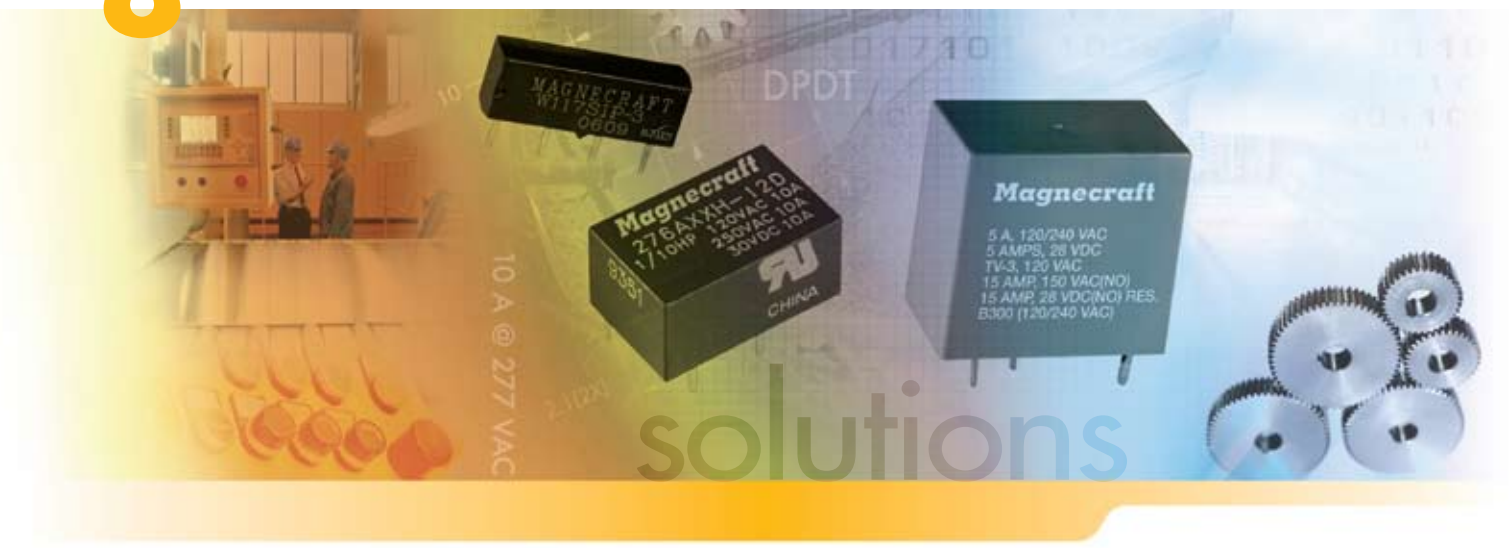
Section

8 Relays - Electromechanical Printed Circuit Board



Introduction:
In the past several years the dry reed relay has become an important product among relay specifiers, primarily because of the tremendous increases in low level switching for computers, business machines, and communication appliances. The dry reed relay has the great advantage of being hermetically sealed and is thus impervious to atmospheric contamination. It is very fast and, when operated within the rated contact loads, it offer a reliable switching component and extremely long life.

How Reed Relays Work:
The basic element of the reed relay is the glass reed capsule commonly known as a reed switch. A reed switch consists of two overlapping, flat, ferromagnetic reeds, separated by a small air gap, sealed in a glass capsule. The reeds are supported at the point where they are sealed into the ends of a glass tube and therefore act as cantilevers. If the free ends of the reeds are placed in a magnetic field, the flux in the gap between the reeds will cause them to pull together. When the magnetic field is removed, the reeds will spring apart due to the spring tension in the reeds. The reeds thus provide a magnetic operating gap and serve as a contact pair to close and open an electrical circuit.

A typical dry reed switch capsule is shown in Figure 1.

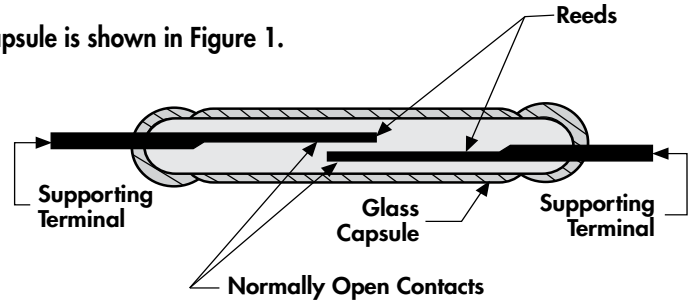


Figure 1

In the basic SPST-NO design, two opposing reeds are sealed into a narrow glass capsule and overlapped at their free ends. The contact area is plated typically with rhodium to produce a low contact resistance when contacts are drawn together. The capsule is made of glass and filled with a dry inert gas and then sealed. The capsule is surrounded by an electromagnetic coil. When the coil is energized, the normally open contacts are brought together; when the coil voltage is removed, the reeds separate by their own spring tension. Some reeds contain permanent magnets for magnetic biasing to achieve normally closed contacts (SPST-NC) or SPDT contact combinations. The current rating, which is dependent upon the size of the reed and the type and amount of plating, may range from low level to 1 amp. Effective contact protection is essential when switching loads other then dry resistive loads.

Advantages:

- Sensitive in operation, which enables the reed relay to be driven by low cost IC's.
- Small Physical Size
- High Insulation Resistance
- High Reliability
- Long Life
- Low Cost
- Fast Switching Capability

Contact Combinations:
The switches used in dry reed relays provide SPST- NO, SPST-NC, SPDT contact combinations. The SPST-NO corresponds with the basic switch capsule design (Figure 1). The SPST-NC results from a combination of the SPST-NO switch and a permanent magnet strong enough to pull the contacts closed but able to open when coil voltage is applied to the relay coil. In typical true SPDT designs, the armature is mechanically tensioned against the normally closed contact, and is moved to the normally open contact upon application of a magnetic field.

Magnetic Fields:
Reed relays in general can be characterized as susceptible to the influences of external magnetic fields. It is important to keep reed relays at a proper distance from each other because of the possibility of magnetic-interaction between them. Proper magnetic shielding must be used to contain stray magnetic fields. When installing reed relays into equipment, one should be aware of the devices within that equipment which can produce magnetic fields. The relays being installed into that equipment should be positioned as far away as possible from any stray magnetic fields and should be shielded to prevent false operations. A general rule is to space reed relays no closer together than 0.5 inches.

Electrical Characteristics:

Sensitivity: The input power required to operate dry reed relays is determined by the sensitivity of the particular reed switch used, by the number of switches operated by the coil, by the permanent magnet biasing (if used), and the efficiency of the coil and the effectiveness of its coupling to the blades. Minimum input required to affect closure ranges from the very low milliwatt level for a single sensitive capsule to several watts for multi-pole relays.

Operate Time: The coil time constant, overdrive on the coil, and the characteristics of the reed switch determine operate time. With the maximum overdrive voltage applied to the coil, reed relays will operate in approximately the 200 microsecond range. When driven at rated coil voltage, usually the relays will operate at about one millisecond.

Release Time: With the coil unsuppressed, dry reed switch contacts release in a fraction of a millisecond. SPST-NO contacts will open in as little as 50 microseconds. Magnetically biased SPST-NC and SPDT switches re-close from 100 microseconds to 1 millisecond respectively. If the relay coil is suppressed, release times are increased. Diode suppression can delay release times for several milliseconds, depending on coil characteristics, coil voltage, and reed release characteristics.

Contact Bounce:
Dry reed contacts bounce on closure as with any other hard contact relay. The duration of bounce on a Dry reed switch is typically very short, and is in part dependent on drive level. In some of the faster devices, the sum of the operate time and bounce is relatively constant. As drive is increased, the operate time decreases with bounce time increasing. The normally closed contacts of a SPDT switch bounce more then the normally open contacts. Magnetically biased SPST-NC contacts exhibit essentially the same bounce characteristics as SPST-NO switches.

Contact Resistance:
The reeds (blades) in a dry reed switch are made of a magnetic material which has a high volume resistivity; terminal-to-terminal resistance is somewhat higher than in some other types of relays. Typical specification limits for initial resistance of a SPST-NO reed relay is 0.200 ohms max (200 milliohms).

Insulation Resistance:
A dry reed switch will have an insulation resistance of 10^{12} to 10^{13} ohms or greater. When it is assembled into a relay, parallel insulation paths reduce this to typical values of 10^{13} ohms. Exposure to high humidity or contaminating environments can appreciably lower final insulation resistance.

Thermal EMF:
Since thermally generated voltages result from thermal gradients within the relay assembly, relays built to minimize this effect often use sensitive switches to reduce required coil power, and thermally conductive materials to reduce temperature gradients.

Noise:
Noise is defined as a voltage appearing between terminals of a switch for a few milliseconds following closure of the contacts. It occurs because the reeds (blades) are moving in a magnetic field and because voltages are produced within them by magnetostrictive effects. From an application standpoint, noise is important if the signal switched by the reed is to be used within a few milliseconds immediately following closure of the contacts. When noise is critical in an application, a peak-to-peak limit must be established by measurement techniques, including filters which must be specified for that particular switching application.

Environmental Characteristics:
Reed relays are used in essentially the same environments as other types of relays. A factor influencing their ability to function would be temperature extremes beyond specified limits.

Vibration:
The reed switch structure, with so few elements free to move, has a better defined response to vibration than other relay types. With vibration inputs reasonably separated from the resonant frequency, the reed relay will withstand relatively high inputs, 20 g's or more. At resonance of the reeds, the typical device can fail at very low input levels. Typical resonance frequency is 2 kHz.

Shock:
Dry reed relays will withstand relatively high levels of shock. SPST-NO contacts are usually rated to pass 30 to 50 g's, 11 milliseconds, half sign wave shock, without false operation of contacts. Switches exposed to a magnetic field that keep the contacts in a closed position, such as in the biased latching form, demonstrate somewhat lower resistance to shock. Normally closed contacts of mechanically biased SPDT switches may also fail at lower shock. Normally closed contacts of mechanically biased SPDT switches may also fail at lower shock levels.

Temperature:
Differential expansion or contraction of reed switches and materials used in relay assemblies can lead to fracture of the switches. Reed relays are capable of withstanding temperature cycling or temperature shock over a range of at least -50˚C to + 100˚C. These limits should be applied to the application to prevent switch failure.

Contact Protection:
Tungsten lamp, inductive and capacitive discharge load are extremely detrimental to reed switches and reduce life considerably. Illustrated below are typical suppression circuits which are necessary for maximum contact life.

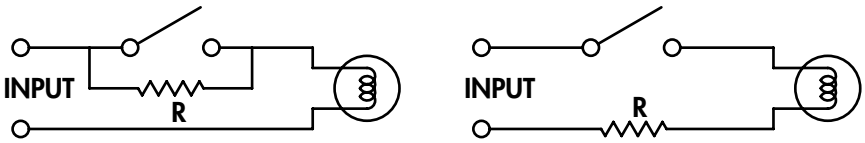


Figure 2

Initial cold filament turn-on current is often 16 times higher than the rated operating current of the lamp. A current limiting resistor in series with the load, or a bleeder resistor across the contacts will suppress the inrush current. The same circuits can be used with capacitive loads, as shown in Figure 2.

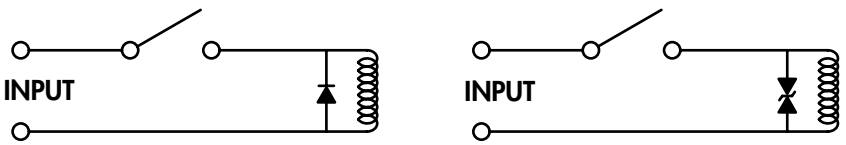


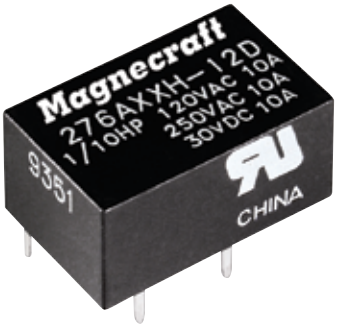
Figure 3

DC inductive loads call for either a diode or a thyristor to be placed across the load. These circuits are necessary to protect the contacts when inductive loads are to be switched in a circuit, as shown in Figure 3.

Advantages of the PCB Relays

Some control system designs require the relay to be mounted directly on the Printed Circuit Board (PCB). These parts will need to be small enough to make PCB mounting practical and more easy to manufacture. The Magnecraft PCB-mounted relays can fit a variety of applications. The line is perfect for low level DC switching and some can handle AC switching. Also, many are rated for UL approved industrial applications.

- DTL Compatible
- Up to 5kV of Surge Resistance Coils
- UL Recognized for 1/6 HP 120VAC Model



276

- Up to 20A
- Less than 1 Cubic Inch
- UL Recognized and meets CSA and TÜV Specifications

976

SIPS & DIPS

Electronic control circuits built on PCB's demand relays that can be populated with the same machinery currently used in the production lines. The Magnecraft SIPS and DIPS are built in small industry standard package styles that do not require unique machinery to populate. The SIPS and DIPS can even withstand a lead-free solder re-flow process so a pin-thru-paste application is possible.

- Up to 1/3 HP 120VAC Switching
- UL Recognized
- Can Be Configured in a Variety of Contact Materials and Mounting Styles

49

- RoHS Compliant
- Designed for Simple Routing on PCB
- Requires only 0.5 Inch Spacing from Adjacent Relays

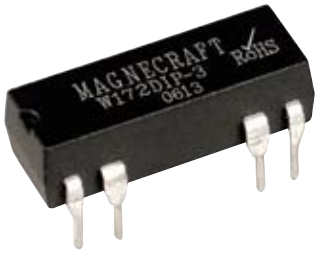
117SIP

- 50 G Shock Resistance
- RoHS Compliant
- Designed for Simple Routing on PCB

107DIP

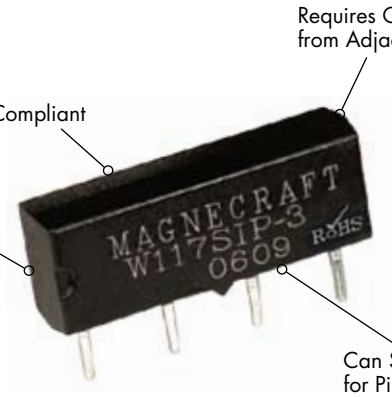
- Available with or without Clamping Diode
- SPST-NO and SPST-NC Versions Available
- A Wide Variety of Standard Parts
- RoHS Compliant

171DIP



- 50 G Shock Resistance
- RoHS Compliant

172DIP

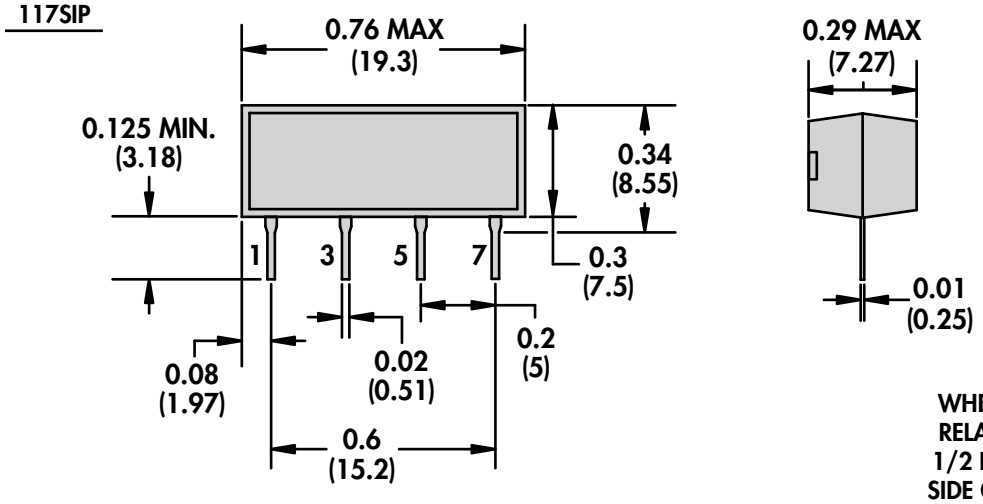


117SIP

General Specifications

Contact Characteristics			**Units**	**117SIP**
Number and type of Contacts				SPST
Contact materials				Rhodium
Current rating			A	0.5
Switching voltage		~	V	120
		⎓	V	200
Minimum Switching Requirement	Minimum		mA	10
Coil Characteristics				
Voltage Range		⎓	V	5....24
Operating Range	% of Nominal	⎓		80% to 110%
Average consumption		⎓	W	0.29
Drop-out voltage threshold		⎓		10%
Performance Characteristics				
Electrical Life	Operations @ Rated Current (Resistive)			50,000,000
Mechanical Life	Unpowered			100,000,000
Operating time (response time)			ms	0.45
Rated insulation voltage	Between coil and contact	~	V	500
Dielectric strength	Between poles	~	V	500
rms voltage	Between contacts	~	V	150
Environment				
Ambient air temperature	Storage		°C	-40...+85
around the device	Operation		°C	-40...+55
Vibration resistance	Operational		g-n	20, 10-200 Hz
Shock resistance			g-n	50
Weight			grams	1

117SIP



WHEN SPACING SIP AND DIP RELAYS, THE RELAYS REQUIRE 1/2 INCH SPACING FROM THE SIDE OF THE ADJACENT RELAYS

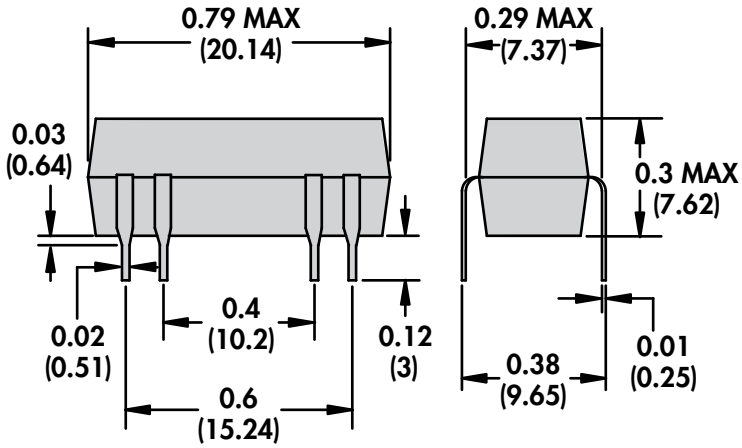
DRAWING ENLARGED TO 200% OF ACTUAL SIZE

107DIP

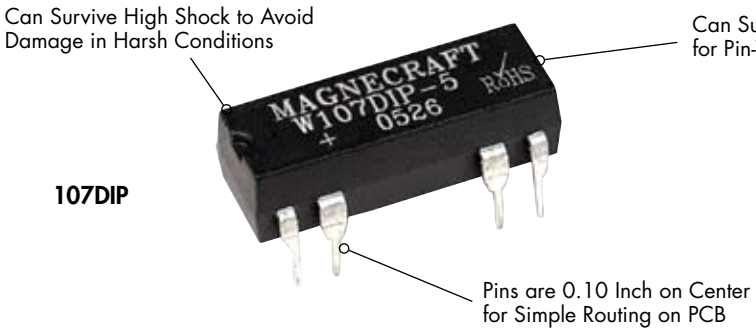
171DIP

107DIP	171DIP	171DIP
SPST-NO	DPST-NO	SPST
Rhodium	Rhodium	Rhodium
0.5	0.5	0.5
120	120	60
100	100	100
10	10	10
5....24	5....24	5....24
80% to 110%	80% to 110%	80% to 110%
0.29	0.29	0.29
10%	10%	10%
50,000,000	50,000,000	50,000,000
100,000,000	100,000,000	100,000,000
1	1	1
1000	1000	1000
1000	1000	1000
200	200	200
-40...+85	-40...+85	-40...+85
-40...+55	-40...+55	-40...+55
20, 10-200 Hz	20, 10-200 Hz	20, 10-200 Hz
50	50	50
1	1	1

107DIP & 171DIP



DRAWING ENLARGED TO 200% OF ACTUAL SIZE



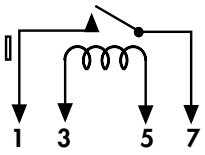
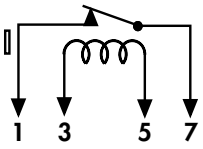
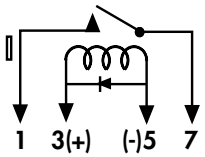
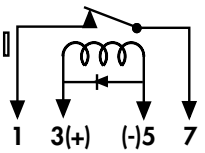
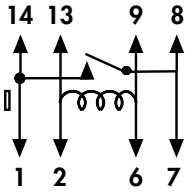
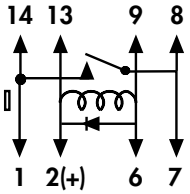
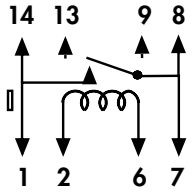
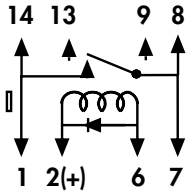
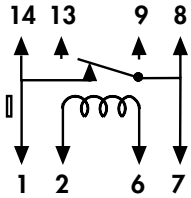
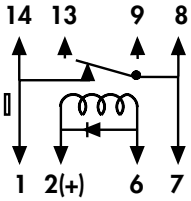
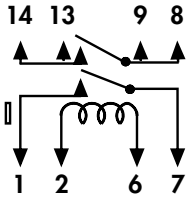
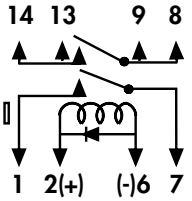
RoHS Compliant

Standard Part Numbers

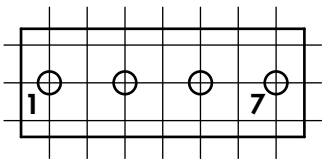
BOLD-FACED PART NUMBERS ARE NORMALLY STOCKED

Nominal Input Voltage	Nominal Coil Resistance (Ω)	Part Number	Contact Configuration	Figure
5 VDC	500 Ω	**W117SIP-1**	SPST-NO	A
12 VDC	1000 Ω	**W117SIP-3**	SPST-NO	A
24 VDC	2000 Ω	**W117SIP-5**	SPST-NO	A
5 VDC	500 Ω	**W117SIP-22**	SPST-NC	B
12 VDC	1000 Ω	**W117SIP-23**	SPST-NC	B
24 VDC	2200 Ω	W117SIP-24	SPST-NC	B
5 VDC	500 Ω	**W117SIP-6**	SPST-NO w/ Clamping Diode	C
12 VDC	1000 Ω	**W117SIP-8**	SPST-NO w/ Clamping Diode	C
24 VDC	2200 Ω	**W117SIP-10**	SPST-NO w/ Clamping Diode	C
5 VDC	500 Ω	**W117SIP-18**	SPST-NC w/ Clamping Diode	D
12 VDC	1000 Ω	W117SIP-25	SPST-NC w/ Clamping Diode	D
24 VDC	2200 Ω	W117SIP-26	SPST-NC w/ Clamping Diode	D
5 VDC	500 Ω	**W107DIP-1**	SPST-NO	E
12 VDC	1000 Ω	**W107DIP-3**	SPST-NO	E
24 VDC	2000 Ω	**W107DIP-4**	SPST-NO	E
5 VDC	500 Ω	**W107DIP-5**	SPST-NO w/ Clamping Diode	F
12 VDC	1000 Ω	**W107DIP-7**	SPST-NO w/ Clamping Diode	F
24 VDC	2000 Ω	**W107DIP-8**	SPST-NO w/ Clamping Diode	F
5 VDC	500 Ω	**W171DIP-2**	SPST-NO	G
12 VDC	1000 Ω	**W171DIP-4**	SPST-NO	G
24 VDC	2200 Ω	**W171DIP-5**	SPST-NO	G
5 VDC	500 Ω	**W171DIP-7**	SPST-NO w/ Clamping Diode	H
12 VDC	1000 Ω	**W171DIP-9**	SPST-NO w/ Clamping Diode	H
24 VDC	2200 Ω	**W171DIP-10**	SPST-NO w/ Clamping Diode	H
5 VDC	500 Ω	**W171DIP-12**	SPST-NC	I
12 VDC	1000 Ω	**W171DIP-14**	SPST-NC	I
24 VDC	2200 Ω	**W171DIP-15**	SPST-NC	I
5 VDC	500 Ω	**W171DIP-17**	SPST-NC w/ Clamping Diode	J
12 VDC	1000 Ω	**W171DIP-19**	SPST-NC w/ Clamping Diode	J
24 VDC	2200 Ω	**W171DIP-20**	SPST-NC w/ Clamping Diode	J
5 VDC	500 Ω	W171DIP-21	DPST-NO	K
12 VDC	1000 Ω	**W171DIP-23**	DPST-NO	K
24 VDC	2200 Ω	**W171DIP-24**	DPST-NO	K
5 VDC	500 Ω	**W171DIP-25**	DPST-NO w/ Clamping Diode	L
12 VDC	1000 Ω	**W171DIP-27**	DPST-NO w/ Clamping Diode	L
24 VDC	2200 Ω	**W171DIP-28**	DPST-NO w/ Clamping Diode	L

WIRING DIAGRAMS
TOP VIEW

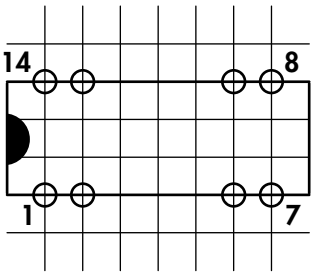
 Figure A SPST-NO WITHOUT DIODE	 Figure B SPST-NC WITHOUT DIODE	 Figure C SPST-NO WITH DIODE	 Figure D SPST-NC WITH DIODE
 Figure E SPST-NO WITHOUT DIODE	 Figure F SPST-NO WITH DIODE	 Figure G SPST-NO WITHOUT DIODE	 Figure H SPST-NO WITH DIODE
 Figure I SPST-NC WITHOUT DIODE	 Figure J SPST-NC WITH DIODE	 Figure K DPST-NO WITHOUT DIODE	 Figure L DPST-NO WITH DIODE

117SIP CIRCUIT BOARD PIN SPACING
VIEWED FROM COMPONENT SIDE
(TOP VIEW)



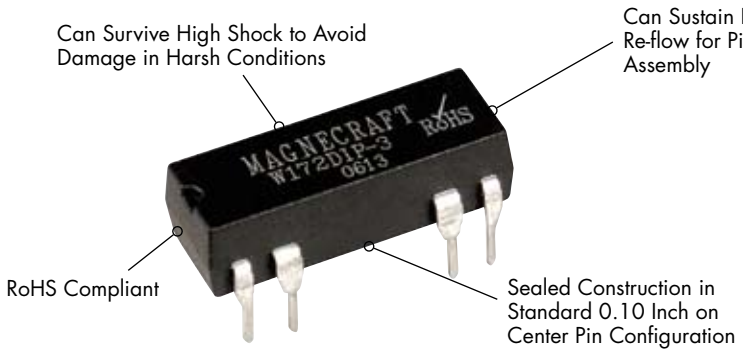
0.1 IN GRID
(2.54 MM)

107DIP & 171DIP CIRCUIT BOARD PIN SPACING
VIEWED FROM COMPONENT SIDE
(TOP VIEW)



CIRCUIT BOARD PIN SPACINGS ENLARGED TO 200% OF ACTUAL SIZE

172DIP PCB Mount Miniature Reed Relay/SPDT and DPDT 0.25 Amp Rated

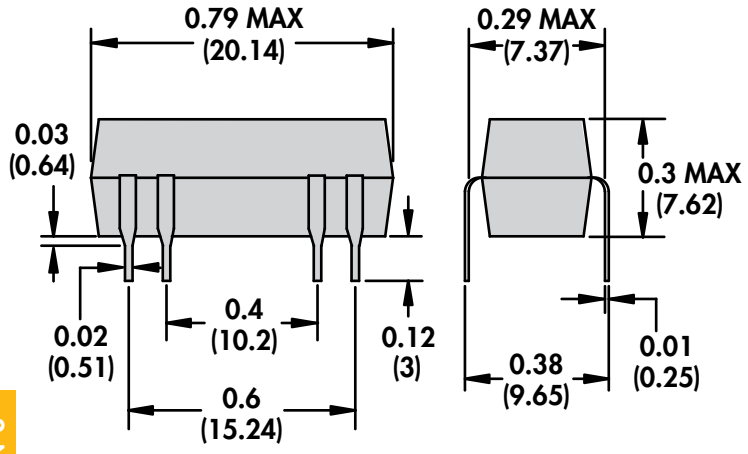


RoHS Compliant

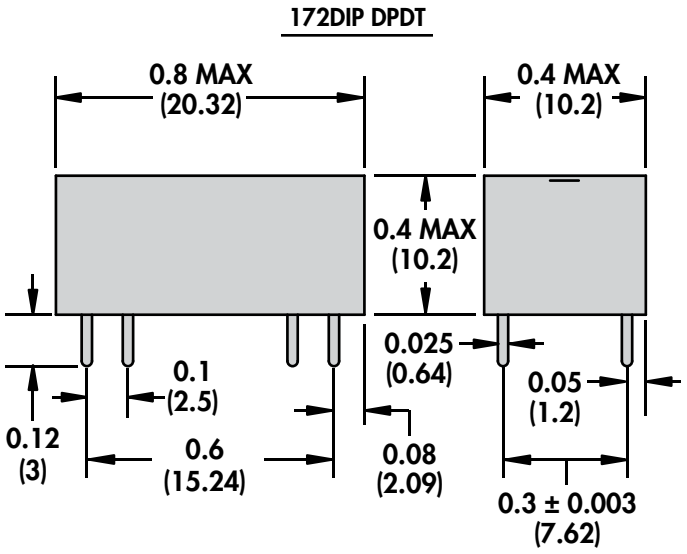
General Specifications

Contact Characteristics			Units	172DIP	172DIP
Number and type of Contacts				SPDT	DPDT
Contact materials				Rhodium	Rhodium
Current rating			A	0.25	0.25
Switching voltage		~	V	60	60
		⎓	V	100	100
Minimum Switching Requirement	Minimum		mA	10	10
Coil Characteristics					
Voltage Range		⎓	V	5....24	5....24
Operating Range	% of Nominal	⎓		80% to 110%	80% to 110%
Average consumption		⎓	W	0.29	0.29
Drop-out voltage threshold		⎓		10%	10%
Performance Characteristics					
Electrical Life	Operations @ Rated Current (Resistive)			50,000,000	50,000,000
Mechanical Life	Unpowered			100,000,000	100,000,000
Operating time (response time)			ms	1	1
Rated insulation voltage	Between coil and contact	~	V	1000	1000
Dielectric strength	Between poles	~	V	1000	1000
rms voltage	Between contacts	~	V	200	200
Environment					
Ambient air temperature	Storage		°C	-40...+85	-40...+85
around the device	Operation		°C	-40...+55	-40...+55
Vibration resistance	Operational		g-n	20, 10-200 Hz	20, 10-200 Hz
Shock resistance			g-n	50	50
Weight			grams	1	1

172DIP SPDT



172DIP DPDT



WHEN SPACING DIP RELAYS, THE RELAYS REQUIRE 1/2 INCH SPACING FROM THE SIDE OF THE ADJACENT RELAYS

DRAWINGS AND PIN SPACING ENLARGED TO 200% OF ACTUAL SIZE

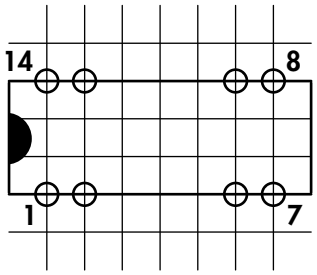
Standard Part Numbers

BOLD-FACED PART NUMBERS ARE NORMALLY STOCKED

Nominal Input Voltage	Nominal Coil Resistance (Ω)	Part Number	Contact Configuration	Figure
5 VDC	200 Ω	**W172DIP-1**	SPDT	A
12 VDC	1000 Ω	**W172DIP-3**	SPDT	A
24 VDC	2200 Ω	**W172DIP-4**	SPDT	A
5 VDC	200 Ω	**W172DIP-5**	SPDT w/ Clamping Diode	B
12 VDC	1000 Ω	**W172DIP-7**	SPDT w/ Clamping Diode	B
24 VDC	2200 Ω	**W172DIP-8**	SPDT w/ Clamping Diode	B
5 VDC	200 Ω	**W172DIP-31**	SPDT	C
12 VDC	1000 Ω	**W172DIP-33**	SPDT	C
24 VDC	2200 Ω	**W172DIP-34**	SPDT	C
5 VDC	200 Ω	**W172DIP-35**	SPDT w/ Clamping Diode	D
12 VDC	1000 Ω	**W172DIP-37**	SPDT w/ Clamping Diode	D
24 VDC	2200 Ω	**W172DIP-38**	SPDT w/ Clamping Diode	D
5 VDC	200 Ω	**W172DIP-141**	SPDT	E
12 VDC	1000 Ω	**W172DIP-145**	SPDT	E
24 VDC	3200 Ω	**W172DIP-146**	SPDT	E
5 VDC	200 Ω	**W172DIP-147**	SPDT w/ Clamping Diode	F
12 VDC	1000 Ω	**W172DIP-149**	SPDT w/ Clamping Diode	F
24 VDC	3200 Ω	**W172DIP-150**	SPDT w/ Clamping Diode	F
5 VDC	46 Ω	**W172DIP-17**	DPDT	G
12 VDC	266 Ω	**W172DIP-19**	DPDT	G
24 VDC	1066 Ω	**W172DIP-20**	DPDT	G
5 VDC	46 Ω	**W172DIP-21**	DPDT w/ Clamping Diode	H
12 VDC	266 Ω	**W172DIP-23**	DPDT w/ Clamping Diode	H
24 VDC	1066 Ω	**W172DIP-24**	DPDT w/ Clamping Diode	H

CIRCUIT BOARD PIN SPACING

VIEWED FROM COMPONENT SIDE
(TOP VIEW)



0.1 IN GRID
(2.54) MM)

WIRING DIAGRAMS TOP VIEW

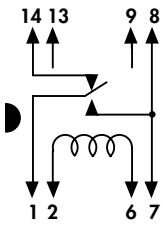


Figure A
SPDT WITHOUT DIODE

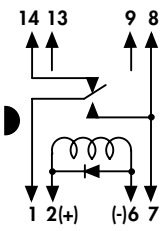


Figure B
SPDT WITH DIODE

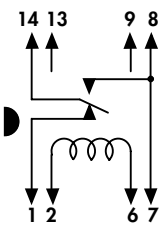


Figure C
SPDT WITHOUT DIODE

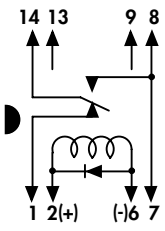


Figure D
SPDT WITH DIODE

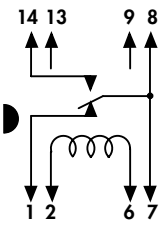


Figure E
SPDT WITHOUT DIODE

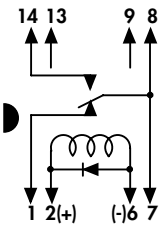


Figure F
SPDT WITH DIODE

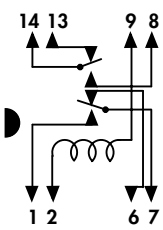


Figure G
DPDT WITHOUT DIODE

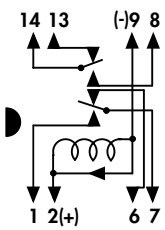
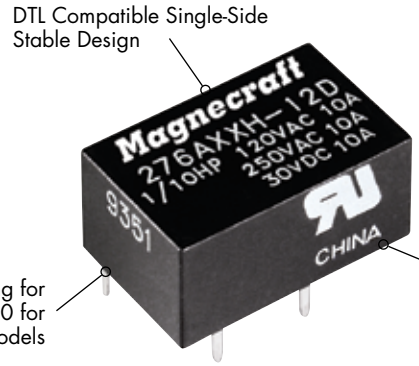


Figure H
DPDT WITH DIODE

276 Low Profile PCB Mount Power Relay/SPST and SPDT 7 - 10 Amp Rated



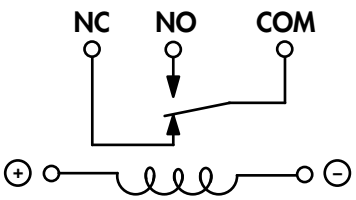
c UL us
UL Recognized
File No. E190964

RoHS Compliant

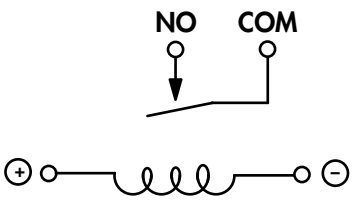
General Specifications (UL 508)

			Units	276XAX 7 Amp	276AXX 10 Amp
Contact Characteristics					
Number and type of Contacts				SPDT	SPST-NO
Contact materials				Silver Alloy	Silver Alloy
Current rating			A	7	10
Switching voltage		~	V	240 50/60 Hz	240 50/60 Hz
		⎓	V	30	30
			HP	1/10 @ 120VAC	1/6 @ 120VAC
Minimum Switching Requirement	Minimum		mA	100	100
Coil Characteristics					
Voltage Range		⎓	V	3....24	3....24
Operating Range		⎓		80% to 110%	80% to 110%
Average consumption	% of Nominal	⎓	W	0.2	0.2
Drop-out voltage threshold		⎓		10%	10%
Performance Characteristics					
Electrical Life	Operations @ Rated Current (Resistive)			100,000	100,000
Mechanical Life	Unpowered			5,000,000	5,000,000
Operating time (response time)			ms	10	10
Dielectric	Between coil and contact	~	V	2000	2000
	Between contacts	~	V	1000	1000
Environment					
Product certifications	Standard version			UL	UL
Ambient air temperature	Storage		°C	-40...+85	-40...+85
around the device	Operation		°C	-40...+55	-40...+55
Vibration resistance	Operational		g-n	3, 10-55 Hz	3, 10-55 Hz
Shock resistance			g-n	20	20
Weight			grams	5.5	5.5

WIRING DIAGRAMS
TOP VIEW



SPDT
276XAX



SPST-NO
276AXX

SECTION 8

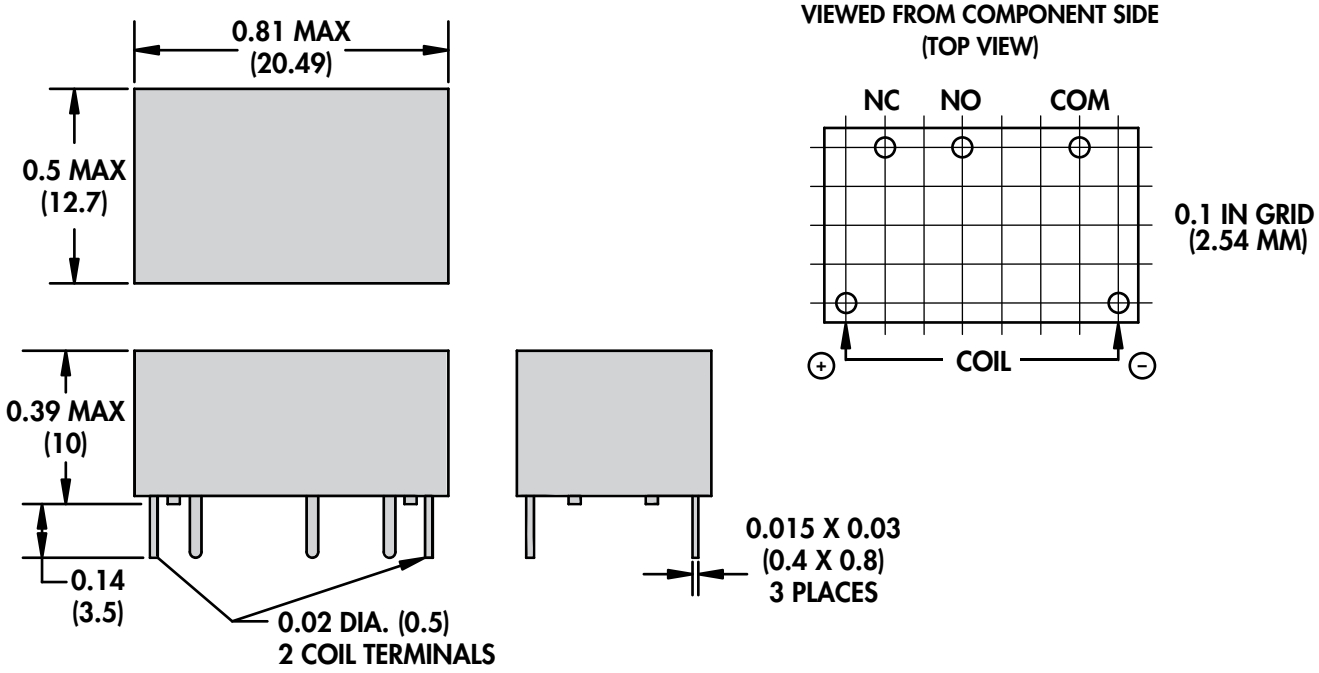
Standard Part Numbers

BOLD-FACED PART NUMBERS ARE NORMALLY STOCKED

Nominal Input Voltage	Nominal Coil Resistance (Ω)	Part Number	Contact Configuration
5 VDC	125 Ω	**276AXXH-5D**	SPST-NO
6 VDC	180 Ω	**276AXXH-6D**	SPST-NO
12 VDC	720 Ω	**276AXXH-12D**	SPST-NO
24 VDC	2880 Ω	**276AXXH-24D**	SPST-NO
5 VDC	125 Ω	**276XAXH-5D**	SPDT
6 VDC	180 Ω	**276XAXH-6D**	SPDT
12 VDC	720 Ω	**276XAXH-12D**	SPDT
24 VDC	2880 Ω	**276XAXH-24D**	SPDT

Part Number Builder

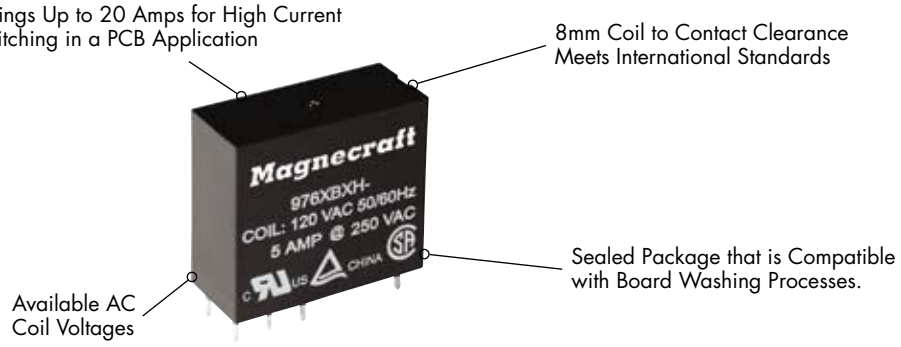
276	XAX	H	-12	D
Series	**Contact Configuration**	**Type of Seal**	**Coil Voltage**	**Current Type**
276	AXX = SPST - NO	H = Epoxy Sealed	5 = 5VDC	D = DC Coil
	XAX = SPDT		6 = 6VDC	
			12 = 12VDC	
			24 = 24VDC	



DRAWING AND PIN SPACING ENLARGED TO 200% OF ACTUAL SIZE

976 Relay Slim-Line PCB Mount Relay/One and Two Pole 5 - 20 Amp Rated (DC and AC)

UL Recognized
File No. E191122



General Specifications (UL 508)

Contact Characteristics			Units	976AXXH 976XAXH 976XXAH 12 Amp	976AXX97H 976XAX97H 976XXA97H 20 Amp	976XXBH 976XBXH 5 Amp
Number and type of Contacts				SPDT	SPDT	DPDT
Contact materials				Silver Alloy	Silver Alloy	Silver Alloy
Thermal (Carrying) Current			A	12	20	5
Maximum Switching Voltage			V	300	300	300
Switching Current @ Voltage		~	Resistive	12A @ 240 50/60Hz (NO) 10A @ 240 50/60Hz (NO)	20A @ 125 50/60 Hz 16A @ 240 50/60 Hz	5A @ 240 50/60 Hz
		⎓	Resistive	12A @ 30V (NO) 10A @ 30V (NC)	20A @ 30 V 10A @ 48 V	5 @ 30 V
Coil Characteristics						
Voltage Range		~	V	6....240	6....240	6....240
		⎓	V	3....110	3....110	3....110
Operating Range	% of Nominal	~		85% to 110%	85% to 110%	85% to 110%
		⎓		85% to 110%	85% to 110%	85% to 110%
Average consumption		~	VA	1.2	1.2	1.2
		⎓	W	0.53	0.53	0.53
Drop-out voltage threshold		~		30%	30%	30%
		⎓		10%	10%	10%
Performance Characteristics						
Electrical Life	Operations @ Rated Current (Resistive)			100,000	100,000	100,000
Mechanical Life	Unpowered			10,000,000	10,000,000	10,000,000
Operating time (response time)			ms	15	15	15
Dielectric	Between coil and contact	~	V	5000	5000	5000
	Between contacts	~	V	1000	1000	1000
Environment						
Product certifications	Standard version			UL, CSA, TUV	UL, CSA, TUV	UL, CSA, TUV
Ambient air temperature	Storage		°C	-40...+85	-40...+85	-40...+85
around the device	Operation		°C	-40...+55	-40...+55	-40...+55
Vibration resistance	Operational		g-n	3, 10 - 55 Hz	3, 10 - 55 Hz	3, 10 - 55 Hz
Shock resistance			g-n	10	10	10
Weight			grams	17	17	17

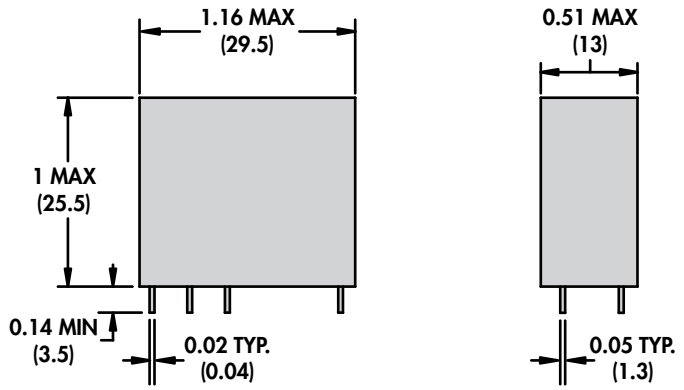
Part Number Builder

976	XBX	97	H	-24	A
Series	**Contact Configuration**	**Construction**	**Type of Seal**	**Coil Voltage**	**Current Type**
976	AXX = SPST - NO	97 = 20A Single Pole Relay	H = Epoxy Sealed	5 = 5 VDC	D = DC Coil
	XAX = SPDT	Blank = Not 20A Construction		6 = 6 VDC	A = AC Coil
	XBX = DPDT			12 = 12 VDC	
				24 = 24 VDC	
				24 = 24 VAC	
				120 = 120 VAC	
				240 = 240 VAC	

Standard Part Numbers

BOLD-FACED PART NUMBERS ARE NORMALLY STOCKED

Nominal Input Voltage	Nominal Coil Resistance (Ω)	Part Number	Supercedes	Contact Configuration	Figure
5 Amp, DC Operated Coil					
5 VDC	47 Ω	**976XBXH-5D**	76EURCPCX-61	DPDT	A
6 VDC	68 Ω	**976XBXH-6D**	76EURCPCX-62	DPDT	A
12 VDC	270 Ω	**976XBXH-12D**	76EURCPCX-63	DPDT	A
24 VDC	1100 Ω	**976XBXH-24D**	76EURCPCX-64	DPDT	A
20 Amp, DC Operated Coil					
5 VDC	47 Ω	**976XAX97H-5D**	76EURCPCX-146	SPDT	B
6 VDC	68 Ω	**976XAX97H-6D**	76EURCPCX-147	SPDT	B
12 VDC	270 Ω	**976XAX97H-12D**	76EURCPCX-148	SPDT	B
24 VDC	1100 Ω	**976XAX97H-24D**	76EURCPCX-149	SPDT	B
12 Amp, DC Operated Coil					
5 VDC	47 Ω	**976XAXH-5D**	76EURCPCX-14	SPDT	C
6 VDC	68 Ω	**976XAXH-6D**	76EURCPCX-15	SPDT	C
12 VDC	270 Ω	**976XAXH-12D**	76EURCPCX-16	SPDT	C
24 VDC	1100 Ω	**976XAXH-24D**	76EURCPCX-17	SPDT	C
5 Amp, AC Operated Coil					
24 VAC 50/60 Hz	250 Ω	**976XBXH-24A**		DPDT	A
120 VAC 50/60 Hz	5600 Ω	**976XBXH-120A**		DPDT	A
240 VAC 50/60 Hz	22000 Ω	**976XBXH-240A**		DPDT	A
20 Amp, AC Operated Coil					
24 VAC 50/60 Hz	250 Ω	**976XAX97H-24A**		SPDT	B
120 VAC 50/60 Hz	5600 Ω	**976XAX97H-120A**		SPDT	B
240 VAC 50/60 Hz	22000 Ω	**976XAX97H-240A**		SPDT	B
12 Amp, AC Operated Coil					
24 VAC 50/60 Hz	250 Ω	**976XAXH-24A**		SPDT	C
120 VAC 50/60 Hz	5600 Ω	**976XAXH-120A**		SPDT	C
240 VAC 50/60 Hz	22000 Ω	**976XAXH-240A**		SPDT	C



DRAWING AND PIN SPACINGS SHOWN AT 100% OF ACTUAL SIZE

CIRCUIT BOARD PIN SPACING
VIEWED FROM COMPONENT SIDE
(TOP VIEW)

Figure A

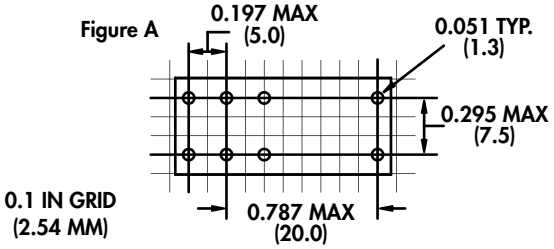


Figure B

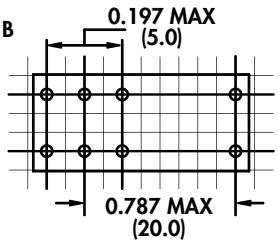
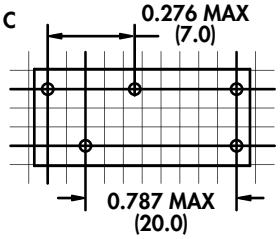
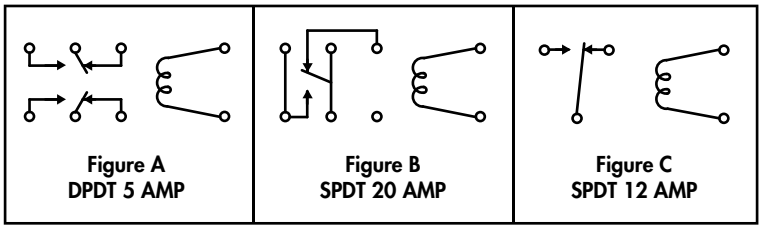


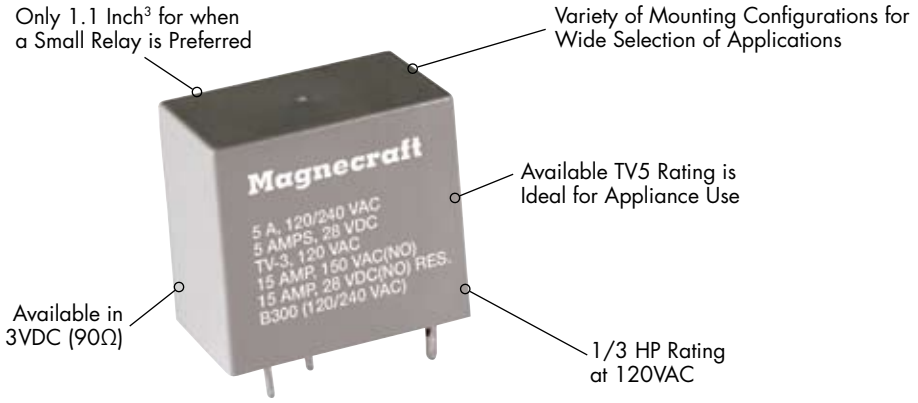
Figure C



WIRING DIAGRAMS
TOP VIEW



49 PCB Mount Enclosed Relay/SPDT 3 - 10 Amp Rated



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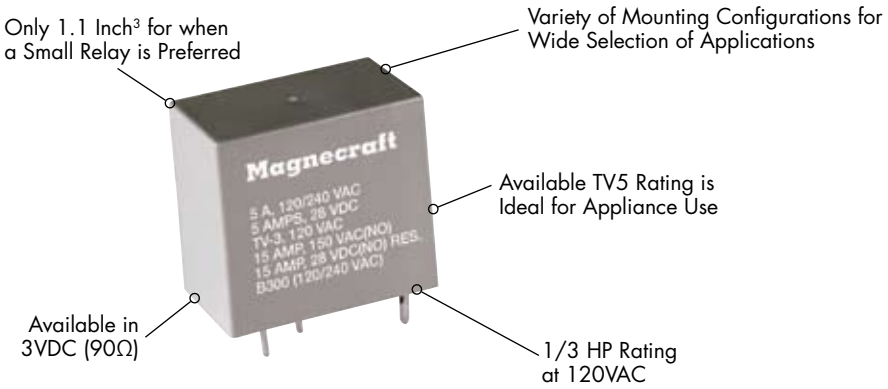
UL Recognized
File No. E258297

General Specifications (UL 508)

Contact Characteristics			Units	10 Amp SCO SPDT	
Number and type of Contacts				Normally Open	Normally Closed
Contact materials				Silver Alloy	
Current rating			A	15	10
Switching voltage		~	V	277 V 50/60 Hz	
		⎓	V	28 V	
			HP	1/3 @ 240 VAC	1/6 @ 240 VAC
			HP	1/4 @ 277 VAC	1/8 @ 277 VAC
			Pilot Duty	B300 (120/240 VAC)	
Minimum Switching Requirement			mA	100	
Coil Characteristics					
Voltage Range		⎓	V	3....24	
Operating Range	% of Nominal	⎓		75% to 120%	
Average consumption		⎓	W	0.11	
Drop-out voltage threshold		⎓		10%	
Performance Characteristics					
Electrical Life	Operations @ Rated Current (Resistive)			100,000	
Mechanical Life	Unpowered			50,000,000	
Operating time (response time)			ms	25	
Dielectric	Between coil and contact	~	V	2500	
	Between contacts	~	V	500	
Environment					
Product certifications	Standard version			UL	
Ambient air temperature around the device	Storage		°C	-40...+85	
	Operation		°C	-40...+55	
Vibration resistance	Operational		g-n	3, 10 to 55 Hz	
Shock resistance			g-n	10	
Weight			grams	42	

5 Amp SCO SPDT		3 Amp Silver SPDT	
Normally Open	Normally Closed	Normally Open	Normally Closed
Silver Alloy		Fine Silver	
5		15	3
120 V 50/60 Hz		150 V 50/60 Hz	
28 V		28 V	
1/3 @ 240 VAC	1/6 @ 240 VAC	1/3 @ 240 VAC	1/6 @ 240 VAC
1/4 @ 277 VAC	1/8 @ 277 VAC	1/4 @ 277 VAC	1/8 @ 277 VAC
B300 (120/240 VAC)		B300 (120/240 VAC)	
100		100	
3....24		3....24	5....24
75% to 120%		75% to 120%	
0.11		0.11	
10%		10%	
100,000		100,000	
50,000,000		50,000,000	
25		25	
2500		2500	
500		500	
UL		UL	
-40...+85		-40...+85	
-40...+55		-40...+55	
3, 10 to 55 Hz		3, 10 to 55 Hz	
10		10	
42		42	



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UL Recognized
File No. E258297

Standard Part Numbers

BOLD-FACED PART NUMBERS ARE NORMALLY STOCKED

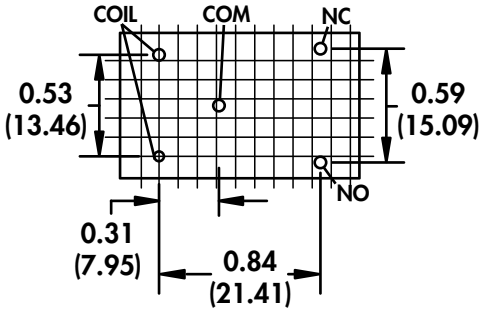
Nominal Input Voltage	Nominal Coil Resistance (Ω)	Part Number	Contact Configuration
3 Amp, Style RE1C1			
3 VDC	90 Ω	**W49RE1C1VG-3DC-SIL**	SPDT
5 VDC	235 Ω	**W49RE1C1VG-5DC-SIL**	SPDT
12 VDC	1350 Ω	**W49RE1C1VG-12DC-SIL**	SPDT
6 VDC	410 Ω	**W49RE1C2VF-6DC-SIL**	SPDT
12 VDC	1640 Ω	**W49RE1C2VF-12DC-SIL**	SPDT
24 VDC	6560 Ω	W49RE1C2VF-24DC-SIL	SPDT
5 Amp, Style RE1C1 and RE1C2			
5 VDC	235 Ω	W49RE1C1VG-5DC-SCO	SPDT
12 VDC	1350 Ω	**W49RE1C1VG-12DC-SCO**	SPDT
24 VDC	5400 Ω	**W49RE1C1VG-24DC-SCO**	SPDT
6 VDC	410 Ω	**W49RE1C2VF-6DC-SCO**	SPDT
12 VDC	1640 Ω	**W49RE1C2VF-12DC-SCO**	SPDT
24 VDC	6560 Ω	W49RE1C2VF-24DC-SCO	SPDT
10 Amp, Style RE1C1			
5 VDC	100 Ω	W49RE1C1VW-5DC-SCO	SPDT
12 VDC	600 Ω	W49RE1C1VW-12DC-SCO	SPDT
24 VDC	2400 Ω	W49RE1C1VW-24DC-SCO	SPDT
10 Amp, Style R1C4			
5 VDC	235 Ω	**W49R1C4VG-5DC-SCO**	SPDT
12 VDC	1350 Ω	**W49R1C4VG-12DC-SCO**	SPDT
10 Amp, Style R1C4			
5 VDC	100 Ω	**W49R1C4VW-5DC-SCO**	SPDT
24 VDC	2400 Ω	**W49R1C4VW-24DC-SCO**	SPDT

Part Number Builder

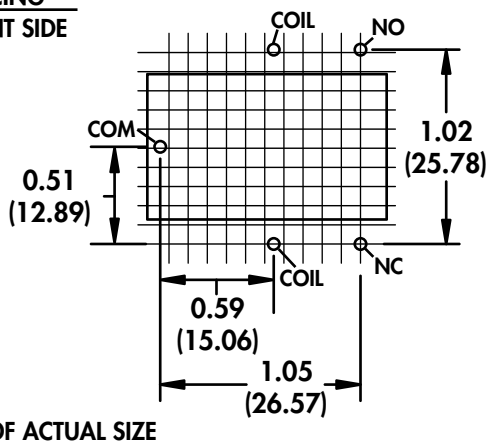
49	R1C4	VW	-5DC	-SCO
Series	**Footprint**	**Rating**	**Coil Voltage**	**Contact Material**
49	RE1C1 = Narrow Footprint	VG = (RE1C1) 5A SCO or 3A Fine Silver	3DC = 3 VDC	SIL = Fine Silver Contacts
	RE1C2 = Wide Footprint	VG (R1C4) = 10A SCO	5DC = 5 VDC	SCO = Silver Alloy Contacts
	R1C4 = Top Mounting Bracket	VF = (RE1C2) 5A SCO or 3A Fine Silver	6DC = 6 VDC	
		VW = 10A SCO	12DC = 12 VDC	
			24DC = 24 VDC	

CIRCUIT BOARD PIN SPACING
VIEWED FROM COMPONENT SIDE
(TOP VIEW)

RE1C1 and R1C4



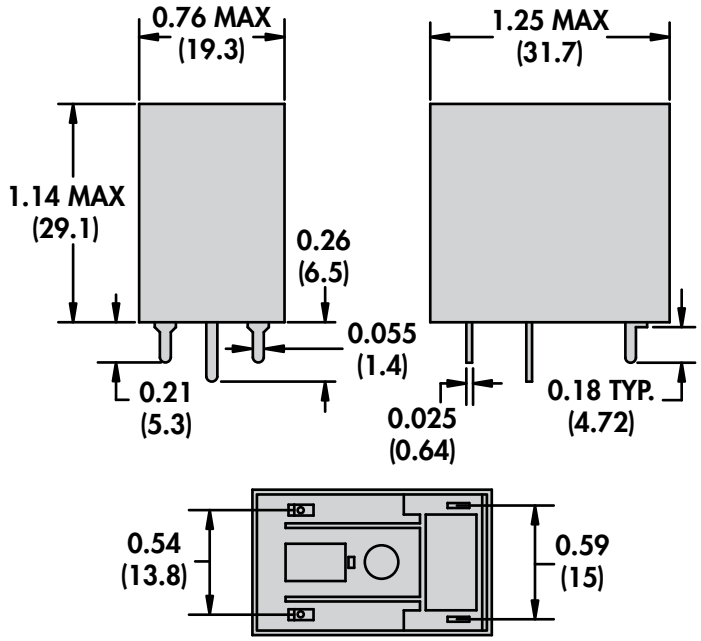
RE1C2



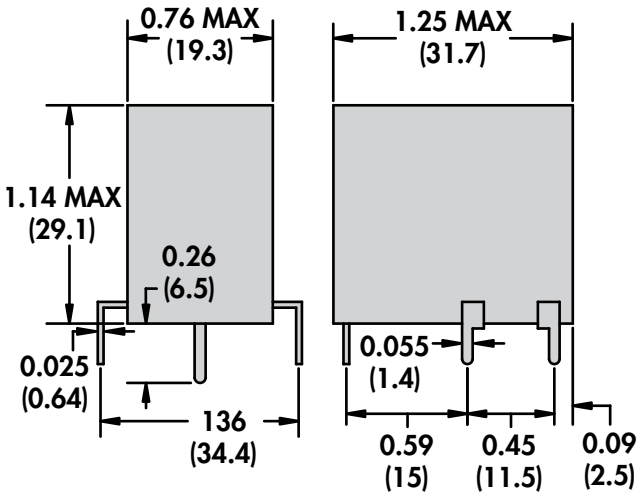
0.1 IN GRID
(2.54 MM)

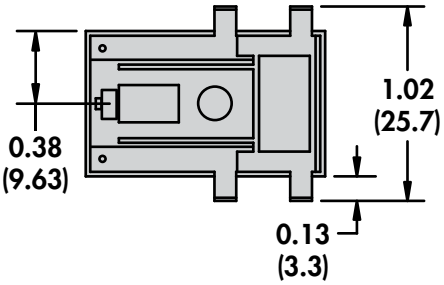
PIN SPACINGS SHOWN AT 100% OF ACTUAL SIZE

STYLE RE1C1

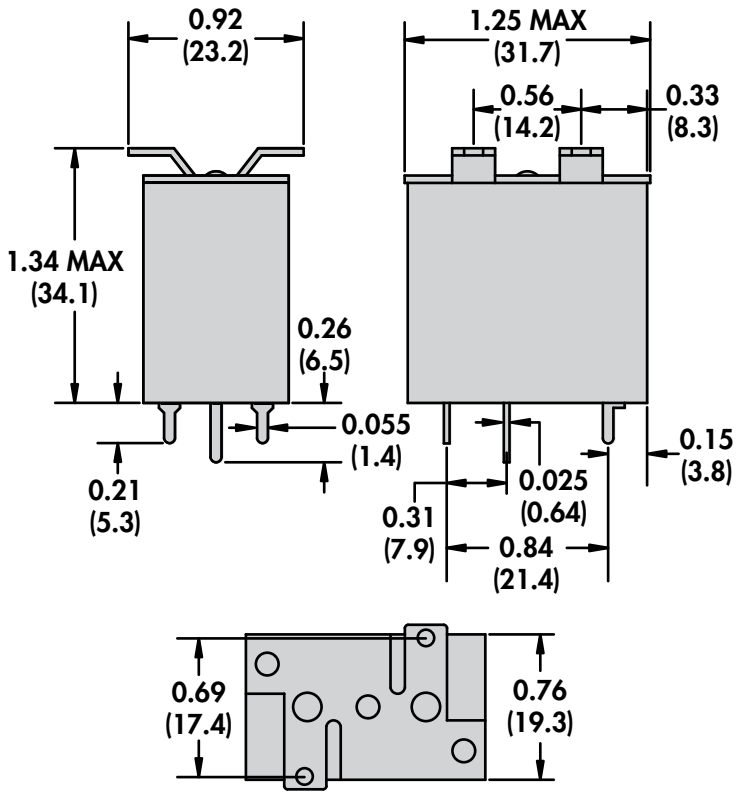


STYLE RE1C2

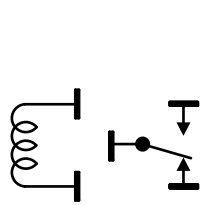




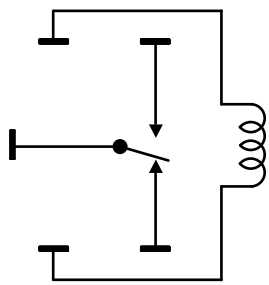
STYLE R1C4



WIRING DIAGRAMS
TOP VIEW



STYLE RE1C1 & R1C4



STYLE RE1C2

DRAWINGS SHOWN AT 100% OF ACTUAL SIZE

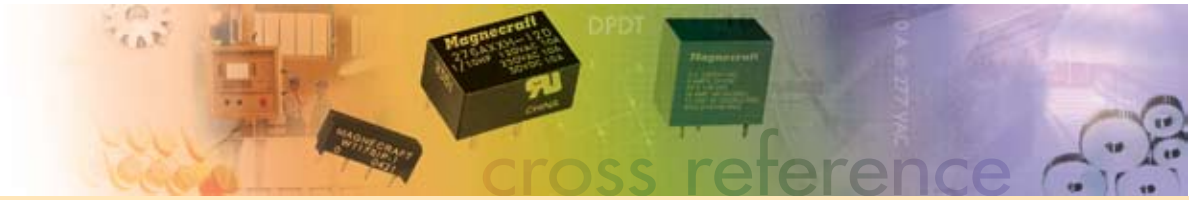
Cross Reference Guide

Magnecraft	Potter & Brumfield	Gordos	Hamlin
W117SIP-1	JWS-117-1	741A-9	HE3621A0500
W117SIP-3	JWS-117-3	741A-3	HE3621A1200
W117SIP-5	JWS-117-5	741A-7	HE3621A2400
W117SIP-22	JWS-117-12	741B-9	HE3621B0500
W117SIP-23	JWS-117-14	741B-5	HE3621B1200
W117SIP-24	JWS-117-15	741B-7	HE3621B2400
W117SIP-6	JWS-117-6	741B-10	HE3621A0510
W117SIP-8	JWS-117-8	741A-4	HE3621A1210
W117SIP-10	JWS-117-10	741A-8	HE3621A2410
W117SIP-18	JWS-117-17	741B-10	HE3621B0510
W117SIP-25	JWS-117-19	741B-6	HE3621B1210
W117SIP-26	JWS-117-30	741B-8	HE3621B2410

Magnecraft	Potter & Brumfield	Gordos
W107DIP-1	JWD-107-1	831A-3
W107DIP-3	JWD-107-3	831A-5
W107DIP-4		831A-7
W107DIP-5	JWD-107-5	831A-4
W107DIP-7	JWD-107-7	831A-6
W107DIP-8		831A-8

Magnecraft	Potter & Brumfield	Gordos	Hamlin
W171DIP-2		831A-3	HE721A0500
W171DIP-4		831A-5	HE721A1200
W171DIP-5	JWD-171-5	831A-7	HE721A2400
W171DIP-7		831A-4	HE721A0510
W171DIP-9		831A-6	HE721A1210
W171DIP-10	JWD-171-10	831A-8	HE721A2410
W171DIP-12	JWD-171-12	831B-3	HE721B0500
W171DIP-14	JWD-171-14	831B-5	HE721B1200
W171DIP-15	JWD-171-15	831B-7	HE721B2400
W171DIP-17	JWD-171-17	831B-4	HE721B0510
W171DIP-19	JWD-171-19	831B-6	HE721B1210
W171DIP-20	JWD-171-20	831B-8	HE721B2410
W171DIP-21	JWD-171-21	832A-1	HE722A0500
W171DIP-23	JWD-171-23	832A-3	HE722A1200
W171DIP-24	JWD-171-24	832A-5	HE722A2400
W171DIP-25	JWD-171-25	832A-2	HE722A0510
W171DIP-27	JWD-171-27	832A-4	HE722A1210
W171DIP-28	JWD-171-28	832A-6	HE722A2410

Magnecraft	Potter & Brumfield	Gordos	Hamlin
W172DIP-1	JWD-172-1	836C-1	HE721R0500
W172DIP-3	JWD-172-3	836C-3	HE721R1200
W172DIP-4	JWD-172-4	836C-5	HE721R2400
W172DIP-5	JWD-172-5	836C-2	HE721R0510
W172DIP-7	JWD-172-7	836C-4	HE721R1210
W172DIP-8	JWD-172-8	836C-6	HE721R2410
W172DIP-141	JWD-172-155	831C-1	HE721C0500
W172DIP-145	JWD-172-157	831C-3	HE721C1200
W172DIP-146	JWD-172-158	831C-5	HE721C2400
W172DIP-147	JWD-172-159	831C-2	HE721C0510
W172DIP-149	JWD-172-161	831C-4	HE721C1210
W172DIP-150	JWD-172-162	831C-6	HE721C2410
W172DIP-31		835C-1	HE721E0500
W172DIP-33		835C-3	HE721E1200



Meder	SRC Devices	Coto	
SIL05-1A75-71L	DSS41A05	90010500	
SIL12-1A75-71L	DSS41A12	90011200	
SIL24-1A75-71L	DSS41A24		
	DSS41B05	90010502	
	DSS41B12		
	DSS41B24		
SIL05-1A75-71D	DSS41A05B	90010501	
SIL12-1A75-71D	DSS41A12B	90011201	
SIL24-1A75-71D	DSS41A24B		
	DSS41B05B		
	DSS41B12B		
	DSS41B24B		

Meder	SRC Devices		
DIP05-1A75-11L	PRMA10037		
DIP12-1A75-11L	PRMA10038		
DIP24-1A75-11L	PRMA10039		
DIP05-1A75-11D	PRMA10037B		
DIP12-1A75-11D	PRMA10038B		
DIP24-1A75-11D	PRMA10039B		

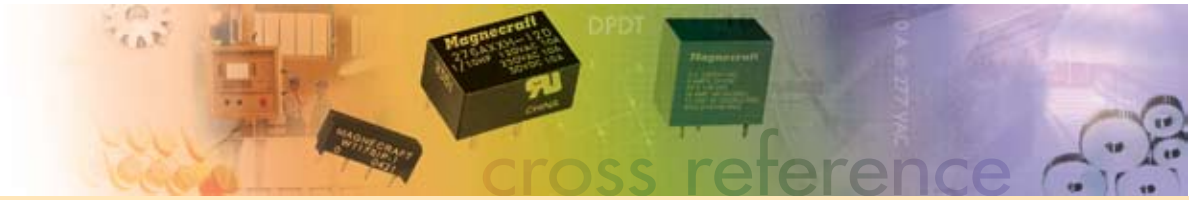
Meder	SRC Devices	Coto	Coto Spartin
DIP05-1A75-11L	PRMA1A05	80010500	8L01-05-001
DIP12-1A75-11L	PRMA1A12	80011200	8L01-12-001
DIP24-1A75-11L	PRMA1A24		8L01-24-001
DIP05-1A75-11D	PRMA1A05B	80010501	8L01-05-011
DIP12-1A75-11D	PRMA1A12B	80011201	8L01-12-011
DIP24-1A75-11D	PRMA1A24B		8L01-24-011
DIP05-1B75-11L	PRMA1B05	80210500	8L21-05-001
DIP12-1B75-11L	PRMA1B12	80211200	8L21-12-001
DIP24-1B75-11L	PRMA1B24		8L21-24-001
DIP05-1B75-11D	PRMA1B05B	80210501	8L21-05-011
DIP12-1B75-11D	PRMA1B12B	80211201	8L21-12-011
DIP24-1B75-11D	PRMA1B24B		8L21-24-011
DIP05-2A75-21L	PRMA2A05	80020500	8L02-05-001
DIP12-2A75-21L	PRMA2A12	80021200	8L02-12-001
DIP24-2A75-21L	PRMA2A24		8L02-24-001
DIP05-2A75-21D	PRMA2A05B	80020501	8L02-05-011
DIP12-2A75-21D	PRMA2A12B	80021201	8L02-12-011
DIP24-2A75-21D	PRMA2A24B		8L02-24-011

Meder	SRC Devices	Coto	
DIP05-1C75-51L	PRMA1C05	80410500	
DIP12-1C75-51L	PRMA1C12	80411200	
DIP24-1C75-51L	PRMA1C24		
DIP05-1C75-51D	PRMA1C05B	80410501	
DIP12-1C75-51D	PRMA1C12B	80411201	
DIP24-1C75-51D	PRMA1C24B		
		80410500	
		80411200	

Magnecraft	Hamlin	Coto	Gordos
W172DIP-34	HE721E2400		835C-5
W172DIP-35	HE721E0510	80410501	835C-2
W172DIP-37	HE721E1210	80411201	835C-4
W172DIP-38	HE721E2410		835C-6

Magnecraft	Supercedes Magnecraft	Potter & Brumfield	Omron
976XBXH-5D	76EURCPCX-61	RTE24005F	G2R-24-5VDC
976XBXH-6D	76EURCPCX-62	RTE24006F	G2R-24-6VDC
976XBXH-12D	76EURCPCX-63	RTE24012F	G2R-24-12VDC
976XBXH-24D	76EURCPCX-64	RTE24024F	G2R-24-24VDC
976XAX97H-5D	76EURCPCX-146	RTD14005F	G2R-14-E-5VDC
976XAX97H-6D	76EURCPCX-147	RTD14006F	G2R-14-E-6VDC
976XAX97H-12D	76EURCPCX-148	RTD14012F	G2R-14-E-12VDC
976XAX97H-24D	76EURCPCX-149	RTD14024F	G2R-14-E-24VDC
976XAX97H-48D	76EURCPCX-150	RTD14048F	G2R-14-E-48VDC
976XAXH-5D	76EURCPCX-14	RTB14005F	G2R-14-5VDC
976XAXH-6D	76EURCPCX-15	RTB14006F	G2R-14-6VDC
976XAXH-12D	76EURCPCX-16	RTB14012F	G2R-14-12VDC
976XAXH-24D	76EURCPCX-17	RTB14024F	G2R-14-24VDC
976XAXH-48D	76EURCPCX-18	RTB14048F	G2R-14-48VDC
976XBXH-24A		RTE24524	G2R-24-24VAC
976XBXH-120A		RTE24615	G2R-24-120VAC
976XBXH-240A		RTE24730	G2R-24-240VAC
976XAX97H-24A		RTD34524	G2R-14-E-24VAC
976XAX97H-120A		RTD34615	G2R-14-E-120VAC
976XAX97H-240A		RTD34730	G2R-14-E-240VAC
976XAXH-24A		RTB14524	G2R-14-24VAC
976XAXH-120A		RTB14615	G2R-14-120VAC
976XAXH-240A		RTB14730	G2R-14-240VAC

Magnecraft	Cornell Dubilier
W49E1C1VG-3DC-SIL	653-3K
W49E1C1VG-5DC-SIL	653-6K
W49E1C1VG-12DC-SIL	653-12K
W49E1C1VG-5DC-SCO	603-6B
W49E1C1VG-12DC-SCO	603-12B
W49E1C1VG-24DC-SCO	603-24B
W49E1C1VW-5DC-SCO	613-6B
W49E1C1VW-12DC-SCO	613-12B
W49E1C1VW-24DC-SCO	613-24B



American Zettler	**Aromat**		
AZ733-2C-5DE	JW2SN-DC5V		
AZ733-2C-6DE	JW2SN-DC6V		
AZ733-2C-12DE	JW2SN-DC12V		
AZ733-2C-24DE	JW2SN-DC24V		
AZ755-1C-5DE			
AZ755-1C-6DE			
AZ755-1C-12DE			
AZ755-1C-24DE			
AZ755-1C-48DE			
	JW1FSN-DC5V		
	JW1FSN-DC6V		
	JW1FSN-DC12V		
	JW1FSN-DC24V		
	JW1FSN-DC48V		