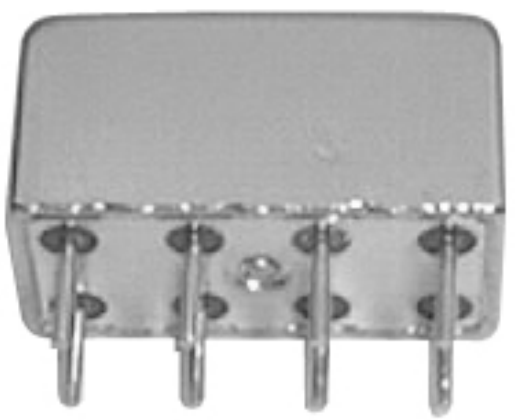
ENGINEERING DATA SHEET

SERIES 144

RAILWAY RELAY

2 PDT FOR INRUSH CURRENT, 4 AMP



APPLICATION NOTES:
001
007
009

APPLICABLE SOCKET
For Socket selection, please contact factory

HRCW

Non polarized, non latching, hermetically sealed relay

Contact arrangement	**2 PDT**
Coil supply	**Direct current**

PRINCIPLE TECHNICAL CHARACTERISTICS

Contacts rated at	**28 Vdc / 4 Amps**

Rated for capacitive and lamp loads

Weight	**< 11 grams**
Dimensions of can without hardware	**20.6mm x 10.4mm x 10.5mm max**

Tin plated, hermetically sealed metal can.

CONTACT ELECTRICAL CHARACTERISTICS

Minimum operating cycles	Contact rating per pole and load type	Load Current in Amps	
		@28 Vdc	@115 Vac/60-400Hz
100,000 cycles	resistive load	4	0.3
100,000 cycles	inductive load (L/R=5ms)	2	-
500,000 cycles	low level (30 µA/30 mV)	-	-
100,000 cycles	on capacitive load at 28 to 72Vdc	Inrush = 8 Amps / 1ms	
100,000 cycles	on lamp load at 28 to 72Vdc	0.8	

Life expectancy for DC loads other than 28Vdc: See application note n°009

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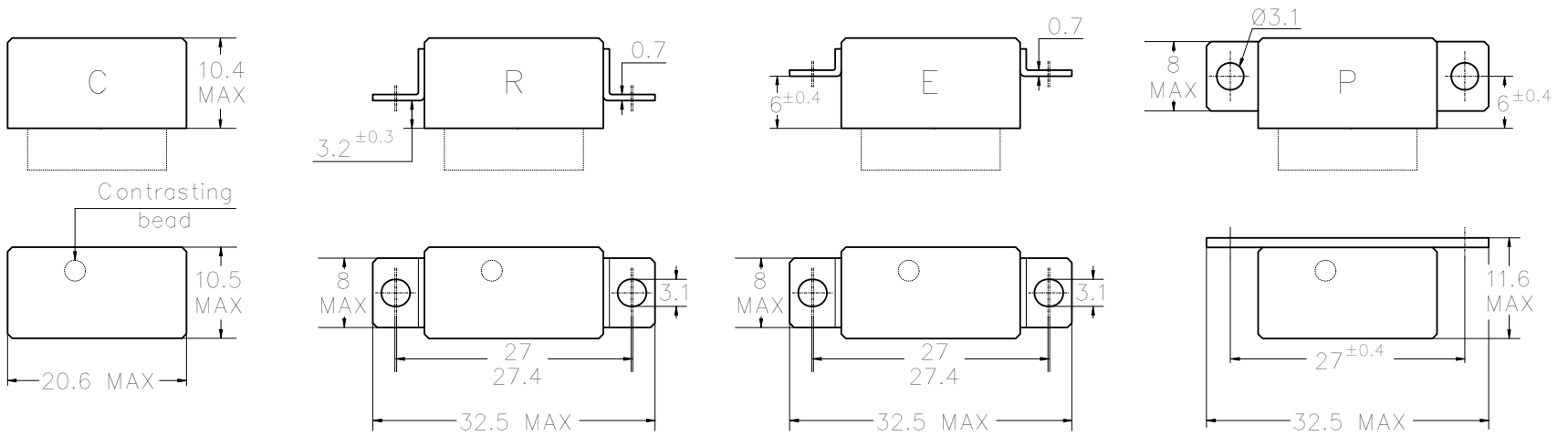
COIL CHARACTERISTICS (Vdc) SERIES 144

CODE	06	12	24	36	48	72
Nominal operating voltage	6	12	24	36	48	72
Maximum operating voltage	7.5	15	33	45	60	90
Minimum operating voltage at +70°, coil previously energized at 1.15 Un	5	10	22	25.2	33.6	50.4
Minimum operating voltage at +70°, coil non previously energized	4.4	8.8	19.3	22.1	29.5	44.3
Hold voltage at +85°C	2.5	5	12	15	20	30
Drop-out voltage at -25°C	0.4	0.8	1.5	2.4	3.2	4.8
Coil resistance in Ohms ±10% at +25°C	47.5	190	935	1600	2600	4400

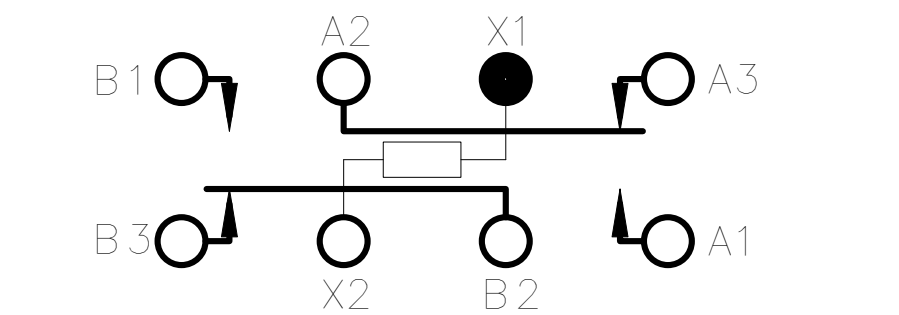
GENERAL CHARACTERISTICS

Operating temperature	-25°C to +70°C
Storage temperature	-40°C to +85°C
Dielectric strength at sea level, all points	500 Vrms / 50 Hz
Initial insulation resistance at 100 Vdc	>1000 M Ω
Sinusoidal vibration	30 G / 70 to 3000 Hz
Shock	100 G / 11 ms
Maximum contact opening time under vibration and shock	10 µs
Operate time at nominal voltage (including bounce)	5 ms max
Release time	5 ms max
Bounce time	2 ms max
Contact resistance at 0.5 Amp load current	30 mΩ max

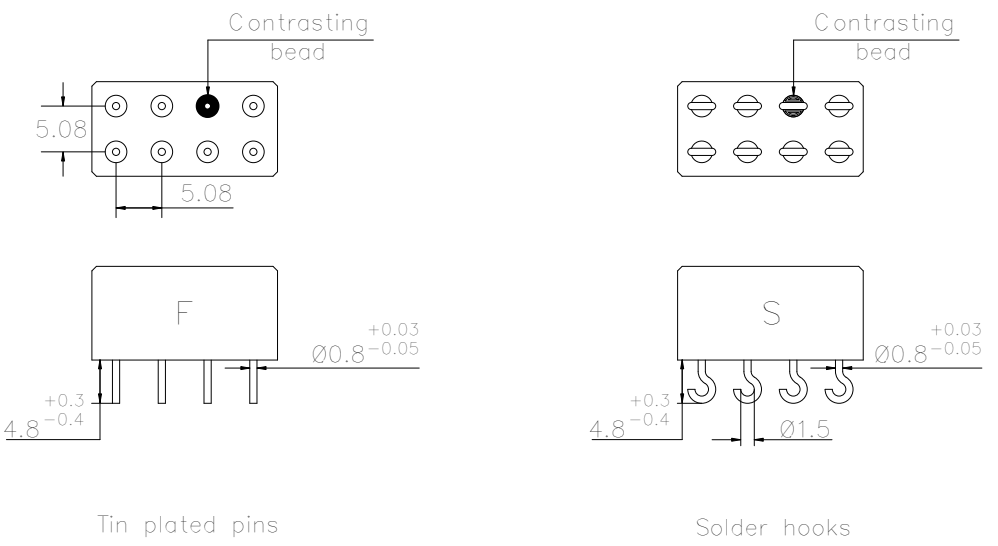


Dimensions in mm
Tolerances unless otherwise specified ±0.25mm

SCHEMATIC DIAGRAM



TERMINAL TYPES



NUMBERING SYSTEM

	144	F	D	C	24
Basic series designation	|				
1-Terminal Types(F,S)	|	|			
2-Mounting Styles (C,R,E,P)	|	|	|		
3-Coil Voltage (06,12,24,36,48,72)	|	|	|	|	

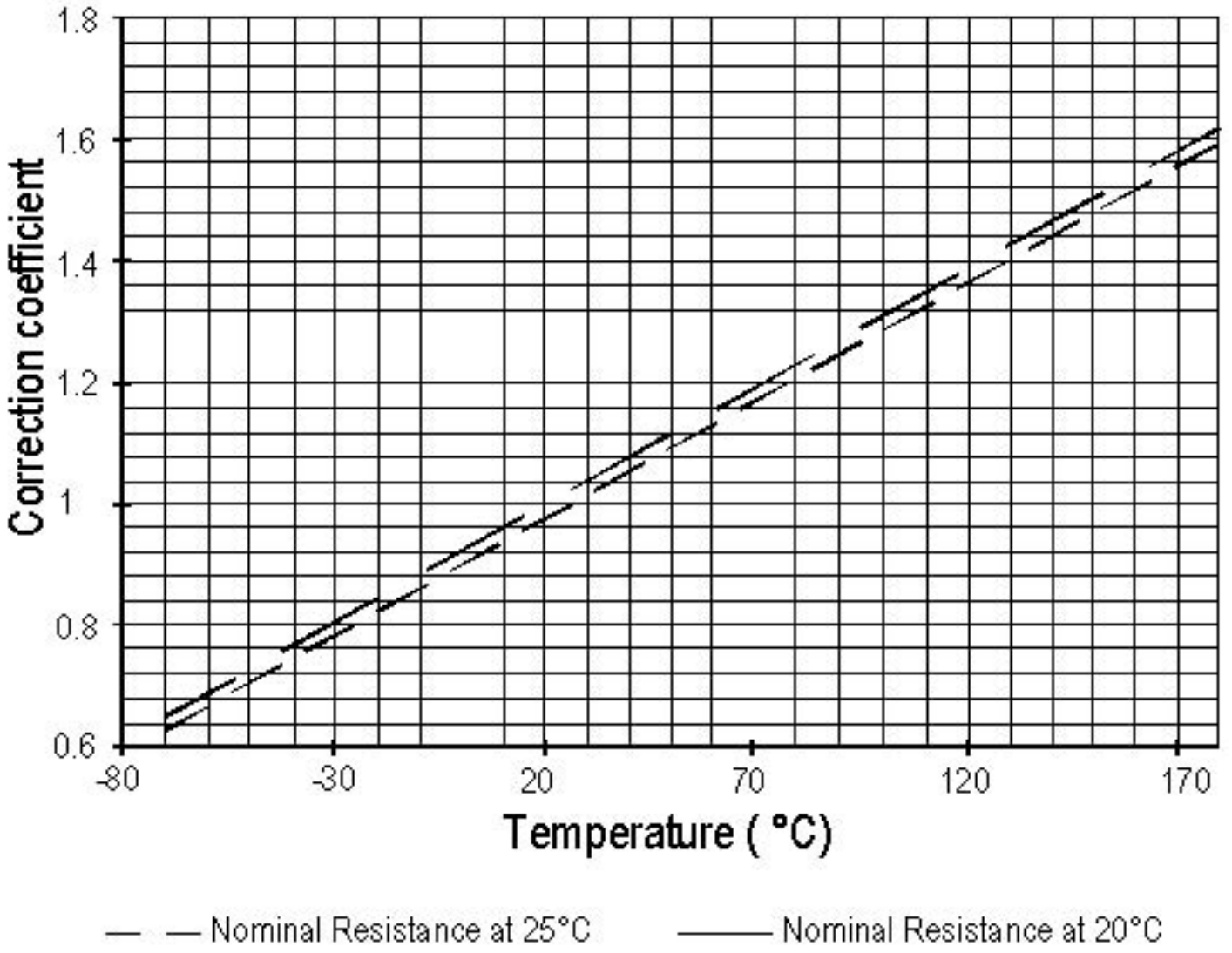
1. For socket selection, please contact factory.
2. Isolation spacer pads for PCB mounting available on request.
3. Ultra sonic cleaning may adversly affect the normally closed contacts.

TYPICAL CHARACTERISTICS

- Coil resistance temperature change: See application note n°001
- Coil L/R ratio for all types of DC coils is = 1.5 ms

Application notes	N°001

CORRECTION DUE TO COIL COPPER WIRE RESISTANCE CHANGE IN TEMPERATURE



Example: Coil resistance at 25°C: 935 ohms. What is it at 125°C?
Correction coefficient on diagram is: 1.39 at 125°C. R becomes: 935x1.39=1299 Ohms

Correction also applies to operating voltages

SUPPRESSOR DEVICES FOR RELAY COILS

The inductive nature of relay coils allows them to create magnetic forces which are converted to mechanical movements to operate contact systems. When voltage is applied to a coil, the resulting current generates a magnetic flux, creating mechanical work. Upon deenergizing the coil, the collapasing magnetic field induces a reverse voltage (also known as back EMF) which tends to maintain current flow in the coil. The induced voltage level mainly depends on the duration of the deenergization. The faster the switch-off, the higher the induced voltage.

All coil suppression networks are based on a reduction of speed of current decay. This reduction may also slow down the opening of contacts, adversly effecting contact life and reliability. Therefore, it is very important to have a clear understanding of these phenomena when designing a coil suppression circuitry.

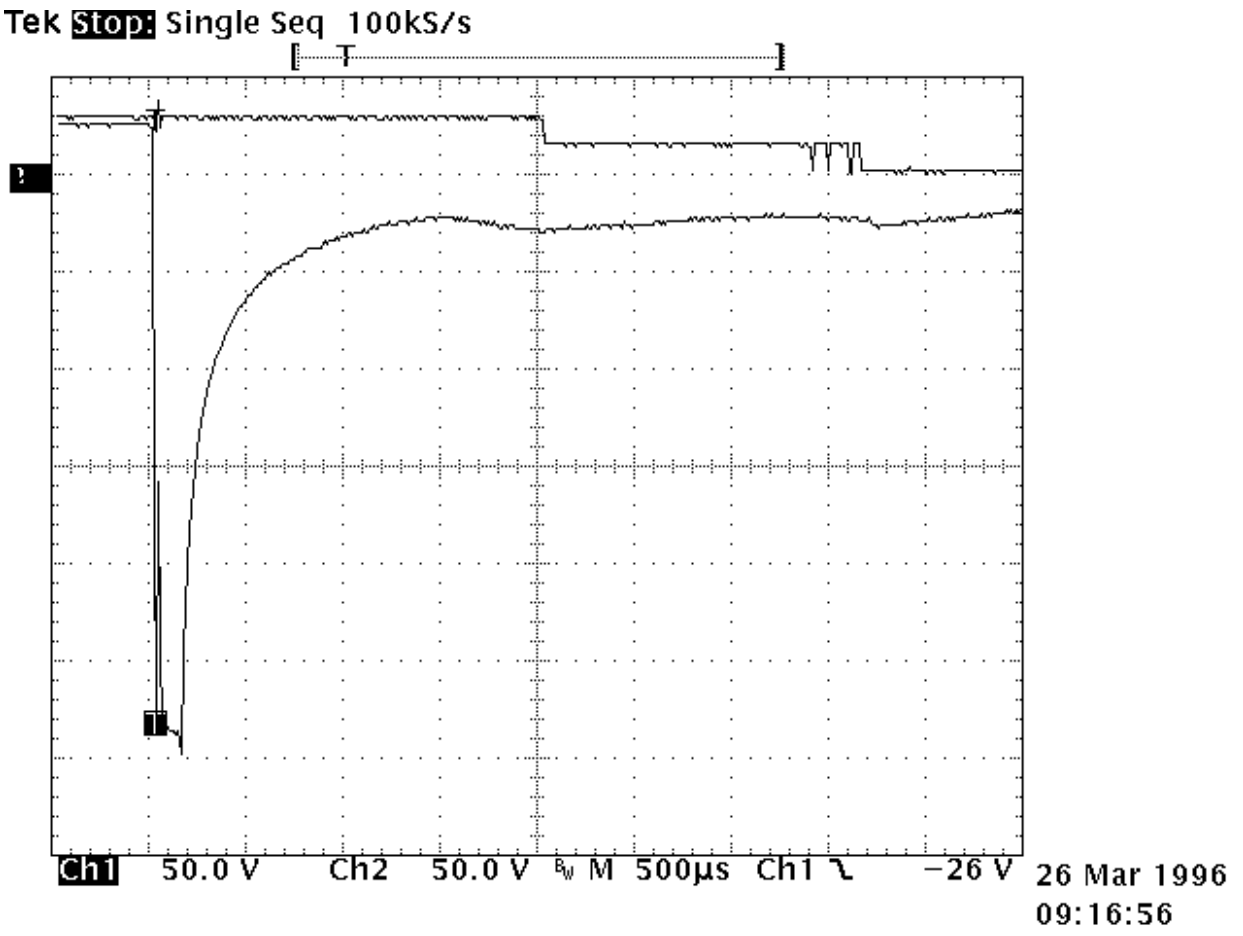
Typical coil characteristics

On the graph below, the upper record shows the contacts state. (High level NO contacts closed, low level NC contacts closed, intermediate state contact transfer). The lower record shows the voltage across the coil when the current is switched off by another relay contact.

The surge voltage is limited to -300V by the arc generated across contact poles. Discharge duration is about 200 mircoseconds after which the current change does not generate sufficient voltage. The voltage decreases to the point where the contacts start to move, at this time, the voltage increases due to the energy contained in the NO contact springs. The voltage decreases again during transfer, and increases once more when the magnetic circuit is closed on permanent magnet.

Operating times are as follows:
Time to start the movement 1.5ms
Total motion time 2.3ms
Transfer time 1.4ms

Contact State



Types of suppressors:

Passive devices.

The resistor capacitor circuit

It eliminates the power dissipation problem, as well as fast voltage rises. With a proper match between coil and resistor, approximate capacitance value can be calculated from:

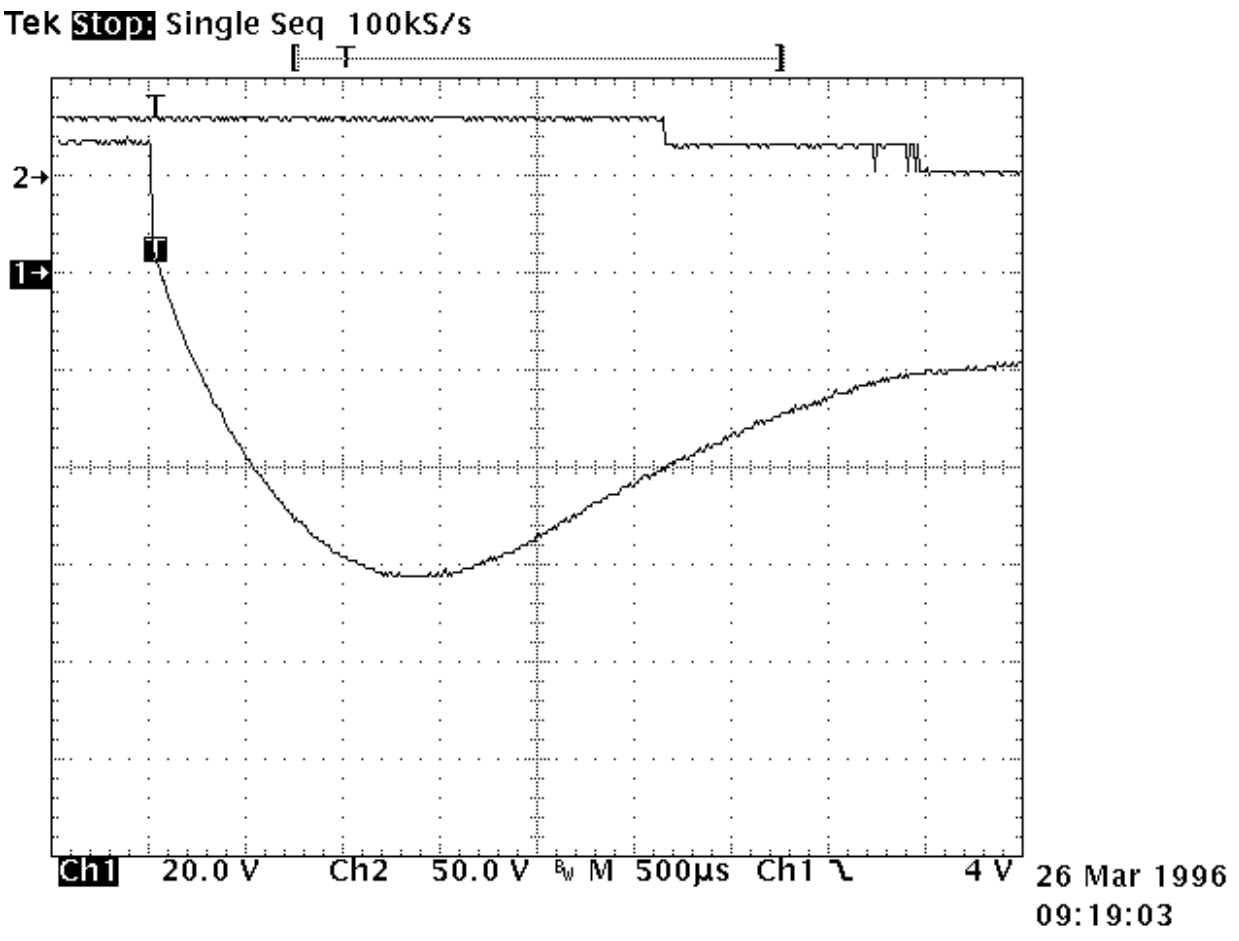
C = 0.02xT/R, where

T = operating time in milliseconds
R = coil resistance in kiloOhms
C = capacitance in microFarads

The series resistor must be between 0.5 and 1 times the coil resistance. Special consideration must be taken for the capacitor inrush current in the case of a low resistance coil.

The record shown opposite is performed on the same relay as above. The operation time becomes:
- time to start the movement 2.3ms
- transfer time 1.2ms

The major difficulty comes from the capacitor volume. In our example of a relay with a 290 Ω coil and time delay of 8 ms, a capacitance value of C=0.5 uF is found. This non polarized capacitor, with a voltage of 63V minimum, has a volume of about 1cm^3. For 150V, this volume becomes 1.5 cm^3.



The bifilar coil

The principle is to wind on the magnetic circuit of the main coil a second coil shorted on itself. By a proper adaptation of the internal resistance of this second coil it is possible to find an acceptable equilibrium between surge voltage and reduction of the opening speed. To be efficient at fast voltage changes, the coupling of two coils must be perfect. This implies embedded windings. The volume occupied by the second coil reduces the efficiency of the main coil and results in higher coil power consumption. This method cannot be applied efficiently to products not specifically designed for this purpose.

The resistor (parallel with the coil)
For efficient action, the resistor must be of the same order of magnitude as the coil resistance. A resistor 1.5 times the coil resistance will limit the surge to 1.5 times the supply voltage. Release time and opening speed are moderately affected. The major problem is the extra power dissipated.

Semi-conductor devices

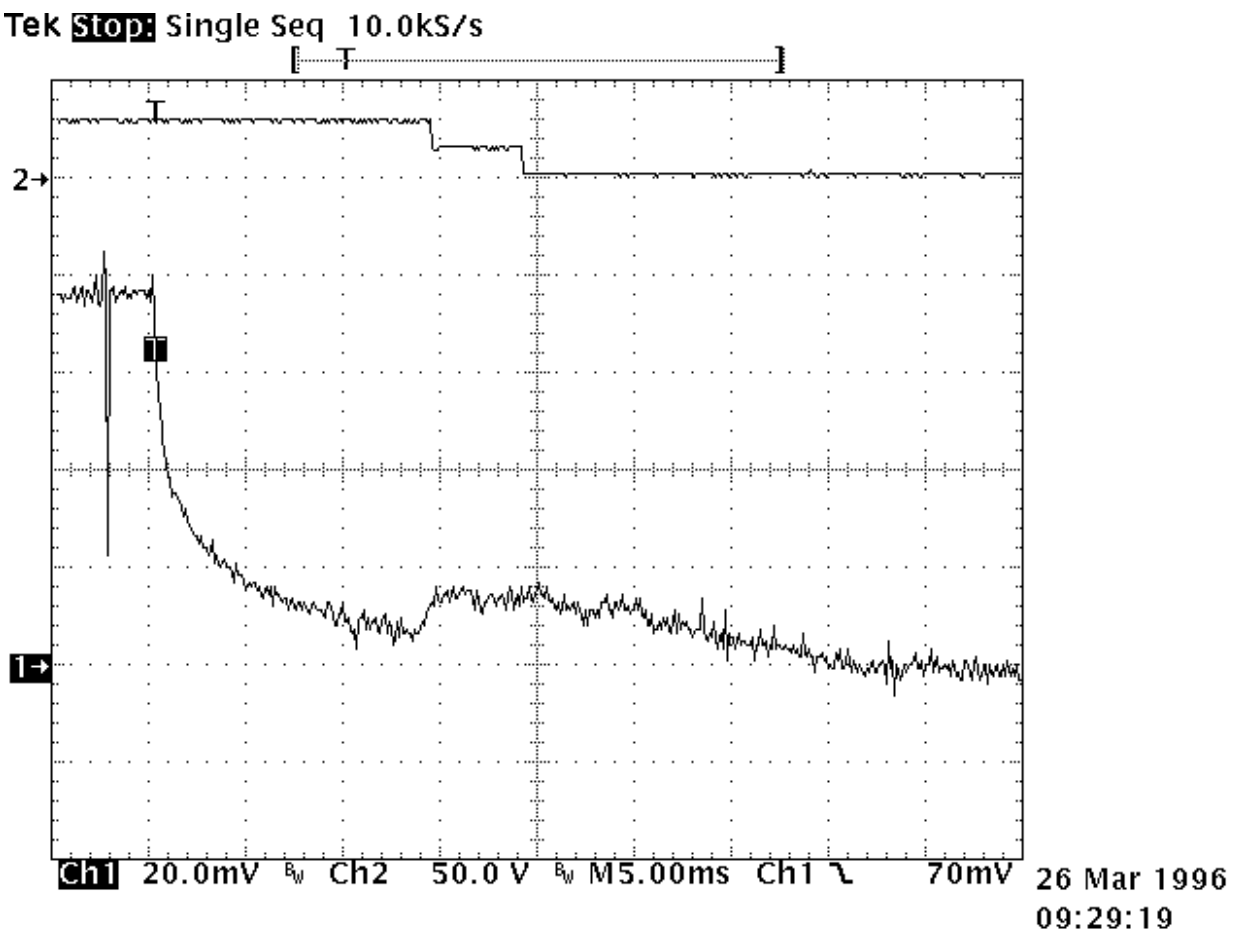
The diode

It is the most simple method to totally suppress the surge voltage. It has the major disadvantage of the higher reduction of contact opening speed. This is due to the total recycling, through the diode, of the energy contained in the coil itself. The following measurement is performed once again on the same relay. Operation times are given by the upper curve:

- time to start the movement 14ms
- transfer time 5ms

These times are multiplied by a coefficient from 4 to 8.
The lower curve shows the coil current. The increase prior to NO contact opening indicates that the contact spring dissipates its energy. At the opening time the current becomes constant as a result of practically zero opening speed.

Due to this kind of behavior, this type of suppression must be avoided for power relays. For small relays which have to switch low currents of less than 0.2 A, degradation of life is not that significant and the method may be acceptable.



The diode + resistor network

It eliminates the inconvenience of the resistor alone, explained above, and it limits the action of a single diode. It is now preferred to used the diode + zener network.

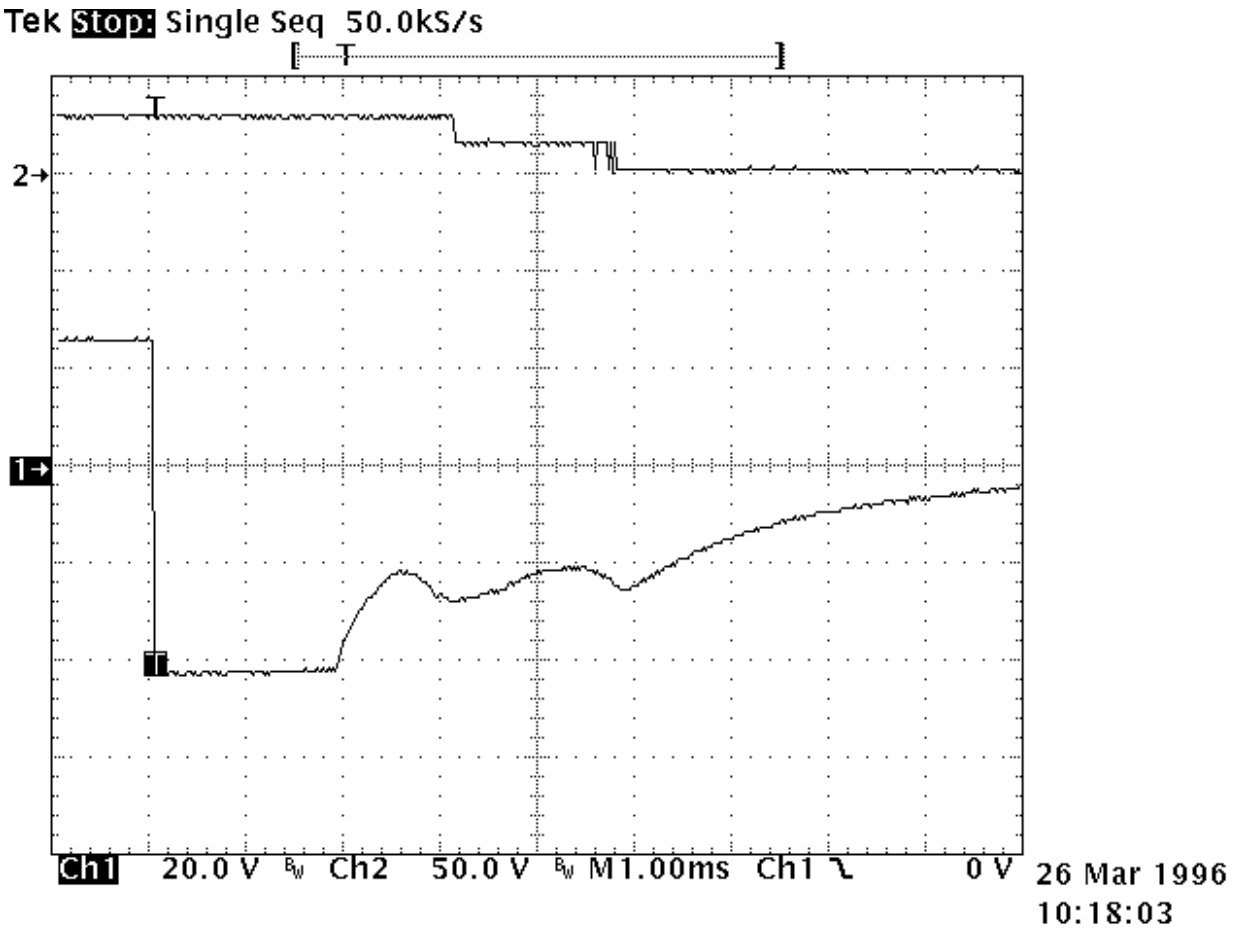
The diode + zener network

Like the resistor, the zener allows a faster decurrent decay. In addition it introduces a threshold level for current conduction which avoids the recycling of energy released during contact movement.

The lower curve on the opposite record demonstrates those characteristics. Voltage limitation occurs at 42V. The two voltages spikes generated by internal movement are at lower levels than zener conduction. As a result, no current is recycled in the coil.

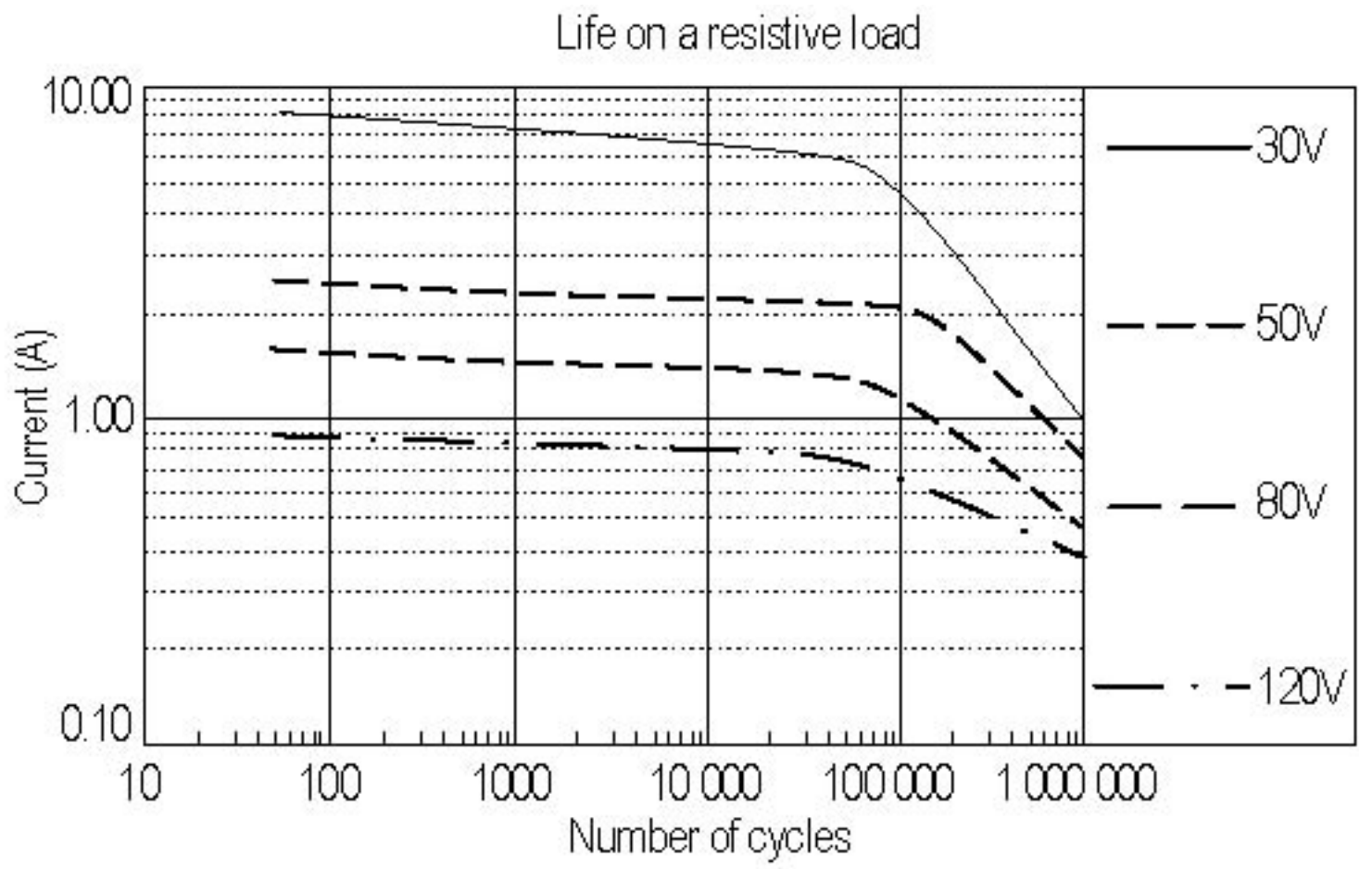
The opening time phases are as follows:
- time to start the movement 2.6ms
- total motion time 2.4ms
- transfer time 1.4ms

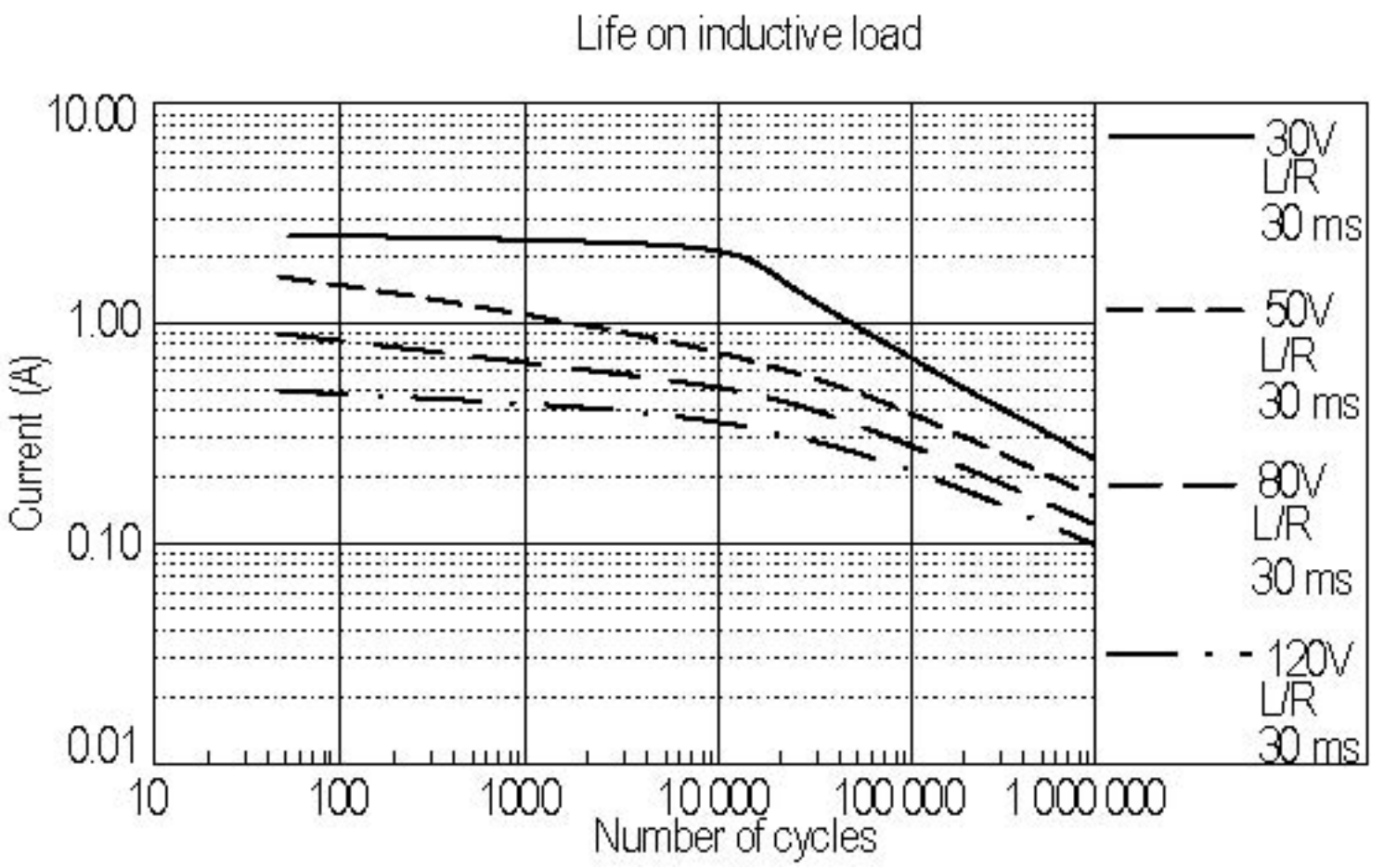
The release time is slightly increased. The contacts' opening speed remains unchanged.



LIFE CAPABILITY VERSUS VOLTAGE

Relay Series 144



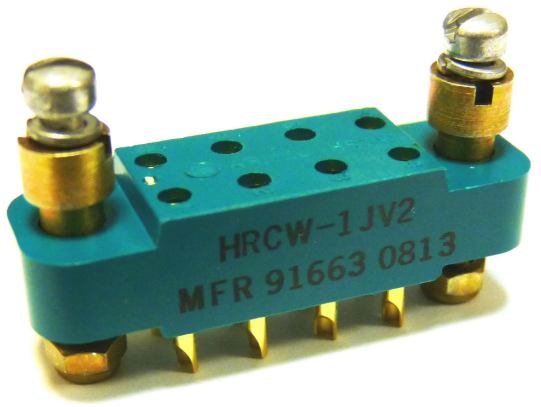


To define life at values of L/R different to 30 ms, it is possible to consider the product N cycles X L/R = constant. This for a given current and voltage.
For example if a 80 V L/R 30ms 0.25 A, life is found on the graph at 100,000 cycles. For a L/R of 10 ms, and the same current, 0.25 A, life should be 100,000 x 30 / 10 = 300,000 cycles.

ENGINEERING DATA SHEET

HRCW

RELAY SOCKET
2 AMP



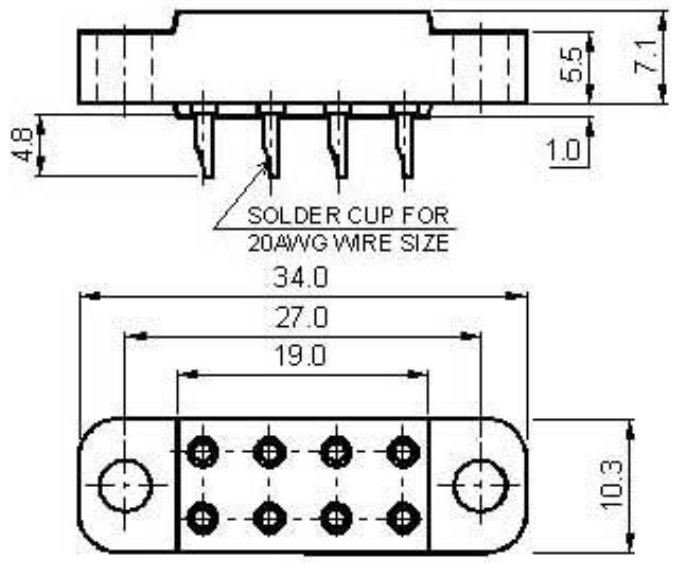
BASIC SOCKET SERIES DESIGNATION FOR:

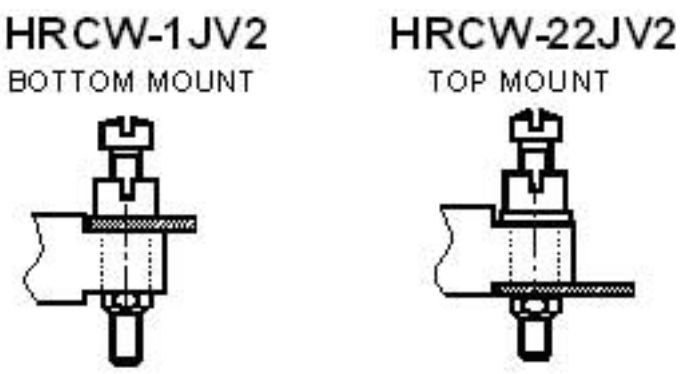
SERIES F250, F257, W260, GP5, and 144

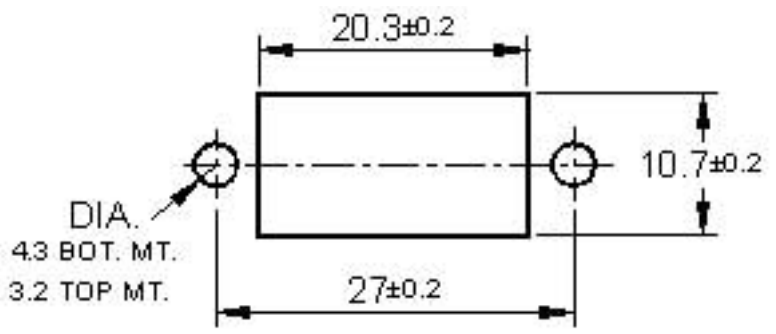
MEETS THE REQUIREMENTS OF:

MIL-S-12883

DIMENSIONS







GENERAL CHARACTERISTICS

Supplied with mounting hardware.	
Temperature range	-65°C to +125°C
Weight	10 grams
Dielectric Strength at sea level	1500 Vrms / 50 Hz Minimum
Gold plated contact per MIL-G-45204	
Dallyl phthalate, glass-fiber filled per MIL-M-14	

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