

# HASCO®

*Quality and Reliability Since 1976*



**Relays**  
**Reed Relays**  
**Reed Switches**



**Hasco Components International Corporation**  
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About



**Hasco Components International Corporation was established in 1976 as a reed switch and reed relay company. In 1979 Hasco added electromechanical relays to its line. It's mission has been simple. Produce high quality parts, keep a large inventory, keeps costs down and most important, give everyone you are dealing with 100% personal attention. Our founder once said, "anyone can sell a relay, Hasco sells service."**

## **Our Factory:**

### **Deal with the manufacturer and not an importer**

Since the mid 1990's Hasco has made its own relays in our own factory. Buying relays from a company with over three decades of experience that produces its own parts is better than buying them from someone who imports them from different factories. Factory Tours are Available

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## **Sales & Service: 516-328-9292 email: [info@hascorelays.com](mailto:info@hascorelays.com)**

Sales are done through our headquarters in New York or our branch office in Shanghai for overseas inquiries. Hasco also has 15 affiliated sales rep offices as well as a stocking branch in Brazil. Drop shipments world wide are available to save time and money.

---

## **Hasco Stocks!**

For over 30 years Hasco has kept a large inventory of relays, reed switches and reed relays as well as magnets and proximity sensors in New York. We also keep inventory at our factory outside of Shanghai. Hasco specializes in JIT and Kanban programs.

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## **Hasco Clients:**

Presently we help sample, engineer and supply to the following industries. These include automotive, security and fire, UPS, Telecom, industrial controls, HVAC, lighting controls and liquid level sensors to name a few.

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## **No Time to Read a Catalog?**

Free specifying is available by our engineering experts. We recommend you stop taking the time to go through web and catalog pages. Rather than going through web or catalog pages why not simply tell us what you need. Simply advise us the number of the poles needed, switching voltage and current as well as the coil voltage? We can save you time by recommending the best relay at the lowest cost in a matter of minutes.

For instant help call: 516 328 9292 8:15AM to 5:30 PM or email: [info@hascorelays.com](mailto:info@hascorelays.com)

**See us anytime at [www.hascorelays.com](http://www.hascorelays.com)**

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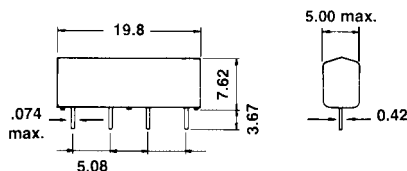
## SIP/DIP REED RELAYS LOW COST D & S SERIES

- Molded epoxy body.
- FCC Part 68

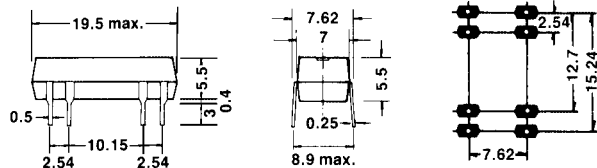
DIMENSIONS: unit in mm



S1A Series Standard SIP



Shielding optional



DIP TYPE

 File E75887

 File LR49291

### DIP SPECIFICATIONS COIL RATINGS (20°C)

| Contact Form  | Part Number | Nominal Voltage (VDC) | Coil Resistance $\pm 10\%$ | Must Operate (VDC) | Must Release (VDC) | Rated Current (mA) | Continuous Voltage (max) | Circuit Schematic                                                                     |
|---------------|-------------|-----------------------|----------------------------|--------------------|--------------------|--------------------|--------------------------|---------------------------------------------------------------------------------------|
| 1A<br>SPST-NO | D1A05(D)    | 5                     | 500                        | 3.75               | 1.0                | 10                 | 10                       |    |
|               | D1A12(D)    | 12                    | 1000                       | 9.00               | 1.2                | 12                 | 20                       |                                                                                       |
|               | D1A24(D)    | 24                    | 2150                       | 18.00              | 2.4                | 11.1               | 28                       |                                                                                       |
| 1B<br>SPST-NC | D1B05(D)    | 5                     | 500                        | 3.75               | 1.0                | 10                 | 7                        |   |
|               | D1B12(D)    | 12                    | 1000                       | 9.00               | 1.2                | 12                 | 15                       |                                                                                       |
|               | D1B24(D)    | 24                    | 2150                       | 18.00              | 2.4                | 11.1               | 28                       |                                                                                       |
| 2A<br>DPST-NO | D2A05(D)    | 5                     | 140                        | 3.75               | 1.0                | 35.7               | 10                       |  |
|               | D2A12(D)    | 12                    | 500                        | 9.00               | 1.2                | 24                 | 20                       |                                                                                       |
|               | D2A24(D)    | 24                    | 2150                       | 18.00              | 2.4                | 11.1               | 28                       |                                                                                       |
| 1C<br>SPDT-CO | D1C05(D)    | 5                     | 200                        | 3.75               | 1.0                | 25                 | 10                       |  |
|               | D1C12(D)    | 12                    | 500                        | 9.00               | 1.2                | 24                 | 20                       |                                                                                       |
|               | D1C24(D)    | 24                    | 2150                       | 18.00              | 2.4                | 11.1               | 28                       |                                                                                       |

(D): Clamp diode optional

### SIP SPECIFICATIONS COIL RATINGS (20°C)

| Contact Form  | Part Number | Nominal Voltage (VDC) | Coil Resistance $\pm 10\%$ | Must Operate (VDC) | Must Release (VDC) | Rated Current (mA) | Continuous Voltage (max) | Circuit Schematic                                                                     |
|---------------|-------------|-----------------------|----------------------------|--------------------|--------------------|--------------------|--------------------------|---------------------------------------------------------------------------------------|
| 1A<br>SPST-NO | S1A05(D)    | 5                     | 500                        | 3.75               | 1.0                | 10                 | 10                       |  |
|               | S1A12(D)    | 12                    | 1000                       | 9.00               | 1.2                | 12                 | 20                       |                                                                                       |
|               | S1A24(D)    | 24                    | 2000                       | 18.00              | 2.4                | 12                 | 28                       |                                                                                       |

(S): Shielded (D): Clamp diode optional

Form B SIP Available

### CHARACTERISTICS

| Item                     | Contact Form | 2A, 1A, 1B                                                    | 1C                                                            |
|--------------------------|--------------|---------------------------------------------------------------|---------------------------------------------------------------|
| Contact Resistance       |              | 100m $\Omega$ max. (initial)                                  | 150m $\Omega$ max. (initial)                                  |
| Operate Time             |              | 0.5msec max.                                                  | 1.0msec max.                                                  |
| Bounce Time              |              | 0.5msec max.                                                  | 2.0msec max.                                                  |
| Release Time             |              | 0.2msec max.                                                  | 0.2msec max.                                                  |
| Insulation Resistance    |              | 10 <sup>11</sup> (min)                                        | 10 <sup>11</sup> (min)                                        |
| Contact Material         |              | Rhodium                                                       | Rhodium                                                       |
| Power                    |              | 10VA max.                                                     | 3VA max.                                                      |
| Switching Voltage        |              | 200VDCmax.                                                    | 100VDCmax.                                                    |
| Switching Current        |              | 0.5Amps max.                                                  | 0.25Amps max.                                                 |
| Carry Current            |              | 1.0Amps max.                                                  | 0.5Amps max.                                                  |
| Life Expectancy          |              | 10 <sup>8</sup> (signal level)                                | 5 x 10 <sup>7</sup> (signal level)                            |
| Breakdown Voltage        |              | DC250V across open contact<br>DC500V between coil and contact | DC200V across open contact<br>DC500V between coil and contact |
| Operating Temp           |              | - 40 ~ 85°C                                                   | - 40 ~ 85°C                                                   |
| Storage Temp             |              | - 50 ~ 125°C                                                  | - 50 ~ 125°C                                                  |
| Minimum Permissible Load |              | 100mVDC 10 $\mu$ A                                            | 100mVDC 10 $\mu$ A                                            |
| Vibration                |              | 20g (10 ~ 2000Hz)                                             | 20g (10 ~ 2000Hz)                                             |
| Resonant Frequency       |              | 3.5 KHz                                                       | 3.5KHz                                                        |

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## DRY CONTACT REED RELAYS 700 SIP SERIES

### FEATURES

- Choice of normal, heavy duty or hi voltage
- Epoxy molded
- FCC Part 68



File E75887



File LR49291

### SPECIFICATIONS

| Part Number | Nominal Voltage (V) | Must Operate (V) | Must Release (V) | Coil Resistance (Ohms) | Contact Rating                                                                 | Breakdown Voltage                                    |
|-------------|---------------------|------------------|------------------|------------------------|--------------------------------------------------------------------------------|------------------------------------------------------|
| 711-5       | 5                   | 3.75             | 0.5              | 500                    | AC 10VA, DC 10W max.<br>100V DC max.<br>1.0A max. carry<br>0.3A max. switching | 250V DC across contacts<br>2500V DC contacts to coil |
| 711-12      | 12                  | 9.0              | 1.2              | 1000                   |                                                                                |                                                      |
| 711-24      | 24                  | 18.0             | 2.4              | 2000                   |                                                                                |                                                      |

### HEAVY DUTY

|        |    |      |     |      |                                                                                                               |                                                      |
|--------|----|------|-----|------|---------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| 712-5  | 5  | 3.75 | 0.5 | 500  | AC 70VA, DC 50W max.<br>150VAC, 200VDC<br>2.5A max. carry<br>1.0A max. switching DC<br>0.7A max. switching AC | 300V DC across contacts<br>2500V DC contacts to coil |
| 712-12 | 12 | 9.0  | 1.2 | 1000 |                                                                                                               |                                                      |
| 712-24 | 24 | 18.0 | 2.4 | 2000 |                                                                                                               |                                                      |

### HIGH VOLTAGE

|        |    |      |     |      |                                                                                  |                                                      |
|--------|----|------|-----|------|----------------------------------------------------------------------------------|------------------------------------------------------|
| 713-5  | 5  | 3.75 | 0.5 | 500  | AC 50VA, DC 50W max.<br>300VAC, 350VDC<br>2.5A max. carry<br>0.5A max. switching | 600V DC across contacts<br>2500V DC contacts to coil |
| 713-12 | 12 | 9.0  | 1.2 | 1000 |                                                                                  |                                                      |
| 713-24 | 24 | 18.0 | 2.4 | 2000 |                                                                                  |                                                      |

### EXTRA HIGH VOLTAGE BREAKDOWN

|        |    |      |     |      |                                                                                          |                                                       |
|--------|----|------|-----|------|------------------------------------------------------------------------------------------|-------------------------------------------------------|
| 714-5  | 5  | 3.75 | 0.5 | 500  | 100VA max.<br>1.0A max. switching<br>2.5A max. carry<br>350 VDC / 300 VAC max. switching | 1000V DC across contacts<br>2500V DC contacts to coil |
| 714-12 | 12 | 9.0  | 1.2 | 1000 |                                                                                          |                                                       |
| 714-24 | 24 | 18.0 | 2.4 | 2000 |                                                                                          |                                                       |

### S.P.D.T. (FORM C)

|        |    |      |     |     |                                                                  |                                       |
|--------|----|------|-----|-----|------------------------------------------------------------------|---------------------------------------|
| 703-5  | 5  | 3.75 | 0.5 | 125 | AC 3VA, DC 3W max.<br>DC 30V<br>0.5Amp carry<br>0.2Amp switching | 200V min.<br>2500V DC contact to coil |
| 703-12 | 12 | 9.0  | 1.2 | 500 |                                                                  |                                       |
| 703-24 | 24 | 18.0 | 2.4 | —   |                                                                  |                                       |

## MERCURY WETTED REED RELAYS AVAILABLE

### ENGINEERING DATA

Operate Time: 0.5 mSec max.

Release Time: 0.2 mSec max.

Bounce Time: 0.5 mSec max.

Contact Resistance:

150 mΩ max. (initial)

Life Expectancy:

50 x 10<sup>6</sup> operations at signal level

3 x 10<sup>6</sup> at full rated load

Insulation Resistance: 10<sup>9</sup>Ω min.

Vibration: 20G (10-2000 Hz)

Thermal Shock: -55 ~ 105°C

Moisture Resistance:

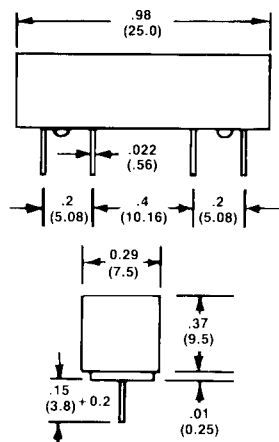
60°C-90% 240 hours

Terminal Strength: 225g

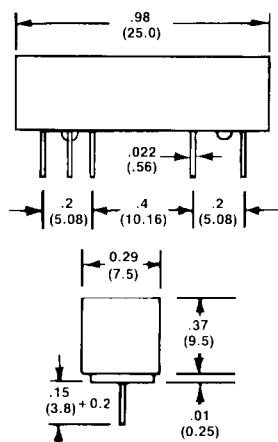
Operating Temperature: -40 ~ 85°C

Storage Temperature: -55 ~ 105°C

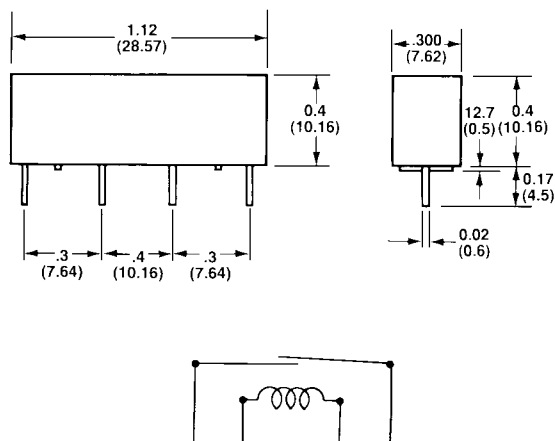
### SERIES 711 FORM A



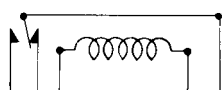
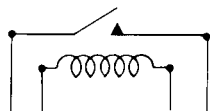
### SERIES 703 FORM C



### SERIES 712, 713 & 714



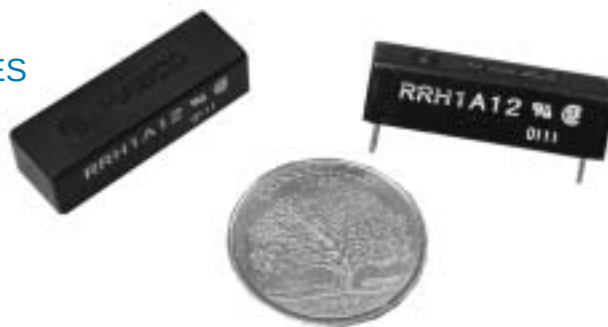
Dimensions: inches (mm)



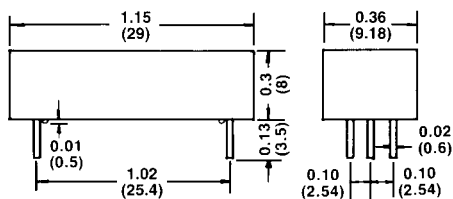
For magnetic shielding add letter: S

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## STANDARD FORM 1A REED RELAY RRH SERIES

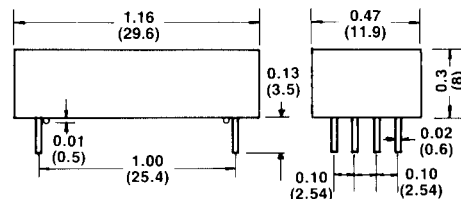


METAL COVER



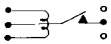
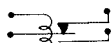
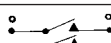
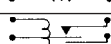
FORM 1A, 1C

DIMENSIONS: inch (mm)



FORM 2A, 2C

### SPECIFICATIONS COIL RATINGS (20°C)

| Contact Form  | Part Number | Nominal Voltage (VDC) | Coil Resistance $\pm 10\%$ | Must Operate (VDC) | Must Release (VDC) | Rated Current (mA) | Continuous Voltage (max) | Circuit Schematic                                                                     |
|---------------|-------------|-----------------------|----------------------------|--------------------|--------------------|--------------------|--------------------------|---------------------------------------------------------------------------------------|
| 1A<br>SPST-NO | RRH1A05     | 5                     | 500                        | 3.75               | 0.8                | 10                 | 10                       |  |
|               | RRH1A12     | 12                    | 1000                       | 9.00               | 1.2                | 12                 | 20                       |                                                                                       |
|               | RRH1A24     | 24                    | 2150                       | 18.00              | 2.4                | 11.1               | 28                       |                                                                                       |
| 1C<br>SPST-NO | RRH1C05     | 5                     | 200                        | 3.75               | 0.8                | 25                 | 10                       |  |
|               | RRH1C12     | 12                    | 500                        | 9.00               | 1.2                | 24                 | 20                       |                                                                                       |
|               | RRH1C24     | 24                    | 2150                       | 18.00              | 2.4                | 11.1               | 28                       |                                                                                       |
| 2A<br>DPST-NO | RRH2A05     | 5                     | 140                        | 3.75               | 0.5                | 35.7               | 10                       |  |
|               | RRH2A12     | 12                    | 500                        | 9.00               | 1.0                | 24                 | 20                       |                                                                                       |
|               | RRH2A24     | 24                    | 2150                       | 18.00              | 2.0                | 11                 | 28                       |                                                                                       |
| 2C<br>DPDT-NO | RRH2C05     | 5                     | 140                        | 3.75               | 0.5                | 35.7               | 10                       |  |
|               | RRH2C12     | 12                    | 500                        | 9.00               | 1.0                | 24                 | 20                       |                                                                                       |
|               | RRH2C24     | 24                    | 2150                       | 18.00              | 2.0                | 11                 | 28                       |                                                                                       |

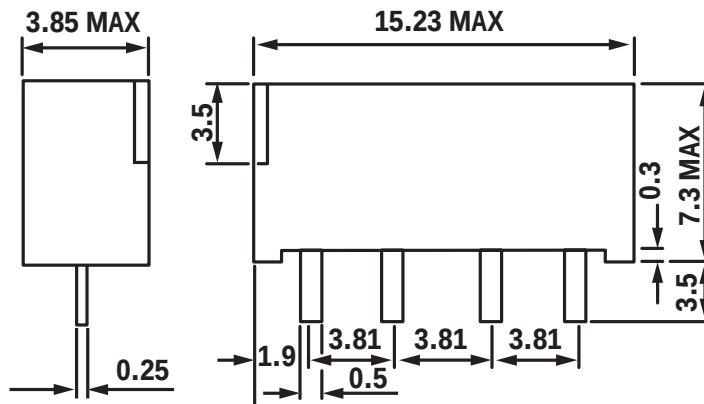
### CHARACTERISTICS

| Item                     | Contact Form | 1A, 2A                           | 1C, 2C                             |
|--------------------------|--------------|----------------------------------|------------------------------------|
| Contact Resistance       |              | 100m $\Omega$ max. (initial)     | 150m $\Omega$ max. (initial)       |
| Operate Time             |              | 0.5msec max.                     | 1.0msec max.                       |
| Bounce Time              |              | 0.5msec max.                     | 2.0msec max.                       |
| Release Time             |              | 0.2msec max.                     | 0.2msec max.                       |
| Insulation Resistance    |              | 10 <sup>11</sup> (min)           | 10 <sup>11</sup> (min)             |
| Contact Material         |              | Rhodium                          | Rhodium                            |
| Power                    |              | 10VA max.                        | 3VA max.                           |
| Switching Voltage        |              | 200VDC max.                      | 30VDC max.                         |
| Switching Current        |              | 0.5Amps max.                     | 0.25Amps max.                      |
| Carry Current            |              | 1.0Amps max.                     | 0.5Amps max.                       |
| Life Expectancy          |              | 10 <sup>9</sup> (signal level)   | 5 x 10 <sup>7</sup> (signal level) |
| Breakdown Voltage        |              | DC250V across open contact       | DC200V across open contact         |
|                          |              | DC1500V between coil and contact | DC1500V between coil and contact   |
| Operating Temp           |              | - 40 ~ 80°C                      | - 40 ~ 80°C                        |
| Storage Temp             |              | - 40 ~ 100°C                     | - 40 ~ 100°C                       |
| Minimum Permissible Load |              | 100mVDC 10 $\mu$ A               | 100mVDC 10 $\mu$ A                 |
| Vibration                |              | 20g (10 ~ 2000Hz)                | 20g (10 ~ 2000Hz)                  |
| Resonant Frequency       |              | 3.5 KHz                          | 3.5KHz                             |



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## 611 REED RELAY SERIES



### FEATURES

- Encapsulated Body
- Small size
- Available with external shield

### SIP SPECIFICATIONS COIL RATINGS (20°C)

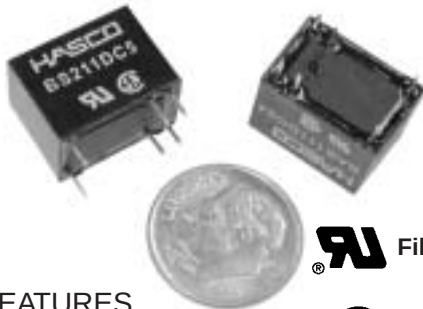
| Contact Form | Part Number | Nominal Voltage (VDC) | Coil Resistance $\pm 10\%$ | Must Operate (VDC) | Must Release (VDC) | Rated Current (mA) | Contiguous Voltage (max) | Circuit Schematic                                                                    |
|--------------|-------------|-----------------------|----------------------------|--------------------|--------------------|--------------------|--------------------------|--------------------------------------------------------------------------------------|
| 1A SPST-NO   | 611-05      | 5                     | 500                        | 3.75               | 0.4                | 10                 | 10                       |  |

### CHARACTERISTICS

|                                 |                                 |
|---------------------------------|---------------------------------|
| <b>Contact Arrangement</b>      | 1A                              |
| <b>Contact Resistance</b>       | 200m Ohms max. (initial)        |
| <b>Operate Time</b>             | 0.3msec max.                    |
| <b>Bounce Time</b>              | 0.3msec max.                    |
| <b>Release Time</b>             | 0.05msec max.                   |
| <b>Insulation Resistance</b>    | $10^9$ (min)                    |
| <b>Contract Material</b>        | Rhodium                         |
| <b>Power</b>                    | 10VA max.                       |
| <b>Switching Voltage</b>        | 24VDC max.                      |
| <b>Switching Current</b>        | 0.1 Amps max.                   |
| <b>Carry Current</b>            | 0.3 Amps max.                   |
| <b>Life expectancy</b>          | 10 x 8 (signal level)           |
| <b>Breakdown Voltage</b>        | DC150V across open contact      |
|                                 | DC500V between coil and contact |
| <b>Operating Temp</b>           | -40 ~ 85° C                     |
| <b>Storage Temp</b>             | -50 ~ 125° C                    |
| <b>Minimum Permissible Load</b> | 100m VDC 10 $\mu$ A             |
| <b>Vibration</b>                | 20g (10 ~ 55Hz)                 |
| <b>Resonant Frequency</b>       | 3.5KHz                          |

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## SPDT—BAS/BS./SC SINGLE BUTTON CONTACT 2.0 AMP, 5.0 AMP

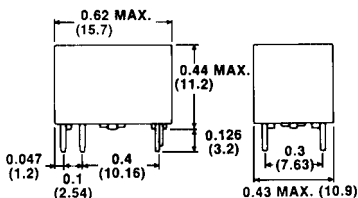


 File E75887

 File LR49291

### FEATURES

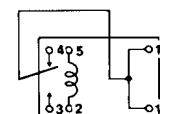
- FCC Pt 68
- Small Package
- Fully sealed



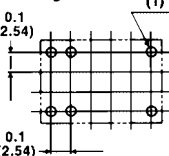
DIMENSIONS: inch (mm)

### BAS/BS Series

Internal Connections (Bottom View)

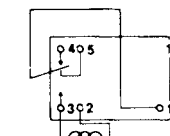


Drilling Plan 6- $\phi$  0.039 hole (1)



### SC Series

Internal Connections (Bottom View)



### COIL RATINGS FOR STANDARD MODEL

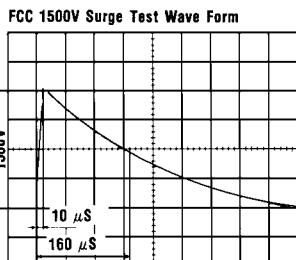
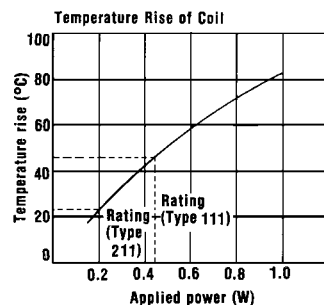
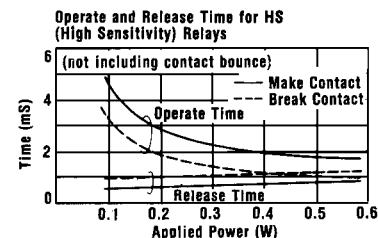
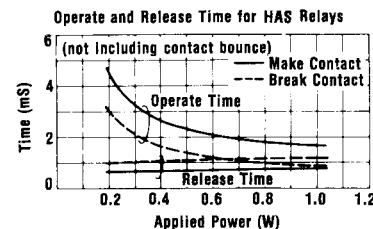
| Relay Codes |            |           | Contact Arrangement | Nom. Volt. (V) | Coil Resist. ( $\Omega$ $\pm 10\%$ ) | Nom. Curr. (mA) | Pick-Up Volt. (V) | Drop-Out Volt. (V) | Max. Volt. (V) | Nom. Pwr (W) Cons'p-tion |
|-------------|------------|-----------|---------------------|----------------|--------------------------------------|-----------------|-------------------|--------------------|----------------|--------------------------|
| 2 Amp       | 5 Amp      | 2 Amp     |                     |                |                                      |                 |                   |                    |                |                          |
| BAS-111-3   | BAS-511-3  | SC-111-3  | SPDT (1 Form C)     | 3              | 20                                   | 150             | 2.1               | 0.3                | 3.3            | Approx. 0.45             |
| BAS-111-5   | BAS-511-5  | SC-111-5  |                     | 5              | 56                                   | 89.3            | 3.5               | 0.5                | 5.5            |                          |
| BAS-111-6   | BAS-511-6  | SC-111-6  |                     | 6              | 80                                   | 75              | 4.2               | 0.6                | 6.6            |                          |
| BAS-111-9   | BAS-511-9  | SC-111-9  |                     | 9              | 180                                  | 50              | 6.3               | 0.9                | 9.9            |                          |
| BAS-111-12  | BAS-511-12 | SC-111-12 |                     | 12             | 320                                  | 37.5            | 8.4               | 1.2                | 13.2           |                          |
| BAS-111-24  | BAS-511-24 | SC-111-24 |                     | 24             | 1280                                 | 18.8            | 16.8              | 2.4                | 26.4           |                          |
| BAS-111-48  | BAS-511-48 | SC-111-48 |                     | 48             | 5120                                 | 9.4             | 33.6              | 4.8                | 52.8           |                          |

### COIL RATINGS FOR SENSITIVE MODEL

| Relay Codes |           | Contact Arrangement | Coil Nom. Volt. (V) | Resist. ( $\Omega$ $\pm 10\%$ ) | Pick Nom. Curr. (mA) | Drop-Up Volt. (V) | Out Volt. (V) | Nom. Volt. (V) | Pwr (W) Cons'p-tion |
|-------------|-----------|---------------------|---------------------|---------------------------------|----------------------|-------------------|---------------|----------------|---------------------|
| 2 Amp       | 2 Amp     |                     |                     |                                 |                      |                   |               |                |                     |
| BS-211-3    | SC-211-3  | SPDT (1 Form C)     | 3                   | 45                              | 66.7                 | 2.1               | 0.3           | 4.8            | Approx. 0.20        |
| BS-211-5    | SC-211-5  |                     | 5                   | 120                             | 41.7                 | 3.5               | 0.5           | 8.0            |                     |
| BS-211-6    | SC-211-6  |                     | 6                   | 180                             | 33.3                 | 4.2               | 0.6           | 9.6            |                     |
| BS-211-9    | SC-211-9  |                     | 9                   | 400                             | 22.5                 | 6.3               | 0.9           | 14.4           |                     |
| BS-211-12   | SC-211-12 |                     | 12                  | 700                             | 17.1                 | 8.4               | 1.2           | 19.2           |                     |
| BS-211-24   | SC-211-24 |                     | 24                  | 2800                            | 8.6                  | 16.8              | 2.4           | 38.4           |                     |
| BS-211-48   | SC-211-48 |                     | 48                  | 11200                           | 4.3                  | 33.6              | 4.8           | 76.8           |                     |

### RATING PERFORMANCE

| Specifications |                           |                                                                                                                             | Note                                                             |
|----------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Coil           | Nominal Voltage           | 3, 5, 6, 9, 12, 24, 48 VDC                                                                                                  |                                                                  |
|                | Nominal Power Consumption | 0.45W                                                                                                                       |                                                                  |
|                | Pick-up Voltage           | 70% of nominal voltage                                                                                                      |                                                                  |
|                | Drop-out Voltage          | 10% of nominal voltage                                                                                                      |                                                                  |
| Contact        | Contact Arrangement       | SPDT, 1 Form C                                                                                                              |                                                                  |
|                | Contact Material          | SC111 Silver<br>SC211 Silver-Cadmium Oxide<br>BAS 111 Silver<br>BS 211 Silver-Cadmium Oxide<br>BAS 511 Silver-Cadmium Oxide |                                                                  |
|                | Contact Resistance        | Max. 100 m $\Omega$                                                                                                         | at initial value                                                 |
|                | Max. Switching Power      | DC 30W/<br>AC 60 VA                                                                                                         |                                                                  |
|                | Max. Switching Volt.      | 60 VDC/120 VAC                                                                                                              | at resistive load                                                |
| Time           | Max. Switching Current    | 2A DC/AC BAS BS, SC<br>5A DC/AC BAS 511                                                                                     |                                                                  |
|                | Operate Time              | Approx. 2 mS                                                                                                                | at nominal voltage                                               |
|                | Release Time              | Approx. 1 mS                                                                                                                |                                                                  |
|                | Bounce Time (Operating)   | Max. 2 mS                                                                                                                   | no bounce in break contact                                       |
| Insulation     | Bounce Time (Releasing)   | Max. 7 mS                                                                                                                   | no bounce in make contact                                        |
|                | Insulation Resistance     | Min. 100 M $\Omega$                                                                                                         | at 500 VDC                                                       |
|                | Dielectric Strength       | 1000 VAC                                                                                                                    | 1 minute                                                         |
|                | Vibration Resistance      | 1.5 mm DA<br>10 ~ 55 Hz                                                                                                     |                                                                  |
| Life           | Temperature Range         | -25°C ~ +55°C                                                                                                               |                                                                  |
|                | Mechanical Life           | 500 x 10 <sup>4</sup> times                                                                                                 |                                                                  |
|                | Electrical Life           | 50 x 10 <sup>4</sup> times<br>10 x 10 <sup>4</sup> times                                                                    | at 24 VDC, 1A resistive load<br>at 120 VAC, 0.5A, resistive load |
| Weight         |                           | Approx. 4 g                                                                                                                 |                                                                  |





\* SINCE 1976 \*

## DPDT—DIP PC STANDARD or SENSITIVE 2.0 AMP BIFURCATED CONTACT RELAY



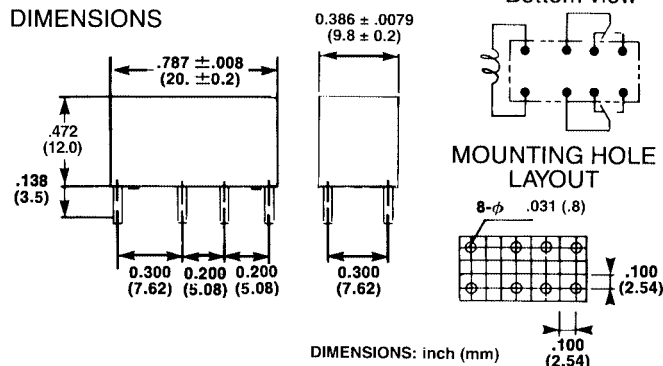
### FEATURES

- Sensitive available.
- Fully sealed.

 File E75887

 File LR49291

### DIMENSIONS



### COIL RATINGS FOR STANDARD CAS 112

| Relay Code (V) | Contact Arrangement | Nom. Volt. (VDC) | Coil Resist. (Ω ±10%) | Nom. Curr. (mA) | Pick-Up Volt. (VDC) | Drop-Out Volt. (V) | Max. Volt. (VDC) | Nom. Pwr (W) Cons'p-tion |
|----------------|---------------------|------------------|-----------------------|-----------------|---------------------|--------------------|------------------|--------------------------|
| CAS-112-5      | DPDT (2 Form C)     | 5                | 45                    | 111.0           | 3.5                 | 0.5                | 7.8              | Approx. 0.56             |
| CAS-112-6      |                     | 6                | 70                    | 90.9            | 4.4                 | 0.6                | 9.7              |                          |
| CAS-112-9      |                     | 9                | 140                   | 85.7            | 6.3                 | 0.9                | 12.6             |                          |
| CAS-112-12     |                     | 12               | 280                   | 43.1            | 8.7                 | 1.2                | 19.4             |                          |
| CAS-112-24     |                     | 24               | 1070                  | 22.4            | 17.6                | 2.4                | 37.6             |                          |
| CAS-112-48     |                     | 48               | 4300                  | 11.1            | 35.7                | 4.8                | 74.2             |                          |

Data Measured at 20°C

### COIL RATINGS FOR SENSITIVE CS 212

| Relay Code (V) | Contact Arrangement | Nom. Volt. (VDC) | Coil Resist. (Ω ±10%) | Nom. Curr. (mA) | Pick-Up Volt. (VDC) | Drop-Out Volt. (V) | Max. Volt. (VDC) | Nom. Pwr (W) Cons'p-tion |
|----------------|---------------------|------------------|-----------------------|-----------------|---------------------|--------------------|------------------|--------------------------|
| CS-212-5       | DPDT (2 Form C)     | 5                | 167                   | 29.9            | 3.2                 | 0.5                | 15.0             | 0.15                     |
| CS-212-6       |                     | 6                | 240                   | 25.0            | 3.7                 | 0.6                | 18.0             | 0.15                     |
| CS-212-9       |                     | 9                | 540                   | 16.7            | 5.8                 | 0.9                | 27.0             | 0.15                     |
| CS-212-12      |                     | 12               | 960                   | 12.5            | 8.2                 | 1.2                | 35.6             | 0.15                     |
| CS-212-18      |                     | 18               | 2160                  | 8.3             | 11.8                | 1.8                | 53.4             | 0.15                     |
| CS-212-24      |                     | 24               | 3840                  | 6.3             | 16.6                | 2.4                | 70.1             | 0.15                     |
| CS-212B-48     |                     | 48               | 11520                 | 4.2             | 28.1                | 4.8                | 121.4            | 0.20                     |
| CS-212-48      |                     | 48               | 7680                  | 6.5             | 22.6                | 4.8                | 99.1             | 0.31                     |

The tolerance is ±10% for the resistance value, pull-in voltage and drop-out voltage. The values are at ambient temperature, 20°C.

### RATING PERFORMANCE

| Specifications        |                                                                    |                                         | Note                                    |
|-----------------------|--------------------------------------------------------------------|-----------------------------------------|-----------------------------------------|
| Contact               | Contact Arrangement                                                | DPDT, 2 Form C                          | at initial value                        |
|                       | Contact Material                                                   | Gold-clad, Ag-Pd alloy                  |                                         |
|                       | Contact Resistance                                                 | 100 mΩ                                  |                                         |
|                       | Max. Switching Power                                               | DC 30W<br>AC 50 VA                      |                                         |
|                       | Max. Switching Voltage                                             | 125VDC<br>150VAC                        |                                         |
| Time                  | Max. Switching Current                                             | 2A 30VDC<br>0.6 / 125 VAC<br>2.5A @ 12V | at resistive load                       |
|                       | Operate Time (Type CS)                                             | Approx. 5 msec.                         |                                         |
|                       | (Type CAS)                                                         | Approx. 5 msec.                         |                                         |
|                       | Release Time (Type CS)                                             | Approx. 3 msec.                         |                                         |
|                       | (Type CAS)                                                         | Approx. 3 msec.                         |                                         |
| Bounce Time           | (Operating)                                                        | Approx. 0.5 to 1 msec.                  | at 500 VAC, 25°C, 50% relative humidity |
|                       | (Releasing)                                                        | Approx. 0.25 to 3 msec.                 |                                         |
| Insulation Resistance |                                                                    | 1000 MΩ                                 |                                         |
| Dielectric Strength   | 1000VAC Between coil and contacts<br>1000VAC Between open contacts |                                         | CAS, CS                                 |
| FCC Surge Strength    | 1500V Between coil and contacts<br>Between Adjacent contacts       |                                         | CS                                      |
| Vibration Resistance  |                                                                    | 10g (10 - 55 Hz)                        |                                         |
| Temperature           |                                                                    | -25°C ~ +75°C<br>-25°C ~ +85°C          | CAS, CS                                 |
| Life                  | Mechanical Life                                                    | 2 x 10 <sup>7</sup> times               | at 20mV 1KHz 1mA resistive load         |
|                       | Electrical Life                                                    | 2 x 10 <sup>6</sup> times               |                                         |
| Weight                |                                                                    | 5 g                                     |                                         |

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## POWER CONSUMPTION 150mW SMALL SIZED POLARIZED RELAY BEING CAPABLE FOR WIDE USE

### FEATURES

- High sensitive 2 pole relay suitable for signal circuit
- Ultra-high sensitive type 150mW.  
High sensitive type 200mW. Standard type 400mW
- Latching type relay provided with memory function is available too
- Adopts twin contacts that are superior in contact reliability
- Gold-clad Silver palladium contact available too
- Completely enclosed type relay with sealed construction being superior in durability to the environment
- UL File No. 75887
- CSA File No. 180958 (LR93742)
- BABT Certificate No. 609662

### APPLICATIONS

- Switch board. Facsimile. Telephones
- Audio equipment. Industrial machines

### CONTACT RATING

|                                   |                        |                                |
|-----------------------------------|------------------------|--------------------------------|
| Contact arrangement               |                        | DPDT (2C)                      |
| Contact Material.                 |                        | Ag + Au clad or AgPd + Au Clad |
| Initial contact resistance max. . |                        | Max. 50mΩ                      |
| Contacting<br>(Resistive load)    | Max. switching voltage | 220V DC 250V AC.               |
|                                   | Max. switching current | 2A                             |
|                                   | Max. switching power   | 60W (DC) 125VA (AC)            |
|                                   | Max. carry current     | 2A                             |
|                                   | Rated contact load     | 2A 30VDC 1A 125VAC             |

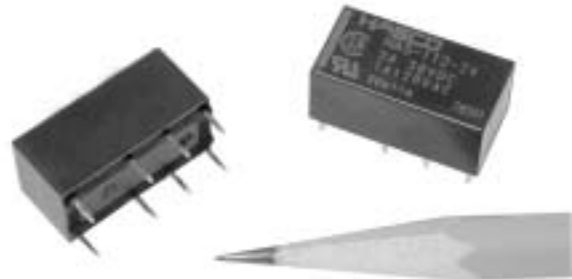
### GENERAL DATA

|                               |                               |           |                                                                                        |
|-------------------------------|-------------------------------|-----------|----------------------------------------------------------------------------------------|
| Life expectancy               | Mechanical Life               |           | 100,000,000 Operations (at 600cpm)                                                     |
|                               | Electrical Life               |           | 300,000 Operations (2A 30VDC) (at 20cpm)<br>1,000,000 Operations (1A 30VDC) (at 20cpm) |
| Operate/Release time          | Operate time (Set/Reset time) |           | Max. 5 msec.                                                                           |
|                               | Release time                  |           | Max. 3.5 msec.                                                                         |
| Temperature Characteristics   | Coil Temp. Rise               | Standard  | Less than 40°C (at nominal coil voltage)                                               |
|                               |                               | Sensitive | Less than 30°C (at nominal coil voltage)                                               |
|                               | Operate ambient temp.         |           | -40°C to +70°C (Without being frozen)                                                  |
|                               | Storage ambient temp.         |           | -40°C to +80°C (Without being frozen)                                                  |
|                               | Between coil and contacts     |           | 1,500Vrms (1 minute)                                                                   |
| Initial breakdown voltage     | Between open contacts         |           | 1,000Vrms (1 minute)                                                                   |
| Initial insulation resistance |                               |           | Min. 100M Ω (at 500V DC)                                                               |
| Environmental requirement     | Ambient humidity              |           | Max. 85% RH                                                                            |
| Vibration resistance          | Vibration (Malfunction)       |           | 10 ~ 55Hz at double amplitude of 1.5mm                                                 |
| Shock resistance              | Mechanical damage             |           | Min. 980m/s <sup>2</sup> (100G)                                                        |
|                               | Malfunction                   |           | Min. 342m/s <sup>2</sup> (40G)                                                         |

### ORDERING INFORMATION

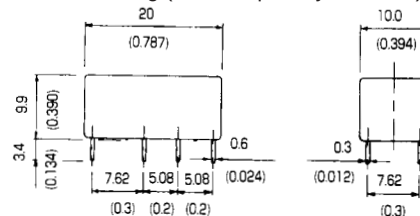
HAS112 (standard)  
HS212 (sensitive)  
NIL: Single side stable  
L: 2 coil latching K: 1 coil latching  
Coil Voltage  
5, 6, 9, 12, 24, 48

See Page 12  
for Graphs

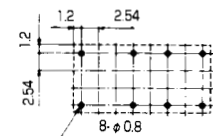


### DIMENSIONS

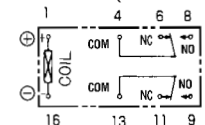
Single Side Stable  
1 coil latching (Reverse polarity available)



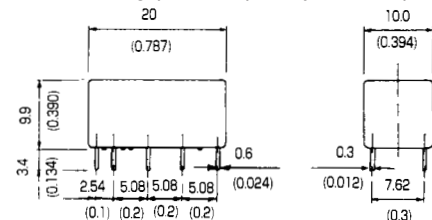
### PC Board Pattern



### Schematic (Bottom View)



2 coil latching (Reverse polarity available)



\* SINCE 1976 \*

**COIL RATING** Single Side Stable at 120°C \*1.5 & 3V Available

| Relay Code | Nominal Voltage | Coil Resistance ( $\Omega$ ) $\pm 10\%$ | Nominal Current (mA) | Pick-Up Voltage        | Drop-Out Voltage       | Max. Allowable Voltage  | Nominal Power (mW) |
|------------|-----------------|-----------------------------------------|----------------------|------------------------|------------------------|-------------------------|--------------------|
| HAS-112-5  | 5               | 62.5                                    | 80                   | 70% of Nominal Voltage | 10% of Nominal Voltage | 150% of Nominal Voltage | Approx. 400mW      |
| HAS-112-6  | 6               | 90                                      | 60                   |                        |                        |                         |                    |
| HAS-112-9  | 9               | 203                                     | 40                   |                        |                        |                         |                    |
| HAS-112-12 | 12              | 360                                     | 30                   |                        |                        |                         |                    |
| HAS-112-24 | 24              | 1440                                    | 10                   |                        |                        |                         |                    |
| HAS-112-48 | 48              | 5760                                    | 8                    |                        |                        |                         |                    |

**COIL RATING** 1 Coil Latching at 20°C

| Relay Code  | Nominal Voltage | Coil Resistance ( $\Omega$ ) $\pm 10\%$ | Nominal Current (mA) | Pick-Up Voltage        | Max. Allowable Voltage  | Nominal Power (mW) |
|-------------|-----------------|-----------------------------------------|----------------------|------------------------|-------------------------|--------------------|
| HAS-112K-5  | 5               | 69.4                                    | 72                   | 70% of Nominal Voltage | 150% of Nominal Voltage | Approx. 360mW      |
| HAS-112K-6  | 6               | 100                                     | 60                   |                        |                         |                    |
| HAS-112K-9  | 9               | 225                                     | 40                   |                        |                         |                    |
| HAS-112K-12 | 12              | 400                                     | 30                   |                        |                         |                    |
| HAS-112K-24 | 24              | 1600                                    | 15                   |                        |                         |                    |
| HAS-112K-48 | 48              | 6400                                    | 7.5                  |                        |                         |                    |

**COIL RATING** 2 Coil Latching at 20°C

| Relay Code  | Nominal Voltage | Coil Resistance ( $\Omega$ ) $\pm 10\%$ | Nominal Current (mA) | Pick-Up Voltage        | Max. Allowable Voltage  | Nominal Power (mW) |
|-------------|-----------------|-----------------------------------------|----------------------|------------------------|-------------------------|--------------------|
| HAS-112L-5  | 5               | 69.4                                    | 72                   | 70% of Nominal Voltage | 150% of Nominal Voltage | Approx. 360mW      |
| HAS-112L-6  | 6               | 100                                     | 60                   |                        |                         |                    |
| HAS-112L-9  | 9               | 225                                     | 40                   |                        |                         |                    |
| HAS-112L-12 | 12              | 400                                     | 30                   |                        |                         |                    |
| HAS-112L-24 | 24              | 1600                                    | 15                   |                        |                         |                    |
| HAS-112L-48 | 48              | 6400                                    | 7.5                  |                        |                         |                    |

**COIL RATING** Single Stable at 20°C

| Relay Code | Nominal Voltage | Coil Resistance ( $\Omega$ ) $\pm 10\%$ | Nominal Current (mA) | Pick-Up Voltage        | Drop-Out Voltage       | Max. Allowable Voltage  | Nominal Power (mW) |
|------------|-----------------|-----------------------------------------|----------------------|------------------------|------------------------|-------------------------|--------------------|
| HS-212-5   | 5               | 167                                     | 29                   | 80% of Nominal Voltage | 10% of Nominal Voltage | 230% of Nominal Voltage | Approx. 150mW      |
| HS-212-6   | 6               | 240                                     | 25                   |                        |                        |                         |                    |
| HS-212-9   | 9               | 540                                     | 16.6                 |                        |                        |                         |                    |
| HS-212-12  | 12              | 960                                     | 12.5                 |                        |                        |                         |                    |
| HS-212-24  | 24              | 3840                                    | 6                    |                        |                        |                         |                    |
| HS-212-48  | 48              | 15360                                   | 3                    |                        |                        |                         |                    |

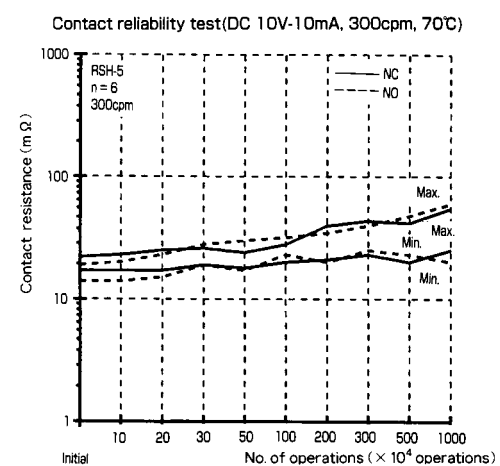
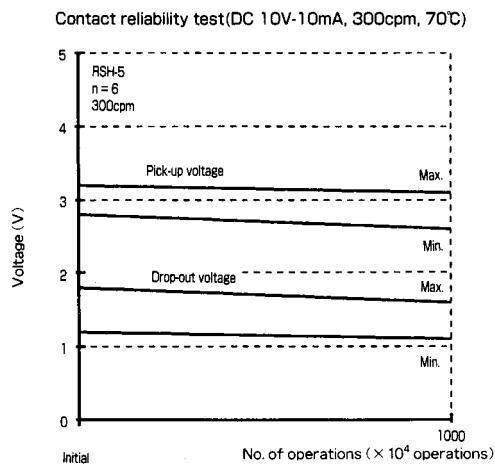
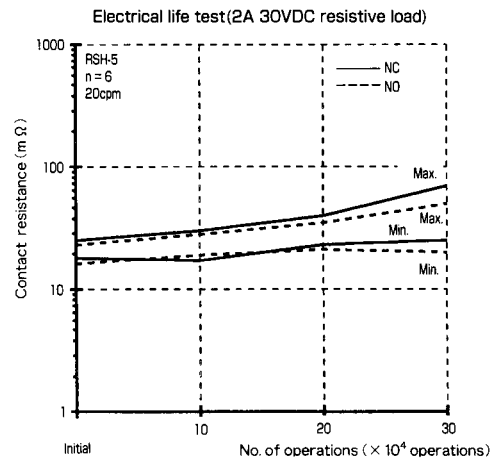
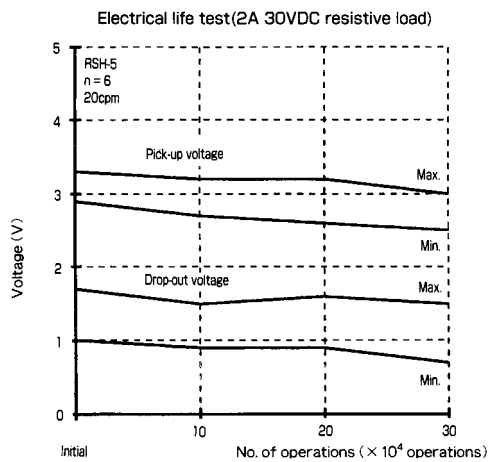
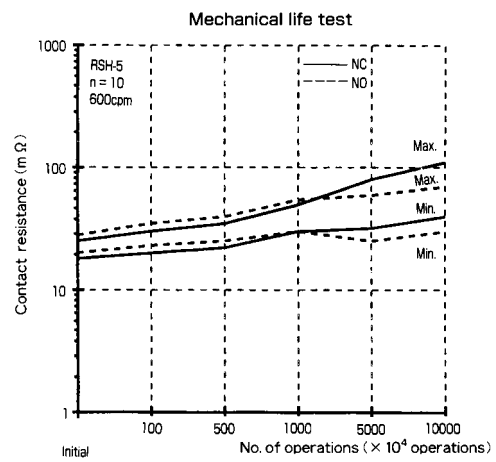
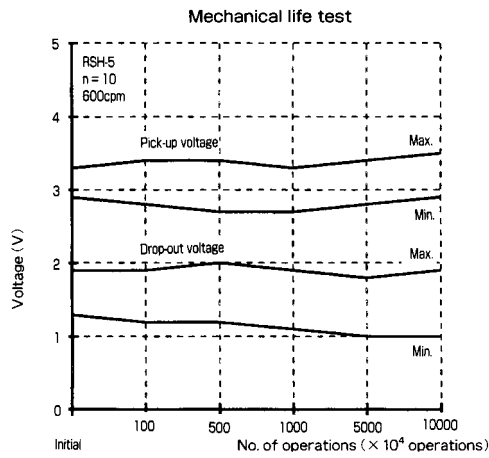
**COIL RATING** 1 Coil Latching at 20°C

| Relay Code | Nominal Voltage | Coil Resistance ( $\Omega$ ) $\pm 10\%$ | Nominal Current (mA) | Pick-Up Voltage        | Max. Allowable Voltage  | Nominal Power (mW) |
|------------|-----------------|-----------------------------------------|----------------------|------------------------|-------------------------|--------------------|
| HS-212K-5  | 5               | 139                                     | 35.9                 | 70% of Nominal Voltage | 200% of Nominal Voltage | Approx. 180mW      |
| HS-212K-6  | 6               | 200                                     | 30                   |                        |                         |                    |
| HS-212K-9  | 9               | 450                                     | 20                   |                        |                         |                    |
| HS-212K-12 | 12              | 800                                     | 15                   |                        |                         |                    |
| HS-212K-24 | 24              | 3200                                    | 7.5                  |                        |                         |                    |
| HS-212K-48 | 48              | 12800                                   | 3.7                  |                        |                         |                    |

**COIL RATING** 2 Coil Latching at 20°C

| Relay Code | Nominal Voltage | Coil Resistance ( $\Omega$ ) $\pm 10\%$ | Nominal Current (mA) | Pick-Up Voltage        | Max. Allowable Voltage  | Nominal Power (mW) |
|------------|-----------------|-----------------------------------------|----------------------|------------------------|-------------------------|--------------------|
| HS-212L-5  | 5               | 139                                     | 35.9                 | 70% of Nominal Voltage | 200% of Nominal Voltage | Approx. 180mW      |
| HS-212L-6  | 6               | 200                                     | 30                   |                        |                         |                    |
| HS-212L-9  | 9               | 450                                     | 20                   |                        |                         |                    |
| HS-212L-12 | 12              | 800                                     | 15                   |                        |                         |                    |
| HS-212L-24 | 24              | 3200                                    | 7.5                  |                        |                         |                    |
| HS-212L-48 | 48              | 12800                                   | 3.7                  |                        |                         |                    |

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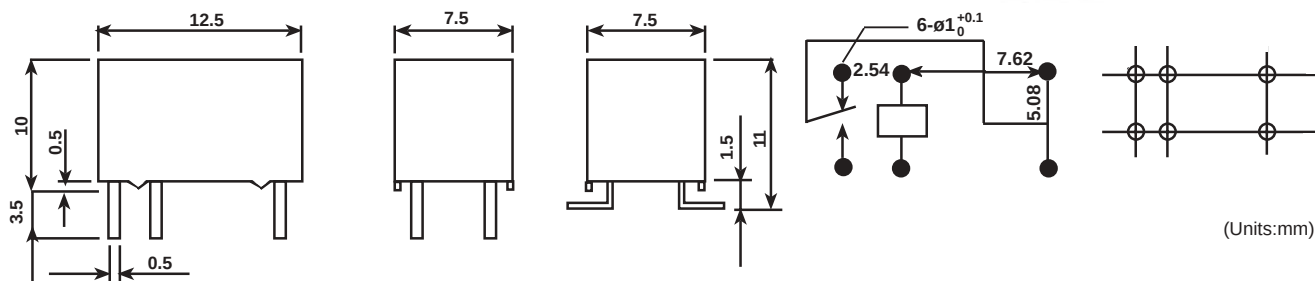
\* SINCE 1976 \*

## HBS RELAYS

### FEATURES

- Small size
- Through hole and surface mount available
- Full sealed

### DIMENSIONS



COIL DATA (at 20°C)

FOR STANDARD TYPE

FOR SENSITIVE TYPE

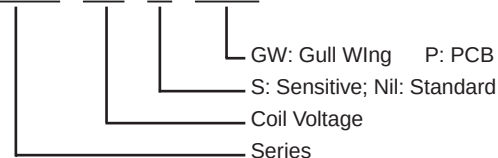
| Coil Power W | Coil Resistance Ohm $\pm 10\%$ | Must Coil Current mA | Must Operate Voltage VDC(max) | Release Voltage VDC(min) | Rated Voltage VDC | Coil Resistance Ohm $\pm 10\%$ | Coil Current mA | Must Operate Voltage VDC(max) | Must Release Voltage VDC(min) | Coil Power W |
|--------------|--------------------------------|----------------------|-------------------------------|--------------------------|-------------------|--------------------------------|-----------------|-------------------------------|-------------------------------|--------------|
| 0.20         | 11.3                           | 132.7                | 1.20                          | 0.15                     | 1.5               | 15                             | 100             | 1.20                          | 0.15                          | 0.15         |
|              | 45                             | 66.7                 | 2.40                          | 0.30                     | 3                 | 60                             | 50.0            | 2.40                          | 0.30                          |              |
|              | 125                            | 40.0                 | 4.00                          | 0.50                     | 5                 | 167                            | 29.9            | 4.00                          | 0.50                          |              |
|              | 180                            | 33.3                 | 4.80                          | 0.60                     | 6                 | 240                            | 25.0            | 4.80                          | 0.60                          |              |
|              | 405                            | 22.2                 | 7.20                          | 0.90                     | 9                 | 540                            | 16.7            | 7.20                          | 0.90                          |              |
|              | 720                            | 16.7                 | 9.60                          | 1.20                     | 12                | 960                            | 12.5            | 9.60                          | 1.20                          |              |
|              | 2880                           | 8.3                  | 19.2                          | 2.40                     | 24                | 3840                           | 6.25            | 19.2                          | 2.40                          |              |

### CHARACTERISTICS

|                           |            |                                                  |
|---------------------------|------------|--------------------------------------------------|
| Contact Arrangement       |            | SPDT                                             |
| Contact Material          |            | AgPd (Au clad)                                   |
| Rated Load                |            | 0.5A/125VAC 30VDC                                |
| Permission Load           |            | Min. 1mA 5VDC                                    |
| Max. Switching Power      |            | 62.5VA/30W                                       |
| Max. Switching Current 1A |            |                                                  |
| Max. Switching Voltage    |            | 125VAC/60VDC                                     |
| Contact Resistance        |            | MAX. 100mOhm (measured at 1A 6VDC)               |
| Operate Time              |            | 5ms                                              |
| Release Time              |            | 5ms                                              |
| Bounce Time               |            | 5ms                                              |
| Insulation Resistance     |            | 1000Mohm min (at 500VDC)                         |
| Dielectric Strength       |            | 400VAC 1min. between open contacts               |
|                           |            | 1000VAC 1min. between contact and coil           |
| Shock Operation           |            | 100m/s <sup>2</sup>                              |
| Vibration Operational     |            | 10~55Hz 3.3mm                                    |
| Ambient Temperature       |            | -30~70°C                                         |
| Humidity                  |            | 35% ~85%                                         |
| Operation Life            | Mechanical | 1 x 10 <sup>5</sup> (1800 operation times/hour)  |
|                           | Electrical | 1 x 10 <sup>7</sup> (36000 operation times/hour) |
| Dimensions                |            | 12.5 x 7.5 x 10 mm                               |
| Construction              |            | Sealed                                           |
| Termination               |            | PCB & SMT                                        |
| Weight                    |            | 2.2g Approx                                      |

### ORDERING INFORMATION

**HBS 12 S GW**



\* SINCE 1976 \*

## SUBMINIATURE RELAYS T SERIES

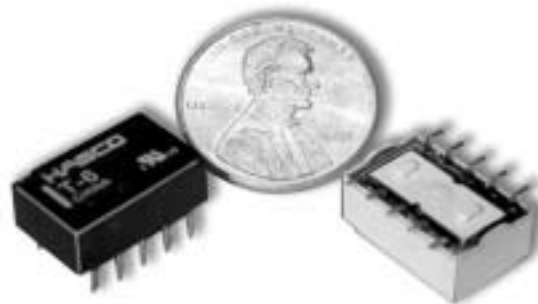
Compact, Highly Sensitive Relays with  
Balanced Armature Mechanism

### FEATURES

- Compact size and low profile: 5H x 14L x 9W (mm)
- Meets FCC part 68 requirements
- High sensitivity: 140 mW nominal operating power
- Dual-in line packaging arrangement fits IC socket
- Single latching type available
- Fully sealed (immersion cleanable)
- UL/CSA

 File E75887

 File LR49291



### SPECIFICATIONS

#### Contacts

|                                       |                                                         |
|---------------------------------------|---------------------------------------------------------|
| Arrangement 2 Form C (DPDT)           |                                                         |
| Type Bifurcated crossbar              |                                                         |
| Material Movable contact              | Ag-Pd alloy                                             |
| Station contact                       | Gold-clad Ag-Pd alloy                                   |
| Rating (resistive load)               |                                                         |
| Max. switching power                  | 30W DC, 62.5VA AC                                       |
| Max. switching voltage                | 125V DC/AC                                              |
| Max. switching current                | 1A DC/AC                                                |
| UL/CSA rating 1A 30V DC, 0.5A 125V AC |                                                         |
| Expected life (min. operations)       |                                                         |
| mechanical                            | 100 million                                             |
| Electrical (resistive load)           | 0.2 million at 1A 30V DC<br>0.1 million at 0.5A 125V AC |
| Contact Resistance                    | 50mΩ max. at initial value                              |

|                    |                             |              |
|--------------------|-----------------------------|--------------|
| Single side stable | Minimum operating power     | 80 to 110mW  |
|                    | Nominal operating power     | 140 to 200mW |
| 1 Coil latching    | Minimum set and reset power | 60 to 80mW   |
|                    | Nominal set and reset power | 100 to 150mW |

#### Characteristics (at 20° C)

|                              |                                                                  |                    |
|------------------------------|------------------------------------------------------------------|--------------------|
| Single side stable           | Max. operate time<br>Max. release time<br>(not including bounce) | 3mS<br>3mS         |
| Latching                     | Max. set time<br>Max. reset time<br>(not including bounce)       | 3mS<br>3mS         |
| Dielectric withstand voltage |                                                                  |                    |
| Between open contacts        |                                                                  | 1000V AC           |
| Between coil and contacts    |                                                                  | 1000V AC           |
| Between contact poles        |                                                                  | 1000V AC           |
| Surge withstand voltage      |                                                                  |                    |
| Between open contacts        |                                                                  | 1500V AC           |
| Between coil and contacts    |                                                                  | 1500V AC           |
| Between contact poles        |                                                                  | 1500V AC           |
| Insulation resistance        |                                                                  |                    |
| Vibration resistance         |                                                                  |                    |
| Functional                   |                                                                  | 3mm DA, 10 to 55Hz |
| Destructive                  |                                                                  | 5mm DA, 10 to 55Hz |
| Shock resistance             |                                                                  |                    |
| Functional                   |                                                                  | 50G (11mS)         |
| Destructive                  |                                                                  | 100G (6mS)         |
| Temperature range            |                                                                  |                    |
| Thru-hole type               |                                                                  | -40°C to 70°C      |
| Weight                       |                                                                  | Approx. 1.5g       |

### TYPES AND COIL DATA AT 20°C (68°F)

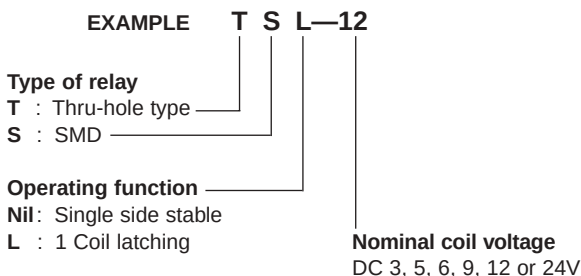
#### Single side stable

| Thru-hole type | Nominal voltage V DC | Coil resistance (Ω±10%) | Pick-up voltage V DC | Drop-out voltage V DC | Nominal power consumption W DC | Maximum continuous voltage V DC |
|----------------|----------------------|-------------------------|----------------------|-----------------------|--------------------------------|---------------------------------|
| T-3            | 3                    | 64.4                    | 2.25                 | 0.3                   | 0.14                           | 4.5                             |
| T-5            | 5                    | 178                     | 3.75                 | 0.5                   | 0.14                           | 7.5                             |
| T-6            | 6                    | 257                     | 4.5                  | 0.6                   | 0.14                           | 9.0                             |
| T-9            | 9                    | 579                     | 6.75                 | 0.9                   | 0.14                           | 13.5                            |
| T-12           | 12                   | 1028                    | 9.0                  | 1.2                   | 0.14                           | 18.0                            |
| T-24           | 24                   | 2880                    | 18.0                 | 2.4                   | 0.2                            | 36.0                            |

#### 1 Coil latching

| Thru-hole type | Nominal voltage V DC | Coil resistance (Ω±10%) | Pick-up voltage V DC | Drop-out voltage V DC | Nominal power consumption W DC | Maximum continuous voltage V DC |
|----------------|----------------------|-------------------------|----------------------|-----------------------|--------------------------------|---------------------------------|
| TL-3           | 3                    | 90                      | 2.25                 | 2.25                  | 0.1                            | 4.5                             |
| TL-5           | 5                    | 250                     | 3.75                 | 3.75                  | 0.1                            | 7.5                             |
| TL-6           | 6                    | 360                     | 4.5                  | 4.5                   | 0.1                            | 9.0                             |
| TL-9           | 9                    | 810                     | 6.75                 | 6.75                  | 0.1                            | 13.5                            |
| TL-12          | 12                   | 1440                    | 9.0                  | 9.0                   | 0.1                            | 18.0                            |
| TL-24          | 24                   | 3840                    | 18.0                 | 18.0                  | 0.15                           | 36.0                            |

### ORDERING INFORMATION



**Also Available As  
Surface Mount Device  
Call for Availability**



\* SINCE 1976 \*

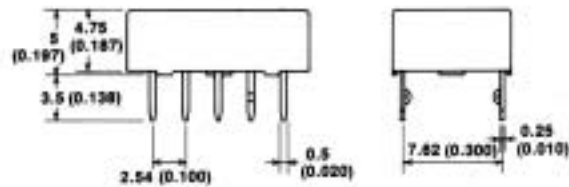
## SUBMINIATURE RELAYS T SERIES

### DIMENSIONS

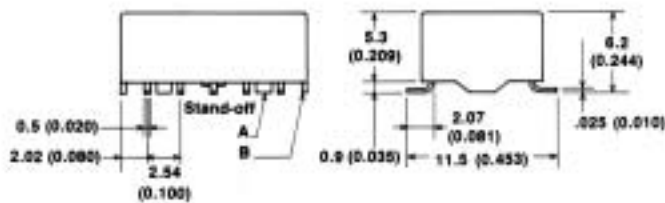
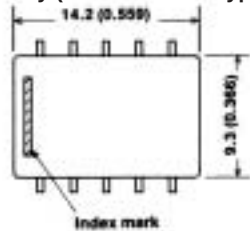
#### T-RELAY (THRU-HOLE TYPE)

(b) Formed terminal type

DIMENSIONS: mm (inch)



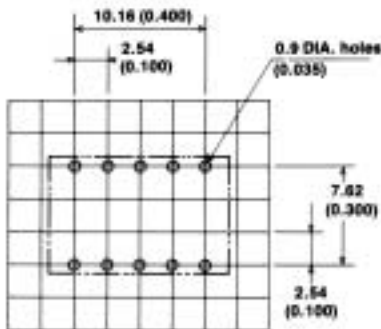
#### TS-relay (Surface mount type)



(Call for specifications on complete mounting & hole layout as well as surface mount pinouts)

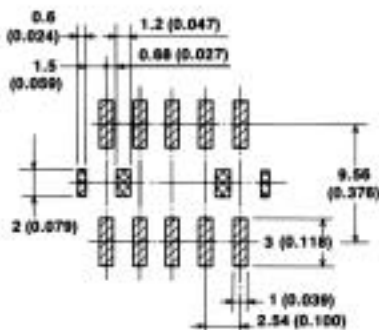
### MOUNTING LAYOUT

Mounting hole layout for T-relay



Tolerance:  $\pm 0.1$  ( $\pm 0.004$ )

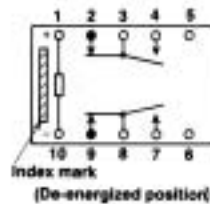
Mounting pad layout for TS-relay



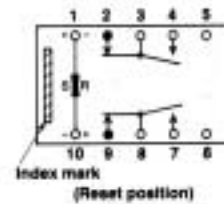
Soldering pad for terminal  
 Temporary glue pad for stand-off A or B  
 Tolerance:  $\pm 0.1$  ( $\pm 0.004$ )

### WIRING DIAGRAM

Single side stable



1 coil latching

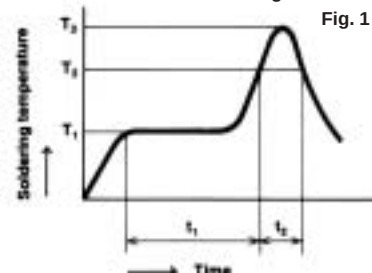


### SURFACE MOUNT TYPE--Soldering & Mounting

#### Recommendations

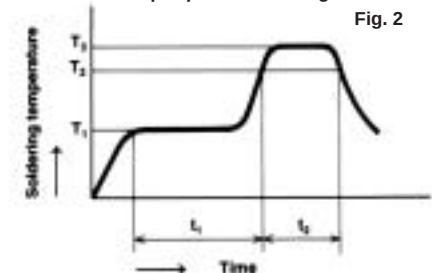
1. Conditions for terminal soldering by reflow soldering method.

a. In case of infrared soldering



$T_1 = +120^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$   $t_1 = 60\text{s}$  to  $90\text{s}$   
 $T_2 = +180^{\circ}\text{C}$  to  $+200^{\circ}\text{C}$   $t_2 = 30\text{s}$  max.  
 $T_3 = +245^{\circ}\text{C}$  max.

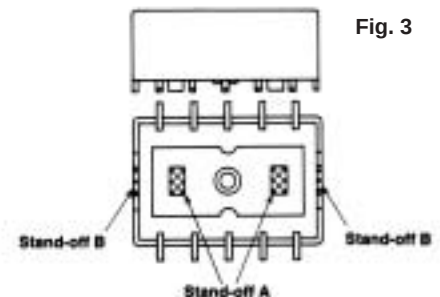
b. In case of vapor phase soldering



$T_1 = +120^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$   $t_1 = 40\text{s}$  to  $60\text{s}$   
 $T_2 = +180^{\circ}\text{C}$  to  $+200^{\circ}\text{C}$   $t_2 = 60\text{s}$  max.  
 $T_3 = +215^{\circ}\text{C}$  max.

2. Usage of stand-off A & B in base area.

The Stand-offs shown in the Fig. 3 are designed to anchor relays temporarily to PC board with glue before terminal soldering.



\* SINCE 1976 \*

## KLT MINIATURE POWER RELAYS SPDT 3, 6, 12, 15 & 20 AMP



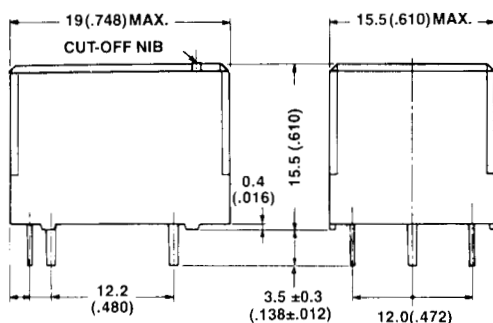
File E75887



File LR49291

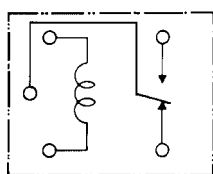
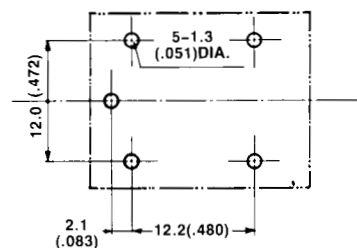


DIMENSIONS: mm (inch)



MOUNTING HOLES  
(BOTTOM VIEW)

TERMINAL ARRANGEMENT  
(BOTTOM VIEW)



### ORDERING INFORMATION

Model No. \_\_\_\_\_

NIL: Class B  
Class F

Contact Arrangement: \_\_\_\_\_

A = 1 Form A B = 1 Form B C = 1 Form C  
(SPST-NO) (SPST-NC) (SPDT)

Contact Material & Rating: \_\_\_\_\_

3 Amp = Silver, gold flash  
6 Amp = Silver cadmium oxide  
12 Amp = Silver cadmium oxide  
15 Amp = Silver tin indium oxide  
20 Amp = Silver tin indium oxide

Nominal Voltage: \_\_\_\_\_

3 = 3VDC; 5 = 5VDC; 6 = 6VDC  
9 = 9VDC; 12 = 12VDC; 24 = 24VDC; 48 = 48VDC

NIL = Sealed  
1 = Unsealed

**KLT - F - 1C - 12 - DC12 - 1**

### FEATURES

- Highly reliable, low cost
- Miniature size & large switch capacity up to 20A
- High dielectric strength type
- Fully Sealed
- Inexpensive

### ELECTRICAL RATINGS

3 Amp: 3A at 120VAC or 28VDC resistive

6 Amp: 6A at 120VAC or 28VDC; 6A at 240VAC general purpose;  
1/4 hp at 120VAC

12 & 15 Amp: 12A at 120VAC or 28VDC; 12A at 240VAC general purpose;  
7A at 277VAC general purpose; 1/4 hp at 120VAC; 15A at 120VAC resistive

Pilot duty: 40A in-rush, 4A steady state at 125VAC  
10A in-rush, 1A steady state at 240VAC

N.O. only, Single Pole:

10A at 12VDC Tungsten; 15A at 120VAC Tungsten

1/2 hp at 120VAC; 5.4A at 277 VAC Ballast

### GENERAL DATA

Contact resistance: 50mΩ Max.

Operate Time: 8ms Max. (at nominal voltage)

Operate Bounce Time: 3 ms Max.

Release Time: 5 ms Max.

Release Bounce Time: 8 ms Max.

Max. Switching Voltage: 277VAC & 125VDC

Min. Permissible Load (reference value):

3 Amp: 5VDC at 1mA

6, 12, 15 & 20 Amp: 5VDC at 100mA

**Insulation Rating: Class B & Class F**

Insulation Resistance: more than 100MΩ at 500VDC

Dielectric Strength: 750VAC (50/60Hz), between open contacts

1500VAC (50/60Hz), between coil & contact

Vibration: 1.5mm double amplitude, 10 to 50Hz

Shock: 100 m/sec<sup>2</sup> (approx. 10G's)

Operation Frequency: Mechanical: 18,000 operations/hour

Electrical: 1,800 operations/hour (under rated load)

Service Life: Mechanical: 10 million operations

Electrical: 100,000 operations min. at rated resistive load

Temperature Range: Class B: -40°C to 85°C

Class F: -40°C to 105°C

Temperature Rise: Less than 35 degrees

Humidity: 45% - 85% RH

Approximate Weight: 12 grams

### COIL RATINGS

| Nominal Coil Voltage | Coil Resistance in Ohms, ±10% at 20°C<br>6, 12, 15 Amp | Coil Resistance in Ohms, ±10% at 20°C<br>20 Amp | Must Operate Voltage at 20°C | Must Release Voltage at 20°C | Maximum Voltage         |
|----------------------|--------------------------------------------------------|-------------------------------------------------|------------------------------|------------------------------|-------------------------|
| 3VDC                 | 25                                                     | 20                                              | 75% max. of nominal voltage  | 10% min. of nominal voltage  | 130% of nominal voltage |
| 5VDC                 | 70                                                     | 55                                              |                              |                              |                         |
| 6VDC                 | 100                                                    | 80                                              |                              |                              |                         |
| 9VDC                 | 225                                                    | 180                                             |                              |                              |                         |
| 12VDC                | 400                                                    | 320                                             |                              |                              |                         |
| 18VDC                | 900                                                    | 1100                                            |                              |                              |                         |
| 24VDC                | 1600                                                   | 1280                                            |                              |                              |                         |
| 48VDC                | 6400                                                   | 5120                                            |                              |                              |                         |

### REMARK

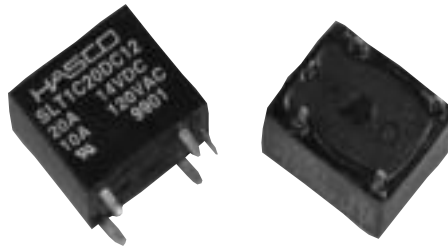
- Use alcohol, freon or water for cleaning. (water temperature not to exceed 50°C)

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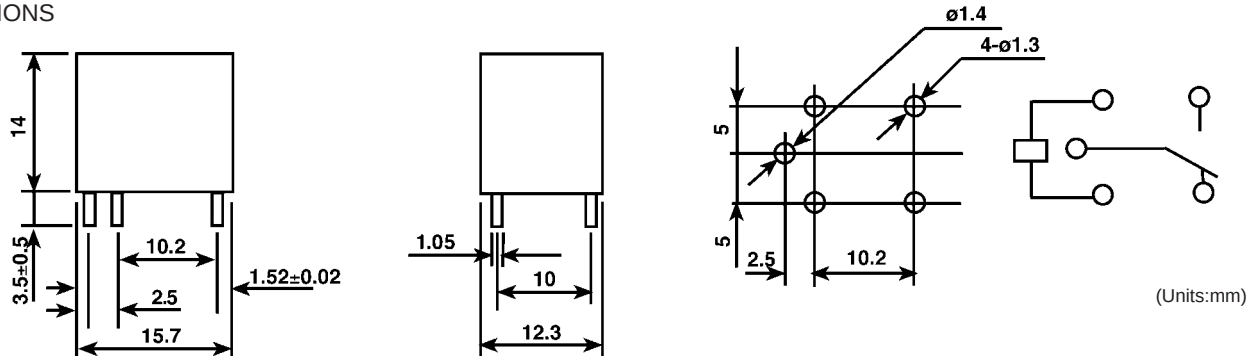
## SLT RELAYS

### FEATURES

- Small size
- Light weight
- Low power consumption
- PC board mounting
- Fully sealed



### DIMENSIONS



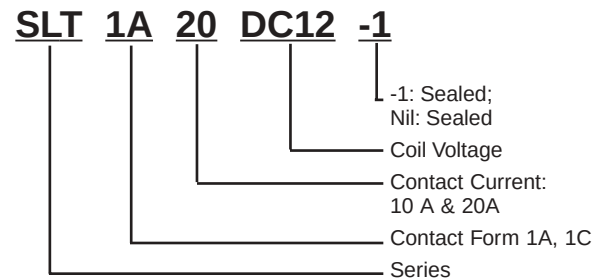
### COIL DATA (at 20°C)

| Rated Voltage VDC | Coil Resistance Ohm±10% | Must Operate Voltage VDC(max) | Must Release Voltage VDC(min) | Maximum Voltage VDC   | Coil Power W |
|-------------------|-------------------------|-------------------------------|-------------------------------|-----------------------|--------------|
| 6                 | 60                      | 4.8                           | 0.30                          | 110% of rated voltage | 0.6          |
| 9                 | 135                     | 7.2                           | 0.45                          |                       |              |
| 12                | 240                     | 9.6                           | 0.60                          |                       |              |
| 24                | 960                     | 19.2                          | 1.20                          |                       |              |

### CHARACTERISTICS

|                            |                                      |            |
|----------------------------|--------------------------------------|------------|
| Contact Arrangement        | 1A, 1C                               |            |
| Contact Material           | AgCdo AgSnO2 AgSnO2In2O3             |            |
| Contact Rating (resistive) | 20A/14VAC 10A/120VAC                 |            |
| Max. Switching Power       | 280W 120VA                           |            |
| Max. Switching Voltage     | 42VDC 380VAC                         |            |
| Contact Resistance         | MAX. 100mOhm                         |            |
| Operate Time               | MAX. 10ms                            |            |
| Release Time               | MAX. 5ms                             |            |
| Insulation Resistance      | 1000Mohm min (at 500VDC)             |            |
| Dielectric Strength        | 50Hz 500VAC between contacts         |            |
|                            | 50Hz 500VAC between contact and coil |            |
| Shock Operation            | 100g                                 |            |
| Vibration Operational      | 10~55Hz Double Amplitude 1.5mm       |            |
| Ambient Temperature        | -40~85 C degree                      |            |
| Humidity                   | 20 C degree 85%                      |            |
| Operation Life             | Mechanical                           | 10M times  |
|                            | Electrical                           | 0.1M times |
| Weight                     | 6g Approx                            |            |

### ORDERING INFORMATION



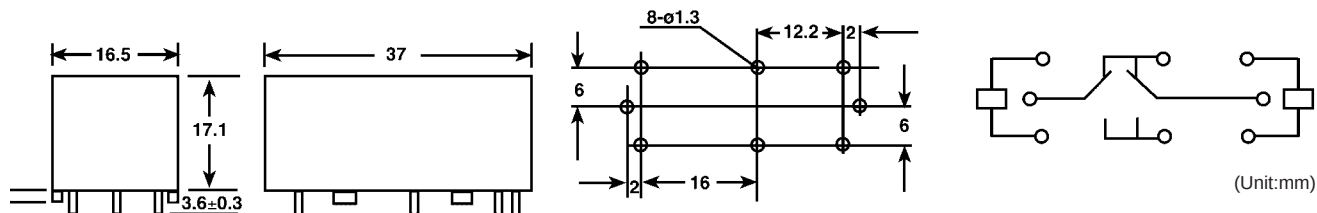
\* SINCE 1976 \*

## 2KLT RELAYS

### FEATURES

- Small size, light weight
- Withstands high temperature, operational under 105°C ambient temperature

### DIMENSIONS



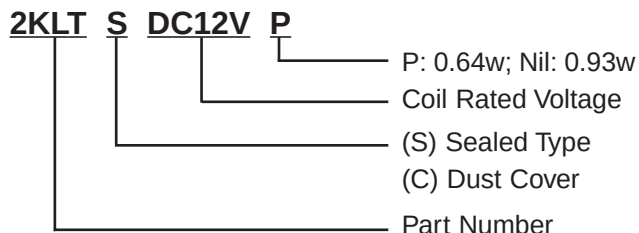
### COIL DATA

| Rated Voltage | Coil Resistance<br>$\Omega \pm 10\%$ | Must Operate Voltage<br>VDC(max) | Must Release Voltage<br>VDC(min) | Maximum Voltage<br>VDC | Coil Power<br>W |
|---------------|--------------------------------------|----------------------------------|----------------------------------|------------------------|-----------------|
| 12            | 225                                  | 6.8                              | 1.2                              | 120% of rated voltage  | 0.64            |
|               | 155                                  | 6.0                              | 0.9                              |                        | 0.93            |

### CHARACTERISTICS

|                            |            |                                                                                |
|----------------------------|------------|--------------------------------------------------------------------------------|
| Contact Arrangement        |            | Two 2 x 1C                                                                     |
| Contact Material           |            | AgSnO <sub>2</sub> Ag-SnO <sub>2</sub> In <sub>2</sub> O <sub>3</sub>          |
| Contact Rating (resistive) |            | 2 x 10A 14VDC                                                                  |
| Max. Switching Power       |            | 2 x 140W                                                                       |
| Max. Switching Voltage     |            | 2 x 24VDC                                                                      |
| Contact Resistance         |            | ≤ 100mΩ Max.                                                                   |
| Operate Time               |            | 10ms                                                                           |
| Release Time               |            | 5ms                                                                            |
| Insulation Resistance      |            | 1000MΩ min (500VDC)                                                            |
| Dielectric Strength        |            | 50Hz 1000V 1min. between contacts<br>50Hz 1000V 1min. between contact and coil |
| Shock Operation            |            | 10g                                                                            |
| Vibration Operational      |            | 10~40Hz Amplitude 1.27mm                                                       |
| Ambient Temperature        |            | -40~105°C                                                                      |
| Operation Life             | Mechanical | 10 <sup>7</sup>                                                                |
|                            | Electrical | 10 <sup>5</sup> (at rated load)                                                |
| Weight                     |            | 25g Approx                                                                     |

### ORDERING INFORMATION



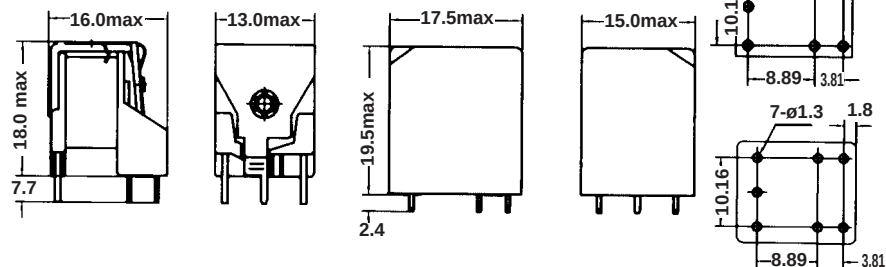
\* SINCE 1976 \*

## MKB

### FEATURES

- Switching capacity up to 20A
- Six different contact arrangements
- PCB mounting
- Open and sealed type is available

### DIMENSIONS



### CONTACT DATA

| Arrangements           | 1 Form A<br>1A                                                                    | 1 Form B<br>1B                                                                    | 1 Form C<br>No                                                                    | 1C<br>NC | 2 Form mA<br>2A                                                                     | 2 Form B<br>2B                                                                      | 2 Form C<br>No                                                                      | 2C<br>NC |
|------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------|
| Schematic              |  |  |  |          |  |  |  |          |
| Max. Switching Current | 20A                                                                               | 10A                                                                               | 20A                                                                               | 10A      | 2X20A                                                                               | 2X7A                                                                                | 2X15A                                                                               | 2X5A     |
| Max. Switching Voltage | 75VDC/60VAC                                                                       |                                                                                   |                                                                                   |          |                                                                                     |                                                                                     |                                                                                     |          |
| Continuous Current     | 15A                                                                               | 10A                                                                               | 15A                                                                               | 10A      | 2X10A                                                                               | 2X7A                                                                                | 2X7A                                                                                | 2X5A     |
| Max. Switching Power   | 200W/500VA                                                                        |                                                                                   |                                                                                   |          |                                                                                     |                                                                                     |                                                                                     |          |
| Min. Load              | 0.5A, 12VDC                                                                       |                                                                                   |                                                                                   |          |                                                                                     |                                                                                     |                                                                                     |          |
| Contact Material       | Silver Alloy                                                                      |                                                                                   |                                                                                   |          |                                                                                     |                                                                                     |                                                                                     |          |
| Initial Resistance     | 100 mΩ (at 1 A, 5 VDC)                                                            |                                                                                   |                                                                                   |          |                                                                                     |                                                                                     |                                                                                     |          |
| Electrical Life        | 2X10 <sup>5</sup> OPS (at 10 A, 5VDC)                                             |                                                                                   |                                                                                   |          |                                                                                     |                                                                                     |                                                                                     |          |
| Mechanical Life        | 1X10 <sup>7</sup> OPS                                                             |                                                                                   |                                                                                   |          |                                                                                     |                                                                                     |                                                                                     |          |

### SPECIFICATIONS

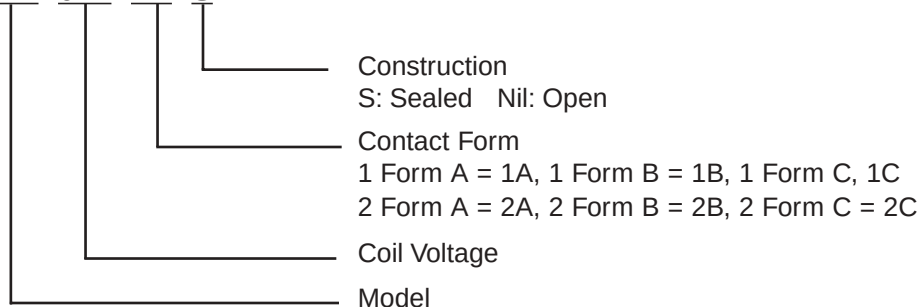
|                       |                     |                     |                                |
|-----------------------|---------------------|---------------------|--------------------------------|
| Insulation Resistance | 100MΩ, 500VDC, 1min | Vibration           | DA, 1.5mm, 10~55Hz, functional |
| Dielectric Strength   | 500Vrms             | Shock               | 10g, 11ms, functional          |
| Operate Time          | 3ms                 | Drop                | 1 m                            |
| Release Time          | 1.5ms               | Ambient Temperature | -40 ~ +85°C                    |
| Power Consumption     | 1.1W                | Weight              | Open: 8g Sealed : 12g          |

### COIL DATA

| Coil VDC | Pull-in Voltage VDC |     | Drop-out Voltage VDC |                | Nominal Current mA | Coil Resistance Ω±10% | Max. Operating Voltage VDC |
|----------|---------------------|-----|----------------------|----------------|--------------------|-----------------------|----------------------------|
|          | 1A, 1B, 1C, 2A, 2B  | 2C  | 1B, 2B               | 1A, 1C, 2A, 2C |                    |                       |                            |
| 006      | 3.75                | 4.5 | 0.35                 | 0.7            | 215                | 28                    | 8                          |
| 012      | 7.5                 | 9.0 | 0.7                  | 1.4            | 93                 | 130                   | 16                         |
| 024      | 15.0                | 18  | 1.4                  | 2.8            | 46                 | 520                   | 31                         |

### ORDERING INFORMATION

**MKB 012 1H S**



\* SINCE 1976 \*

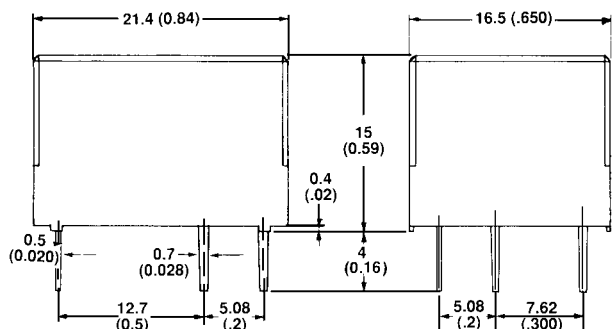
## SSD SERIES/3, 6 OR 10 AMP SPDT RELAY



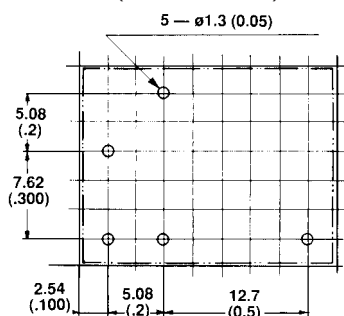
 File E75887

DIMENSIONS: mm (inch)

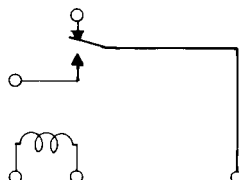
 File LR49291



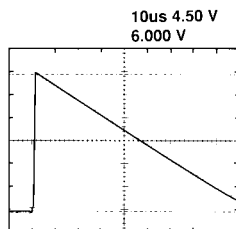
MOUNTING HOLES  
(BOTTOM VIEW)



TERMINAL ARRANGEMENT  
(BOTTOM VIEW)



LIGHTNING IMPULSE TEST



### ORDERING INFORMATION

| SSD       |                              | 106PH                                                                                                                                      | DC12                                                                                               |
|-----------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Model No. | Nil = Class B<br>F = Class F | <b>Contact Material &amp; Rating:</b><br>103 = Silver, gold flash, 3A<br>106 = Silver Cadmium oxide, 6A<br>110 = Silver Cadmium oxide, 10A | <b>Nominal Voltage:</b><br>3 = 3VDC; 5 = 5VDC;<br>6 = 6VDC; 9 = 9VDC;<br>24 = 24VDC;<br>48 = 48VDC |

### FEATURES

- Highly reliable, low cost
- Miniature size & large switch capacity up to 10A
- High dielectric strength type
- Printed circuit terminals fits grid with 2.54 mm
- UL/CSA recognized
- Fully Sealed

### SPECIFICATIONS

#### CONTACT DATA

Arrangement: 1 Form C (SPDT), 1 Form A (SPST-NO), 1 Form B (SPST-NC)

Material & Rating: Silver, gold flash: 3A at 24 VDC or 120V AC, 1.5A at 240V AC, resistive

Silver Cadmium oxide: 6A at 24VDC or 120VDC, 3A at 240V AC, resistive

Silver Cadmium Oxide: 10A at 24 VDC or 120VAC, 5A at 240VAC, resistive 6A, 300VAC and 1/8hp. 120/240VAC

Max. operating Voltage: 250VAC & 125VDC

Min. permissible load (reference value): Silver contact: 5VDC, 1mA

Other contact: 5VDC, 100mA

Service life: Mechanical: 20 Million operations

Electrical: 100,000 operations min. at rated resistive load

(See coil data chart)

Voltages: From 3V to 48V

Power (at 20°C): Nominal: 0.45 watt

#### GENERAL DATA

Contact resistance: 50m  $\Omega$  Max.

Operate time: Approx. 6ms (at nominal voltage)

Operate bounce time: Approx. 2ms

Release time: Approx 2ms

Insulation resistance: More than 100M  $\Omega$  at DC 500V

Dielectric strength: 750V AC (50/60 Hz), between open contact;  
3000V AC (50/60 Hz), between coil & contact

Vibration: 1.5mm double amplitude, 10 to 50 Hz

Shock: 100m/sec<sup>2</sup> (approx. 10G's)

Operation frequency: Mechanical: 18,000 operations/hour

Electrical: 1,800 operations/hour (under rated load)

Temperature range: Class B: -45°C to 85°C

Class F: -45°C to 105°C

Temperature rise: Less than 35 degrees

Humidity: 45% - 85% RH

Approximate weight: 10g

NOTE: The data shown above are of initial value

### 4000V AC DIELECTRIC STRENGTH BETWEEN COIL & CONTACT AVAILABLE

### COIL RATINGS

| Nominal Coil Voltage | Coil Resistance in Ohms $\pm$ 10% at 20°C | Sensitive Coil Resistance in Ohms $\pm$ 10% at 20°C | Must Operate Voltage at 20°C | Must Release Voltage at 20°C | Maximum Voltage         |
|----------------------|-------------------------------------------|-----------------------------------------------------|------------------------------|------------------------------|-------------------------|
| 3VDC                 | 20                                        |                                                     |                              |                              |                         |
| 5VDC                 | 56                                        | 80                                                  | 75% max. of nominal voltage  | 10% min. of nominal voltage  | 130% of nominal voltage |
| 6VDC                 | 80                                        | 110                                                 |                              |                              |                         |
| 9VDC                 | 180                                       | 250                                                 |                              |                              |                         |
| 12VDC                | 320                                       | 440                                                 |                              |                              |                         |
| 24VDC                | 1150                                      | 1780                                                |                              |                              |                         |

### REMARK

- Use alcohol, freon or water for cleaning. (water temperature not to exceed 50°C)

\* SINCE 1976 \*

## SPDT 10 AMP HIGH SENSITIVE LOW PROFILE MHR SERIES



### FEATURES

- Subminiature Light Weight Relay
- High Sensitivity
- Switching Capacity Up to 16 Amp
- P.C. Board Mounting, Direct Pitch Terminal

### COIL RATING

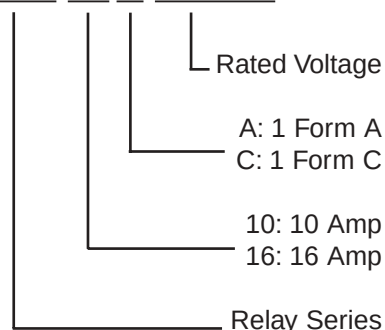
| Rate Voltage<br>(VDC) | Coil Resistance |      | Rated Current |      | Must Operate Voltage        | Must Dropout Voltage | Maximum Voltage | Power Consumption<br>(W)                             |
|-----------------------|-----------------|------|---------------|------|-----------------------------|----------------------|-----------------|------------------------------------------------------|
|                       | Ω±10%           |      | (mA)          |      | % of Rate Voltage (at+20°C) |                      |                 |                                                      |
|                       | 1A              | 1C   | 1A            | 1C   |                             |                      |                 |                                                      |
| 5                     | 125             | 55.5 | 40            | 90   | 80 Max                      | 5 Min                | 130 Max         | 1 Form A:<br>0.2 Approx.<br>1 Form C:<br>0.4 Approx. |
| 6                     | 180             | 80   | 33            | 76   |                             |                      |                 |                                                      |
| 9                     | 405             | 180  | 22            | 50   |                             |                      |                 |                                                      |
| 12                    | 720             | 320  | 16            | 37.5 |                             |                      |                 |                                                      |
| 24                    | 2880            | 1280 | 8             | 18.7 |                             |                      |                 |                                                      |

### CHARACTERISTICS

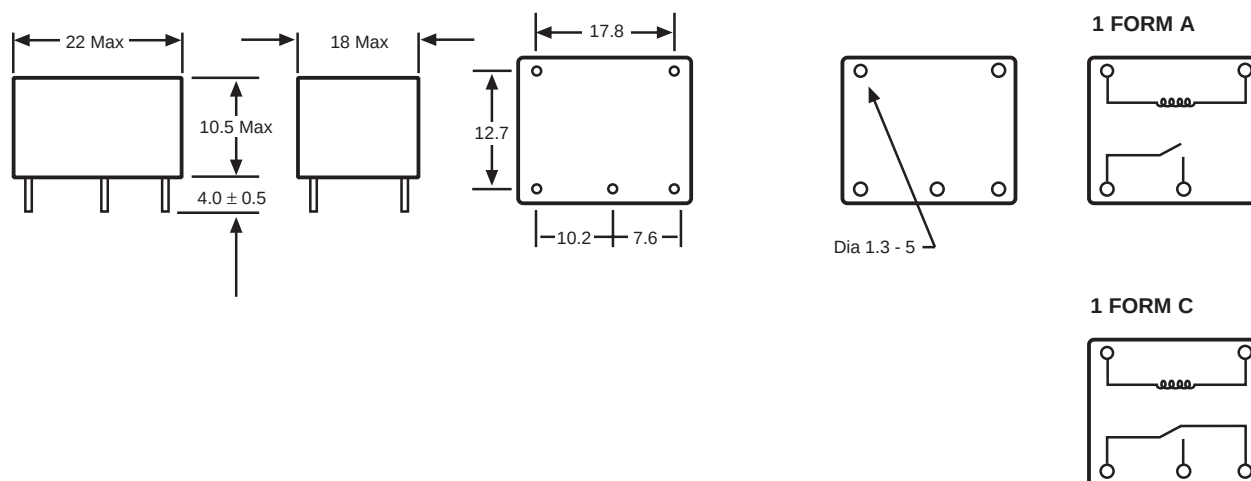
|                                        |                                                                                                                                                                          |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Contact Arrangement</b>             | SPST (1 Form A)                                                                                                                                                          |
| <b>Contact Material</b>                | AgCdO <sub>2</sub> , AgSnO <sub>3</sub> , AgInO <sub>2</sub>                                                                                                             |
| <b>Contact Resistance</b>              | 50mOhms Max                                                                                                                                                              |
| <b>Contact Rating (resistive load)</b> | 1 Form A:<br>"H" Type: 16A/125, 250VAC<br>Standard: 10A/125, 250VAC, 10A/30VDC<br>1/10 HP 125, 277VAC<br>1 Form C:<br>10A/125VAC<br>5A/250VAC, 3VDC<br>1/10HP125, 277VAC |
| <b>Switching Voltage</b>               | DC125V/AC 250V Max                                                                                                                                                       |
| <b>Operate Time</b>                    | 10ms Max                                                                                                                                                                 |
| <b>Release Time</b>                    | 4ms Max                                                                                                                                                                  |
| <b>Insulation Resistance</b>           | 500MOhms min. (500V DC)                                                                                                                                                  |
| <b>Dielectric Strength</b>             | 1000V/ms, 1 minute between open contact<br>1500V/ms, 1 minute between coil and contact                                                                                   |
| <b>Shock resistance</b>                | 10g Approx.                                                                                                                                                              |
| <b>Vibration</b>                       | 55Hz, Amplitude 1.5mm                                                                                                                                                    |
| <b>Ambient Temperature</b>             | -40°C to +85°C                                                                                                                                                           |
| <b>Operation Life</b>                  | Mechanical: 10 <sup>7</sup> Electrical: 10 <sup>5</sup>                                                                                                                  |
| <b>Weight</b>                          | 9g Approx.                                                                                                                                                               |

### ORDERING INFORMATION

#### MHR 16 C DC12V



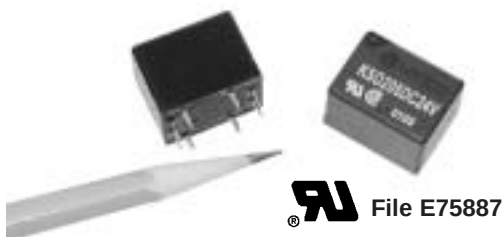
### DIMENSIONS mm (inches)





\* SINCE 1976 \*

KSD205  
DPDT 6 AMP



 File E75887

## FEATURES

- Miniature Two Pole Relay
- High Reliability
- 6 Amp Switching
- Fully Sealed
- Low Cost

## COIL RATINGS

| Type | Rated Voltage | Rated current (mA) | Coil resistance (Ω) | Must operate Voltage | Must dropout Voltage | Maximum Voltage | Power consumption (mW) |
|------|---------------|--------------------|---------------------|----------------------|----------------------|-----------------|------------------------|
|      |               |                    |                     | % of rated voltage   |                      |                 |                        |
| KSD  | 3VDC          | 167                | 18                  | Max                  | 10 min.              |                 | Approx. 510            |
|      | 5VDC          | 102                | 49                  | 70 at 20°C           |                      | 150 at 20°C     |                        |
|      | 6VDC          | 85.7               | 70                  | 73 30°C              |                      | 142 30°C        |                        |
|      | 9VDC          | 56.3               | 160                 | 76 40°C              |                      | 133 40°C        |                        |
|      | 12VDC         | 42.9               | 280                 | 79 50°C              |                      | 123 50°C        |                        |
|      | 24VDC         | 21.2               | 1130                | 82 60°C              |                      | 113 60°C        |                        |

Note: The rated current and coil resistance are measured at a coil temperature at 20°C with tolerances of +15%, -20% for rated current +10% for rated coil resistance.

## CONTACT RATINGS

| Item                                       | Load Type | Resistive load (p.f. = 1) | Inductive Load (p.f. = 0.4, L/R = 7msec) |
|--------------------------------------------|-----------|---------------------------|------------------------------------------|
|                                            |           | Ag CdO                    |                                          |
| Material                                   |           |                           |                                          |
| Rated load                                 |           | 120VAC 6A                 | 120VAC 3.0A                              |
|                                            |           | 30VDC 6A                  | 30VDC 3.0A                               |
| Carry current                              |           | 6A                        |                                          |
| Max. operating voltage                     |           | 250VAC, 125VDC            |                                          |
| Max. operating current                     |           | 6A                        | 3.0A                                     |
| Max. switching capacity                    |           | 600A, 120W                | 300VA, 60W                               |
| Minimum permissible load (reference value) |           | 5VDC, 100mA               |                                          |

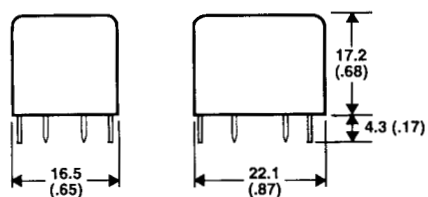
## CHARACTERISTICS

|                       |                                                                                                                                                              |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Contact resistance    | 50m Ω max.                                                                                                                                                   |
| Operate time          | 10 msec. max.                                                                                                                                                |
| Release time          | 5 msec. max.                                                                                                                                                 |
| Operating Frequency   | Mechanically: 18,000 operations/hour,<br>Electrically: 1,800 operations/hour (under rated load)                                                              |
| Insulation resistance | 100M Ω min. (at 500VDC)                                                                                                                                      |
| Dielectric strength   | 1,500 VAC, 50/60 Hz for 1 minute between coil and contact,<br>dissimilar pole 750 VAC, 50/60 Hz for 1 minute between<br>non-continuous contacts of same pole |
| Vibration             | 1.5mm double amplitude, 10 to 55 Hz                                                                                                                          |
| Shock                 | 100 m/sec <sup>2</sup> (approx 10 G's)                                                                                                                       |
| Ambient temperature   | Operating: -25 to +60°C                                                                                                                                      |
| Humidity              | 45-85% RH                                                                                                                                                    |
| Service life          | Mechanically: 10,000,000 operations min.                                                                                                                     |
| Weight                | Approx. 10g.                                                                                                                                                 |

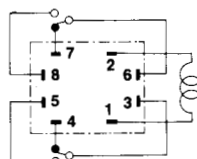
## ORDERING INFORMATION

KSD205      DC xx  
                         |  
                         3 to 24 VDC

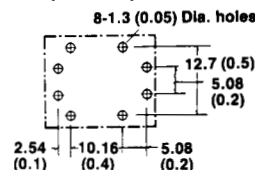
## DIMENSIONS: mm (inch)



## TERMINAL ARRANGEMENT (Bottom View) Numbers For Reference Only



## MOUNTING HOLES (Pin View)



\* SINCE 1976 \*

## HAT-900 SERIES HEAVY DUTY SPDT 40A NORMALLY OPEN & 30A NORMALLY CLOSED



 File E75887

 File LR49291

### ORDERING INFORMATION

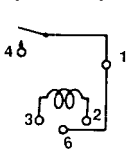
|             |                                         |            |                      |          |              |                  |    |
|-------------|-----------------------------------------|------------|----------------------|----------|--------------|------------------|----|
| HAT         |                                         | 901        | C                    | S        | DC           | 12               | -1 |
| Temp. Class | Type                                    | Form       | Style                | Coil     | Coil Voltage | Option           |    |
| Nil:        | 901: PC Pins Only                       | A: SPST-NO | Nil: Open            | AC or DC | See Table    | Pin 6 is Omitted |    |
| Class B     | 902: PC Pins & Quick Connects           | B: SPST-NC | C: Cover, not sealed |          |              | UL 840           |    |
| F:          | 903: Quick Connects Only — Flange Mount | C: SPDT    | S: Cover, sealed     |          |              | *                |    |

\*Note: 902 relays do not have pin 6.

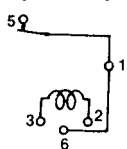
### WIRING DIAGRAMS

#### PIN VIEW

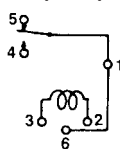
1 FORM A  
(SPST-NO)



1 FORM B  
(SPST-NC)



1 FORM C  
(SPDT)



### GENERAL SPECIFICATIONS

Contact Material: silver cadmium oxide with copper base  
Max. continuous rated voltage: 110% of nominal voltage.  
Pull-In voltage: 75% of nominal voltage. Max @ 25°C.  
Drop-Out voltage: 10% of nominal voltage. Min @ 25°C.  
Contact Resistance: 20 mΩ max. (Initial value)  
Operating Temp: Class B: -20°C to 85°C  
Class F: -20°C to 105°C

Insulation Resist: DC 500V 10 MΩ min.

Dielectric Strength: AC 2000V between contact and coil, frame and contact, coil and frame one minute. AC 1500V between contacts one minute.

Operate Time: approx. 15 ms.

Release Time: approx. 10 ms.

Electrical Life: 10 x 10<sup>4</sup> operation min. for 30A resistive load (N.O.)  
5 x 10<sup>4</sup> operations min. for 40A Resistive Load (N.O.)

Mechanical Life: 10 x 10<sup>6</sup> operation min.

### DC COIL SPECIFICATIONS

| Nominal Voltage (VDC) | Resistance ±10% @ 25°C (Ohms) | Coil Power @ 25°C (Watts) |
|-----------------------|-------------------------------|---------------------------|
| 5                     | 27                            | .93                       |
| 6                     | 40                            | .90                       |
| 9                     | 97                            | .84                       |
| 12                    | 155                           | .93                       |
| 15                    | 256                           | .88                       |
| 18                    | 380                           | .85                       |
| 22                    | 640                           | .76                       |
| 24                    | 660                           | .87                       |
| 48                    | 2560                          | .88                       |
| 110                   | 13400                         | .90                       |

### AC COIL SPECIFICATIONS

| Nominal Voltage (at 25°C) | Resistance ±10% @ 25°C (Ohms) | Coil Power @ 25°C (VA) |
|---------------------------|-------------------------------|------------------------|
| 12VAC                     | 27                            | Approx 2VA             |
| 24VAC                     | 120                           |                        |
| 110VAC                    | 2,360                         |                        |
| 120VAC                    | 3,040                         |                        |
| 220VAC                    | 13,490                        |                        |
| 240VAC                    | 15,735                        |                        |
| 277VAC                    | 20,300                        |                        |

### MAXIMUM LOAD SPECIFICATIONS

| Voltage | Load Type       | SPNC                     | SPNO                      |
|---------|-----------------|--------------------------|---------------------------|
| AC      | Resistive       | 30A 277VAC               | 40A 277VAC                |
|         | Motor           | 1HP 120VAC<br>2HP 277VAC | 1HP 120 VAC<br>2HP 277VAC |
|         | General Purpose | 30A 277VAC               | 40A 277VAC                |
|         | Ballast         | 10A 120VAC<br>10A 277VAC | 30A 120VAC<br>20A 277VAC  |
|         | Tungsten        | 2A 120VAC                | 10A 120VAC                |
| DC      | Resistive       | 30A 28VDC                | 30A 28VDC                 |

Shock Operational - 10g for 11ms w/no contact opening

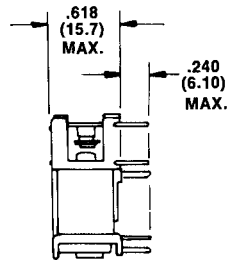
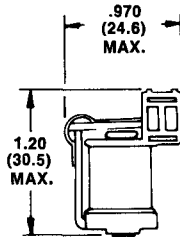
Shock Destructive - 100g

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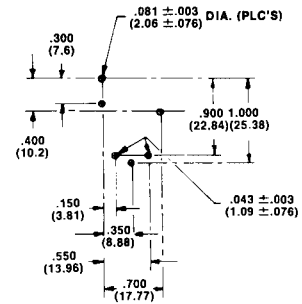
## HAT-900 SERIES HEAVY DUTY

### OUTLINE DIMENSIONS

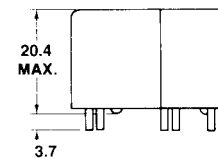
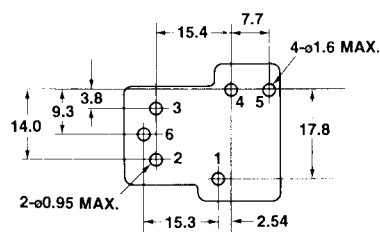
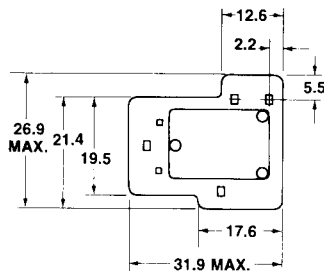
MECHANICAL SPECIFICATIONS  
901 OPEN STYLE



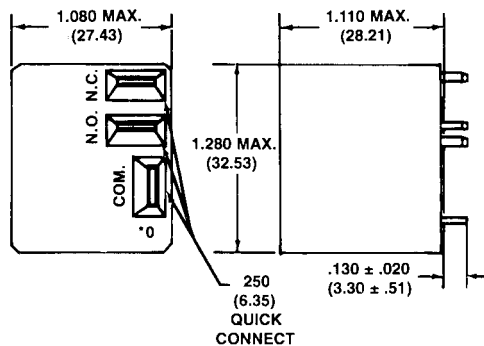
PC BOARD LAYOUT  
VIEWED TOWARD TERMINALS



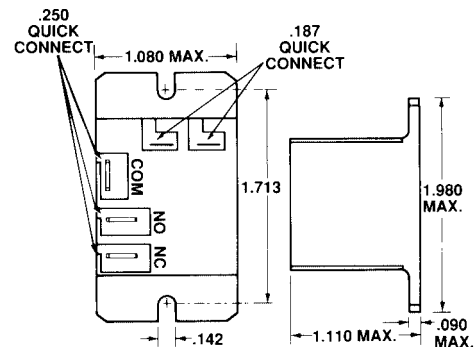
### HAT 901 SERIES



### HAT 902 SERIES



### HAT 903 SERIES



\* SINCE 1976 \*

## HAT-904 SERIES DPDT HEAVY DUTY



### FEATURES

- 30A switching capabilities
- DPST-NO and DPDT configuration
- Meets VDE 8mm spacing, 4 KV dielectric
- Meets UL Class F construction
- Dust cover or sealed version: PCB or QC Terminal

### CONTACT DATA

|                                      |    |                                                                                  |
|--------------------------------------|----|----------------------------------------------------------------------------------|
| Contact Form                         |    | DPST-NO(2H), DPDT (2Z)                                                           |
| Initial Contact Resistance           |    | 50mΩ<br>(measured at 1A 6VDC)                                                    |
| Contact Material                     |    | Silver cadmium oxide                                                             |
| R<br>A<br>T<br>I<br>O<br>N<br>A<br>L | NO | 30A 120VAC/277V AC<br>20A 28VDC<br>1HP 120V AC, 2.5HP25V AC<br>TV - 10           |
|                                      | NC | 3A 28VDC/277V AC<br>2A 480V AC 1A 600V AC                                        |
| Switching Current                    |    | Max 30A                                                                          |
| Switching Voltage                    |    | Max 277V AC                                                                      |
| Electrical Life                      |    | (Resistive)30A 250V AC 1-10 <sup>5</sup><br>(Motor)2HP 250V AC 1-10 <sup>5</sup> |
| Mechanical Life                      |    | 5 - 10 <sup>6</sup>                                                              |

### COIL DATA

|                  |                           |
|------------------|---------------------------|
| Coil Consumption | AC±4.0VA,DC±1.7W          |
| Coil Voltage     | DC±6 – 110V, AC±24 – 277V |
| Coil Resistance  | see table below           |

### SPECIFICATION

|                         |                                              |
|-------------------------|----------------------------------------------|
| Insulation Resistance   | 1000MΩ 500VDC                                |
| Dielectric Strength     |                                              |
| Between coil & contacts | 4000V AC                                     |
| Between open contacts   | 1500V AC                                     |
| Between contact poles   | 2000V                                        |
| Operate Time            | 15 ms                                        |
| Release Time            | 10 ms                                        |
| Ambient Temperature     | At rated voltage                             |
| AC                      | -40 ±66°C                                    |
| DC                      | -55 ±85°C                                    |
| Humidity                | 35 – 85%                                     |
| Vibration               | 1.65mm 10 – 55Hz                             |
| Shock                   | 100 m/s² Malfunction<br>1000 m/s² Mechanical |
| Dimensions (mm)         | 52.32 x 34.5 x 30.43                         |
| Weight                  | approx. 86g                                  |
| Termination             | PCB & QC                                     |
| Construction            | Dust cover and Sealed                        |
| Flammability            | U1.94-V0                                     |

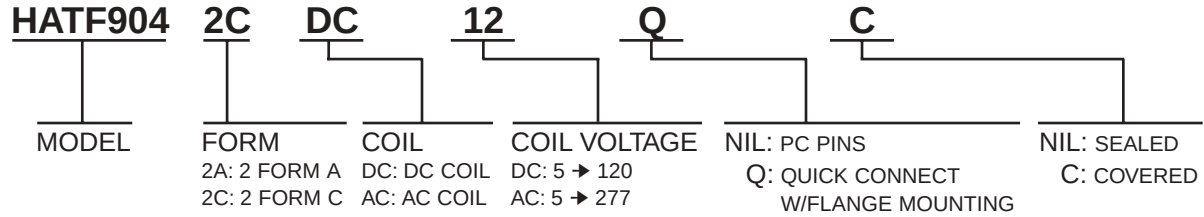
### TABLE

| Nominal Voltage<br>VDC | Pull-in Voltage<br>VDC | Drop-out Voltage<br>VDC | Coil Resistance Ω<br>( ±10%) | Nominal Voltage<br>V AC | Pull-in Voltage<br>V AC | Drop-out Voltage<br>V AC | Coil Ω (±10%) |       |
|------------------------|------------------------|-------------------------|------------------------------|-------------------------|-------------------------|--------------------------|---------------|-------|
|                        |                        |                         |                              |                         |                         |                          | 60 Hz         | 50 Hz |
| 6                      | 4.5                    | 0.6                     | 22                           | 24                      | 19.2                    | 7.2                      | 39            | 52    |
| 12                     | 9.0                    | 1.2                     | 86                           | 120                     | 96.0                    | 36.0                     | 950           | 1390  |
| 24                     | 18.0                   | 2.4                     | 350                          | 208                     | 166.4                   | 62.4                     | 2841          | 3900  |
| 48                     | 36.0                   | 4.8                     | 1390                         | 240                     | 192.0                   | 72.0                     | 3800          | 5200  |
| 110                    | 82.5                   | 11.0                    | 7255                         | 277                     | 221.6                   | 83.1                     | 5200          | 7255  |

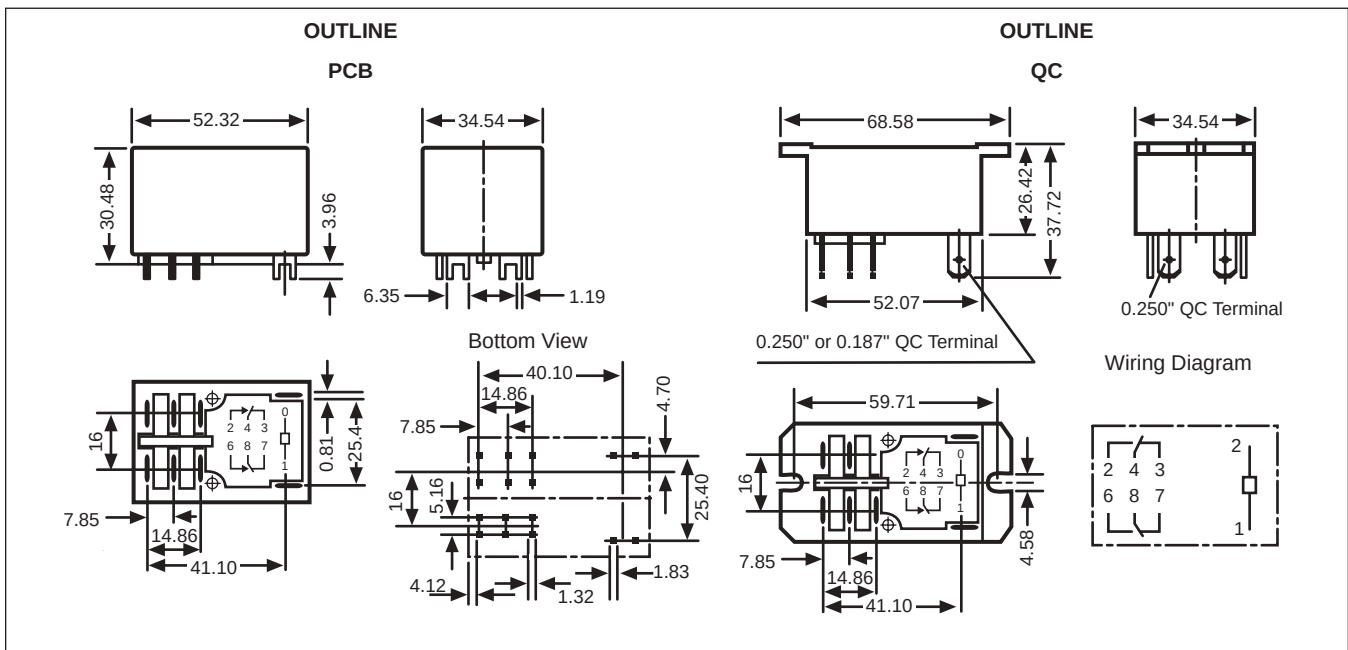
\*When recounting pull-in voltage < 70% of nominal voltage, special order powered.

\* SINCE 1976 \*

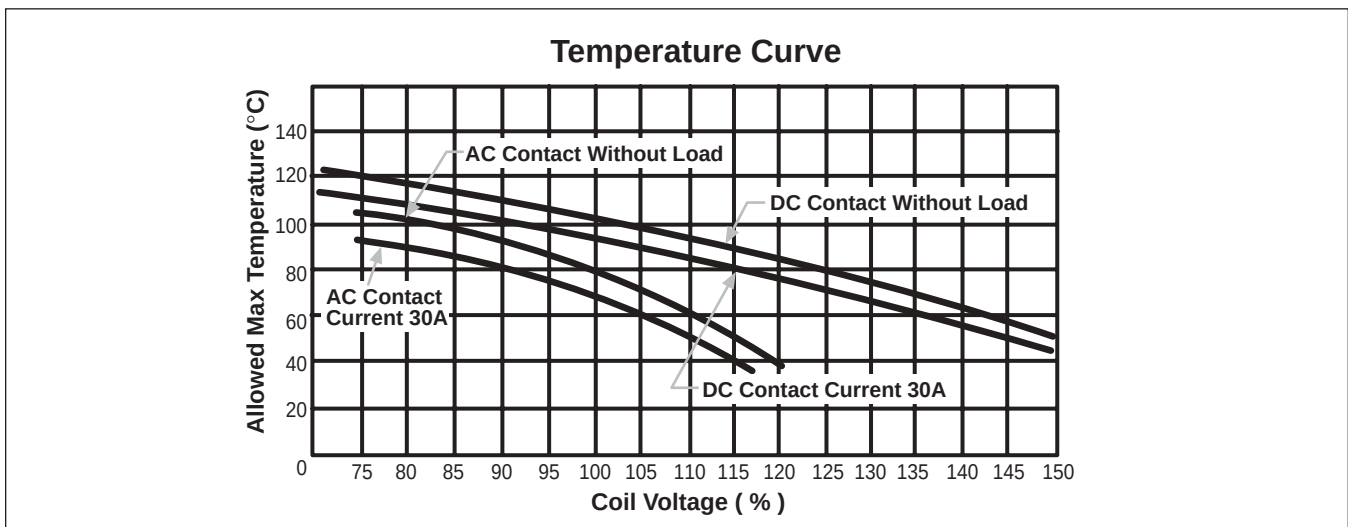
## ORDERING INFORMATION



## OUTLINE DIMENSIONS, WIRING DIAGRAM AND PC BOARD LAYOUT



## USEFUL CURVES



\* SINCE 1976 \*

## SUBMINIATURE RELAYS/AUTOMOBILE RELAYS P.C. BOARD TYPE CARB SERIES

### SPECIFICATIONS

|                       |                                                                                                                |
|-----------------------|----------------------------------------------------------------------------------------------------------------|
| Operate Time          | 15 msec. max.                                                                                                  |
| Release Time          | 10 msec. max.                                                                                                  |
| Breakdown Voltage     | 1000C AC (60HZ) for 1 minute between open contacts.<br>1500V AC (60HZ) for 1 minute between coil and contacts. |
| Insulation Resistance | More than 100MΩ at 500V DC                                                                                     |
| Shock Resistance      | 10G min.                                                                                                       |
| Ambient Temperature   | N - 40°C ~ +85°C<br>H - 55°C ~ +125°C                                                                          |
| Operating Speed       | 1800 operations/hour                                                                                           |
| Life                  | Mechanical: Over 10,000,000 operations<br>Electrical: Over 100,000 operations                                  |
| Weight                | Approx. 18 ~ 19 g                                                                                              |



### COIL RATINGS

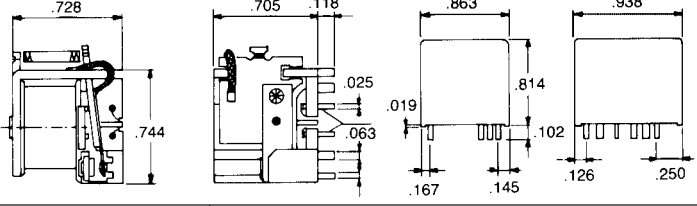
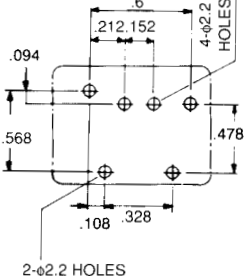
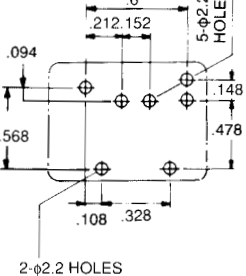
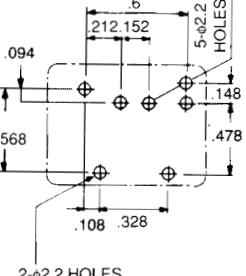
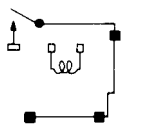
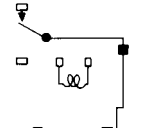
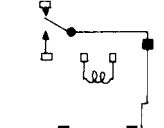
| Rated Voltage | Resistance (±10% at 20C) | Rated Current (±10% at 20C) | Pick-up Voltage (Max.) | Drop-out Voltage (Min.) | Allowable Voltage (Max.) | Rated Operating Power Consumption |
|---------------|--------------------------|-----------------------------|------------------------|-------------------------|--------------------------|-----------------------------------|
| 12V DC        | 90 ohm                   | 133mA                       | 9.6V                   | 1.2V                    | 14.4V                    | 1.6W                              |
| 24V DC        | 380 ohm                  | 63mA                        | 19.2V                  | 2.4V                    | 28.8V                    | 1.5W                              |
| 48V DC        | 2300 ohm                 | 21mA                        | 38.4V                  | 4.8V                    | 57.6V                    | 1.0W                              |

### CONTACT RATINGS

| Type & Arrangement      | 1 Form A                                 | 1 Form B                                 | 1 Form C                                                       |
|-------------------------|------------------------------------------|------------------------------------------|----------------------------------------------------------------|
| Load                    | R Load (p.f. = 1)<br>L Load (p.f. = 0.4) | R Load (p.f. = 1)<br>L Load (p.f. = 0.4) | R Load (p.f. = 1)<br>L Load (p.f. = 0.4)                       |
| Rated Load              | NC: —<br>NO: 30A 240V AC<br>30A 28V DC   | NC: —<br>NO: 15A 240V AC<br>15A 28V DC   | NC: 15A 240V AC<br>15A 28V DC<br>NO: 20A 240V AC<br>20A 28V DC |
| Carry Current           | 30A                                      | 15A                                      | 20A                                                            |
| Max. operating Vol.     | 30A                                      | 380V AC 120V DC                          | 20A                                                            |
| Max. operating Current  | 30A                                      | 15A                                      | 20A                                                            |
| Max. switching capacity | NC: —<br>NO: 7200VA<br>840W              | NC: —<br>NO: 3600VA<br>420W              | NC: 3600VA<br>420W<br>NO: 4800VA<br>560W                       |
| Material                | Ag Alloy                                 |                                          |                                                                |
| Contact Resistance      | Less than 50mΩ (an initial value)        |                                          |                                                                |

### DIMENSIONS AND SCHEMATICS

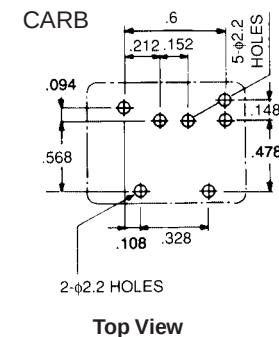
Units: Inches

|                |                                                                                                                                                                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Outline        |                                                                                                                                                                                                                                |
| P.C.B. Pattern | <div>Form a</div>  <div>Form b</div>  <div>Form c</div>  |
| Schematic      |                                                          |

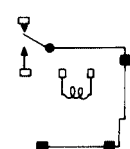
### ORDERING INFORMATION

CARB 1A 24 H 1 S

| Contact Arrangement | Rated Coil Voltage | Ambient temperature range | Construction  | Option |
|---------------------|--------------------|---------------------------|---------------|--------|
| 1A: 1 FORM A        | 12:12V DC          | N: -40°C ~ +85°           | 1. Open Type  | Sealed |
| 1B: 1 FORM B        | 24:24V DC          | H: -55°C ~ +125°C         | 2. Cover Type |        |
| 1C: 1 FORM C        | 48:48V DC          |                           |               |        |



### Schematic



### Bottom View

\* SINCE 1976 \*

## CAR 40 AMP OR 30 AMP AUTOMOTIVE RELAY

### FEATURES

- High contact rating (40A)
- High temperature design
- 1 Form A and 1 Form C arrangements
- Quick connect and P.C. Board terminals
- Mounting Tab option

### COIL RATING

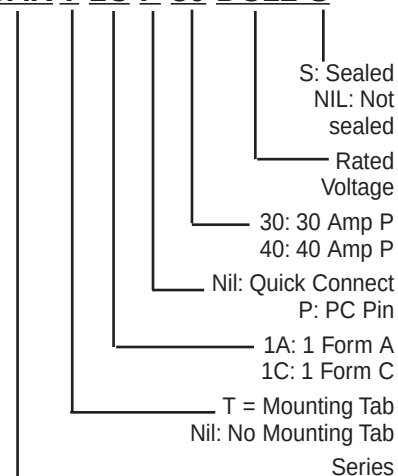
| Rate Voltage (VDC) | Coil Resistance $\Omega \pm 10\%$ | Rated Current (mA) | Must Operate Voltage<br>% of Rate Voltage (At +20°C) | Must Dropout Voltage<br>10 Min | Maximum Voltage (20°C) | Power Consumption (W) |
|--------------------|-----------------------------------|--------------------|------------------------------------------------------|--------------------------------|------------------------|-----------------------|
| 6                  | 20                                | 300                | 70 Max                                               | 10 Min                         | 130Max                 | 1.8W                  |
| 12                 | 80                                | 150                |                                                      |                                |                        |                       |
| 24                 | 320                               | 75                 |                                                      |                                |                        |                       |

### CHARACTERISTICS

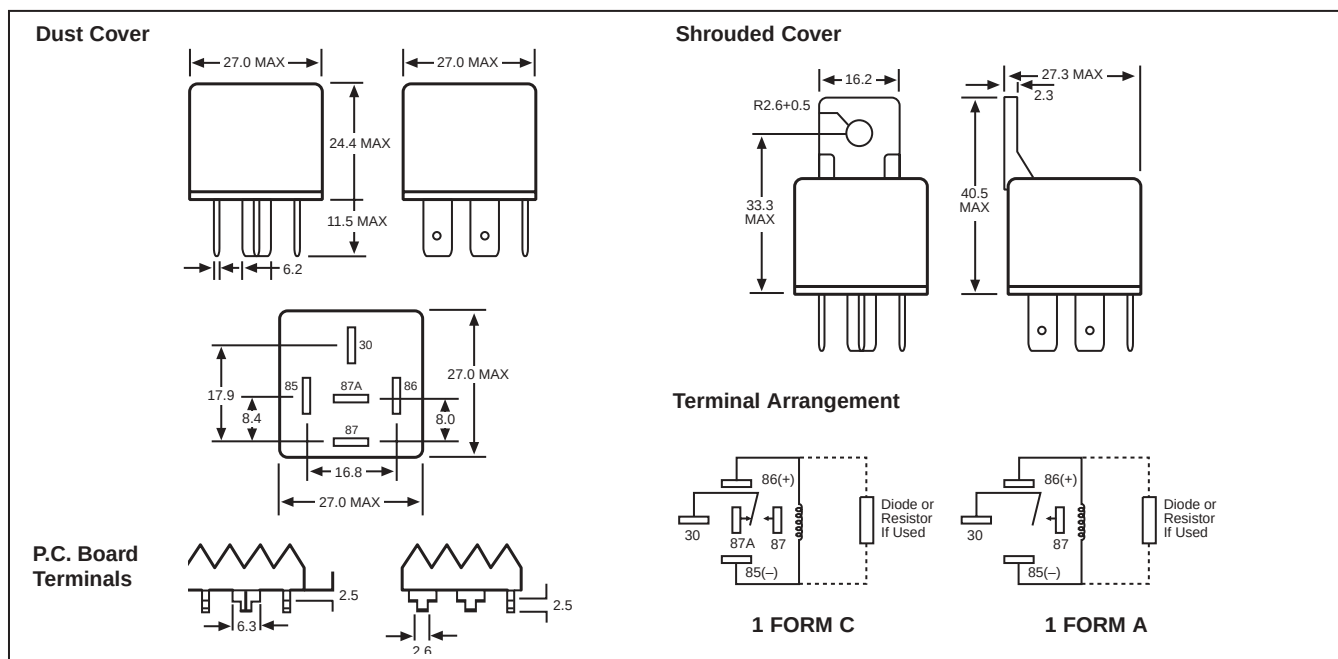
|                                 |                                                         |
|---------------------------------|---------------------------------------------------------|
| Contact Arrangement             | SPST (1 Form A), SPDT (1 Form C)                        |
| Contact Material                | 40A (AGSNO2)                                            |
| Contact Resistance              | 50m $\Omega$ Max                                        |
| Contact Rating (resistive load) | 40A 14VDC (1 Form A) 30A/14VDC (1 Form C)               |
| Switching Voltage               | DC75V                                                   |
| Operate Time                    | 10ms Max                                                |
| Release Time                    | 10ms Max                                                |
| Insulation Resistance           | 100M $\Omega$ min. (500V DC)                            |
| Dielectric Strength             | 500V/ msBetween coil and contact                        |
| Shock resistance                | 20g Approx. 20g                                         |
| Vibration Resistance            | 10–40Hz, Amplitude 1.27mm, 10–40Hz 1.27mm               |
| Ambient Temperature             | –40°C to +85°C                                          |
| Humidity                        | 20 to 85% R.H                                           |
| Operation Life                  | Mechanical: 10 <sup>5</sup> Electrical: 10 <sup>5</sup> |
| Weight                          | 30 gr. Approx.                                          |

### ORDERING INFORMATION

#### CAR T 1C P 30 DC12-S



### DIMENSIONS mm (inches)





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## CAR & CART 80 AMP AUTOMOTIVE RELAY

### FEATURES

- High contact rating (80A)
- Quick connect and P.C. Board terminals
- 1 Form A and 1 Form C arrangements
- Mounting Tab optional

### COIL RATING

| Rate Voltage (VDC) | Coil Resistance Ohms±10% | Max Coil Voltage | Rated Current (mA) | Must Operate Voltage | Must Dropout Voltage | Power Consumption (W) |
|--------------------|--------------------------|------------------|--------------------|----------------------|----------------------|-----------------------|
| 6                  | 20                       | 7.8              | 300                | 4.2                  | 0.6                  | 1.8W                  |
| 12                 | 80                       | 15.6             | 150                | 8.4                  | 1.2                  |                       |
| 24                 | 320                      | 31.2             | 75                 | 16.8                 | 2.4                  |                       |

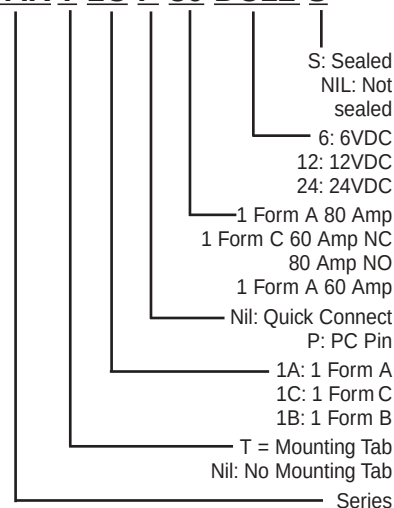
CAUTION: 1. The use of any coil voltage less than the rated coil voltage will compromise the operation of the relay.  
2. Pickup and release voltages are for test purposes only and are not to be used for design criteria

### CHARACTERISTICS

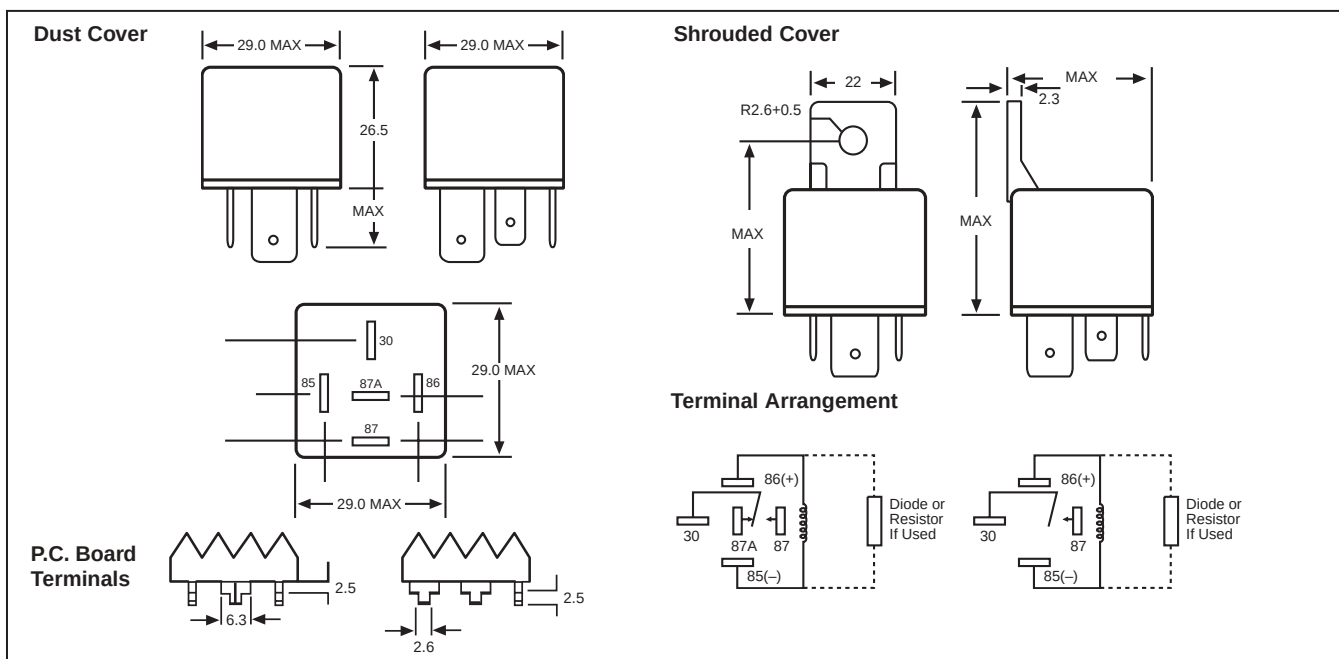
|                                           |                   |                                                                                                               |
|-------------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------|
| <b>Contact Arrangement</b>                |                   | SPST (1 Form A), SPST (1 Form B), SPDT (1 Form C)                                                             |
| <b>Contact Material</b>                   |                   | AgSnO <sub>2</sub> , AgNi                                                                                     |
| <b>Contact Resistance</b>                 |                   | ≤ 30 mΩ Item 3.12 of IEC2555-7                                                                                |
| <b>Contact Rating (resistive load)</b>    |                   | 50A, 80A 14 VDC (1 Form A); 40A, 60A/ 14 VDC (1 Form B);<br>NO: 50A, 80A 14VDC; NC: 40A, 60A/14VDC (1 Form C) |
| <b>Max Switching Voltage</b>              |                   | 75VDC                                                                                                         |
| <b>Max Switching Power</b>                |                   | 980W                                                                                                          |
| <b>Max Switching Current</b>              |                   | 80A                                                                                                           |
| <b>Operate Time</b>                       |                   | ≤ 7mS Max                                                                                                     |
| <b>Release Time</b>                       |                   | ≤ 5 mS Max                                                                                                    |
| <b>Operation Life</b>                     | <b>Mechanical</b> | 1,000,000                                                                                                     |
|                                           | <b>Electrical</b> | 100,000 1 Form A @ 80Amp;<br>15,000 1 Form B & 1 Form C @ 80 Amps,                                            |
| <b>Insulation Resistance<sup>1)</sup></b> |                   | 100MOhms min. (500V DC)                                                                                       |
| <b>Dielectric Strength<sup>1)</sup></b>   |                   | 500V/ms between coil and contact                                                                              |
| <b>Shock Resistance</b>                   |                   | 20g Approx. 20g                                                                                               |
| <b>Vibration Resistance</b>               |                   | 10-40Hz, Amplitude 1.27mm, 10-40Hz 1.27mm                                                                     |
| <b>Ambient Temperature</b>                |                   | -40°C to +85°C                                                                                                |
| <b>Relative Humidity</b>                  |                   | 85% R.H. (at 40°C)                                                                                            |
| <b>Weight</b>                             |                   | 46g (CAR); 48g (CART)                                                                                         |

### ORDERING INFORMATION

#### CART 1C P 80 DC12-S



### DIMENSIONS mm (inches)



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## SPR RELAYS

### FEATURES

- Small size for high density mounting
- Up to 5000VAC Dielectric strength
- Fully Sealed



### DIMENSIONS (Units: mm)

| Rated Voltage<br>V DC | Coil Resistance<br>Ohm $\pm 10\%$ | Must Operate Voltage<br>V DC (max) | Must Release Voltage<br>V DC (min) | Maximum Voltage<br>V DC | Coil Power<br>W |
|-----------------------|-----------------------------------|------------------------------------|------------------------------------|-------------------------|-----------------|
| 5                     | 62                                | 3.50                               | 0.5                                | 130% of rated voltage   | 0.40            |
| 6                     | 90                                | 4.20                               | 0.6                                |                         |                 |
| 12                    | 360                               | 8.40                               | 1.2                                |                         |                 |
| 24                    | 1,440                             | 16.8                               | 2.4                                |                         |                 |
| 48                    | 5,760                             | 33.6                               | 4.8                                |                         |                 |
| 60                    | 7,500                             | 42.0                               | 6.0                                |                         |                 |
| 110                   | 25,200                            | 77.0                               | 11.0                               |                         |                 |

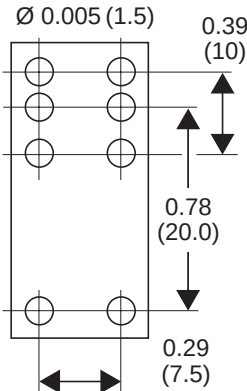
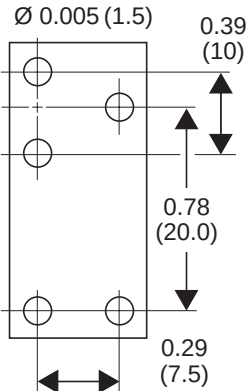
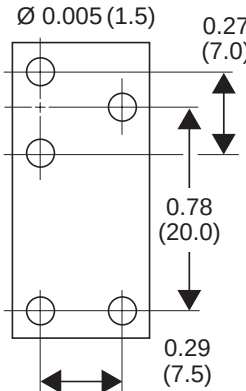
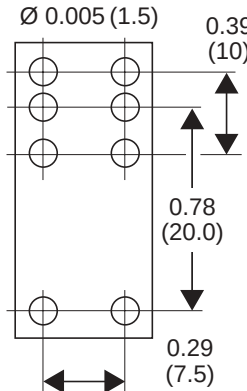
### CHARACTERISTICS

|                                         |             |                                                                                                      |                     |
|-----------------------------------------|-------------|------------------------------------------------------------------------------------------------------|---------------------|
| Contact Arrangement                     |             | 1A, 1B, 1C,                                                                                          | 2A, 2B, 2C          |
| Contact Material                        |             | AgCdO <sub>2</sub> , AgSnO <sub>2</sub>                                                              |                     |
| Contact Rating (resistive);             |             | 12A/ 16A 250VAC; 10A 24VDC                                                                           | 8A 250VAC, 8A 24VDC |
| Max. Switching Power                    |             | 3,000VA/ 4,000VA                                                                                     | 2,000VA             |
| Max. Switching Voltage                  |             | 440VAC                                                                                               |                     |
| Max. Switching Current                  |             | 16 A                                                                                                 | 8 A                 |
| Initial Contact Resistance (at 1A 6VDC) |             | MAX. 50mOhm                                                                                          |                     |
| Operate time                            |             | MAX. 10 ms                                                                                           |                     |
| Release Time                            |             | MAX. 5 ms                                                                                            |                     |
| Insulation Resistance                   |             | 1,000 M ohm min (at 500VDC)                                                                          |                     |
| Dielectric Strength                     |             | 1,000VAC between open contacts<br>5,000VAC between contact and coil<br>2,500VAC between contact sets |                     |
| Operating temperature                   |             | -40°C~85°C                                                                                           |                     |
| Storage temperature                     |             | -40°C~100°C                                                                                          |                     |
| Humidity                                |             | 20°C 35% - 85%                                                                                       |                     |
| Operation life                          | Mechanical  | 10 x 10 <sup>6</sup> operations (72,000 operations/hour)                                             |                     |
|                                         | Electric    | 10 x 10 <sup>4</sup> operations (360 operations/hour)                                                |                     |
| Weight                                  |             | 13.5 g Approx.                                                                                       |                     |
| Vibration Resistance                    |             | 10 to 150 Hz 10g/5g                                                                                  |                     |
| Shock                                   | Functional  | 100m/s2                                                                                              |                     |
| Resistance                              | Destructive | 1000m/s2                                                                                             |                     |

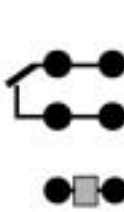
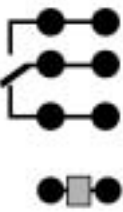
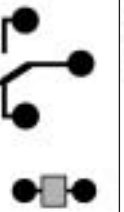
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## SPR RELAYS

### SPR PCB LAYOUT (BOTTOM VIEW) 400 mW COIL

| 16A: 1A, 1B, 1C                                                                   | 12A: 1A, 1B, 1C                                                                   |                                                                                    | 8A: 2A, 2B, 2C                                                                      |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| K Type                                                                            | K Type                                                                            | R Type                                                                             | K Type                                                                              |
|  |  |  |  |

### SCHEMATIC

| 16A Type                                                                            |                                                                                     |                                                                                     | 12A Type                                                                            |                                                                                     |                                                                                      | 8A Type                                                                               |                                                                                       |                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |  |  |

### ORDERING INFORMATION

| SPR    |                          | 16              | DC                                    | K                                   |
|--------|--------------------------|-----------------|---------------------------------------|-------------------------------------|
| Series | Contact Form: 1A, 1B, 1C | Contact Current | Voltage DC: 5, 6, 12, 24, 48, 60, 110 | Pole Distance<br>K: 5mm <b>ONLY</b> |

| SPR    |                          | 12              | DC                                    |                                      |
|--------|--------------------------|-----------------|---------------------------------------|--------------------------------------|
| Series | Contact Form: 1A, 1B, 1C | Contact Current | Voltage DC: 5, 6, 12, 24, 48, 60, 110 | Pole Distance:<br>K: 5mm<br>R: 3.5mm |

| SPR    |                          | 8               | DC                                    |                                      |
|--------|--------------------------|-----------------|---------------------------------------|--------------------------------------|
| Series | Contact Form: 2A, 2B, 2C | Contact Current | Voltage DC: 5, 6, 12, 24, 48, 60, 110 | Pole Distance:<br>K: 5mm <b>ONLY</b> |

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## PR SERIES

### COMPACT POWER RELAYS 1C (16A, 10A), 2C (5A)

#### FEATURES

- High breakdown voltage (4,000V AC between coil and contact)
- Large switching capacity (16A 240V AC)
- Fully sealed



File E75887



File LR49291



#### TYPICAL APPLICATIONS

General electronic controls or systems, Machine tool controls, Energy control circuits, Industrial machinery controls, Consumer

controls (Air-conditioner, Refrigerator, Microwave Oven, etc.), Vending machine, Office machine, etc.

#### COIL RATINGS

| Rated Voltage | Resistance (±10% at 20°C) | Rated Current (±10% at 20°C) | Pick-up Voltage (Max.) | Drop-Out Voltage (Min.) | Allowable Voltage (Max.) | Rated operating power |
|---------------|---------------------------|------------------------------|------------------------|-------------------------|--------------------------|-----------------------|
| 5V DC         | 47 Ω                      | 106.3 mA                     | 4V DC                  | 0.5V DC                 | 6V DC                    | Approx 0.5W           |
| 6V DC         | 68 Ω                      | 88 mA                        | 4.8V DC                | 0.6V DC                 | 7.2V DC                  |                       |
| 9V DC         | 155 Ω                     | 58 mA                        | 7.2V DC                | 0.9V DC                 | 10.8V DC                 |                       |
| 12V DC        | 275 Ω                     | 44 mA                        | 9.6V DC                | 1.2V DC                 | 14.4V DC                 |                       |
| 24V DC        | 1,100 Ω                   | 22 mA                        | 19.2V DC               | 2.4V DC                 | 28.8V DC                 |                       |
| 48V DC        | 4,400 Ω                   | 11 mA                        | 38.4V DC               | 4.8V DC                 | 57.6V DC                 |                       |
| 110V DC       | 14,400 Ω                  | 7.6 mA                       | 80V DC                 | 11V DC                  | 120V DC                  |                       |

\* Coil resistance varies ± 0.4% for each ± 1°C change in coil temperature

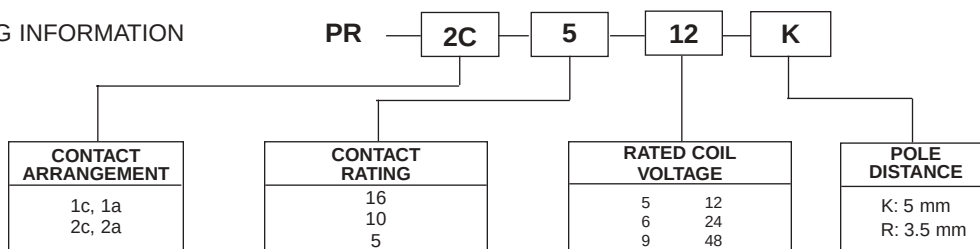
#### CONTACT RATINGS

| Type & Arrangement              | PR-1 (1a, 1c)                  |                          | PR-1 (1a, 1c)             |                          | PR-2 (2a, 2c)           |                           |
|---------------------------------|--------------------------------|--------------------------|---------------------------|--------------------------|-------------------------|---------------------------|
| <div>Load</div> <div>Item</div> | R load<br>(p.f. = 1)           | L load<br>(p.f. = 0.7)   | R load<br>(p.f. = 1)      | L load<br>(p.f. = 0.7)   | R load<br>(p.f. = 1)    | L load<br>(p.f. = 0.7)    |
| Rated load                      | 16A 220V AC<br>16A 30V DC      | 16A 220V AC<br>8A 30V DC | 10A 220V AC<br>10A 30V DC | 10A 220V AC<br>5A 30V DC | 5A 220V AC<br>5A 30V DC | 5A 220V AC<br>2.5A 30V DC |
| Carry current                   | 1/2 hp 120VAC 16A              |                          | 1/4 hp 120VAC 10A         |                          | 1/8 hp 120VAC 5A        |                           |
| Max. operating voltage          | 380V AC, 120V DC               |                          |                           |                          |                         |                           |
| Max. operating current          | 16A/3A Tungsten                |                          | 10A/3A Tungsten           |                          | 5A                      |                           |
| Max. switching capacity         | 3,520VA, 480W                  | 1,760VA, 240W            | 2,200VA, 300W             | 1,100VA, 150W            | 1,100VA, 150W           | 550VA, 75W                |
| Material                        | AgCdO                          |                          |                           |                          |                         |                           |
| Contact resistance              | Less than 50mΩ (initial value) |                          |                           |                          |                         |                           |

#### SPECIFICATIONS

|                           |                     |                                                                                                                |
|---------------------------|---------------------|----------------------------------------------------------------------------------------------------------------|
| Operate time              |                     | 15m sec. max.                                                                                                  |
| Release time              |                     | 10m sec. max.                                                                                                  |
| Breakdown voltage         |                     | 1,000V AC (60Hz) for 1 minute between open contacts<br>4,000V AC (60Hz) for 1 minute between coil and contacts |
| Insulation resistance     |                     | More than 1,000 MΩ at 500V DC                                                                                  |
| Vibration resistance      |                     | 10 ~ 55 Hz at double amplitude of 1.5 mm                                                                       |
| Shock resistance          |                     | 10G min.                                                                                                       |
| Ambient temperature range |                     | -40°C ~ +85°C                                                                                                  |
| Operating speed           |                     | 1,800 operations/hour                                                                                          |
| Life                      | Mechanical          | Over 10,000,000 operations                                                                                     |
|                           | Electrical (R load) | Over 100,000 operations                                                                                        |
| Weight                    |                     | Approx. 17 g (PR-1), Approx. 22 g (PR-2)                                                                       |

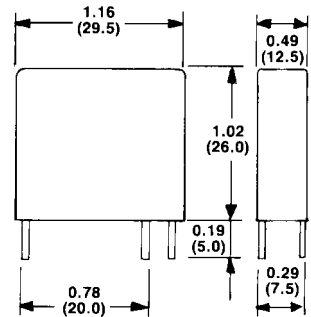
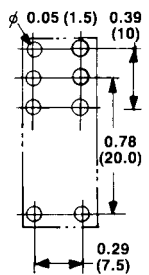
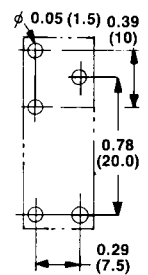
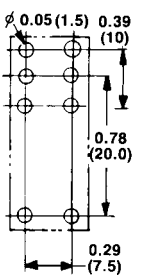
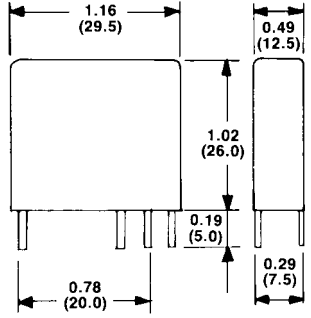
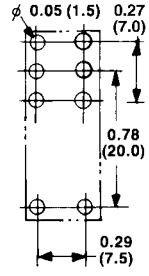
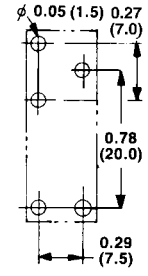
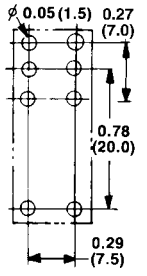
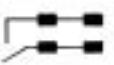
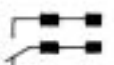
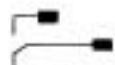
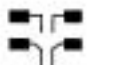
#### ORDERING INFORMATION



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## PR SERIES COMPACT POWER RELAYS

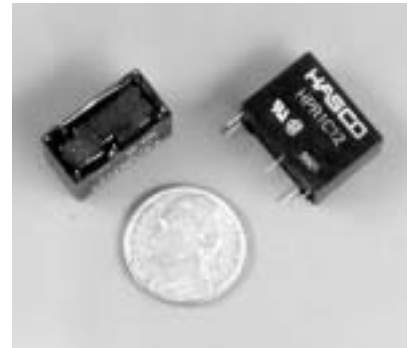
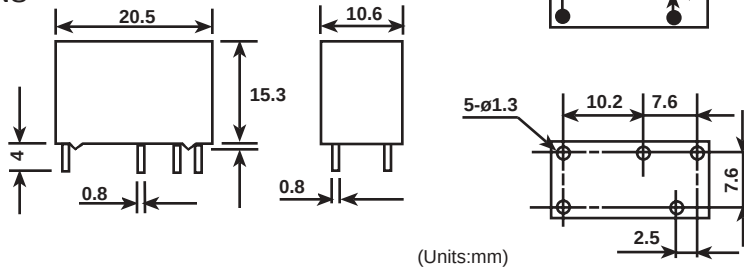
### DIMENSIONS AND SCHEMATICS PR

| Outline                                                                             |                                                                                     | P.C.B. Pattern (Bottom View)                                                        |                                                                                      |                                                                                       |                                                                                       |  |  |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--|--|
| Contact<br>Arrangement "a"                                                          |    | PR1                                                                                 |                                                                                      |                                                                                       | PR2                                                                                   |  |  |
|                                                                                     |                                                                                     | 16A Type                                                                            | 10A Type                                                                             |                                                                                       | 5A Type                                                                               |  |  |
|                                                                                     |                                                                                     | K Type                                                                              | K Type                                                                               |                                                                                       | K Type                                                                                |  |  |
|                                                                                     |                                                                                     |    |    |                                                                                       |    |  |  |
| Contact<br>Arrangement "c"                                                          |   | PR1                                                                                 |                                                                                      |                                                                                       | PR2                                                                                   |  |  |
|                                                                                     |                                                                                     | 16A Type                                                                            | 10A Type                                                                             |                                                                                       | 5A Type                                                                               |  |  |
|                                                                                     |                                                                                     | R Type                                                                              | R Type                                                                               |                                                                                       | R Type                                                                                |  |  |
|                                                                                     |                                                                                     |  |  |                                                                                       |  |  |  |
| P.C.B. Pattern (Bottom View)                                                        |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |  |  |
| PR1                                                                                 |                                                                                     |                                                                                     |                                                                                      | PR2                                                                                   |                                                                                       |  |  |
| 16A Type                                                                            |                                                                                     | 10A Type                                                                            |                                                                                      | 5A Type                                                                               |                                                                                       |  |  |
| a                                                                                   | c                                                                                   | a                                                                                   | c                                                                                    | a                                                                                     | c                                                                                     |  |  |
|  |  |  |   |  |  |  |  |
|  |  |  |   |  |  |  |  |

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## HPR RELAYS

### DIMENSIONS



### COIL DATA (at 20°C)

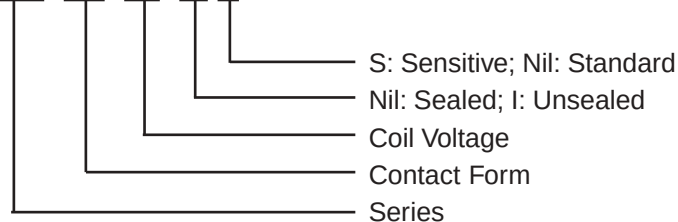
| Rated Voltage<br>VDC | Coil Resistance<br>Standard Type<br>Ohm±10% | Coil Resistance<br>Sensitive Type<br>Ohm±10% | Must Operate<br>Voltage<br>VDC(max) | Must Release<br>Voltage<br>VDC(min) | Coil Power<br>Standard Type<br>W | Coil Power<br>Sensitive Type<br>W |
|----------------------|---------------------------------------------|----------------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|-----------------------------------|
| 3                    | 20                                          | 45                                           | 2.25                                | 0.15                                | 0.45                             | 0.20                              |
| 5                    | 55                                          | 125                                          | 3.75                                | 0.25                                |                                  |                                   |
| 6                    | 80                                          | 180                                          | 4.50                                | 0.30                                |                                  |                                   |
| 9                    | 180                                         | 400                                          | 6.75                                | 0.45                                |                                  |                                   |
| 12                   | 320                                         | 720                                          | 9.00                                | 0.60                                |                                  |                                   |
| 18                   | 720                                         | 1600                                         | 13.5                                | 0.90                                |                                  |                                   |
| 24                   | 1280                                        | 2800                                         | 18.0                                | 1.20                                |                                  |                                   |

### CHARACTERISTICS

|                                   |                   |                                        |                                 |
|-----------------------------------|-------------------|----------------------------------------|---------------------------------|
| <b>Contact Arrangement</b>        |                   | SPST-NO, SPDT                          |                                 |
| <b>Contact Material</b>           |                   | Silver Alloy                           |                                 |
| <b>Contact Rating (resistive)</b> |                   | SPST-NO                                | 5A/250VAC, 5A/30VDC, 10A/125VAC |
|                                   |                   | SPDT NO                                | 5A/250VAC, 5A/30VDC, 10A/125VAC |
|                                   |                   | NC                                     | 3A/250VAC, 3A/30VDC             |
| <b>Contact Resistance</b>         |                   | Max. 100mOhm (measured at 1A, 24VDC)   |                                 |
| <b>Operate Time</b>               |                   | Max. 8ms                               |                                 |
| <b>Release Time</b>               |                   | Max. 5ms                               |                                 |
| <b>Insulation Resistance</b>      |                   | 1000Mohm min (at 500VDC)               |                                 |
| <b>Dielectric Strength</b>        |                   | 1000VAC 1min. between open contacts    |                                 |
|                                   |                   | 4000VAC 1min. between contact and coil |                                 |
| <b>Shock Operation</b>            |                   | 100m/s <sup>2</sup> Malfunction        |                                 |
|                                   |                   | 1000m/s <sup>2</sup> Mechanical        |                                 |
| <b>Vibration Operational</b>      |                   | 10~55Hz 1.66mm                         |                                 |
| <b>Ambient Temperature</b>        |                   | -40~70°C                               |                                 |
| <b>Humidity</b>                   |                   | 35%~95%                                |                                 |
| <b>Operation Life</b>             | <b>Mechanical</b> | 10 x 10 <sup>7</sup>                   |                                 |
|                                   | <b>Electrical</b> | 10 x 10 <sup>6</sup>                   |                                 |
| <b>Dimensions</b>                 |                   | 20.5 x 10.6 x 15.3mm                   |                                 |
| <b>Terminal</b>                   |                   | PCB                                    |                                 |
| <b>Weight</b>                     |                   | 7g Approx                              |                                 |

### ORDERING INFORMATION

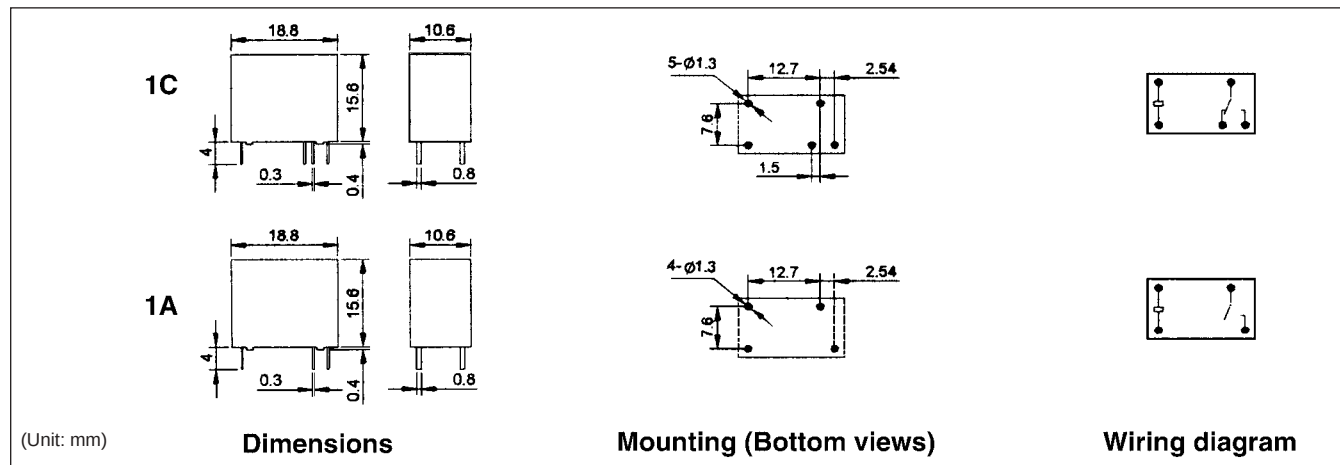
**HPR 1A 12 -1 S**



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## RPR RELAYS

### DIMENSIONS



### COIL RATINGS

| Rated Voltage VDC | Coil Resistance Standard Type Ohm $\pm$ 10% | Coil Resistance Sensitive Ohm $\pm$ 10% | must Operate Voltage VDC(max) | Must Release Voltage VDC(max) | Coil Power Standard Type | Coil Power Sensitive Type |
|-------------------|---------------------------------------------|-----------------------------------------|-------------------------------|-------------------------------|--------------------------|---------------------------|
| 3                 | 20                                          | 45                                      | 2.25                          | 0.15                          | 0.45                     | 0.20                      |
| 5                 | 55                                          | 125                                     | 3.75                          | 0.25                          |                          |                           |
| 6                 | 80                                          | 180                                     | 4.50                          | 0.30                          |                          |                           |
| 9                 | 180                                         | 400                                     | 6.75                          | 0.45                          |                          |                           |
| 12                | 320                                         | 720                                     | 9.00                          | 0.60                          |                          |                           |
| 18                | 720                                         | 1600                                    | 13.5                          | 0.90                          |                          |                           |
| 24                | 1280                                        | 2800                                    | 18.0                          | 1.20                          |                          |                           |

### CONTACT RATINGS

|                            |            |                                       |                                  |                                                |
|----------------------------|------------|---------------------------------------|----------------------------------|------------------------------------------------|
| Contact Arrangement        |            | Form 1A = SPST-NO    Form 1C = SPDT   |                                  |                                                |
| Contact Material           |            | Silver Alloy                          |                                  |                                                |
| Contact Rating (Resistive) |            | Form 1A = SPDT-NO                     | 0.20W<br>3A/250VAC,<br>3A/30VDC, | 0.45W<br>5A/250VAC,<br>5A/30VDC,<br>10A/125VAC |
|                            |            | SPDT                  NO              | 5A/250VAC, 5A/30VDC, 10A/125VAC  |                                                |
|                            |            | NC                                    | 3A/250VAC, 3A/30VDC              |                                                |
| Contact Resistance         |            | MAX. 100mOhm (measured at 1A, 24VDC)  |                                  |                                                |
| Operate Time               |            | MAX. 8ms                              |                                  |                                                |
| Release Time               |            | MAX. 5ms                              |                                  |                                                |
| Insulation Resistance      |            | 1000Mohm min (at 500VDC)              |                                  |                                                |
| Dielectric Strength        |            | 1000VAC 1min between open contacts    |                                  |                                                |
|                            |            | 2500VAC 1min between contact and coil |                                  |                                                |
| Shock Operation            |            | 10g                                   |                                  |                                                |
| Vibration Operational      |            | 10~55Hz 1.5mm                         |                                  |                                                |
| Ambient Temperature        |            | ~40~700°C                             |                                  |                                                |
| Humidity                   |            | 35%~95%                               |                                  |                                                |
| Operational Life           | Mechanical | 10 times 10 <sup>7</sup>              |                                  |                                                |
|                            | Electrical | 10 times 10 <sup>5</sup>              |                                  |                                                |
| Terminal                   |            | PCB                                   |                                  |                                                |
| Weight                     |            | 6g Approx                             |                                  |                                                |

### ORDERING INFORMATION

| RPR    | 1A                     | 12                                     | -1                          | S                              |
|--------|------------------------|----------------------------------------|-----------------------------|--------------------------------|
| Series | Contact Form<br>1A, 1C | Coil Voltage<br>3, 5, 6, 9, 12, 18, 24 | Nil: Sealed,<br>I: Unsealed | S: Sensitive;<br>Nil: Standard |



## UJ SERIES

## PCB AND RAILMOUNT SOCKETS AVAILABLE

| <b>UJ</b>    | <b>2</b>                            | <b>C</b>                                                      | <b>P</b>                                                  | <b>AC</b>                       | <b>220</b>                                   | <b>L</b>                    | <b>FT</b>                                                                 |
|--------------|-------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------|---------------------------------|----------------------------------------------|-----------------------------|---------------------------------------------------------------------------|
| SERIES<br>UJ | NUMBER<br>POLES<br>1<br>2<br>3<br>4 | CONTACT<br>ARRANGEMENT<br>A: SPST-NO<br>B: SPST-NC<br>C: SPDT | TERMINAL<br>STYLE<br>P: P.C. Board<br>S: Quick<br>Connect | COIL<br>INPUT<br>A: AC<br>D: DC | RATED COIL<br>VOLTAGE<br>SEE COIL<br>RATINGS | OPTION<br>L: LED<br>N: NEON | OPTION<br>FT: FLANGE<br>TOP<br>FB: FLANGE<br>BOTTOM<br>FS: FLANGE<br>SIDE |

|                                  |                            |                                                                                                                |
|----------------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Operate time</b>              |                            | 25 msec. max. (AC, DC)                                                                                         |
| <b>Release time</b>              |                            | 25 msec. max. (AC, DC)                                                                                         |
| <b>Breakdown voltage</b>         |                            | 1,000V AC (60Hz) for 1 minute between open contacts<br>1,500V AC (60Hz) for 1 minute between coil and contacts |
| <b>Insulation resistance</b>     |                            | More than 100 MΩ at 500V DC                                                                                    |
| <b>Vibration resistance</b>      |                            | 10~55 Hz at double amplitude of 1mm.                                                                           |
| <b>Shock resistance</b>          |                            | 100 m/s <sup>2</sup> Malfunction, 1000 m/s <sup>2</sup> Mechanical                                             |
| <b>Ambient temperature range</b> |                            | -40~ +70°C                                                                                                     |
| <b>Life</b>                      | <b>Mechanical</b>          | 2 x 10 <sup>7</sup>                                                                                            |
|                                  | <b>Electrical (R load)</b> | 10 x 10 <sup>4</sup>                                                                                           |
| <b>Weight</b>                    |                            | Approx 37 g                                                                                                    |

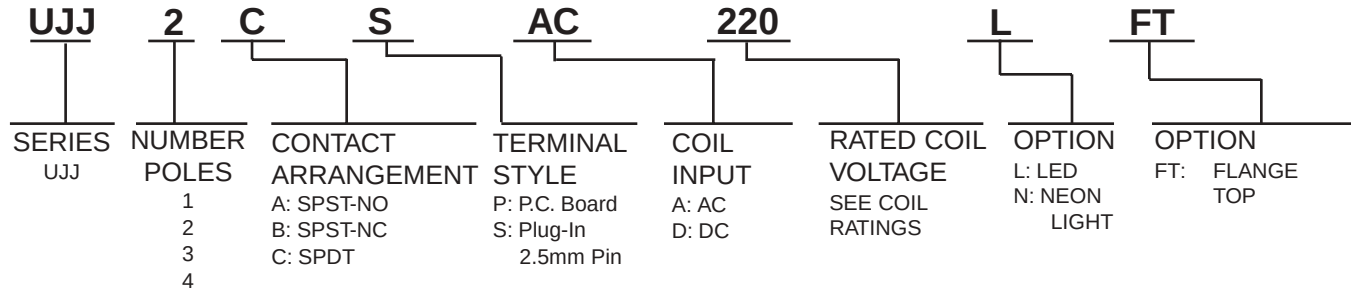
| Nominal Voltage<br>VDC | Pick-up Voltage<br>VDC | Drop-Out Voltage<br>VDC | Coil Resistance<br>$\Omega$ | Nominal Voltage<br>VAC | Pick-up Voltage<br>VAC | Drop-out Voltage<br>VAC | Coil Resistance<br>$\Omega$ |
|------------------------|------------------------|-------------------------|-----------------------------|------------------------|------------------------|-------------------------|-----------------------------|
| 5                      | 4.0                    | 0.5                     | 27.5±10%                    | 6                      | 4.8                    | 1.8                     | 11.5±10%                    |
| 6                      | 4.8                    | 0.6                     | 40±10%                      | 12                     | 9.6                    | 3.6                     | 46±10%                      |
| 12                     | 9.6                    | 1.2                     | 160±10%                     | 24                     | 19.2                   | 7.2                     | 184±10%                     |
| 24                     | 19.2                   | 2.4                     | 650±10%                     | 48                     | 38.4                   | 14.4                    | 735±10%                     |
| 48                     | 38.4                   | 4.8                     | 2600±5%                     | 120                    | 96.0                   | 36.0                    | 4550±15%                    |
| 110                    | 88.0                   | 11.0                    | 11000±15%                   | 220/240                | 176.0                  | 66.0                    | 14400±15%                   |

|      | Bottom View | P.C.B. pattern | Schematic | Outline |
|------|-------------|----------------|-----------|---------|
| UJ-1 |             |                |           |         |
| UJ-2 |             |                |           |         |

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## UJJ SERIES MINI POWER RELAYS

### ORDERING INFORMATION



### CONTACT DATA

|                            |                                 |                       |                       |                       |
|----------------------------|---------------------------------|-----------------------|-----------------------|-----------------------|
| Contact Form               | 2C, 3C                          |                       | 4C                    |                       |
| Initial Contact Resistance | 50mΩ<br>(measured at 1A, 30VDc) |                       |                       |                       |
| Contact Material           | Silver Alloy                    |                       |                       |                       |
| Contact Rating             | 5A                              | 7A                    | 3A                    | 5A                    |
|                            | 30VDC/220VAC                    |                       |                       |                       |
| Switching Capacity         | 150W/110VA                      | 210W/1540VA           | 90W/660VA             | 150W/110VA            |
| Switching Current          | 5A                              | 7A                    | 3A                    | 5A                    |
| Switching Voltage          | 125VDC/250VAC                   |                       |                       |                       |
| Electrical Life            | 2X10 <sup>5</sup> OPS           | 1X10 <sup>5</sup> OPS | 2X10 <sup>5</sup> OPS | 1x10 <sup>5</sup> OPS |
| Mechanical Life            | 2X10 <sup>7</sup> OPS           |                       |                       |                       |

### COIL DATA

|                  |                 |           |
|------------------|-----------------|-----------|
| Coil Consumption | DC: 0.9W        | AC: 1.2VA |
| Coil Voltage     | 5~110VDC        | 6~240VDC  |
| Coil Resistance  | see table below |           |

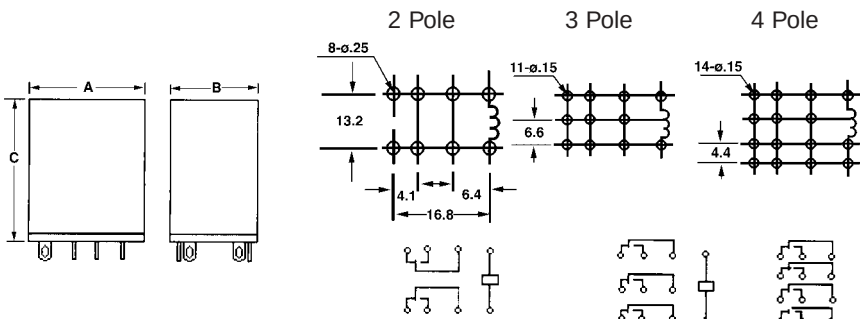
### TABLE

| Nominal Voltage VDC | Pick-up Voltage VDC | Drop-Out Voltage VDC | Coil Resistance Ω | Nominal Voltage VAC | Pick-up Voltage VAC | Drop-out Voltage VAC | Coil Resistance Ω |
|---------------------|---------------------|----------------------|-------------------|---------------------|---------------------|----------------------|-------------------|
| 5                   | 4.0                 | 0.5                  | 27.5±10%          | 6                   | 4.8                 | 1.8                  | 11.5±10%          |
| 6                   | 4.8                 | 0.6                  | 40±10%            | 12                  | 9.6                 | 3.6                  | 46±10%            |
| 12                  | 9.6                 | 1.2                  | 160±10%           | 24                  | 19.2                | 7.2                  | 184±10%           |
| 24                  | 19.2                | 2.4                  | 650±10%           | 48                  | 38.4                | 14.4                 | 735±10%           |
| 48                  | 38.4                | 4.8                  | 2600±5%           | 120                 | 96.0                | 36.0                 | 4550±15%          |
| 110                 | 88.0                | 11.0                 | 11000±15%         | 220/240             | 176.0               | 66.0                 | 14400±15%         |

\* When requiring pull-in voltage <80% of nominal voltage, special order.

### DIMENSIONS

| Series | A    | B    | C  |
|--------|------|------|----|
| UJ1    | 27.6 | 21.5 | 34 |
| UJ2    | 27.6 | 21.5 | 36 |
| UJ3    | 27.6 | 21.5 | 36 |
| UJ4    | 27.6 | 21.5 | 36 |



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## CONTACT

### (1) Contact arrangement

Denotes the contact switching combinations available on a relay and are defined in terms of number of poles, number of throws (single or double), normal position (open or close), and the sequence to make and break.

Fundamental contact arrangements are given in Table 1.

### (2) Contact type

The one structure of contact forming the contact parts, Single contact and Bifurcated contact are offered.

### (3) Contact material

The contacts are fastened to the movable leaf spring and stationary terminal to ensure electrical contact. Usually they are made of materials that mainly consist of silver because of its high electrical and thermal conductivity. For small-current loads, the gold-plated or the gold-overlay silver contacts are generally used.

### (4) Contacting

The typical power, voltage or current, which a relay can turn on and off under specified conditions of load, ambient temperature and humidity. Usually, the contact rating refers to resistive load.

### (5) Max. switching power

The upper limit of power which can be switched by the contacts. This value will be lower than the product of the maximum voltage and the maximum current. Care should be taken not to be exceed this value.

### (6) Max. switching voltage

The maximum open circuit voltage which can safely be switched by the contacts. AC and DC voltage maximums will differ in most cases.

### (7) Max. switching current

The maximum current which can safely be switched by the contacts. AC and DC current maximums may differ.

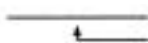
### (8) Min. switching current

The minimum value of current that can be reliably switched by the contacts.

### (9) Contact resistance

The electrical resistance of closed contacts measured at their associated terminals.

**Table 1 Fundamental contact arrangement**

| Form | Description      | Symbol                                                                             | Performance                                                                          |
|------|------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| A    | Make (NO)        |  | The combination in which the contacts are open in normal or unoperated position.     |
| B    | Break (NC)       |  | The combination in which the contacts are closed in the unoperated position.         |
| C    | Transfer (BBM)   |  | The combination in which Form B (NC) contact open before Form A (NO) contacts close. |
| D    | Continuous (BBM) |  | The combination in which Form A (NO) contact close before Form B (NC) contacts open. |

Note: 1. Abbreviations used to define the nature of the contacts are as follows:

NO: Normally open      M: Make      BBM: Break before Make  
 NC: Normally closed      B: Break      MBB: Make before Break

2. Double switching combinations are called 2 Form A (2A) or 2 Form C (2C).

3. The following abbreviations are used occasionally.

SP: Single pole      ST: Single throw  
 DP: Double pole      DT: Double throw

Ex. SPST NO : 1 Make      (1 Form A or 1a)  
 SPST NC : 1 Break      (1 Form B or 1b)  
 SPDT : 1 Transfer      (1 Form C or 1c)  
 DPDT : 2 Transfer      (2 Form C or 2c)  
 4 PDT : 4 Transfer      (4 Form C or 4c)

## COIL

### (1) Nominal voltage

A single value of voltage intended to be applied to the coil.

### (2) Nominal power

The value of power used by the coil at nominal voltage. For DC coils, expressed in Watts.

$$\text{Nominal power} = \frac{V^2}{R}$$

V: Nominal Voltage

R: Coil Resistance (at 20°C)

### (3) Coil resistance

The resistance of the coil for temperature conditions listed in the catalog. (usually at 20°C/68°F)

### (4) Pick-up (Set) voltage

When the coil voltage is increased gradually from 0V, the relay will operate at a certain voltage. This voltage is called the Pick-up voltage. The Pick-up voltage in the catalog shows the maximum value. In case of latching relay, the Pick-up voltage is called the Set Voltage.

### (5) Drop-out (Reset) voltage

When the coil voltage on an operate relay is decreased gradually, the relay will release at a certain voltage. This voltage is called the Drop-out voltage. The Drop-out Voltage in the catalog shows the minimum value. In case of latching relay, the Drop-out voltage is called the Reset voltage, when the reverse voltage is increased on the coil of operate relay, the voltage which the relay will release.

### (6) Operating power

The value of power used by the coil at Pick-up voltage

### (7) Max. continuous voltage

The maximum value of voltage that can be applied continuously to the coil without causing damage.

### (8) Operating function

#### • Single side stable type:

Relay which turns on when the coil is energized and turns off when de-energized.

#### • 1 Coil latching type:

Relay with a latching construction that can maintain the on or off state with a pulse input. With one coil, the relay is set or reset by applying signals of opposite polarities.

#### • 2 Coil latching type:

Relay with a latching construction composed of 2 coils, set coil and reset coil. The relay is set or reset by alternately applying pulse signals of the same polarity.

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## MAIN POINTS TO SELECT SUITABLE RELAY

A relay may meet with a variety of ambient conditions during actual usage. In order to avoid unexpected failure in result, testing over practical range under actual operating condition is required. For proper use of relays, the characteristics of the selected

relay should be well known, and the conditions of relay use has to be investigated to determine whether they are matched to the environmental conditions. In addition, the coil conditions, contact conditions, and the ambient conditions for the relay that is actu-

ally used must be sufficiently known in determining the relay specifications. The table below shows a summary of points of consideration for relay selection. It may be used as a reference for investigation of items and points of caution.

**Table 2. Main Points to Select Relays**

| Item        | Specification Points                                                    | Consideration Points                                                                                |
|-------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Contact     | Contact arrangement                                                     | Contact forms, number of poles, Contact sequence                                                    |
|             | Contact load                                                            | Level of load, AC or DC, resistive or inductive or capacitive, counter voltage of inductive load    |
|             | Contact material                                                        | Contact material should be matched to the level of load                                             |
|             | Life                                                                    | Number of operations, Frequency in switching                                                        |
| Coil        | Coil voltage                                                            | Nominal voltage, power source ripple                                                                |
|             | Pick-up and Drop-out voltage                                            | Fluctuation in supply voltage, Rise in Pick-up and Drop-out voltage due to the coil resistance rise |
|             | Coil resistance                                                         | Power consumption of coil. Increase of resistance due to the coil temperature rise                  |
|             | Temperature rise                                                        | Ambient temperature and coil temperature rise according to the applied voltage.                     |
| Insulation  | Dielectric strength<br>Surge withstand voltage<br>Insulation resistance | Do specifications of the relays match that required in the equipment?                               |
| Environment | Ambient temperature and humidity                                        | Range of ambient temperature and humidity in the use location.                                      |
|             | Vibration and shock                                                     | Level of vibration and shock in the use location.                                                   |
|             | Ambient atmosphere                                                      | No presence of gas which may cause contact failure.                                                 |
| Others      | Mounting method                                                         | The method of flux coating, soldering, washing and mounting                                         |
|             | Cover                                                                   | Material of cover (compatibility with washing solution)                                             |
|             | Relay construction                                                      | Sealed or non-sealed type relays                                                                    |
|             | Special condition                                                       | Are there any special conditions?                                                                   |

## CONTACT

### (1) Contact load

The phenomena in the contacts of relays greatly vary depending on contact load level such as kind of load and current level as well as contact material and size, opening speed and contact bounce.

#### • Switching current

AC current is alternately reduced to zero but DC current is not, so the arc discharge current at breaking of load current is hard to be extinguished for DC current. Therefore the duration of the arc discharge is longer in DC circuit than AC circuit and the maximum DC switching current is smaller than AC load.

#### • Resistive load

Resistive load is a standard load in life tests and the contact ratings in catalogue are usually specified with resistive load. In resistive load circuit, it is assumed that there is no inrush or counter breaking current on switching of loads.

#### • Inductive load

Inductive loads such as electromagnetic relay, solenoids and motors easily generate a high counter voltage between their coils and cause arc discharge across the relay contacts.

Because the level of inductive load is affected by the load current and the power factor (cos $\phi$ ), the life is decreased when the power factor is lowered.

In circuit with load such as motor, solenoid, transformer and others, an inrush current

of several times larger than the steady current is generated at the time of connecting the load.

It is necessary to select the contact that has a sufficient capacity for the conditions.

#### • Capacitive load

In a capacitive load circuit, an inrush current of 20 to 40 times larger than the steady state current is produced. A surge suppressor should be used to prevent contact welding.

**Table 3. Typical Load and Inrush Current**

| Kind of Load           | Inrush current                              |
|------------------------|---------------------------------------------|
| Resistive load         | Steady state current                        |
| Solenoid load          | 10 ~ 20 times of the steady state current   |
| Motor load             | 5 ~ 10 times of the steady state current    |
| Incandescent lamp load | 10 ~ 15 times of the steady state current   |
| Mercury lamp load      | Approx. 3 times of the steady state current |
| Condenser load         | 20 ~ 40 times of the steady state current   |
| Transformer load       | 5 ~ 15 times of the steady state current    |
| Contact load           | 3 ~ 10 times of the steady state current    |

### (2) Contact material

Relay contacts must be made from material that allows contact resistance to be low and stable, that is not quickly worn by the arc, and that has a high fusing point. At present there is no material that meets these conditions, and it appears unlikely that one will be found in the near future.

### (3) Low level circuit

Circuits with several volts and several mA or less are called low-level circuits. At low levels, silver contacts form an oxide or sulfide film on their surface under certain conditions, which makes contact resistance unstable.

If the circuit impedance is high, although the high contact resistance itself does not cause problems, the noise is easily produced.

To maintain stability of contact resistance in a sulfurating atmosphere, contacts of gold overlaid on silver-palladium are effective.

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## COIL

### (1) Coil voltage of DC relay

For the operation of DC relays, standards exist for power source voltage, with DC voltage standards set at 5, 6, 9, 12, 24 and 48. Because of the gradual increase or decrease of the current impressed on the coil causing possible delay in movement of the contacts, there is a possibility that the specified contact capacity may not be satisfied. So, consideration should be given to the method of applying voltage on the coil.

### (2) Power source fluctuation

As a power source for DC relays, a battery or either a half or full wave rectifier circuit with smoothing capacitor is used.

The characteristics with regard to the excitation voltage of the relay will change depending on the type of power source, and thus, in order to display stable characteristics, the most desirable method is perfect DC.

In the case of ripple included in the DC power source, if the smoothing capacitor is too small, humming develops and unsatisfactory condition is produced, due to the influence of the ripple.

This ripple is calculated using the formula described in Fig. 4 and it is necessary to give consideration to use of a power source with less than a 5% ripple.

### (3) Coil resistance

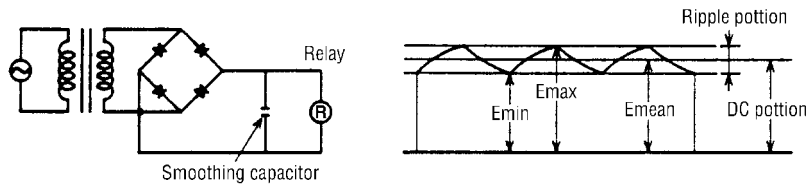
The resistance of coil is specified according to the nominal voltage of the relay. Generally, the nominal value of coil resistance is that at 20°C (68°F) and the allowable range is limited to within ±10%.

ed to within ±10%.

The resistance/temperature relationship for copper wire is about 0.4% for 1°C, and with this ratio, the coil resistance increases.

In order to operate the relay, the voltage necessary, becomes higher than the specified voltage accompanying the rise in the coil resistance.

Fig. 4. Ripple factor of rectifier circuit



$$\text{Ripple factor} = \frac{E_{\text{max}} - E_{\text{min}}}{E_{\text{mean}}} \times 100 (\%)$$

E max. = Maximum value of ripple portion

E min. = Minimum value of ripple portion

E mean = Average value of ripple portion

## PERFORMANCE

### (1) Contact resistance

#### (a) Contact wipe

The contact resistance of clean surface is extremely low, such as several mΩ. In practice, some kind of film is formed on to almost all of the contact surfaces and the contact resistance varies depending on the properties of that film.

To clean such film and stabilize contact resistance, distance of the contact wipe is increased.

When contacts open and close, the contacted surfaces slid together, thus effecting a breakage of nonconductive film formed on the contact surfaces.

#### (b) Contamination of contact surface

The possible causes of contamination that effects increases in contact resistance are as follows.

- Adherence of fiber, scale and particles of plastic mold, etc.
- Adherence of silicone oxides.
- Adherence and deposits of non-conducting material produced through a chemical reaction with the gas absorbed onto the contact face.
- Adherence and deposits of carbon powders produced at contact surface.
- Oxidation and sulfuration of metallic powders on the contact surface.

#### (c) A bifurcated contact is contaminated

The bifurcated spring is cut deeply enough and separated so as to provide a good independence in a contact even when some insulating particle is trapped between the contact on one side.

In this case, the contact of the other side can

serve to maintain a good contact, with the sufficient mechanical independence between the two members. So, the bifurcated contacts have successfully reduced contact failures.

#### (d) Sealed relay

Sealed relays are available. This feature excludes the ingress of organic gases and dust in atmosphere and allows immersion cleaning.

When a sealed type relay switches the load in the presence of organic gases inside relay, it produces carbon powders on the contacts which create rise of contact resistance and acceleration of contact consumption. In order to avoid such problems, the constituent components are annealed for physical and chemical stability. This annealing process drives off residual volatiles in the plastics, insuring a contaminant free environment inside the sealed relay, resulting in more stable contact resistance over life.

### (2) Coil

#### • Nominal Coil Voltage (Rated Coil Voltage)

A single value voltage intended by design to be applied to the coil or input.

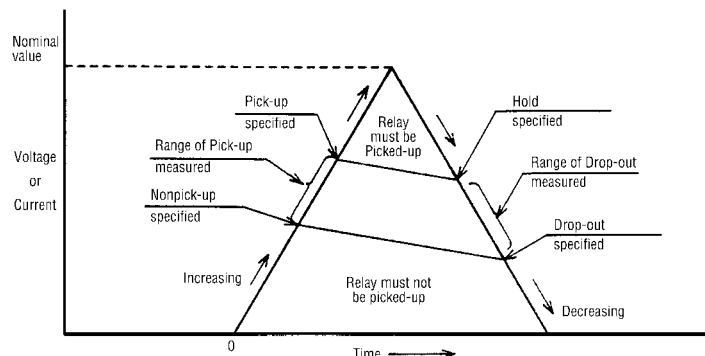
#### • Pick-up Voltage (Pull-In Voltage or Must Operate Voltage)

When the voltage on an unoperated relay is increased, the value at or below which all contacts must function (transferred). The pick-up voltage is generally assigned to 70% of nominal coil voltage so that the relay can function without failure owing to fluctuation of voltage supplied, ambient temperature raise and irregularity of coil resistance.

#### • Drop-out Voltage (Release or Must Release Voltage)

When the voltage on an operated relay is decreased, the value at or above which all contacts must revert to their unoperated position. The drop-out voltage is generally assigned to 10% of nominal coil voltage. Figure 5 shows the relationship between Pick-up Voltage and Drop-Out Voltage.

Fig. 5. Relationship of Relay Performance





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## PERFORMANCE

### (3) Coil temperature rise

When voltage is applied to a coil, its temperature increases due to Joule heat. Coil temperature rise can be calculated from the temperature coefficient of the copper wire by measuring the coil resistance. The coil temperature rise can be obtained by the next expression.

$$T = T_2 - T_a = \frac{R_2 - R_1}{RI} (K + T_1) + T_1 - T_a$$

where, T: Coil temperature rise (°C)

T<sub>1</sub>: Initial ambient temperature (°C)

T<sub>2</sub>: Coil temperature after the test (°C)

T<sub>a</sub>: Ambient temperature after the test (°C)

R<sub>1</sub>: Coil resistance at T<sub>1</sub> °C (Ω)

R<sub>2</sub>: Coil resistance at T<sub>2</sub> °C (Ω)

K: Constant (= 235 for copper wire)

however,  $|T_1 - T_a| \leq 5$  (°C)

### (4) Hot coil and Cool coil

The coil temperature with no voltage applied on the coil is usually to be equal to the ambient temperature. When voltage is applied to the coil, the coil temperature rises, increasing both coil resistance and pick-up voltage. The coil with its temperature rise due to voltage impression is called a Hot Coil. To the contrary, when no voltage is impressed on coil, the coil temperature of which is equal to ambient temperature, is called a Cool Coil.

In general, the values for characteristics such as pick-up voltage, drop-out voltage and so on are measured at the ambient temperature of 20°C 68°F, Cool Coil conditions. For the Hot Coil, because of its pick-up voltage rise, there is a possibility that it may not operate under the same conditions as Cool Coil. Thus, care is required.

### (5) Operating range

#### (a) Maximum continuous voltage

The maximum voltage that can be applied continuously to the coil without causing damage. When a voltage greater than the maximum continuous voltage is applied to the coil (layers may short) the coil may burn out, due to the temperature rise. Do not exceed the usable operating range shown in the Fig. 7.

#### (b) Pick-up voltage

As the ambient temperature rises, the coil resistance increases, pick-up voltage. Figure 7, line B refers to the relationship. The upper

Coil temperature rise

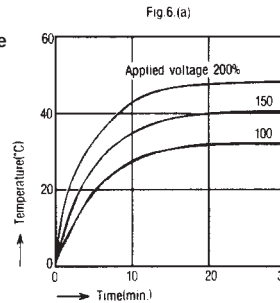
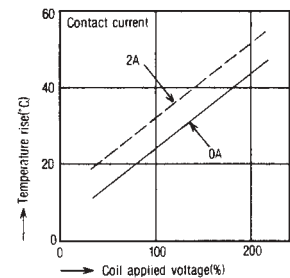


Fig.6 (b)

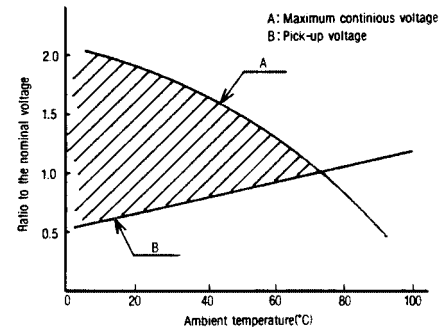


**Figure 6(a)** shows the duration characteristics. **Fig. 6(b)** shows the voltage characteristics in a steady state at constant supply voltage.

portion of line-B in Fig. 7 shows the range of voltage which can be applied to the coil. Line-A is maximum continuous voltage. Thus the relay operating range is the portion surrounded by line A and B.

In order to have stable operation of relay, the APP voltage and the ambient temperature should be in the operating range. If the ambient temperature increases, pick-up voltages rises, while maximum continuous voltage decrease. Care is required.

**Fig. 7 Operating range**

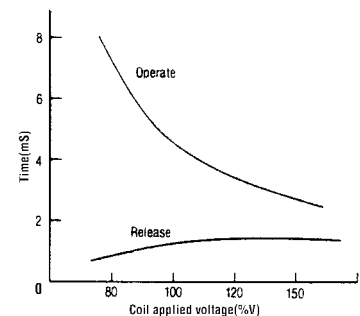


### (6) Operate time and Release time

There is variation in Operate time and Release Time depending upon voltage/power applied to coil.

Figure 8 shows an example of relationship between Operate Time and Release Time. Figure 8 refers to the phenomenon that according to the fluctuation of coil impressed voltage, Operate Time greatly varies, while Release Time is small. To the extent of large coil impressed voltage, the Operate Time is rapid, but if it is too rapid, the make contact bounce time may be extended.

**Fig. 8 Operate and Release time**



### (7) Safety standards

Laws and regulations demand securing the safety of users from dangers such as electric shock and fire lying around household appliances and other consumer electric equipment or devices.

Major industrial countries across the world already have their own safety standards such as those under control of 'The Electrical Appliance and Material Control Law' in Japan, UL in U.S. .A., CSA in Canada, VDE in Germany, SEMKO in North Europe and BS in GB.

## AMBIENT ENVIRONMENT

### (1) Silicone compound atmosphere

Silicone compounds such as silicone rubber, silicone paint, silicone grease, etc. emit volatile silicone gas. Note that when silicone is used near relays, switching contacts in the presence of its gas causes silicon to adhere to the contacts and may result in contact failure. In this case, use a substitute that is not silicone based. If the use of silicone com-

pound is inevitable, use a plastic-sealed relay.

### (2) Influence of external magnetic field

When transformers, speakers or magnets are located near a relay the characteristics may change and faulty operations may result due to the strong magnetic field generated from the equipment.

The influence depends on the strength of the magnetic field and it should be checked at the installation. In such a case suitable measures such as magnetic shielding or selection of adequate in arrangement of relay should be taken so as to avoid problems.

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### MOUNTING OF RELAYS

#### (1) Mounting direction

Mounting direction is important for optimum relay characteristics.

#### (2) Shock and vibration resistance

It is ideal to mount the relay so that the movement of contacts and armature is perpendicular to the direction of vibration or shock, as shown in Fig. 10.

#### (3) Contact reliability

It is recommended to mount the relays so that the surfaces of its contacts are vertical and in Lipper location of relay inside. Such mounting methods prevent dirt and dust as well as scattered contact material (produced due to large loads from which arcs are gen-

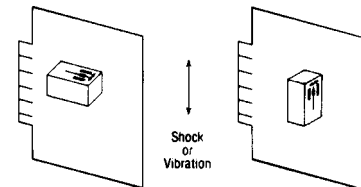
erated) and powdered metal from adhering to them. Furthermore, it is not desirable to switch both a large load and a low level load with a single relay. The scattered contact material produced when switching large load adheres to the contacts when switching the low level load and may cause contact failure. Therefore, avoid mounting the relay with its low level load contacts located below the large load contacts.

#### (4) Adjacent mounting

When many relays are mounted close together, abnormally high temperatures may result from the combined heat generated. Mount relays with sufficient spacing

between them to prevent heat buildup. This also applies when a large number of boards mounted with relays are installed as in a card rack. Be sure the ambient temperature of the relays does not exceed the value listed in the catalog.

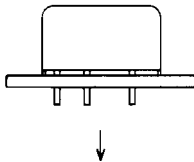
Fig 10. Direction of relays



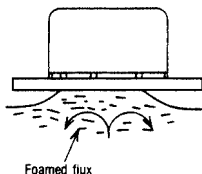
### RELAY SOLDERING AND WASHING GUIDELINES

#### Process

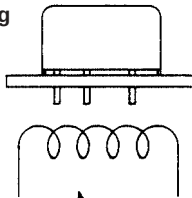
##### 1. Mounting of relay



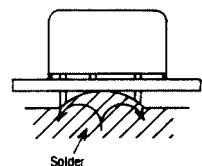
##### 2. Flux coating



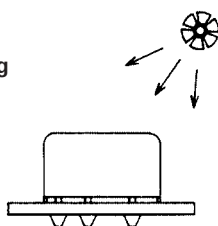
##### 3. Preheating



##### 4. Soldering



##### 5. Cooling



#### Guidelines

- Avoid bending and terminals to make the relay self-clinching. Relay performance cannot be guaranteed if the terminals are bent.

- Adjust the position of the PC board so that flux does not overflow onto the top of it.
- Use rosin-based flux, which is non-corrosive and requires no washing.
- Do not use Automatic Flux Coating Method to dust-cover type relays.
- Do not overflow onto the top of PC Board, in such a case, the flux may even penetrate a flux-resistant type relay.

- Be sure to preheat before soldering.
- Preheating acts to improve solderability.
- Preheat according to the following conditions.

|             |                        |
|-------------|------------------------|
| Temperature | 100°C 212°F or less    |
| Time        | Within approx.1 minute |

- Note that long exposure to high temperatures (e.g. due to a malfunctioning unit) may affect relay characteristics.

#### Automatic Soldering

- Flow solder is the optimum method for soldering.
- Adjust the level of solder so that It does not overflow onto the top of the PC board.
- Unless otherwise specified, solder under the following conditions depending on the type of relay.

|                    |                          |
|--------------------|--------------------------|
| Solder Temperature | Approx. 250°C 482°F      |
| Soldering Time     | Within approx. 5 seconds |
| Solder Ratio       | Sn/Pb = 60/40 or 63/37   |

#### Hand Soldering • Keep the tip of the soldering iron clean.

|                      |                          |
|----------------------|--------------------------|
| Solder Iron          | 30W to 60W               |
| Iron Tip Temperature | Approx. 300°C 572°F      |
| Solder Time          | Within approx. 3 seconds |

- Immediate air cooling is recommended to prevent deterioration of the relay and surrounding parts due to soldering heat.
- Although the sealed type relay can be cleaned, avoid immersing the relay into cold liquid (such as washing solvent) immediately after soldering. Doing so may deteriorate the sealing performance.

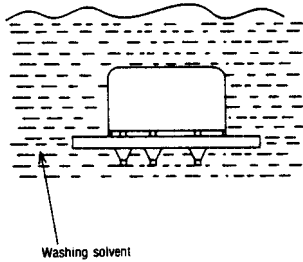


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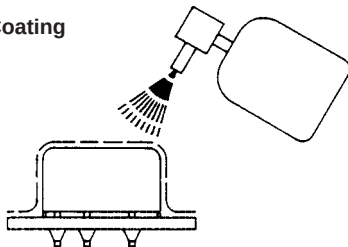
## RELAY SOLDERING AND WASHING GUIDELINES

### Process

#### 6. Washing



#### 7. Coating



### Guidelines

- Do not wash flux-resistant type relays and dust cover type relays by immersion.
- Careless washing may cause washing solvent to penetrate the relay.
- Plastic sealed type relays can be washed by immersion. Use washing solvents shown in Table 6.
- Use of other washing solvents may damage the relay case and cover, and also cause washing solvent to penetrate the relay.
- Avoid ultrasonic washing on relays. Use of ultrasonic cleaning may cause breaks in the coil or slight sticking of contacts due to the ultrasonic energy.

Table 6. Washing solvent compatibility chart for sealed relays

| Washing solvent |                                                                                   |
|-----------------|-----------------------------------------------------------------------------------|
| Chlorinated     | Chlorothene VG, N<br>Trichloroethylene<br>Perchloroethylene<br>Methylene chloride |
| Alcohol         | Ethanol<br>IPA                                                                    |
| Aqueous         | Hollis 310<br>Indusco 624, 1000<br>Lonco Terg                                     |

- If the PC board is to be coated to prevent the insulation of the PC board from deteriorating due to corrosive gases and high temperature, note the following.
  - Do not coat dust-cover type relays and flux-resistant type relays.
  - Depending on the type, some coating materials may have an adverse affect on relays, select coating materials carefully.

## RELAY TERMINOLOGY: PERFORMANCE

### (1) Operate (Set) time

Time from initial energization to the first opening of closed contact or first closing of open contact. This time does not include any bounce time. In case of latching relays, this is called "Set time". (cf. Fig. 1.)

### (2) Release (Reset) time

Time from initial de-energization of the relay coil to first opening of closed contact or first closing of open contact. This time does not include any bounce time. In case of latching relays, this is called "Reset time".

This means the time from initial reverse energization of the coil to first opening of closed contact or first closing of open contact. (cf. Fig. 1.)

### (3) Bounce time

Internally caused intermittent and undesired opening of closed contact or closing of open contacts of a relay. (cf. Fig. 1)

### (4) Dielectric strength

The maximum allowable AC (RMS) voltage (50/60 Hz) which may be applied between two specified test points, usually for 1 minute in duration. In general, the maximum leak current is 1 mA.

### (5) Surge withstand voltage

The maximum allowable peak surge voltage which may be applied between two specified test points.

Usually, wave form of this test is specified indicating peak value, rise time and fall time. (cf. Fig. 2.) In FCC Part 66, T1 = 10  $\mu$ S, Vp 1500V are specified.

### (6) Insulation resistance

The resistance between all mutually insulated conducting sections of the relay. This value changes depending on the ambient temperature and humidity.

Fig. 1 Typical time traces of relay

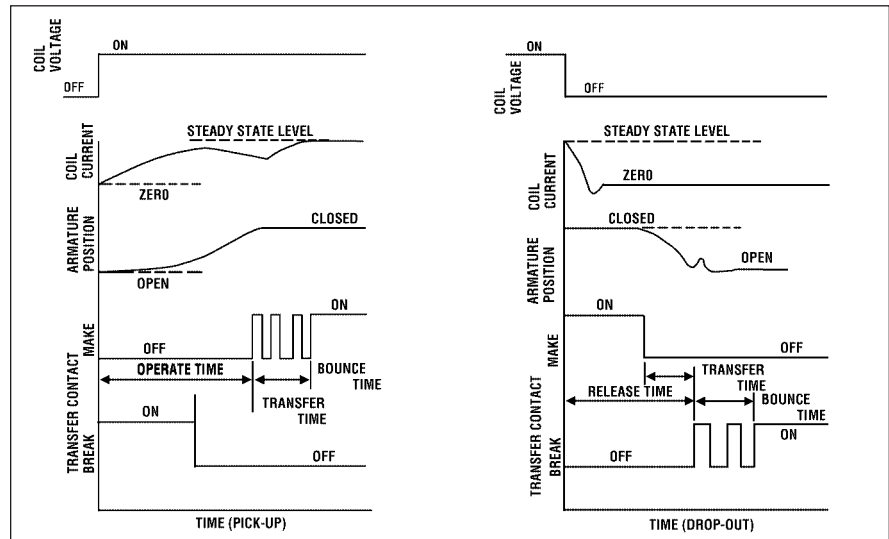
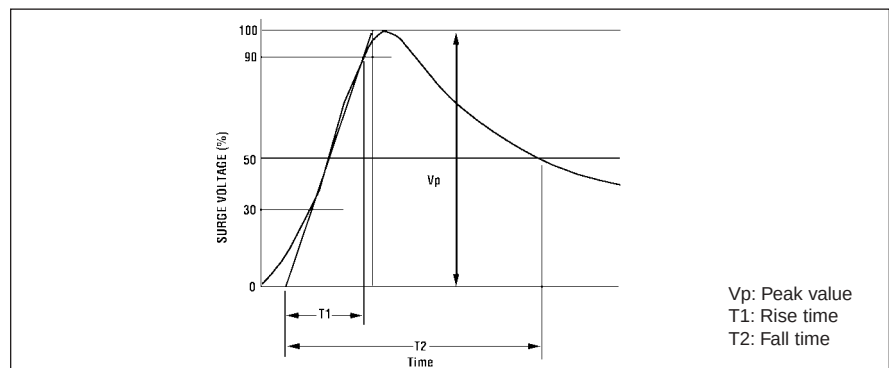


Fig. 1 Wave form of Surge test



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## RELAY TERMINOLOGY: PERFORMANCE

### (7) Capacitance

The electrostatic capacitance between mutually insulated conducting sections of the relay. Usually this value is measured at 1 kHz.

### (8) Life

#### • Mechanical life

The minimum number of operations which the relay can be operated under nominal conditions with no load on the contacts.

#### • Electrical life

The minimum number of operations which the relay can be operated under nominal conditions with specified load on the contacts.

### (9) Vibration resistance

The resistance to the vibration applicable to the relay, expressed as a displacement and frequency range.

#### • Functional

The vibration which can be applied to the relay during service without causing the openings of the closed contacts for more than the specified time.

#### • Destructive

The vibration which can be allowed by the relay during shipping, installation, without damages and changes in its operating characteristics.

### (10) Shock resistance

The resistance to the shock applicable to the relay, expressed as an acceleration in G.

#### • Functional

The shock can be applied to the relay during service without causing the openings of the closed contacts for more than the specified time.

#### • Destructive

The shock which can be allowed by the relay during shipping, installation, without damage and changes in its operating characteristics.

### (11) Temperature range

The range of ambient temperature in which the relay can be used without damages in its characteristics or functions.

### (12) Safely standard

Standard for the prevention of electric shock hazards and fire accidents differs in content from country to country.

UL (U.S.A.),

SEMKO (Sweden),

BS (G.B.)

VDE (Germany)

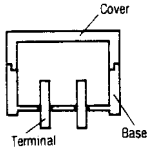
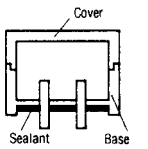
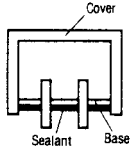
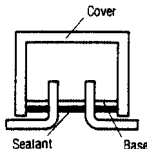
CSA (Canada)

### (13) Structure of relays

Relays are classified in 4 types as Fig. 3 by the structure of terminals, cover and case, and mounting method of the relay.

Fig. 3. Structure of relays

(Y: Yes N: No)

| Item                         | Dust cover Type                                                                                  | Flux Free Type                                                                                                         | Sealed Type                                                                          | Surface Mount Type                                                                                                                                           |
|------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Structure                    |                |                                      |  |                                                                          |
| Characteristics              | Most basic construction and there is gap between cover and base, and between base and terminals. | Terminals are sealed with base by sealant. The joint level between cover and base is higher than the PC board surface. | All the gaps between case and base, base and terminals are sealed by sealant.        | All the gaps between case and base, base and terminals are sealed by sealant. Terminals are formed in "L" shape intended to be soldered by reflow soldering. |
| Mounting Method              | Insertion mounting                                                                               | Insertion mounting                                                                                                     | Insertion mounting                                                                   | Surface mounting                                                                                                                                             |
| Automatic Flux Coating       | N                                                                                                | Y                                                                                                                      | Y                                                                                    | Y                                                                                                                                                            |
| Automatic Soldering          | N                                                                                                | Y                                                                                                                      | Y                                                                                    | Y                                                                                                                                                            |
| Automatic Washing            | N                                                                                                | N                                                                                                                      | Y Note 1                                                                             | Y Note 1                                                                                                                                                     |
| Manual Soldering             | Y                                                                                                | Y                                                                                                                      | Y                                                                                    | —                                                                                                                                                            |
| Environmental Gas Resistance | N                                                                                                | N                                                                                                                      | Y Note 2                                                                             | Y Note 2                                                                                                                                                     |

Note 1. It is needed to select suitable washing solvent.

2. In explosive gas environment, use the metallic hermetic seal types.

# High Reliability Supported by Uniques Technology

## Deactivated Rhodium Contact:

OKI reed switches are highly reliable because rhodium is used as the contact material. Rhodium has two excellent features as the contact material: Extreme hardness, which improves the resistance against sticking; and a high melting point, which greatly reduces the contact surface consumption due to Joule heat or arc discharge affected by the current, and also improves the resistance against sticking. However, being a platinum metal, the surface of rhodium has active absorption and catalytic actions. Rhodium plating greatly absorbs organic impurities and forms a polymer in the course of operation, increasing contact resistance as shown in Fig. 21. This is especially noticeable a lower load level operation. OKI has developed a unique oxygen treatment method to deactivate the rhodium surface, in which organic impurities adhered to the surface are burned with oxygen and oxygen molecules are selectively absorbed to

produce a stabilized contact resistance. This unique method won the highest prize (Schneider Award) on the occasion of the 21st Annual National Relay Conference held in Oklahoma, U.S.A. in 1973. Patents have been obtained not only in Japan (Pat. No. 916386) but also in U.S.A. (Pat. No. 3857175) and West Germany (Pat. No. 2303587).

## Automatic Sealing:

Sealing, the moment when a pressed and plated reed contact and a glass tube are united to form a reed switch, is the most important stage in the manufacturing process requiring strict control of conditions. At this stage, the working temperature reaches approx. 1,000°C causing evaporation of impurities from the glass tube and contamination and damage of the contact part of the reed switch. To prevent this, OKI has imposed severe standards on the selection of materials, and established a unique automatic

sealing method. By thus improving the manufacturing process, OKI is able to produce reed switches of the highest quality.

## Flux Scanning Method:

In spite of severe control of the sealing process, there is a slight probability that foreign matter such as magnetic particles may enter the glass. After extensive study in the detection of micro impurities, OKI has adopted the highly reliable flux scanning method. In flux scanning, as shown in Fig. 22, external magnetism is moved so that foreign matter near the reed is forced to jump to the contact part. The contact resistance then measured is used as the standard for the selection of characteristics. We have thus succeeded in remarkably improving the reliability of reed switches by replacing conventional visual checking with the latest flux scanning method.

Fig. 21

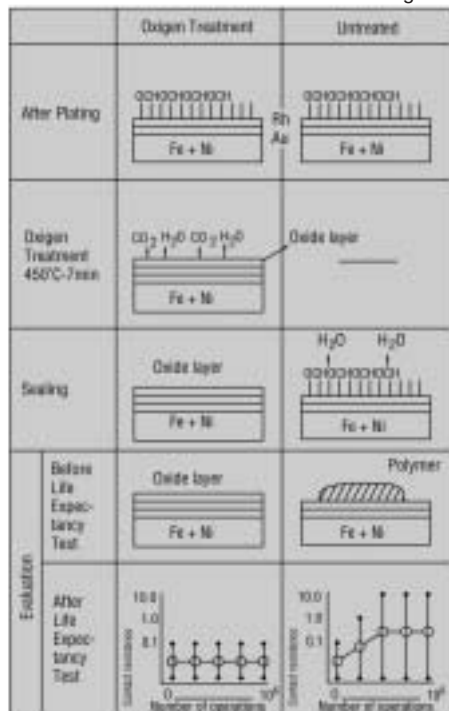
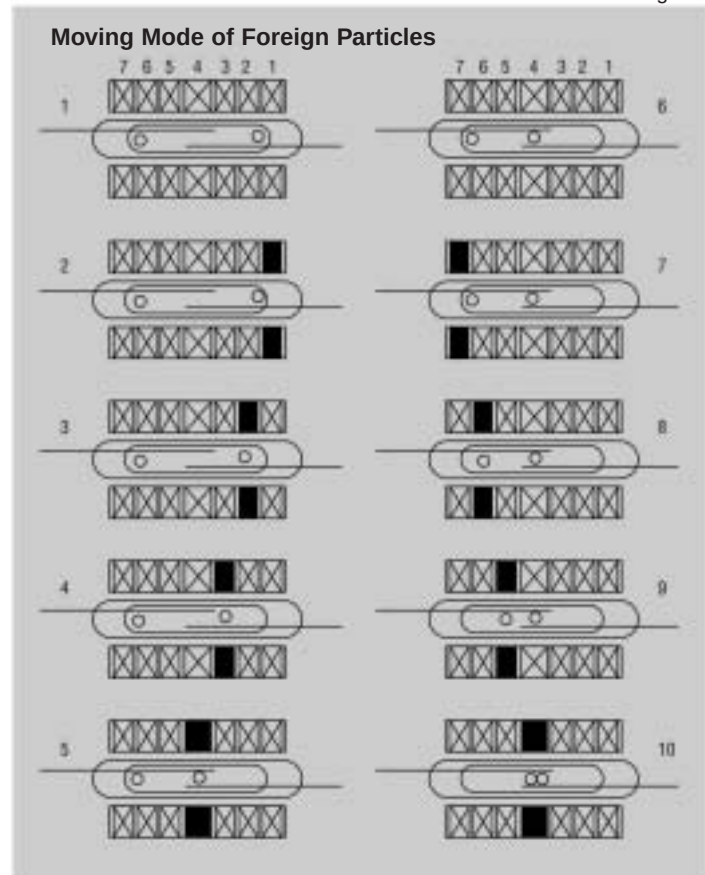


Fig. 22

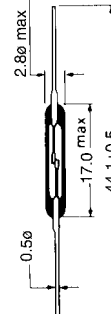
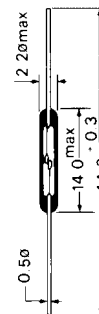
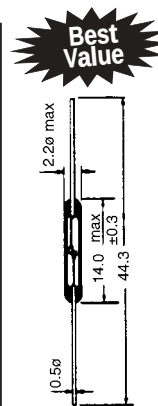
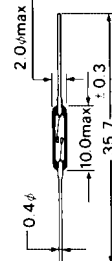
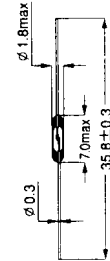


# Specifications

UL File E70063

See following pages for technical quality control support (or reliability data).

Actual dimensions  
All dimensions are in mm.



|                                       |                                            | ORD213                  | ORD211                  | ORD9216                           | ORD228                            | ORD9215                           |
|---------------------------------------|--------------------------------------------|-------------------------|-------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| <b>Electrical</b>                     | Contact                                    | 1A                      | 1A                      | 1A                                | 1A                                | 1A                                |
| <b>Characteristics</b>                | Pull-in Available in $\pm 5$ AT ranges     | 10 ~ 40                 | 10 ~ 40                 | 10 ~ 50                           | 10 ~ 50                           | 10 ~ 50                           |
|                                       | Drop-out [AT]                              | 5 min.                  | 5 min.                  | 5 min.                            | 5 min.                            | 4 min.                            |
|                                       | Contact resistance (Initial) [m $\Omega$ ] | 200 max.                | 100 max.                | 100 max.                          | 100 max.                          | 150 max.                          |
|                                       | Breakdown voltage [DCV]                    | 150 min.                | 150 min.                | 200 min.                          | 200 min.                          | 200 min.                          |
|                                       | Insulation resistance [ $\Omega$ ]         | $10^9$ min.             | $10^9$ min.             | $10^9$ min.                       | $10^9$ min.                       | $10^9$ min.                       |
|                                       | Electrostatic capacitance [pF]             | 0.4 max.                | 0.2 max.                | 0.3 max.                          | 0.3 max.                          | 0.3 max.                          |
|                                       | Contact rating [VA, W]                     | 1.0                     | 1.0                     | 10                                | 10                                | 10                                |
|                                       | Maximum switching voltage [V]              | AC 24 / DC 24           | AC 24 / DC 24           | AC 100 / DC 100                   | AC 100 / DC 100                   | AC 100 / DC 100                   |
|                                       | Maximum switching current [A]              | DC 0.1                  | DC 0.1                  | DC 0.5                            | DC 0.4                            | 0.3                               |
|                                       | Maximum carry current [A]                  | 0.3                     | 0.3                     | 1.0                               | 1.0                               | 1.0                               |
| <b>Operating</b>                      | Operating time [ms]                        | 0.3 max.                | 0.3 max.                | 0.3 max.                          | 0.3 max.                          | 0.4 max.                          |
| <b>Characteristics</b>                | Bounce time [ms]                           | 0.3 max.                | 0.3 max.                | 0.3 max.                          | 0.3 max.                          | 0.4 max.                          |
|                                       | Release time [ms]                          | 0.05 max.               | 0.05 max.               | 0.05 max.                         | 0.05 max.                         | 0.05 max.                         |
|                                       | Resonant frequency [Hz]                    | $1100 \pm 500$          | $7500 \pm 500$          | $5000 \pm 400$                    | $5300 \pm 300$                    | $3700 \pm 300$                    |
|                                       | Maximum operating frequency [Hz]           | 500                     | 500                     | 500                               | 500                               | 500                               |
| <b>Standard coil</b>                  | Coil resistance [ $\Omega$ ]               | 600                     | 600                     | 450                               | 450                               | 450                               |
|                                       | No. of turns [T]                           | 5000                    | 5000                    | 5000                              | 5000                              | 5000                              |
|                                       | Dimensions [mm]                            | $3.3\phi \times 10$     | $3.3\phi \times 10$     | $3.7\phi \times 15$               | $3.7\phi \times 15$               | $3.7\phi \times 15$               |
|                                       | Type No.                                   | 8                       | 8                       | 6                                 | 6                                 | 6                                 |
| <b>Features</b><br>(Contact material) |                                            | Ultra-miniature<br>(Rh) | Ultra-miniature<br>(Rh) | General purpose<br>miniature (Rh) | General purpose<br>miniature (Rh) | General purpose<br>miniature (Rh) |

\* Magnets also available Available Cut and Bent as Well as on Reed.

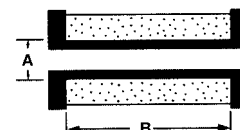
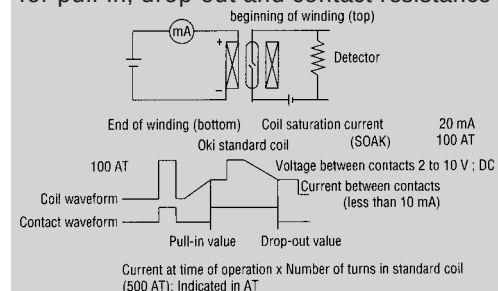
## Notes:

- 1 Pull-in & drop-out were measured by using OKI standard coil. \* This value of drop-out is prescribed when pull-in is over 20AT. When pull-in is less than 20AT, drop-out are 5 MIN & RLS/OP > 0.7. Tolerance at measurement is  $\pm 2$ AT. (Fig.1)
- 2 Measurements are made by the four-terminal voltage reduction method where the 100AT excitation is given to the switch using the OKI standard coil to close the contacts, and 10 mA current is applied.
- 3 This value varies depending on the pull-in value (contact gap). In this measurement, the pull-in value is about 20AT. (MIL-STD-202D METHOD 301)
- 4 Measurement is made by using a DC 100 V super megger. (MIL-STD-202D METHOD 302)
- 5 The values show those at MHz.
- 6 The value is obtained from the dry test under continuous current flow.
- 7 The value shows the time required for the contacts to cause the first contact bounce after applying the voltage to the OKI standard test coil. The time is shown at Top in Fig. 2

- 8 Bouncing is caused when the contact close. Bounce time means the time when opening and closing of the contacts are being repeated before the contacts are completely closed. Shown by T bounce.
- 9 Release time means the time from the moment the voltage applied to the test coil as removed to the moment the contacts open. Shown by Tris.
- 10 Resonant frequency is a vibrating frequency inherent to the reed switch. Avoid application of vibration at this frequency to the switch, otherwise it will cause misoperation.
- 11 The reed switch can be operated with a frequency higher than the maximum operating frequency. However, operation with such a frequency will often cause an endless chattering at the time of ON operation. It is recommended for the designer to take the maximum operating frequency into consideration when designing systems and circuits.
- 12 Dimensions of standard coil.  
A: Inner diameter of standard coil.  
B: Length of standard coil.

Fig. 1

## Test Procedure (1) for pull-in, drop-out and contact resistance



| ORD221                | ORD229                      | ORD2210               | ORD2211                                  | ORD2212                  | ORD2210V                    | ORT551                        |
|-----------------------|-----------------------------|-----------------------|------------------------------------------|--------------------------|-----------------------------|-------------------------------|
| 1A (offset)           | 1A                          | 1A                    | 1A                                       | 1A                       | 1A                          | 1C                            |
| 1 ~ 40                | 15 ~ 60                     | 15 ~ 60               | 15 ~ 60                                  | 15 ~ 45                  | 20 ~ 60                     | 10 ~ 30                       |
| 5 min.                | 6 min.                      | 7 min.                | 8 min.                                   | RLS/OP>0.8               | 7 min.                      | 5 min.                        |
| 100 max.              | 100 max.                    | 100 max.              | 100 max.                                 | 100 max.                 | 100 max.                    | 100 max.                      |
| 200 min.              | 600 min.                    | 250 min.              | 200 min.                                 | 150 min.                 | 1000 min.*                  | 200 min.                      |
| 10 <sup>9</sup> min.  | 10 <sup>10</sup> min.       | 10 <sup>10</sup> min. | 10 <sup>9</sup> min.                     | 10 <sup>9</sup> min.     | 10 <sup>10</sup> min.       | 10 <sup>9</sup> min.          |
| 0.3 max.              | 0.5 max.                    | 0.5 max.              | 0.3 max.                                 | 0.5 max.                 | 0.5 max.                    | 1.5 max.                      |
| 10                    | 50                          | AC70(VA) / DC50(W)    | 50                                       | 10                       | 100                         | 3                             |
| AC100 / DC100         | AC300 / DC350               | AC150 / DC200         | AC100 / DC100                            | AC100 / DC100            | AC300 / DC350               | AC30 / DC30                   |
| DC 0.3                | DC 0.5                      | AC0.7 / DC1.0         | 0.5 In rush 3A                           | DC 0.2                   | DC 1.0 max                  | DC 0.2                        |
| 1.0                   | 2.5                         | 2.5                   | 2.5                                      | 0.5                      | 2.5 max                     | 0.5                           |
| 0.3 max.              | 0.6 max.                    | 0.5 max.              | 0.6 max.                                 | 0.4 max.                 | 0.5 max.                    | 1.0 max.                      |
| 0.5 max.              | 0.5 max.                    | 0.5 max.              | 0.4 max.                                 | 1.0 max.                 | 0.5 max.                    | (NC)1.5 max. / (NO)1.0 max.   |
| 0.5 max.              | 0.05 max.                   | 0.05 max.             | 0.05 max.                                | 0.05 max.                | 0.05 max.                   | 0.5 max.                      |
| 2750 ± 250            | 2500 ± 250                  | 2500 ± 250            | 4600 ± 500                               | 4200 ± 300               | 2500 ± 250                  | 6000 ± 4000                   |
| 500                   | 500                         | 500                   | 500                                      | 500                      | 500                         | 200                           |
| 450                   | 500                         | 500                   | 450                                      | 450                      | 450                         | 550                           |
| 5000                  | 5000                        | 5000                  | 5000                                     | 5000                     | 5000                        | 5000                          |
| 3.7ø x 15             | 4.6ø x 21                   | 4.6ø x 21             | 3.7ø x 15                                | 3.7ø x 15                | 3.7ø x 15                   | 4.6ø x 10                     |
| 6                     | 3                           | 3                     | 6                                        | 6                        | 6                           | 10                            |
| Miniature offset (Rh) | High breakdown voltage (Rh) | High power (Rh)       | Lamp load (Rh)<br>3.4W<br>Low sound (Rh) | Closed differential type | Vacuum<br>*Dependent on A/T | Ultra-miniature transfer (Rh) |

Fig. 2

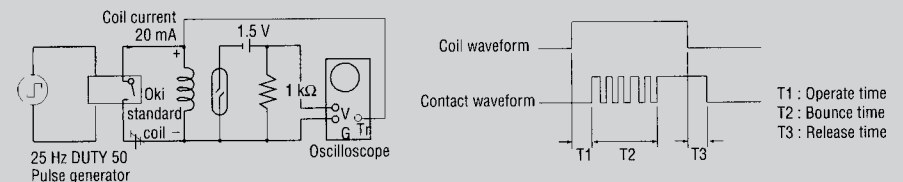
**13** If a shock of more than 30G is applied to a reed switch, the pull-in value of the switch will be often caused to change from the standard specification. Therefore, it is recommended not to use the reed switch which has been given such a shock.

**14** If a vibration of more than 1 kHz is applied to a reed switch, even a very small acceleration to it will easily cause the switch to misoperate to close due to its resonant frequency.

**15** In practice the reed switch can operate beyond the specified range. In case of magnet driving, however, some magnets show decrease of magnetic flux even at the lowest temperature of the range depending on their temperature characteristics. Therefore, it is recommended to consider the range as a general guide line.

**16** The actual tensile strength is more than 5 kg (breakdown). However, considering the lead not to get out of position, the value for the static load is shown here.

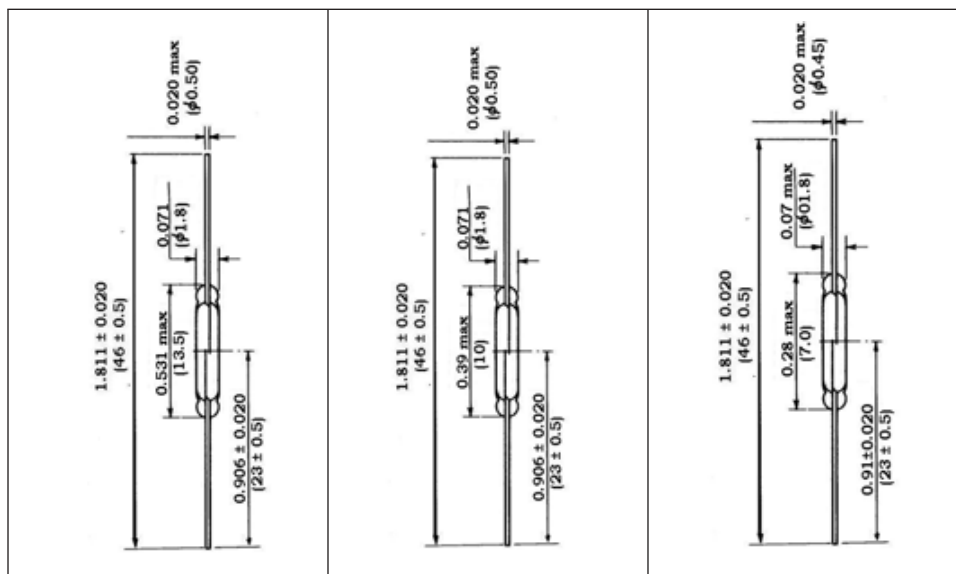
### Test Procedure (2) for operate, release and bounce time



Environmental Characteristics Table 2

|                       | Characteristics (Common to All Types)                    | Test Conditions          | Notes |
|-----------------------|----------------------------------------------------------|--------------------------|-------|
| Shock                 | Shall not misoperate with shock of 30G (11 msec) applied | MIL-STD-202E METHOD 213B | 13    |
| Vibration             | Shall not misoperate with max. 20G (10-55Hz)             | MIL-STD-202E METHOD 210A | 14    |
| Temperature range     | Shall be operational in the range of -40 to 125°C        | MIL-STD-202E METHOD 107D | 15    |
| Lead tensile strength | Shall withstand against 2 kg static load                 | MIL-STD-202E METHOD 211A | 16    |

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|                                   | <b>HCC228</b>                     | <b>HCC211</b>                     | <b>HCC213</b>                      |
|-----------------------------------|-----------------------------------|-----------------------------------|------------------------------------|
| Contact Form                      | 1A                                | A                                 | 1A                                 |
| Contact Position                  | Center                            | Center                            | Center                             |
| Contact Material                  | Ruthenium/Gold                    | Ruthenium/Gold                    | Ruthenium/Gold                     |
| Max Contact Rating                | 10W                               | 10W                               | 10W                                |
| Max Switching Voltage             | 200VDC 140VAC                     | 200VDC 140VAC                     | 170 DC 120 AC                      |
| Max Switching Current             | 500mA                             | 500 mA VDC VAC                    | 500mA AC/DC                        |
| Max Initial Contact Resistance    | 10 <sup>6</sup> mΩ                | 95 mΩ (25AT)                      | 150mΩ (AT)                         |
| Pull in Value ±5(AT)              | 10-35                             | 7/20                              | 7/20                               |
| Min Drop out Value (AT)           | 4-20                              | 3-15                              | 3-16                               |
| Min Breakdown Voltage             | 10/15 15/20 20/35<br>180 240 280  | 230V                              | 210                                |
| Max Contact Capacitance           | 0.3pF                             | 0.25pF                            | 0.35pF                             |
| Min Insulation Resistance         | 10 <sup>6</sup> mΩ                | 10 <sup>6</sup> mΩ                | 10 <sup>6</sup> mΩ                 |
| Typ Resonant Frequency            | 6700Hz                            | 11300 HZ                          | 17900Hz                            |
| Electrical Life (Resistive loads) | 2x10 <sup>7</sup> @5V 100mA 125Hz | 2x10 <sup>7</sup> @5V 100mA 125Hz | 2x10 <sup>7</sup> @50V 100mA 125Hz |

For a comprehensive engineering Reed Switch Catalog, contact factory. (Magnets Also Available.)

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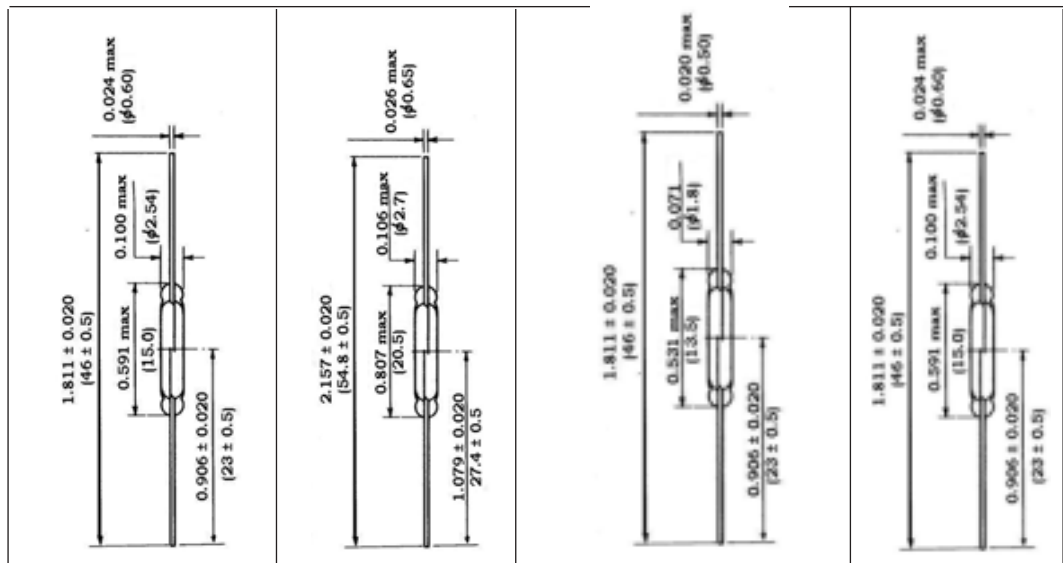
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|                                   | <b>HCC2212</b>                     | <b>HCC229</b>                    | <b>HCC9216</b>                                  | <b>HCC9215</b>                      |
|-----------------------------------|------------------------------------|----------------------------------|-------------------------------------------------|-------------------------------------|
| Contact Form                      | 1A                                 | 1A                               | 1A                                              | 1A                                  |
| Contact Position                  | Center                             | Center                           | Center                                          | Center                              |
| Contact Material                  | Ruthenium/Gold                     | Ruthenium/Gold                   | Ruthenium/Gold                                  | Gold/Ruthenium                      |
| Max Contact Rating                | 15/30 30/50<br>15W 20W             | 70W                              | 10W                                             | 10W                                 |
| Max Switching Voltage             | 200 VDC 140VAC                     | 200VDC 250VDC                    | 7/15 AT 15/25 AT<br>180VDC 130VAC 200VDC 140VAC | 200VDC 140VAC                       |
| Max Switching Current             | 1000 mA AC/DC                      | 15/25 25/70                      | 7/15 AT 15/25AT<br>250mA AC/DC 500 AC/DC        | 8/15 15/70<br>250mA DC/AC 500 AC/DC |
| Max Initial Contact Resistance    | 110mΩ                              | 90mΩ                             | 100mΩ                                           | 100mΩ                               |
| Pull in Value ±5(AT)              | 15/50                              | 15/70                            | 7/25                                            | 8/70                                |
| Min Drop out Value (AT)           | 11/35                              | 8/32                             | 3/18                                            | 4/16                                |
| Min Breakdown Voltage             | 15/25 25/35 35/50<br>275 325 400   | 15/25 25/51 45/70<br>400 580 780 | 7/15AT 15/25AT<br>200 250                       | 8/15 15/25 20/30<br>200 275 325     |
| Max Contact Capacitance           | 15/25 25/50<br>0.3PF 0.25PF        | 0.2pF                            | 7/15 15/25<br>0.30pF 125pF                      | 8/25AT 20/<br>0.3                   |
| Min Insulation Resistance         | 10 <sup>6</sup> mΩ                 | 10 <sup>6</sup> mΩ               | 10 <sup>6</sup> mΩ                              | 10 <sup>6</sup> mΩ                  |
| Typ Resonant Frequency            | 5500Hz                             | 3200                             | 9000Hz                                          | 5500Hz                              |
| Electrical Life (Resistive loads) | 5x10 <sup>7</sup> @20V 500mA 125Hz | 10 <sup>7</sup> @20V 500mA 125Hz | 10 <sup>6</sup> @12V 4mA 170Hz                  | 10 <sup>7</sup> 12V 4mA             |

For a comprehensive engineering Reed Switch Catalog, contact factory. (Magnets Also Available.)

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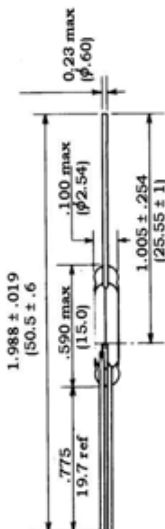
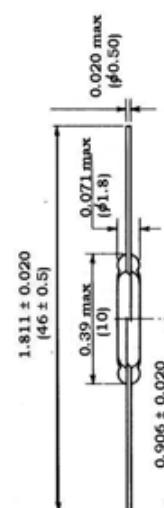
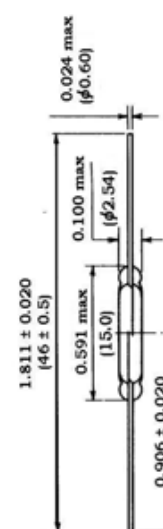
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|                                   |                                                                                   |                                                                                    |                                                                                     |
|-----------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                   |  |  |  |
|                                   | <b>HCC551</b>                                                                     | <b>HCC311</b>                                                                      | <b>HCC3215</b>                                                                      |
| Contact Form                      | C                                                                                 | A                                                                                  | 1A                                                                                  |
| Contact Position                  | Offset                                                                            | Center                                                                             | Center                                                                              |
| Contact Material                  | Ruthenium/Gold                                                                    | Ruthenium/Gold                                                                     | Ruthenium/Gold                                                                      |
| Max Contact Rating                | 5W                                                                                | 10W                                                                                | 5/15 15/35<br>5W 10W                                                                |
| Max Switching Voltage             | 175VDC 125VAC                                                                     | 200VDC 140VAC                                                                      | 5/15 15/35<br>160VDC 200VAC 140VAC                                                  |
| Max Switching Current             | 400mA DC 280mA AC                                                                 | 500mA 1000 mA AC/DC                                                                | 5/15 15/35<br>250mA 500                                                             |
| Max Initial Contact Resistance    | 140mΩ                                                                             | 150mΩ                                                                              | 100mΩ                                                                               |
| Pull in Value                     | 10/30                                                                             | 7/21                                                                               | 6/35                                                                                |
| Min Drop out Value (AT)           | 5                                                                                 | 3/16                                                                               | 3/27                                                                                |
| Min Breakdown Voltage             | 200V                                                                              | 200V                                                                               | 15/15 14/23 18/32<br>200 250 300                                                    |
| Max Contact                       | 0.8pF                                                                             | 0.30pF                                                                             | 0.30pF                                                                              |
| Min Insulation Resistance         | 10 <sup>6</sup> mΩ                                                                | 10 <sup>6</sup> mΩ                                                                 | 10 <sup>6</sup> mΩ                                                                  |
| Typ Resonant Frequency            |                                                                                   | 10800                                                                              | 8600Hz                                                                              |
| Electrical Life (Resistive loads) |                                                                                   | 2x10 <sup>6</sup> @5V 100mA 125Hz                                                  | 10 <sup>6</sup> @12V 4mA 170Hz                                                      |

For a comprehensive engineering Reed Switch Catalog, contact factory. (Magnets Also Available.)

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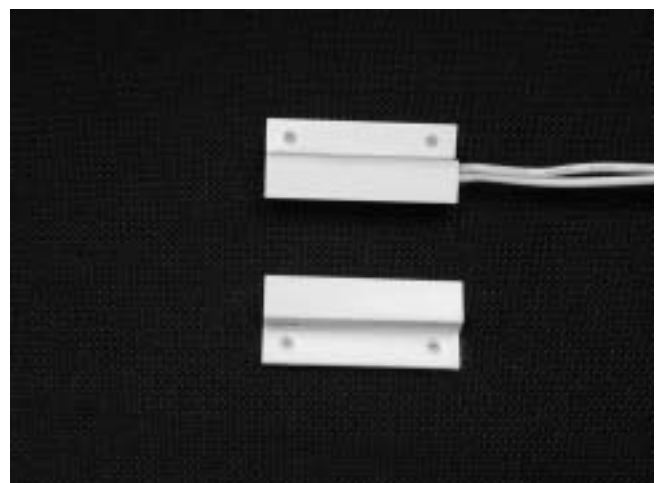
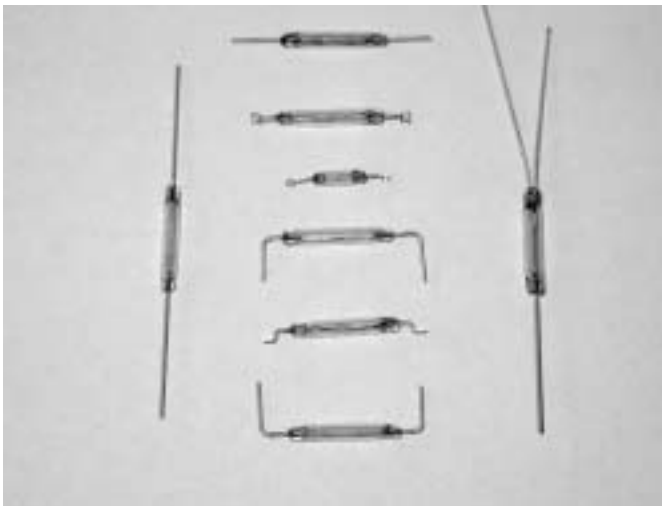
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