contact	Typ. 60 mV, 250 mV max. at 30 A
Mechanical endurance (without load)	Typ. 10^6 operations
Electrical endurance (example of resistive load, further information on request)	> 1 x 10^5 operations 40 A, 13.5 V (NO contact) > 1 x 10^5 operations 30 A, 13.5 V (NC contact)
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V or 27 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve

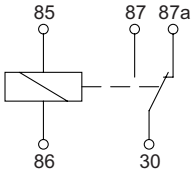


Load limit curve 1 ≙ arc extinguishes during transit time (changeover contact)
Load limit curve 2 ≙ safe shutdown, no stationary arc (make contact)

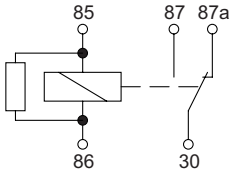
VF4 A (Standard, Shrouded and Weatherproof)

Circuit Diagram

CO
1 Changeover contact/1 Form C



CR
1 Changeover contact/1 Form C
with Resistor

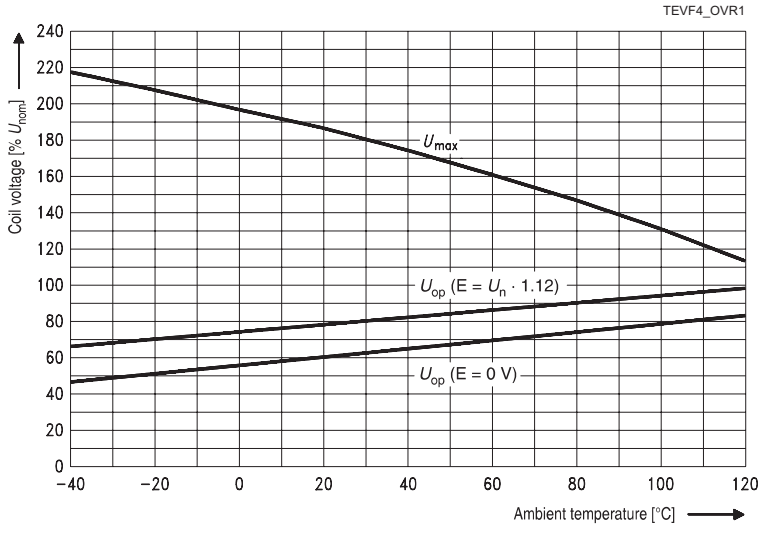


Coil Data	
Available for nominal voltages	12 V / 24 V
Nominal power consumption of the unsuppressed coil at nominal voltage	1.6 W
Nominal power consumption at nominal voltage with suppression resistor	1.8 W / 2.1 W (standard/high performance 24 V)
Test voltage winding/contact	500 VAC_{rms}
Ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 7 ms
Release time at nominal voltage [1)]	Typ. 2 ms

1) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

VF4 A (Standard, Shrouded and Weatherproof)

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	200 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1]
Resistance to bending, force applied to side	10 N [1]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures
Shrouded dust cover	Protects relay and relay connector (order separately) from dust and splash
Weatherproof cover	Mates with a connector (order separately) to seal relay from salt spray etc. Recommended for under hood application

[1] Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

Environmental Conditions

Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Vibration resistance	1.27 mm double amplitude 5 g constant 0.5 mm double amplitude 10 g constant		10 - 40 Hz 40 - 70 Hz 70 - 100 Hz 100 - 500 Hz	Valid for NC contacts, NO contacts are significantly higher
Shock resistance	Half sine wave pulse		20 g 11 ms	No change in the switching state > 1 ms
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			internal external
Overload Current [2]	54 A, 1800 s 80 A, 60 s 240 A, 1 s			

[1] FMVSS: Federal Motor Vehicle Safety Standard.
[2] Current and time are compatible with circuit protection by a typical 40 A automotive fuse. Relay will make, carry and break the specified current.

VF4 A (Standard, Shrouded and Weatherproof)

Ordering Information

Part Numbers (see table below for coil data) Relay Description	Part Number	Circuit/Contact Arrangement	Contact Material	Enclosure	Coil Suppression	Bracket
12 V Plug-In Relays [1]						
VF4-15F11	6-1393298-0	C0/1 Form C	AgNi0.15	Dust cover		
VF4-15F11-C05	6-1393298-2	CR/1 Form C	AgNi0.15	Sealed	Resistor 680 Ω	
VF4-15F11-S01	6-1393298-4	CR/1 Form C	AgNi0.15	Dust cover	Resistor 680 Ω	
VF4-15F21-S01	7-1393298-3	CR/1 Form C	$AgSnO_2$	Dust cover	Resistor 680 Ω	
VF4-45F11	8-1393298-8	C0/1 Form C	AgNi0.15	Dust cover		Yes
VF4-45F11-S01	1-1393302-0	CR/1 Form C	AgNi0.15	Dust cover	Resistor 680 Ω	Yes
VF4-55F11-S01	8-1393305-7	CR/1 Form C	AgNi0.15	Weatherproof cover	Resistor 680 Ω	Yes
VF4-65F11-S01	9-1393305-5	CR/1 Form C	AgNi0.15	Weatherproof cover	Resistor 680 Ω	Yes
24 V Plug-In Relays [1]						
VF4-15H11	8-1393298-1	C0/1 Form C	AgNi0.15	Dust cover		
VF4-15H11-S08	5-1393305-7	C0/1 Form C	AgNi0.15	Dust cover	Resistor 2700 kΩ	
VF4-45H11	1-1393302-1	C0/1 Form C	AgNi0.15	Dust cover		Yes

[1] Versions with diode or varistor in parallel to the coil on request. Versions with special labels or color shapes on request.

Coil Versions

Coil Data for VF4 A	Rated Coil Voltage (V)	Coil Resistance [2] ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V) at 23°C	at 85°C
VF4-**F**-**	12	90	7.2	1.2	20.2	15.7
VF4-**H**-**	24	360	14.4	2.4	40.5	31.5

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] Including parallel resistor.

Standard Delivery Packs (orders in multiples of delivery pack)

VF4-1: 357 pieces
VF4-2, VF4-3: 165 pieces
VF4-4: 136 pieces
VF4-5, VF4-6: 110 pieces

Power Relay B

Features

- Limiting continuous current 35 A at 85°C
- Pin assignment according to ISO 7588 part 1
- Standardized dimensions
- Plug-in or PCB terminals

Customized Versions on Request

- 24 V versions with contact gap > 0.8 mm
- Integrated components (e.g. resistor, diode)
- Customized marking/color
- Special covers (e.g. notches, release features, brackets)
- Various contact arrangements and materials

- For latching (bistable) version refer to Mini Relay Latching
- For shrouded/weatherproof dust cover versions refer to Shrouded Power Relay F4 A and VF4 A

Typical Applications

Cross carline up to 35 A
for example:

- Rear window defogger
- Battery disconnection
- Power distribution (clamp 15)

Please contact Tyco Electronics for relay application support.

234_kop1

Design

- ELV/RoHS/WEEE compliant
- Dustproof: protection class IP54 to IEC 529 (EN 60 529)

Weight

Approx. 35 g (1.2 oz.)

Nominal Voltage

12 V or 24 V; other nominal voltages available on request

Terminals

Quick connect terminals similar to ISO 8092-1, coil and load 6.3 x 0.8 mm; surfaces tin plated or PCB terminals

Accessories

Connectors see page 229 ff

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

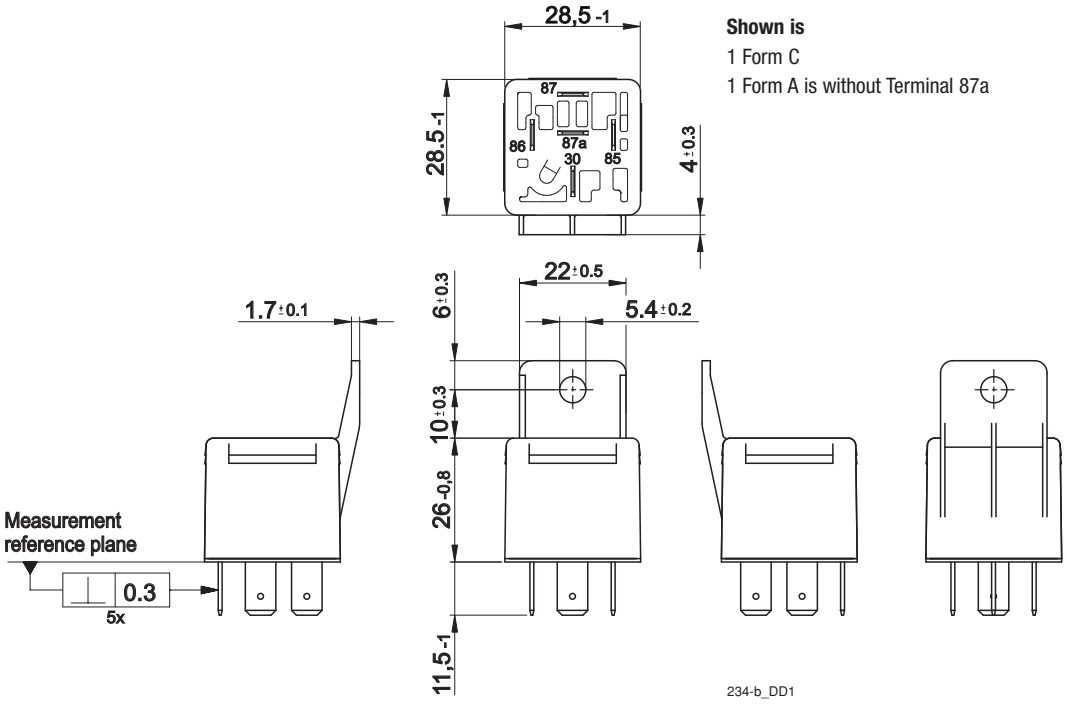
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

Power Relay B

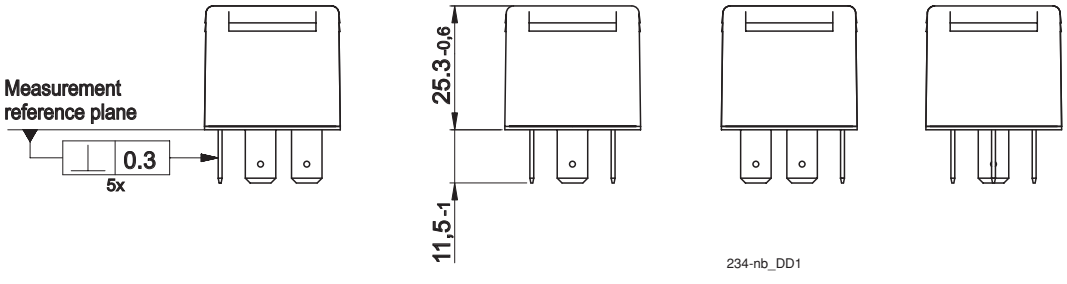
Dimensional Drawing

Power Relay B with Bracket



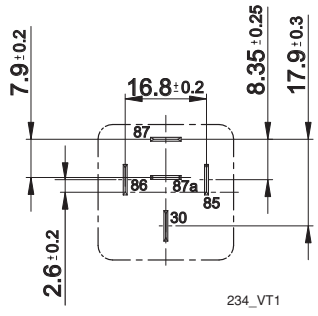
Shown is
1 Form C
1 Form A is without Terminal 87a

Power Relay B without Bracket

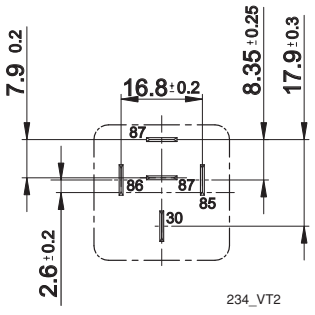


View of the Terminals (bottom view)

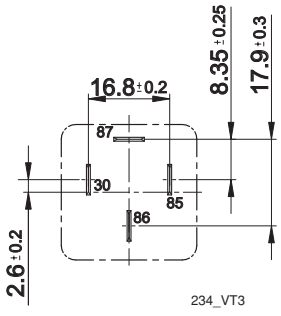
1 Form C
1 Form A is without 87a



1 Form A (2 x 87)



1 Form A non ISO
(Terminals 30 and 86 changed position)



Power Relay B

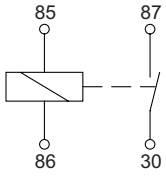
Contact Data

Contact configuration	1 Make contact/ 1 Form A		1 Changeover contact/ 1 Form C	
Circuit symbol				
Rated voltage	12 V	24 V	12 V	24 V
Rated current	20 A	14 A	20/14 A	14/6 A
Limiting continuous current			NC/NO	
23°C	50 A		35/50 A	
85°C	35 A		25/35 A	
125°C	15 A		10/15 A	
Contact material	Silver based			
Max. switching voltage/power	See load limit curve			
Max. switching current [1]	NC/NO	NC/NO	NC/NO	NC/NO
On [2]	120 A	120 A	45/120 A	45/120 A
Off	30 A	20 A	20/30 A	10/20 A
Min. recommended load [3]	1 A at 12 V/0.5 at 24 V			
Voltage drop at 10 A (initial)				
NO contact	Typ. 15 mV, 300 mV max.		Typ. 15 mV, 300 mV max.	
NC contact			Typ. 20 mV, 300 mV max.	
Mechanical endurance (without load)	Typ. 10^6 operations			
Electrical endurance (example of resistive load, further information on request)	> 2.5 x 10^5 operations 30 A, 13.5 V (NO contact)	> 2,5 x 10^5 operations 20 A, 27 V (NO contact)	> 2,5 x 10^5 operations 30 A, 13.5 V (NO contact) > 1 x 10^5 operations 20 A, 13.5 V (NC contact)	> 2,5 x 10^5 operations 20 A, 27 V (NO contact) > 2,5 x 10^5 operations 10 A, 27 V (NC contact)
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)			

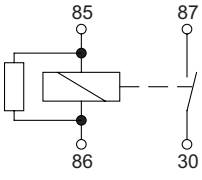
[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V or 27 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Circuit Diagram

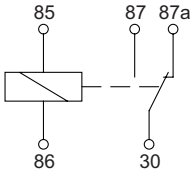
A0
1 Make contact/1 Form A



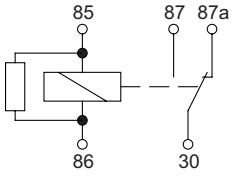
AR
1 Make contact/1 Form A with Resistor



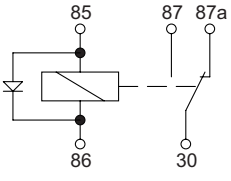
C0
1 Changeover contact/1 Form C



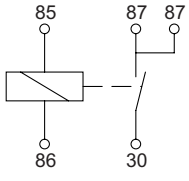
CR
1 Changeover contact/1 Form C with Resistor



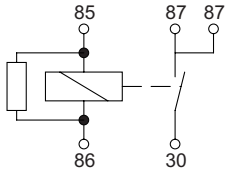
CD
1 Changeover contact/1 Form C with Diode



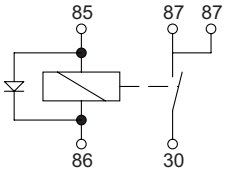
D0
1 Make contact/1 Form A (2 x 87)



DR
1 Make contact/1 Form A (2 x 87) with Resistor



DD
1 Make contact/1 Form A (2 x 87) with Diode



Power Relay B

Coil Data

Available for nominal voltages	12 V / 24 V
Nominal power consumption of the unsuppressed coil at nominal voltage	1.6 W / 2.3 W
Nominal power consumption at nominal voltage with suppression resistor	2.2 W / 2.7 W
Test voltage winding/contact	500 VAC_{rms}
Ambient temperature range	–40 to +125°C
Operate time at nominal voltage	< 10 ms
Release time at nominal voltage	< 10 ms
Release time at nominal voltage with suppression diode	< 15 ms

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	200 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1]
Resistance to bending, force applied to side	10 N [1]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures.

[1] Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

Environmental Conditions

Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation	EN ISO 6988		6 cycles	Storage 8/16 h
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat				
cyclic	IEC 68-2-30	Db, Variant 1	6 cycles	Upper air temperature 55°C
constant	IEC 68-2-3	Ca	56 days	
Corrosive gas	IEC 68-2-42	10 ±2 cm^3/m^3 SO_2	10 days	
	IEC 68-2-43	1 ±0.3 cm^3/m^3 H_2S	10 days	
Vibration resistance	IEC 68-2-6 (sine sweep)		10 - 500 Hz min. 5 g	No change in the switching state > 10 µs Valid for NC contacts, NO contact values significantly higher
Shock resistance	IEC 68-2-27 (half sine form single pulses)		min. 20 g 11 ms	
Load dump	ISO 7637-1 (12 V)	Test pulse 5	Vs = +86.5 V	
	ISO 7637-2 (24 V)	Test pulse 5	Vs = +200 V	
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			
Overload current for relays with rated currents as shown in contact data table [2]	1.35 x Rated current 1800 s 2.00 x Rated current 5 s 3.50 x Rated current 0.5 s 6.00 x Rated current 0.1 s			

[1] FMVSS: Federal Motor Vehicle Safety Standard.
[2] Current and time are compatible with circuit protection by a typical automotive fuse. Relay will make, carry and break the specified current.

Power Relay B

Ordering Information

Part Numbers (see table below for coil data)		Circuit/Contact Arrangement	Contact Material	Enclosure	Coil Suppression	Bracket
Relay Description	**Part Number**					
12 V Plug-In Relays						
V23234-A0001-X040	4-1904020-7	C0/1 Form C	Silver based	Dust cover		
V23234-A0001-X032	1-1904020-2	CR/1 Form C	Silver based	Dust cover	Resistor 680 Ω	
V23234-A0001-X038	1-1904020-5	CD/1 Form C	Silver based	Dust cover	Diode (cathode at 86)	
V23234-A1001-X036	3-1904022-2	C0/1 Form C	Silver based	Dust cover		Yes
V23234-A1001-X033	1-1904022-1	CR/1 Form C	Silver based	Dust cover	Resistor 680 Ω	Yes
V23234-A1001-X041	2-1904022-3	CD/1 Form C	Silver based	Dust cover	Diode (cathode at 86)	Yes
V23234-B0002-X012	1-1904008-2	A0/1 Form A	Silver based	Dust cover		
V23234-B1001-X010	1-1904007-2	A0/1 Form A	Silver based	Dust cover		Yes
V23234-B0001-X001	5-1904006-1	AR/1 Form A	Silver based	Dust cover	Resistor 680 Ω	
V23234-B1001-X004	1-1904007-1	AR/1 Form A	Silver based	Dust cover	Resistor 680 Ω	Yes
V23234-C0001-X006	2-1904011-2	D0/1 Form A (2 x 87)	Silver based	Dust cover		
V23234-C0001-X003	2-1904011-1	DD/1 Form A (2 x 87)	Silver based	Dust cover	Diode (cathode at 86)	
V23234-C1001-X005	5-1904012-1	D0/1 Form A (2 x 87)	Silver based	Dust cover		Yes
V23234-K1001-X024	5-1904018-1	AR/1 Form A non ISO	Silver based	Dust cover	Resistor 680 Ω	Yes
24 V Plug-In Relays						
V23234-A0004-X048	4-1904025-1	C0/1 Form C	Silver based	Dust cover		
V23234-A1004-X050	1-1904027-1	C0/1 Form C	Silver based	Dust cover		Yes
V23234-A0004-X051	2-1904025-3	CD/1 Form C	Silver based	Dust cover	Diode (cathode at 86)	
V23234-A0004-X053	2-1904025-5	CR/1 Form C	Silver based	Dust cover	Resistor 1400 Ω	
V23234-A1004-X054	3-1904027-2	CR/1 Form C	Silver based	Dust cover	Resistor 1400 Ω	Yes
V23234-B0004-X019	5-1904015-2	A0/1 Form A	Silver based	Dust cover		
V23234-C0004-X020	1-1904015-3	D0/1 Form A (2 x 87)	silver based	Dust cover		
V23234-C1004-X017	5-1904014-1	D0/1 Form A (2 x 87)	Silver based	Dust cover		Yes
V23234-C0004-X018	2-1904015-1	DR/1 Form A (2 x 87)	Silver based	Dust cover	Resistor 1400 Ω	

Coil Versions

Coil Data for Power B (with Resistor or Diode)	Rated Coil Voltage (V)	Coil Resistance [3] ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V)	
					at 23°C	at 85°C
V23234-**001-****	12	85	8.0	1.5	22	17
V23234-**001-**** [2]	12	75	8.0	1.5	22	17
V23234-**002-****	12	75	6.5	1.0	22	17
V23234-**004-****	24	255	16	3	38	32
V23234-**004-**** [2]	24	216	16	3	38	32

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] Including resistor as suppression device.
[3] Measured between the terminals 85 and 86.

Standard Delivery Packs (orders in multiples of delivery pack)

Power B: 200 pieces

Mini Relay Latching

Features

- Magnetically latched ISO plug-in relay
- Two coils with set and reset function
- Pin assignment similar to ISO 7588 part 1
- Plug-in terminals

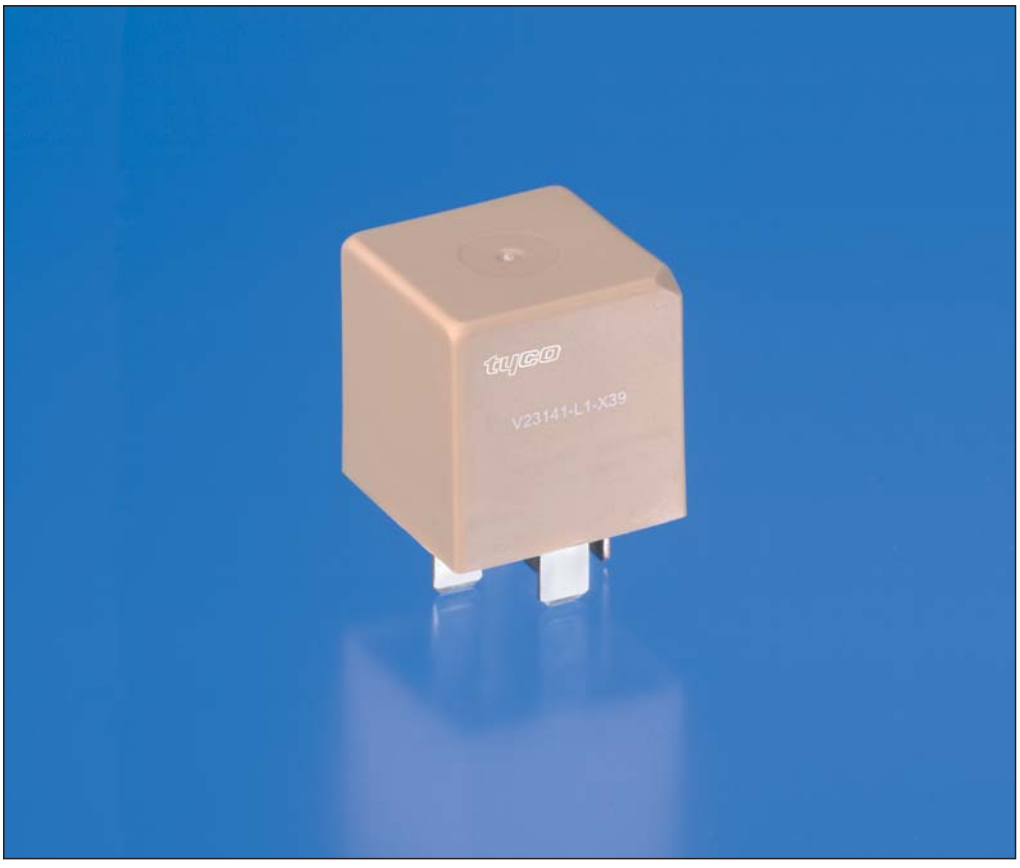
Customized Versions on Request

- Special marking
- Special covers (e.g. notches, release features, brackets)

Typical Applications

- Active power management
- Disconnection of power outlets
- Security systems

Please contact Tyco Electronics for relay application support.



141L_3D2

Design

- ELV/RoHS/WEEE compliant
- Dustproof; protection class IP54 to IEC 529 (EN 60 529)

Weight

Approx. 30 g (1.06 oz.)

Nominal Voltage

12 V

Terminals

Quick connect terminals similar to ISO 8092-1, coil and load 6.3 x 0.8 mm; surfaces tin plated

Accessories

Connectors see page 229 ff

Conditions

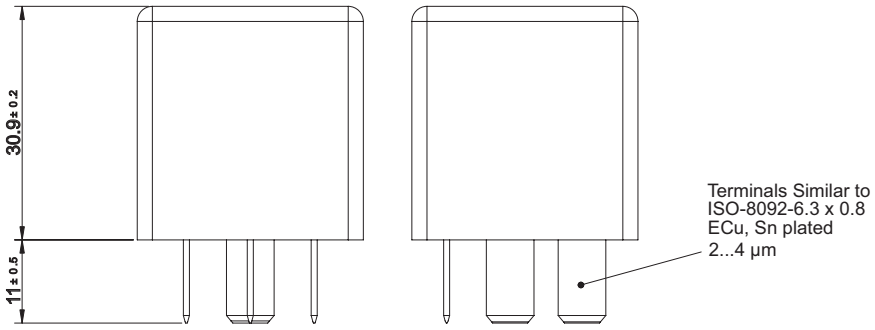
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

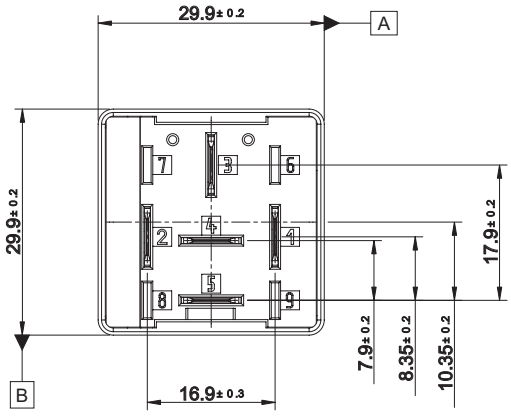
Disclaimer

Mini Relay Latching

Dimensional Drawing



View of the Terminals (bottom view)

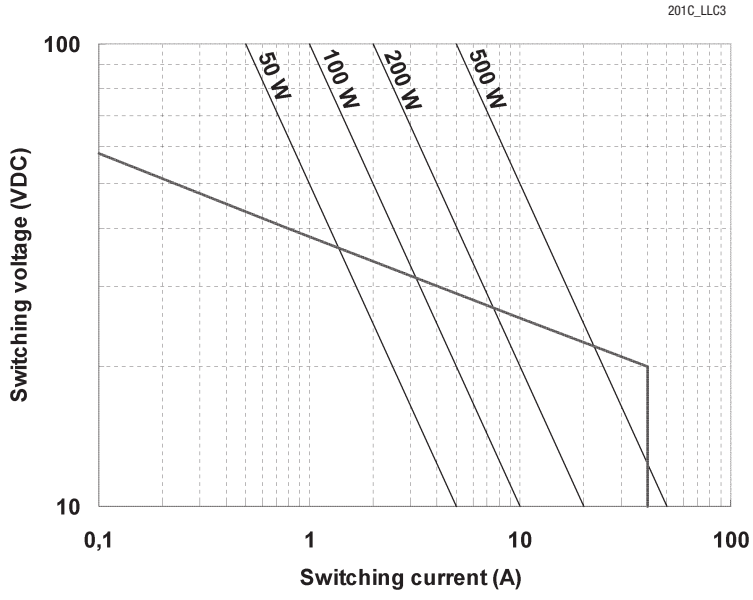


Mini Relay Latching

Contact Data	
Typical areas of application	Resistive, inductive and capacitive loads
Contact configuration	1 Make contact/ 1 Form A
Circuit symbol (see also Pin assignment)	
Rated voltage	12 V
Rated current	30 A
Limiting continuous current	
23°C	40 A
85°C	30 A
125°C	10 A
Contact material	Silver based
Max. switching voltage/power	See load limit curve
Max. switching current [1]	
On [2]	200 A
Off	40 A
Min. recommended load [3]	1 A at 5 V
Voltage drop at 10 A (initial)	
NO contact	Typ. 50 mV, 300 mV max.
Mechanical endurance (without load)	Typ. 10^6 operations
Electrical endurance example at cyclic temperature –40/+23°C/+85°C and 14 V	Resistive load [4] > 1 x 10^5 operations 40 A on / 40 A off
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V.
[2] Corresponds to a capacitive peak inrush current on initial actuation (cold filament).
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/
[4] For a load current duration of maximum 3 s for a make/break ratio of 1:10.

Load Limit Curve

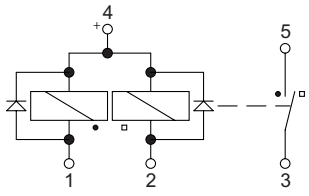


Load limit curve ≙ safe shutdown, no stationary arc/make contact

Mini Relay Latching

Circuit Diagram

AS
1 Make contact/1 Form A
with Diodes



Coil Data

Available for nominal voltages	12 V			
Polarity for energizing/deenergizing contact	Set		Reset	
	+	–	+	–
	Pin 4	Pin 1	Pin 4	Pin 2
Min. and max. set pulse width [1]	10 ms < pulse width < 100 ms			
Test voltage winding/contact	500 VAC_{rms}			
Ambient temperature range	–40 to +125°C			
Operate time at nominal voltage	Typ. 1.5 ms			
Release time at nominal voltage	Typ. 1.5 ms			

[1] Longer pulse width may be possible, please contact Technical Marketing (Relay Application Support).

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	150 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1]
Resistance to bending, force applied to side	10 N [1]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures.

[1] Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

Mini Relay Latching

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation	EN ISO 6988	6 cycles	Storage 8/16 h	
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat cyclic constant	 IEC 68-2-30 IEC 68-2-3	 Db, Variant 1 Ca	 6 cycles 56 days	 Upper air temperature 55°C
Corrosive gas	IEC 68-2-42 IEC 68-2-43	10 ±2 cm^3/m^3 SO_2 1 ±0.3 cm^3/m^3 H_2S	10 days 10 days	
Vibration resistance	IEC 68-2-6 (sine sweep)		10 - 500 Hz min. 10 g	No change in the switching state > 10 µs
Shock resistance	IEC 68-2-27 (half sine form single pulses)		min. 30 g 6 ms	
Flammability	UL94-HB or better (meets FMVSS 302) [1]			

[1] Current and time are compatible with circuit protection by a typical 20 A automotive fuse. Relay will make, carry and break the specified current.

Ordering Information

Part Numbers (see table below for coil data)		**Circuit/Contact Arrangement**	**Contact Material**	**Enclosure**	**Terminals**
Relay Description	**Part Number**				
V23141-L0001-X039	On request	AS/1 Form A	Silver based	Dust cover	Quick connect

Coil Versions

Coil Data for Mini Latching	**Rated Coil Voltage (V)**	**Coil Resistance ±10% (Ω)**		**Must Pulse Voltage (V)**		**Allowable Overdrive [1] Voltage (V)**			
						at 23°C		**at 85°C**	
		Set	**Reset**	**Set**	**Reset**	**Set**	**Reset**	**Set**	**Reset**
V23141-L0001-X039	12	20	19	6.9	6.9	28	18; 28 [2] [3]	28	18; 28 [2] [3]

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] Overvoltage according to ISO 16750-2 functional status C. In case of a reset latch pulse up to 28 V the contact may reclose, but will not remain closed (no latching function).
[3] The delay between driving impulses at cyclic energizing at T_{Amb} = 85°C must be at least 10 s.

Standard Delivery Packs (orders in multiples of delivery pack)

Mini Latching: On request

Power Relay F7/VF7

Features

- Limiting continuous current 70 A
- Pin assignment according to ISO 7588 part 1

Customized Versions on Request

- 24 V versions with contact gap > 0.8 mm
- Plug-in or PCB terminals
- Integrated components (e.g. resistor, diode)
- Customized marking/color
- Special covers (e.g. notches, release features, brackets)

- For shrouded/weatherproof dust cover versions refer to Shrouded Power Relay F7 A and VF7 A

Typical Applications

- ABS control
- Cooling fan
- Energy management
- Engine control
- Glow plug
- Heated front screen
- Ignition
- Lamps front, rear, fog light
- Main switch/supply relay

Please contact Tyco Electronics for relay application support.

134J_3Dco_1

Design

- ELV/RoHS/WEEE compliant
- Dustproof: protection class IP 54 to IEC 529 (EN 60 529)
- Sealed: protection class IP67 to IEC 529 (EN 60 529)

Weight

Approx. 38 g (1.3 oz.)

Nominal Voltage

12 V or 24 V; other nominal voltages available on request

Terminals

Quick connect terminals similar to ISO 8092-1, coil 6.3 x 0.8 mm, load 9.5 x 1.2 mm; surfaces tin plated or PCB terminals

Accessories

Connectors see page 234

Conditions

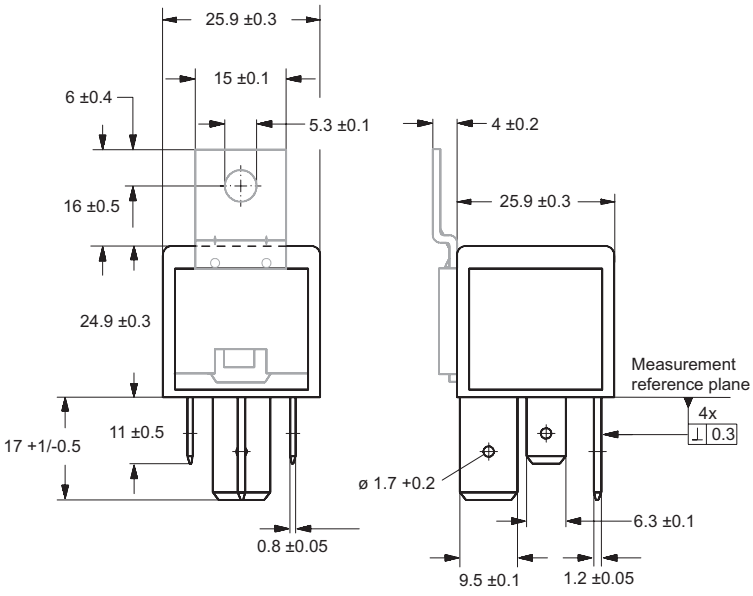
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

Dimensional Drawing

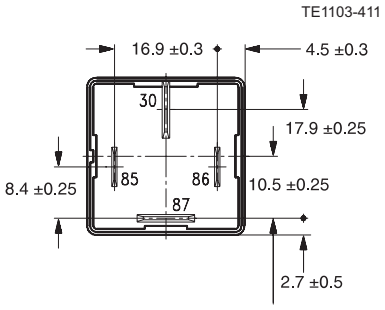
Power Relay F7/VF7 with Quick Connect Terminals



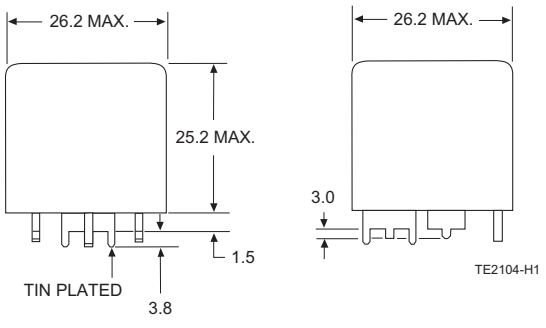
Quick connect terminal similar to ISO 8092-1

TE1098-Y1

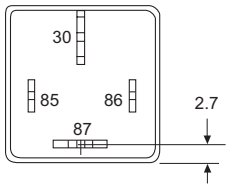
View of the Terminals (bottom view)



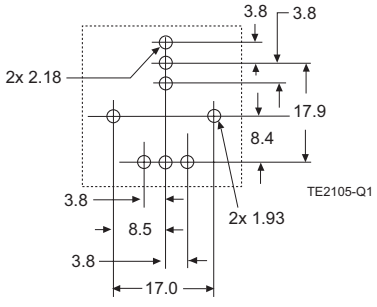
Power Relay F7/VF7 with PCB Terminals



View of the Terminals (bottom view)



Mounting Holes (bottom view)



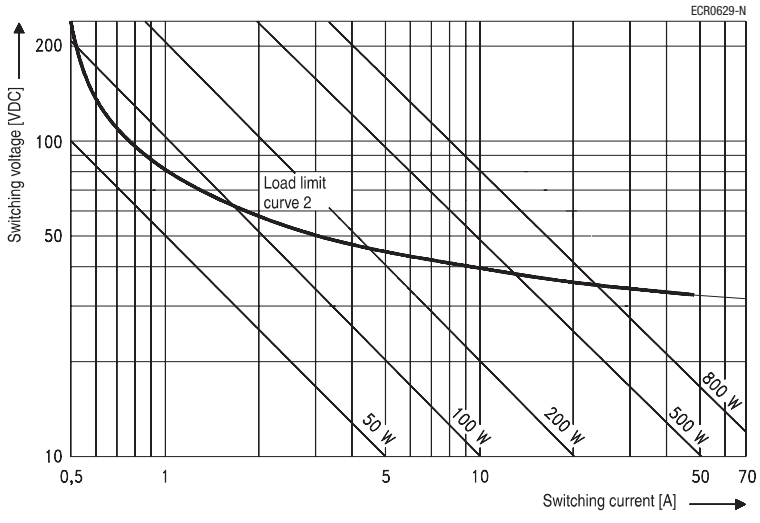
Power Relay F7/VF7

Contact Data

Contact configuration	1 Make contact/ 1 Form A		
Circuit symbol (see also Pin assignment)			
Rated voltage	12 V	24 V	24 V [3]
Rated current	50 A	25 A	40 A
Limiting continuous current			
23°C	70 A		
85°C	50 A		
125°C	30 A		
Contact material	AgNi0.15		$AgSnO_2$
Max. switching voltage/power	See load limit curve		
Max. switching current [1]			
On [2]	240 A	240 A	240 A
Off	70 A	25 A	40 A
Min. recommended load [4]	1 A at 5 V		
Voltage drop at 10 A (initial) NO contact	Typ. 10 mV, 300 mV max.		
Mechanical endurance (without load)	> 10^7 operations		
Electrical endurance (example of resistive load, without component in parallel to the coil, further information on request)	> 1 x 10^5 operations 70 A, 13.5 V > 2 x 10^5 operations 50 A, 13.5 V	> 1 x 10^5 operations 25 A, 28 V	> 1 x 10^5 operations 50 A, 28 V
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)		

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V or 27 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] Special high performance 24 V version with contact gap > 0.8 mm, part number V23134-J0056-X408 (see ordering information).
[4] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve

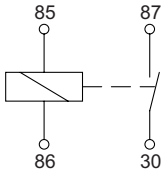


Load limit curve 2 ≙ safe shutdown, no stationary arc (make contact)

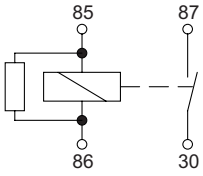
Power Relay F7/VF7

Circuit Diagram

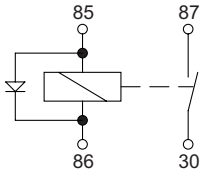
A0
1 Make contact/1 Form A



AR
1 Make contact/1 Form A
with Resistor



AD
1 Make contact/1 Form A
with Diode



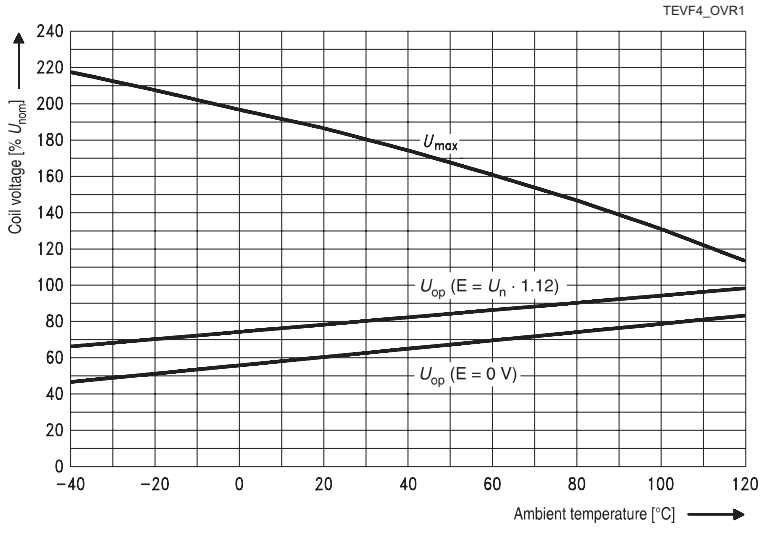
Coil Data

Available for nominal voltages	12 V / 24 V
Nominal power consumption of the unsuppressed coil at nominal voltage	1.6 V / 2.0 W (F7/VF7)
Nominal power consumption at nominal voltage with suppression resistor	1.8 W / 2.2 W / 2.1 W (F7/VF7/high performance 24 V)
Test voltage winding/contact and contact/contact	500 VAC_{rms}
Ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 7 ms
Release time at nominal voltage [1)]	Typ. 2 ms

1) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Power Relay F7/VF7

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	150 N
Push force	150 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1]
Resistance to bending, force applied to side	10 N [1]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures.

[1] Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

Environmental Conditions

Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation	EN ISO 6988		6 cycles	Storage 8/16 h
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat				
cyclic	IEC 68-2-30	Db, Variant 1	6 cycles	Upper air temperature 55°C
constant	IEC 68-2-3	Ca	56 days	
Corrosive gas	IEC 68-2-42	10 ±2 cm^3/m^3 SO_2	10 days	
	IEC 68-2-43	1 ±0.3 cm^3/m^3 H_2S	10 days	
Vibration resistance	IEC 68-2-6 (sine sweep)		10 - 500 Hz min.10 g	No change in the switching state > 10 µs
Shock resistance	IEC 68-2-27 (half sine form single pulses))		min. 30 g 6 ms	
Load dump	ISO 7637-1 (12 V)	Test pulse 5	Vs = +86.5 V	
	ISO 7637-2 (24 V)	Test pulse 5	Vs = +200 V	
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			
Overload current for relays with rated currents as shown in contact data table [2]	67.5 100 175 300			

[1] FMVSS: Federal Motor Vehicle Safety Standard.
[2] Current and time are compatible with circuit protection by a typical 50 A automotive fuse. Relay will make, carry and break the specified current.

Ordering Information

Part Numbers (see table below for coil data) Relay Description	Internal Reference	Part Number	Circuit/Contact Arrangement	Contact Material	Enclosure	Coil Suppression	Bracket
12 V Plug-In Relays							
V23134-J0052-D642		7-1393303-3	A0/1 Form A	Silver based	Dust cover		
V23134-J1052-D642		1393304-9	A0/1 Form A	Silver based	Dust cover		Yes
V23134-J0052-X429		1-1414147-0	AR/1 Form A	Silver based	Dust cover	Resistor 680 Ω	
V23134-J0052-X439		1-1414286-0	AD/1 Form A	Silver based	Dust cover	Diode (cathode at 86)	
V23134-J0052-X461 [1]		1-1414469-0	AR/1 Form A	Silver based	Dust cover	Resistor 560 Ω	
12 V PCB Relays							
V23134-J0052-X455		1-1414478-0	AR/1 Form A	Silver based	Dust cover	Resistor 470 Ω	
24 V Plug-In Relays							
V23134-J0053-D642		9-1393303-7	A0/1 Form A	Silver based	Dust cover		
V23134-J1053-D642		1-1393304-1	A0/1 Form A	Silver based	Dust cover		Yes
V23134-J0056-X408 [2]		1393304-5	AR/1 Form A	Silver based	Dust cover	Resistor 1200 kΩ	
12 V Plug-In Relays							
VF7-11F11	V23134-J0055-X834	4-1393306-5	A0/1 Form A	Silver based	Dust cover		
VF7-11F11-S01	V23134-J0055-X836	4-1393306-6	AR/1 Form A	Silver based	Dust cover	Resistor 680 Ω	
VF7-41F11	V23134-J1055-X845	5-1393306-8	A0/1 Form A	Silver based	Dust cover		Yes
VF7-41F11-C05	V23134-J1056-X846	1432055-1	AR/1 Form A	Silver based	Dust cover, sealed	Resistor 680 Ω	Yes
VF7-41F11-S01	V23134-J1055-X849	1-1393302-6	AR/1 Form A	Silver based	Dust cover	Resistor 680 Ω	Yes
12 V PCB Relays							
VF7-11F12	V23134-J0055-X838	1-1393302-3	A0/1 Form A	Silver based	Dust cover		
VF7-11F12-C05	V23134-J0055-X864	1432556-1	AR/1 Form A	Silver based	Dust cover, sealed	Resistor 680 Ω	
24 V Plug-In Relays							
VF7-11H11	V23134-J0065-X839	1-1393302-4	A0/1 Form A	Silver based	Dust cover		
VF7-41H11	V23134-J1065-X853	1-1393302-7	A0/1 Form A	Silver based	Dust cover		Yes
VF7-41H11-S08	V23134-J1065-X855	6-1393306-7	AR/1 Form A	Silver based	Dust cover	Resistor 2700 Ω	Yes
24 V PCB Relays							
VF7-11H12	V23134-J0065-X841	1-1393302-5	A0/1 Form A	Silver based	Dust cover		

[1] Special feature: 14.5 mm load terminals.
[2] Special feature: contact gap > 0.8 mm.

Coil Versions

Coil Data for Power F7/VF7	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V) at 23°C	Allowable Overdrive [1] Voltage (V) at 85°C
V23134-**052****	12	90	7.2	1.6	22	17
V23134-**053****	24	324	14.4	3.2	41	30
V23134-**056****	24	268	16.0	4.0	38	29
VF7-**F**-**	12	72	7.2	1.2	18	14
VF7-**H**-**	24	288	14.4	2.4	36	28

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (orders in multiples of delivery pack)

Power F7:	Plug-in version:	210 pieces
	Plug-in version with bracket:	208 pieces
	PCB version:	200 pieces
VF7:		300 pieces

Shrouded Power Relay F7 A

Features

- Limiting continuous current 70 A
- Pin assignment according to ISO 7588 part 1
- Bracket

Customized Versions on Request

- Integrated components (e.g. diode)
- Customized marking

Typical Applications

- ABS control
- Blower fans
- Cooling fan
- Energy management
- Engine control
- Fuel pump
- Heated front screen
- Ignition
- Lamps front, rear, fog light
- Main switch/supply relay
- Wiper control

Please contact Tyco Electronics for relay application support.

136J_3D03

Design

- ELV/RoHS/WEEE compliant
- Protection class IP67 to IEC 529 (EN 60 529) if used with special connector

Weight

Approx. 60 g (2.1 oz.)

Nominal Voltage

12 V; other nominal voltages available on request

Terminals

Quick connect terminals similar to ISO 8092-1, coil 6.3 x 0.8 mm, load 9.5 x 1.2 mm; surfaces tin plated

Accessories

Fitting connectors see table Ordering Information

Conditions

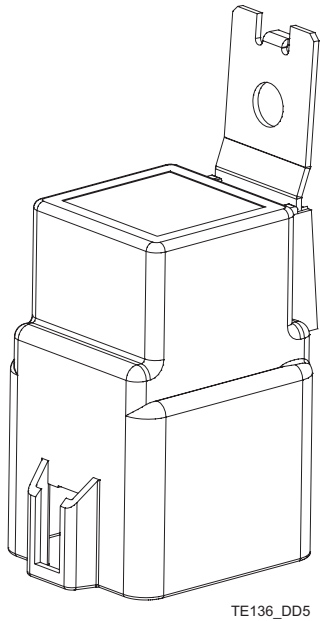
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

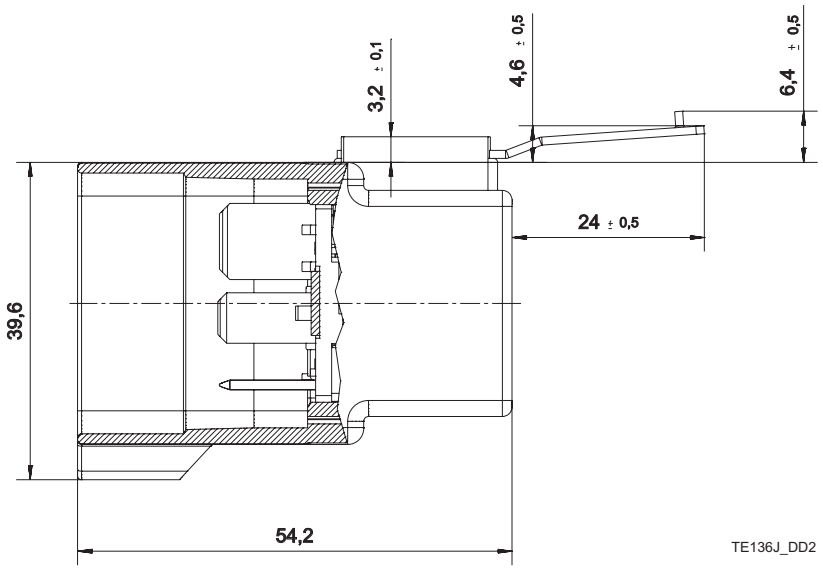
Disclaimer

Shrouded Power Relay F7 A

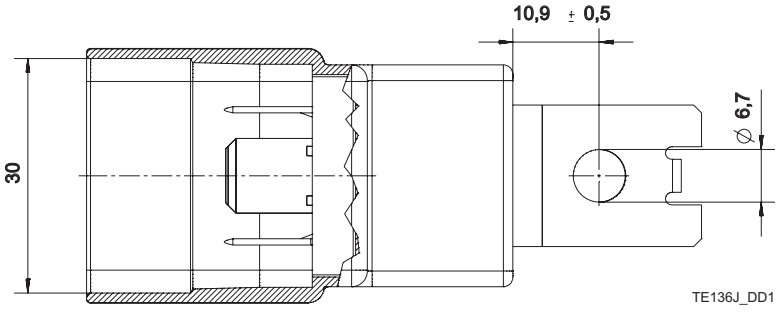
Dimensional Drawing



TE136_DD5

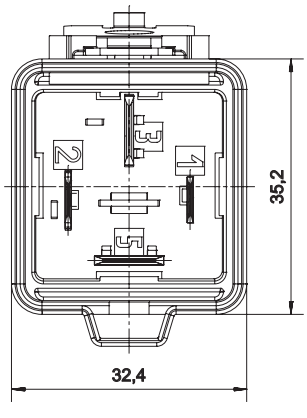


TE136J_DD2

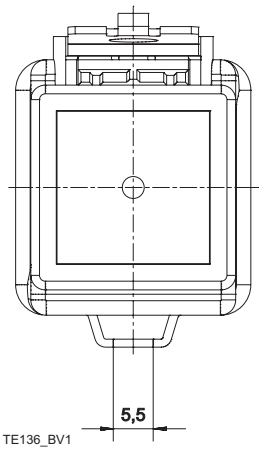


TE136J_DD1

View of the Terminals (bottom view)



TE136J_VT1



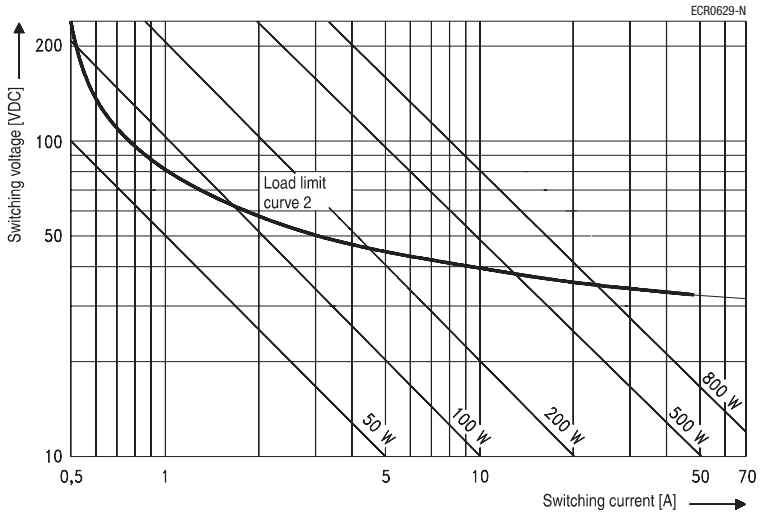
TE136_BV1

Shrouded Power Relay F7 A

Contact Data	
Contact configuration	1 Make contact/ 1 Form A
Circuit symbol	
Rated voltage	12 V
Rated current	50 A
Limiting continuous current [1]	
23°C	70 A
85°C	50 A
125°C	30 A
Contact material	Silver based
Max. switching voltage/power	See load limit curve
Max. switching current [2]	
On	120 A
Off	60 A
Min. recommended load [3]	1 A at 12 V
Voltage drop A (initial)	Typ. 15 mV, 300 mV max.
Mechanical endurance (without load)	Typ. 10^7 operations
Electrical endurance (example of resistive load, further information on request)	> 2 x 10^5 operations 40 A on NO
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve

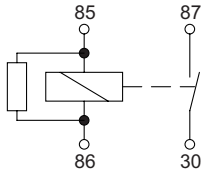


Load limit curve 2 ≙ safe shutdown,
no stationary arc (make contact)

Shrouded Power Relay F7 A

Circuit Diagram

AR
1 Make contact/1 Form A
with Resistor

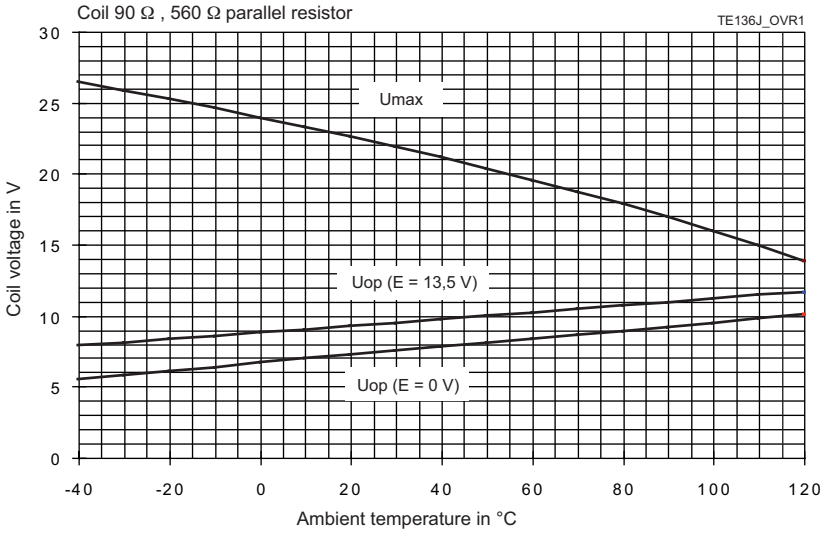


Coil Data	
Available for nominal voltages	12 V
Nominal power consumption at nominal voltage with suppression resistor	1.8 W
Test voltage winding/contact and contact/contact	500 VAC_{rms}
Ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 8.5 ms
Release time at nominal voltage [1)]	Typ. 4.0 ms

1) For unsuppressed relay coil.

Note
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization
Uop = operate voltage

Mechanical Data	
Cover retention	
Axial force	150 N
Pull force	200 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N

Shrouded Power Relay F7 A

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation	EN ISO 6988		6 cycles	Storage 8/16 h
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat				
cyclic	IEC 68-2-30	Db, Variant 1	6 cycles	Upper air temperature 55°C
constant	IEC 68-2-3	Ca	56 days	
Corrosive gas	IEC 68-2-42	10 ±2 cm^3/m^3 SO_2	10 days	
	IEC 68-2-43	1 ±0.3 cm^3/m^3 H_2S	10 days	
Vibration resistance	IEC 68-2-6 (sine sweep)		10 - 500 Hz min. 5 g	No change in the switching state > 10 µs
Shock resistance	IEC 68-2-27 (half sine form single pulses)		min. 20 g 11 ms	
Load dump	ISO 7637-1 (12 V)	Test pulse 5	Vs = +86.5 V	
	ISO 7637-2 (24 V)	Test pulse 5	Vs = +200 V	
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			
Overload current for relays with rated currents as shown in contact data table [2]	1.35 x Rated current 1800 s 2.00 x Rated current 5 s 3.50 x Rated current 0.5 s 6.00 x Rated current 0.1 s			
Protection class	IEC 529 (EN 60 529)	IP67 if used with special connector		

[1] FMVSS: Federal Motor Vehicle Safety Standard.
[2] Current and time are compatible with circuit protection by a typical automotive fuse. Relay will make, carry and break the specified current.

Ordering Information

Part Numbers (see table below for coil data)		Circuit/Contact Arrangement	Contact Material	Enclosure	Coil Suppression	Fitting Connectors FCI Order Number
Relay Description	Part Number					
V23136-J1004-X050	1-1414122-0	AR/1 Form A	Silver based	Shrouded cover	Resistor 560 Ω	6 043 10 11

Coil Versions

Coil Data for Shrouded Power F7 A	Rated Coil Voltage (V)	Coil Resistance [2] ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V)	
					at 23°C	at 85°C
V23136-**004-****	12	78	7.2	1.6	22	17

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] Resistance measured between terminals 1 and 2.

Standard Delivery Packs (orders in multiples of delivery pack)

Shrouded Power F7 A: 108 pieces

VJ28

Features

- Limiting continuous current 20 A at 85°C
- 2.8 mm quick connect terminals (per SAE J1744)

Customized Versions on Request

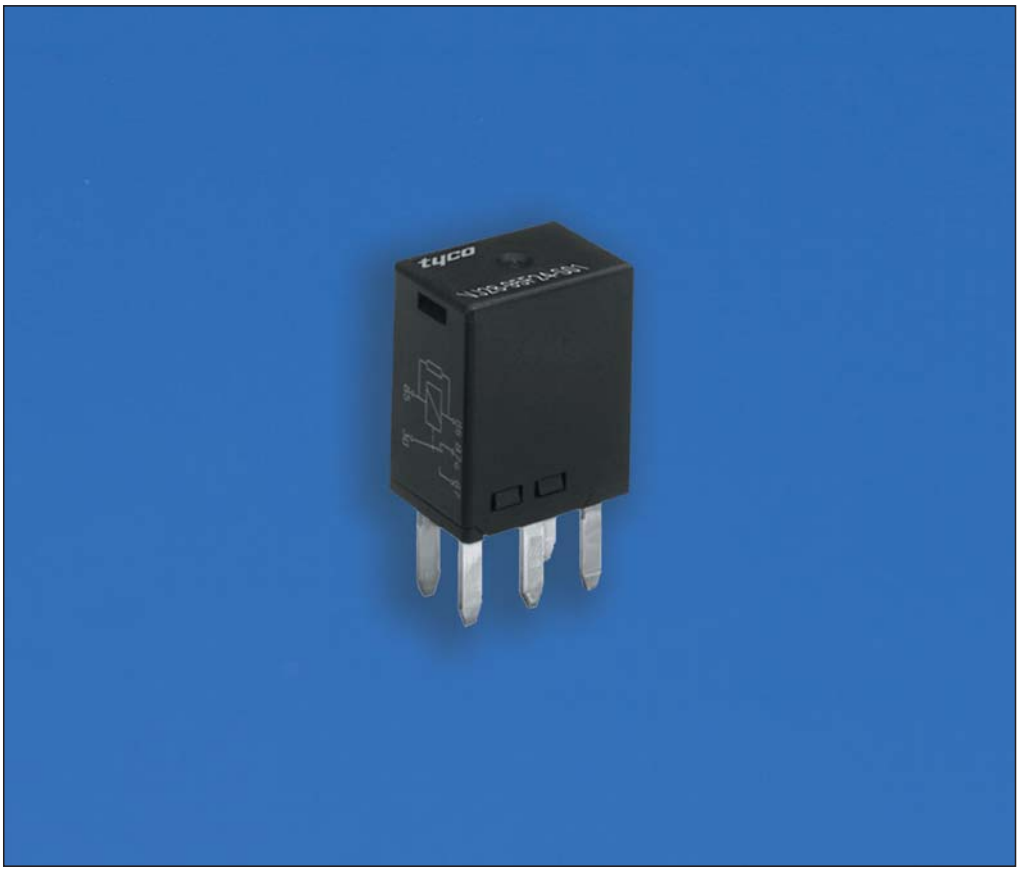
- Integrated components (e.g. resistor, diode)
- Special marking

Typical Applications

Cross carline up to 20 A for example:

- ABS control
- Blower fans
- Cooling fan
- Door control
- Door lock
- Fuel pump
- Heated front screen
- Immobilizer
- Interior lights
- Seat control
- Seatbelt pretensioner
- Sun roof
- Trunk lock
- Valves
- Window lifter
- Wiper control

Please contact Tyco Electronics for relay application support.



VJ28_3d3

Design

- ELV compliant
- Dustproof; protection class IP54 to IEC 529 (EN 60 529)

Weight

Approx. 20 g (0.7 oz.)

Nominal Voltage

12 V

Terminals

Quick connect terminals per SAE J1744; coil and load 2.8 mm dual in-line

Conditions

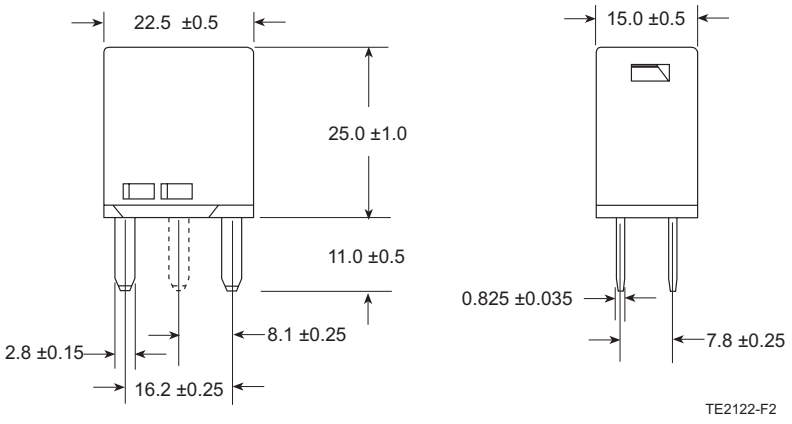
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

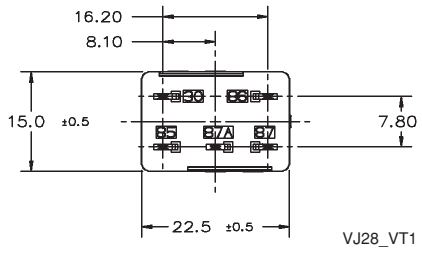
Disclaimer

VJ28

Dimensional Drawing



View of the Terminals (bottom view)

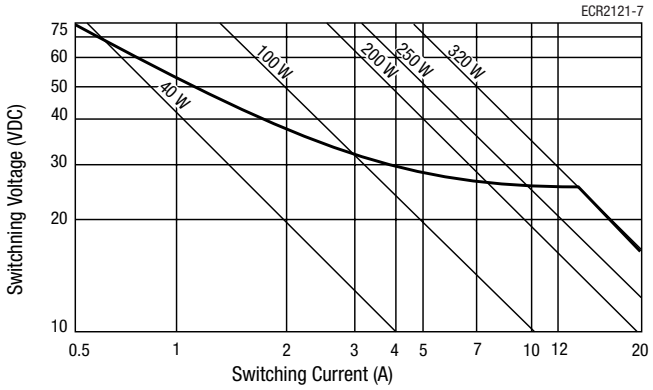


Contact Data

Contact configuration	1 Make contact/ 1 Form A	1 Changeover contact/ 1 Form C
Circuit symbol (see also Pin assignment)		
Rated voltage	12 V	12 V
Rated current	20 A	10/20 A
Limiting continuous current		NC/NO
23°C	25 A	15/25 A
85°C	20 A	10/20 A
125°C	8 A	5/8 A
Contact material	Silver based	
Max. switching voltage/power	See load limit curve	
Max. switching current [1]		NC/NO
On [2]	90 A	30/90 A
Off	30 A	15/30 A
Min. recommended load [3]	1 A at 5 V	
Voltage drop (initial)		
NO contact at 20 A	200 mV max.	200 mV max.
NC contact at 10 A		250 mV max.
Mechanical endurance (without load)	Typ. 10^7 operations	
Electrical endurance (example of resistive load, further information on request)	> 1 x 10^5 operations 20 A, 14 V	> 1 x 10^5 operations 20 A, 14 V / 10 A, 14 V NO contact / NC contact
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)	

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

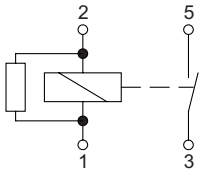
Load Limit Curve



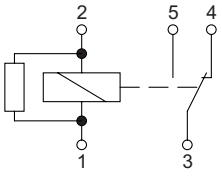
Safe breaking, arc extinguished (normally open contact) for resistive loads.

Circuit Diagram

AR
1 Make contact/1 Form A
with Resistor



CR
1 Changeover contact/1 Form C
with Resistor



Coil Data

Available for nominal voltages	12 V
Nominal power consumption of the unsuppressed coil at nominal voltage	1.4 W
Nominal power consumption at nominal voltage with suppression resistor	1.6 W
Test voltage winding/contact	500 VAC_{rms}
Ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 5 ms
Release time at nominal voltage [1)]	Typ. 2 ms

1) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	200 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1)]
Resistance to bending, force applied to side	10 N [1)]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures
Weatherproof cover	Mates with VC28-1003 connector.

1) Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

VJ28

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Vibration resistance	1.27 mm double amplitude 5 g constant 0.5 mm double amplitude 10 g constant		10 - 40 Hz 40 - 70 Hz 70 - 100 Hz 100 - 500 Hz	Valid for NC contacts NO contacts are significantly higher
Shock resistance	Half sine wave pulse		20 g 11 ms	No change in the switching state > 1 ms
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			internal external
Overload Current [2]	27 A, 1800 s 40 A, 5 s 70 A, 0.5 s 120 A, 0.1 s			

[1] FMVSS: Federal Motor Vehicle Safety Standard.
[2] Current and time are compatible with circuit protection by a typical 20 A automotive fuse. Relay will make, carry and break the specified current.

Ordering Information

Part Numbers (see table below for coil data)		Circuit/Contact Arrangement	Contact Material	Enclosure	Coil Suppression
Relay Description	Part Number				
VJ28-91F24-S01	1432257-1	AR/1 Form A	$AgSnO_2$	Dust Cover	680 Ω resistor in parallel
VJ28-95F24-S01	1432223-1	CR/1 Form C	$AgSnO_2$	Dust Cover	680 Ω resistor in parallel

Coil Versions

Coil Data for VJ28	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V)	
					at 23°C	at 85°C
VJ28-**F**-S01	12	97	7.2	1.2	20.4	14.9

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] Coil suppression suffix: S01 for 12 V (680 Ω parallel resistor).

Standard Delivery Packs (orders in multiples of delivery pack)

VJ28: 600 pieces

VH28 Half Width

Features

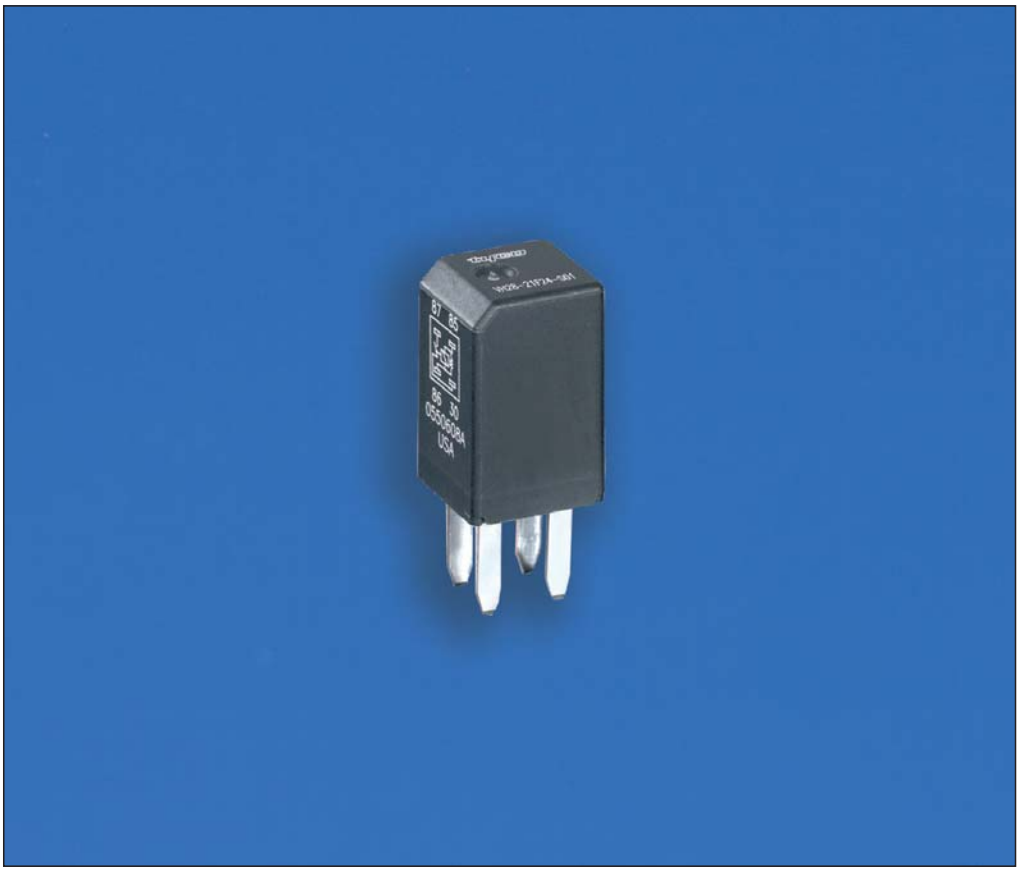
- Limiting continuous current 20 A
- 2.8 mm quick connect terminals (per SAE J1744)
- Maximum utilization of terminal spacing

Typical Applications

Cross carline up to 20 A
for example:

- ABS control
- Blower fans
- Cooling fan
- Door control
- Door lock
- Fuel pump
- Heated front screen
- Immobilizer
- Interior lights
- Seat control
- Seatbelt pretensioner
- Sun roof
- Trunk lock
- Valves
- Window lifter
- Wiper control

Please contact Tyco Electronics for relay application support.



VH28_3D3

Design

- ELV compliant
- Sealed or dust cover plastic enclosure
- Dustproof: protection class IP54 to IEC 529 (EN 60 529)
- Sealed: protection class IP67 to IEC 529 (EN 60 529)

Weight

Approx. 12.7 g (0.45 oz.)

Nominal Voltage

12 V

Terminals

Quick connect terminals per SAE J1744; coil and load 2.8 mm dual in-line

Conditions

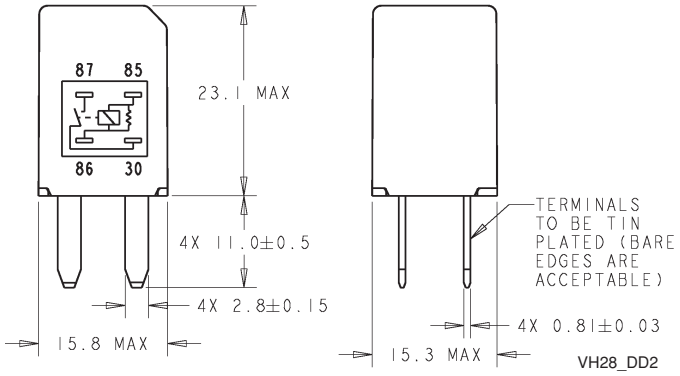
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

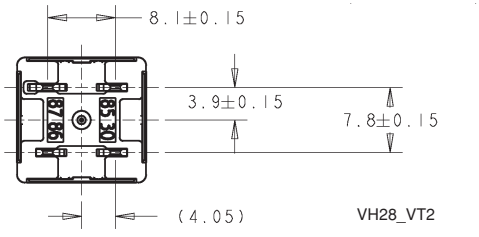
Disclaimer

VH28 Half Width

Dimensional Drawing



View of the Terminals (bottom view)

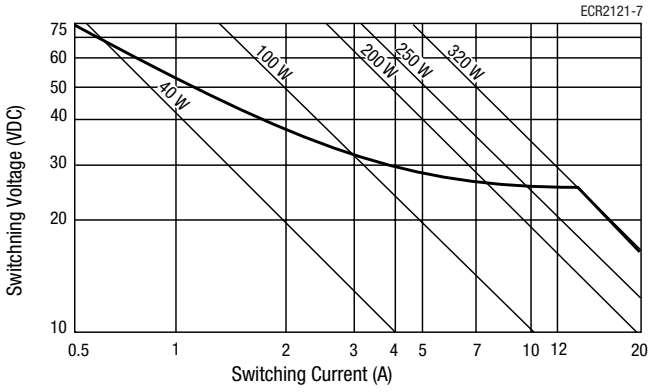


Contact Data	
Contact configuration	1 Make contact/ 1 Form A
Circuit symbol (see also Pin assignment)	
Rated voltage	12 V
Rated current	20 A
Limiting continuous current	
23°C	20 A
85°C	15 A
125°C	8 A
Contact material	Silver based
Max. switching voltage/power	See load limit curve
Max. switching current [1]	
On [2]	100 A at 16 V (lamp)
Off	30 A at 16 V (resistive)
Min. recommended load [3]	1 A at 5 V
Voltage drop (initial) NO contact at 20 A	Typ. 20 mV, 200 mV max.
Mechanical endurance (without load)	Typ. 10^7 operations at 20 operations/s max.
Electrical endurance (example of resistive load, further information on request)	> 1 x 10^5 operations 20 A, 14 V
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

VH28 Half Width

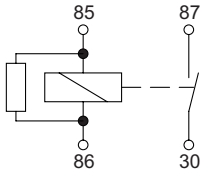
Load Limit Curve



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

Circuit Diagram

AR
1 Make contact/1 Form A
with Resistor



Coil Data	
Available for nominal voltages	12 V
Nominal power consumption of the unsuppressed coil at nominal voltage	1.03 W
Nominal power consumption at nominal voltage with suppression resistor	1.17 W
Test voltage winding/contact	500 VAC_{rms}
Ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 5 ms
Release time at nominal voltage [1)]	Typ. 2 ms

[1)] For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Mechanical Data	
Cover retention	
Pull force	220 N
Push force	220 N
Terminals	
Pull force	110 N
Push force	110 N
Resistance to bending, force applied to front	10 N [1)]
Resistance to bending, force applied to side	10 N [1)]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures
Sealed	Protects relay from moisture. For use in areas where exposure to moisture is possible.

[1)] Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

VH28 Half Width

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Vibration resistance	1.27 mm double amplitude 5 g constant 0.5 mm double amplitude 10 g constant		10 - 40 Hz 40 - 70 Hz 70 - 100 Hz 100 - 500 Hz	No change in the switching state > 1 ms
Shock resistance	IEC 68-2-27 (half sine form single pulses)		20 g 11 ms	No change in the switching state > 1 ms deenergized. Values are significantly higher in the energized state
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			
Overload Current [2]	40.5 A, 1800 s 60 A, 60 s 180 A, 1 s			

[1] FMVSS: Federal Motor Vehicle Safety Standard.
[2] Current and time are compatible with circuit protection by a typical 30 A automotive fuse. Relay will make, carry and break the specified current. Testing performed at 23°C.

Ordering Information

Part Numbers [1] (see table below for coil data)		**Circuit/Contact Arrangement**	**Contact Material**	**Enclosure**	**Coil Suppression**	**Terminals**
Relay Description	**Part Number**					
VH28-11F24-S01	1432833-1	AR/1 Form A	$AgSnO_2$	Dust cover	Resistor 1000 Ω	Quick connect
VH28-21F24-S01	1432726-1	AR/1 Form A	$AgSnO_2$	Epoxy sealed	Resistor 1000 Ω	Quick connect

[1] Contact factory for mating connector information

Coil Versions

Coil Data for VH28	**Rated Coil Voltage (V)**	**Coil Resistance ±10% (Ω)**	**Must Operate Voltage (V)**	**Must Release Voltage (V)**	**Allowable Overdrive [1] Voltage (V)**	
					at 23°C	**at 125°C**
VH28-*1F24-S01	12	123	7.2	1.2	24	16

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] Coil suppression suffix: S01 for 12 V (1000 Ω parallel resistor).

Standard Delivery Packs (orders in multiples of delivery pack)

VH28: 900 pieces

VF28 (Standard and Shrouded)

Features

- Limiting continuous current 30 A at 85°C
- 2.8 mm quick connect terminals (per SAE J1744)

Customized Versions on Request

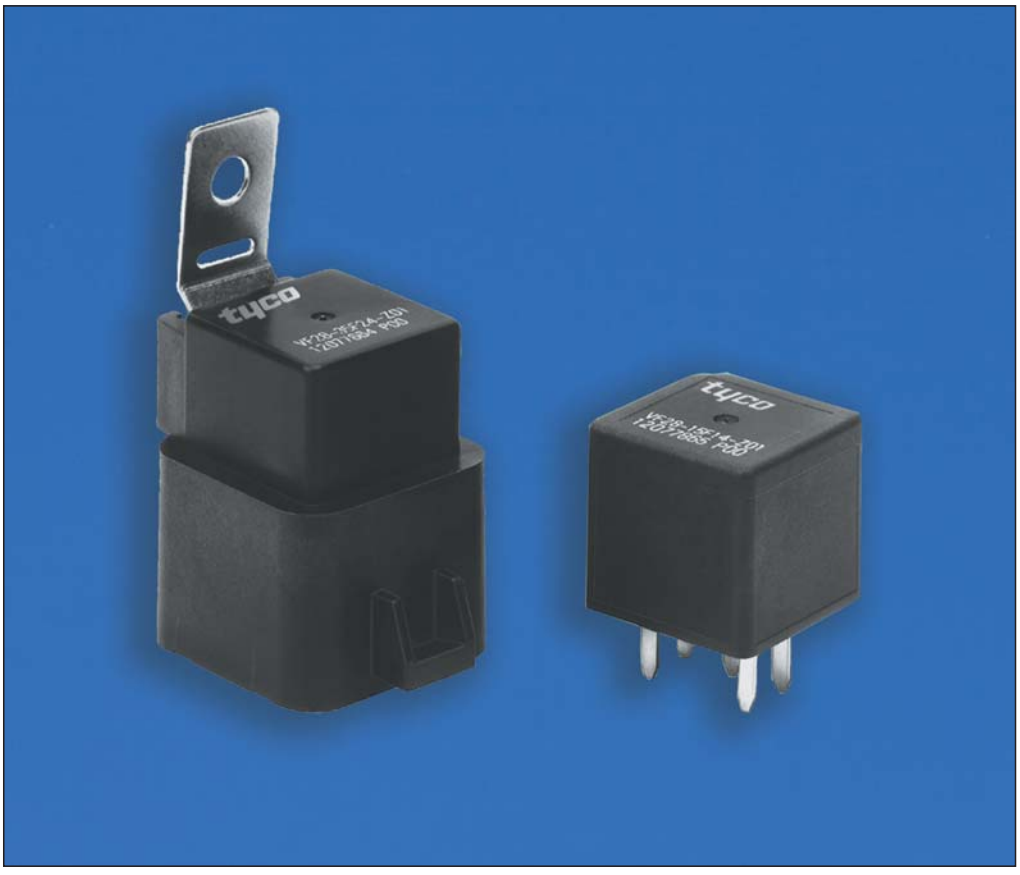
- Integrated components (e.g. resistor, diode)
- Customized marking
- Special covers (e.g. brackets, shrouded)

Typical Applications

Cross carline up to 30 A for example:

- ABS control
- Blower fans
- Cooling fan
- Energy management
- Engine control
- Fuel pump
- Heated front screen
- Ignition
- Lamps front, rear, fog light
- Main switch/supply relay
- Wiper control

Please contact Tyco Electronics for relay application support.



VF28_3D2R2

Design

- ELV compliant
- Dustproof; protection class IP54 to IEC 529 (EN 60 529)
- Shrouded: protection class IP67 to IEC 529 (EN 60 529) if used with special connector

Weight

Approx. 34 g (1.2 oz.)

Nominal Voltage

12 V or 24 V

Terminals

Quick connect terminals per SAE J1744; coil and load 2.8 mm dual in-line

Accessories

Connectors see page 235

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

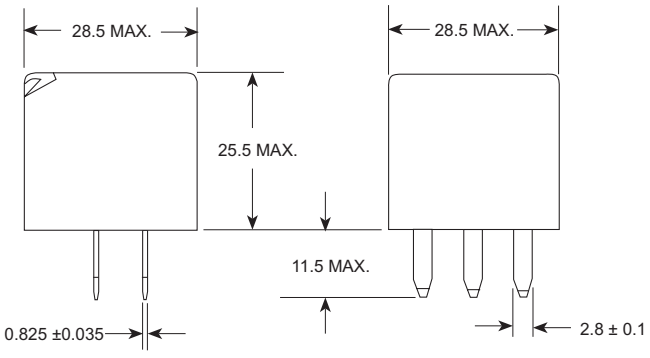
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

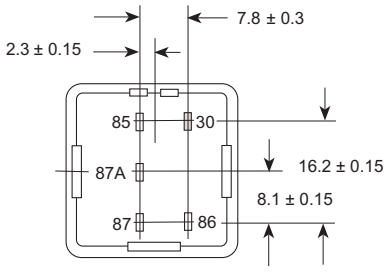
VF28 (Standard and Shrouded)

Dimensional Drawing

VF28 with Dust Cover
VF28-1****

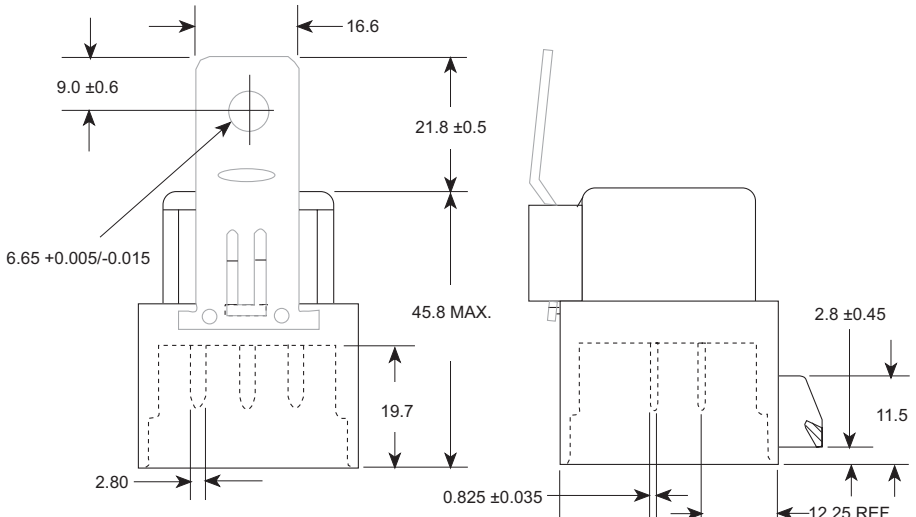


View of the Terminals (bottom view)



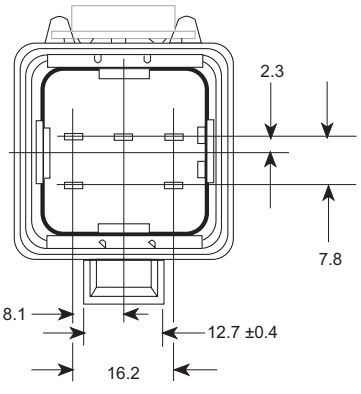
TE2118-M2

VF28 with Shrouded/Weatherproof cover
VF28-3** and VF28-6******



TE2119-V1

View of the Terminals (bottom view)



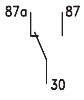
TOLERANCE UNLESS OTHERWISE NOTED:

2 DECIMAL: ±0.1

1 DECIMAL: ±0.15

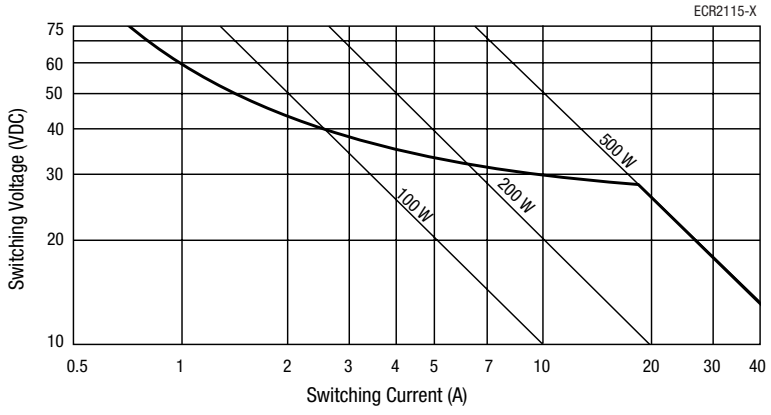
VF28 (Standard and Shrouded)

Contact Data

Contact configuration	1 Make contact/ 1 Form A	1 Changeover contact/ 1 Form C
Circuit symbol		
Rated voltage	12 V	12 V
Rated current	35 A	20/35 A
Limiting continuous current		NC/NO
23°C	45 A	25/45 A
85°C	30 A	20/30 A
125°C	12 A	8/12 A
Contact material	Silver based	
Max. switching voltage/power	See load limit curve	
Max. switching current [1]		NC/NO
On [2]	120 A	45/120 A
Off	40 A	30/40 A
Min. recommended load [3]	1 A at 5 V	
Voltage drop A (initial)		
NO contact at 35 A	200 mV max.	200 mV max.
NC contact at 20 A		250 mV max.
Mechanical endurance (without load)	Typ. 10^7 operations	
Electrical endurance	> 1 x 10^5 operations	> 1 x 10^5 operations
(example of resistive load,	35 A, 14 V	35 A, 14 V/20 A, 14 V
further information on request)		NO contact/NC contact
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)	

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve

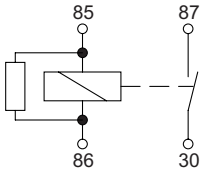


Safe breaking, arc extinguished (normally open contact) for resistive loads with resistor suppression.

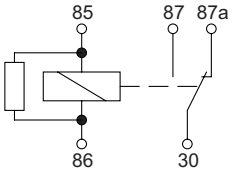
VF28 (Standard and Shrouded)

Circuit Diagram

AR
1 Make contact/1 Form A
with Resistor



CR
1 Changeover contact/1 Form C
with Resistor



Coil Data

Available for nominal voltages	12 V
Nominal power consumption of the unsuppressed coil at nominal voltage	1.6 W
Nominal power consumption at nominal voltage with suppression resistor	1.8 W
Test voltage winding/contact	500 VAC_{rms}
Ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 7 ms
Release time at nominal voltage [1)]	Typ. 4 ms

1) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	200 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1)]
Resistance to bending, force applied to side	10 N [1)]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures
Weatherproof cover	Mates with VC28-1003 connector.

1) Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

VF28 (Standard and Shrouded)

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Vibration resistance	1.27 mm double amplitude 5 g constant 0.5 mm double amplitude 10 g constant		10 - 40 Hz 40 - 70 Hz 70 - 100 Hz 100 - 500 Hz	Valid for NC contacts, NO contacts are significantly higher
Shock resistance	Half sine wave pulse		20 g 11 ms	No change in the switching state > 1 ms
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			Internal External
Overload Current [2]	54 A, 1800 s 80 A, 60 s 240 A, 1 s			

[1] FMVSS: Federal Motor Vehicle Safety Standard.
[2] Current and time are compatible with circuit protection by a typical 40 A automotive fuse. Relay will make, carry and break the specified current.

Ordering Information

Part Numbers (see table below for coil data)		Circuit/Contact Arrangement	Contact Material	Enclosure	Coil Suppression	Terminals
Relay Description	Part Number					
VF28-11F14-S01	1393297-1	AR/1 Form A	AgNi0.15	Dust cover	Resistor 680 Ω	Quick connect
VF28-11F24-S01	2-1419084-3	AR/1 Form A	$AgSnO_2$	Dust cover	Resistor 680 Ω	Quick connect
VF28-15F14-S01	1393297-8	CR/1 Form C	AgNi0.15	Dust cover	Resistor 680 Ω	Quick connect
VF28-15F24-S01	1-1393297-3	CR/1 Form C	$AgSnO_2$	Dust cover	Resistor 680 Ω	Quick connect
VF28-61F14-S01	3-1393297-6	AR/1 Form A	AgNi0.15	Weatherproof	Resistor 680 Ω	Quick connect
VF28-65F14-S01	4-1393297-5	CR/1 Form C	AgNi0.15	Weatherproof	Resistor 680 Ω	Quick connect

Coil Versions

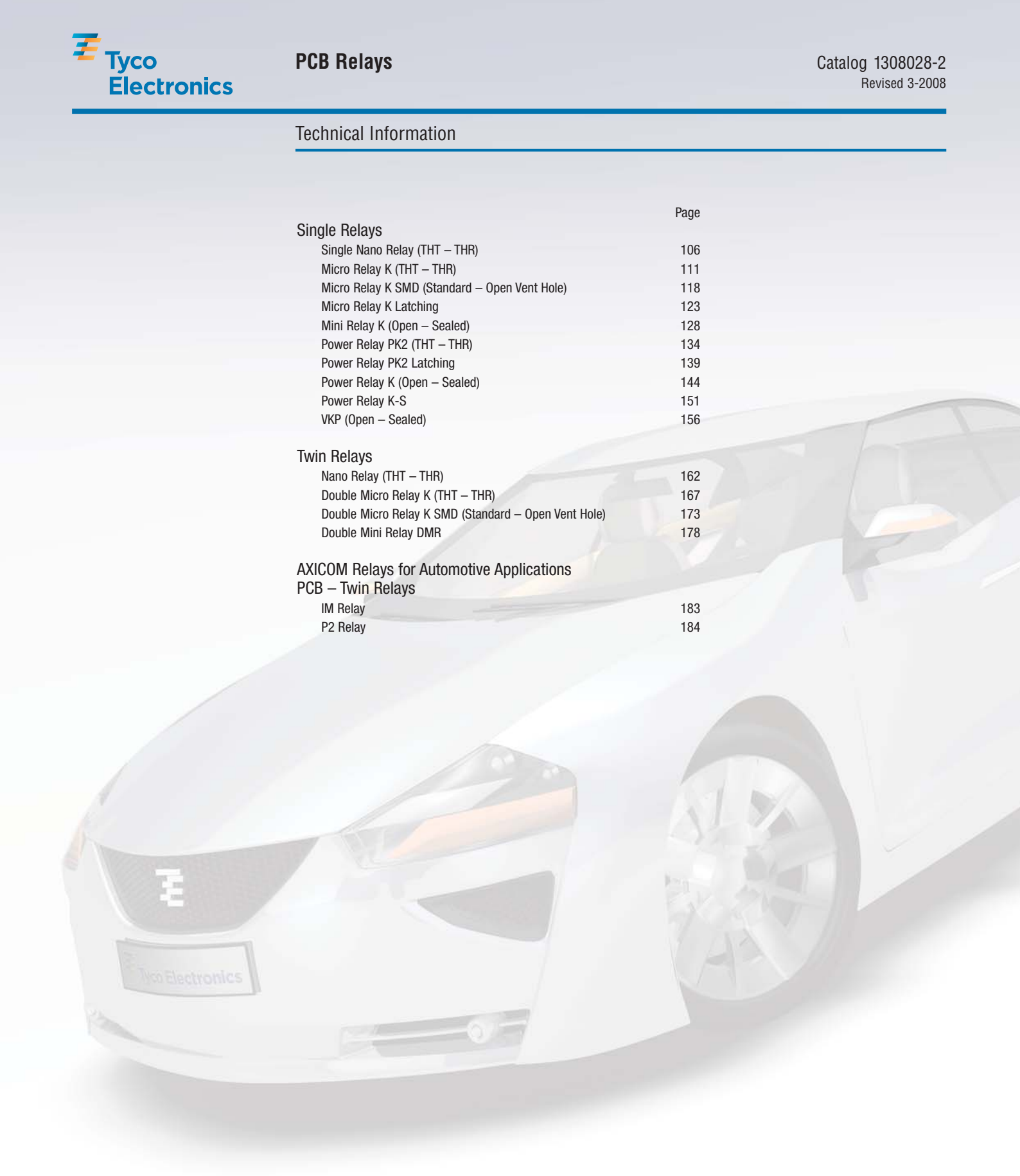
Coil Data for VF28	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V)	
					at 23°C	at 85°C
VF28-**F**-S01 [2]	12	79.5	7.2	1.2	20.2	15.7

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] Coil suppression suffix: S01 for 12 V (680 Ω parallel resistor).

Standard Delivery Packs (orders in multiples of delivery pack)

Dust cover version: 357 pieces
Weatherproof version with bracket: 110 pieces

Technical Information



Single Nano Relay (THT – THR)

Features

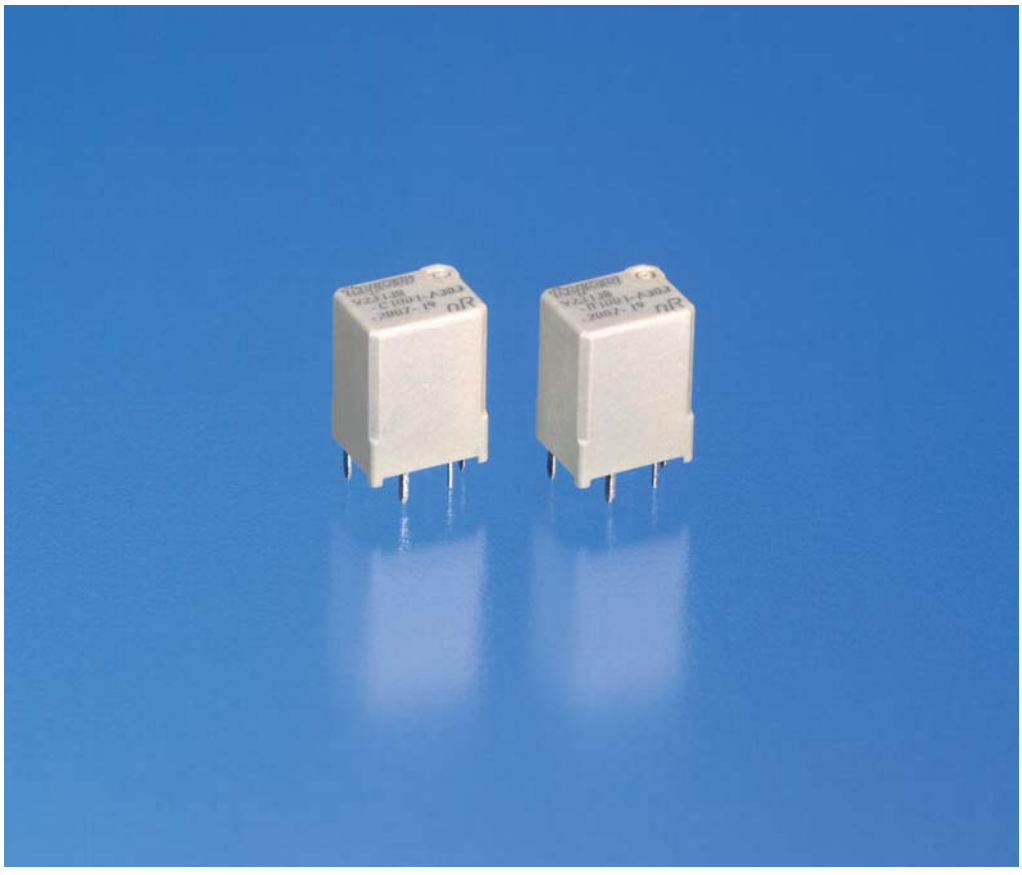
- Smallest automotive PCB relay in its class:
  - Minimum PCB area required: 81 mm²
  - Dimensions: L x H x W (mm) 10.2 x 14.0 x 8
  - Minimal height: 14.0 mm
  - Minimal weight
- First automotive relay using overmolding technology
- Highest reliability due to overmolding process
- Limiting continuous current 30 A
- Very easy routing of PCB-layout
- Power-saving high-impedance coil
- Low noise operation
- Wave (THT) and reflow (THR/pin-in-paste) solderable versions

- For twin version refer to Nano Relay

Typical Applications

- Car alarm
- Door lock
- Heated rear screen
- Horn
- Immobilizer
- Interior lights
- Seat control

Please contact Tyco Electronics for relay application support.



138_C-R1_3D1

Design

- ELV/RoHS/WEEE compliant
- THT: sealed type washable
- THR: sealed type open vent hole

Weight

Approx. 4 g (0.14 oz.)

Nominal Voltage

12 V

Terminals

PCB terminals for assembly on printed circuit boards

Conditions

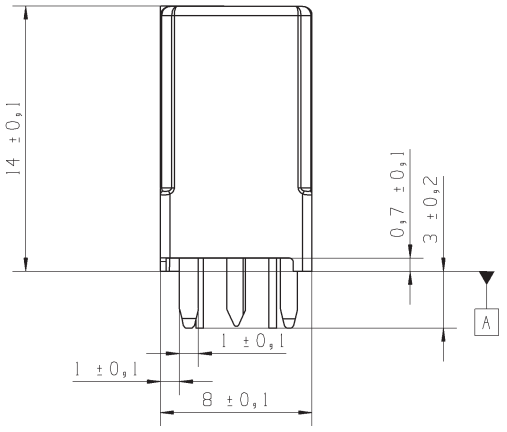
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

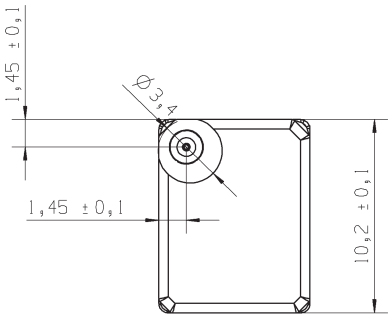
Disclaimer

Single Nano Relay (THT – THR)

Dimensional Drawing

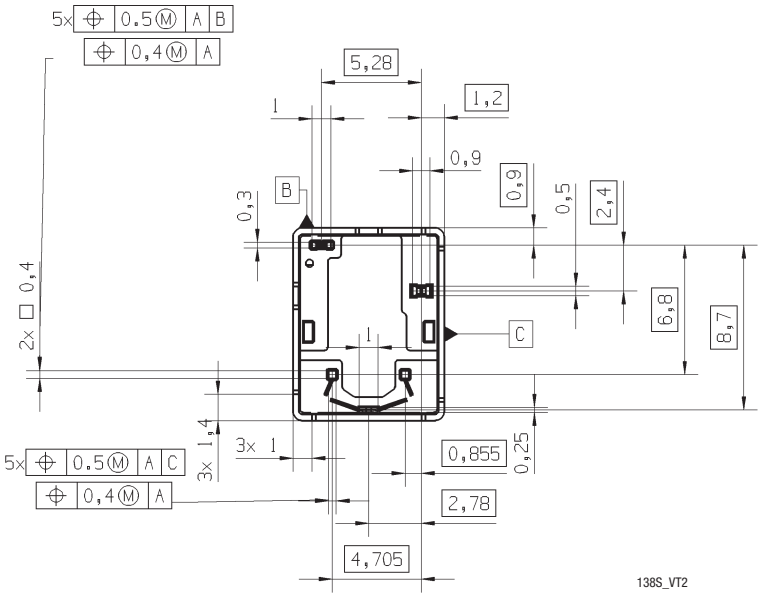


138S_DD1



138S_DD2

View of the Terminals (bottom view)



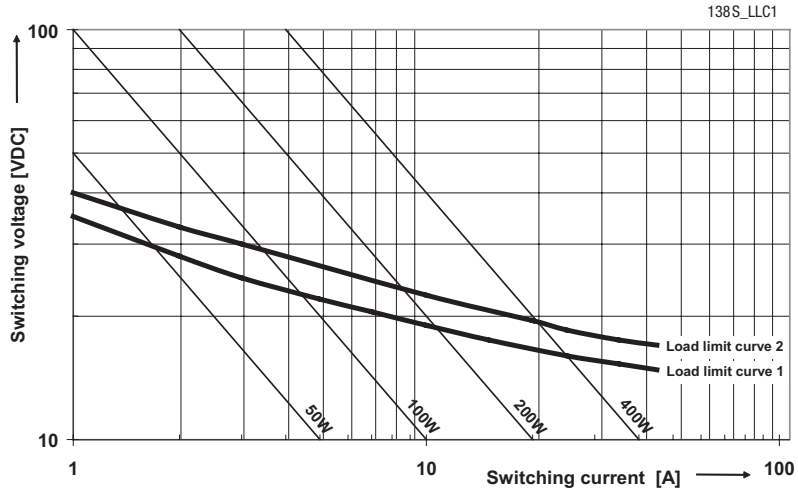
138S_VT2

Single Nano Relay (THT – THR)

Contact Data	
Typical areas of application	Resistive/inductive load
Contact configuration	1 Changeover contact / 1 Form C
Circuit symbol (see also Pin assignment)	
Rated voltage	12 V
Rated current	NC/NO 15 A/20 A
Limiting continuous current	
23°C	25 A/30A
85°C	15 A/20 A
105°C	10 A/12 A
Contact material	Silver based
Max. switching voltage/power	See load limit curve
Max. switching current [1]	NC/NO
On [2]	30 A
Off	30 A
Min. recommended load [3]	1 A at 5 V
Voltage drop at 10 A (initial) for NC/NO contacts	Typ. 30 mV, 300 mV max.
Mechanical endurance (without load)	> 5 x 10^6 operations
Electrical endurance at cyclic temperature –40/+23/+85°C and 13.5 V	Motor reverse blocked: > 10^5 operations at 25 A, 0.77 mH inductive load

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve



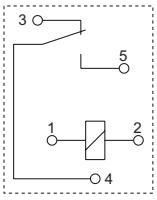
Load limit curve 1 ≙ arc extinguishes during transit time

Load limit curve 2 ≙ safe shutdown, no stationary arc

Single Nano Relay (THT – THR)

Circuit Diagram

1 Changeover contact/1 Form C



138S_PA3

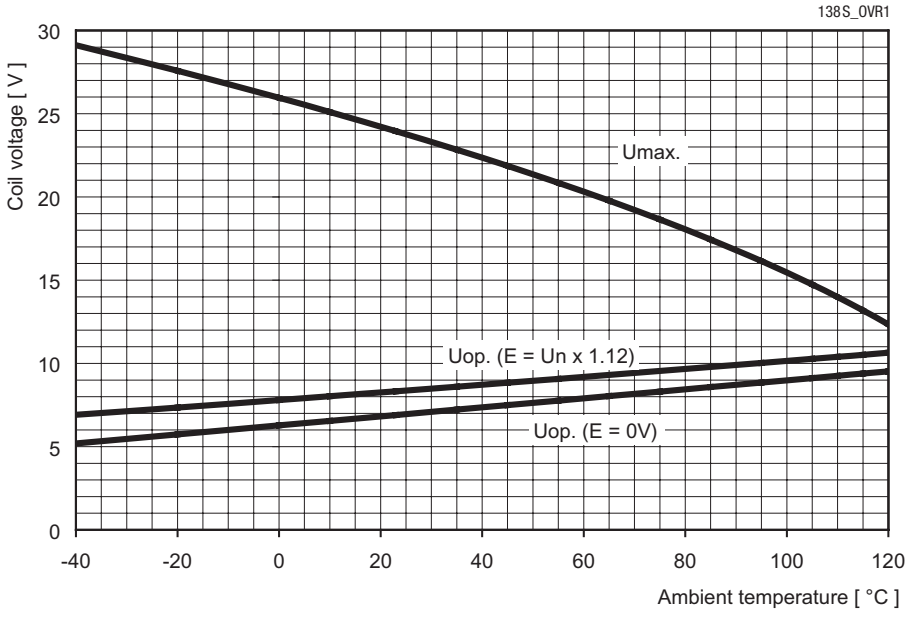
Coil Data

Available for nominal voltages	12 V
Nominal power consumption of the unsuppressed coil at nominal voltage	0.8 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range [1)]	–40 to +105°C
Operate time at nominal voltage	Typ. 3 ms
Release time at nominal voltage [2)]	Typ. 1.5 ms

1) Permanent use above 85°C could be critical, see also operating voltage range diagram.
2) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Single Nano Relay (THT – THR)

Environmental Conditions					
Temperature range, storage		Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test		Relevant standard	Testing as per	Dimension	Comments
Cold storage		IEC 68-2-1		1000 h	–40°C
Dry heat		IEC 68-2-2	Ba	1000 h	125°C
Climatic cycling with condensation					
	THT	EN ISO 6988		20 cycles	Storage 8/16 h
Thermal change		IEC 68-2-14	Nb	35 cycles	–40/+125°C
Thermal shock		IEC 68-2-14	Na	1000 cycles	–40/+125°C Dwell time 1 h
Damp heat					
cyclic	THT	IEC 68-2-30	Db, Variant 2	6 cycles	40°C/55°C/93%
constant	THT	IEC 68-2-3	Method Ca	56 days	40°C/93%
Corrosive gas					
		IEC 68-2-42		10 days	
		IEC 68-2-43		10 days	
Vibration resistance		IEC 68-2-6 (sine pulse form)		10 - 500 Hz 6 g	No change in the switching state > 10 µs
Shock resistance		IEC 68-2-27 (half sine form single pulses)		6 ms up to 30 g	No change in the switching state > 10 µs
Solderability				Hot dip 5 s	Aging 3 (4 h/155°C)
	THT	IEC 68-2-20	Ta, Method 1	215°C	for leaded process (Tm = 183°C)
	THR	IEC 68-2-58		245°C	for Pb-free process (Tm = 217°C)
Resistance to soldering heat				Hot dip 10 s	with thermal screen
	THT	IEC 68-2-20	Ta, Method 1A	260°C	
	THR	IEC 68-2-58		260°C	Preheating min 130°C
Sealing					
	THT	IEC 68-2-17	Qc, Method 2		1 min/70°C
	THR				Open vent hole

Ordering Information

Part Numbers (see table below for coil data)		Contact Arrangement	Contact Material	Enclosure	Soldering Technology
Relay Description	Part Number				
V23138-C1005-A303	8-1414964-9	1 Form C	Silver based	Sealed	THT
V23138-C1005-A403	9-1414964-1	1 Form C	Silver based	Sealed	THT
V23138-R1005-A303	9-1414964-0	1 Form C	Silver based	Open vent hole	THR
V23138-R1005-A403	1-1414960-7	1 Form C	Silver based	Open vent hole	THR

Coil Versions

Coil Data for Nano Single	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive[1] Voltage (V)	
					at 23°C	at 105°C
V23138-**005-****	12	180	6.9	1.0	24	14.7

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (orders in multiples of delivery pack)
Nano Single: 2600 pieces

Micro Relay K (THT – THR)

Features

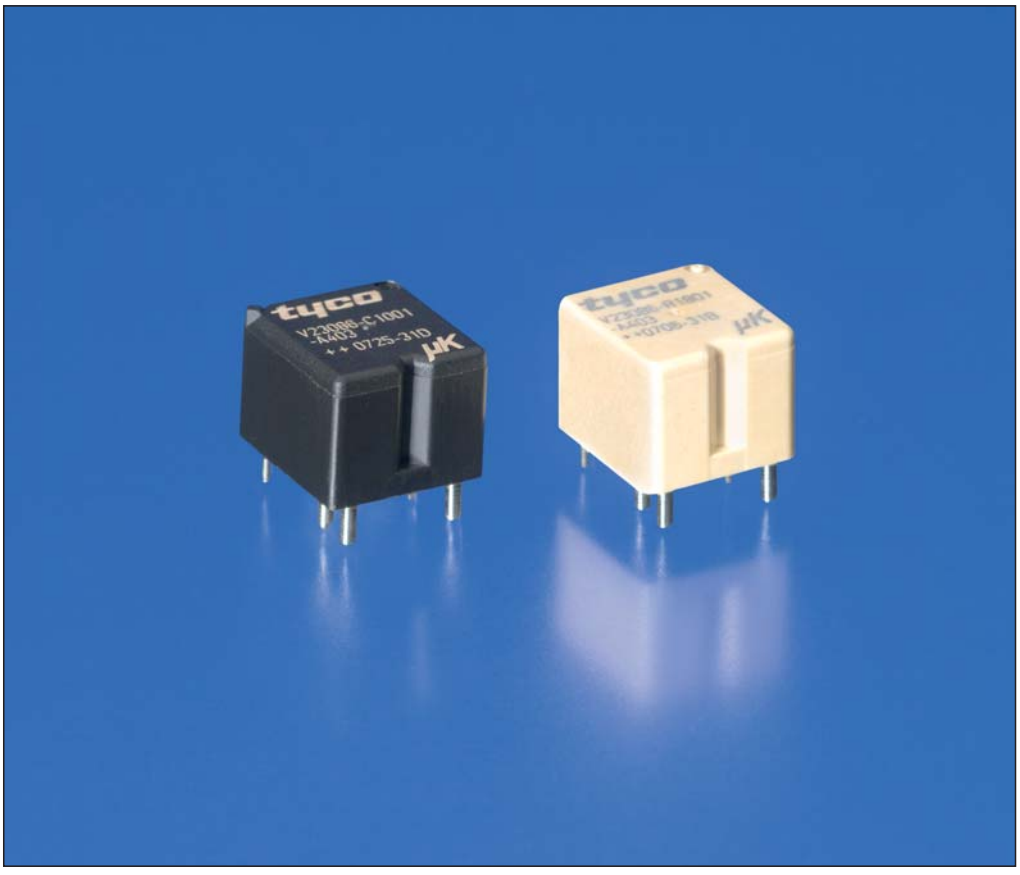
- Small power relay
- Limiting continuous current 30 A
- Minimal weight
- Low noise operation
- Wave (THT) and reflow (THR/pin-in-paste) solderable versions

- For twin version refer to Double Micro Relay K
- For latching (bistable) version refer to Micro Relay K Latching
- For surface mounted technology refer to SMD versions

Typical Applications

- Car alarm
- Door control
- Door lock
- Hazard warning signal
- Heated front/rear screen
- Immobilizer
- Lamps front, rear, fog light
- Interior lights
- Seat control
- Sun roof
- Turn signal
- Window lifter
- Wiper control

Please contact Tyco Electronics for relay application support.



86CR1_3Dco1

Design

- ELV/RoHS/WEEE compliant
- THT: sealed type washable
- THR: sealed type open vent hole

Weight

Approx. 4 g (0.14 oz.)

Nominal Voltage

10 V or 12 V; other nominal voltages available on request

Terminals

PCB terminals for assembly on printed circuit boards

Conditions

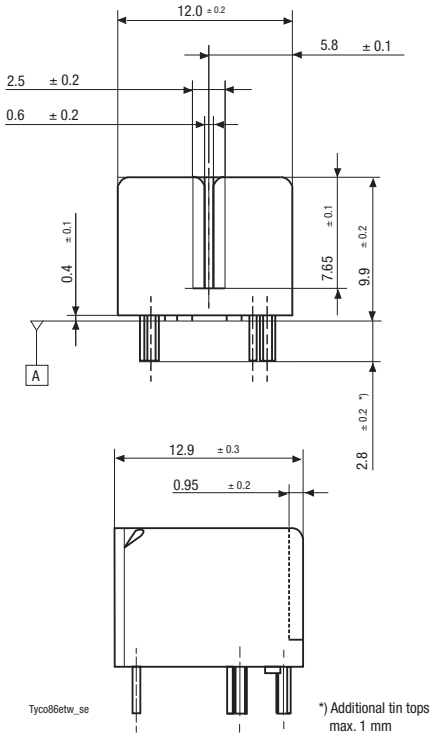
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

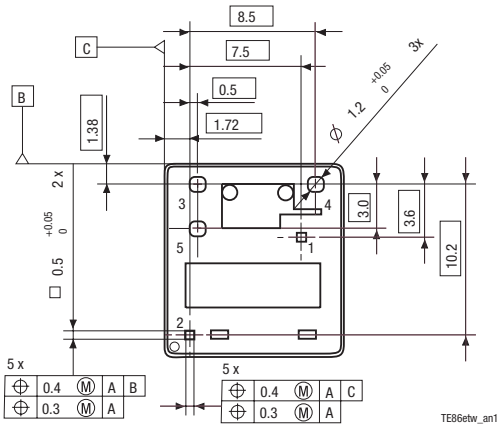
Disclaimer

Dimensional Drawing

Micro Relay K THT



View of the Terminals (bottom view)

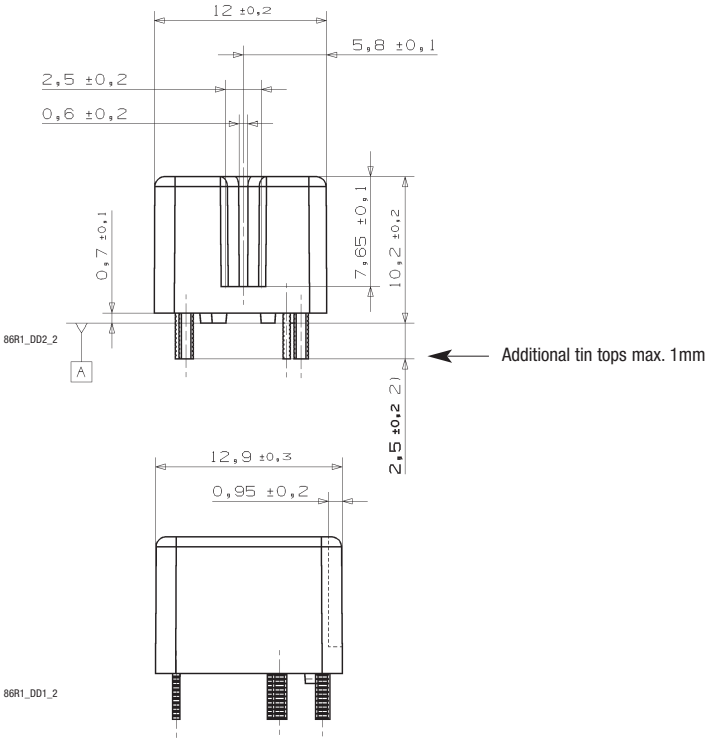


Remark: Positional tolerances according to DIN EN ISO 5458

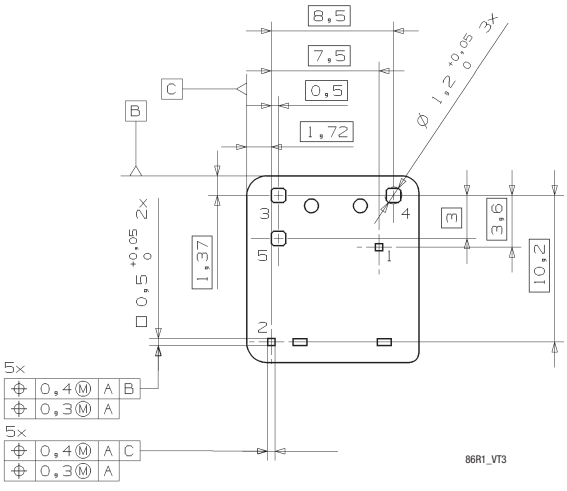
Micro Relay K (THR)

Dimensional Drawing

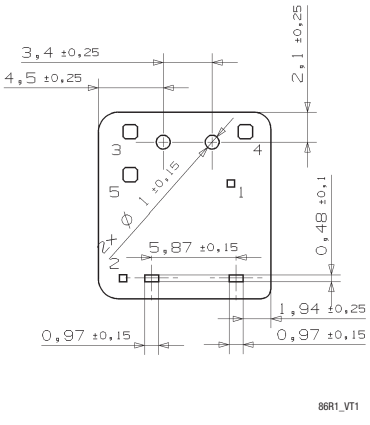
Micro Relay K THR



View of the Terminals (bottom view)



View of the Terminals (stand off dimension)

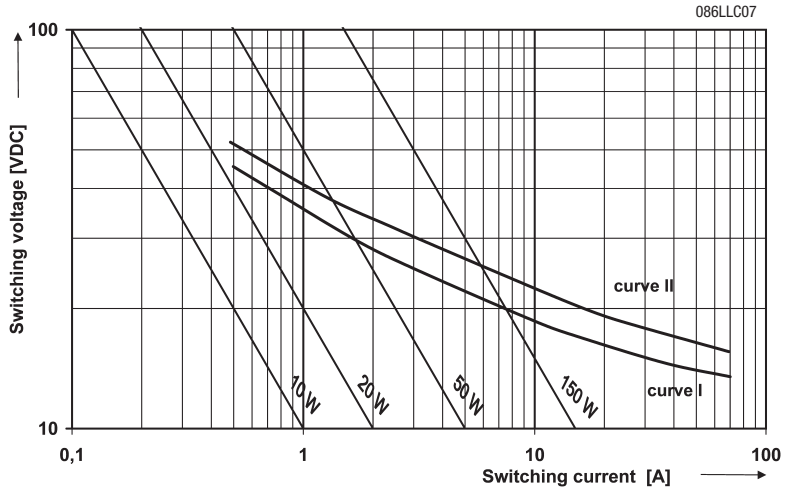


Micro Relay K (THT – THR)

Contact Data	**THT/THR**			**THT**	**THT/THR**
Typical areas of application	Resistive/ inductive load		Wiper load[5] V23086-*1*02-A803	Flasher load V23086-C100*-A602	Lamp load V23086-***21-A502
Contact configuration	Changeover contact/ 1 Form C			Make contact/ 1 Form A	Make contact/ 1 Form A
Circuit symbol (see also Pin assignment)					
Rated voltage	12 V				
Rated current	NC/NO 15 A/20 A			20 A	20 A
Limiting continuous current	NC/NO				
23°C	25 A/30 A			30 A	30 A
85°C	15 A/20 A			20 A	20 A
Contact material	Silver based				
Max. switching voltage/power	See load limit curve				
Max. switching current[1]					
On	40 A[2]			40 A[2]/70 A[3]	40 A[2]/100 A[3]
Off	30 A			30 A	30 A
Min. recommended load[4]	1 A at 5 V				
Voltage drop at 10 A (initial) for NC/NO contacts	Typ. 30 mV, 300 mV max.				
Mechanical endurance (without load)	> 5 x 10^6 operations				
Electrical endurance at cyclic temperature –40/+23/+85°C and 13.5 V	Resistive load: > 3 x 10^5 operations 20 A on NO-contact	Motor reverse: blocked: > 1 x 10^5 operations 25 A L = 0.77 mH	Wiper [5] > 1 x 10^6 operations 20 A make/5 A make, generator peak - 20 A L = 0.7 mH	Flasher load: > 2 x 10^6 operations up to 3 x 21 W, turn and hazard signal in sequence	Lamp load: > 1 x 10^5 operations 100 A inrush/ 10 A steady state

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] Corresponds to the peak inrush current on initial actuation (cold filament).
[4] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/
[5] Avoid using capacitive protection circuits. It will reduce lifetime. Wiper loads always to be tested with original loads.

Load Limit Curve



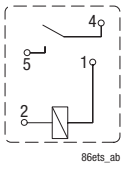
Load limit curve 1 ≙ arc extinguishes during transit time

Load limit curve 2 ≙ safe shutdown, no stationary arc

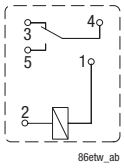
Micro Relay K (THT – THR)

Circuit Diagram

1 Make contact/1 Form A



1 Changeover contact/1 Form C

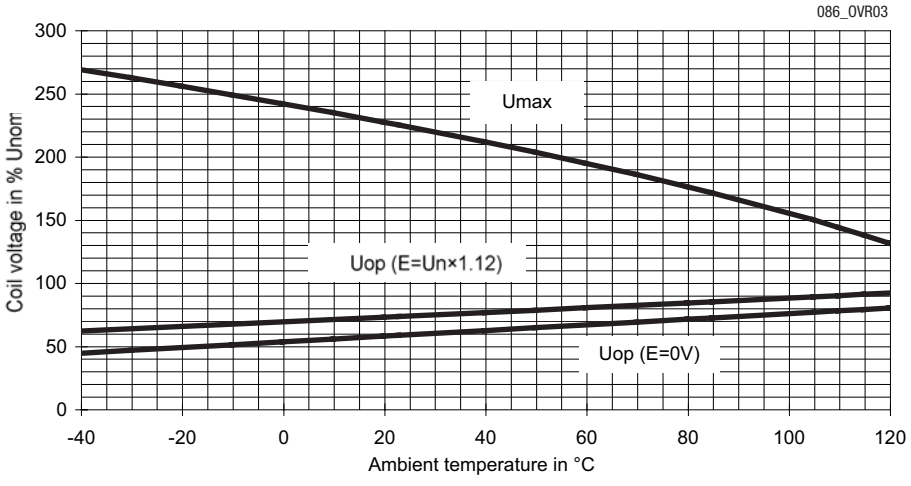


Coil Data	
Available for nominal voltages	10 V / 12 V (other coils on request)
Nominal power consumption of the unsuppressed coil at nominal voltage	0.55 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range [1)]	–40 to +105°C
Operate time at nominal voltage [2)]	Typ. 3 ms
Release time at nominal voltage [2)]	Typ. 1.5 ms

1) See also operating voltage range diagram.
2) Measured at nominal voltage without coil suppression unit.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Micro Relay K (THT – THR)

Environmental Conditions					
Temperature range, storage		Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test		Relevant standard	Testing as per	Dimension	Comments
Cold storage		IEC 68-2-1		1000 h	–40°C
Dry heat		IEC 68-2-2	Ba	1000 h	125°C
Climatic cycling with condensation					
	THT	EN ISO 6988		20 cycles	Storage 8/16 h
Thermal change		IEC 68-2-14	Nb	35 cycles	–40/+125°C
Thermal shock		IEC 68-2-14	Na	100 cycles	–40/+125°C Dwell time 1 h
Damp heat					
cyclic	THT	IEC 68-2-30	Db, Variant 2	6 cycles	40°C/55°C/93%
constant	THT	IEC 68-2-3	Method Ca	56 days	40°C/93%
Corrosive gas					
	THT	IEC 68-2-42			10 days
	THT	IEC 68-2-43			10 days
Vibration resistance		IEC 68-2-6 (sine pulse form)		10 - 500 Hz 6 g	No change in the switching state > 10 µs
Shock resistance		IEC 68-2-27 (half sine form single pulses)		6 ms up to 30 g	No change in the switching state > 10 µs
Solderability				Hot dip 5 s	Aging 3 (4 h/155°C)
	THT	IEC 68-2-20	Ta, Method 1	215°C	for leaded process (Tm = 183°C)
	THR	IEC 68-2-58		245°C	for Pb-free process (Tm = 217°C)
Resistance to soldering heat				Hot dip 10 s	with thermal screen
	THT	IEC 68-2-20	Tb, Method 1A	260°C	
	THR	IEC 68-2-58		260°C	Preheating min 130°C
Sealing					
	THT	IEC 68-2-17	Qc, Method 2		1 min/70°C
	THR				Open vent hole

Ordering Information

Part Numbers (see table below for coil data)		**Contact Arrangement**	**Contact Material**	**Enclosure**	**Soldering Technology**
Relay Description	**Part Number**				
V23086-C1021-A502	8-1416000-7	1 Form A: lamp load	Silver based	Sealed	THT
V23086-C1001-A602	9-1416000-6	1 Form A: flasher load	Silver based	Sealed	THT
V23086-C1001-A403	1393280-6	1 Form C	Silver based	Sealed	THT
V23086-C1002-A403	1-1393280-1	1 Form C	Silver based	Sealed	THT
V23086-C1002-A803	On request	1 Form C	Silver based	Sealed	THT
V23086-R1801-A403	6-1414920-0	1 Form C	Silver based	Open vent hole	THR
V23086-R1802-A403	5-1414920-9	1 Form C	Silver based	Open vent hole	THR
V23086-R1802-A803	7-1414967-8	1 Form C	Silver based	Open vent hole	THR
V23086-R1821-A502	6-1414918-8	1 Form A	Silver based	Open vent hole	THR

Micro Relay K (THT – THR)

Coil Versions

Coil Data for Micro K – THT/THR	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive[1] Voltage (V)	
					at 23°C	at 105°C
V23086-**001-****	12	254	6.9	1.5	27	18
V23086-**002-****	10[2]	181	5.7	1.25	22	15
V23086-**021-****	12	181	6.9	1.5	27	18
V23086-**801-****	12	254	6.9	1.0	27	18
V23086-**802-****	10	181	5.7	1.25	22	15
V23086-**821-****	10	181	6.9	1.0	22	15

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] See operating voltage range.

Standard Delivery Packs (orders in multiples of delivery pack)

Micro K – THT/THR: 2000 pieces

Micro Relay K SMD (Standard – Open Vent Hole)

Features

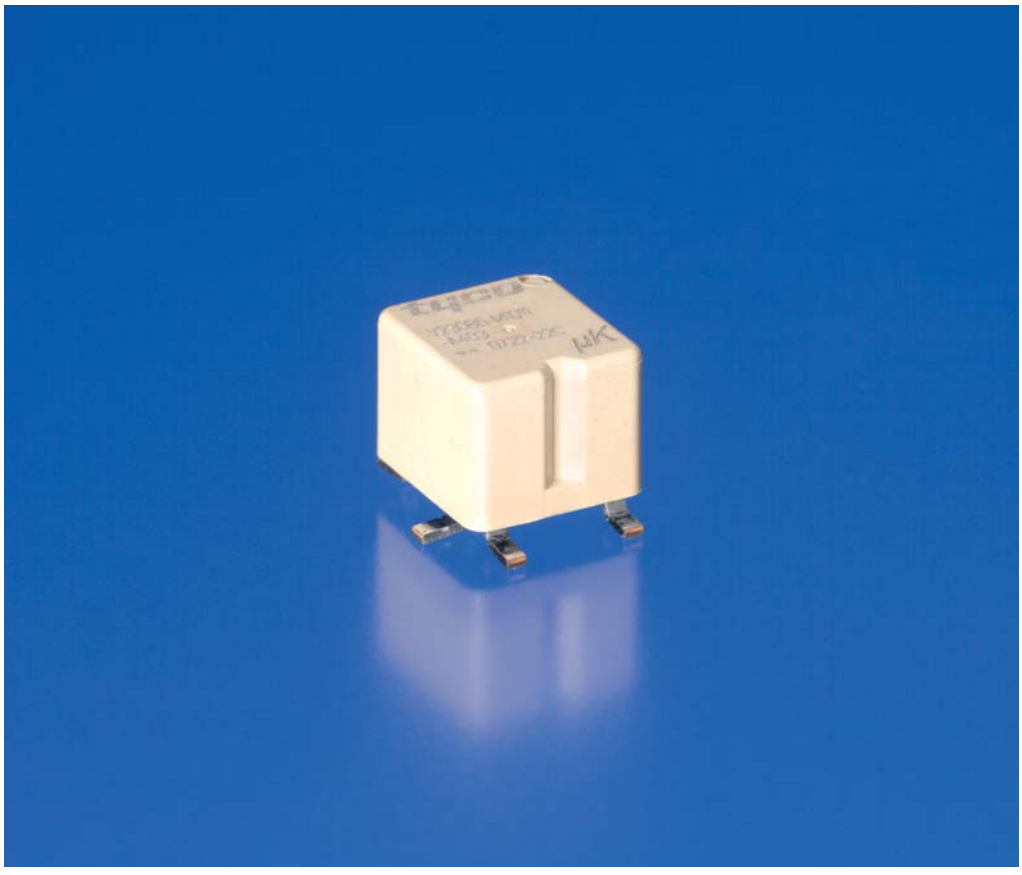
- Small power relay for surface mounted technology
- Limiting continuous current 30 A
- Minimal weight
- Low noise operation
- Relay designed for convection and infrared reflow soldering
- Standard SMD and SMD with open vent hole versions

- For twin version refer to Double Micro Relay K SMD
- For latching (bistable) version refer to Micro Relay K Latching
- For through hole technology refer to Micro Relay K

Typical Applications

- Car alarm
- Door control
- Door lock
- Hazard warning signal
- Immobilizer
- Interior lights
- Seat control
- Sun roof
- Window lifter
- Wiper control

Please contact Tyco Electronics for relay application support.



86M1_3D1

Design

- ELV/RoHS/WEEE compliant
- SMD (standard): sealed type washable
- SMD (open vent hole): sealed type open vent hole

Weight

Approx. 4 g (0.14 oz.)

Nominal Voltage

12 V

Terminals

SMD terminals for assembly on printed circuit boards

Conditions

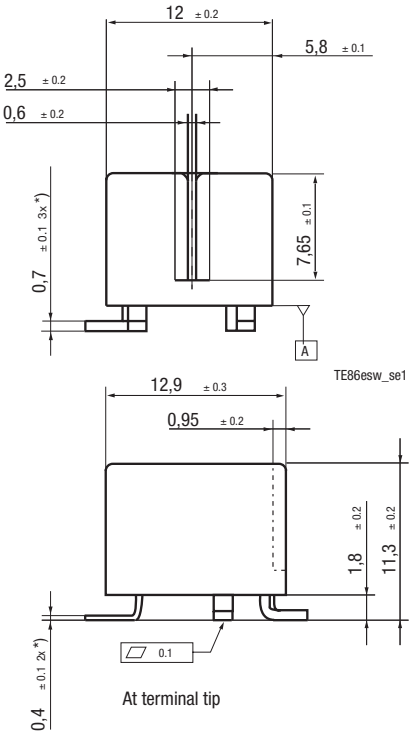
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

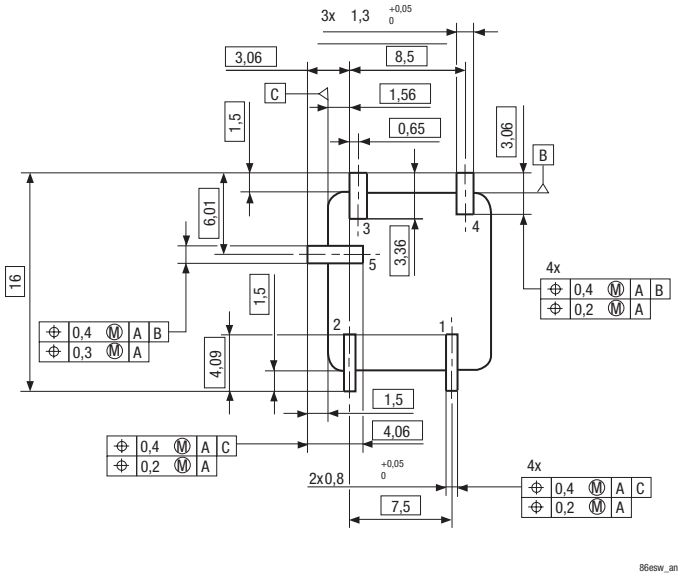
Micro Relay K SMD (Standard – Open Vent Hole)

Dimensional Drawing



*) Dimension without soldering

View of the Terminals (bottom view)



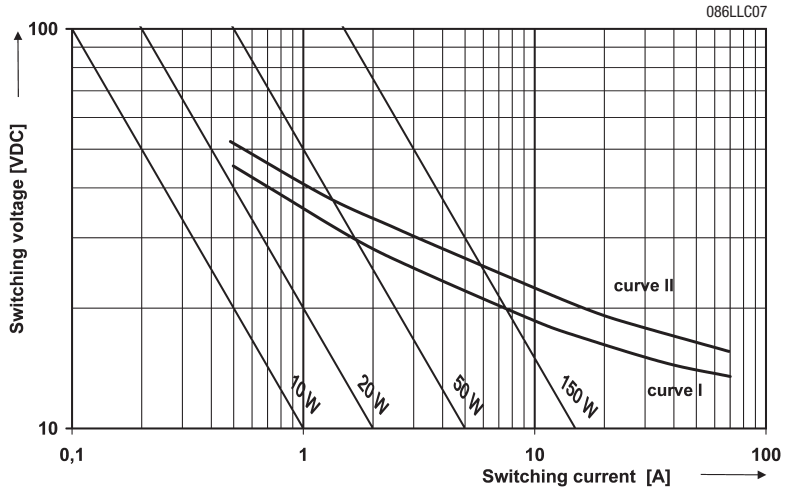
Remark: Positional tolerances according to DIN EN ISO 5458

Micro Relay K SMD (Standard – Open Vent Hole)

Contact Data			
Typical areas of application	Resistive/inductive load		
Contact configuration	1 Changeover contact/ 1 Form C		
Circuit symbol (see also Pin assignment)			
Rated voltage	12 V		
Rated current	NC/NO 15 A/20 A		
Limiting continuous current			
23°C	25 A/30 A		
85°C	15 A/20 A		
105°C	5 A/10 A		
Contact material	Silver based		
Max. switching voltage/power	See load limit curve		
Max. switching current [1]	NC/NO		
On [2]	40 A		
Off	30 A		
Min. recommended load [3]	1 A at 5 V		
Voltage drop at 10 A (initial) for NC/NO contacts	Typ. 30 mV, 300 mV max.		
Mechanical endurance (without load)	> 5 x 10^6 operations		
Electrical endurance at cyclic temperature –40/+23/+85°C and 13.5 V	Resistive load: > 3 x 10^5 operations 20 A on NO-contact	Wiper reverse [4]: > 3 x 10^5 operations 25 A make/5 A break; generator peak - 10 A L = 1.0 mH	Motor reverse blocked: > 1 x 10^5 operations 25 A L = 0.77 mH inductive load

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/
[4] Avoid using capacitive protection circuits. It will reduce lifetime.

Load Limit Curve



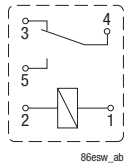
Load limit curve 1 ≙ arc extinguishes during transit time

Load limit curve 2 ≙ safe shutdown, no stationary arc

Micro Relay K SMD (Standard – Open Vent Hole)

Circuit Diagram

1 Changeover contact/1 Form C



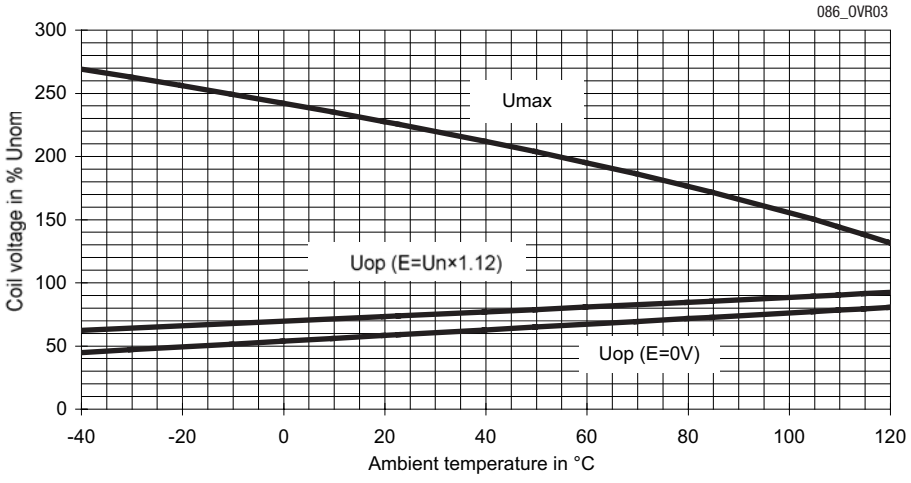
Coil Data

Available for nominal voltages	10 V / 12 V
Nominal power consumption of the unsuppressed coil at nominal voltage	0.64 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range [1)]	–40 to +105°C
Operate time at nominal voltage	Typ. 3 ms
Release time at nominal voltage [2)]	Typ. 1.5 ms

1) See also operating voltage range diagram.
2) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Micro Relay K SMD (Standard – Open Vent Hole)

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Cold storage	IEC 68-2-1		1000 h	–40°C
Dry heat	IEC 68-2-2	Ba	1000 h	125°C
Climatic cycling with condensation [1]	EN ISO 6988		20 cycles	Storage 8/16 h
Thermal change	IEC 68-2-14	Nb	35 cycles	–40/+125°C
Thermal shock	IEC 68-2-14	Na	1000 cycles	–40/+125°C Dwell time 1 h
Damp heat cyclic constant	 IEC 68-2-30 IEC 68-2-3	 Db, Variant 2 Method Ca	 6 cycles 56 days	 40°C/55°C/93% 40°C/93%
Corrosive gas [1]	IEC 68-2-42 IEC 68-2-43		10 days 10 days	
Vibration resistance	IEC 68-2-6 (sine pulse form)		10 - 500 Hz	No change in the switching state > 10 µs, 6 g
Shock resistance	IEC 68-2-27 (half sine single form pulses)		6 ms	No change in the switching state > 10 µs up to 30 g
Solderability	IEC 68-2-58		Hot dip 5 s 245°C	Aging 3 (4 h/155°C) for leaded process (Tm = 183°C) for Pb-free process (Tm = 217°C)
Resistance to soldering heat	IEC 68-2-58		Hot dip 10 s 260°C	with thermal screen Preheating min 130°C
Sealing	IEC 68-2-17	Qc, Method 2		1 min/70°C

[1] Not applicable for SMD with open vent hole.

Ordering Information

Part Numbers (see table below for coil data)		**Contact Arrangement**	**Contact Material**	**Enclosure**	**Terminals/ Soldering Technology**
Relay Description	**Part Number**				
V23086-M1011-A403	1393281-1	1 Form C	Silver based	Sealed	Printed circuit/SMD
V23086-M1012-A403	8-1416000-5	1 Form C	Silver based	Sealed	Printed circuit/SMD
V23086-U1011-A303	1416001-2	1 Form C	Silver based	Open vent hole	Printed circuit/SMD
V23086-U1012-A303	3-1414933-1	1 Form C	Silver based	Open vent hole	Printed circuit/SMD

Coil Versions

Coil Data for Micro K SMD (Standard – Open Vent Hole)	**Rated Coil Voltage (V)**	**Coil Resistance ±10% (Ω)**	**Must Operate Voltage (V)**	**Must Release Voltage (V)**	**Allowable Overdrive [1] Voltage (V)**	
					at 23°C	**at 105°C**
V23086-M*011-****	12	225	6.9	1.5	27	18
V23086-M*012-****	10	156	5.7	1.25	22	15
V23086-U*011-****	12	225	6.9	1.5	27	18
V23086-U*012-****	10	156	5.7	1.25	22	15

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (in reels)

Micro Relay K SMD
(Standard – Open Vent Hole): 200 pieces

Micro Relay K Latching

Features

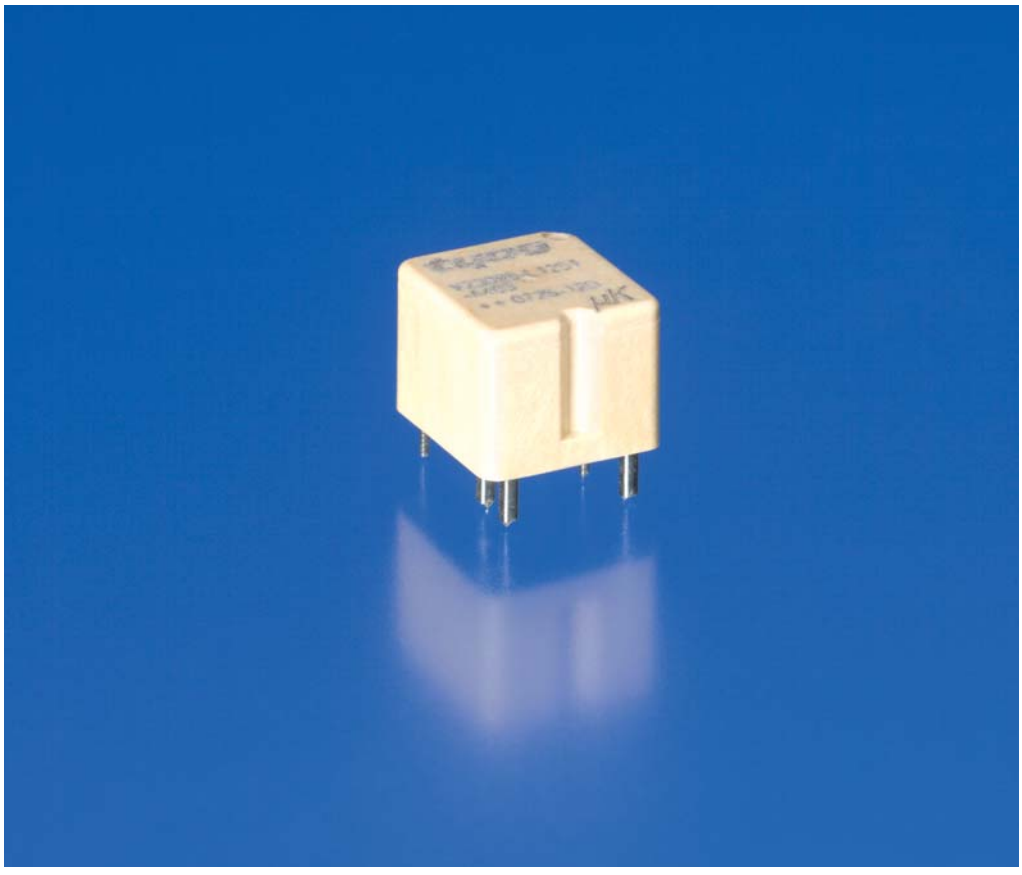
- Smallest magnetically latched PCB relay
- Only set and reset pulse no continuous coil power required
- Increased ambient temperature range up to 125°C
- Limiting continuous current up to 35 A
- Footprint compatible with Micro Relay K
- Two coils with set and reset function
- Minimal weight

- For monostable single version refer to Micro Relay K
- For monostable twin version refer to Double Micro Relay K

Typical Applications

- Active power management
- Energy management
- Main switch/supply relay
- Quiescent current management

Please contact Tyco Electronics for relay application support.



86L1_3D1

Design

- ELV/RoHS/WEEE compliant
- THT: Sealed type washable

Weight

Approx. 4 g (0.14 oz.)

Nominal Voltage

12 V; other nominal voltages available on request

Terminals

PCB terminals for assembly on printed circuit boards

Conditions

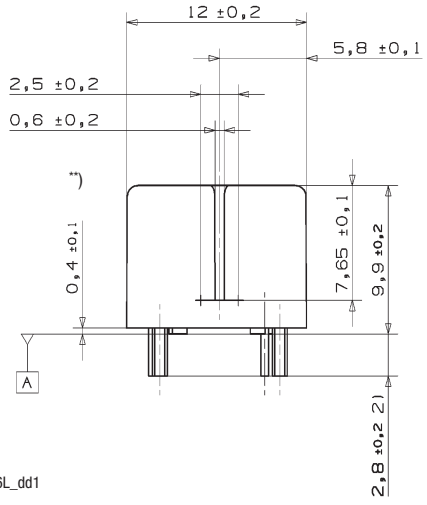
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

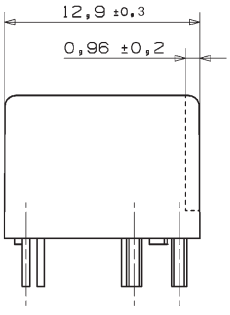
Disclaimer

Dimensional Drawing

**) Epoxy height at terminals max. 0.7 mm

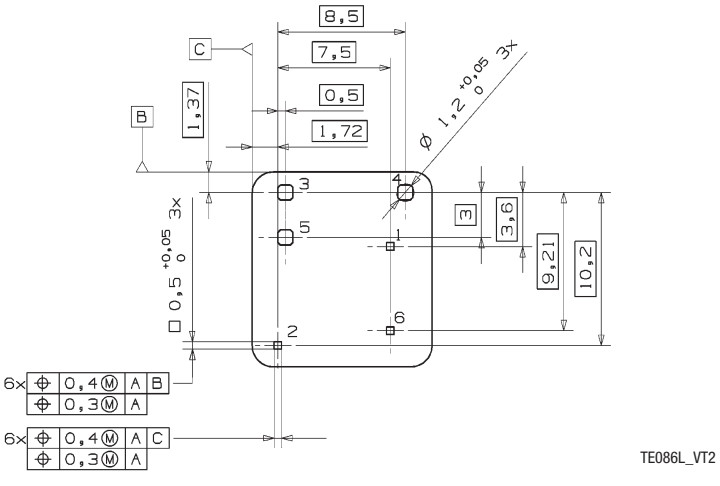


086L_dd1



086L_dd2

View of the Terminals (bottom view)

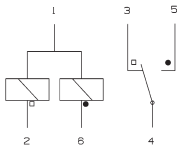


TE086L_VT2

Remark: Positional tolerances according to DIN EN ISO 5458

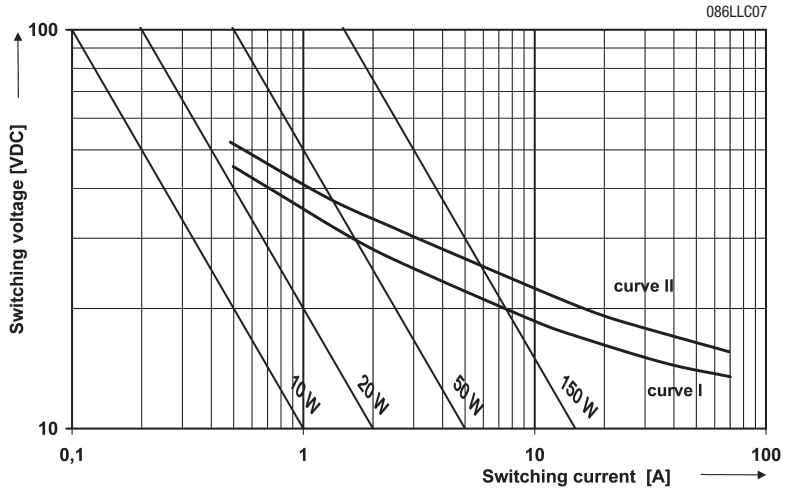
Micro Relay K Latching

Contact Data

Typical areas of application	Resistive/inductive/ capacitive loads		
Contact configuration	Changeover contact/ 1 Form C		
Circuit symbol [1), 2)] (see also Pin assignment)			
Rated voltage	12 V		
Rated current	Auxiliary contact: Pin 3 - 4		Main contact: Pin 5 - 4
	15 A		30 A
Limiting continuous current			
23°C	20 A		40 A
85°C	15 A		30 A
105°C	12 A		25 A
Contact material	$AgSnO_2$		
Max. switching voltage/power	See load limit curve		
Max. switching current			
On [3)]	20 A		50 A [4)]
Off	20 A		30 A
Min. recommended load [5)]	1 A at 5 V		
Voltage drop at 10 A (initial)	Typ. 30 mV, 300 mV max.		
Mechanical endurance (without load)	> 1 x 10^6 operations		
Electrical endurance	Resistive load:	Inductive load:	Lamp load:
	On 20 A/Off 20 A	On 25 A/Off 25 A	On 50 A/Off 5 A
	On 1 s/Off 1 s	On 120 ms/Off 4880 ms	On 120 ms/Off 4880 ms
	at +85°C	L = 0.6 mH	
	> 1 x 10^5 operations	at cyclic temperature change	at cyclic temperature change
		–40/+23/+85°C	–40/+23/+85°C
		> 1 x 10^5 operations	> 1 x 10^5 operations

1) Delivery status “ex works”.
2) Refer to *Latching Relay* in the “Glossary”.
3) The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V load voltages.
4) Corresponds to the peak inrush current on initial actuation (cold filament).
5) See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve

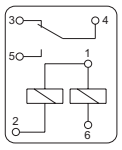


Load limit curve 1 ≙ arc extinguishes during transit time

Load limit curve 2 ≙ safe shutdown, no stationary arc

Circuit Diagram

1 Changeover contact/1 Form C



86elw_ab2

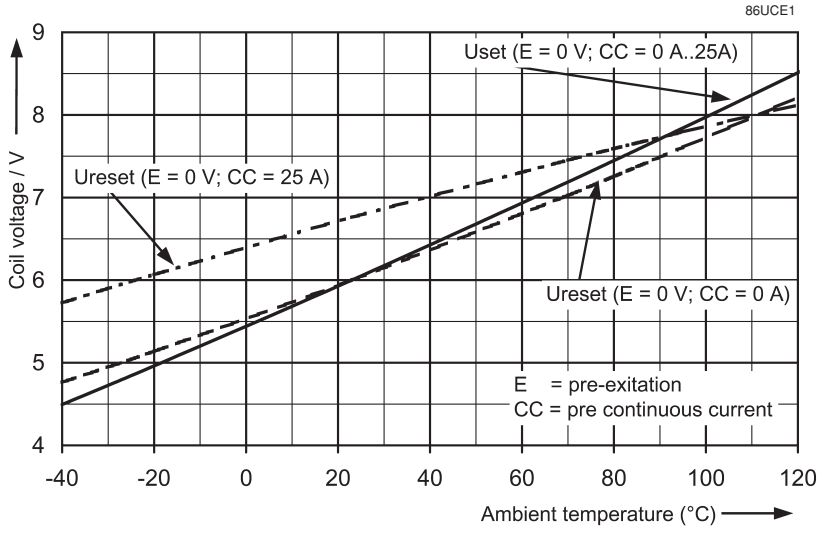
Coil Data

Available for nominal voltages	12 V						
Polarity for energizing/deenergizing main contact (pin 4 - 5)	Set			Reset			
	+ Pin 1	0 V Pin 2	n.a. Pin 6	+ Pin 1	n.a. Pin 2	0 V Pin 6	
Min. and max. set pulse width	5 ms < pulse width < 1 s						
Test voltage winding/contact	500 VAC_{rms}						
Maximum ambient temperature range [1]	–40 to +125°C						
Operate time at nominal voltage	Typ. 1.5 ms						
Release time at nominal voltage [2]	Typ. 1.5 ms						

[1] See also operating voltage range diagram.
[2] For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Micro Relay K Latching

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Cold storage	IEC 68-2-1		1000 h	–40°C
Dry heat	IEC 68-2-2	Ba	1000 h	125°C
Climatic cycling with condensation	EN ISO 6988		6 cycles	Storage 8/16 h
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat cyclic constant	 IEC 68-2-30 IEC 68-2-3	 Db Method Ca	 6 cycles 56 days	 Upper air temperature 55°C
Vibration resistance	IEC 68-2-6 (sine pulse form)		10 - 2000 Hz Main contact 10 g 10 - 500 Hz Auxiliary contact 6 g	 No change in the switching state > 10 µs
Shock resistance	IEC 68-2-27 (half sine form single pulses)		6 ms Main contact 100 g Auxiliary contact 30 g	 No change in the switching state > 10 µs
Solderability	IEC 68-2-20	Ta, Method 1	Hot dip 5 s 215°C	Aging 3 (4 h/155°C) for leaded process (Tm = 183°C) for Pb-free process (Tm = 217°C)
Resistance to soldering heat	IEC 68-2-20	Td, Method 1A	Hot dip 10 s 260°C	with thermal screen
Sealing	IEC 68-2-17	Qc, Method 2		1 min/70°C

Ordering Information

Part Numbers (see table below for coil data) **Relay Description**	**Part Number**	**Contact Arrangement**	**Contact Material**	**Enclosure**	**Terminals**
V23086-L1251-A403	8-1416000-9	1 Form C	$AgSnO_2$	Sealed	Printed circuit

Coil Versions

Coil Data for Micro K Latching	**Rated Coil Voltage (V)**	**Coil Resistance ±10% (Ω)**		**Must Pulse Voltage (V)**		**Allowable Overdrive[1] Voltage (V)**			
						at 23°C		**at 85°C**	
		Set	**Reset**	**Set**	**Reset**	**Set**	**Reset**	**Set**	**Reset**
V23086-**251-****	12	75	75	6	6	28	18; 28[2)3)]	28	18; 28[2)3)]

[1)] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2)] Overvoltage according to ISO 16750-2 functional status C. In case of a reset latch pulse up to 28 V the contact may reclose, but will not remain closed (no latching function).
[3)] The delay between driving impulses at cyclic energizing at T_{Amb} = 85°C must be at least 10 s.

Standard Delivery Packs (orders in multiples of delivery pack)

Micro K Latching: 2000 pieces

Mini Relay K (Open – Sealed)

Features

- Limiting continuous current 20 A
- Also available for 42 V applications

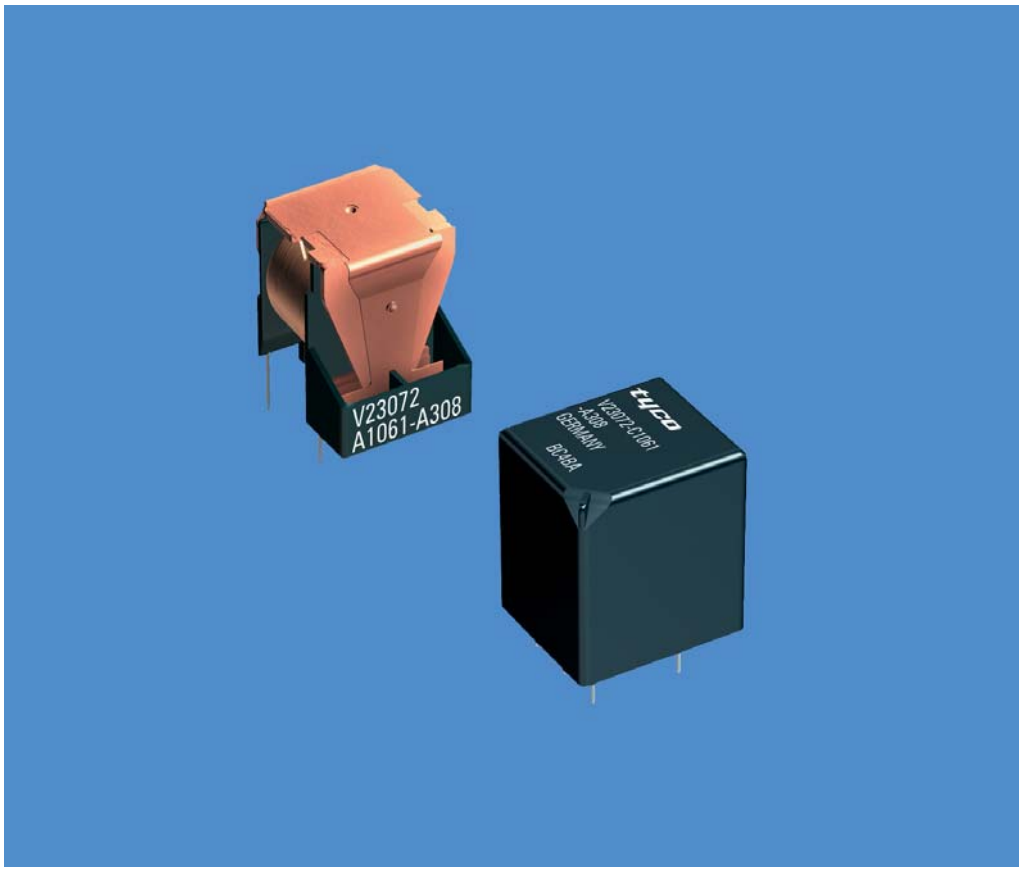
Customized Versions on Request

- 24 V versions with special contact gap
- Various contact arrangements and materials

Typical Applications

- Car alarm
- Hazard warning signal
- Heated rear screen
- Immobilizer
- Lamps front, rear, fog light
- Interior lights
- Sun roof
- Turn signal
- Wiper control

Please contact Tyco Electronics for relay application support.



Mini_Kos_3d01

Design

- ELV/RoHS/WEEE compliant
- Open: flux tight type
- Sealed: washable type

Weight

- Approx. 8 g (0.28 oz.) open version
- Approx. 9 g (0.32 oz.) sealed version

Nominal Voltage

12 V or 24 V

Terminals

PCB terminals for assembly on printed circuit boards.

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

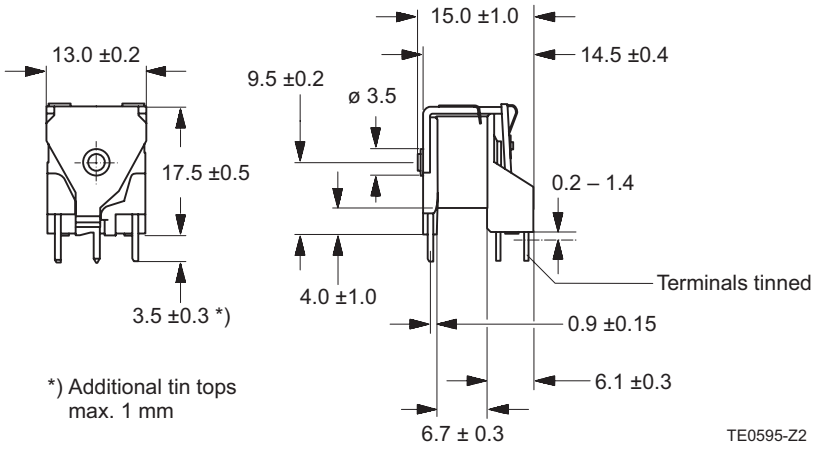
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

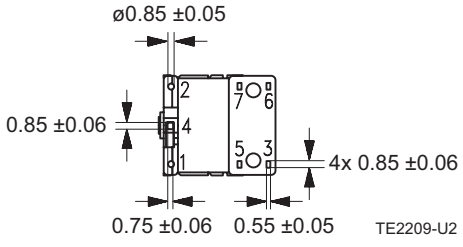
Mini Relay K (Open)

Dimensional Drawing

Mini Relay K Open Version

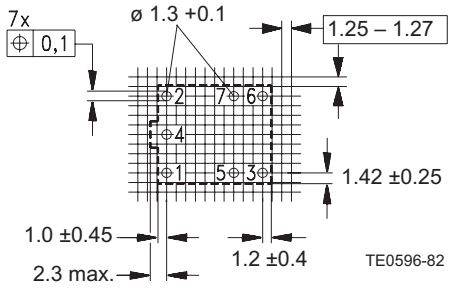


View of the Terminals (bottom view)



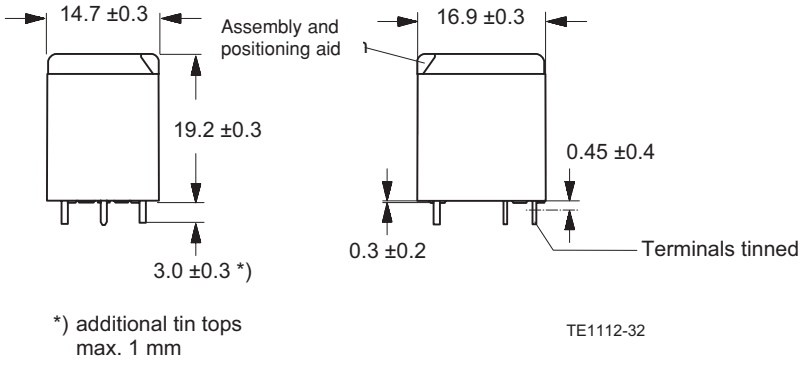
Mounting Hole Layout (bottom view)

Grid 1.25 … 1.27 mm

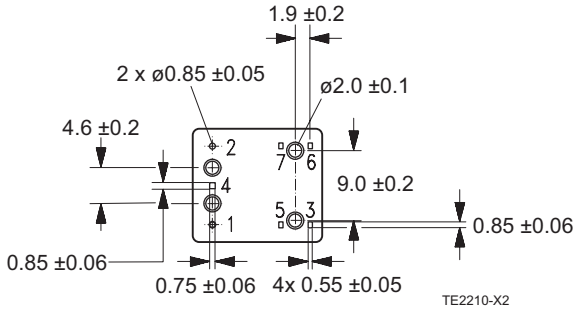


Dimensional Drawing

Mini Relay K Sealed Version

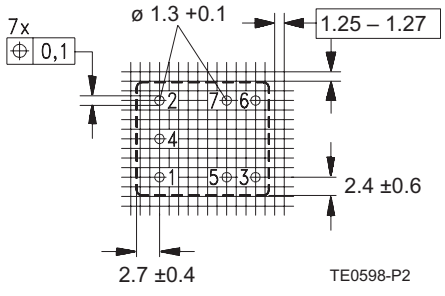


View of the Terminals (bottom view)



Mounting Hole Layout (bottom view)

Grid 1.25 … 1.27 mm



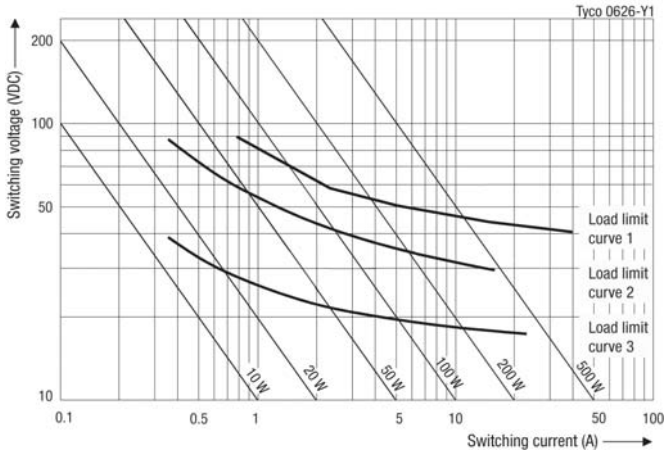
Mini Relay K (Open – Sealed)

Contact Data

Typical areas of application	Resistive/inductive loads			Head/indicator lamps	
Contact configuration	1 Make contact/ 1 Form A	1 Changeover contact/ 1 Form C	1 Double make contact/ 1 Form U	1 Make contact/ Form A	1 Double make contact/ 1 Form U
Circuit symbol (see also Pin assignment)					
Rated voltage	12 V				
Rated current	10 A	5 A/10 A	2 x 6 A	5 A	2 x 5 A
Limiting continuous current					
23°C	15 A	10 A/15 A	2 x 10 A	6 A	2 x 6 A
85°C	10 A	5 A/10 A	2 x 6 A	5 A	2 x 5 A
Contact material	AgNi0.15			$AgSnO_2$	
Max. switching voltage/power	See load limit curve				
Max. switching current [1]		NC/NO			
On [2]	60 A	12 A/60 A	2 x 40 A	60 A [3]	120 A [3]
Off	20 A	10 A/20 A	2 x 20 A	6 A	12 A
Min. recommended load [4]	1 A at 5 V				
Voltage drop at 10 A (initial) for NC/NO contacts	Typ. 50 mV, 300 mV max.		Typ. 2 x 50 mV, 300 mV max.	Typ. 150 mV, 300 mV max.	
Mechanical endurance (without load)	> 10^7 operations				
Electrical endurance	> 2 x 10^5 operations 10 A, 13.5 V			> 1 x 10^6 operations up to 6 x 21 W	> 1.5 x 10^6 operations up to 6 x 21 W
				> 1.5 x 10^5 operations 100 A on/10 A off High beam	> 7.5 x 10^5 operations 100 A on/10 A off High beam

[1] The values apply to a resistive load or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V and 27 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] Corresponds to the peak inrush current on initial actuation (cold filament).
[4] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve

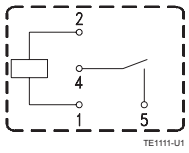


Load limit curve 1 ≙ safe shutdown, connected as Form X, load on pin 5 and 7
Load limit curve 2 ≙ safe shutdown,no stationary arc/make contact
Load limit curve 3 ≙ arc extinguishes during transit time (changeover contact)

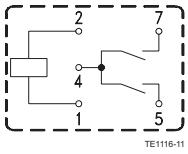
Mini Relay K (Open – Sealed)

Circuit Diagram (Open and Sealed)

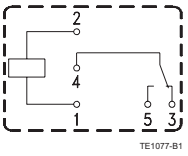
1 Make contact/1 Form A



1 Double make contact/1 Form U



1 Changeover contact/1 Form C



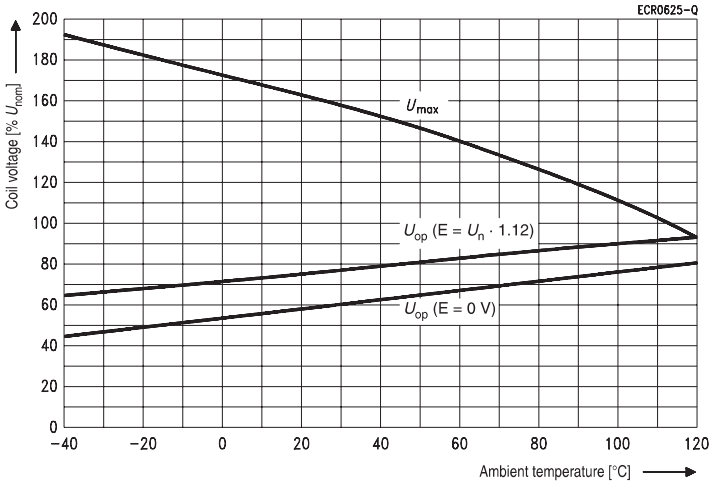
Coil Data

Available for nominal voltages	12 V / 24 V (other coils on request)
Nominal power consumption of the unsuppressed coil at nominal voltage	1.1 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range [1)]	–40 to +85°C
Operate time at nominal voltage	Typ. 3 ms
Release time at nominal voltage [2)]	Typ. 1.5 ms

1) See also operating voltage range diagram.
2) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Mini Relay K (Open – Sealed)

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation [1)]	EN ISO 6988		20 cycles	Storage 8/16 h
Temperature cycling [1)]	IEC 68-2-14	Na	720 cycles	–40/+85°C (dwell time 1 h)
Damp heat [1)] constant	IEC 68-2-3	Method Ca	56 days	Upper air temperature 55°C
Corrosive gas [1)]	IEC 68-2-42 IEC 68-2-43		10 days 10 days	
Vibration resistance	IEC 68-2-6 (sine pulse form) acceleration, acc. to position		10 - 200 Hz 23 - 35 g	No change in the switching state > 10 µs
Shock resistance	IEC 68-2-27 (half sine form single pulses) acceleration		4 - 6 ms 23 - 280 g	No change in the switching state > 10 µs
Solderability	IEC 68-2-20	Ta, Method 1	Hot dip 5 s 215°C	Aging 3 (4 h/155°C) for leaded process (Tm = 183°C) for Pb-free process (Tm = 217°C)
Resistance to soldering heat	IEC 68-2-20	Tb, Method 1A	Hot dip 10 s 260°C	with thermal screen
Sealing [1)]	IEC 68-2-17	Qc, Method 2		1 min/70°C
Flammability	UL94-HB			

[1)] Only sealed version

Ordering Information

Part Numbers (see table below for coil data)		**Contact Arrangement**	**Contact Material**	**Enclosure**	**Terminals**
Relay Description	**Part Number**				
V23072-A1061-A303	3-1393272-2	1 Form C	AgNi0.15	Open	Printed circuit
V23072-A1062-A303	5-1393272-2	1 Form C	AgNi0.15	Open	Printed circuit
V23072-A1061-A308	3-1393272-6	1 Form U, X	AgNi0.15	Open	Printed circuit
V23072-A1062-A308	5-1393272-3	1 Form U, X	AgNi0.15	Open	Printed circuit
V23072-C1061-A302	4-1393273-9	1 Form A	AgNi0.15	Sealed	Printed circuit
V23072-C1062-A302	7-1393273-6	1 Form A	AgNi0.15	Sealed	Printed circuit
V23072-C1061-A303	5-1393273-6	1 Form C	AgNi0.15	Sealed	Printed circuit
V23072-C1062-A303	7-1393273-8	1 Form C	AgNi0.15	Sealed	Printed circuit
V23072-C1061-A308	6-1393273-0	1 Form U, X	AgNi0.15	Sealed	Printed circuit
V23072-C1062-A308	8-1393273-2	1 Form U, X	AgNi0.15	Sealed	Printed circuit
V23072-C1061-A402	2-1416001-0	1 Form A (Lamp load)	$AgSnO_2$	Sealed	Printed circuit
V23072-C1061-A408	1-1416001-4	1 Form U, X (Lamp/Flasher load)	$AgSnO_2$	Sealed	Printed circuit

Coil Versions

Coil Data for Mini K		**Rated Coil Voltage (V)**	**Coil Resistance ±10% (Ω)**	**Must Operate Voltage (V)**	**Must Release Voltage (V)**	**Allowable Overdrive [1)] Voltage (V)**	
						at 23°C	**at 85°C**
Open and sealed	V23072-**061-****	12	130	6.9	1.2	19.2	14.9
	V23072-**062-****	24	520	14.1	2.4	38.4	29.8

[1)] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (orders in multiples of delivery pack)

Mini K – Open: 600 pieces
Mini K – Sealed: 504 pieces

Power Relay PK2 (THT – THR)

Features

- 60% volume reduced Power K at increased performance
- PCB area requirements minimized by 50% to only 293 mm^2
- Size optimized to L x W x H (mm) 18.3 x 16 x 15.9
- Limiting continuous current 40 A
- Maximum switch on current 200 A
- Increased ambient temperature 105°C
- Design allows highest reliability
- High shock and vibration resistance
- Wave (THT) and reflow (THR/pin-in-paste) solderable versions

- For latching (bistable) version refer to Power Relay PK2 Latching

Typical Applications

- ABS control
- Blower fans
- Cooling fan
- Engine control
- Fuel pump
- Glow plug
- Hazard warning signal
- Switched power supply

Please contact Tyco Electronics for relay application support.

201_C-R_3D3

Design

- ELV/RoHS/WEEE compliant
- THT: sealed type washable
- THR: sealed type open vent hole

Weight

Approx. 11 g (0.39 oz.)

Nominal Voltage

12 V

Terminals

PCB terminals for assembly on printed circuit boards

Conditions

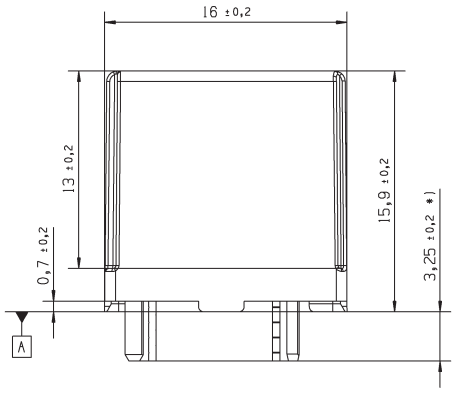
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

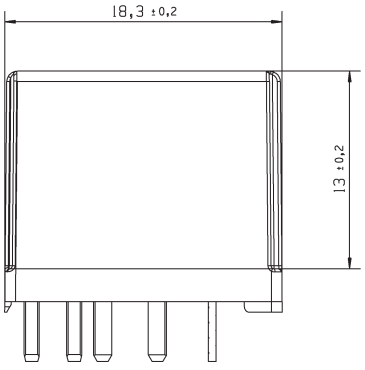
Power Relay PK2 (THT – THR)

Dimensional Drawing



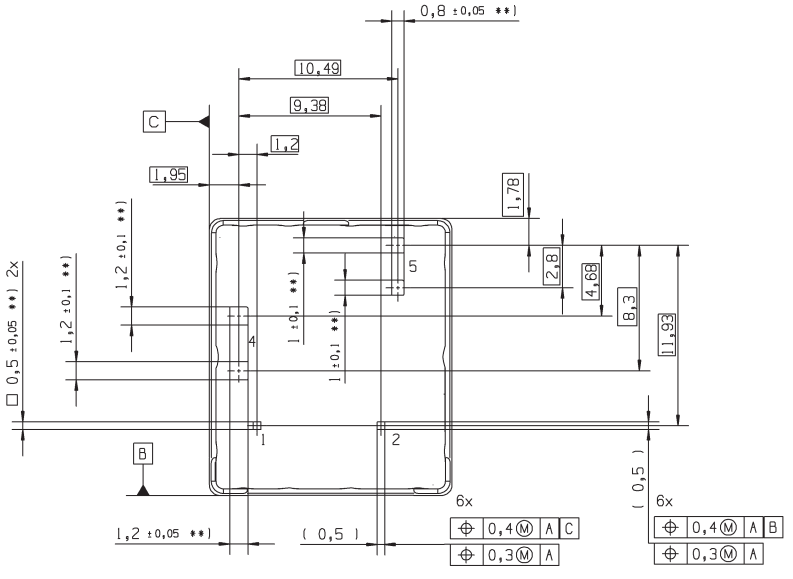
*) Additional tin tops max. 1 mm

201C_DD1



201C_DD2

View of the Terminals (bottom view)



Remark: Positional tolerances according to DIN EN ISO 5458
**) without tinning (hop dip)

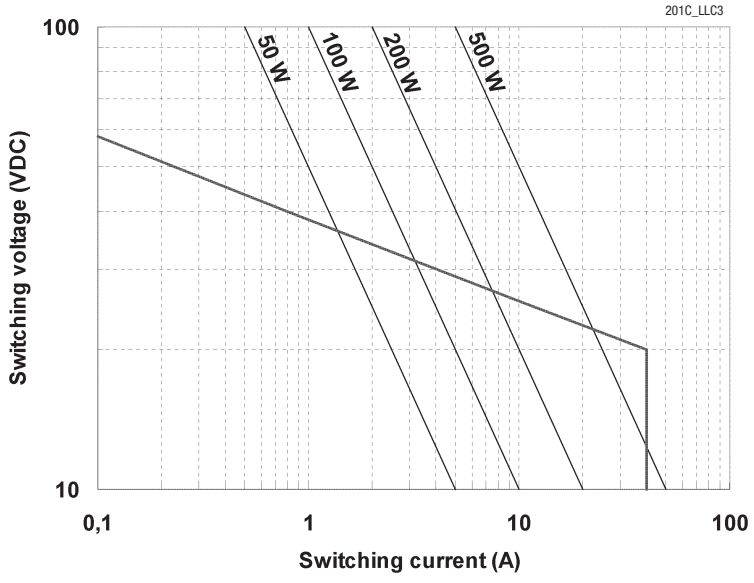
201C_VT1

Power Relay PK2 (THT – THR)

Contact Data	
Typical areas of application	Resistive/inductive/capacitive load
Contact configuration	1 Make contact/ 1 Form A
Circuit Symbol (see also Pin assignment)	5 (+) 4 (-)
Rated voltage	12 V
Rated current [1]	33 A
Limiting continuous current [1]	
23°C	40 A
85°C	33 A
105°C	22 A
Contact material	Silver based
Max. switching voltage/power	See load limit curve
Max. switching current [2]	
On	200 A
Off	40 A
Min. recommended load [3]	1 A at 5 V
Voltage drop at 10 A (initial)	
NO contact	Typ. 30 mV, 300 mV max.
Mechanical endurance (without load)	> 2 x 10^6 operations
Examples of electrical endurance	Inductive load: > 1 x 10^5 operations, 60 A on/35 A 0ff, L = 0.5 mH
at cyclic temperature –40/+23/+85°C	Resistive load: > 1 x 10^5 operations, 40 A on/40 A 0ff
and 13.5 V; 120 ms - on/4880 ms - off	Capacitive load : > 1 x 10^5 operations, 200 A on/20 A 0ff
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)

[1] Measured on 70 mm x 70 mm x 1.5 mm epoxy PCB FR4 with 52 cm^2 (double layer 140 µm thick) copper area.
[2] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V load voltages.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve

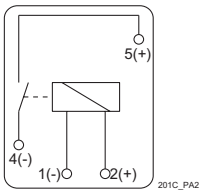


Load limit curve ≙ safe shutdown, no stationary arc/make contact

Power Relay PK2 (THT – THR)

Circuit Diagram

1 Make contact/1 Form A

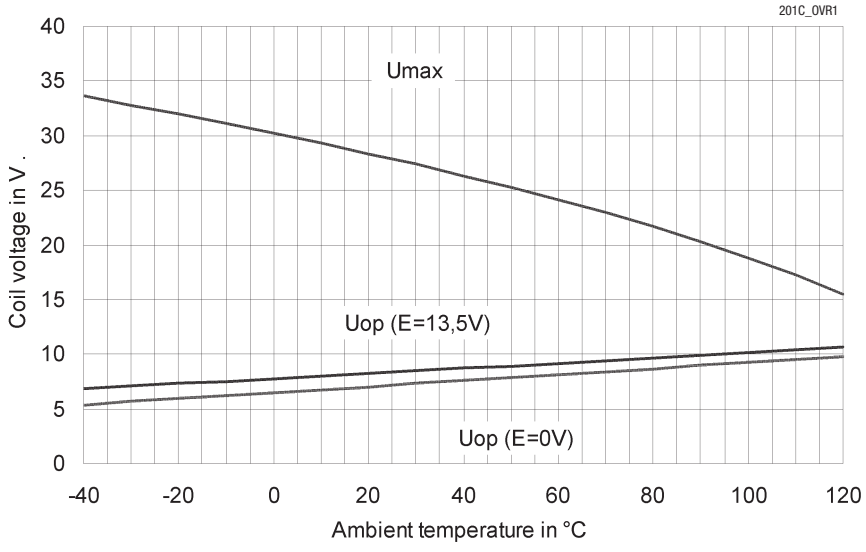


Coil Data	
Available for nominal voltages	12 V
Nominal power consumption of the unsuppressed coil at nominal voltage (monostable)	0.8 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range [1]	–40 to +105°C
Operate time at nominal voltage	Typ. 3 ms
Release time at nominal voltage [2]	Typ. 1.5 ms

[1] See also operating voltage range diagram.
[2] For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding (monostable version only).

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Power Relay PK2 (THT – THR)

Environmental Conditions					
Temperature range, storage		Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test		Relevant standard	Testing as per	Dimension	Comments
Cold storage		IEC 68-2-1		1000 h	–40°C
Dry heat		IEC 68-2-2	Ba	1000 h	125°C
Thermal shock [1]		IEC 68-2-14	Na	1000 cycles	–40/+125°C Dwell time 15 min
Vibration resistance		IEC 68-2-6 (sine pulse form)		30 - 440 Hz > 20 g	No change in the switching state > 10 µs
Shock resistance		IEC 68-2-27 (half sine form single pulses)		6 ms >30 g 11 ms > 100 g	Open contact will not close > 10 µs Closed contact will not open > 10 µs
Solderability				Hot dip 5 s	Aging 3 (4 h/155°C)
	THT	IEC 68-2-20	Ta, Method 1	215°C	for leaded process (Tm = 183°C)
	THR	IEC 68-2-58		245°C	for Pb-free process (Tm = 217°C)
Resistance to soldering heat				Hot dip 10 s	with thermal screen
	THT	IEC 68-2-20	Tb, Method 1A	260°C	
	THR	IEC 68-2-58		260°C	Preheating min 130°C
Sealing					
	THT	IEC 68-2-17	Qc, Method 2		1 min/70°C
	THR				Open vent hole

[1] Only storage.

Ordering Information

Part Numbers (see table below for coil data)		Contact Arrangement	Contact Material	Enclosure	Soldering Technology
Relay Description	Part Number				
V23201-C1001-A502	5-1414782-7	Form A	Silver based	Sealed	THT
V23201-R1005-A502	6-1414932-3	Form A	Silver based	Open vent hole	THR

Coil Versions

Coil Data for PK2 – THT/THR	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive[1] Voltage (V)	
					at 23°C	at 105°C
V23201-***01-****	12	176	6.9	1.5	27	17
V23201-***05-****	12	176	6.9	1.5	27	17

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (orders in multiples of delivery pack)

PK2 – THT/THR: 600 pieces

Power Relay PK2 Latching

Features

- Limiting continuous current 50 A
- Increased ambient temperature 125°C
- Maximum switch on current 200 A
- Reduced coil power consumption of latching version allows higher limiting continuous current and increased ambient temperature
- 60% volume reduced Power K at increased performance
- PCB area requirements minimized by 50% to only 293 mm^2
- Size optimized to L x W x H (mm) 18.3 x 16 x 15.9
- Design allows highest reliability
- High shock and vibration resistance
- No change of switching state version at breakdown of battery voltage

- For monostable version refer to Power Relay PK2

Typical Applications

- Energy management
- Engine control
- Ignition
- Main switch/supply relay
- Preheating system
- Quiescent current management

Please contact Tyco Electronics for relay application support.

201L_3d4

Design

- ELV/RoHS/WEEE compliant
- THT: sealed type washable

Weight

Approx. 11 g (0.39 oz.)

Nominal Voltage

12 V

Terminals

PCB terminals for assembly on printed circuit boards

Conditions

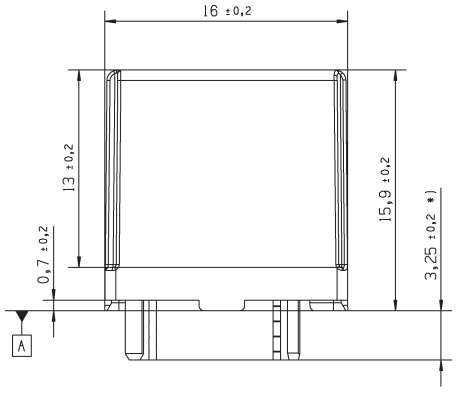
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

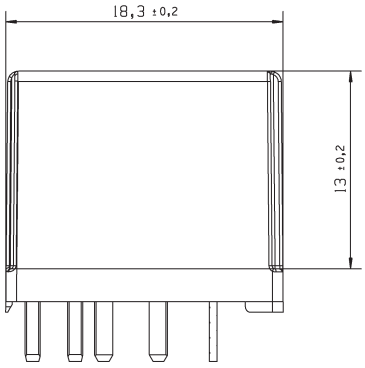
Power Relay PK2 Latching

Dimensional Drawing



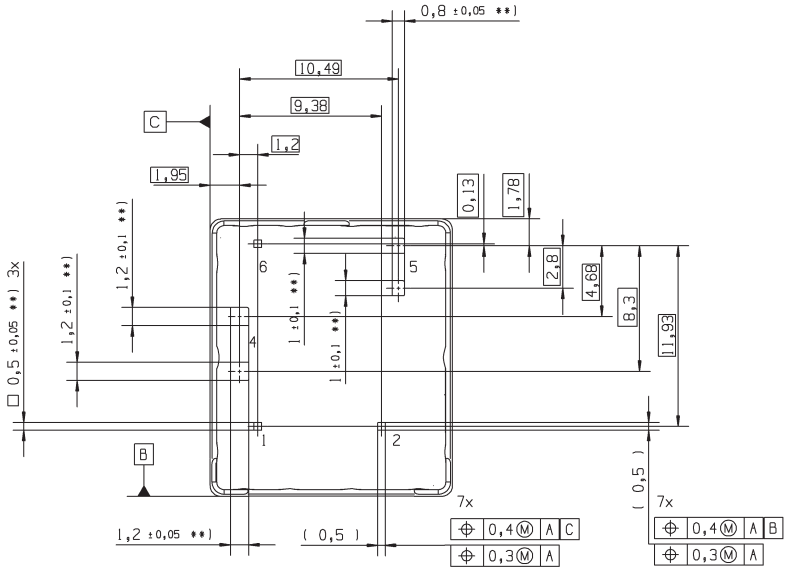
*) Additional tin tops max. 1 mm

201L_DD1



201L_DD2

View of the Terminals (bottom view)



Remark: Positional tolerances according to DIN EN ISO 5458
**) without tinning (hop dip)

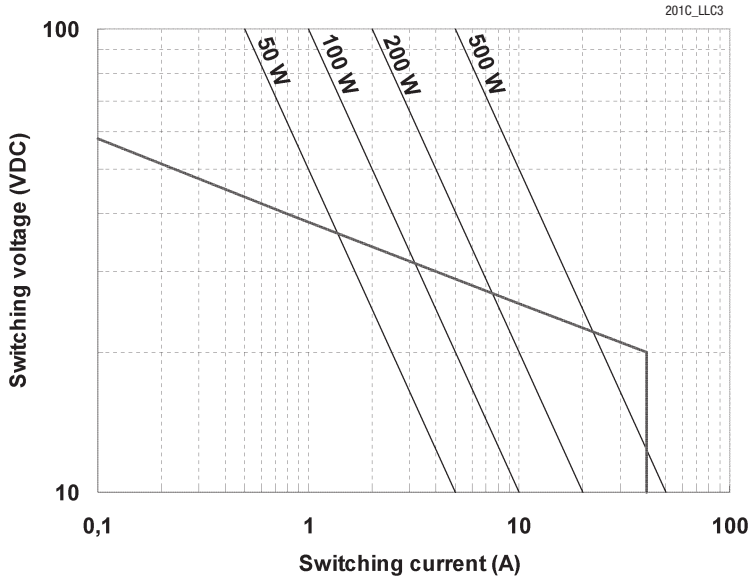
201L_VT1

Power Relay PK2 Latching

Contact Data	
Typical areas of application	Resistive/inductive/capacitive load
Contact configuration	1 Make contact/ 1 Form A
Circuit symbol (see also Pin assignment)	Latching (Delivery status “ex works”) [1] 5 (+) 4 (-) 
Rated voltage	12 V
Rated current [2]	40 A
Limiting continuous current [2]	
23°C	50 A
85°C	40 A
105°C	30 A
Contact material	Silver based
Max. switching voltage/power	See load limit curve
Max. switching current [3]	
On	200 A
Off	40 A
Min. recommended load	1 A at 5 V
Voltage drop at 10 A (initial) NO contact	Typ. 30 mV, 300 mV max.
Mechanical endurance (without load)	> 2 x 10^6 operations
Examples of electrical endurance at cyclic temperature –40/+23/+85°C and 13.5 V; 120 ms - on/4880 ms - off	Motor load: > 1 x 10^5 operations, 60 A on/35 A 0ff, L = 0.5 mH Resistive load: > 1 x 10^5 operations, 40 A on/40 A 0ff Capacitive load: > 1 x 10^5 operations, 200 A on/20 A 0ff
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)

[1] Refer to *Latching Relay* in the “Glossary”at http://relays.tycoelectronics.com/appnotes/
[2] Measured on 70 mm x 70 mm x 1.5 mm epoxy PCB FR4 with 52 cm^2 (double layer 140 µm thick) copper area.
[3] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V load voltages.
[4] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve

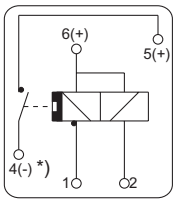


Load limit curve ≙ safe shutdown, no stationary arc/make contact

Power Relay PK2 Latching

Circuit Diagram

1 Make contact/1 Form A



*) Coil polarity as stated is compulsory

Coil Data

Available for nominal voltages	12 V					
Polarity for energizing/deenergizing main contact (pin 4 - 5)	Set			Reset		
	0 V Pin 1	n.a. Pin 2	+ Pin 6	n.a. Pin 1	0 V Pin 2	+ Pin 6
Nominal power consumption of the unsuppressed coil at nominal voltage (latching)	Impuls energy of approx. 1 Ws only required					
Minimum and maximum set pulse width	10 ms < pulse width < 100 ms					
Test voltage winding/contact	500 VAC_{rms}					
Maximum ambient temperature range	–40 to +125°C					
Operate time at nominal voltage	Typ. 1.5 ms					
Release time at nominal voltage	Typ. 1.5 ms					

Environmental Conditions

Temperature range, storage	Refer to *Storage* in the "Glossary" at http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Cold storage	IEC 68-2-1		1000 h	–40°C
Dry heat	IEC 68-2-2	Ba	1000 h	125°C
Thermal shock [1]	IEC 68-2-14	Na	1000 cycles	–40/+125°C Dwell time 15 min
Vibration resistance	IEC 68-2-6 (sine pulse form)		30 - 440 Hz > 20 g	No change in the switching state > 10 µs
Shock resistance	IEC 68-2-27 (half sine form single pulses)		6 ms >30 g 11 ms > 100 g	Open contact will not close > 10 µs Closed contact will not open > 10 µs
Solderability	IEC 68-2-20	Ta, Method 1	Hot dip 5 s 215°C	Aging 3 (4 h/155°C); for leaded process (Tm = 183°C) for Pb-free process (Tm = 217°C)
Resistance to soldering heat	IEC 68-2-20	Ta, Method 1A	Hot dip 10 s 260°C	with thermal screen
Sealing	IEC 68-2-17	Qc, Method 2		1 min/70°C

[1] Only storage.

Power Relay PK2 Latching

Ordering Information

Part Numbers (see table below for coil data)		Contact Arrangement	Contact Material	Enclosure	Special Features
Relay Description	Part Number				
V23201-L1004-A502	4-1414915-9	Form A	Silver based	Sealed	Latching

Coil Versions

Coil Data for PK2 Latching	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)		Must Pulse Voltage (V)		Allowable Overdrive[1] Voltage (V)			
						at 23°C		at 85°C	
		Set	Reset	Set	Reset	Set	Reset	Set	Reset
V23201-***04-****	12	20	19	6.9	6.9	28	18; 28[2) 3)]	28	18; 28[2) 3)]

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] Overvoltage according to ISO 16750-2 functional status C. In case of a reset latch pulse up to 28 V the contact may reclose, but will not remain closed (no latching function).
[3] The delay between driving impulses at cyclic energizing at T_{Amb} = 85°C must be at least 10 s.

Standard Delivery Packs (orders in multiples of delivery pack)

PK2 Latching: 600 pieces

Power Relay K (Open - Sealed)

Features

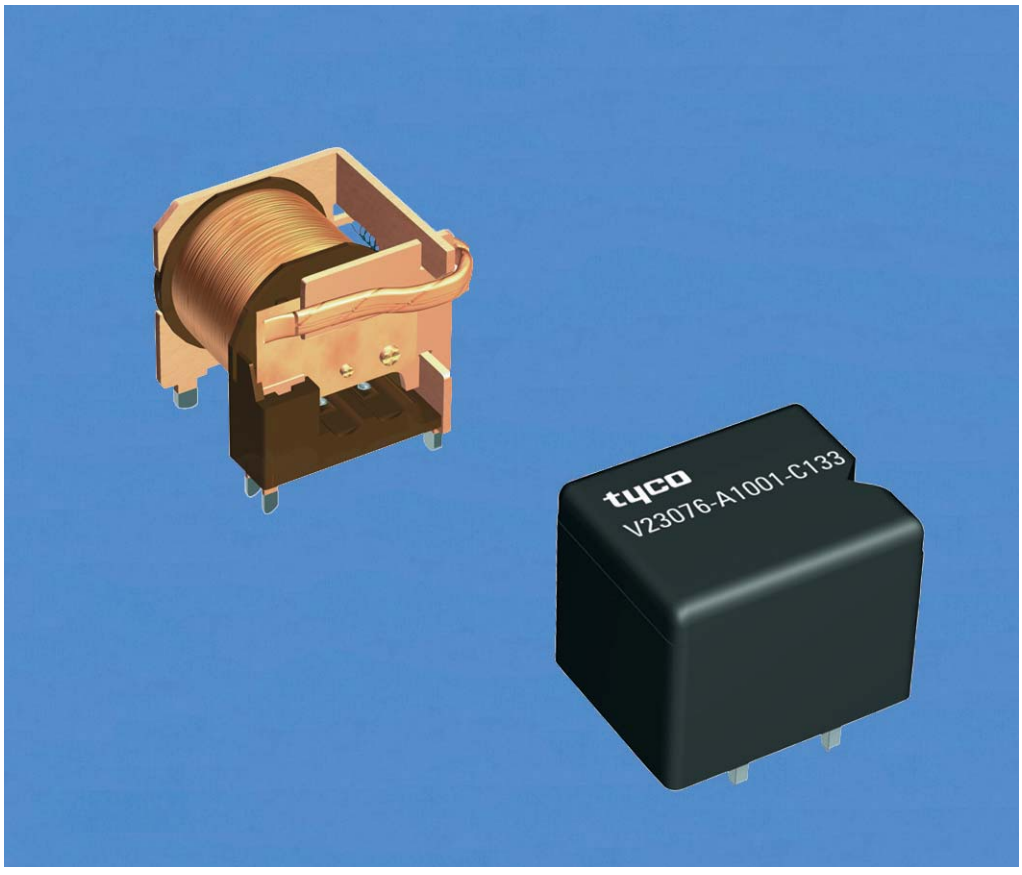
- Limiting continuous current 40 A
- Wide voltage range

- For high current version refer to Power Relay K-S

Typical Applications

- ABS control
- Blower fans
- Car alarm
- Cooling fan
- Engine control
- Fuel pump
- Hazard warning signal
- Heated front screen
- Heated rear screen
- Ignition
- Lamps front, rear, fog light
- Interior lights
- Main switch/supply relay
- Seat control
- Seatbelt pretensioner
- Sun roof
- Turn signal
- Valves
- Window lifter
- Wiper control

Please contact Tyco Electronics for relay application support.



Power_Kos_3d_2

Design

- ELV/RoHS/WEEE compliant
- Open: flux tight type
- Sealed: washable type

Weight

Approx. 19 g (0.67 oz.) open version
Approx. 22 g (0.77 oz.) sealed version

Nominal Voltage

12 V or 24 V; other nominal voltages available on request

Terminals

PCB terminals for assembly on printed circuit boards

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

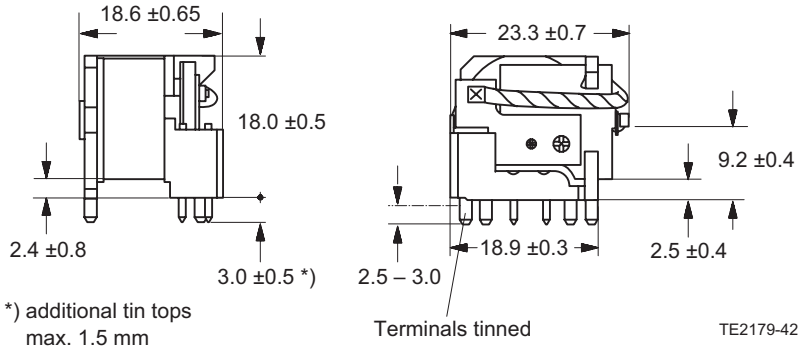
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

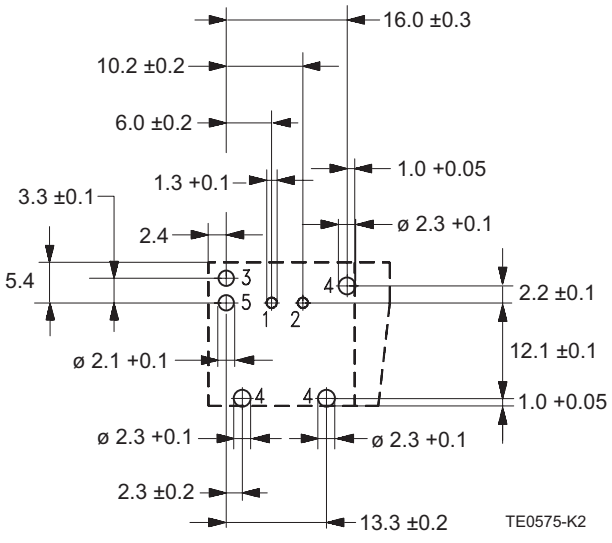
Power Relay K (Open)

Dimensional Drawing

Power Relay K Open Version



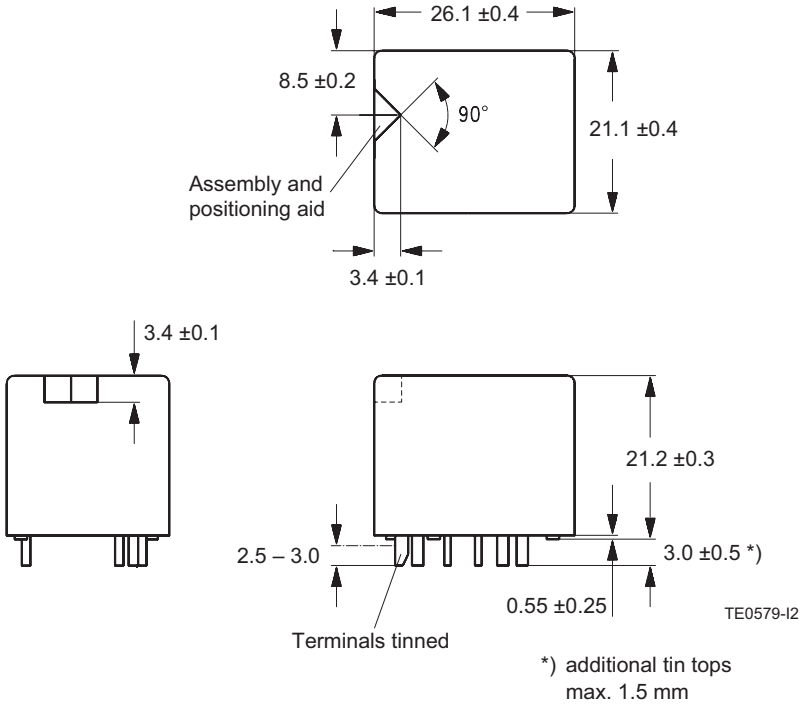
Mounting Hole Layout (bottom view)



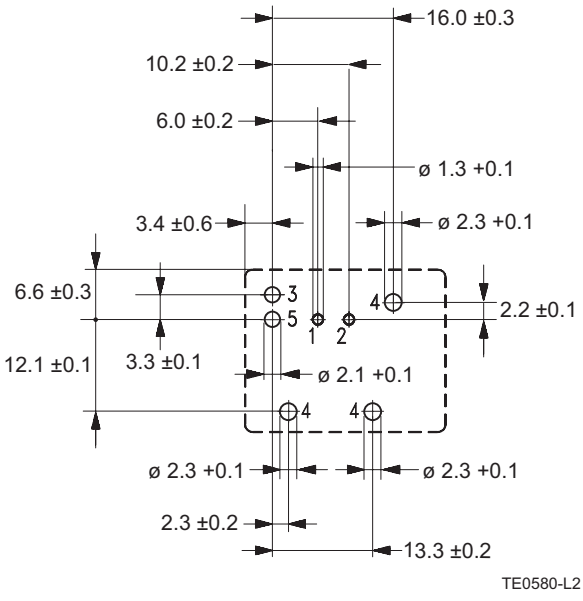
Power Relay K (Sealed)

Dimensional Drawing

Power Relay K Sealed Version

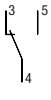
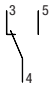


Mounting Hole Layout (bottom view)



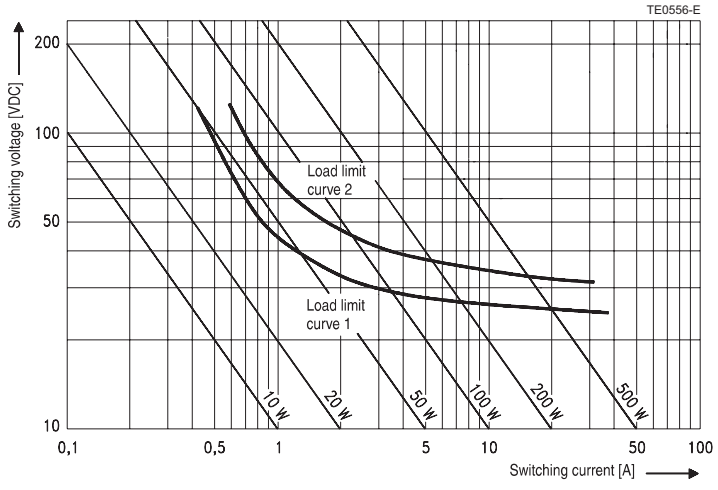
Power Relay K (Open – Sealed)

Contact Data

Typical areas of application	Resistive/inductive loads		Indicator lamps V23133-A3*-D152	Headlights, capacitive loads V23133/076-*****-D142	
Contact configuration	1 Make contact/ 1 Form A	1 Changeover contact/ 1 Form C	1 Make contact/ 1 Form A	1 Make contact/ 1 Form A	1 Changeover contact/ 1 Form C
Circuit symbol (see also Pin assignment)					
Rated voltage	12 V	12 V	12 V	12 V	12 V
Rated current	30 A	NC/NO 25/30 A	25 A	25 A	NC/NO 20/25 A
Limiting continuous current					
23°C	45 A	30/45 A	30 A	40 A	25/40 A
85°C	30 A	25/30 A	25 A	25 A	20/25 A
Contact material	AgNi0.15		$AgSnO_2$		
Max. switching voltage/power	See load limit curve				
Max. switching current [1]		NC/NO			NC/NO
On [2]	100 A	30/100 A	120 A [3]	180 A	60/180 A
Off	60 A	30/60 A	60 A	60 A	30/60 A
Min. recommended load [4]	1 A at 5 V				
Voltage drop at 10 A (initial)	Typ. 20 mV, 300 mV max.				
Mechanical endurance (without load)	$> 10^7$ operations				
Electrical endurance (example of resistive load)	$> 2 \times 10^5$ operations at 13.5 V/40 A		$> 2.2 \times 10^6$ operations up to 8 x 21 W	$> 10^5$ operations up to 4 x 60 W	

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V or 27 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] Corresponds to a peak inrush current on initial actuation (cold filament).
[4] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/
[5] For 24 V please contact your nearest Tyco Electronics representative.

Load Limit Curve



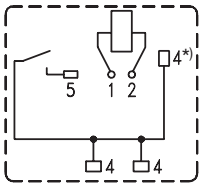
Load limit curve 1 ≙ arc extinguishes, during transit time (changeover contact)

Load limit curve 2 ≙ safe shutdown, no stationary arc (make contact)

Power Relay K (Open – Sealed)

Circuit Diagram

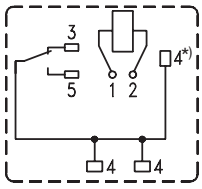
1 Make contact/1 Form A



TE1091-B1

*) Terminal 4 to be bridged

1 Changeover contact/1 Form C



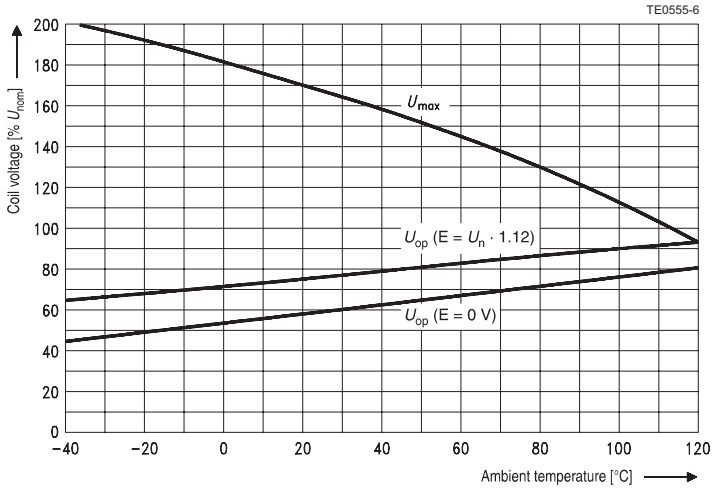
TE1086-A1

Coil Data	
Available for nominal voltages	12 V / 24 V
Nominal power consumption of the unsuppressed coil at nominal voltage	1.6 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range [1]	–40 to +85°C
Operate time at nominal voltage	Typ. 5 ms
Release time at nominal voltage [2]	Typ. 3 ms

[1] See also operating voltage range diagram.
[2] For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Power Relay K (Open – Sealed)

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation [1]	EN ISO 6988		3 cycles	Storage 8/16 h
Temperature cycling [1]	IEC 68-2-14	Na	20 cycles	–40/+85°C (dwell time 1 h)
Damp heat [1]				
cyclic	IEC 68-2-30	Db, Variant 1	6 cycles	Upper air temperature 55°C
constant	IEC 68-2-3	Method Ca	56 days	
Corrosive gas [1]	IEC 68-2-42		10 days	
	IEC 68-2-43		10 days	
Vibration resistance	IEC 68-2-6 (sine pulse form)		10 - 200 Hz	
	acceleration, acc. to position		20 - 40 g	No change in the
Shock resistance	IEC 68-2-27 (half sine form single pulses)		8 ms	switching state > 10 µs
	acceleration, acc. to position		30 g	
Solderability	IEC 68-2-20	Ta, Method 1	Hot dip 5 s	Aging 3 (4 h/155°C)
			215°C	for leaded process (Tm = 183°C)
				for Pb-free process (Tm = 217°C)
Resistance to soldering heat	IEC 68-2-20	Tb, Method 1A	Hot dip 10 s	with thermal screen
			260°C	
Sealing [1]	IEC 68-2-17	Qc, Method 2		1 min/70°C

[1] Only sealed version.

Ordering Information

Part Numbers (see table below for coil data)		Contact Arrangement	Contact Material	Enclosure	Terminals
Relay Description	**Part Number**				
12 V PCB Relays					
V23133-A1001-C133	1393278-7	1 Form C	AgNi0.15	Open	Printed circuit
V23133-A1001-D143	1-1393278-3	1 Form C	$AgSnO_2$	Open	Printed circuit
V23133-A3001-C132	5-1393278-7	1 Form A	AgNi0.15	Open	Printed circuit
V23133-A3001-D142	5-1393278-9	1 Form A	$AgSnO_2$	Open	Printed circuit
V23133-A3001-D152 [1]	1-1414173-0	1 Form A	$AgSnO_2$	Open	Printed circuit
24 V PCB Relays					
V23133-A1022-C133	3-1393278-7	1 Form C	AgNi0.15	Open	Printed circuit
V23133-A1022-D143	3-1393278-9	1 Form C	$AgSnO_2$	Open	Printed circuit
V23133-A3022-C132	7-1393278-1	1 Form A	AgNi0.15	Open	Printed circuit
V23133-A3022-D142	7-1393278-2	1 Form A	$AgSnO_2$	Open	Printed circuit
V23133-A3022-D152 [1]	1-1414174-0	1 Form A	$AgSnO_2$	Open	Printed circuit
12 V PCB Relays					
V23076-A1001-C133	1393277-4	1 Form C	AgNi0.15	Sealed	Printed circuit
V23076-A1001-D143	1393277-6	1 Form C	$AgSnO_2$	Sealed	Printed circuit
V23076-A3001-C132	1-1393277-4	1 Form A	AgNi0.15	Sealed	Printed circuit
V23076-A3001-D142	1-1393277-7	1 Form A	$AgSnO_2$	Sealed	Printed circuit
V23076-A3001-D152 [1]	1-1414175-0	1 Form A	$AgSnO_2$	Sealed	Printed circuit
24 V PCB Relays					
V23076-A1022-C133	1393277-8	1 Form C	AgNi0.15	Sealed	Printed circuit
V23076-A1022-D143	1393277-9	1 Form C	$AgSnO_2$	Sealed	Printed circuit
V23076-A3022-C132	1-1393277-8	1 Form A	AgNi0.15	Sealed	Printed circuit
V23076-A3022-D142	1-1393277-9	1 Form A	$AgSnO_2$	Sealed	Printed circuit

[1] For indicator lamps.

Power Relay K (Open – Sealed)

Coil Versions

Coil Data for Power K	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive[1] Voltage (V)	
					at 23°C	at 85°C
V23133-**001-****	12	90	6.9	1.2	20.8	15.5
V23133-**022-****	24	362	14.1	2.4	41.2	32.5
V23076-**001-****	12	90	6.9	1.2	20.8	15.5
V23076-**022-****	24	362	14.1	2.4	41.2	32

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Note: further coils on request.

Standard Delivery Packs (orders in multiples of delivery pack)

Power K – Open: 500 pieces
Power K – Sealed: 300 pieces

Power Relay K-S

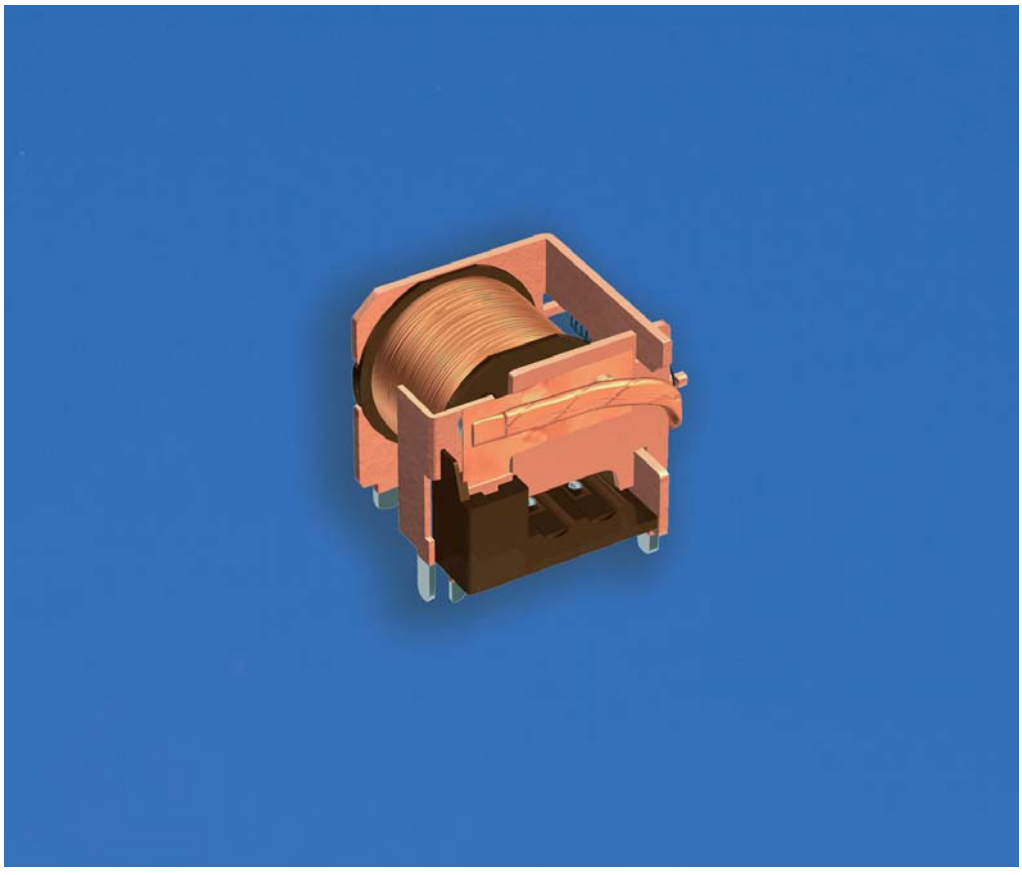
Features

- High current design: limiting continuous current 50 A at 85°C
- Very low voltage drop
- Wide voltage range

Typical Applications

- ABS control
- Blower fans
- Cooling fan
- Engine control
- Glow plug
- Heated rear screen
- Ignition
- Main switch/supply relay
- Preheating system
- Valves
- Wiper control

Please contact Tyco Electronics for relay application support.



071S_3d_3

Design

- ELV/RoHS/WEEE compliant
- Open: flux tight type

Weight

Approx. 19 g (0.68 oz.)

Nominal Voltage

12 V or 24 V; other nominal voltages available on request

Terminals

PCB terminals for assembly on printed circuit boards

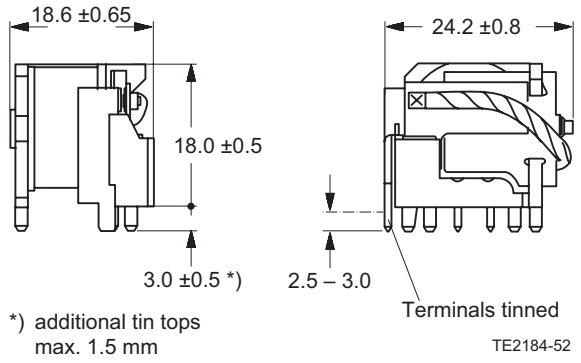
Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

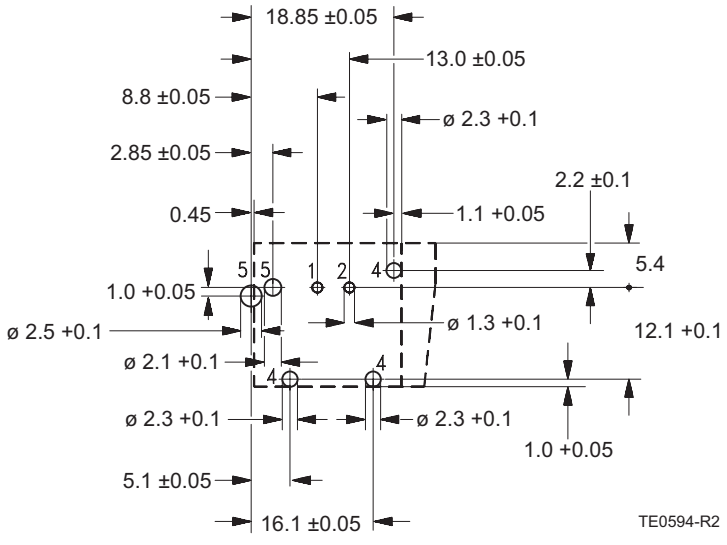
Disclaimer

Dimensional Drawing



*) additional tin tops
max. 1.5 mm

Mounting Hole Layout (bottom view)



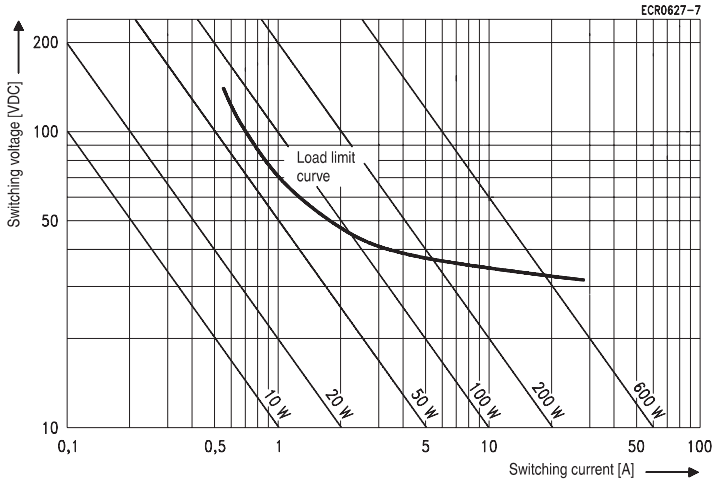
Power Relay K-S

Contact Data

Contact configuration	1 Make contact/ 1 Form A	
Circuit symbol (see also Pin assignment)		
Rated voltage	12 V	24 V
Rated current	50 A	
Limiting continuous current 23°C 85°C	 70 A 50 A	
Contact material	AgNi0.15	
Max. switching power	See load limit curve	
Max. switching current [1] On [2] Off	 300 A 70 A	 150 A 35 A
Min. recommended load [3]	1 A at 5 V	
Voltage drop at 10 A (initial)	Typ. 10 mV, 300 mV max.	
Mechanical endurance (without load)	> 10^6 operations	
Electrical endurance (example of resistive load)	> 5 x 10^4 operations at 13.5 V/50 A	> 1 x 10^5 operations at 27.5 V/15 A

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V or 27 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

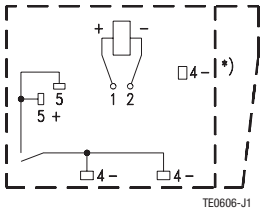
Load Limit Curve



Load limit curve ≙ safe shutdown, no stationary arc

Circuit Diagram

1 Make contact/1 Form A



Note:
Check polarity and frame connection (ground)

* For mounting only, not for electrical connection.

Power Relay K-S

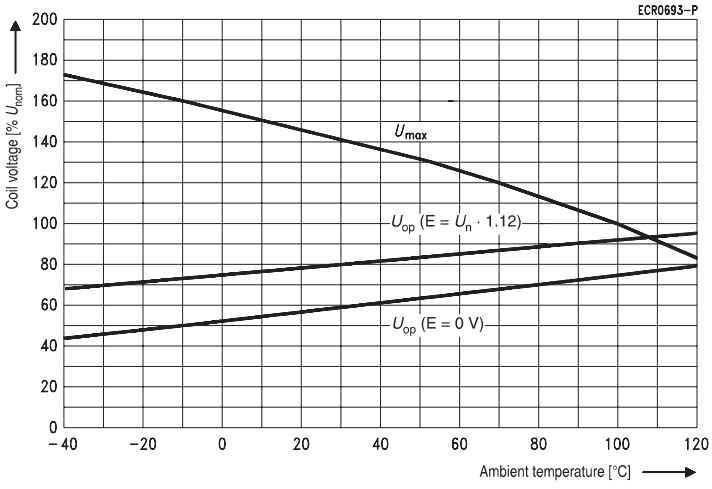
Coil Data

Available for nominal voltages	12 V / 24 V
Nominal power consumption of the unsuppressed coil at nominal voltage	2.25 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range [1)]	–40 to +85°C
Operate time at nominal voltage	Typ. 4 ms
Release time at nominal voltage [2)]	Typ. 3 ms

1) See also operating voltage range diagram.
2) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Environmental Conditions

Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Vibration resistance	IEC 68-2-6 (sine pulse form) acceleration, acc. to position		10 - 200 Hz 20 - 40 g	No change in the switching state > 10 µs
Shock resistance	IEC 68-2-27 (half sine form single pulses) acceleration		8 ms 30 g	
Solderability	IEC 68-2-20	Ta, Method 1	Hot dip 5 s 215°C	Aging 3 (4 h/155°C) for leaded process (Tm = 183°C) for Pb-free process (Tm = 217°C)
Resistance to soldering heat	IEC 68-2-20	Tb, Method 1A	Hot dip 10 s 260°C	with thermal screen

Power Relay K-S

Ordering Information

Part Numbers (see table below for coil data)		Contact Arrangement	Contact Material	Enclosure	Terminals
Relay Description	Part Number				
V23071-A1009-A132	1393276-3	1 Form A (make contact)	AgNi0.15	Open	Printed circuit
V23071-A1010-A132	1393276-7	1 Form A (make contact)	AgNi0.15	Open	Printed circuit

Coil Versions

Coil Data for Power K-S	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive[1] Voltage (V)	
					at 23°C	at 85°C
V23071-**009-***	12	64	6.9	1.2	18.5	14.5
V23071-**010-***	24	234	14.1	2.4	31.1	24.7

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (orders in multiples of delivery pack)

Power K-S: 400 pieces

VKP (Open – Sealed)

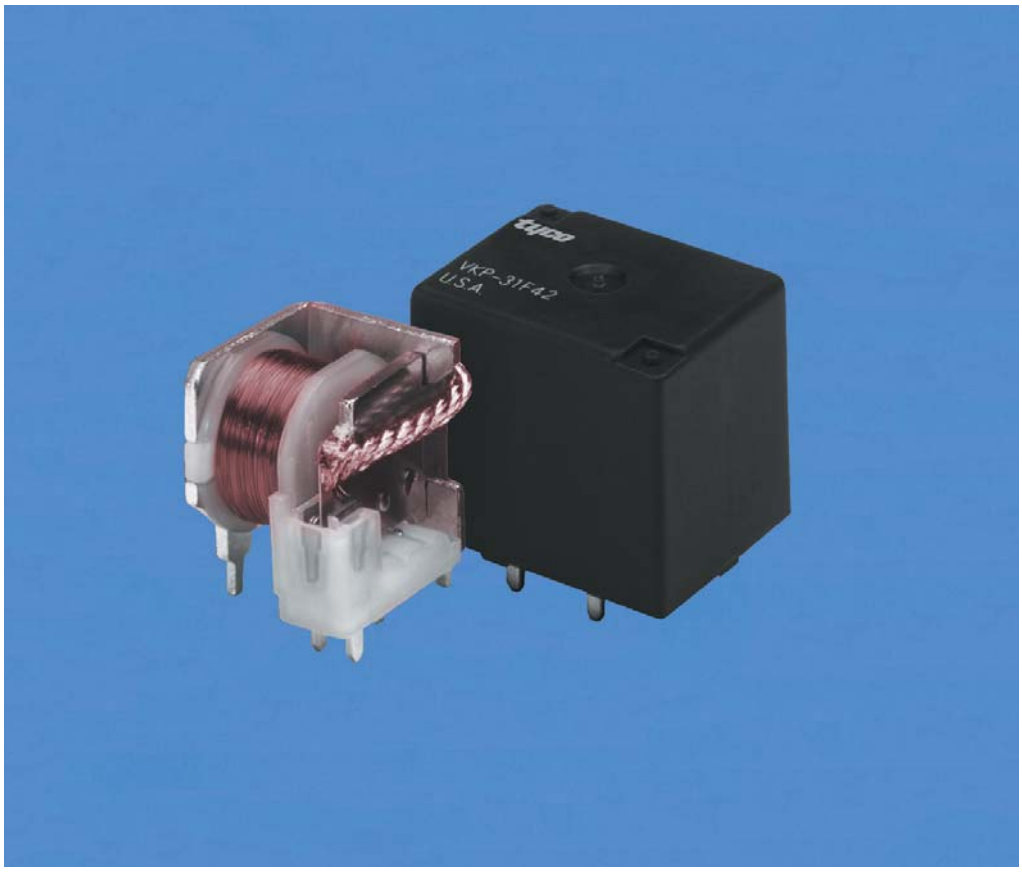
Features

- Limiting continuous current 40 A
- Wide voltage range

Typical Applications

- ABS control
- Blower fans
- Car alarm
- Cooling fan
- Engine control
- Fuel pump
- Hazard warning signal
- Heated front screen
- Heated rear screen
- Ignition
- Lamps front, rear, fog light
- Interior lights
- Main switch/supply relay
- Seat control
- Seatbelt pretensioner
- Sun roof
- Turn signal
- Valves
- Window lifter
- Wiper control

Please contact Tyco Electronics for relay application support.



VKP_3d01

Design

- ELV/RoHS/WEEE compliant
- Open: flux tight type
- Sealed: washable type

Weight

- Approx. 19 g (0.67 oz.) open version
- Approx. 22 g (0.77 oz.) sealed version

Nominal Voltage

6 V, 12 V or 24 V

Terminals

PCB terminals, for assembly on printed circuit boards

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

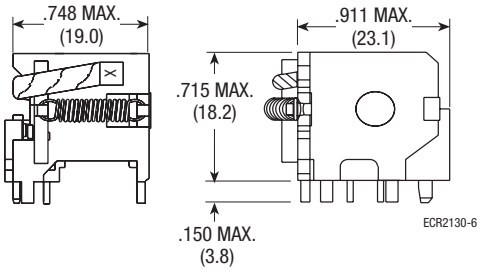
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

VKP (Open – Sealed)

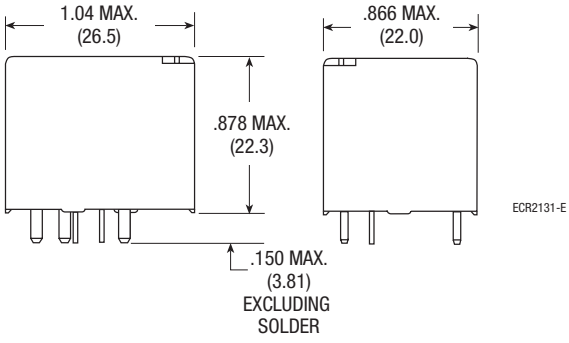
Dimensional Drawing

VKP Open Version



Dimensional Drawing

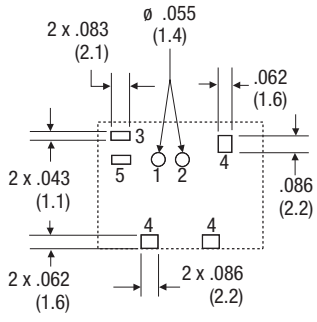
VKP Sealed Version



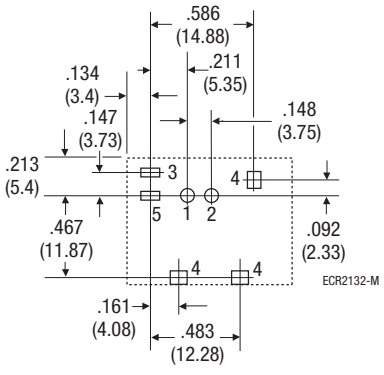
Mounting Hole Layout (bottom view)

Open version

Hole Size

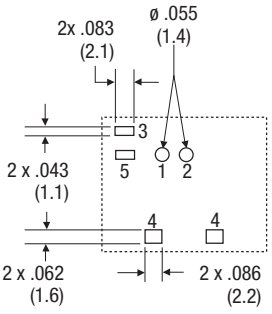


Center-To-Center

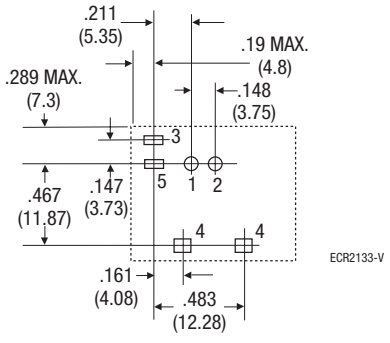


Sealed Version

Hole Size



Center-To-Center



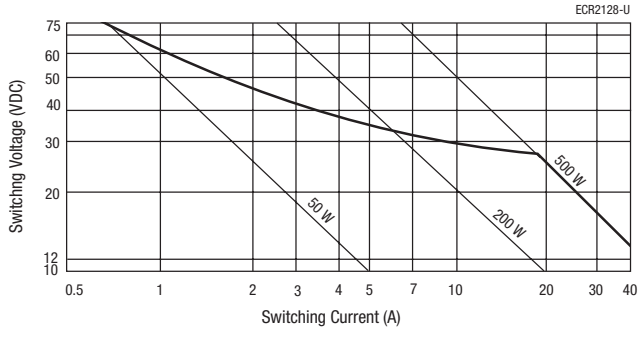
VKP (Open – Sealed)

Contact Data

Typical areas of application	Resistive/inductive loads		High inrush, lamp and capacitive loads	
Contact configuration	1 Make contact/ 1 Form A	1 Changeover contact/ 1 Form C	1 Make contact/ 1 Form A	1 Changeover contact/ 1 Form C
Circuit symbol (see also Pin assignment)				
Rated voltage	12 V			
Rated current	40 A	NC/NO 25/40 A	40 A	NC/NO 25/40 A
Limiting continuous current				
23°C	45 A	30/45 A	45 A	30/45 A
85°C	40 A	25/40 A	40 A	25/40 A
Contact material	AgNi0.15 (VKP-***42)		$AgSnO_2$ (VKP-***52)	
Max. switching voltage/power	See load limit curve			
Max. switching current		NC/NO		NC/NO
On [1]	100 A	30 A/100 A	180 A	30 A/180 A
Off [2]	60 A	30 A/60 A	60 A	30 A/60 A
Min. recommended current	1 A at 5 V			
Voltage drop at 10 A (initial)	Typ. 15 mV	Typ. 20/15 mV	Typ. 20 mV	Typ. 25/20 mV
Mechanical endurance (without load)	> 10^7 operations			
Electrical endurance (example of resistive load)	10^5 operations at 40 A, 14 V, on NO contact			

[1] Inrush current for lamp load.
[2] See load limit curve.

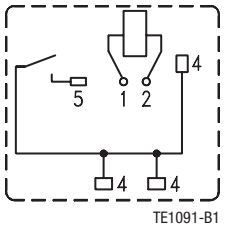
Load Limit Curve



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

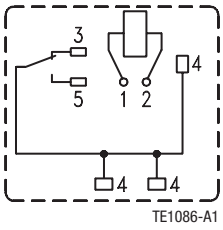
Circuit Diagram

1 Make contact/1 Form A



TE1091-B1

1 Changeover contact/1 Form C



TE1086-A1

VKP (Open – Sealed)

Contact Data

Typical areas of application	Flashing lamps	
Contact configuration	1 Make contact/ 1 Form A	1 Changeover contact/ 1 Form C
Circuit symbol (see also Pin assignment)		
Rated voltage	12 V	
Contact material	$AgSnO_2$ (VKP-***72) [1]	
Max. switching voltage/power	See load limit curve on previous page	
Max. switching current	High current version	High current version NC/NO
On [2]	240 A	60 A/240 A
Off	30 A	20 A/30 A
Steady-state flashing [3]		NC/NO
Open	30 A	10 A/30 A
Sealed	25 A	10 A/25 A
Alternate flashing [4]		NC/NO
Open		8 A/8 A
Sealed		8 A/8 A
Min. recommended load [5]	1 A at 5 V	
Voltage drop (initial) at 10 A	100 mV max. for NO contacts, 200 mV max. for NC contacts, typ. 40 mV	
Mechanical endurance (without load)	Typ. 10^7 operations	
Electrical endurance	See application information below	

[1] Center contact pin 4 to be connected to positive potential.
[2] Inrush current for lamp load.
[3] Continuous On-Off cycling of a single set of lamps at 60 to 90 operations per minute and approx. a 50% duty cycle.
[4] Continuous cycling between two sets of lamps with one set switched by the NO contacts and the other by the NC contacts, at 60 to 90 operations per minute and approx. a 50% duty cycle.
[5] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Coil Data

Available for nominal voltages	6 V / 12 V / 24 V
Nominal power consumption of the unsuppressed coil at nominal voltage	1.6 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 5 ms
Release time at nominal voltage [1]	Typ. 3 ms

[1] For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

VKP (Open – Sealed)

Application Information

Load Polarity: VKP series relays for flashing lamp applications are constructed with special AgSnO movable contacts and standard AgSnO 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 special AgSnO contact material and will result in significantly reduced relay life.

Typical Applications: Typical applications: VKP series relays for flashing lamp applications are typically used for turn signals, hazard warning, emergency vehicle, and security system applications. They may also be suitable 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 in applications, which do not have a significant make current, as high contact voltage drop may result.

Note: The VKP-***72 series relay with special AgSnO contact material replaces the VKP-XXX32 standard current and the VKP-***62 high current PdCu/AgNi0.15 contact relays.

High Current Relays: VKP-***72 series relays for flashing lamp applications are generally suitable for passenger car, light truck with or without special trailering requirements, and medium duty truck, and emergency vehicle applications. They are also generally suitable for security system applications for flashing lamps and for most audio amplifier applications. This relay is also recommended for alternating flasher applications, such as emergency vehicles. This version has much improved performance on the normally open contacts, so optimum life can be attained for alternating applications by using two normally open relays and powering the coils alternately.

Electrical Life Test Information

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 represents about the limit of the performance capability of the "Flashing Lamp" type VKP relay. It should be noted that the low current operations have very little effect on the product life where as the 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 copper lead frame type construction under these conditions to prevent failure of the solder joint.

VKP (Open – Sealed)

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Vibration resistance	1.27 mm double amplitude 5 g constant 0.5 mm double amplitude 10 g constant		10 - 40 Hz 40 - 70 Hz 70 - 100 Hz 100 - 500 Hz	Valid for NC contacts. NO contacts are significantly higher
Shock resistance	Half sine wave pulse		11 ms 20 g	No change in the switching state > 10 μs
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete in final enclosure			
Flammability	UL94-HB or better, internal parts (meets FMVSS 302)			

Ordering Information

Part Numbers (see table below for coil data)		Contact Arrangement	Contact Material	Enclosure	Applications
Relay Description	Part Number				
VKP-11F42	3-1393277-7	1 Form A	AgNi0.15	Open	General automotive loads
VKP-11H42	5-1419148-4	1 Form A	AgNi0.15	Open	General automotive loads
VKP-15F42	1393278-1	1 Form C	AgNi0.15	Open	General automotive loads
VKP-15H42	5-1393277-5	1 Form C	AgNi0.15	Open	General automotive loads
VKP-15F52	5-1393277-1	1 Form C	$AgSnO_2$	Open	High inrush loads
VKP-31F42	1393277-1	1 Form A	AgNi0.15	Sealed	General automotive loads
VKP-31H42	1393277-2	1 Form A	AgNi0.15	Sealed	General automotive loads
VKP-35F42	1393277-3	1 Form C	AgNi0.15	Sealed	General automotive loads
VKP-35H42	7-1393277-9	1 Form C	AgNi0.15	Sealed	General automotive loads
VKP-31F52	6-1393277-2	1 Form A	$AgSnO_2$	Sealed	High inrush loads
VKP-31H52	1432198-1	1 Form A	$AgSnO_2$	Sealed	High inrush loads
VKP-35F52	7-1393277-3	1 Form C	$AgSnO_2$	Sealed	High inrush loads
VKP-35H52	1432197-1	1 Form C	$AgSnO_2$	Sealed	High inrush loads
VKP-11F72	1432444-1	1 Form A	Special $AgSnO_2$	Open	Flashing lamp loads
VKP-15F72	1432445-1	1 Form C	Special $AgSnO_2$	Open	Flashing lamp loads
VKP-31F72	1432413-1	1 Form A	Special $AgSnO_2$	Sealed	Flashing lamp loads
VKP-35F72	1432438-1	1 Form C	Special $AgSnO_2$	Sealed	Flashing lamp loads

Coil Versions

Coil Data for VKP	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive[1] Voltage (V)	
					at 23°C	at 85°C
VKP-**D**[2]	6	19	3.3	0.6	9.0	6.5
VKP-**F**	12	90	6.8	1.2	19.6	14.3
VKP-**H**[2]	24	362	13.9	2.4	39.3	28.6

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] On request.

Standard Delivery Packs (orders in multiples of delivery pack)

VKP: 525 pieces

Nano Relay (THT – THR)

Features

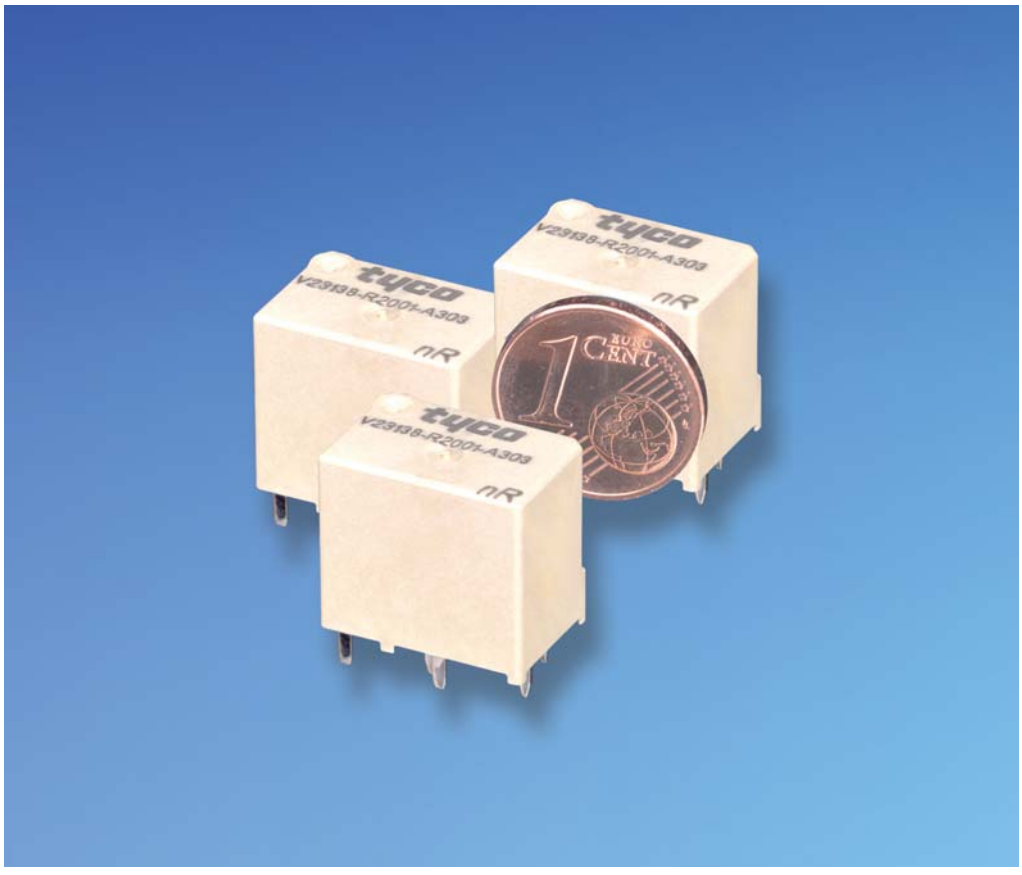
- Smallest automotive PCB relay in its class:
  - Minimum PCB area required: 157 mm²
  - Dimensions: L x H x W (mm) 15.4 x 14.0 x 10.2
  - Minimal height: 14.0 mm
  - Minimal weight
- First automotive relay using overmolding technology
- Highest reliability due to overmolding process
- Limiting continuous current 30 A
- Very easy routing of PCB-layout
- Power-saving high-impedance coil
- Low noise operation
- Wave (THT) and reflow (THR/pin-in-paste) solderable versions

- For single version refer to Single Nano Relay

Typical Applications

- Car alarm
- Door control
- Door lock
- Electrical steering column lock
- Heated rear screen
- Immobilizer
- Seat control
- Sun roof
- Window lifter

Please contact Tyco Electronics for relay application support.



138_3D03

Design

- ELV/RoHS/WEEE compliant
- THT: sealed type washable
- THR: sealed type open vent hole

Weight

Approx. 6.5 g (0.23 oz.)

Nominal Voltage

12 V

Terminals

PCB terminals for assembly on printed circuit boards

Conditions

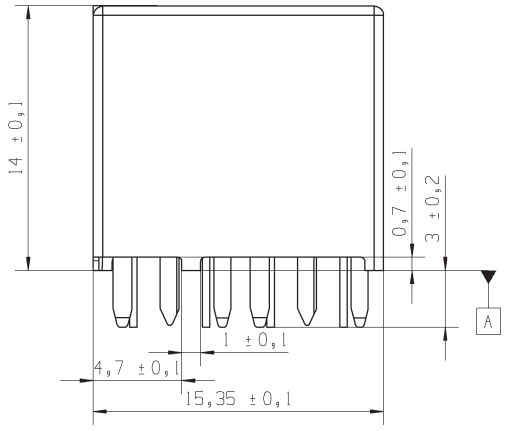
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

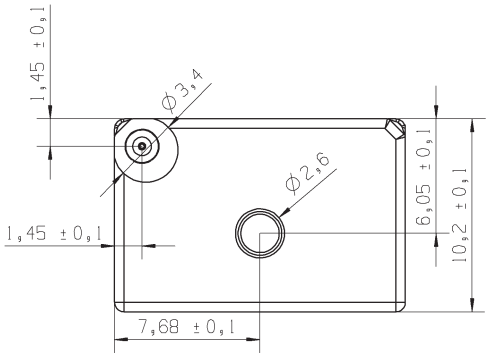
Disclaimer

Nano Relay (THT – THR)

Dimensional Drawing



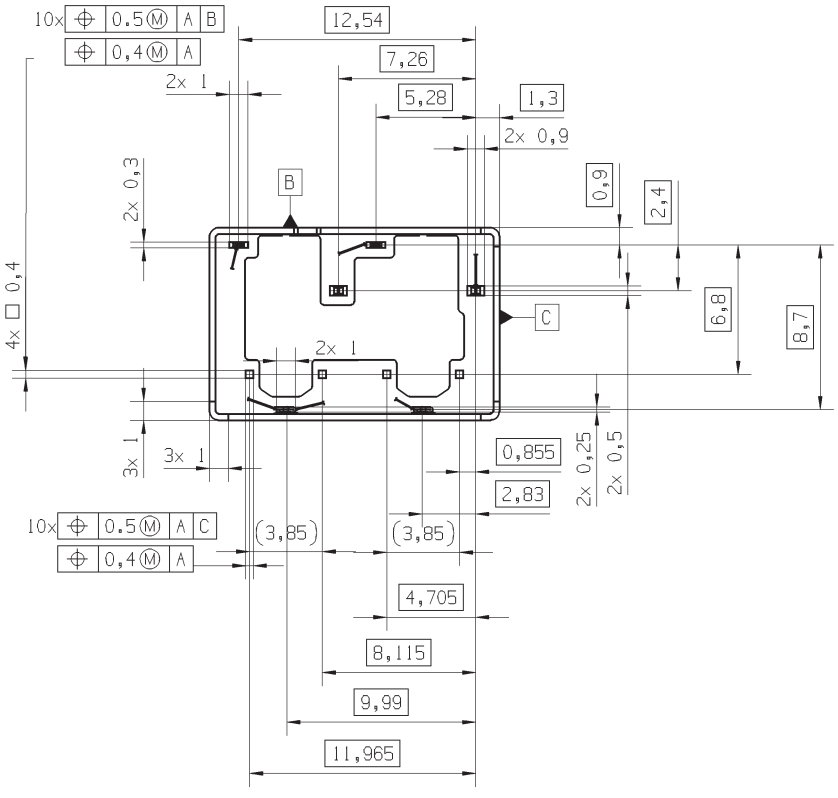
138_DD3



Tolerances unless otherwise specified + / - 0.2

138_DD3

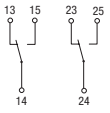
View of the Terminals (bottom view)



138_VT3

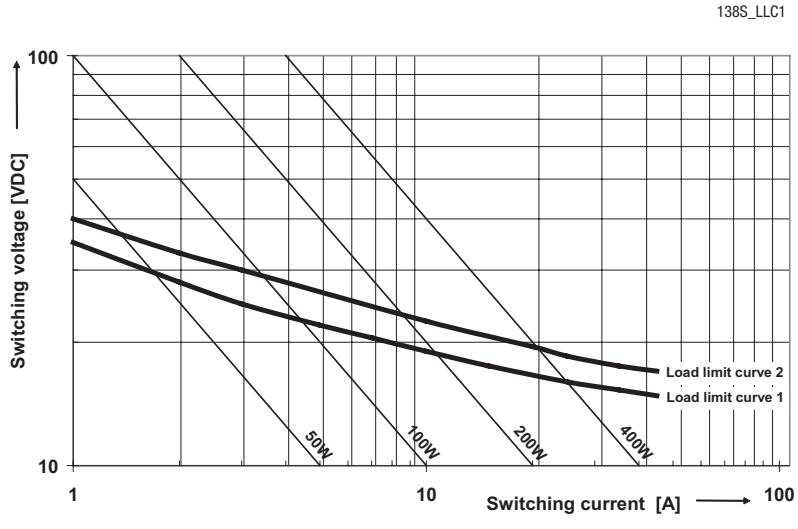
Nano Relay (THT – THR)

Contact Data

Typical areas of application	Resistive/inductive load	
Contact configuration	2 Changeover contacts/ 2 Form C	
Circuit symbol (see also Pin assignment)		
Rated voltage	12 V	
Rated current	NC/NO 15 A/20 A	
Limiting continuous current	Single excitation NC/NO	H-bridge configuration
23°C	25 A/30 A	25 A
85°C	15 A/20 A	15 A
105°C	10 A/10 A	10 A
Contact material	Silver based	
Max. switching voltage/power	See load limit curve	
Max. switching current [1] On [2] Off	NC/NO 30 A 30 A	
Min. recommended load [3]	1 A at 5 V	
Voltage drop at 10 A (initial) for NC/NO contacts	Typ. 30 mV, 300 mV max.	
Mechanical endurance (without load)	> 5 x 10^6 operations	
Electrical endurance at cyclic temperature –40/+23/+85°C and 13.5 V	Motor reverse blocked: > 10^5 operations at 25 A, 0.77 mH inductive load	

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve



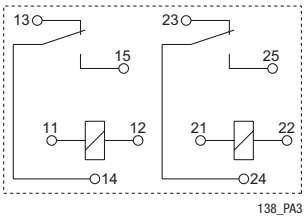
Load limit curve 1 ≙ arc extinguishes during transit time

Load limit curve 2 ≙ safe shutdown, no stationary arc

Nano Relay (THT – THR)

Circuit Diagram

2 Changeover contacts/2 Form C



138_PA3

Coil Data

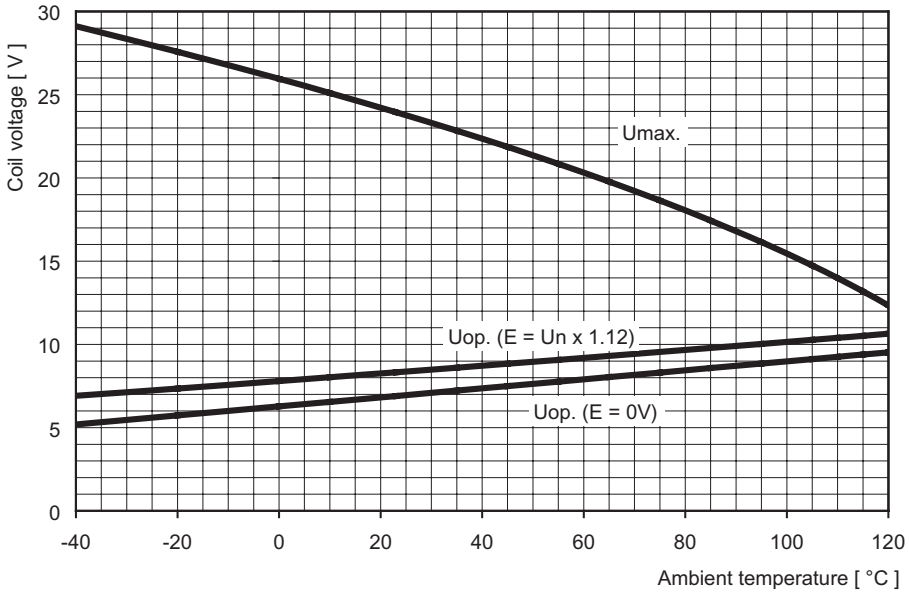
Available for nominal voltages	12 V
Nominal power consumption of the unsuppressed coil at nominal voltage	0.8 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range [1)]	–40 to +105°C
Operate time at nominal voltage	Typ. 3 ms
Release time at nominal voltage [2)]	Typ. 1.5 ms

1) Permanent use above 85°C could be critical.
2) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range

138S_OVR1



Does not take into account the temperature rise due to the contact current
E = pre-energization

Nano Relay (THT – THR)

Environmental Conditions					
Temperature range, storage		Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test		Relevant standard	Testing as per	Dimension	Comments
Cold storage		IEC 68-2-1		1000 h	–40°C
Dry heat		IEC 68-2-2	Ba	1000 h	125°C
Climatic cycling with condensation					
	THT	EN ISO 6988		20 cycles	Storage 8/16 h
Thermal change		IEC 68-2-14	Nb	35 cycles	–40/+125°C
Thermal shock		IEC 68-2-14	Na	1000 cycles	–40/+125°C Dwell time 1 h
Damp heat					
cyclic	THT	IEC 68-2-30	Db, Variant 2	6 cycles	25°C/55°C/93%
constant	THT	IEC 68-2-3	Method Ca	56 days	40°C/93%
Corrosive gas					
		IEC 68-2-42		10 days	
		IEC 68-2-43		10 days	
Vibration resistance		IEC 68-2-6 (sine pulse form)		10 - 500 Hz 6 g	No change in the switching state > 10 µs
Shock resistance		IEC 68-2-27 (half sine form single pulses)		6 ms up to 30 g	No change in the switching state > 10 µs
Solderability				Hot dip 5 s	Aging 3 (4 h/155°C)
	THT	IEC 68-2-20	Ta, Method 1	215°C	for leaded process (Tm = 183°C)
	THR	IEC 68-2-58		245°C	for Pb-free process (Tm = 217°C)
Resistance to soldering heat				Hot dip 10 s	with thermal screen
	THT	IEC 68-2-20	Ta, Method 1A	260°C	
	THR	IEC 68-2-58		260°C	Preheating min 130°C
Sealing					
	THT	IEC 68-2-17	Qc, Method 2		1 min/70°C
	THR				Open vent hole

Ordering Information

Part Numbers (see table below for coil data)		Contact Arrangement	Contact Material	Enclosure	Soldering Technology
Relay Description	Part Number				
V23138-C2005-A303	8-1414964-6	2 Form C	Silver based	Sealed	THT
V23138-C2005-A403	8-1414964-8	2 Form C	Silver based	Sealed	THT
V23138-R2005-A303	8-1414964-7	2 Form C	Silver based	Open vent hole	THR
V23138-R2005-A403	1-1414960-2	2 Form C	Silver based	Open vent hole	THR

Coil Versions

Coil Data for Nano	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V)	
					at 23°C	at 105°C
V23138-**005-****	12	180	6.9	1.0	24	14.7

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (orders in multiples of delivery pack)

Nano – THT/THR: 1360 pieces

Double Micro Relay K (THT – THR)

Features

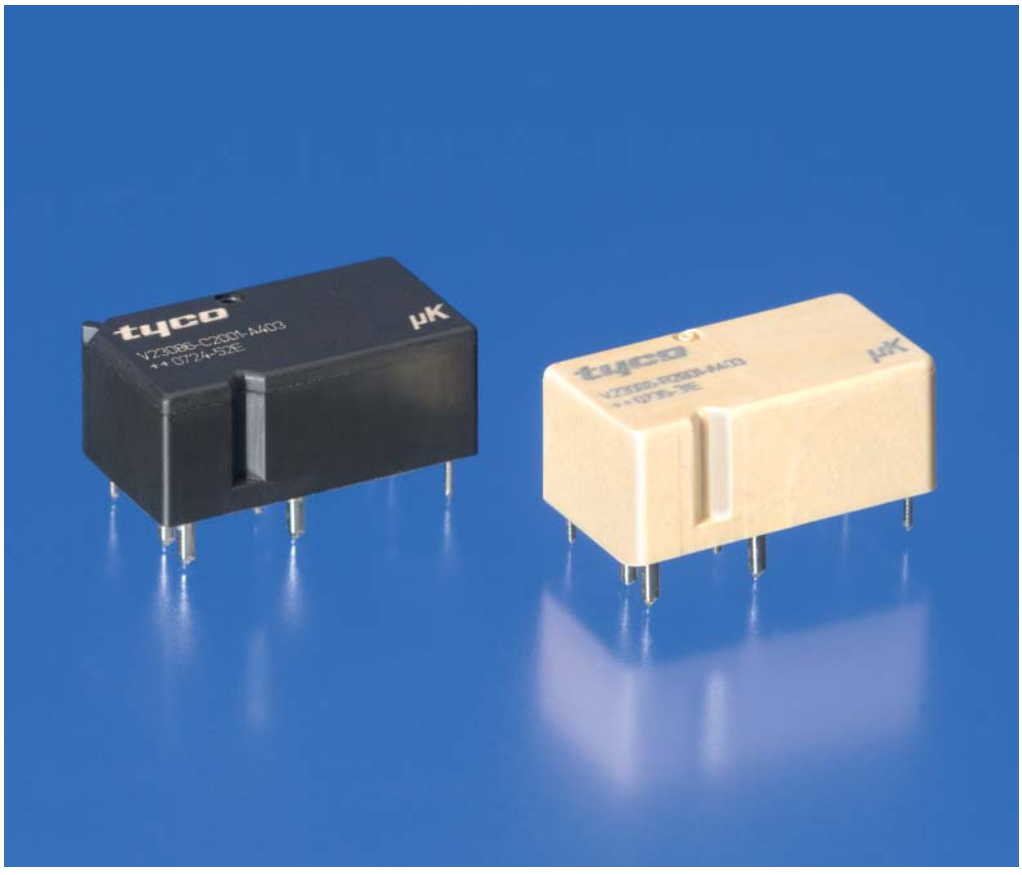
- Small power relay
- Limiting continuous current 30 A
- Minimal weight
- Low noise operations
- Wave (THT) and reflow (THR/pin-in-paste) solderable versions

- For single version refer to Micro Relay K
- For latching (bistable) version refer to Micro Relay K Latching
- For surface mounted technology refer to SMD versions

Typical Applications

- Car alarm
- Door control
- Door lock
- Immobilizer
- Lights interior
- Seat control
- Sun roof
- Trunk lock
- Window lifter

Please contact Tyco Electronics for relay application support.



86CR2_3Dco1

Design

- ELV/RoHS/WEEE compliant
- THT: sealed type washable
- THR: sealed type open vent hole

Weight

Approx. 8 g (0.28 oz.)

Nominal Voltage

10 V or 12 V; other nominal voltages available on request

Terminals

PCB terminals for assembly on printed circuit boards

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

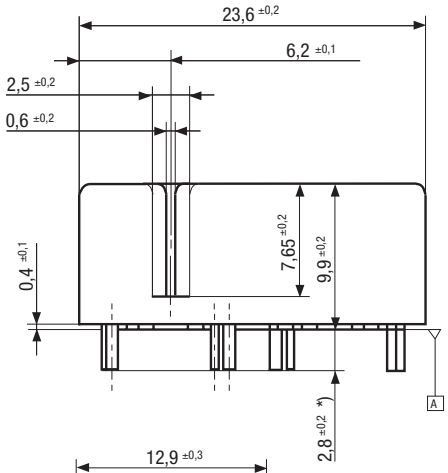
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

Double Micro Relay K (THT – THR)

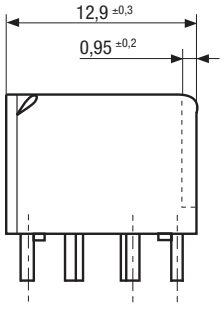
Dimensional Drawing

Double Micro Relay THT



Nipp-off-pin

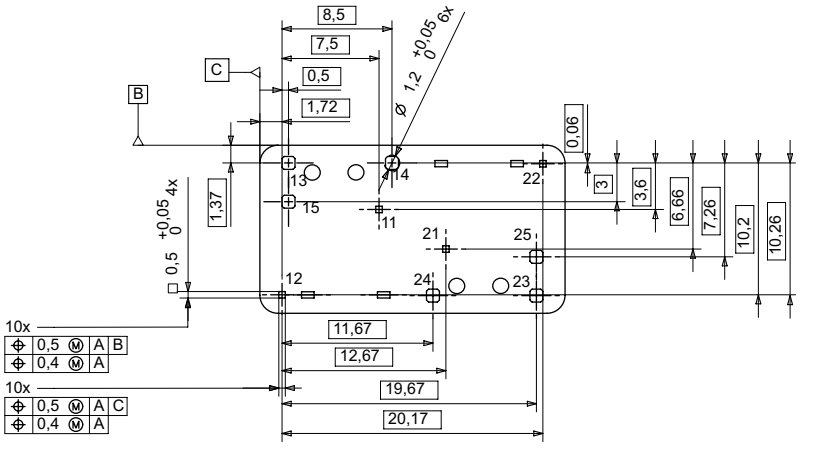
The nipp-off-pin may be removed after soldering and washing (for ventilation)



*) Additional tin tops max. 1 mm

86dtw_se

View of the Terminals (bottom view)



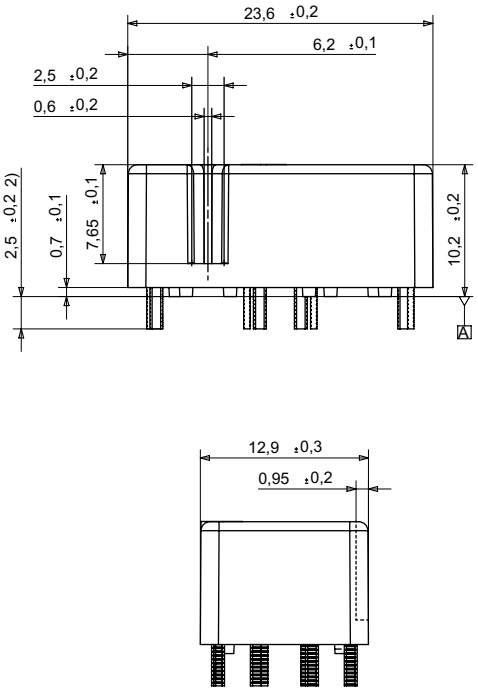
086R2_VT4

Remark: Positional tolerances according to DIN EN ISO 5458

Double Micro Relay K (THT – THR)

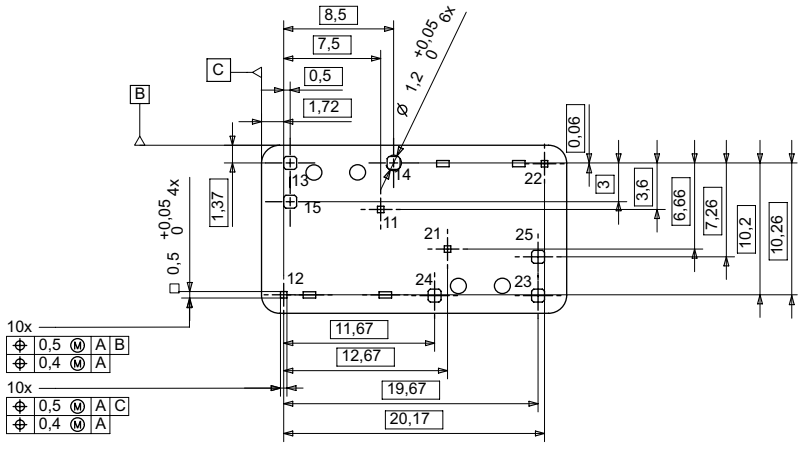
Dimensional Drawing

Double Micro Relay THR

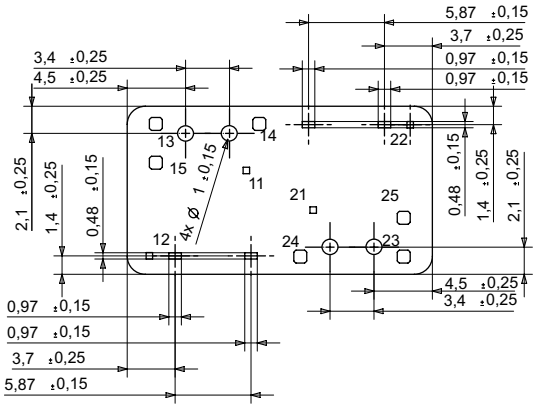


086R2_DD3

View of the Terminals (bottom view)



View of the Terminals (stand offs)

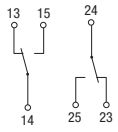


086R2_VT4

Remark: Positional tolerances according to DIN EN ISO 5458

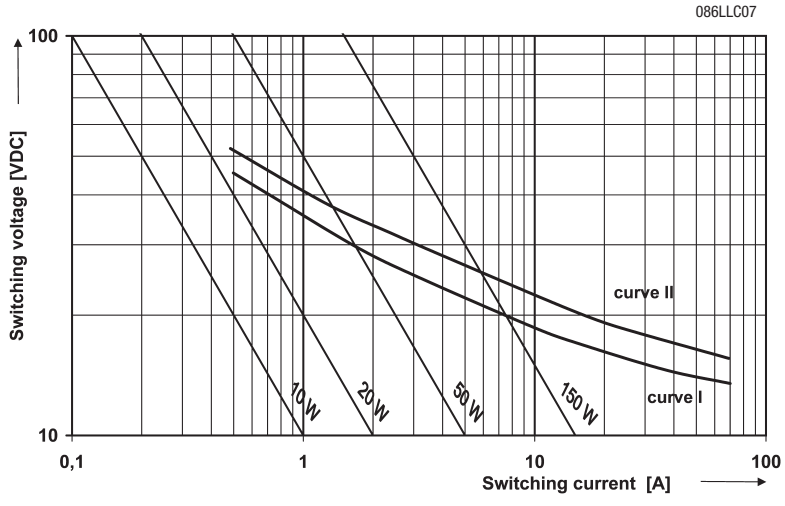
Double Micro Relay K (THT – THR)

Contact Data

Typical areas of application		Resistive/inductive load		
Contact configuration		2 changeover contacts/ 2 form C		
Circuit symbol (see also Pin assignment)				
Rated voltage		12 V		
Rated current		NC/NO 15 A/20 A		
Limiting continuous current (one system energized)	23°C 85°C 105°C	NC/NO 25 A/30 A 15 A/20 A 5 A/10 A		
Contact material		Silver based		
Max. switching voltage/power		See load limit curve		
Max. switching current [1] On [2] Off		NC/NO 40 A 30 A		
Min. recommended load [3]		1 A at 5 V		
Voltage drop at 10 A (initial) for NC/NO contacts		. Typ. 30 mV, 300 mV max.		
Mechanical endurance (without load)			> 5 x 10^6 operations	
Electrical endurance at cyclic temperature –40/+23/+85°C and 13.5 V		Resistive load: > 3 x 10^5 operations 20 A on NO-contact	Wiper reverse [4]: > 3 x 10^5 operations 25 A make/5 A break; generator peak - 10 A L = 1.0 mH	Motor reverse blocked: > 1 x 10^5 operations 25 A L = 0.77 mH [5]

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/
[4] Avoid using capacitive protection circuits. It will reduce lifetime.
[5] At 50% ON period: max. make time 15 s.

Load Limit Curve



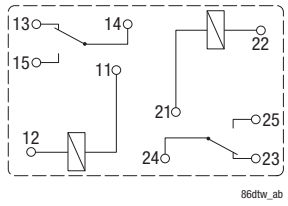
Load limit curve 1 ≙ arc extinguishes during transit time

Load limit curve 2 ≙ safe shutdown, no stationary arc

Double Micro Relay K (THT – THR)

Circuit Diagram

2 Changeover contacts/2 Form C

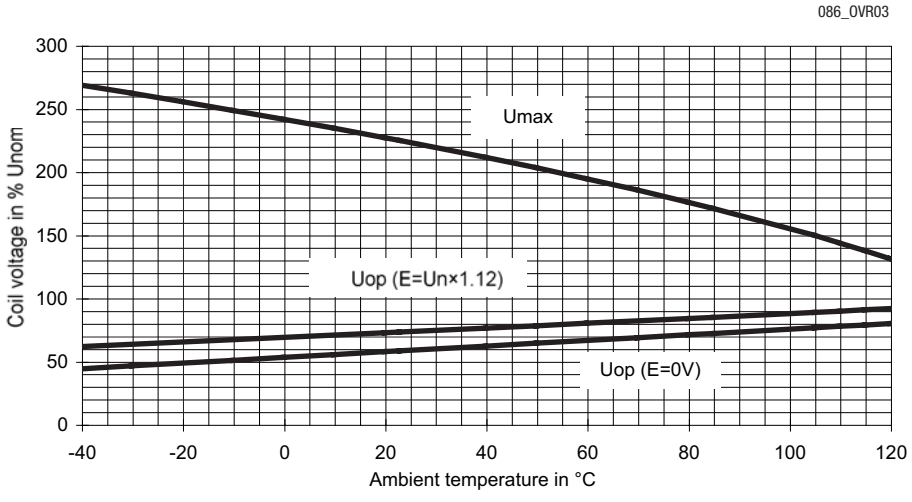


Coil Data	
Available for nominal voltages	10 V / 12 V
Nominal power consumption of the unsuppressed coil at nominal voltage	0.57 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range	–40 to +105°C
Operate time at nominal voltage	Typ. 3 ms
Release time at nominal voltage [1)]	Typ. 1.5 ms

[1)] For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Double Micro Relay K (THT – THR)

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Cold storage	IEC 68-2-1		1000 h	–40°C
Dry heat	IEC 68-2-2	Ba	1000 h	125°C
Climatic cycling with condensation				
THT	EN ISO 6988		20 cycles	Storage 8/16 h
Thermal change	IEC 68-2-14	Nb	35 cycles	–40/+125°C
Thermal shock	IEC 68-2-14	Na	100 cycles	–40/+125°C Dwell time 1 h
Damp heat				
cyclic	IEC 68-2-30	Db, Variant 2	6 cycles	25°C/55°C/93%
constant	IEC 68-2-3	Method Ca	56 days	40°C/93%
Corrosive gas				
THT	IEC 68-2-42		10 days	
THR	IEC 68-2-43		10 days	
Vibration resistance	IEC 68-2-6 (sine pulse form)		10 - 500 Hz 6 g	No change in the switching state > 10 µs
Shock resistance	IEC 68-2-27 (half sine form single pulses)		6 ms up to 30 g	No change in the switching state > 10 µs
Solderability			Hot dip 5 s	Aging 3 (4 h/155°C)
THT	IEC 68-2-20	Ta, Method 1	215°C	for leaded process (Tm = 183°C)
THR	IEC 68-2-58		245°C	for Pb-free process (Tm = 217°C)
Resistance to soldering heat			Hot dip 10 s	with thermal screen
THT	IEC 68-2-20	Tb, Method 1A	260°C	
THR	IEC 68-2-58		260°C	Preheating min 130°C
Sealing				
THT	IEC 68-2-17	Qc, Method 2		1 min/70°C
THR				Open vent hole

Ordering Information

Part Numbers (see table below for coil data)		Contact Arrangement	Contact Material	Enclosure	Soldering Technology
Relay Description	Part Number				
V23086-C2001-A403	1413009-9	2 Form C	Silver based	Sealed	THT
V23086-C2002-A403	8-1419137-4	2 Form C	Silver based	Sealed	THT
V23086-R2801-A403	6-1414920-1	2 Form C	Silver based	Open vent hole	THR
V23086-R2802-A403	6-1414920-2	2 Form C	Silver based	Open vent hole	THR

Coil Versions

Coil Data for DMK – THT/THR	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V)	
					at 23°C	at 105°C
V23086-**001-****	12	254	6.9	1.5	27	18
V23086-**002-****	10	181	5.7	1.25	22	15

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (orders in multiples of delivery pack)

DMK – THT/THR: 990 pieces

Double Micro Relay K SMD (Standard – Open Vent Hole)

Features

- Small twin relay for surface mounted technology
- Limiting continuous current 30 A
- Minimal weight
- Low noise operation
- Relay designed for convection and infra-red reflow soldering
- Standard SMD and SMD with open vent hole versions

- For single version refer to Micro Relay K SMD
- For latching (bistable) version refer to Micro Relay K Latching
- For through hole technology refer to Double Micro Relay K

Typical Applications

- Car alarm
- Door control
- Door lock
- Immobilizer
- Interior lights
- Seat control
- Sun roof
- Window lifter

Please contact Tyco Electronics for relay application support.

86M2_3D1

Design

- ELV/RoHS/WEEE compliant
- SMD (Standard): Sealed type washable
- SMD (Open Vent Hole): sealed type open vent hole

Weight

Approx. 8 g (0.28 oz.)

Nominal Voltage

12 V

Terminals

SMD terminals for assembly on printed circuit boards

Conditions

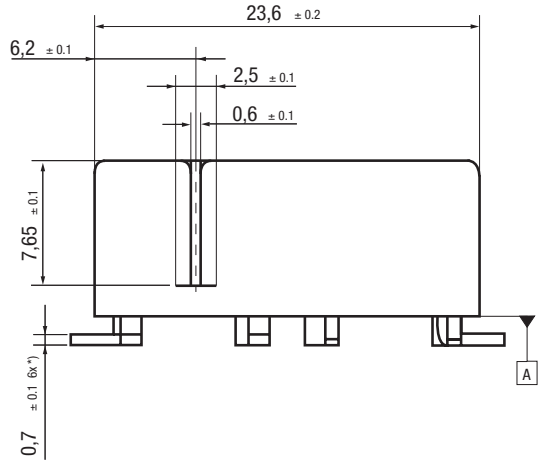
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

Double Micro Relay K SMD (Standard – Open Vent Hole)

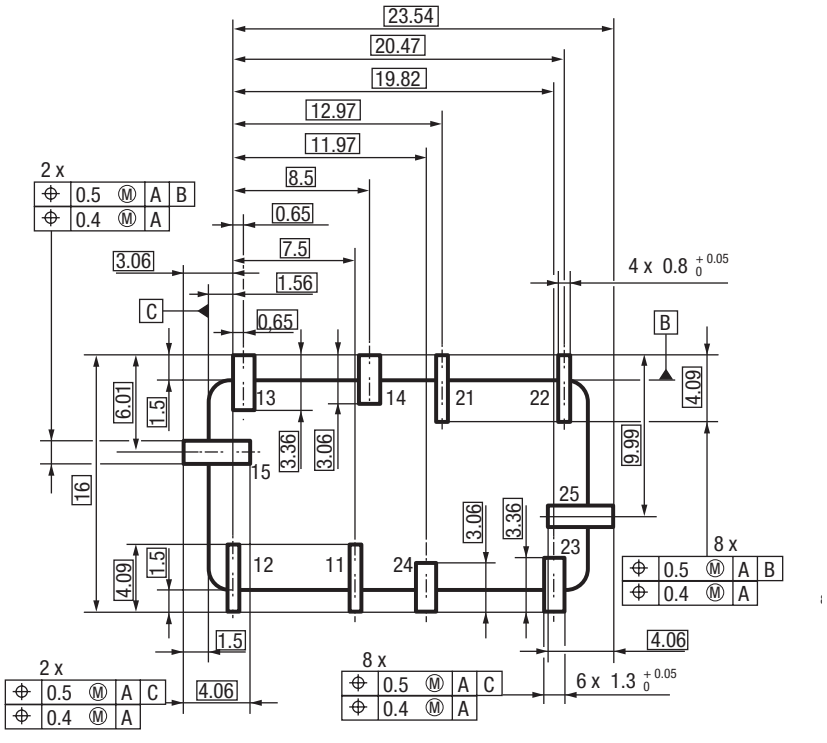
Dimensional Drawing



At terminal tip

*) Dimension without soldering

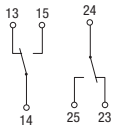
View of the Terminals (bottom view)



Remark: Positional tolerances according to DIN EN ISO 5458

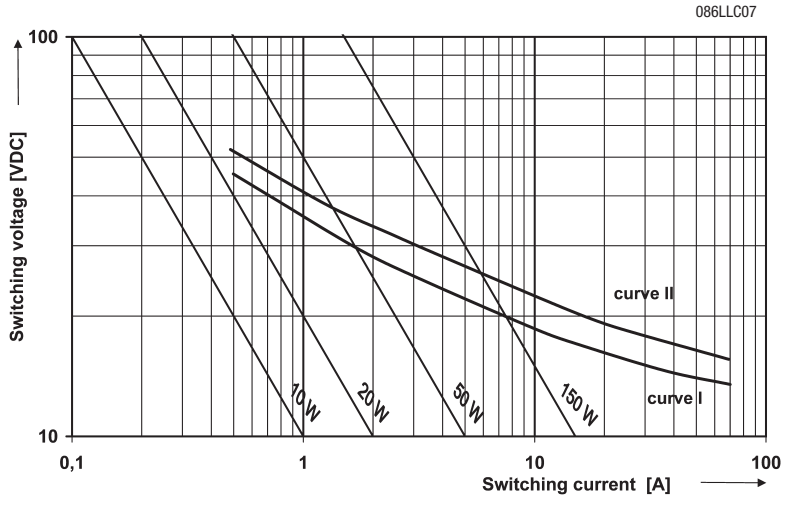
Double Micro Relay K SMD (Standard – Open Vent Hole)

Contact Data

Typical areas of application	Resistive/inductive load		
Contact configuration	2 changeover contacts/ 2 form C		
Circuit symbol (see also Pin assignment)			
Rated voltage	12 V		
Rated current	NC/NO 15 A/20 A		
Limiting continuous current	NC/NO		
23°C	25 A/30 A		
85°C	15 A/20 A		
105°C	5 A/10 A		
Contact material	Silver based		
Max. switching voltage/power	See load limit curve		
Max. switching current [1] On [2] Off	NC/NO 40 A 30 A		
Min. recommended load [3]	1 A at 5 V		
Voltage drop at 10 A (initial) for NC/NO contacts	. Typ. 30 mV, 300 mV max.		
Mechanical endurance (without load)		> 5 x 10^6 operations	
Electrical endurance at cyclic temperature –40/+23/+85°C and 13.5 V	Resistive load: > 3 x 10^5 operations 20 A on NO-contact	Wiper reverse [4]: > 3 x 10^5 operations 25 A make/5 A break; generator peak - 10 A L = 1.0 mH	Motor reverse blocked: > 1 x 10^5 operations 25 A L = 0.77 mH [5]

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/
[4] Avoid using capacitive protection circuits. It will reduce lifetime.
[5] At 50% ON period: max. make time 15 s.

Load Limit Curve



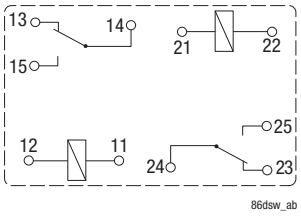
Load limit curve 1 ≙ arc extinguishes during transit time

Load limit curve 2 ≙ safe shutdown, no stationary arc

Double Micro Relay K SMD (Standard – Open Vent Hole)

Circuit Diagram

2 Changeover contacts/2 Form C



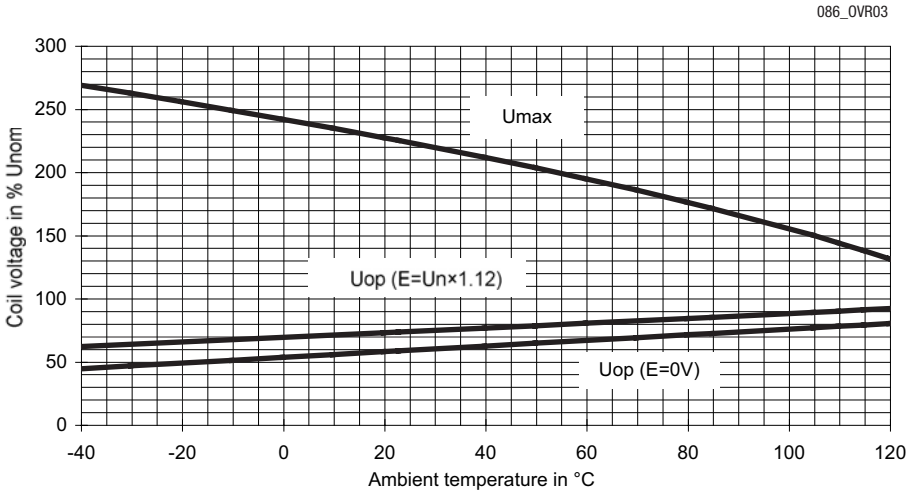
Coil Data

Available for nominal voltages	12 V
Nominal power consumption of the unsuppressed coil at nominal voltage	0.64 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range	–40 to +105°C
Operate time at nominal voltage	Typ. 3 ms
Release time at nominal voltage [1)]	Typ. 1.5 ms

1) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Double Micro Relay K SMD (Standard – Open Vent Hole)

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Cold storage	IEC 68-2-1		1000 h	–40°C
Dry heat	IEC 68-2-2	Ba	1000 h	125°C
Climatic cycling with condensation [1]	EN ISO 6988		20 cycles	Storage 8/16 h
Thermal change	IEC 68-2-14	Nb	35 cycles	–40/+125°C
Thermal shock	IEC 68-2-14	Na	1000 cycles Dwell time 1 h	–40/+125°C
Damp heat cyclic constant	 IEC 68-2-30 IEC 68-2-3	 Db, Variant 2 Method Ca	 6 cycles 56 days	 40°C/55°C/93% 40°C/93%
Corrosive gas [1]	IEC 68-2-42 IEC 68-2-43		10 days 10 days	
Vibration resistance	IEC 68-2-6 (sine pulse form)		10 - 500 Hz 6 g	No change in the switching state > 10 µs
Shock resistance	IEC 68-2-27 (half sine form single pulses)		6 ms up to 30 g	No change in the switching state > 10 µs
Solderability	IEC 68-2-58		Hot dip 5 s 245°C	Aging 3 (4 h/155°C) for leaded process (Tm = 183°C) for Pb-free process (Tm = 217°C)
Resistance to soldering heat	IEC 68-2-58		Hot dip 10 s 260°C	with thermal screen Preheating min 130°C
Sealing Standard Open vent hole	IEC 68-2-17	Qc, Method 2		1 min/70°C Open vent hole

[1] Not applicable for SMD with open vent hole.

Ordering Information

Part Numbers (see table below for coil data)		**Contact Arrangement**	**Contact Material**	**Enclosure**	**Terminals**
Relay Description	**Part Number**				
V23086-M2011-A403	2-1419137-6	2 Form C	Silver based	Sealed	Printed circuit/SMD
V23086-U2011-A403	On request	2 Form C	Silver based	Open vent hole	Printed circuit/SMD

Coil Versions

Coil Data for DMK SMD (Standard – Open Vent Hole)	**Rated Coil Voltage (V)**	**Coil Resistance ±10% (Ω)**	**Must Operate Voltage (V)**	**Must Release Voltage (V)**	**Allowable Overdrive [1] Voltage (V)**	
					at 23°C	**at 105°C**
V23086-**011-****	12	225	6.9	1.5	27	18

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (in reels)

Double Micro Relay K SMD
(Standard – Open Vent Hole): 200 pieces

Double Mini Relay DMR

Features

- Limiting continuous current 30 A
- Easiest PCB routing among all PCB relays

Typical Applications

- Car alarm
- Door control
- Door lock
- Immobilizer
- Seat control
- Sun roof
- Window lifter
- Wiper control

Please contact Tyco Electronics for relay application support.

84C_3d05

Design

- ELV/RoHS/WEEE compliant
- Sealed type washable

Weight

Approx. 10 g (0.35 oz.)

Nominal Voltage

12 V

Terminals

PCB terminals for assembly on printed circuit boards

Conditions

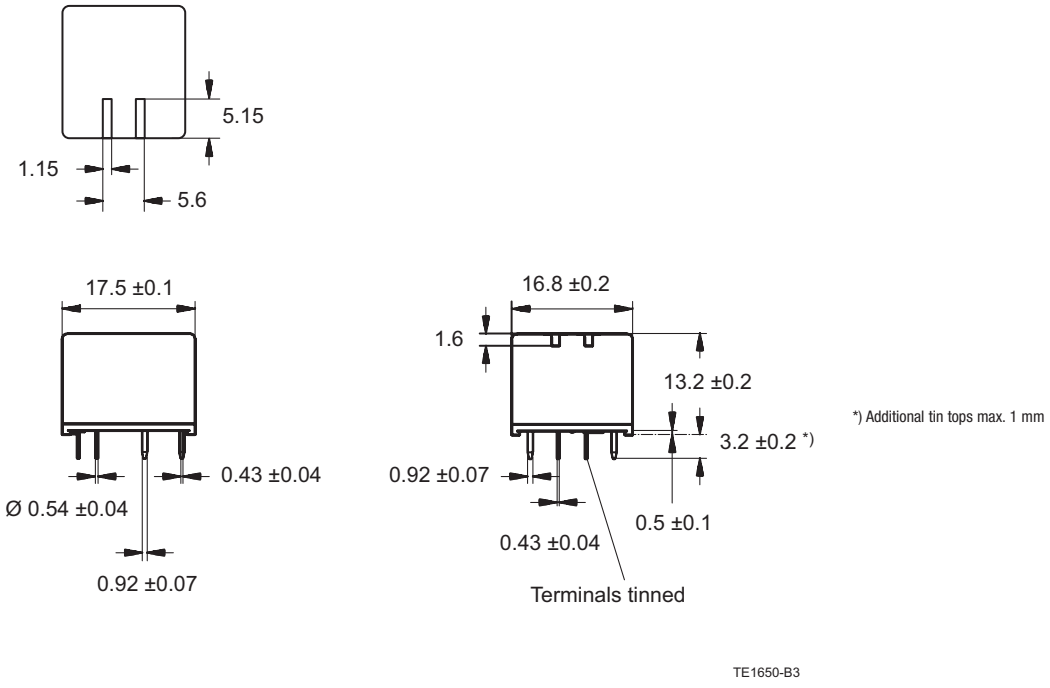
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

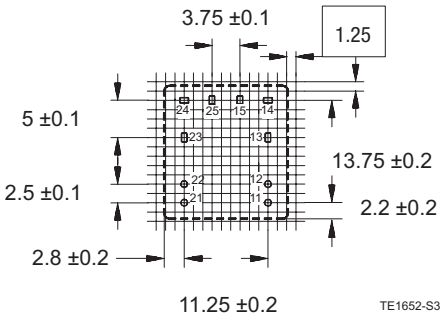
Disclaimer

Double Mini Relay DMR

Dimensional Drawing

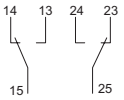


View of the Terminals (bottom view)



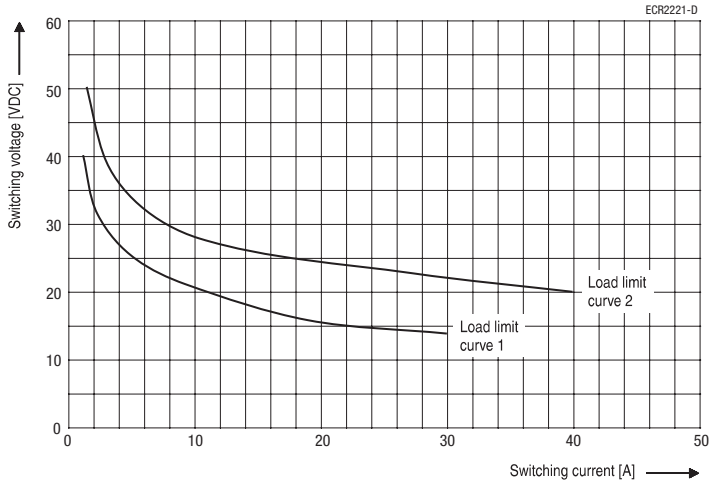
Double Mini Relay DMR

Contact Data

Contact configuration	2 Changeover contacts/ 2 Form C			
Circuit symbol (see also Pin assignment)				
Rated voltage	12 V (standard)			
Rated current	Both systems 15 A/15 A	Motor reverse[1) 3)] 30 A/30 A	Both systems 12 A/12 A	Motor reverse[1) 3)] 30 A/30 A
Limiting continuous current				
23°C	20 A/20 A	30 A/30 A[3)]	18 A/18 A	30 A/30 A[3)]
85°C	15 A/15 A	30 A/30 A	12 A/12 A	30 A/30 A
105°C	0 A	0 A	0 A	0 A
Contact material	AgNi 0,15		$AgSnO_2$	
Max. switching voltage/power	See load limit curve			
Max. switching current[1)] Off	NC/NO 35 A/35 A			
Min. recommended load[2)]	1 A at 5 V			
Voltage drop at 10 A (initial) for NC/NO contacts	Typ. 30 mV, 300 mV max.			
Mechanical endurance (without load)	> 10^7 operations			
Electrical endurance at cyclic temperature –40/+23/+85°C and 13.5 V	Motor reverse blocked: > 10^5 operations at 25 A 0.77 mH inductive load		Lamp load: > 2 x 10^5 operations at 45 A (on), 8 A (off), 13.5 V, 80°C Resistive load: > 2 x 10^5 operations at 20 A, 13.5 V, 80°C	

[1)] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V load voltages.
[2)] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/
[3)] At 50% ON period: max. make time 15 s.

Load Limit Curve



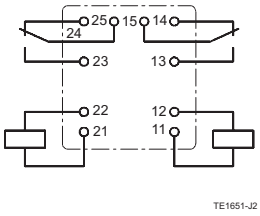
Load limit curve 1 ≙ arc extinguishes during transit time

Load limit curve 2 ≙ safe shutdown, no stationary arc

Double Mini Relay DMR

Circuit Diagram

2 Changeover contacts/2 Form C
PCB terminals

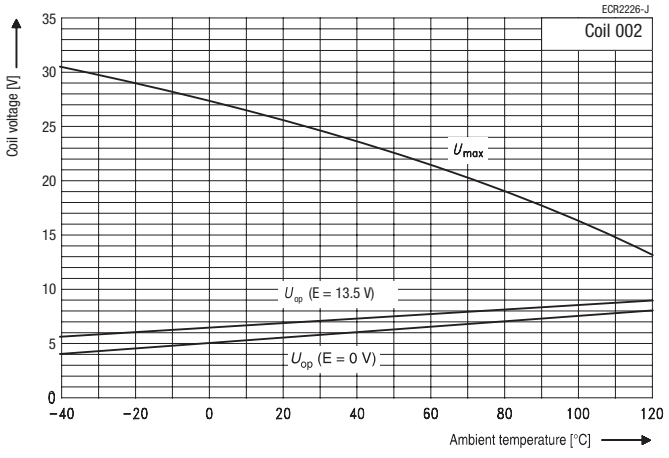


Coil Data	Standard Coil 001	Sensitive Coil 002
Available for nominal voltages	12 V	
Nominal power consumption of the unsuppressed coil at nominal voltage	0.56 W	0.81 W
Test voltage winding/contact	500 VAC_{rms}	
Maximum ambient temperature range	–40 to +85°C	
Operate time at nominal voltage	Typ. 3 ms	
Release time at nominal voltage[1)]	Typ. 1.3 ms	

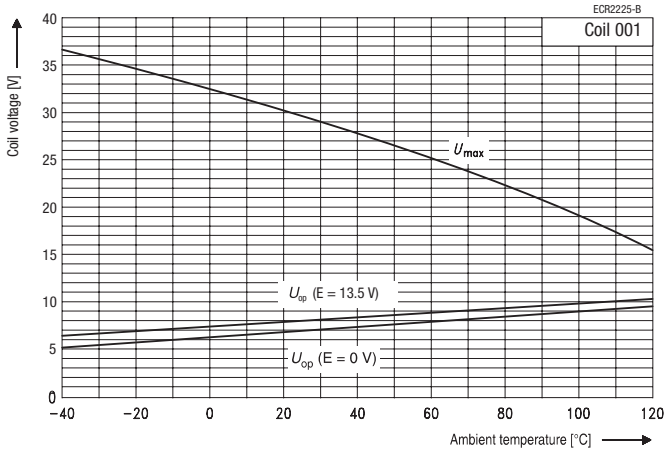
[1)] For unsuppressed relay coil

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization



Does not take into account the temperature rise due to the contact current
E = pre-energization

Double Mini Relay DMR

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Cold storage	IEC 68-2-1		1000 h	–40°C
Dry heat	IEC 68-2-2	Ba	1000 h	125°C
Temperature cycling	IEC 68-2-14	Nb	35 cycles	–40/+125°C
Thermal shock	IEC 68-2-14	Na	1000 cycles	–40/+125°C
Damp heat [1)]				
cyclic	IEC 68-2-30	Db, variant 2	6 cycles	25°C/55°C/93% rh
constant	IEC 68-2-3	Method Ca	56 days	40°C/95% rh[1)]
Resistance to aggressive liquids	VDA-test-conditions 621	Liquid 1-11		48 h/50°C drying
Vibration resistance	IEC 68-2-6 (vibration, sinusoidal) acceleration, depending on position		10 - 200Hz 6 - 30 g	No change in the switching state > 10 µs
Shock resistance	IEC 68 - 2 - 29 (half sine)		6 ms 30 g	No change in the switching state > 10 µs
Solderability	IEC 68-2-20	Ta, method 1	Hot dip 5 s 215°C	Aging 3 (4 h/155°C) for leaded process (Tm = 183°C) for Pb-free process (Tm = 217°C)
Resistance to soldering heat	IEC 68-2-20	Tb, method 1A	Hot dip 10 s 260°C	with thermal screen
Sealing	IEC 68-2-17	Qc, method 2		1 min/70°C
Wipe resistance	IEC 68-2-45	Propanol-2-ol or dest. water	5 min	Room temperature

[1)] Relays have to be dried at 85°C for 24 hours after test.

Ordering Information

Part Numbers (see table below for coil data)		**Contact Arrangement**	**Contact Material**	**Enclosure**	**Terminals**
Relay Description	**Part Number**				
V23084-C2001-A303	1393267-2	2 Form C	AgNi0.15	Immersion cleanable	Printed circuit
V23084-C2002-A303	1-1393267-0	2 Form C	AgNi0.15	Immersion cleanable	Printed circuit
V23084-C2001-A403	1393267-6	2 Form C	$AgSnO_2$	Immersion cleanable	Printed circuit
V23084-C2002-A403	1-1393267-2	2 Form C	$AgSnO_2$	Immersion cleanable	Printed circuit

Coil Versions

Coil Data for DMR	**Rated Coil Voltage (V)**	**Coil Resistance ±10% (Ω)**	**Must Operate Voltage (V)**	**Must Release Voltage (V)**	**Allowable Overdrive [1)] Voltage (V)**	
					at 23°C	**at 85°C**
V23084-**001-****	12	255	6.9	1	31	24
V23084-**002-****	12	178	5.8	0.8	25.8	19.5

[1)] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (orders in multiples of delivery pack)

DMR: 600 pieces

IM Relay

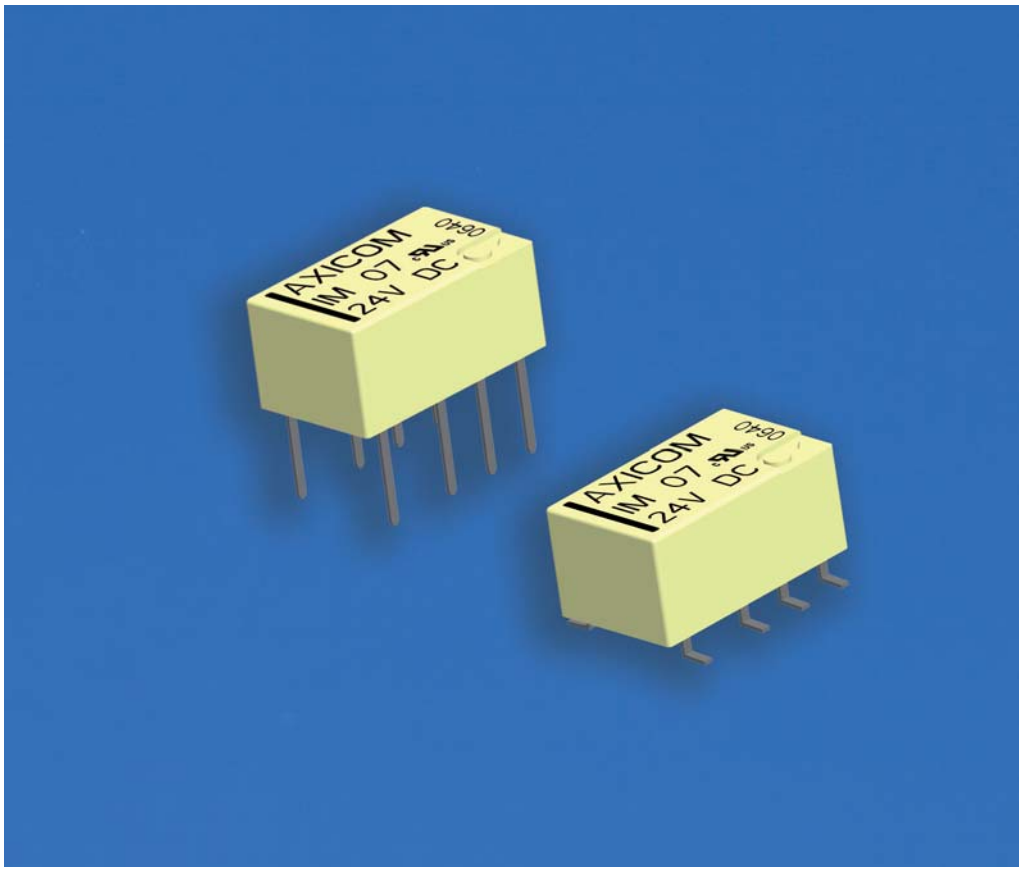
Features

- Smallest PCB Signal relay:
  - Twin IM: 60 mm²
  - L x H x W (mm) 10 x 5.65 x 6
  - Minimum PCB area: 60 mm²
  - Minimum weight: 0.75 g
- Switching current: 0 to 2 (5) A
- 2 changeover contacts (2 Form C)
- Bifurcated contacts, gold plated
- High sensitivity results in low nominal power consumption:
  - 140 mW for non latching standard
  - 100 mW for latching version and non latching high sensitive version
- Ultra high sensitive type 50 mW for non latching
- High mechanical shock resistance up to 50 g functional, up to 500 g damage

Typical Applications

- Special automotive:
  - Car diagnostics – CAN Bus
  - Keyless entry systems
  - Handsfree/Loudspeaker switch
  - Infotainment systems
  - Communications, audio and video systems
  - Mirror control
  - Cross carline low level switching applications

Please contact Tyco Electronics axicom@tycoelectronics.com or http://relays.tycoelectronics.com/axicom/ for further technical information and relay application support.



IM_kop2

Design

- RoHS compliant; (Directive 2002/95/EC) as per product date code 0438
- Slim line and low profile
- Relay types: non-latching with 1 coil, latching with 1 coil
- Hermetically sealed (RTV); protection class IP67
- Hermetically sealing enables stable contact resistance even if relay is only seldomly operated

Weight

Approx. 0.75 g (0.03 oz.)

Nominal Voltage

3, 4.5, 5, 6, 9, 12 or 24 V;

Terminals

2 pole signal relay, polarized

- Through-hole technology (THT)
- Surface mounted device (SMD)

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the "Glossary" page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

P2 Relay

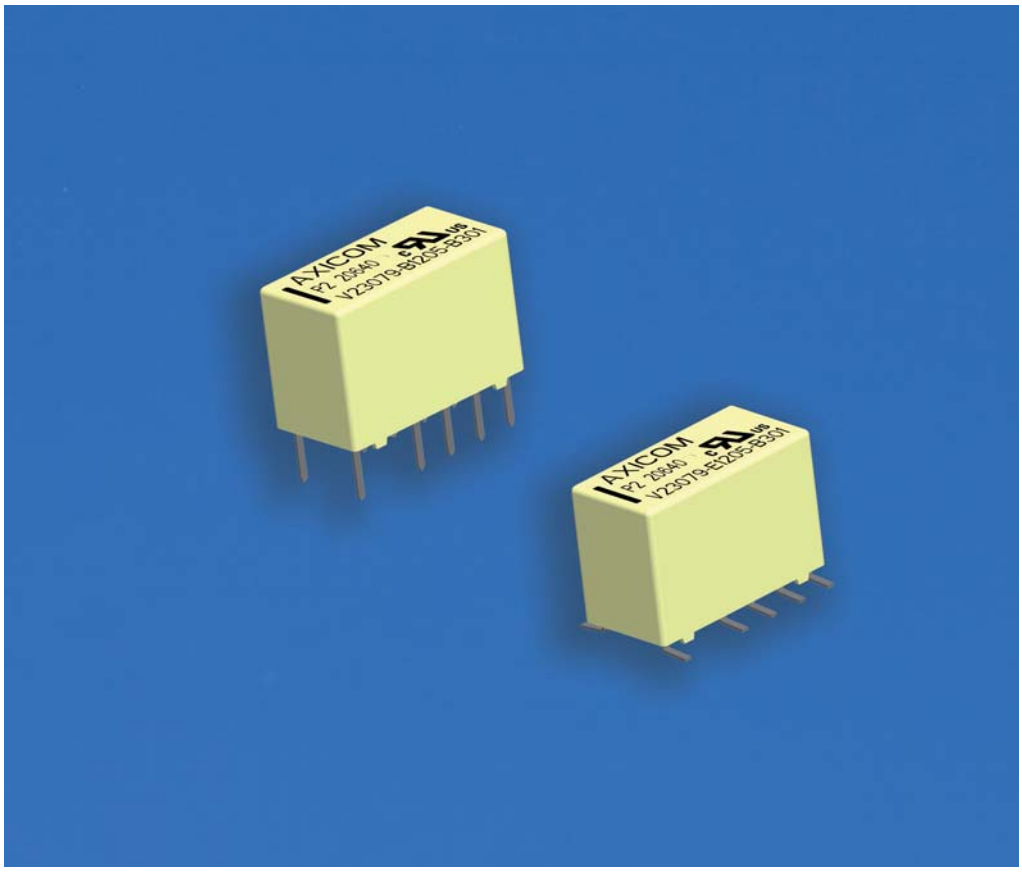
Features

- 2 pole telecom relay, polarized THT or SMD version
  - L x H x W (mm) 14.5 x 9.9 x 7.2
  - Weight: 2.8 g
- Switching current 0 to 2 (5) A
- 2 changeover contacts (2 Form C)
- Bifurcated contacts, gold plated
- High sensitivity results in low nominal power consumption:
  - 140 mW for non latching standard and latching with 2 coils 70 mW for latching with 1 coil
- Highest reliability
- ROHS/ELV compliant
- THT and SMD types

Typical Applications

- Special automotive:
  - Car diagnostics – CAN Bus
  - Keyless entry systems
  - Handsfree/Loudspeaker switch
  - Infotainment systems
  - Communications, audio and video systems
  - Mirror control
  - Cross carline low level switching applications

Please contact Tyco Electronics axicom@tycoelectronics.com or http://relays.tycoelectronics.com/axicom/ for further technical information and relay application support.



P2_kop2

Design

- RoHS compliant; (Directive 2002/95/EC) as per product date code 0427– Slim line and low profile
- Relay types: non-latching with 1 coil, latching with 1 coil or 2 coils
- RTV III; protection class IP67
- Hermetically sealing enables stable contact resistance even if relay is only seldomly operated

Weight

Approx. 2.8 g (0.98 oz.)

Nominal Voltage

3, 4.5, 5, 6, 9, 12 or 24 V;

Terminals

2 pole signal relay, polarized

- Through-hole technology (THT)
- Surface mounted device (SMD)

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

Technical Information

Star Point Relay SPR

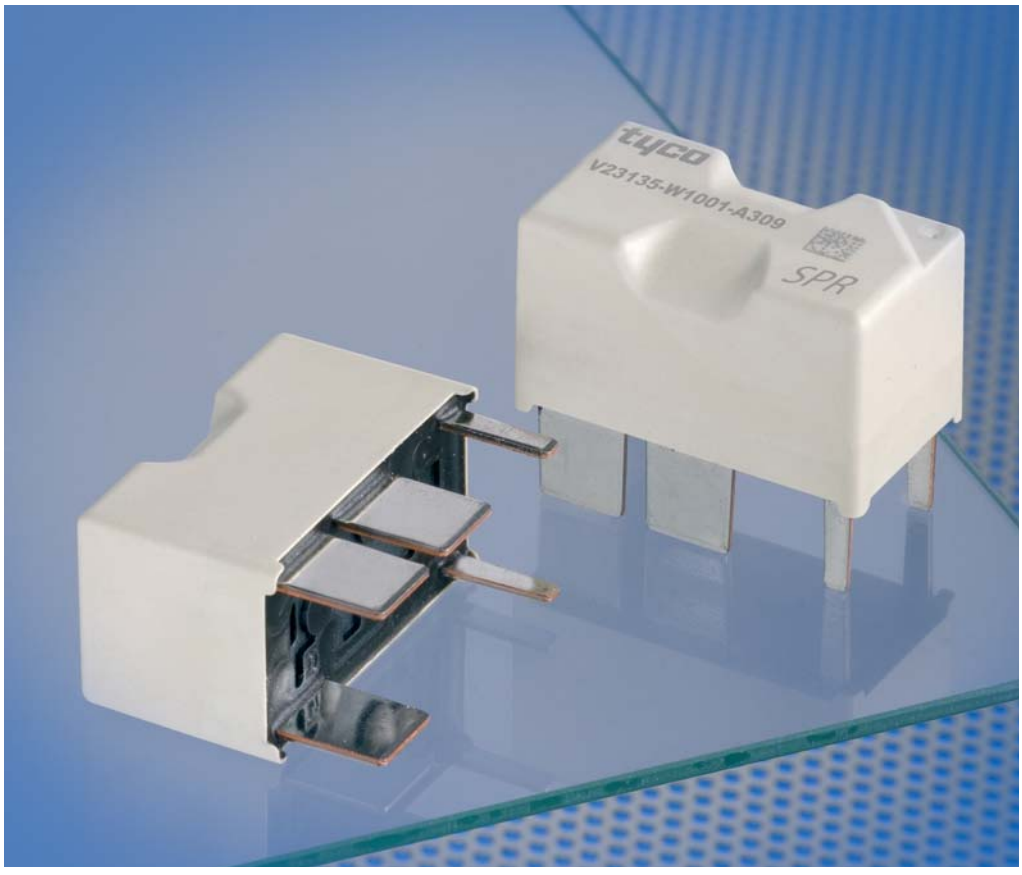
Features

- Full, symmetric star-point disconnection of an electric power steering motor
- Limiting continuous current 90 A
- Disconnection of high over-currents up to 200 A in 12 V and up to 60 A in 36 V power nets
- Contact arrangement fulfills 42 V power net requirements
- Optimized dimensions: L x H x W (in mm) 32 x 17.5 x 18
- Resistant against high ambient temperature up to 135°C
- Contact resistance typ. < 2 mΩ per path for load current 20 A (after fritting)

Typical Applications

- All EPA/EPS applications

Please contact Tyco Electronics for relay application support.



135_3D03

Design

- ELV/RoHS/WEEE compliant
- Sealed: sealing in accordance with IEC 68; immersion cleanable: protection class IP67 to IEC 529 (EN 60 529)

Weight

Approx. 30 g (1.06 oz.)

Nominal Voltage

12 V, 24 V or 42 V

Terminals

Terminals optimized for welding assembly

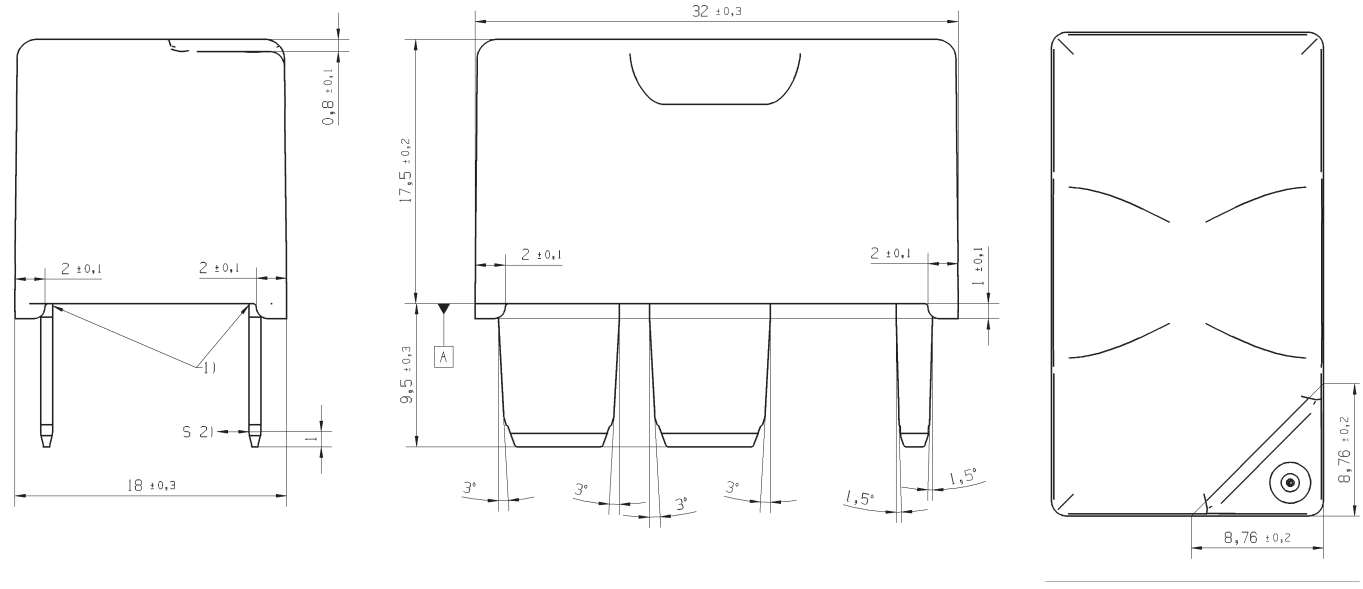
Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

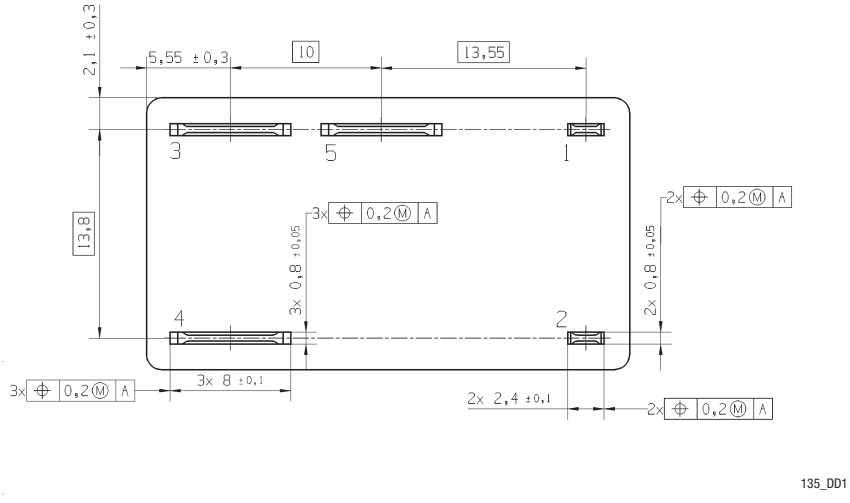
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

Dimensional Drawing



View of the Terminals (bottom view)



1) Epoxy at terminals exceeds max. 0.9 mm over coverage.
2) Permanent acceptable deformation 0.25 mm respectively 0.5 mm temporarily.

Maximum permissible thermal load of the terminals during the resistance welding process depends on leadframe design.

Star Point Relay SPR

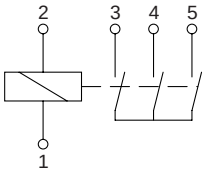
Contact Data

Contact configuration	Triple make contact		
Circuit symbol			
Rated voltage	12 V	–	36 V
Rated current [1]	90 A		
Contact material	AgNi0.15		
Limiting continuous current [1]			
23°C	120 A		
85°C	90 A		
125°C	60 A		
Emergency switch off > 10 cycles without suppression device	200 A [2]	–	60 A [2]
Voltage drop at 90 A (initial) [3] per load path	< 180 mV		
Mechanical endurance (without load)	> 10^6 operations		
Electrical endurance dry switching (I load only carried, not switched) [4]	> 2 x 10^5 operations I load = 120 A at 23°C 500 ms on/off		

[1] Max. terminal temperatures up to 180°C are allowed. Final temperatures depend on the leadframe layout.
[2] Parallel diode is not recommended in any case.
[3] After fritting with 90 A for 30 s.
[4] Important.

Circuit Diagram

T0
1 Triple make contact/Form 3



Coil Data

Available for nominal voltages	12 V
Nominal power consumption of the unsuppressed coil at nominal voltage	1.5 W
Test voltage winding/contact	500 VAC_{rms}
Ambient temperature range	–40 to +125°C
Operate time at nominal voltage	< 20 ms
Release time at nominal voltage [1]	< 10 ms

[1] For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Star Point Relay SPR

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Random vibration	IEC 60068-2-64 Energized Not energized		20 - 1000 Hz Min. 6 g rms Min. 4 g rms	No change in the switching state > 10 µs
Shock resistance	IEC 60068-2-27 (half sine form single pulses) Energized Not energized		6 ms Min. 40 g Min. 10 g	No change in the switching state > 10 µs
Sealing	IEC 60068-2-17	Qc, Method 2		1 min/70°C
Protection class	IEC 529 (EN60529)		IP67	

Ordering Information

Part Numbers (see table below for coil data)		**Circuit/Contact Arrangement**	**Contact Material**	**Enclosure**	**Special Features**
Relay Description	**Part Number**				
V23135-W1001-A309	1-1414704-0	TO/Form 3	AgNi0.15	IP67	Terminals for welding assembly
V23135-W1002-A309	1-1414705-0	TO/Form 3	AgNi0.15	IP67	Terminals for welding assembly

Coil Versions

Coil Data for SPR	**Rated Coil Voltage (V)**	**Coil Resistance ±10% (Ω)**	**Must Operate Voltage at 23°C (V)**	**Must Release Voltage at 23°C (V)**
V23135-W1001-****	12	150	6.2	1.0
V23135-W1002-****	10	97	5.0	0.8

Standard Delivery Packs (orders in multiples of delivery pack)

SPR: 357 pieces

High Current Relay 75

Features

– Limiting continuous current 75 A

Typical Applications

– Rear window defogger
– Battery disconnection
– Power distribution (clamp 15)
– Glow plug relay

Please contact Tyco Electronics for relay application support.

232_3D1

Design

– ELV/RoHS/WEEE compliant
– Dustproof; protection class IP54 to IEC 529 (EN 60 529)
– Sealed: sealing in accordance with IEC 68; immersion cleanable: protection class IP67 to IEC 529 (EN 60 529)

Weight

Approx. 38 g (1.3 oz.)

Nominal Voltage

12 V or 24 V

Terminals

– Quick connect terminals (coil)
– Screw terminals (load)

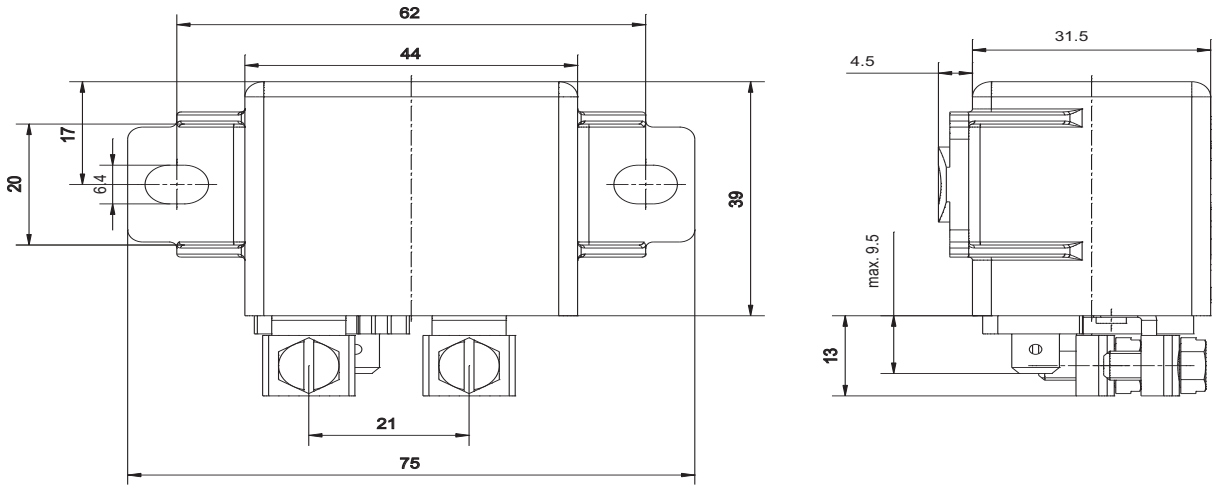
Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

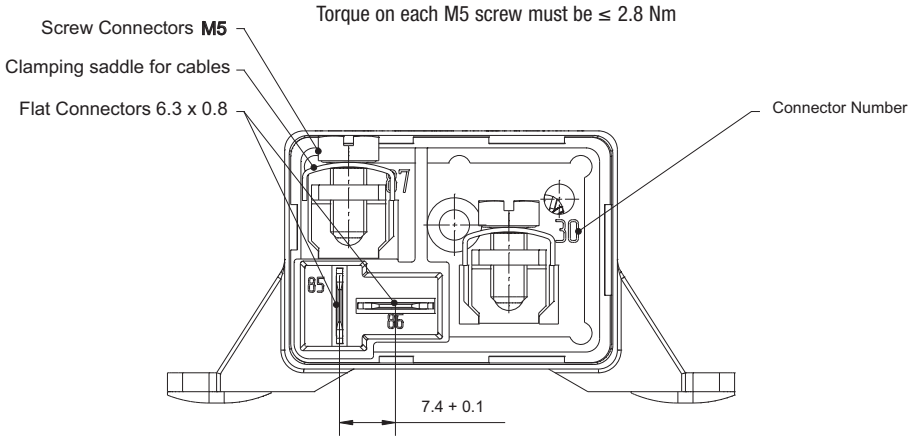
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

Dimensional Drawing



View of the Terminals (bottom view)



Fitting connector for coil terminals 85 and 86 is Tyco Electronics' 2 way FF receptacle housing Part Number 180907

High Current Relay 75

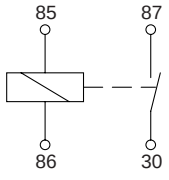
Contact Data

Contact configuration	1 Make contact/ 1 Form A		1 Bifurcated contact (Double contact make)/ 1 Form A (bifurcated)
Circuit symbol (see also Pin Assignment)			
Rated voltage	12 V	24 V	24 V
Rated current	50 A	30 A	50 A
Limiting continuous current			
23°C	75 A	50 A	75 A
85°C	50 A	30 A	50 A
105°C	20 A	8 A	20 A
Contact material	Silver based		
Max. switching voltage/power	See load limit curve		
Max. switching current [1]			
On [2]	75 A	50 A	150 A
Off	75 A	50 A	100 A
Min. recommended load [3]	1 A at 5 V		
Voltage drop at 100 A (initial)	Typ. < 100 mV, 200 mV max.		Typ. < 50 mV, 200 mV max.
Mechanical endurance (without load)	> 10^6 operations		
Example of electrical endurance with resistive load and copper wire with cross section ≥ 10 mm²	> 1.25 x 10^5 operations at 23°C 75 A on NO, 13.5 V	> 1 x 10^5 operations at 85°C 75 A on NO, 13.5 V	> 5 x 10^4 operations at 23°C 50 A on NO, 27 V
Max switching rate at nominal load	6 operations per minute (0.1 Hz)		

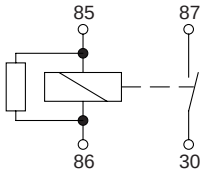
[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V or 27 V for 24 V load voltages.
[2] For a resistive load of maximum 1 s on and a minimum of 45 s off.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Circuit Diagram

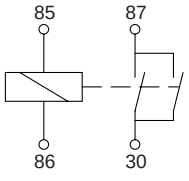
A0
1 Make contact/1 Form A



AR
1 Make contact/1 Form A
with Resistor



E0
1 Bifurcated contact (Double contact make)/
1 Form A (bifurcated)



Polarity for all HCR 75: Terminals 30 and 86 on +

Coil Data

Available for nominal voltages	12 V / 24 V
Nominal power consumption of the unsuppressed coil at nominal voltage	3.1 W / 4.4 W
Nominal power consumption at nominal voltage with suppression resistor	7.2 W / n.a.
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 7 ms
Release time at nominal voltage [1]	Typ. 2 ms

[1] For unsuppressed relay coil.

Note:

A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

High Current Relay 75

Mechanical Data	
Cover retention	
Axial force	150 N
Pull force	200 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures.

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation	EN ISO 6988		6 cycles	Storage 8/16 h
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat				
cyclic	IEC 68-2-30	Db	6 cycles	Upper air temperature 55°C
constant	IEC 68-2-3	Ca	56 days	
Corrosive gas	IEC 68-2-42	10 ±2 cm^3/m^3 SO_2	10 days	
	IEC 68-2-43	1 ±0.3 cm^3/m^3 H_2S	10 days	
Vibration resistance	IEC 68-2-6 (sine sweep)		10 - 500 Hz min. 5 g	No change in the switching state > 10 µs Valid for NC contacts, NO contact values significantly higher
Shock resistance	IEC 68-2-27 (half sine form single pulses)		11 ms min. 20 g	
Load dump	ISO 7637-1 (12 V)	Test pulse 5	Vs = +86.5 V	
	ISO 7637-2 (24 V)	Test pulse 5	Vs = +200 V	
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			

[1] FMVSS: Federal Motor Vehicle Safety Standard.

Ordering Information

Part Numbers (see table below for coil data)		Circuit/Contact Arrangement	Contact Material	Enclosure	Coil Suppression
Relay Description	Part Number				
12 V					
V23232-D0001-X001	1904000-1	E0/1 Form A (bifurcated)	Silver based	Dust cover	
V23232-A0001-X005	2-1904001-3	AR/1 Form A	Silver based	Dust cover	Resistor
24 V					
V23232-A0002-X008	1904001-4	A0/1 Form A	Silver based	Dust cover	

Coil Versions

Coil Data for HCR 75	Rated Coil Voltage (V)	Coil Resistance [3] ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V)	
					at 23°C	at 100°C
V23232-D0001-X001	12	46	8.8	1.5	22	15
V23232-A0001-X005	12	20 [2]	7.5	0.5	22	15
V23232-A0002-X008	24	130	19.0	1.0	32	32

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.
[2] Including resistor as suppression device.
[3] Measured between the terminals 85 and 86.

Standard Delivery Packs (orders in multiples of delivery pack)

HCR 75: 50 pieces

High Current Relay 150

Features

- Limiting continuous current 150 A at 85°C
- Current switching ability up to 300 A
- Suitable for voltage levels up to 42 V
- Heat, moisture and vibration resistant
- Minimal contact resistance
- Dustproof and sealed versions

Typical Applications

- Engine control
- Glow Plug
- Heated front screen
- Preheating systems (e.g. for diesel engines, catalytic converters)
- Switches for loading ramps

Please contact Tyco Electronics for relay application support.

132_3D5

Design

- ELV/RoHS/WEEE compliant
- Dustproof; protection class IP 54 to IEC 529 (EN 60 529)
- Sealed: sealing in accordance with IEC 68; immersion cleanable: protection class IP67 to IEC 529 (EN 60 529)

Weight

Approx. 220 g (7.8 oz.)

Nominal Voltage

12 V, 24 V or 42 V

Terminals

- Quick connect terminals (coil)
- Screw terminals (load)

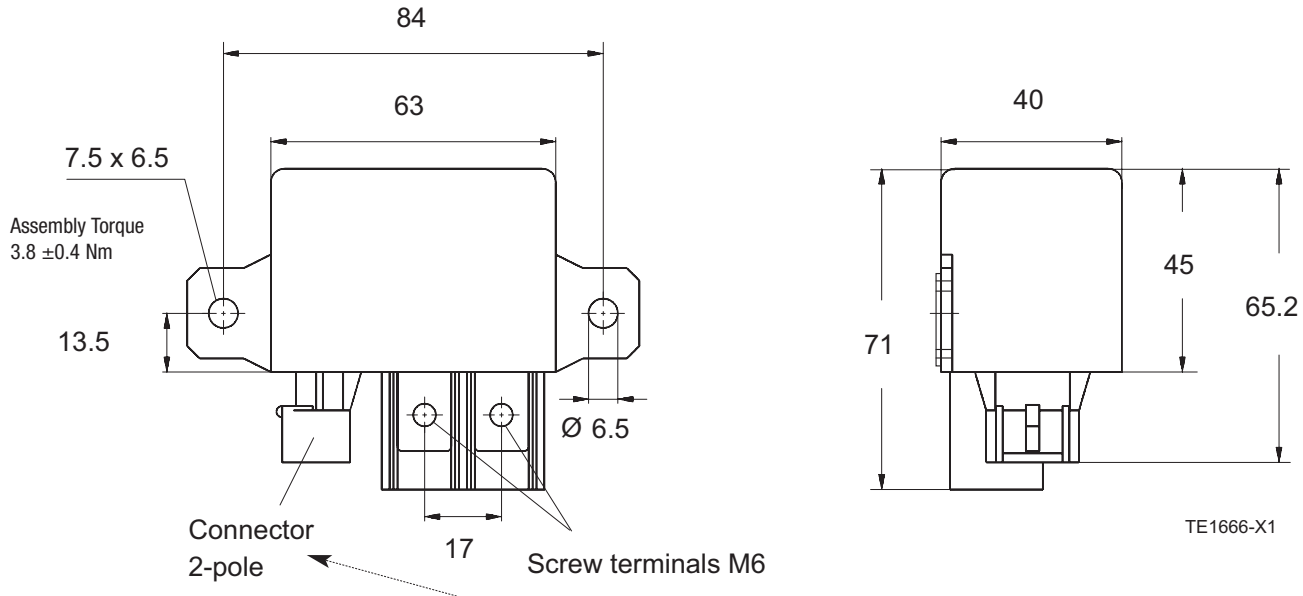
Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

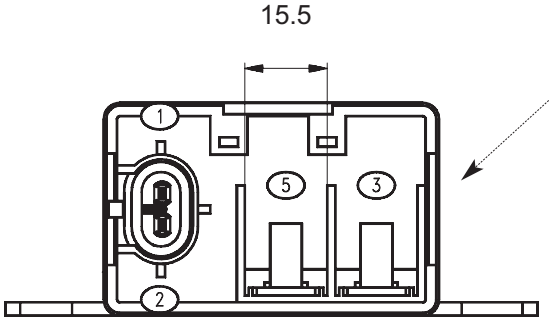
Dimensional Drawing



Connector Information
AMP SUPERSEAL 1.5 SERIES

Coil side	
- Receptacle connector	282080-1
- Single wire seal	281934-2
- Contact	282110-1
Load side	
- Thimble	710026-0

View of the Terminals (bottom view)



TE1667-61

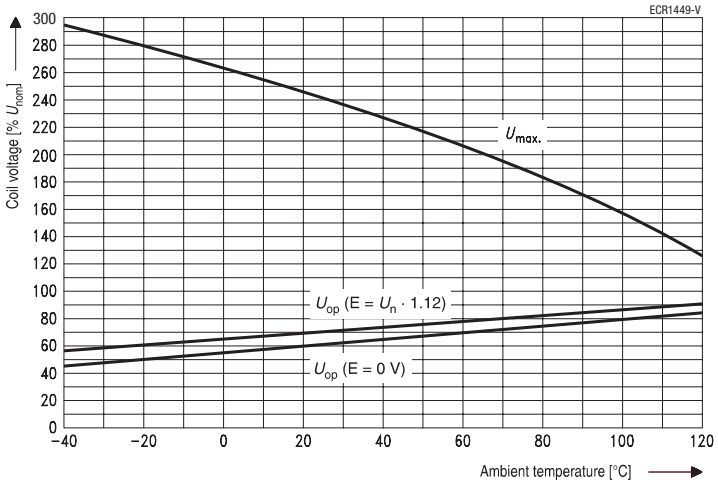
High Current Relay 150

Contact Data

Contact configuration		1 Make contact/ 1 Form A		1 Double make contact/ 1 Form X	
Circuit symbol (see also Pin Assignment)					
Rated voltage		12 V	12 V	24 V	24 V
Rated current					
Cable 16 mm²		130 A	120 A	120 A	100 A
Cable 25 mm²		150 A	130 A	135 A	120 A
Limiting continuous current					
Cable 16 mm²	23°C	150 A	130 A	140 A	120 A
	85°C	130 A	120 A	120 A	100 A
	125°C	70 A	60 A	60 A	50 A
Limiting continuous current					
Cable 25 mm²	23°C	200 A	180 A	180 A	170 A
	85°C	150 A	130 A	135 A	120 A
	125°C	80 A	70 A	70 A	60 A
Contact material		AgNi0.15	$AgSnO_2$	AgNi0.15	$AgSnO_2$
Max. switching current [1]					
On [2]		150 A	300 A	150 A	300 A
Off		150 A	300 A	150 A	300 A
Min. recommended load [3]		1 A at 5 V			
Voltage drop at 100 A (initial)		Typ. 50 mV, 100 mV max.	Typ. 70 mV, 200 mV max.	Typ. 70 mV, 200 mV max.	Typ. 70 mV, 400 mV max.
Mechanical endurance (without load)		$> 10^7$ operations			
Electrical endurance at 23°C; 1 s: on, 5 s: off (example of resistive load)		$> 3 \times 10^4$ operations 150 A, 13.5 V	$> 5 \times 10^4$ operations 300 A, 13.5 V	$> 1 \times 10^4$ operations 150 A, 27 V	$> 5 \times 10^4$ operations 200 A, 27 V
Max switching rate at nominal load		6 operations per minute (0.1 Hz)			

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V or 27 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Operating Voltage Range

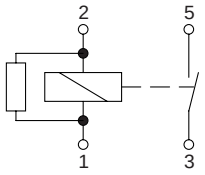


Does not take into account the temperature rise due to the contact current
E = pre-energization

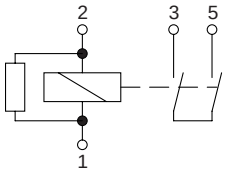
High Current Relay 150

Circuit Diagram

AR
1 Make contact/1 Form A
with Resistor



XR
1 Double make contact/1 Form X
with Resistor



Coil Data

Available for nominal voltages	12 V / 24 V (other coils on request)
Nominal power consumption of the unsuppressed coil at nominal voltage	3.3 W
Nominal power consumption at nominal voltage with suppression resistor	4.1 W
Test voltage winding/contact	1000 VAC_{rms}
Maximum ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 25 ms
Release time at nominal voltage [1)]	Typ. 8 ms

[1)] For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Mechanical Data

Cover retention	
Axial force	500 N
Pull force	500 N
Push force	500 N
Terminals	
Pull force	150 N
Push force	150 N
Resistance to bending, force applied to front	20 N [1)]
Resistance to bending, force applied to side	20 N [1)]
Max. torsion of screw bolts	5 Nm
Enclosures	Protects relay from dust. For use in passenger compartment or enclosures.
Dust cover	Please refer to the Application Notes in this catalog.

[1)] Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

High Current Relay 150

Environmental Conditions				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Dry heat	IEC 68-2-2	Ba	500 h	100°C
Damp heat constant	IEC 68-2-3	Ca	500 h	40°C, 93% RH
Industrial atmosphere	IEC 68-2-60	Method 4	21 days	25°C
Corrosive gas	IEC 68-2-42 IEC 68-2-43	10 ±2 cm^3/m^3 SO_2 1 ±0.3 cm^3/m^3 H_2S	10 days 10 days	
Vibration resistance Shock resistance	IEC 68-2-6 (sine sweep) IEC 68-2-27 (half sine form single pulses)		10 - 200 Hz 5 g 6 ms min. 20 g	No change in the switching state > 10 µs Valid for NC contacts, NO contact values significantly higher
Load dump	ISO 7637-1 (12 V)	Test pulse 5	Vs = +86.5 V	
	ISO 7637-2 (24 V)	Test pulse 5	Vs = +200 V	
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			

[1] FMVSS: Federal Motor Vehicle Safety Standard.

Ordering Information

Part Numbers (see table below for coil data) Relay Description	Part Number	Nominal Voltage	Circuit/Contact Arrangement	Contact Material	Protection Class according to IEC 529 (EN 60 529)
12 V					
V23132-A2001-A100	1393315-1	12 V	AR/1 Form A	AgNi0.15	IP54
V23132-A2001-A200	1393315-2	12 V	AR/1 Form A	$AgSnO_2$	IP54
V23132-A2001-B100	1393315-3	12 V	AR/1 Form A	AgNi0.15	IP67
V23132-A2001-B200	1416010-1	12 V	AR/1 Form A	$AgSnO_2$	IP67
24 V					
V23132-B2002-A100	1393315-8	24 V	XR/1 Form X	AgNi0.15	IP54
V23132-B2002-A200	1393315-9	24 V	XR/1 Form X	$AgSnO_2$	IP54
V23132-B2002-B100	1-1414428-0	24 V	XR/1 Form X	AgNi0.15	IP67
V23132-B2002-B200	1-1393315-1	24 V	XR/1 Form X	$AgSnO_2$	IP67

Coil Versions

Coil Data for HCR 150	Rated Coil Voltage (V)	Coil Resistance (Ω) without suppression device	Coil Resistance (Ω) with suppression device	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive [1] Voltage (V) at 23°C	Allowable Overdrive [1] Voltage (V) at 85°C
V23132-**001-****	12	44	37	7.2	1.2	27	20
V23132-**002-****	24	178	141	14.4	2.4	54	38

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Standard Delivery Packs (orders in multiples of delivery pack)

HCR 150: 10 pieces

Battery Disconnect Switch BDS-A

Features

- Limiting continuous current 190 A at 85°C
- Electrically settable and resettable ON/OFF bistable device
- Suitable for voltage levels up to 42 V
- High peak current carrying capability up to 1500 A

Typical Applications

- Preheating systems (e.g. for diesel engines, catalytic converters)
- Battery disconnection to prevent fire caused by short circuits during an accident
- Dual battery applications provide the start reliability by a separate starter battery
- Energy-management
- Keeps the power net in balance and to control and secure the health of the energy storage systems
- Seasonal, service and transport deactivation

Please contact Tyco Electronics for relay application support.

130-C_3D2

Design

- ELV/RoHS/WEEE compliant
- Dustproof; protection class IP54 to IEC 529 (EN 60 529)
- Weatherproof protection

Weight

Approx. 210 g (7.41 oz.)

Nominal Voltage

12 V or 24 V

Terminals

- Quick connect terminals (coil)
- Screw terminals (load)

Conditions

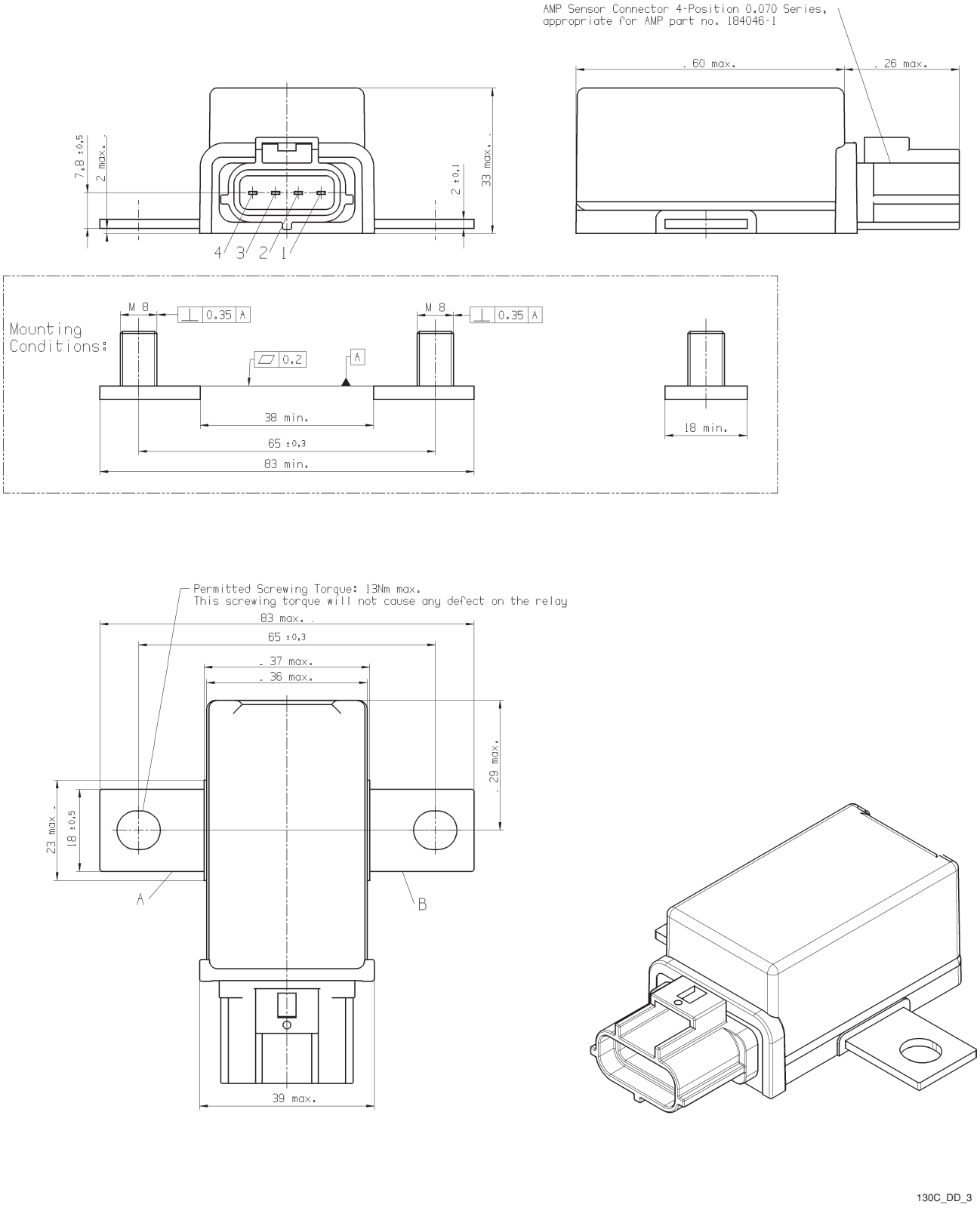
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

Battery Disconnect Switch BDS-A

Dimensional Drawing



130C_DD_3

Battery Disconnect Switch BDS-A

Contact Data for cable size ≥ 50 mm²

Contact configuration		Form X	
Circuit symbol [1), 2)]			
Rated voltage		12 V	24 V
Rated current		190 A	
Limiting continuous current			
	23°C	260 A	
	85°C	190 A	
	125°C	88 A	
Contact material		Silver based	
Load current		From terminal B to A	
Carrying capability: 1000 A 1 s on, 9 s off, 23°C, 50 mm²		50.000 operations [3)]	
Carry starter current: 1500 A-0.2 s/600 A-5 s on, 60 s off, 23°C, 50 mm²		50.000 operations [3)]	
Voltage drop at 100 A (initial, after 1 min)		< 40 mV	
Electrical endurance: 180 A 0.1 mH 1.5 s on, 5 s off, (–40/25/120)°C/2 h each, 35 mm²		13.000 operations	–
Electrical endurance: 100 A 0.1 mH 1.5 s on, 5 s off, (–40/25/120)°C/2 h each, 35 mm²		50.000 operations	–
Electrical endurance: 150 A 0.1 mH 0.5 s on, 5 s off, (–40/25/120)°C/2 h each, 35 mm²		–	25.000 operations
Electrical endurance: 100 A 0.1 mH 0.5 s on, 5 s off, (–40/25/120)°C/2 h each, 35 mm²		–	70.000 operations
Switching capability: 1500 A 0.5 s on, 10 min off, 23°C, 50 mm² resistive load		5 operations [3)]	
Max. temperature at load terminals		140°C	
Mechanical shock, half sine, 6 ms, 6 directions (OFF→ON)		40 g [3)]	

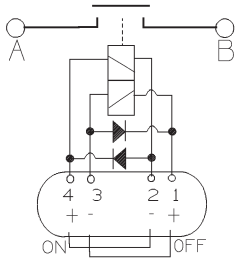
1) Delivery status “ex works”.

2) Refer to *Latching Relay* in the “Glossary”.

3) Values are influenced by system temperature and load current. For further details please consult our Technical Application Engineers.

Circuit Diagram

X2C2D
1 Double make contact/1 Form X
with 2 Coils and 2 Diodes



Terminal	Function
4	Set Coil (+)
3	Reset Coil (-)
2	Set Coil (-)
1	Reset Coil (+)
A	Load Terminal
B	Load Terminal

Set = A and B get connected

130C_PA_3

Coil Data

Available for nominal voltages	12 V	24 V
Must operate voltage at 20°C (ON→OFF→ON) [1)]	6 V	12 V
Non operate voltage at 20°C [1)]	2 V	4 V
Test voltage winding/contact, contact-contact [1)]	500 VAC_{rms}	
Ambient temperature range	–40 to +120°C	
Coil excitation pulse length recommended/maximum	50 ms/100 ms	
Switching time at 14 V	ON-OFF typ. 5 ms/OFF-ON typ. 5 ms	
Noise level [2)]	Typ. 86 dB (A)	

1) Values are influenced by system temperature and load current. For further details please consult our Technical Application Engineers.

2) Equivalent average sound pressure level leq, switch cycled with 1 Hz, microphone distance 10 cm, measuring time 15 s.

Battery Disconnect Switch BDS-A

Environmental Conditions			
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/		
Test	Relevant standard Testing as per	Dimension	Comments
Vibration resistance [1)]	IEC 68-2-6 (sine sweep)	22 - 500 Hz, min. 10 g	No change in the switching state > 10 µs
Shock resistance [1)]	IEC 68-2-27	11 ms, min. 40 g	No change in the switching state > 10 µs
Sealing	EN 60529 (IEC 529)	IP54	

1) Values are influenced by system temperature and load current. For further details please consult our Technical Application Engineers.

Ordering Information

Part Numbers (see table below for coil data)		**Circuit/Contact Arrangement**	**Contact Material**	**Enclosure**
Relay Description	**Part Number**			
V23130-C2021-A412	1-1414939-4	1 Form X/1 Double make contact	Silver based	IP54
V23130-C2421-A431	7-1414778-3	1 Form X/1 Double make contact	Silver based	IP54

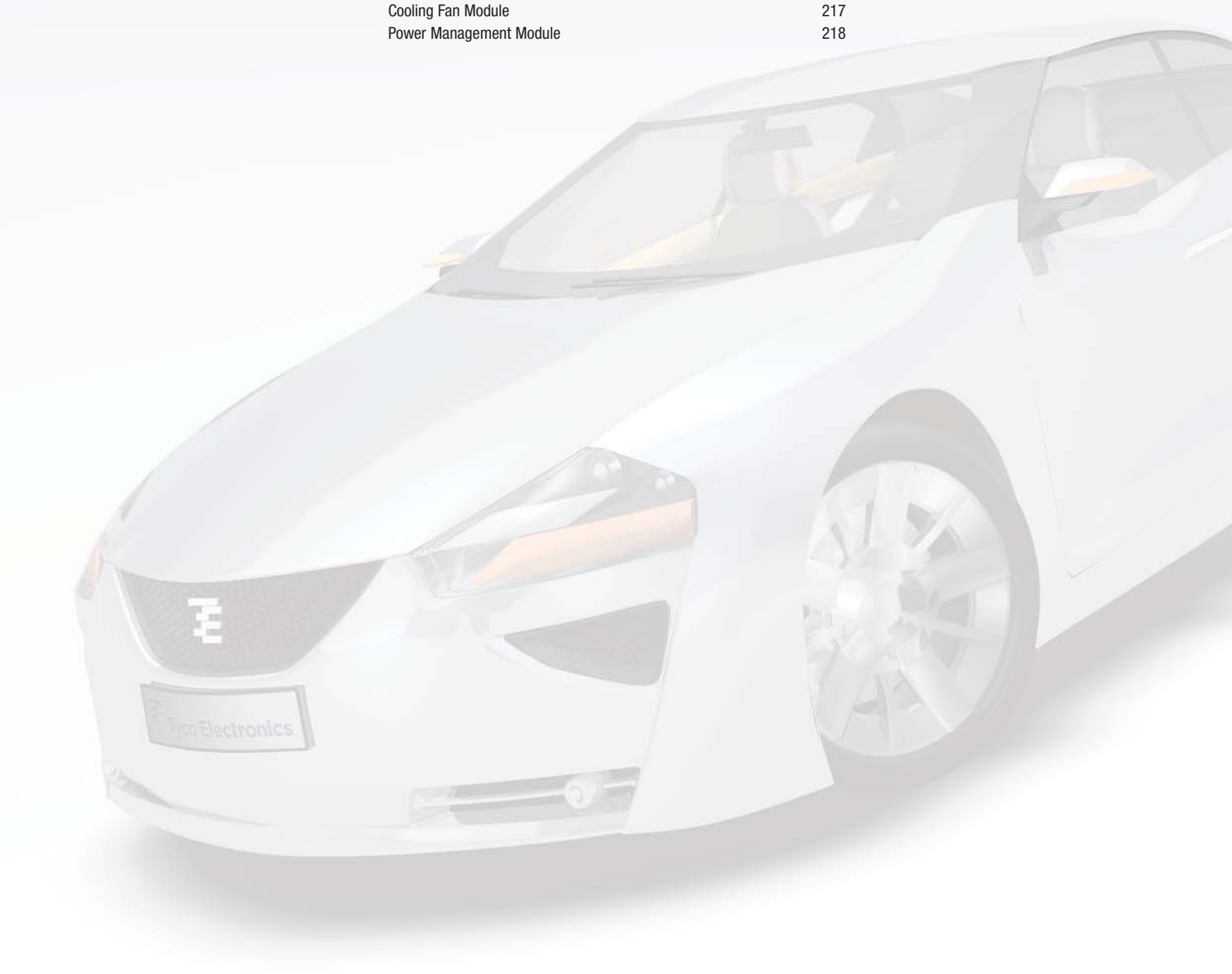
Coil Versions

Coil Data for BDS-A	**Rated Coil Voltage (V)**	**Coil Resistance ±10% (Ω)**	**Must Operate Voltage at 20°C (V)**	**Must Release Voltage at 20°C (V)**
V23130-C2021-****	12	4.7	6.0 (Set-Reset)	6.0 (Set-Reset)
V23130-C2421-****	24	19.9	12.0 (Set-Reset)	12.0 (Set-Reset)

Standard Delivery Packs (orders in multiples of delivery pack)

BDS-A: 24 pieces

Technical Information



Power Module Relay F4/F7

Description

Modular unit based on Power Relay F4/F7 to be customized with one or more relays, electronics or further components. Examples shown on page 215.

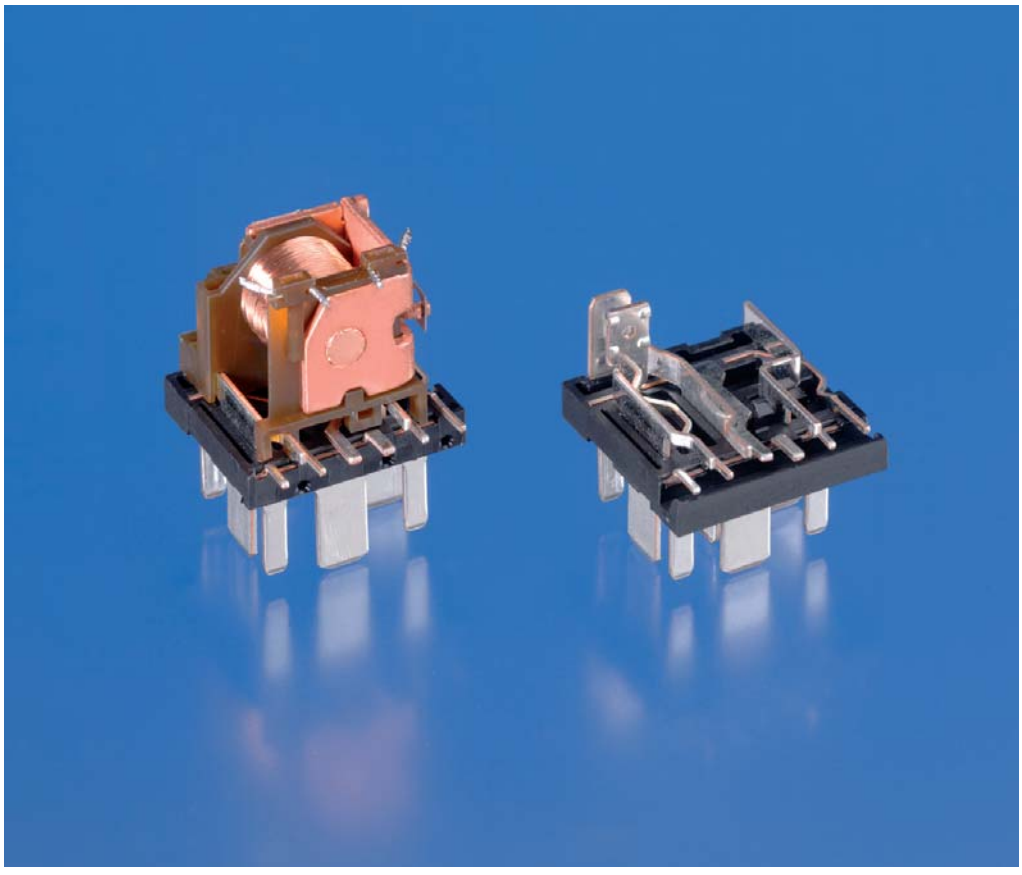
Features

- Limiting continuous current up to 70 A
- Pin assignment according to ISO 7588 part 1
- Terminals 1, 2, 6, 7, 8, 9 are optional. Terminals 3, 4, 5 are fixed in function (make or changeover contacts)
- Terminals prepared for soldering to an integrated printed circuit board
- For relay operation a printed circuit board or leadframe is required
- Mounting bracket or clip on request
- Also applicable for 42 V loads (please contact our specialists)

Typical Applications

- Automatic wash/ wiper control
- Battery disconnection
- Cooling fan controls
- Energy distribution
- Fuel/water pump control unit
- Flexible control unit functions
- Light control applications
- Motor antennas
- Over voltage protection
- Power management
- Power outlet control
- Power window actuator
- Rear window defogger
- Seat adjustment
- Seat and stationary heating
- Timer
- Wiper control

Please contact Tyco Electronics for relay application support.



140_kop1

Design

- ELV/RoHS/WEEE compliant
- Dustproof; protection class IP54 to IEC 529 (EN 60 529)

Weight

- Power Module F4: approx. 35 g (1.2 oz.)
- Power Module F7: approx. 38 g (1.3 oz.)

Nominal Voltage

12 V or 24 V; other nominal voltages available on request

Terminals

- Power Module F4: Quick connect terminals similar to ISO 8092-1, coil and load 6.3 x 0.8 mm; surfaces tin plated
- Power Module F7: Quick connect terminals similar to ISO 8092-1, coil 6.3 x 0.8 mm, load 9.5 x 1.2 mm; surfaces tin plated

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

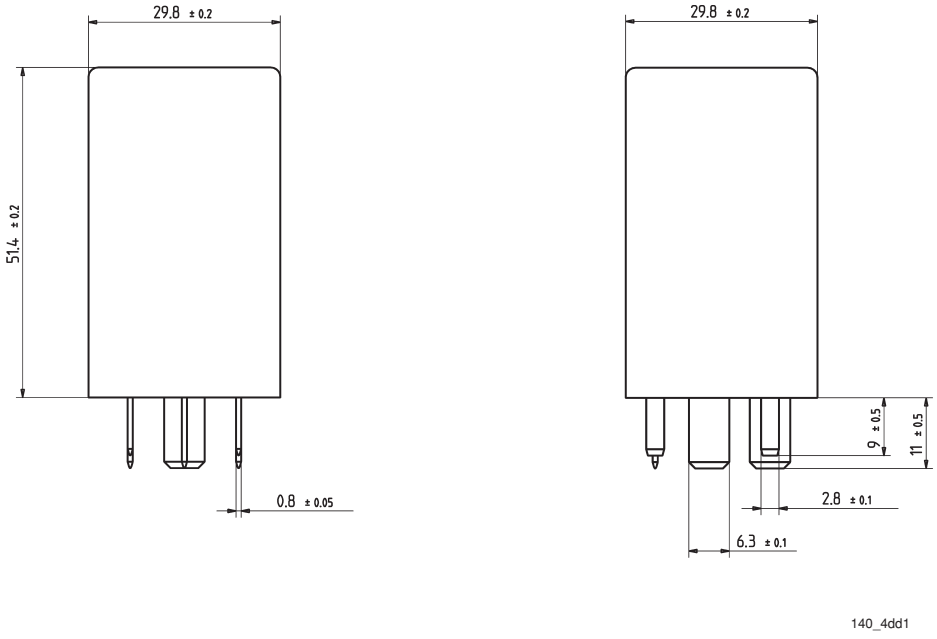
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

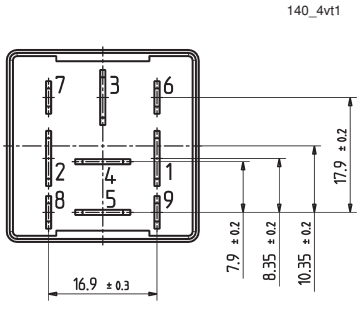
Power Module Relay F4

Dimensional Drawing

Power Module Relay F4



View of the Terminals (bottom view)



Connector Information
Connector 929102
Fitting FASTIN-FASTON Contacts
2.8 FF e.g. 160655-2 for 0.5-1.5 mm^2
6.3 FF e.g. 6-160448-5 for 1.0-2.5 mm^2

For the make contact (2 x 87), pin 4 = 5.
For the double make contact, pin 4 = 5b.

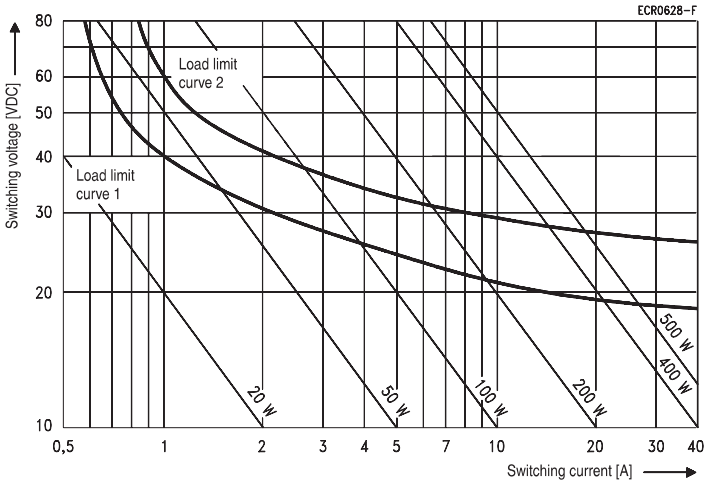
Power Module Relay F4

Contact Data

Contact configuration	1 Make contact/ 1 Form A or Form A with 2 x 87		1 Changeover contact/ 1 Form C	
Circuit symbol				
Rated voltage	12 V	24 V	12 V	24 V
Rated current	40 A	20 A	30/40 A	15/20 A
Limiting continuous current			NC/NO	
23°C	60 A		45/60 A	
85°C	40 A		30/40 A	
125°C	17 A		12/17 A	
Contact material	AgNi0.15			
Max. switching voltage/power	See load limit curve			
Max. switching current [1]			NC/NO	NC/NO
On [2]	120 A	120 A	45/120 A	45/120 A
Off	60 A	20 A	40/60 A	15/20
Min. recommended load [3]	1 A at 5 V			
Voltage drop at 10 A (initial)				
NO contact	Typ. 15 mV, 200 mV max.		Typ. 15 mV, 200 mV max.	
NC contact			Typ. 20 mV, 250 mV max.	
Mechanical endurance (without load)	Typ. 10^7 operations			
Electrical endurance (example of resistive load)	> 2 x 10^5 operations 40 A, 14 V	> 1 x 10^5 operations 20 A, 28 V	> 1 x 10^5 operations 40 A, 14 V (NO contact)	> 1 x 10^5 operations 20 A, 28 V (NO contact)
Max. switching rate at nominal load	6 operations per minute (0.1 Hz)			

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V or 27 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve



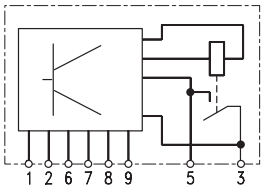
Load limit curve 1 ≙ arc extinguishes during transit time (changeover contact)

Load limit curve 2 ≙ safe shutdown, no stationary arc (make contact)

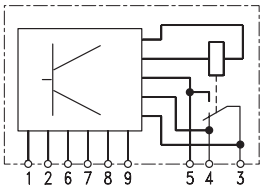
Power Module Relay F4

Circuit Diagram

1 Make contact/1 Form A



1 Changeover contact/1 Form C

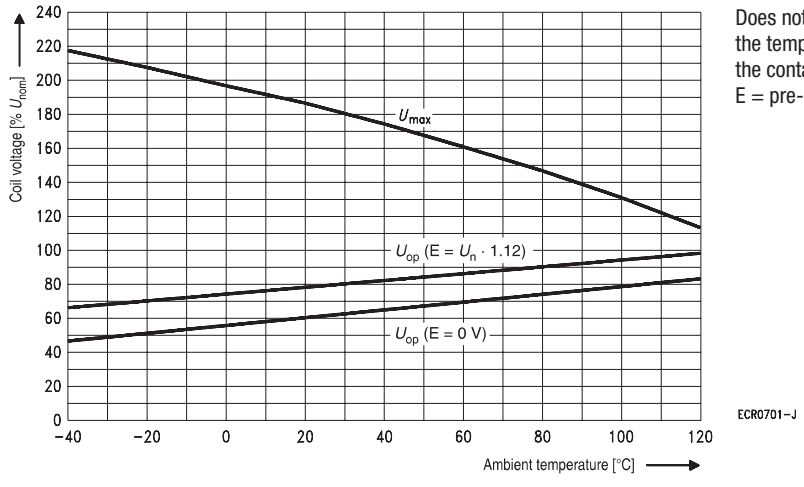


Coil Data	
Available for nominal voltages	12 V / 24 V
Nominal power consumption of the unsuppressed coil at nominal voltage	Typ. 1.6 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 7 ms
Release time at nominal voltage [1)]	Typ. 2 ms

1) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Power Module Relay F4

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	200 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1]
Resistance to bending, force applied to side	10 N [1]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures

[1] Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

Environmental Conditions

Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation	EN ISO 6988		6 cycles	Storage 8/16 h
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat				
cyclic	IEC 68-2-30	Db, Variant 1	6 cycles	Upper air temperature 55°C
constant	IEC 68-2-3	Ca	56 days	
Corrosive gas	IEC 68-2-42	10 ±2 cm^3/m^3 SO_2	10 days	
	IEC 68-2-43	1 ±0.3 cm^3/m^3 H_2S	10 days	
Vibration resistance	IEC 68-2-6 (sine sweep)		10 - 500 Hz min. 5 g	No change in the switching state > 10 µs Valid for NC contacts, NO contact values significantly higher
Shock resistance	IEC 68-2-27 (half sine form single pulses)		min. 20 g 11 ms	
Load dump	ISO 7637-1 (12 V)	Test pulse 5	Vs = +86.5 V	
	ISO 7637-2 (24 V)	Test pulse 5	Vs = +200 V	
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302)[1]			
Overload current [2]	54 A, 1800 s 80 A, 5 s 140 A, 0.5 s 240 A, 0.1 s			

[1] FMVSS: Federal Motor Vehicle Safety Standard.
[2] Current and time are compatible with circuit protection by a typical 40 A automotive fuse. Relay will make, carry and break the specified current.

Power Module Relay F4/Base

Ordering Information

Part Numbers for Module Relay F4 (see table below for coil data)		Contact Arrangement	Contact Material	Enclosure	Terminals
Relay Description	**Part Number**				
12 V Plug-In Relays					
V23140-A0052-C643	1-1414672-0	1 Form C	AgNi0.15	Dust cover	Quick connect
V23140-B0052-C642	1-1414676-0	1 Form A	AgNi0.15	Dust cover	Quick connect
24 V Plug-In Relays					
V23140-A0053-C643	1-1414673-0	1 Form C	AgNi0.15	Dust cover	Quick connect
V23140-B0053-C642	1-1414675-0	1 Form A	AgNi0.15	Dust cover	Quick connect

Part Numbers for Base[1] (see table below for coil data)		Description	Coil	Contact Material	Cover Height (mm)
Relay Description	**Part Number**				
Base					
V23140-Z0000-X023	1-1414548-0	Base, ledge and all 9 terminals only (without relay)	None	None	N/A
Cover					
V23140-Z0000-X024	1-1414546-0	Cover, black	None	None	51.4
V23140-Z0000-X025	1-1414547-0	Cover, black, release feature, notches	None	None	51.4
V23140-Z0000-X026	1-1414690-0	Cover, black, release feature, notches	None	None	30.9

[1] Base and covers only, no relay included. Dimensional drawings on request.

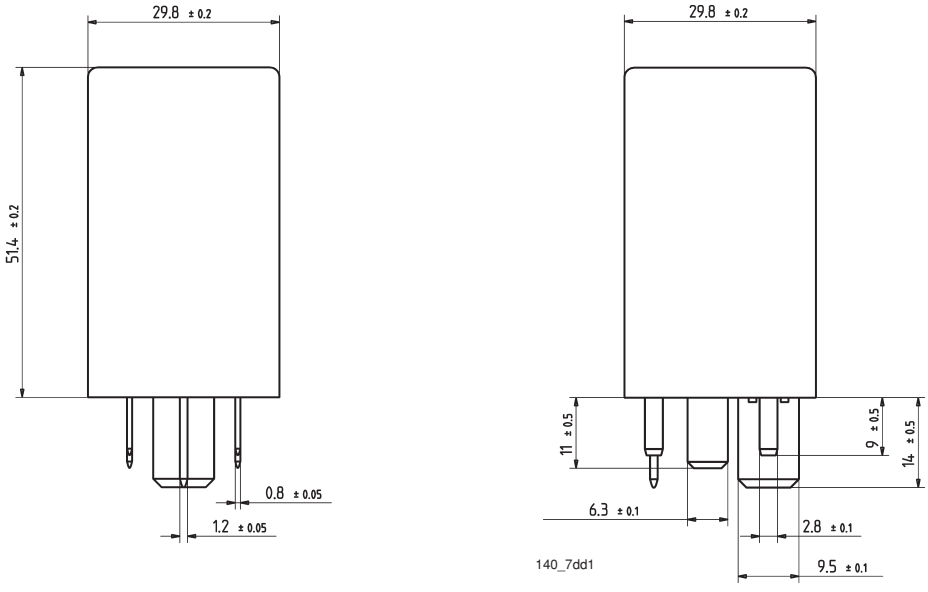
Coil Versions

Coil Data for Module Relay F4	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive[1] Voltage (V)	
					at 23°C	at 85°C
V23140-**052-****	12	90	7.2	1.6	22	17
V23140-**053-****	24	324	14.4	3.2	41	32

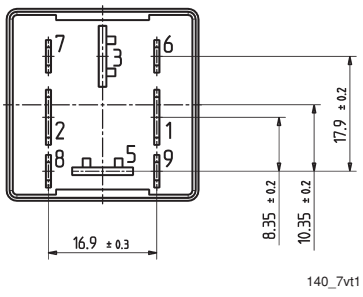
[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Dimensional Drawing

Power Module Relay F7



View of the Terminals (bottom view)

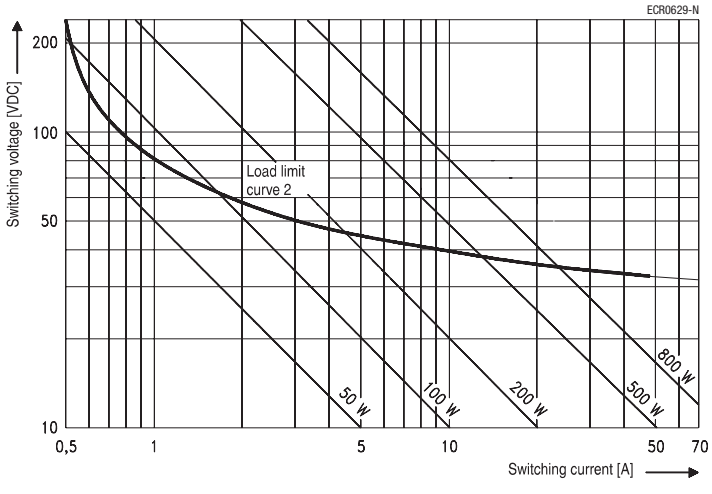


Power Module Relay F7

Contact Data		
Contact configuration	1 Make contact/ 1 Form A	
Circuit symbol (see also Pin assignment)		
Rated voltage	12 V	24 V
Rated current	50 A	25 A
Limiting continuous current		
23°C	70 A	
85°C	50 A	
125°C	30 A	
Contact material	AgNi0.15	
Max. switching power	See load limit curve	
Max. switching current [1]		
On [2]	240 A	240 A
Off	70 A	25 A
Min. recommended load [3]	1 A at 5 V	
Voltage drop at 10 A (initial)	Typ. 10 mV, 200 mV max.	
Mechanical endurance (without load)	> 10^7 operations	
Electrical endurance (example of resistive load)	> 1 x 10^5 operations at 14 V/70 A > 2 x 10^5 operations at 14 V/50 A	> 1 x 10^5 operations at 28 V/25 A

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V or 27 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Load Limit Curve

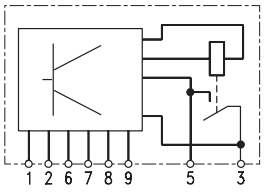


Load limit curve 2 ≙ safe shutdown,
no stationary arc (make contact)

Power Module Relay F7

Circuit Diagram

1 Make contact/1 Form A

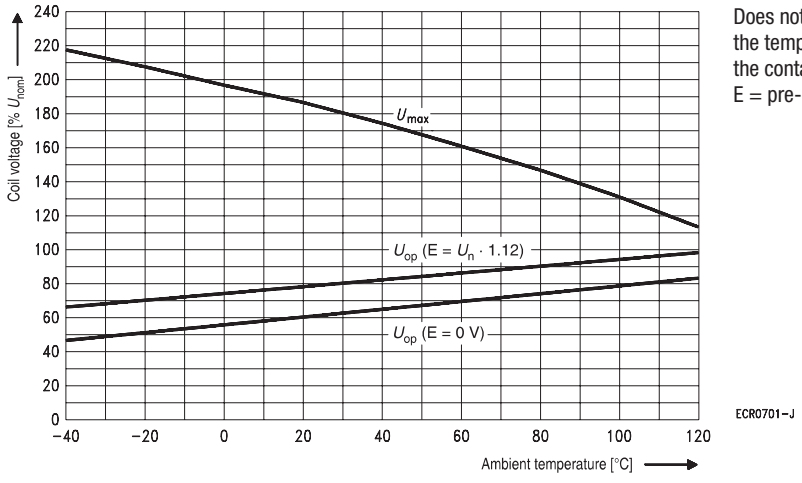


Coil Data	
Available for nominal voltages	12 V / 24 V
Nominal power consumption of the unsuppressed coil at nominal voltage	1.6 W
Nominal power consumption at nominal voltage with suppression resistor	1.8 W
Test voltage winding/contact	500 VAC_{rms}
Maximum ambient temperature range	–40 to +125°C
Operate time at nominal voltage	Typ. 7 ms
Release time at nominal voltage [1)]	Typ. 2 ms

1) For unsuppressed relay coil.

Note:
A low resistive suppression device in parallel to the relay coil increases the release time and reduces the lifetime caused by increased erosion and/or higher risk of contact tack welding.

Operating Voltage Range



Does not take into account the temperature rise due to the contact current
E = pre-energization

Power Module Relay F7

Mechanical Data

Cover retention	
Axial force	150 N
Pull force	200 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1]
Resistance to bending, force applied to side	10 N [1]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures

[1] Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

Environmental Conditions

Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Climatic cycling with condensation	EN ISO 6988		6 cycles	Storage 8/16 h
Temperature cycling	IEC 68-2-14	Nb	10 cycles	–40/+85°C (5°C per min)
Damp heat				
cyclic	IEC 68-2-30	Db, Variant 1	6 cycles	Upper air temperature 55°C
constant	IEC 68-2-3	Ca	56 days	
Corrosive gas	IEC 68-2-42	10 ±2 cm^3/m^3 SO_2	10 days	
	IEC 68-2-43	1 ±0.3 cm^3/m^3 H_2S	10 days	
Vibration resistance	IEC 68-2-6 (sine sweep)		10 - 500 Hz min. 5 g	No change in the switching state > 10 µs Valid for NC contacts, NO contact values significantly higher
Shock resistance	IEC 68-2-27 (half sine form single pulses)		min. 20 g 11 ms	
Load dump	ISO 7637-1 (12 V)	Test pulse 5	Vs = +86.5 V	
	ISO 7637-2 (24 V)	Test pulse 5	Vs = +200 V	
Jump start	24 V for 5 minutes conducting nominal current at 23°C			
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [1]			
Overload current [2]	95 A, 1800 s 140 A, 5 s 245 A, 0.5 s 420 A, 0.1 s			

[1] FMVSS: Federal Motor Vehicle Safety Standard.
[2] Current and time are compatible with circuit protection by a typical 40 A automotive fuse. Relay will make, carry and break the specified current.

Power Module Relay F7

Ordering Information

Part Numbers (see table below for coil data) Relay Description	Part Number	Contact Arrangement	Contact Material	Enclosure	Terminals
12 V Plug-In Relays					
V23140-J0052-D642	1-1414654-0	1 Form A	AgNi0.15	Dust cover	Quick connect
24 V Plug-In Relays					
V23140-J0053-D642	1-1414674-0	1 Form A	AgNi0.15	Dust cover	Quick connect

Coil Versions

Coil Data for Module Relay F7	Rated Coil Voltage (V)	Coil Resistance ±10% (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Allowable Overdrive[1] Voltage (V) at 23°C	Allowable Overdrive[1] Voltage (V) at 85°C
V23140-**052-****	12	90	7.2	1.6	22	17
V23140-**053-****	24	324	14.4	3.2	41	32

[1] Allowable overdrive is stated with no load applied and minimum coil resistance.

Application Examples of Power Module Relay F4/F7 and Base

Description

Examples of customization with one or more relays, electronics or other components of modular unit based on Power Relay F4/F7.

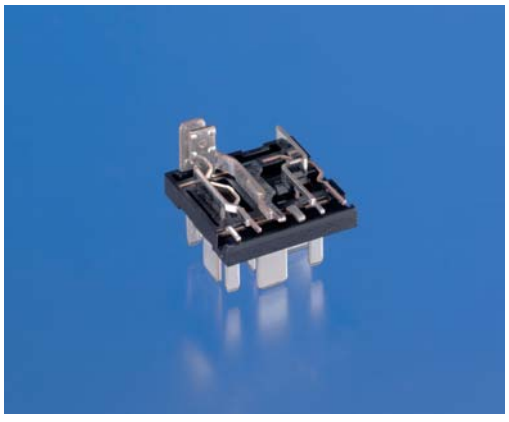
Examples

- Base Power Relay F4 (V23140)
- Base + Power Relay F4 (V23140)
- Base + Power Relay F4 with printed circuit board (V23141)
- Base + additional relay mounted on printed circuit board (V23141)
- Base + Power Relay F4 and additional relay mounted on leadframe (V23141)
- Base + Power Relay F4 and 2 additional relays mounted with overmolded leadframe (V23141)

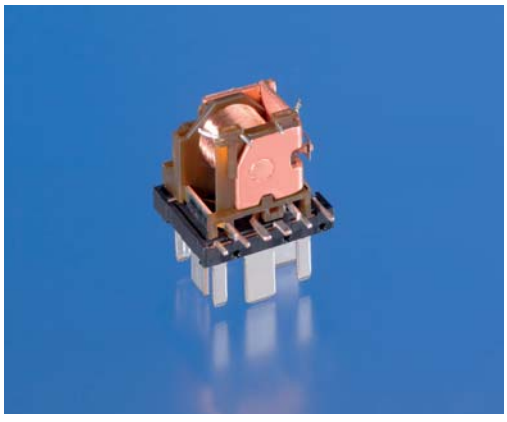
Typical Applications

- Automatic wash/ wiper control
- Battery disconnection
- Cooling fan controls
- Energy distribution
- Fuel/water pump control unit
- Flexible control unit functions
- Light control applications
- Motor antennas
- Over voltage protection
- Power management
- Power outlet control
- Power window actuator
- Rear window defogger
- Seat adjustment
- Seat and stationary heating
- Timer
- Wiper control

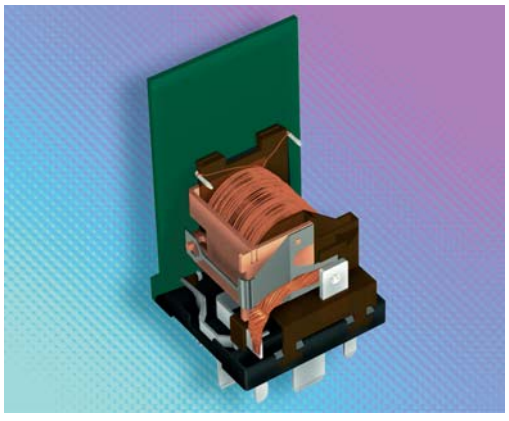
Please contact Tyco Electronics for relay application support.



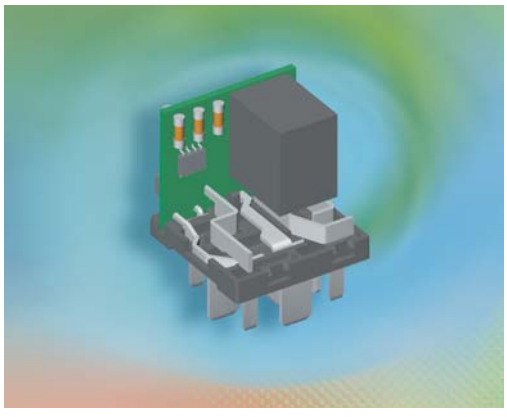
V23140 Base Power Relay F4 141_3d04



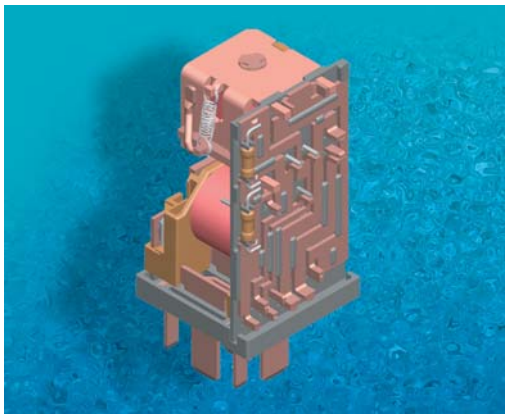
V23140 Base + Power Relay F4 141_3d04



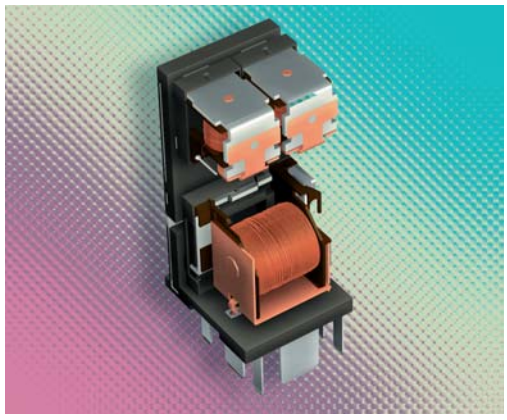
V23141 Base + Power Relay F4 with PCB 141_3d03



V23141 Base + additional relay mounted on PCB 141_3d04



V23141 Base + Power Relay F4 and additional relay mounted on leadframe 141_3d02



V23141 Base + Power Relay F4 and 2 additional relays mounted with overmolded leadframe 141_3d01

Wiper Module

Description

The wiper module is a complete sub-system. It switches the wiper in two steps.

Features

- Limiting continuous current 40 A
- Pin assignment according to ISO 7588 part 1
- Mounting bracket or clip on request

Typical Application

Wiper control

Design

ELV/RoHS/WEEE compliant

Nominal Voltage

12 V

Weight

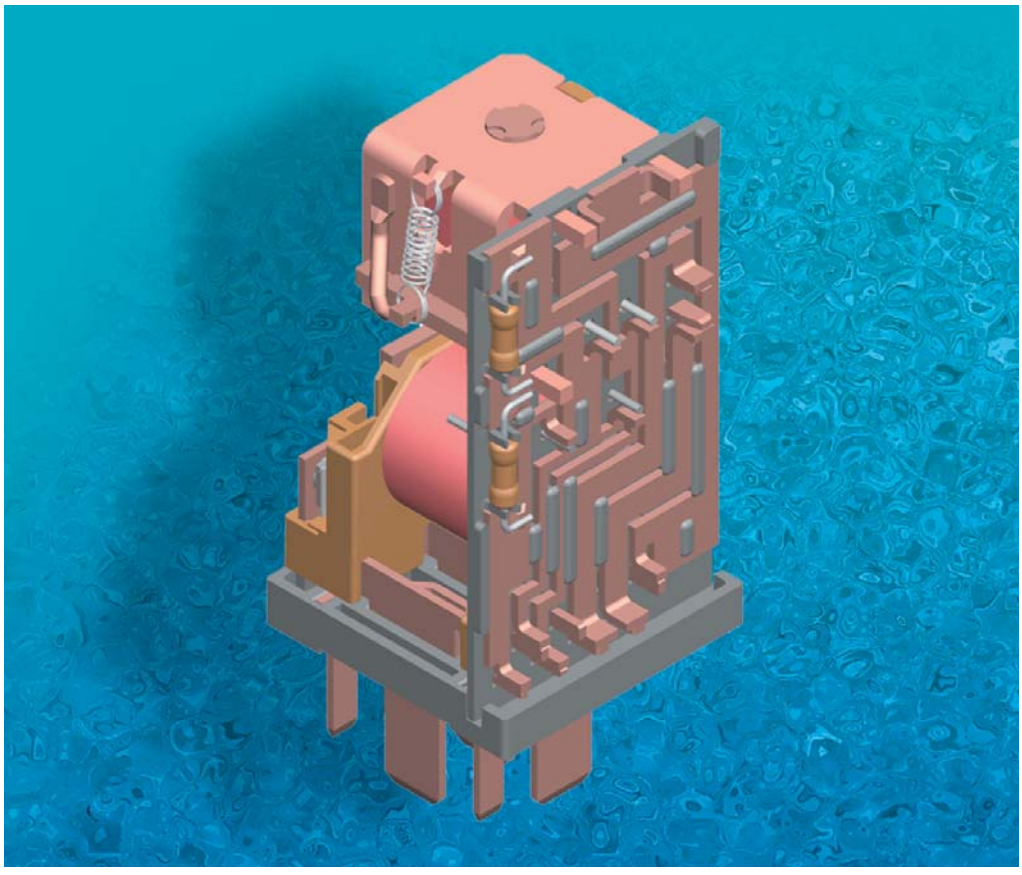
Approx. 70 g (2.5 oz.)

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the "Glossary" page 23 or at http://relays.tycoelectronics.com/appnotes/

Please contact Tyco Electronics for relay application support.



141_3D02

Technical Data [1]	
Contact configuration	1 Changeover contact/ 1 Form C
Contact material	$AgSnO_2$, PdCu15
Max. switching current	
On	120 A
Off	60 A
Operate time	Power F: Typ. 7.5 ms Power K: Typ. 5 ms
Release time	Power F: Typ. 3.5 ms Power K: Typ. 3 ms
Maximum ambient temperature range	–40 to +90°C
Dimensions (L x W x H), approx.	30 x 30 x 50 mm (1.2 x 1.2 x 2.0 inches) with cover

[1] For further information please contact your local sales office.

Disclaimer

Cooling Fan Module

Description

The cooling fan module is a complete electrical subsystem. It is able to set the right speed for the fan. Due to the increasing amount of power consumers (power steering, air-conditioning etc.) it is necessary to protect the engine from overheating.

Features

- Limiting continuous current up to 40 A
- Pin assignment according to ISO 7588 part 1
- Mounting bracket or clip on request

Typical Application

Fan control

Design

ELV/RoHS/WEEE compliant

Nominal Voltage

12 V

Weight

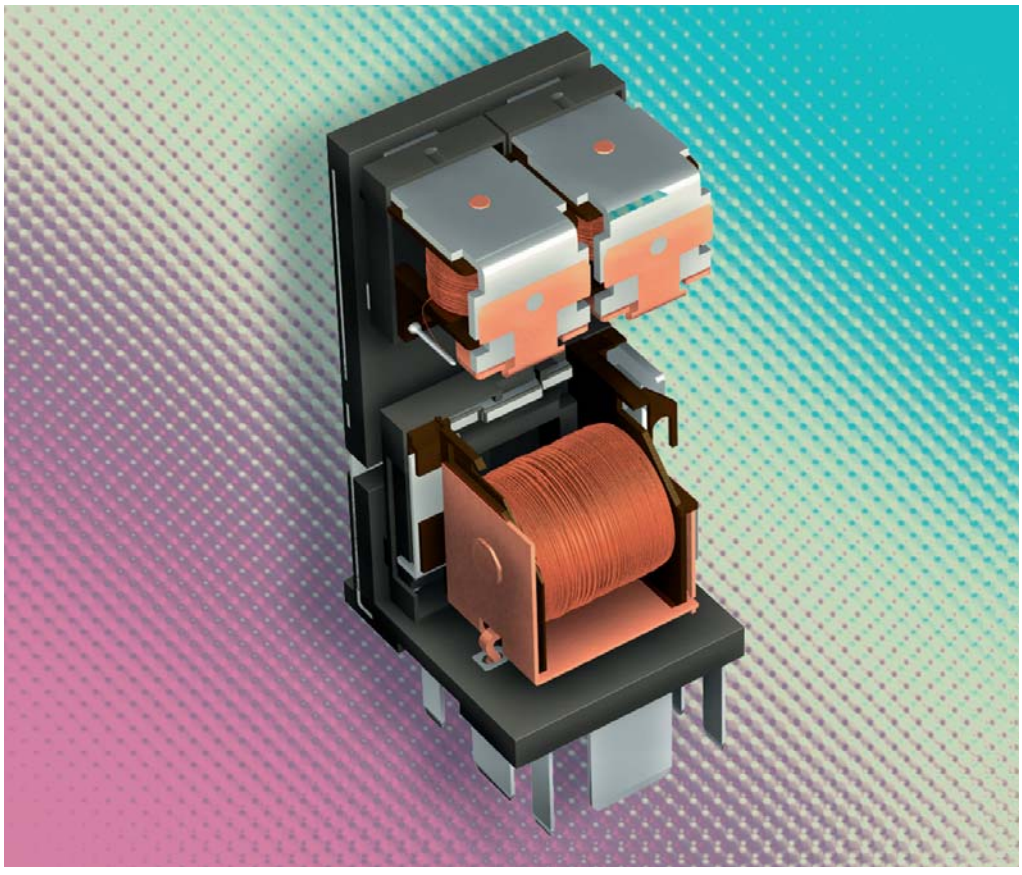
Approx. 113 g (4 oz.)

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the "Glossary" page 23 or at http://relays.tycoelectronics.com/appnotes/

Please contact Tyco Electronics for relay application support.



141_3D01

Technical Data [1]		
Contact configuration	1 fan with or without series resistor:	1 Mini Relay (1 Make/1 Form A) and 1 Micro Relay (1 Make/1 Form A)
	2 fans in series or in parallel:	1 Mini Relay (1 Changeover/1 Form C) + 2 Micro Relays (1 Make/1 Form A)
Contact material	AgNi0.15	
Max. switching current		
On	240 A	
Off	60 A	
Limiting continuous current at 23°C	NC/NO	
	20 A/40 A	
Operate time	Typ. 6 ms	
Release time	Typ. 3 ms	
Maximum ambient temperature range	–40 to +85°C	
Dimensions (L x W x H)	39.6 x 32.4 x 102.7 mm (1.559 x 1.276 x 4.043 inches) with cover	

[1] For further information please contact your local sales office.

Disclaimer

Power Management Module

Description

The Power Management Module is able to disconnect two power outlets in a vehicle if the battery voltage drops below a defined level. The module protects against complete discharging of the battery and guarantees an improved ability to start the engine.

Features

- Limiting continuous current up to 20 A at 85°C
- No power consumption (latching relays)
- Very compact design
- Two separate load circuits with common control

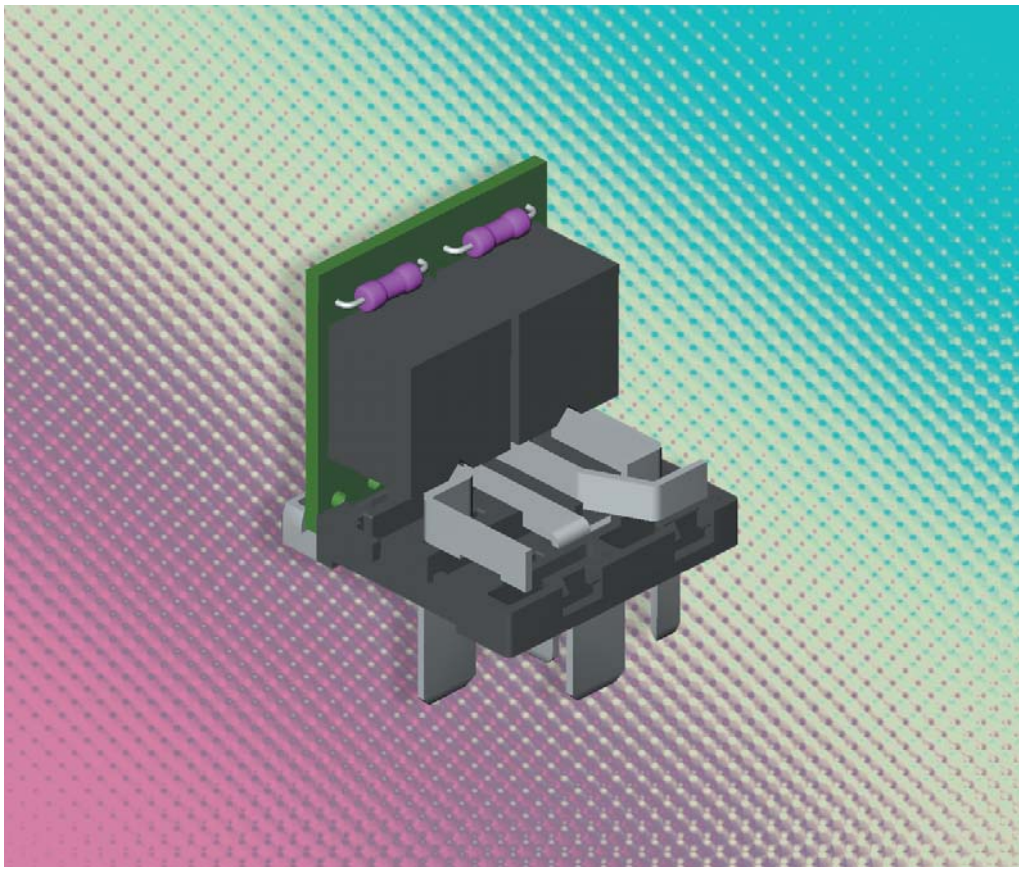
Customized Versions on Request

- Mounting bracket or mounting clip
- Customer specific design

Typical Application

Active Power Management

Please contact Tyco Electronics for relay application support.



130-C_3D1

Design

- ELV/RoHS/WEEE compliant
- Dustproof; protection class IP54 to IEC 529 (EN 60 529)

Weight

Approx. 35 g (1.2 oz.)

Nominal Voltage

12 V

Terminals

- Quick connect terminals similar to ISO 8092-1, coil and load terminals 6.3 x 0.8 mm; surfaces tin plated

Conditions

All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

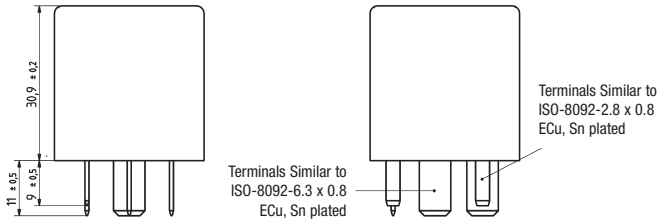
For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

Disclaimer

Power Management Module

Dimensional Drawing

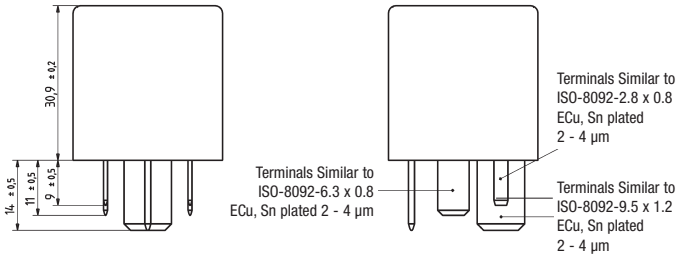
V23141-B001-X030 and X037



141X30dd1

Dimensional Drawing

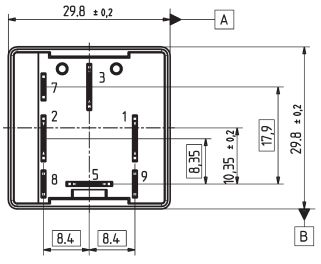
V23141-B001-X031 and X038



141X31dd1

View of the Terminals (bottom view)

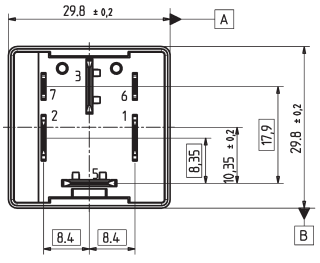
V23141-B0001-X030 standard PCB
V23141-B0001-X037 advanced PCB



141X30vt1

View of the Terminals (bottom view)

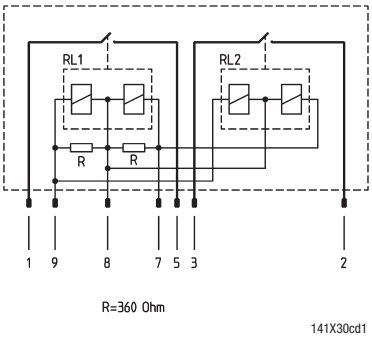
V23141-B0001-X031 standard PCB
V23141-B0001-X038 advanced PCB



141X31vt1

Circuit Diagram

V23141-B0001-X030 and X037

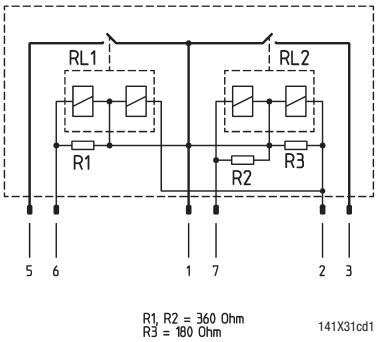


141X30cd1

Two separate load circuits (1 - 5, 2 - 3) with common control.

Circuit Diagram

V23141-B0001-X031 and X038



141X31cd1

Two load circuits (1 - 5, 3 - 1) can be switched on separately but have common switch off.

Power Management Module

Contact Data

Contact configuration	2 Make contacts/ 2 Form A	
Circuit symbol	See circuit diagram	
Rated voltage	12 V	
Rated current	One relay in use	Both relays in use
Standard PCB	15 A	10 A
Advanced PCB	20 A	15 A
Limiting continuous current (standard PCB)		
23°C	20 A	15 A
85°C	15 A	10 A
105°C	12 A	8 A
Contact material	$AgSnO_2$	
Max. switching current [1]		
On [2]	50 A	
Off	30 A	
Min. recommended load [3]	1 A at 5 V	
Voltage drop at 10 A (initial)	Typ. 15 mV, 200 mV max.	
Mechanical endurance (without load)	> 10^6 operations	
Electrical endurance (tested on relay V23086-L1252-A403 used in this module)	Resistive load: at 13.5 V at +85°C	> 1 x 10^5 operations on 20 A/off 20 A on 120 ms/off 4880 ms
	Inductive load: at 13.5 V at cyclic temperature change –40/+23/+85°C	> 1 x 10^5 operations on 25 A/off 5 A on 120 ms/off 4880 ms L = 0.6 mH
	Lamp load: at 13.5 V at cyclic temperature change –40/+23/+85°C	> 1 x 10^5 operations on 50 A [2]/off 5 A on 120 ms/off 4880 ms

[1] The values apply to a resistive or inductive load with suitable spark suppression and at maximum 13.5 V for 12 V or 27 V for 24 V load voltages.
[2] For a load current duration of maximum 3 s for a make/break ratio of 1:10.
[3] See chapter Diagnostics of Relays in our Application Notes page 31 or consult the internet at http://relays.tycoelectronics.com/appnotes/

Power Management Module

Coil Data for V23141-B0001-X030 and V23141-B0001-X037 [1)]			
Available for nominal voltages	12 V		
Nominal power consumption	Continuous power on coil not allowed		
Test voltage coil/contact	500 VAC_{rms}		
Maximum ambient temperature range	–40 to +105°C		
Set			
Function	Close contacts		
Terminals 1-5 and 2-3	Connected		
Polarity	Terminal 7 Negative potential	Terminal 8 Positive potential	Terminal 9 No current
Must set voltage (ambient temperature 23°C)	6 V		
Maximum set voltage (coil temperature 23°C)	22 V		
Minimum set voltage pulse width at 6 V	5 ms		
Maximum set voltage pulse width at 22 V	1 s		
Resistance between 7-8 with coils at 23°C	34 ±4 Ω		
Set time (nominal voltage; coil temperature 23°C)	Typ. 2.5 ms		
Reset			
Function	Open contacts		
Terminals 1-5 and 2-3	Not connected		
Polarity	Terminal 7 No current	Terminal 8 Positive potential	Terminal 9 Negative potential
Must set voltage (ambient temperature 23°C)	6 V		
Maximum set voltage (coil temperature 23°C)	22 V		
Minimum set voltage pulse width at 6 V	5 ms		
Maximum set voltage pulse width at 22 V	1 s		
Resistance between 8-9 with coils at 23°C	34 ±4 Ω		
Set time (nominal voltage; coil temperature 23°C)	Typ. 2.0 ms		

[1)] Verified on separate relay produced in series.

Power Management Module

Coil Data for V23141-B0001-X031 and V23141-B0001-X038 [1]				
Available for nominal voltages	12 V			
Nominal power consumption	Continuous power on coil not allowed			
Test voltage coil/contact	500 VAC_{rms}			
Maximum ambient temperature range	–40 to +105°C			
Set System 1				
Function	Close contacts			
Terminals 1-3	Connected			
Polarity	Terminal 1 Positive potential	Terminal 2 No current	Terminal 7 Negative potential	Terminal 6 No current
Must set voltage (ambient temperature 23°C)	6 V			
Maximum set voltage (coil temperature 23°C)	22 V			
Minimum set voltage pulse width at 6 V	5 ms			
Maximum set voltage pulse width at 22 V	1 s			
Resistance between 1-7 with coils at 23°C	62 ±6 Ω			
Set time (nominal voltage; coil temperature 23°C)	Typ. 2.5 ms			
Set System 2				
Function	Close contacts			
Terminals 1-5	Connected			
Polarity	Terminal 1 Positive potential	Terminal 2 No current	Terminal 7 No current	Terminal 6 Negative potential
Must set voltage (ambient temperature 23°C)	6 V			
Maximum set voltage (coil temperature 23°C)	22 V			
Minimum set voltage pulse width at 6 V	5 ms			
Maximum set voltage pulse width at 22 V	1 s			
Resistance between 1-6 with coils at 23°C	62 ±6 Ω			
Set time (nominal voltage; coil temperature 23°C)	Typ. 2.0 ms			
Reset Both Systems				
Function	Open contacts			
Terminals 1-5 and 2-3	Connected			
Polarity	Terminal 1 Positive potential	Terminal 2 Negative potential	Terminal 7 No current	Terminal 6 No current
Must set voltage (ambient temperature 23°C)	6 V			
Maximum set voltage (coil temperature 23°C)	22 V			
Minimum set voltage pulse width at 6 V	5 ms			
Maximum set voltage pulse width at 22 V	1 s			
Resistance between 1-2 with coils at 23°C	31 ±4 Ω			
Set time (nominal voltage; coil temperature 23°C)	Typ. 2.0 ms			

[1] Verified on separate relay produced in series.

Mechanical Data	
Cover retention	
Axial force	150 N
Pull force	200 N
Push force	200 N
Terminals	
Pull force	100 N
Push force	100 N
Resistance to bending, force applied to front	10 N [1]
Resistance to bending, force applied to side	10 N [1]
Torsion	0.3 Nm
Enclosures	
Dust cover	Protects relay from dust. For use in passenger compartment or enclosures

[1] Values apply 2 mm from the end of the terminal. When the force is removed, the terminal must not have moved by more than 0.3 mm.

Power Management Module

Environmental Conditions [1]				
Temperature range, storage	Refer to *Storage* in the "Glossary" catalog page 23 or http://relays.tycoelectronics.com/appnotes/			
Test	Relevant standard	Testing as per	Dimension	Comments
Cold storage	IEC 68-2-1		1000 h	–40°C
Dry heat	IEC 68-2-2	Ba	1000 h	+85°C
Thermal shock	IEC 68-2-14	Na	100 cycles	–40°C/+85°C Dwell time 15 min
Vibration resistance	IEC 68-2-6 (sine pulse form) contacts 1-5 and 2-3 closed		10 - 2000 Hz 10 g	No change in the switching state > 10 µs
Vibration resistance	IEC 68-2-6 (sine pulse form) contacts 1-5 and 2-3 open		10 - 500 Hz 6 g	
Shock resistance	IEC 68-2-27 (half sine form single pulses)		6 ms up to 30 g	
Continuous shock	IEC 68-2-27	Eb	6 ms, 30 g, 1000 shocks in each direction	
Drop test	Capable of meeting specifications after 1.0 m (3.28 ft) drop onto concrete			
Flammability	UL94-HB or better (meets FMVSS 302) [2]			

[1] Verified on separate relay samples produced in series.
[2] FMVSS: Federal Motor Vehicle Safety Standard.

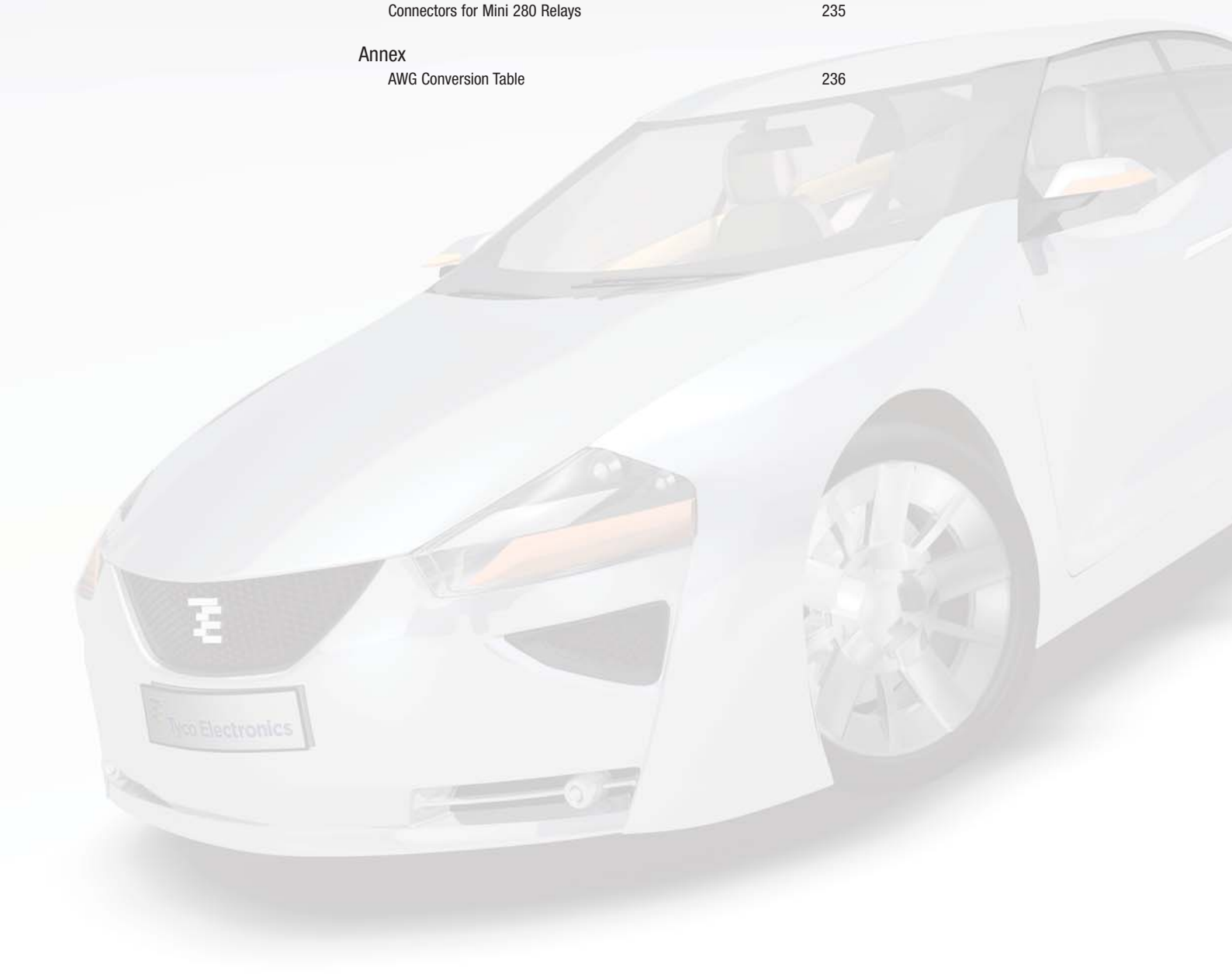
Ordering Information

Part Numbers		Circuit/Contact Arrangement	Contact Material	Enclosure	Special Features
Relay Description	**Part Number**				
12 V modules					
V23141-B0001-X030 [1]	1-1414255-0	see page 219	$AgSnO_2$	Dust cover	Quick connect, standard printed circuit board
V23141-B0001-X037 [1]	1-1414502-0	see page 219	$AgSnO_2$	Dust cover	Quick connect, advanced printed circuit board
V23141-B0001-X031 [2]	1-1414233-0	see page 219	$AgSnO_2$	Dust cover	Quick connect, standard printed circuit board
V23141-B0001-X038 [2]	1-1414501-0	see page 219	$AgSnO_2$	Dust cover	Quick connect, advanced printed circuit board

[1] 7 terminals, 2 separated load circuits.
[2] 6 terminals, common plus for coil and load side.

Engineering Notes

Technical Information



Connectors for Micro ISO Relays

Features

Connectors in 3 different versions

- **PCB Socket**
  With the solderable connector Micro ISO relays with plug-in terminals can be mounted on leadframes. This allows easy and reasonable replacement in case of service.
- **Connector**
  5 pole connector with snap-in pin to lock in frame.
- **Connector with Mounting Flap**
  5 pole connector that can be mounted individually or inter-locked. The connector has a snap-in pin to lock in frame. The mounting bracket also allows screw-on.

Please order terminals separately. For AWG Conversion Table see page 236.

Please contact Tyco Electronics for relay application support.

333_3Dco2

Weight

- PCB Socket
  Approx. 5.9 g (0.18 oz.)
- Connector
  Approx. 5.4 g (0.18 oz.)
- Connector with Mounting Flap
  Approx. 11.9 g (0.39 oz.)

Conditions

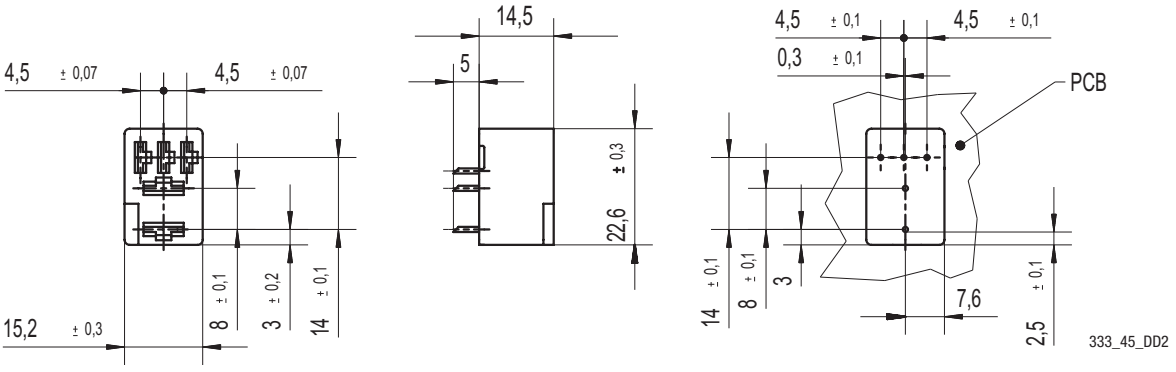
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

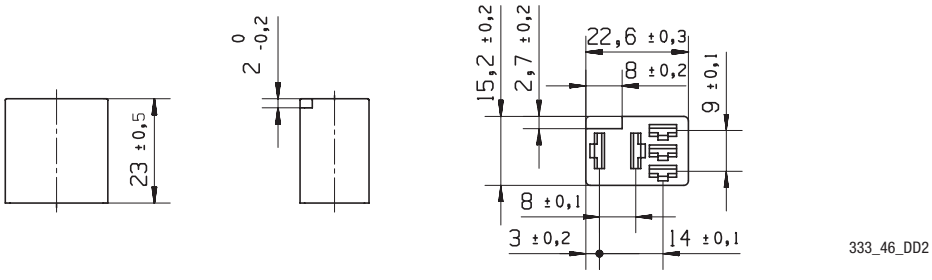
Disclaimer

Connectors for Micro ISO Relays

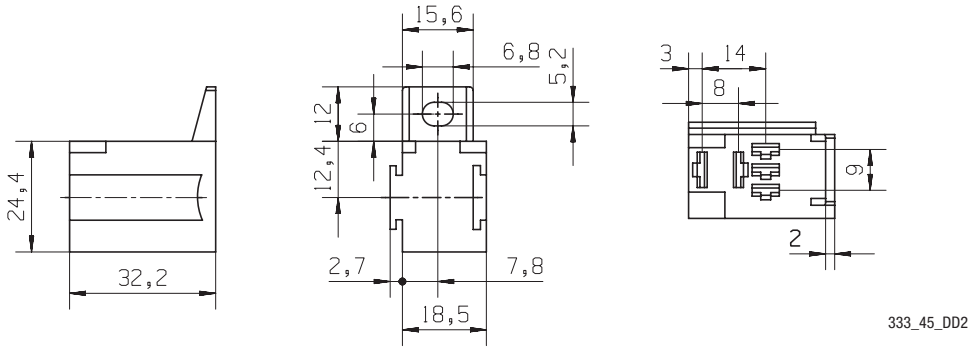
PCB Socket
V23333-Z0002-B049
(Mounting Recommendation: To keep insertion force away from the PCB the soldering of the socket to the PCB should be done with already inserted relay)



Connector
V23333-Z0001-B046
(Terminals to be ordered separately)



Connector with Mounting Flap
(To be mounted individually or can be interlocked)
V23333-Z1001-B045
(Terminals to be ordered separately)



Connectors for Micro ISO Relays

Ordering Information

Part Numbers for Connectors		Selection of Fitting Crimp Terminals[1] (Ph. bronze tin plated)[2]							
Connector Description	Tyco Electronics Part Number	Terminal Size	Tyco Electronics Part Number	Wire mm^2	Use for	Quantity Required Form A	Quantity Required Form C	Use in Cavities Form A	Use in Cavities Form C
V23333-Z0002-B049	2-1904045-7	–	–	–	–	–	–	–	–
V23333-Z0001-B046	1-1904045-6	4.8 x 0.8	280919-4	0.5 - 1.5	Coil	2	2	1 and 2	1 and 2
		4.8 x 0.8	281197-2	1.0 - 2.5	Load	–	1	–	4
		6.3 x 0.8	160927-4	1.0 - 2.5	Load	2	2	3 and 5	3 and 5
V23333-Z1001-B045	1-1904045-5	4.8 x 0.8	280919-4	0.5 - 1.5	Coil	2	2	1 and 2	1 and 2
		4.8 x 0.8	281197-2	1.0 - 2.5	Load	–	1	–	4
		6.3 x 0.8	160917-2	1.0 - 2.5	Load	2	2	3 and 5	3 and 5

[1] Crimp terminals to be ordered separately.
[2] Mentioned crimp terminals are delivered in strip-form, loose pieces and hand tool available on request.

Standard Delivery Packs (orders in multiples of delivery pack)
Connector V23333-Z0002-B049: 800 pieces
Connector V23333-Z0001-B046: 400 pieces
Connector V23333-Z1001-B045: 150 pieces

Connectors for Mini ISO Relays

Features

Connectors in 3 different versions

- **PCB Socket**
  With the solderable connector Mini ISO relays with plug-in terminals can be mounted on leadframes. This allows easy and reasonable replacement in case of service.
- **Connector**
  5 pole connector with snap-in pin to lock in frame.
- **Connector with Mounting Flap**
  5 pole connector that can be mounted individually or inter-locked. The connector has a snap-in pin to lock in frame. The mounting bracket also allows screw-on.

Please order terminals separately. For AWG Conversion Table see page 236.

Please contact Tyco Electronics for relay application support.

333_3Dco1

Weight

- PCB Socket
  Approx. 7.0 g (0.25 oz.)
- Connector
  Approx. 3.9 g (0.11 oz.)
- Connector with Mounting Flap
  Approx. 20.6 g (0.71 oz.)

Conditions

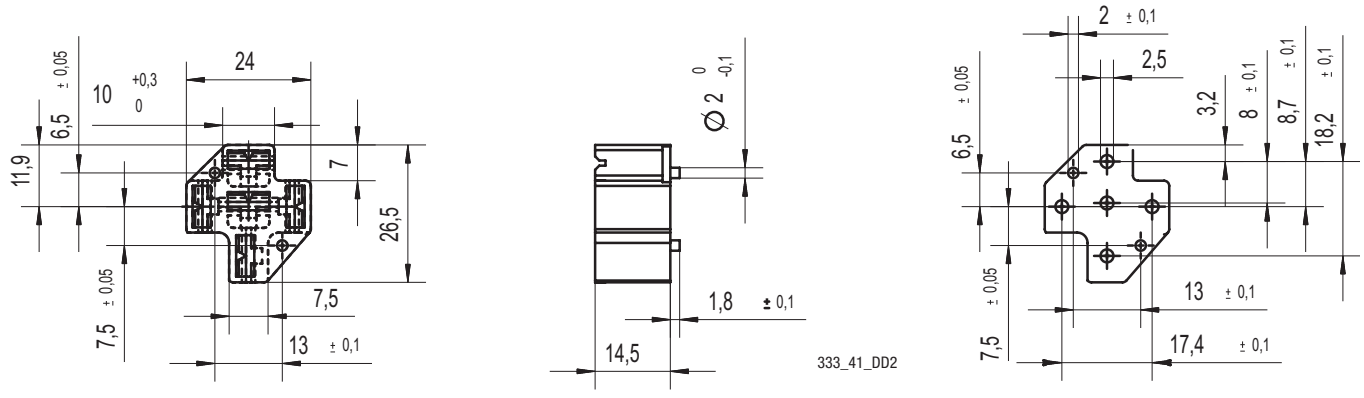
All parametric, environmental and endurance tests are performed according to EIA Standard RS-407-A at standard test conditions unless otherwise noted:
23°C ambient temperature,
20 - 50% RH, 998.9 ±33.9 hPa.

For general storage and processing recommendations please refer to our Application Notes and especially to *Storage* in the “Glossary” page 23 or at http://relays.tycoelectronics.com/appnotes/

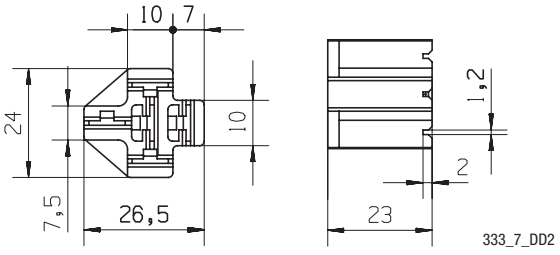
Disclaimer

Connectors for Mini ISO Relays

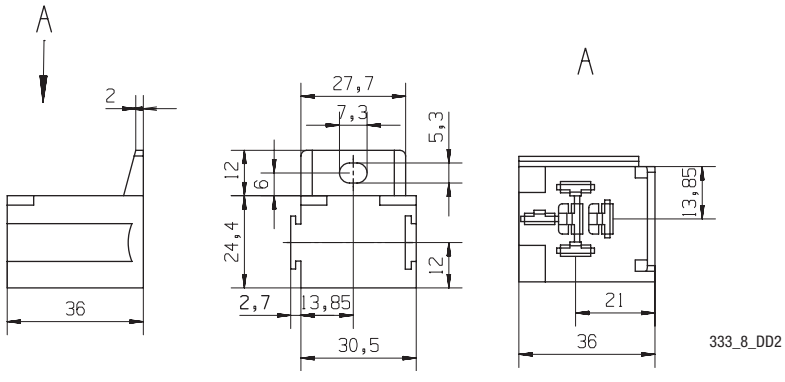
PCB Socket
V23333-Z0002-A041
(Mounting Recommendation: To keep insertion force away from the PCB the soldering of the socket to the PCB should be done with already inserted relay)



Connector
V23333-Z0001-A007
(Terminals to be ordered separately)



Connector with Mounting Flap
(To be mounted individually or can be interlocked)
V23333-Z1001-A008
(Terminals to be ordered separately)



Ordering Information

Part Numbers for Connectors		Selection of Fitting Crimp Terminals[1] (Ph. bronze tin plated)[2]							
Connector Description	Tyco Electronics Part Number	Terminal Size	Tyco Electronics Part Number	Wire mm^2	Use for	Quantity Required Form A	Quantity Required Form C	Use in Cavities Form A	Use in Cavities Form C
V23333-Z0002-A041	2-1904045-4	–	–	–	–	–	–	–	–
V23333-Z0001-A007	1-1904045-1	6.3 x 0.8	5-160526-9	0.5 - 1.5	Coil	2	2	1 and 2	1 and 2
		6.3 x 0.8	160927-4	1.0 - 2.5	Load	2	3	3 and 5	3, 4 and 5
V23333-Z1001-A008	1-1904045-2	6.3 x 0.8	5-160526-9	0.5 - 1.5	Coil	2	2	1 and 2	1 and 2
		6.3 x 0.8	160927-4	1.0 - 2.5	Load	2	3	3 and 5	3, 4 and 5

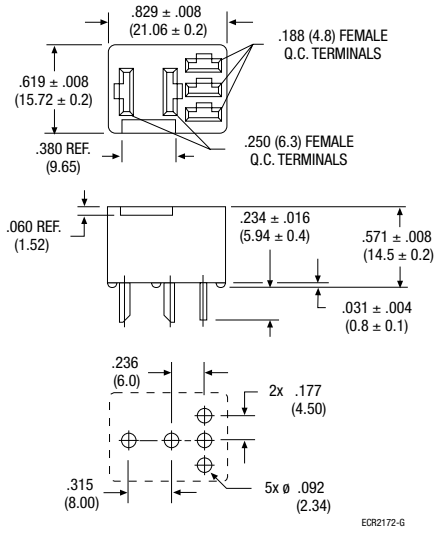
[1] Crimp terminals to be ordered separately.
[2] Mentioned crimp terminals are delivered in strip-form, loose pieces and hand tool available on request.

Standard Delivery Packs (orders in multiples of delivery pack)

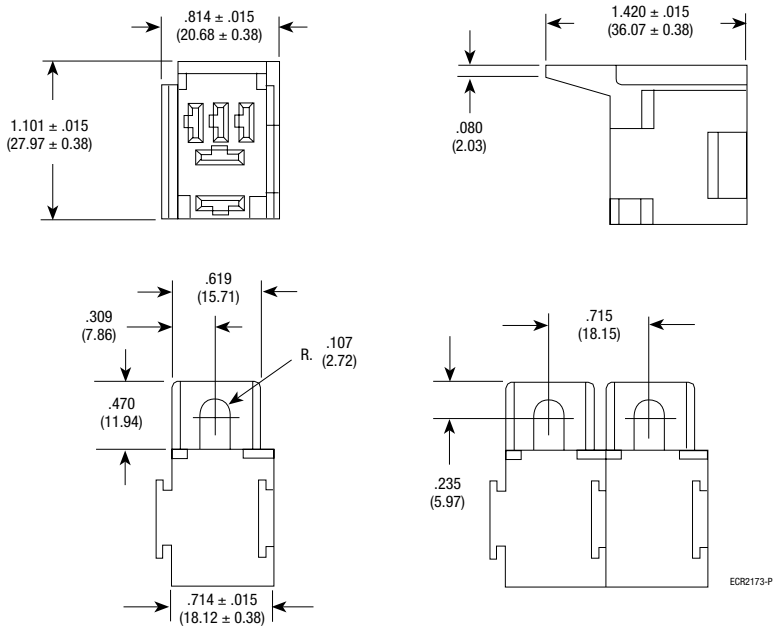
Connector V23333-Z0002-A041: 500 pieces
Connector V23333-Z0001-A008: 500 pieces
Connector V23333-Z1001-A007: 200 pieces

Connectors for Micro ISO Relays

PCB Socket
VCFM-1000
(Mounting Recommendation: To keep insertion force away from the PCB the soldering of the socket to the PCB should be done with already inserted relay)



Connector with Mounting Flap
(To be mounted individually or can be interlocked)
VCFM-1002
(Crimp terminals to be ordered separately)

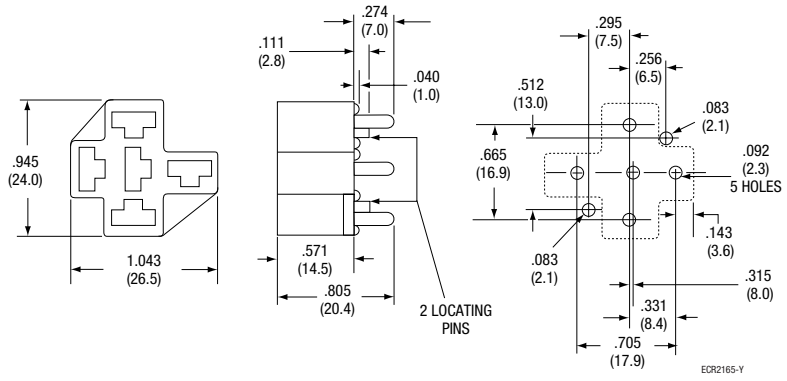


Ordering Information

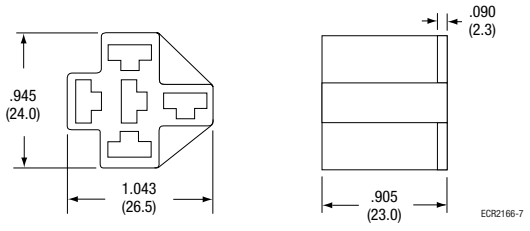
Part Numbers for Connectors and Crimp Terminals								
Connector Description	Tyco Electronics Part Number	Part Number Crimp Terminals	Tyco Electronics Part Number	Wire mm²	Quantity Required Form A	Quantity Required Form C	Use in Cavities Form A	Use in Cavities Form C
VCFM-1000	1393310-2	–	–	–	–	–	–	
VCFM-1002	3-1393310-8	AMP60249-1 AMP42281-1	60249-1 42281-1	1.3 - 3.3 0.8 - 2.1	2	2	3 and 5	3 and 5
		26A1492A 26A1492B	2-1393310-5 2-1393310-6	0.5 - 1.6 1.3 - 2.1	2	3	1 and 2	1, 2 and 4

Connectors for Mini ISO Relays

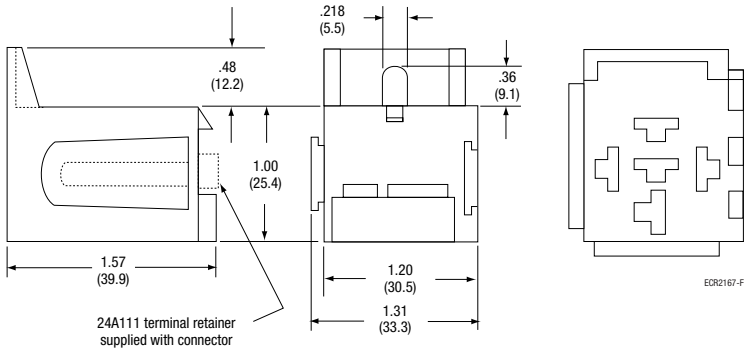
PCB Socket
VCF4-1000
(Mounting Recommendation: To keep insertion force away from the PCB the soldering of the socket to the PCB should be done with already inserted relay)



Connector
VCF4-1001
(Terminals to be ordered separately)



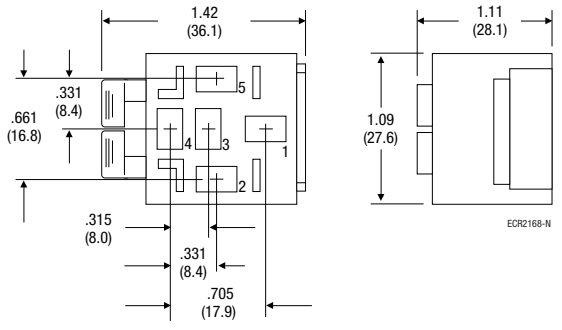
Connector with Mounting Flap
(To be mounted individually or can be interlocked)
VCF4-1002
(Crimp terminals to be ordered separately)



Ordering Information

Part Numbers for Connectors and Crimp Terminals						
Connector Description	Tyco Electronics Part Number	Part Number Crimp Terminals	Tyco Electronics Part Number	Quantity Required Wire mm²	Form A	Form C
VCF4-1000	1393310-3	–	–	–	–	–
VCF4-1001	1393310-7	AMP60249-1 AMP42281-1	60249-1 42281-1	1.3 - 3.3 0.8 - 2.1	4	5
VCF4-1002	4-1419106-0	26A1348A 26A1348B 26A1348C	1-1393310-8 1-1393310-9 2-1393310-0	0.5 - 0.8 1.3 - 2.1 3.3 - 5.3	4	5

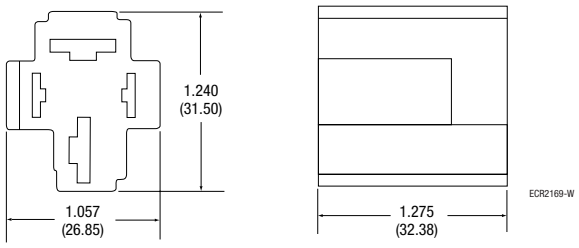
Connectors for Use with Mini ISO Relays with Shrouded Dust Cover
VCF4-1003
(Terminals to be ordered separately)



Ordering Information

Part Numbers for Connectors and Crimp Terminals						
Connector Description	Tyco Electronics Part Number	Part Number Crimp Terminals	Tyco Electronics Part Number	Quantity Required Wire mm²	Form A	Form C
VCF4-1003	1-1393305-3	26A1348A 26A1348B 26A1348C	1-1393310-8 1-1393310-9 2-1393310-0	0.5 - 0.8 1.3 - 2.1 3.3 - 5.3	4	5

Connectors for Use with Maxi ISO Relays
VCF7-1000
(Terminals to be ordered separately)

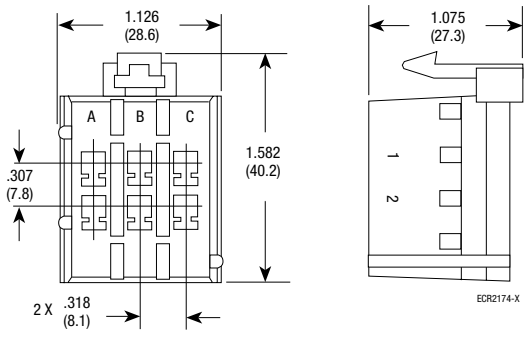


Ordering Information

Part Numbers for Connectors and Crimp Terminals					
Connector Description	Tyco Electronics Part Number	Part Number Crimp Terminals	Tyco Electronics Part Number	Wire mm²	Quantity Required
VCF7-1000	1393310-4	AMP280756-4 AMP280755-4 AMP42281-1	280756-4 280755-4 42281-1	3.3 - 5.3 5.3 - 13.3 0.8 - 2.1	2 (contacts) 2 (contacts) and 2 (coils)

Connectors for Mini 280 Relays

Connectors for Use with Mini 280 Relays
Shrouded (unsealed)
VC28-1003
(Terminals to be ordered separately)



Ordering Information

Part Numbers for Connectors and Crimp Terminals						
Connector Description	**Tyco Electronics Part Number**	**Part Number Crimp Terminal**	**Tyco Electronics Part Number**	**Wire mm²**	**Quantity Required Form A**	**Quantity Required Form C**
VC28-1003	1-1393310-7	26A1494A	2-1393310-7	0.5 - 0.3	4	5
		26A1494B	6-1393159-5	0.8 - 1.3		
		26A1494C	2-1393310-8	1.3 - 2.1		
		26A1494D	2-1393310-9	3.3 - 5.3		

AWG Conversion Table (Average Value)

Conversion Tables

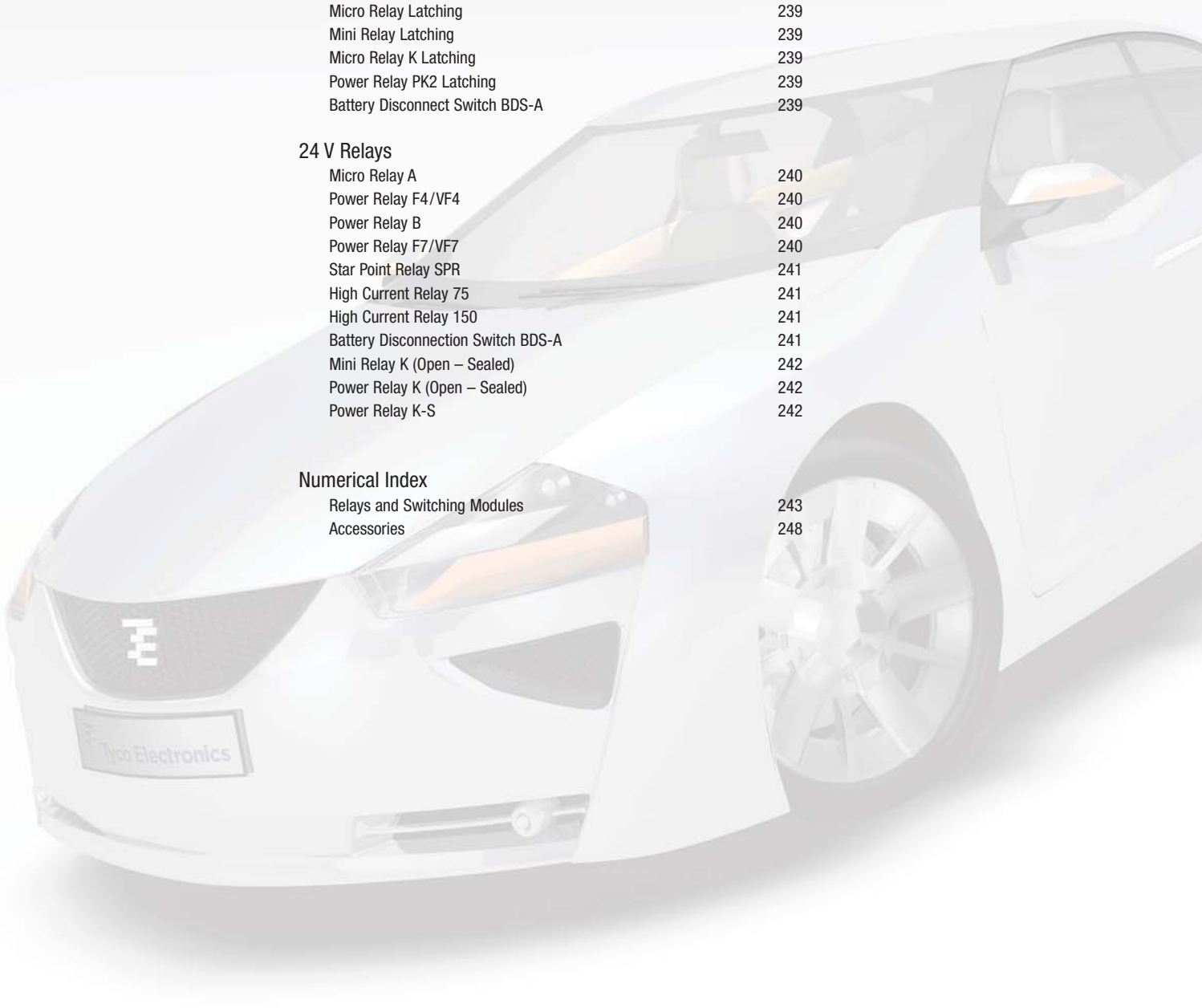
Conversion between:
- AWG
- Diameter (inch)
- Diameter (mm)
- F (mm^2)

Please contact Tyco Electronics for relay application support.

AWG Code	Diameter (inch)	Diameter (mm)	F (mm^2)
000000	0.5800	14.733	170.0
00000	0.5165	13.13	135.0
0000	0.4600	11.684	103.8
000	0.4096	10.4	79.0
00	0.3648	9.27	67.5
0	0.3249	8.25	53.4
1	0.2893	7.34	42.2
2	0.2576	6.55	33.7
3	0.2294	5.82	26.6
4	0.2043	5.18	21.0
5	0.1819	4.62	16.9
6	0.1620	4.115	13.25
7	0.1443	3.66	10.25
8	0.1285	3.26	8.34
9	0.1144	2.90	6.6
10	0.1019	2.59	5.27
11	0.0907	2.30	4.15
12	0.0808	2.05	3.3
13	0.0720	1.83	2.63
14	0.0641	1.63	2.08
15	0.0571	1.45	1.65
16	0.0508	1.29	1.305
17	0.0453	1.14	1.01
18	0.0403	1.02	0.79
19	0.0359	0.91	0.65
20	0.0320	0.81	0.51
21	0.0285	0.72	0.407
22	0.0253	0.64	0.32
23	0.0226	0.57	0.255
24	0.0201	0.51	0.205
25	0.0179	0.455	0.162
26	0.0159	0.400	0.125
27	0.0142	0.360	0.102
28	0.0126	0.320	0.08
29	0.0113	0.287	0.0646
30	0.0100	0.254	0.0516
31	0.0089	0.226	0.04
32	0.0080	0.203	0.0324
33	0.0071	0.180	0.0255
34	0.0063	0.160	0.02
35	0.0056	0.142	0.0158
36	0.0050	0.127	0.0127
37	0.0045	0.114	0.01
38	0.0040	0.101	0.008
39	0.0035	0.089	0.0062
40	0.0031	0.079	0.0049
41	0.0028	0.071	0.00395
42	0.0025	0.064	0.00321
43	0.0022	0.056	0.00246
44	0.00198	0.050	0.00196
45	0.00176	0.045	
46	0.00157	0.040	
47	0.00140	0.036	
48	0.00124	0.031	
49	0.00110	0.028	
50	0.00099	0.025	

Remark: Starting from 0.03 mm^2 (AWG 32) a wire can be crimped.

Contents



Reflow Solderable Relays

Advantages at a Glance

The Pin-in-Paste (Through-Hole-Reflow/ THR) technology combines the advantages of extremely reduced space requirements of the Through-Hole-technology (THT) relays on the printed circuit board with the costing and technology benefits of the reflow soldering process. The printed circuit board area is notably reduced in comparison to the area needed for SMD components.

Available Products

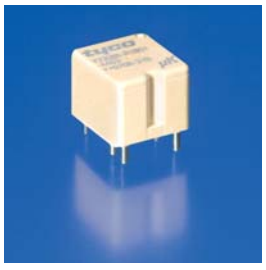
Single Nano Relay THR (Single)

The single version of the innovative Nano Relay well known as the smallest automotive relay in its class, is the first automotive relay developed for Through-Hole-Reflow processing using overmolding technology.

Technical Details Page 106 ff

Micro Relay K THR (Single)

The single version of the Micro Relay K THR is suitable for versatile usage in different automotive applications. The spectrum ranges from motor and heater applications to lamp and turn signal loads.



Technical Details Page 111 ff

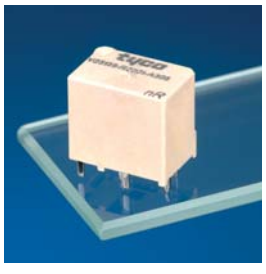
Power Relay PK2 THR

The PK2 Relays set new standards for various cross carline, high performance applications. Their volume was reduced by 60% compared to the predecessor Power K. The PK2 Relays are available in Through-Hole-Reflow technology.

Technical Details Page 134 ff

Nano Relay THR (Twin)

The Nano Relay – smallest twin automotive relay in its class – is the first automotive relay developed for Through-Hole-Reflow processing using overmolding technology.



Technical Details Page 162 ff

Double Micro Relay K THR (Twin)

The Double Micro Relay K THR is suitable for versatile usage in different automotive applications. The spectrum ranges from motor and heater applications to lamp and turn signal loads.

Technical Details Page 167 ff

Latching Relays

Advantages at a Glance

Latching relays represent a smart alternative to satisfy the demand for miniaturization and/or higher ambient temperature. The use of a permanent magnet keeps the armature in operating mode without energizing the coil.

Latching relays are especially suited for active power management e.g. quiescent current elimination, power outlet disconnection in case of critical battery voltage levels, load disconnection during transportation or long time parking. Furthermore, they are ideal for high temperature applications, power supply (clamp) loads as well as a possible replacement of monostable plug-in relays by latching PCB versions.

Available Products

Micro Relay Latching

The Micro Relay Latching is a magnetically latched ISO plug-in relay with two coils and a set and reset function.
The pin assignment is according to ISO 7588 part 3.

Technical Details Page 42 ff

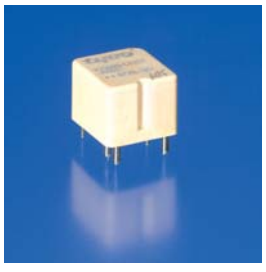
Mini Relay Latching

The Mini Relay Latching is a magnetically latched ISO plug-in relay with two coils and a set and reset function.
The pin assignment is according to ISO 7588 part 1.

Technical Details Page 76 ff

Micro Relay K Latching

The Micro Relay K Latching is the smallest magnetically latched PCB relay with two coils and a set and reset function. It features an increased ambient temperature range up to 125°C and limiting continuous currents up to 35 A. Its footprint is similar to the footprint of the Micro Relay K.



Technical Details Page 123 ff

Power Relay PK2 Latching

The latching version of this 60% volume reduced Power K features reduced coil power consumption and allows limiting continuous currents up to 50 A at increased ambient temperature up to 125°C. Its switching state remains even at breakdown of battery voltage.

Technical Details Page 139 ff

Battery Disconnection Switch BDS-A

Electrically settable and resettable relay especially designed for high voltage levels. Extended operating temperature range from –40°C to +120°C and shock resistance up to 40 g. Besides high peak currents up to 1500 A and a continuous current capability of 190 A at +85°C, short circuit protection is ensured.

Technical Details Page 199 ff

24 V Relays

Advantages at a Glance

Our 24 V Relays feature a broad range of highly robust and versatile relays for cross car line usage to meet the stringent in-field requirements found particularly in the trucks, busses and heavy duty industry.

Those relays are designed to operate in rather harsh environments and with increased contact gaps. They are suitable to operate under conditions of extended shock and vibration.

In the following you will find our current range of standard relays that are suitable for 24 V applications classified according to: ISO Plug-in Relays, High Current Solutions and PCB Relays.

Available ISO Plug-in Relays

Micro Relay A

These Micro plug-in relays are able to carry continuous currents up to 25 A at 85°C. The pin assignment of the Micro Relay A is according to ISO 7588 part 3. The 24 V version is available with a contact gap > 0.6 mm.

Technical Details Page 36 ff

Power Relay F4/VF4

These Mini plug-in relays are able to carry continuous currents up to 40 A at 85°C. The pin assignment of the Power Relay F4/VF4 is according to ISO 7588 part 1. The 24 V version is available with plug-in or PCB terminals and with a contact gap > 0.8 mm on request. It is also available for 42 V applications.

Technical Details Page 52 ff

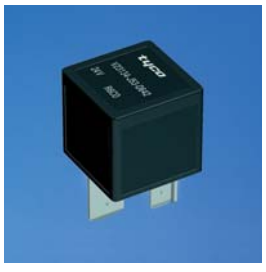
Power Relay B

The Power Relay B features limiting continuous currents of 35 A, its pin assignment is according to ISO 7588 part 1. With standardized dimensions it is available with plug-in or PCB terminals. The 24 V version comes with a contact gap of > 0.8 mm.

Technical Details Page 71 ff

Power Relay F7/VF7

The Maxi plug-in relays are able to carry continuous currents up to 70 A. The pin assignment of the Power Relay F7/VF7 is according to ISO 7588 part 1. The 24 V version is available with plug-in or PCB terminals and with a contact gap > 0.8 mm on request.



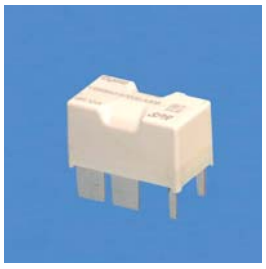
Technical Details Page 81 ff

24 V Relays (continued)

Available High Current Solutions

Star Point Relay SPR

The SPR is specifically designed to operate Electric Power Steering (EPS) motors in the automobile. It is suitable for voltages from 12 V to 42 V. Continuous current carrying capability is up to 60 A (peak 120 A) at max. ambient temperature of 125°C.



Technical Details Page 186 ff

High Current Relay 75

The HCR 75 is suitable for limiting continuous currents up to 75 A and current switching ability up to 150 A.

Technical Details Page 190 ff

High Current Relay 150

The HCR 150 is especially designed for high currents. It is suitable for limiting continuous currents up to 150 A at 85°C and current switching ability up to 300 A. The relay is also available for voltage levels up to 42 V.

Technical Details Page 194 ff

Battery Disconnection Switch BDS-A

Electrically settable and resettable relay especially designed for high voltage levels. Extended operating temperature range from –40°C to +120°C and shock resistance up to 40 g. Besides high peak currents up to 1500 A and a continuous current capability of 190 A at +85°C, short circuit protection is ensured.

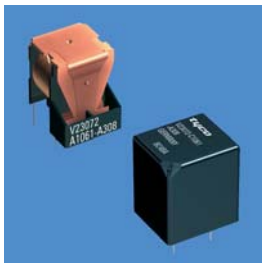
Technical Details Page 199 ff

24 V Relays (continued)

Available PCB Relays

Mini Relay K (Open – Sealed)

The Mini Relay K is available as open and sealed version and has a continuous current carrying capability up to 20 A. As 24 V version it features a special contact gap. The Mini Relay K is also suitable for 42 V applications.



Technical Details Page 128 ff

Power Relay K (Open – Sealed)

The Power Relay K is available as open and sealed version and has a continuous current carrying capability of up to 40 A.

Technical Details Page 144 ff

Power Relay K-S

With a continuous current capability of 50 A the Power Relay K-S is a real high current relay. The voltages range from 12 V to 42 V at very low voltage drop.

Technical Details Page 151 ff

Tyco Electronics Part Number	Relay Description	Series Designation	Page
1393267-2	V23084-C2001-A303	Double Mini Relay DMR	182
1393267-6	V23084-C2001-A403	Double Mini Relay DMR	182
1-1393267-0	V23084-C2002-A303	Double Mini Relay DMR	182
1-1393267-2	V23084-C2002-A403	Double Mini Relay DMR	182
3-1393272-2	V23072-A1061-A303	Mini Relay K (Open – Sealed)	133
3-1393272-6	V23072-A1061-A308	Mini Relay K (Open – Sealed)	133
5-1393272-2	V23072-A1062-A303	Mini Relay K (Open – Sealed)	133
5-1393272-3	V23072-A1062-A308	Mini Relay K (Open – Sealed)	133
4-1393273-9	V23072-C1061-A302	Mini Relay K (Open – Sealed)	133
5-1393273-6	V23072-C1061-A303	Mini Relay K (Open – Sealed)	133
6-1393273-0	V23072-C1061-A308	Mini Relay K (Open – Sealed)	133
7-1393273-6	V23072-C1062-A302	Mini Relay K (Open – Sealed)	133
7-1393273-8	V23072-C1062-A303	Mini Relay K (Open – Sealed)	133
8-1393273-2	V23072-C1062-A308	Mini Relay K (Open – Sealed)	133
1393276-3	V23071-A1009-A132	Power Relay K-S	155
1393276-7	V23071-A1010-A132	Power Relay K-S	155
1393277-1	VKP-31F42	VKP (Open – Sealed)	161
1393277-2	VKP-31H42	VKP (Open – Sealed)	161
1393277-3	VKP-35F42	VKP (Open – Sealed)	161
1393277-4	V23076-A1001-C133	Power Relay K (Open – Sealed)	149
1393277-6	V23076-A1001-D143	Power Relay K (Open – Sealed)	149
1393277-8	V23076-A1022-C133	Power Relay K (Open – Sealed)	149
1393277-9	V23076-A1022-D143	Power Relay K (Open – Sealed)	149
1-1393277-4	V23076-A3001-C132	Power Relay K (Open – Sealed)	149
1-1393277-7	V23076-A3001-D142	Power Relay K (Open – Sealed)	149
1-1393277-8	V23076-A3022-C132	Power Relay K (Open – Sealed)	149
1-1393277-9	V23076-A3022-D142	Power Relay K (Open – Sealed)	149
3-1393277-7	VKP-11F42	VKP (Open – Sealed)	161
5-1393277-1	VKP-15F52	VKP (Open – Sealed)	161
5-1393277-5	VKP-15H42	VKP (Open – Sealed)	161
6-1393277-2	VKP-31F52	VKP (Open – Sealed)	161
7-1393277-3	VKP-35F52	VKP (Open – Sealed)	161
7-1393277-9	VKP-35H42	VKP (Open – Sealed)	161
1393278-1	VKP-15F42	VKP (Open – Sealed)	161
1393278-7	V23133-A1001-C133	Power Relay K (Open – Sealed)	149
1-1393278-3	V23133-A1001-D143	Power Relay K (Open – Sealed)	149
3-1393278-7	V23133-A1022-C133	Power Relay K (Open – Sealed)	149
3-1393278-9	V23133-A1022-D143	Power Relay K (Open – Sealed)	149
5-1393278-7	V23133-A3001-C132	Power Relay K (Open – Sealed)	149
5-1393278-9	V23133-A3001-D142	Power Relay K (Open – Sealed)	149
7-1393278-1	V23133-A3022-C132	Power Relay K (Open – Sealed)	149
7-1393278-2	V23133-A3022-D142	Power Relay K (Open – Sealed)	149
1393280-6	V23086-C1001-A403	Micro Relay K (THT – THR)	116
1-1393280-1	V23086-C1002-A403	Micro Relay K (THT – THR)	116
1393281-1	V23086-M1011-A403	Micro Relay K SMD (Standard – Open Vent Hole)	122
1393292-5	V23074-A1001-A402	Micro Relay A	41
1393292-5	VFM-11F41-S01	Micro Relay A	41
8-1393292-4	V23074-A1001-A403	Micro Relay A	41
8-1393292-4	VFM-15F41-S01	Micro Relay A	41
1393297-1	VF28-11F14-S01	VF28 (Standard and Shrouded)	104
1393297-8	VF28-15F14-S01	VF28 (Standard and Shrouded)	104
1-1393297-3	VF28-15F24-S01	VF28 (Standard and Shrouded)	104
3-1393297-6	VF28-61F14-S01	VF28 (Standard and Shrouded)	104
4-1393297-5	VF28-65F14-S01	VF28 (Standard and Shrouded)	104
6-1393298-0	VF4-15F11	VF4 A (Standard, Shrouded and Weatherproof)	70
6-1393298-2	VF4-15F11-C05	VF4 A (Standard, Shrouded and Weatherproof)	70
6-1393298-4	VF4-15F11-S01	VF4 A (Standard, Shrouded and Weatherproof)	70
7-1393298-3	VF4-15F21-S01	VF4 A (Standard, Shrouded and Weatherproof)	70

Tyco Electronics Part Number	Relay Description	Series Designation	Page
8-1393298-1	VF4-15H11	VF4 A (Standard, Shrouded and Weatherproof)	70
8-1393298-8	VF4-45F11	VF4 A (Standard, Shrouded and Weatherproof)	70
1393302-6	VF4-15F13	Power Relay F4/VF4	57
1393302-6	V23134-A0052-X811	Power Relay F4/VF4	57
1393302-8	VF4-15H13	Power Relay F4/VF4	57
1393302-8	V23134-A0064-X819	Power Relay F4/VF4	57
1-1393302-0	VF4-45F11-S01	VF4 A (Standard, Shrouded and Weatherproof)	70
1-1393302-1	VF4-45H11	VF4 A (Standard, Shrouded and Weatherproof)	70
1-1393302-3	VF7-11F12	Power Relay F7/VF7	86
1-1393302-3	V23134-J0055-X838	Power Relay F7/VF7	86
1-1393302-4	VF7-11H11	Power Relay F7/VF7	86
1-1393302-4	V23134-J0065-X839	Power Relay F7/VF7	86
1-1393302-5	VF7-11H12	Power Relay F7/VF7	86
1-1393302-5	V23134-J0065-X841	Power Relay F7/VF7	86
1-1393302-6	VF7-41F11-S01	Power Relay F7/VF7	86
1-1393302-6	V23134-J1055-X849	Power Relay F7/VF7	86
1-1393302-7	VF7-41H11	Power Relay F7/VF7	86
1-1393302-7	V23134-J1065-X853	Power Relay F7/VF7	86
2-1393302-2	V23134-A0052-C643	Power Relay F4/VF4	57
2-1393302-3	V23134-A0052-G243	Power Relay F4/VF4	57
4-1393302-1	V23134-A0052-X278	Power Relay F4/VF4	57
3-1393302-6	V23134-A0052-X205	Power Relay F4/VF4	57
5-1393302-8	V23134-A1052-C643	Power Relay F4/VF4	57
5-1393302-1	V23134-A0053-C643	Power Relay F4/VF4	57
5-1393302-2	V23134-A0053-G243	Power Relay F4/VF4	57
6-1393302-3	V23134-A1053-C643	Power Relay F4/VF4	57
7-1393302-5	V23134-B0052-C642	Power Relay F4/VF4	57
7-1393302-7	V23134-B0052-G242	Power Relay F4/VF4	57
1393303-9	V23134-B0053-C642	Power Relay F4/VF4	57
1-1393303-0	V23134-B0053-G242	Power Relay F4/VF4	57
3-1393303-4	V23134-B1052-C642	Power Relay F4/VF4	57
3-1393303-7	V23134-B1053-C642	Power Relay F4/VF4	57
3-1393303-9	V23134-C0052-C642	Power Relay F4/VF4	57
4-1393303-0	V23134-C0052-G242	Power Relay F4/VF4	57
4-1393303-4	V23134-C0053-C642	Power Relay F4/VF4	57
4-1393303-5	V23134-C0053-G242	Power Relay F4/VF4	57
4-1393303-7	V23134-C1052-C642	Power Relay F4/VF4	57
5-1393303-0	V23134-C1053-C642	Power Relay F4/VF4	57
7-1393303-3	V23134-J0052-D642	Power Relay F7/VF7	86
9-1393303-7	V23134-J0053-D642	Power Relay F7/VF7	86
1393304-5	V23134-J0056-X408	Power Relay F7/VF7	86
1393304-9	V23134-J1052-D642	Power Relay F7/VF7	86
1-1393304-1	V23134-J1053-D642	Power Relay F7/VF7	86
5-1393304-6	V23134-M0052-C642	Power Relay F4/VF4	57
5-1393304-7	V23134-M0052-G242	Power Relay F4/VF4	57
6-1393304-7	V23134-M0053-C642	Power Relay F4/VF4	57
6-1393304-8	V23134-M0053-G242	Power Relay F4/VF4	57
7-1393304-1	V23134-M1052-C642	Power Relay F4/VF4	57
7-1393304-4	V23134-M1053-C642	Power Relay F4/VF4	57
2-1393305-1	VF4-11F13	Power Relay F4/VF4	57
2-1393305-1	V23134-B0052-X801	Power Relay F4/VF4	57
2-1393305-2	VF4-11F13-C01	Power Relay F4/VF4	57
2-1393305-2	V23134-B0052-X802	Power Relay F4/VF4	57
2-1393305-6	VF4-11H13	Power Relay F4/VF4	57
2-1393305-6	V23134-B0064-X804	Power Relay F4/VF4	57
4-1393305-5	VF4-15F13-C01	Power Relay F4/VF4	57
4-1393305-5	V23134-A0052-X812	Power Relay F4/VF4	57
4-1393305-7	VF4-15F13-C05	Power Relay F4/VF4	57

Tyco Electronics Part Number	Relay Description	Series Designation	Page
4-1393305-7	V23134-A0052-X813	Power Relay F4/VF4	57
5-1393305-3	VF4-15H11-C05	Power Relay F4/VF4	57
5-1393305-3	V23134-A0064-X816	Power Relay F4/VF4	57
5-1393305-7	VF4-15H11-S08	VF4 A (Standard, Shrouded and Weatherproof)	70
5-1393305-9	VF4-15H13-C01	Power Relay F4/VF4	57
5-1393305-9	V23134-A0064-X820	Power Relay F4/VF4	57
6-1393305-9	VF4-41F11-S01	Power Relay F4/VF4	57
6-1393305-9	V23134-B1052-X824	Power Relay F4/VF4	57
7-1393305-0	VF4-41H11	Power Relay F4/VF4	57
7-1393305-0	V23134-B1064-X825	Power Relay F4/VF4	57
7-1393305-1	VF4-41H11-S08	Power Relay F4/VF4	57
7-1393305-1	V23134-A1064-X831	Power Relay F4/VF4	57
7-1393305-2	VF4-45D11	Power Relay F4/VF4	57
7-1393305-2	V23134-A1051-X826	Power Relay F4/VF4	57
7-1393305-5	VF4-45F11-C05	Power Relay F4/VF4	57
7-1393305-5	V23134-A1052-X828	Power Relay F4/VF4	57
8-1393305-4	VF4-15H11-S05	Power Relay F4/VF4	57
8-1393305-4	V23134-A1064-X830	Power Relay F4/VF4	57
8-1393305-7	VF4-55F11-S01	VF4 A (Standard, Shrouded and Weatherproof)	70
9-1393305-5	VF4-65F11-S01	VF4 A (Standard, Shrouded and Weatherproof)	70
4-1393306-5	VF7-11F11	Power Relay F7/VF7	86
4-1393306-5	V23134-J0055-X834	Power Relay F7/VF7	86
4-1393306-6	VF7-11F11-S01	Power Relay F7/VF7	86
4-1393306-6	V23134-J0055-X836	Power Relay F7/VF7	86
5-1393306-8	VF7-41F11	Power Relay F7/VF7	86
5-1393306-8	V23134-J1055-X845	Power Relay F7/VF7	86
6-1393306-7	VF7-41H11-S08	Power Relay F7/VF7	86
6-1393306-7	V23134-J1065-X855	Power Relay F7/VF7	86
1393315-1	V23132-A2001-A100	High Current Relay 150	198
1393315-2	V23132-A2001-A200	High Current Relay 150	198
1393315-3	V23132-A2001-B100	High Current Relay 150	198
1393315-8	V23132-B2002-A100	High Current Relay 150	198
1393315-9	V23132-B2002-A200	High Current Relay 150	198
1-1393315-1	V23132-B2002-B200	High Current Relay 150	198
1413009-9	V23086-C2001-A403	Double Micro Relay K (THT – THR)	172
1-1414099-0	V23134-B0052-X270	Power Relay F4/VF4	57
1-1414121-0	V23136-B1001-X051	Shrouded Power Relay F4 A	63
1-1414122-0	V23136-J1004-X050	Shrouded Power Relay F7 A	91
1-1414147-0	V23134-J0052-X429	Power Relay F7/VF7	86
1-1414167-0	V23134-A0056-X432	Power Relay F4/VF4	57
1-1414168-0	V23134-A0056-X433	Power Relay F4/VF4	57
1-1414173-0	V23133-A3001-D152	Power Relay K (Open – Sealed)	149
1-1414174-0	V23133-A3022-D152	Power Relay K (Open – Sealed)	149
1-1414175-0	V23076-A3001-D152	Power Relay K (Open – Sealed)	149
1-1414233-0	V23141-B0001-X031	Power Management Module	223
1-1414255-0	V23141-B0001-X030	Power Management Module	223
1-1414286-0	V23134-J0052-X439	Power Relay F7/VF7	86
1-1414428-0	V23132-B2002-B100	High Current Relay 150	198
1-1414469-0	V23134-J0052-X461	Power Relay F7/VF7	86
1-1414478-0	V23134-J0052-X455	Power Relay F7/VF7	86
1-1414501-0	V23141-B0001-X038	Power Management Module	223
1-1414502-0	V23141-B0001-X037	Power Management Module	223
1-1414546-0	V23140-Z0000-X024	Cover	209
1-1414547-0	V23140-Z0000-X025	Cover	209
1-1414548-0	V23140-Z0000-X023	Cover	209
1-1414552-0	V23136-A1001-X057	Shrouded Power Relay F4 A	63
1-1414654-0	V23140-J0052-D642	Power Module Relay F7	214
1-1414672-0	V23140-A0052-C643	Power Module Relay F4	209

Tyco Electronics Part Number	Relay Description	Series Designation	Page
1-1414673-0	V23140-A0053-C643	Power Module Relay F4	209
1-1414674-0	V23140-J0053-D642	Power Module Relay F7	214
1-1414675-0	V23140-B0053-C642	Power Module Relay F4	209
1-1414676-0	V23140-B0052-C642	Power Module Relay F4	209
1-1414690-0	V23140-Z0000-X026	Cover	209
1-1414704-0	V23135-W1001-A309	Star Point Relay SPR	189
1-1414705-0	V23135-W1002-A309	Star Point Relay SPR	189
3-1414773-5	V23145-B1101-A402	Micro Relay Low Noise	51
7-1414778-3	V23130-C2421-A431	Battery Disconnect Switch BDS-A	202
5-1414782-7	V23201-C1001-A502	Power Relay PK2 (THT – THR)	138
4-1414915-9	V23201-L1004-A502	Power Relay PK2 Latching	143
6-1414918-8	V23086-R1821-A502	Micro Relay K (THT – THR)	116
5-1414920-9	V23086-R1802-A403	Micro Relay K (THT – THR)	116
6-1414920-0	V23086-R1801-A403	Micro Relay K (THT – THR)	116
6-1414920-1	V23086-R2801-A403	Double Micro Relay K (THT – THR)	172
6-1414920-2	V23086-R2802-A403	Double Micro Relay K (THT – THR)	172
6-1414932-3	V23201-R1005-A502	Power Relay PK2 (THT – THR)	138
7-1414967-8	V23086-R1802-A803	Micro Relay K (THT – THR)	116
3-1414933-1	V23086-U1012-A303	Micro Relay K SMD (Standard – Open Vent Hole)	122
1-1414939-4	V23130-C2021-A412	Battery Disconnect Switch BDS-A	202
1-1414960-2	V23138-R2005-A403	Nano Relay (THT – THR)	166
1-1414960-7	V23138-R1005-A403	Single Nano Relay (THT – THR)	110
9-1414964-1	V23138-C1005-A403	Single Nano Relay (THT – THR)	110
8-1414964-6	V23138-C2005-A303	Nano Relay (THT – THR)	166
8-1414964-7	V23138-R2005-A303	Nano Relay (THT – THR)	166
8-1414964-8	V23138-C2005-A403	Nano Relay (THT – THR)	166
8-1414964-9	V23138-C1005-A303	Single Nano Relay (THT – THR)	110
9-1414964-0	V23138-R1005-A303	Single Nano Relay (THT – THR)	110
2-1414971-4	V23074-H1005-A502	Micro Relay A	41
8-1416000-5	V23086-M1012-A403	Micro Relay K SMD (Standard – Open Vent Hole)	122
8-1416000-7	V23086-C1021-A502	Micro Relay K (THT – THR)	116
8-1416000-9	V23086-L1251-A403	Micro Relay K Latching	127
9-1416000-6	V23086-C1001-A602	Micro Relay K (THT – THR)	116
1416001-2	V23086-U1011-A303	Micro Relay K SMD (Standard – Open Vent Hole)	122
1-1416001-4	V23072-C1061-A408	Mini Relay K (Open – Sealed)	133
2-1416001-0	V23072-C1061-A402	Mini Relay K (Open – Sealed)	133
1416010-1	V23132-A2001-B200	High Current Relay 150	198
2-1419084-3	VF28-11F24-S01	VF28 (Standard and Shrouded)	104
2-1419137-6	V23086-M2011-A403	Double Micro Relay K SMD (Standard – Open Vent Hole)	177
8-1419137-4	V23086-C2002-A403	Double Micro Relay K (THT – THR)	172
5-1419148-4	VKP-11H42	VKP (Open – Sealed)	161
1432055-1	VF7-41F11-C05	Power Relay F7/VF7	86
1432055-1	V23134-J1056-X846	Power Relay F7/VF7	86
1432197-1	VKP-35H52	VKP (Open – Sealed)	161
1432198-1	VKP-31H52	VKP (Open – Sealed)	161
1432219-1	VF4-45H11-C05	Power Relay F4/VF4	57
1432219-1	V23134-A1064-X829	Power Relay F4/VF4	57
1432223-1	VJ28-95F24-S01	VJ28	95
1432257-1	VJ28-91F24-S01	VJ28	95
1432413-1	VKP-31F72	VKP (Open – Sealed)	161
1432438-1	VKP-35F72	VKP (Open – Sealed)	161
1432444-1	VKP-11F72	VKP (Open – Sealed)	161
1432445-1	VKP-15F72	VKP (Open – Sealed)	161
1432556-1	VF7-11F12-C05	Power Relay F7/VF7	86
1432556-1	V23134-J0055-X864	Power Relay F7/VF7	86
1432726-1	VH28-21F24-S01	VH28 Half Width	99
1432833-1	VH28-11F24-S01	VH28 Half Width	99
1904000-1	V23232-D0001-X001	High Current Relay 75	193

Relays and Switching Modules

Tyco Electronics Part Number	Relay Description	Series Designation	Page
1904001-4	V23232-A0002-X008	High Current Relay 75	193
2-1904001-3	V23232-A0001-X005	High Current Relay 75	193
5-1904006-1	V23234-B0001-X001	Power Relay B	75
1-1904007-1	V23234-B1001-X004	Power Relay B	75
1-1904007-2	V23234-B1001-X010	Power Relay B	75
1-1904008-2	V23234-B0002-X012	Power Relay B	75
2-1904011-1	V23234-C0001-X003	Power Relay B	75
2-1904011-2	V23234-C0001-X006	Power Relay B	75
5-1904012-1	V23234-C1001-X005	Power Relay B	75
5-1904014-1	V23234-C1004-X017	Power Relay B	75
1-1904015-3	V23234-C0004-X020	Power Relay B	75
2-1904015-1	V23234-C0004-X018	Power Relay B	75
5-1904015-2	V23234-B0004-X019	Power Relay B	75
5-1904018-1	V23234-K1001-X024	Power Relay B	75
1-1904020-2	V23234-A0001-X032	Power Relay B	75
1-1904020-5	V23234-A0001-X038	Power Relay B	75
4-1904020-7	V23234-A0001-X040	Power Relay B	75
1-1904022-1	V23234-A1001-X033	Power Relay B	75
2-1904022-3	V23234-A1001-X041	Power Relay B	75
3-1904022-2	V23234-A1001-X036	Power Relay B	75
2-1904025-3	V23234-A0004-X051	Power Relay B	75
2-1904025-5	V23234-A0004-X053	Power Relay B	75
4-1904025-1	V23234-A0004-X048	Power Relay B	75
1-1904027-1	V23234-A1004-X050	Power Relay B	75
3-1904027-2	V23234-A1004-X054	Power Relay B	75
On request	V23145-L1101-A402	Micro Relay Latching	46
On request	V23145-A1101-A403	Micro Relay Low Noise	51
On request	V23141-L0001-X039	Mini Relay Latching	80
On request	V23086-C1002-A803	Micro Relay K (THT – THR)	116
On request	V23086-U2011-A403	Double Micro Relay K SMD (Standard – Open Vent Hole)	177

Accessories

Tyco Electronics Part Number	Connector Description	Additional Information	Part Number Crimp Terminal	Tyco Electronics Part Number	Page
6-0160448-5	Connector for Power Module Relay F4	Connector 929102	–	–	205
160655-2	Connector for Power Module Relay F4	Connector 929102	–	–	205
180907-0	Connector for HCR 75	2 way FF receptacle housing	–	–	191
281934-2	Connector for HCR 150	Single wire seal	–	–	195
282080-1	Connector for HCR 150	Receptacle connector	–	–	195
282110-1	Connector for HCR 150	Contact	–	–	195
710026-0	Connector for HCR 150	Thimble	–	–	195
1-1393305-3	VCF4-1003		26A1348A	1-1393310-8	234
1-1393305-3	VCF4-1003		26A1348B	1-1393310-9	234
1-1393305-3	VCF4-1003		26A1348C	2-1393310-0	234
1393310-2	VCFM-1000		–	–	232
1393310-3	VCF4-1000		–	–	233
1393310-4	VCF7-1000		AMP280756-4	280756-4	234
1393310-4	VCF7-1000		AMP280755-4	280755-4	234
1393310-4	VCF7-1000		AMP42281-1	42281-1	234
1393310-7	VCF4-1001		AMP60249-1	60249-1	233
1393310-7	VCF4-1001		AMP42281-1	42281-1	233
1-1393310-7	VC28-1003		26A1494A	2-1393310-7	235
1-1393310-7	VC28-1003		26A1494B	6-1393159-5	235
1-1393310-7	VC28-1003		26A1494C	2-1393310-8	235
1-1393310-7	VC28-1003		26A1494D	2-1393310-9	235
3-1393310-8	VCFM-1002		AMP60249-1	60249-1	232
3-1393310-8	VCFM-1002		AMP42281-1	42281-1	232
3-1393310-8	VCFM-1002		26A1492A	2-1393310-5	232
3-1393310-8	VCFM-1002		26A1492B	2-1393310-6	232
4-1419106-0	VCF4-1002		26A1348A	1-1393310-8	233
4-1419106-0	VCF4-1002		26A1348B	1-1393310-9	233
4-1419106-0	VCF4-1002		26A1348C	2-1393310-0	233
1-1904045-1	V23333-Z0001-A007		–	5-160526-9	231
1-1904045-1	V23333-Z0001-A007		–	160927-4	231
1-1904045-2	V23333-Z1001-A008		–	5-160526-9	231
1-1904045-2	V23333-Z1001-A008		–	160927-4	231
1-1904045-5	V23333-Z1001-B045		–	280919-4	228
1-1904045-5	V23333-Z1001-B045		–	281197-2	228
1-1904045-5	V23333-Z1001-B045		–	160917-2	228
1-1904045-6	V23333-Z0001-B046		–	280919-4	228
1-1904045-6	V23333-Z0001-B046		–	281197-2	228
1-1904045-6	V23333-Z0001-B046		–	160927-4	228
2-1904045-4	V23333-Z0002-A041		–	–	231
2-1904045-7	V23333-Z0002-B049		–	–	228

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