

## **AUTOMOTIVE RELAYS**

### **Twin Relays EN2/ EP2 Series**

### **Single Relays EP1/ MR301 Series**



## DESCRIPTION

The EN2, EP2, EP1 and MR301 series power relays can meet the requirements of high quality and reliability in automotive electronics applications.

The EN2 and EP2 series are the twin relays which have two units in one package and smaller than conventional two relays. These relays are divided into two types for different usage. One is H bridge type and the other is separate type.

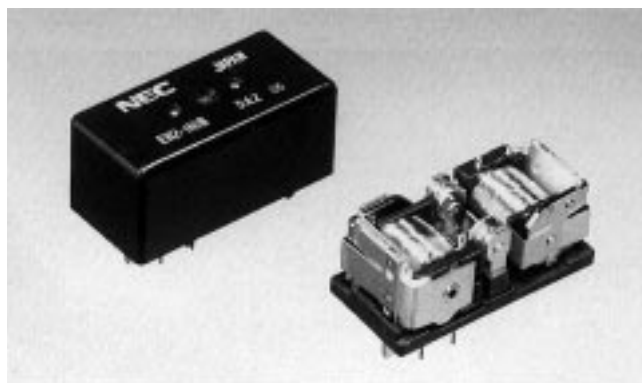
The EN2 series is suitable for heavy load applications (35 A max.). The EP2 series is designed for medium load applications (25 A max.). The EP1 and MR301 series are the 1C contact form relays.

Many of these relays have been used in automotive electronics applications throughout the world.

## EN2 Series

### FEATURES

- Twin relay for motor and solenoid reversible control
- 30% less relay space than conventional two relays
- Contact switching current of 35 A max.
- High performance and productivity by unique symmetrical structure
- Flux tight housing
- Delivered in stick-tube for automatic insertion machine
- Washable type available

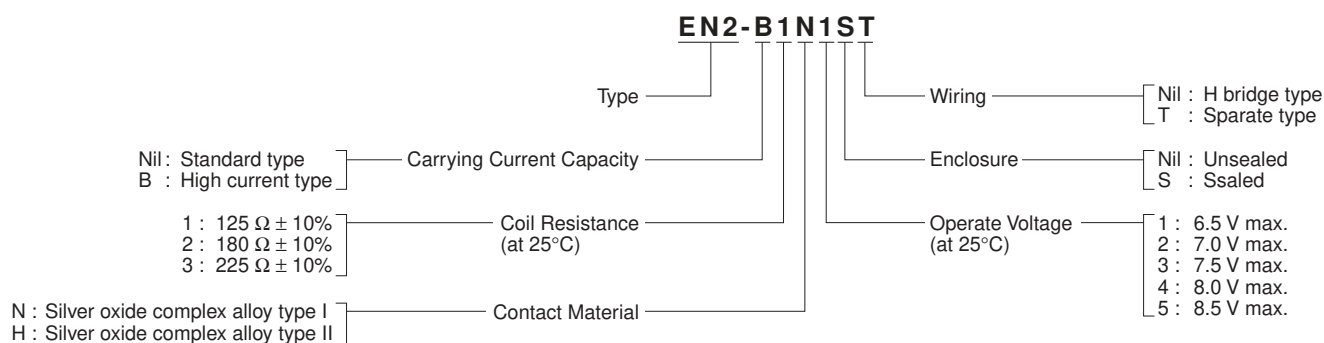


### PART NUMBERS AND COIL RATINGS

at 25°C (77°F)

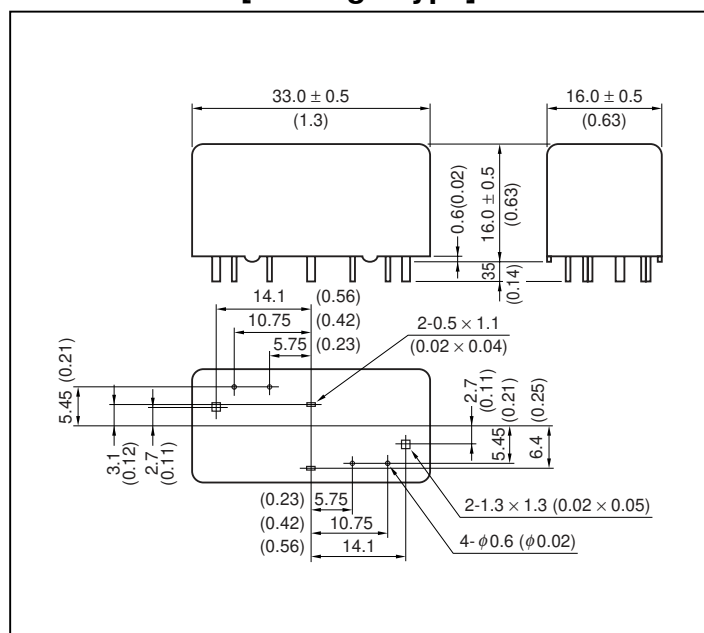
| Part Numbers  |               | Nominal Voltage (Vdc) | Coil Resistance ( $\Omega \pm 10\%$ ) | Nominal Current (mA) | Must Operate Voltage (Vdc max.) | Must Release Voltage (Vdc min.) | Nominal Operate Power (W) |
|---------------|---------------|-----------------------|---------------------------------------|----------------------|---------------------------------|---------------------------------|---------------------------|
| H Bridge Type | Separate Type |                       |                                       |                      |                                 |                                 |                           |
| EN2-1N1S      | EN2-1N1ST     | 12                    | 125                                   | 96.0                 | 6.5                             | 0.6                             | 1.15                      |
| EN2-1N2S      | EN2-1N2ST     | 12                    | 125                                   | 96.0                 | 7.0                             | 0.6                             | 1.15                      |
| EN2-2N3S      | EN2-2N3ST     | 12                    | 180                                   | 67.0                 | 7.5                             | 0.6                             | 0.8                       |
| EN2-2N4S      | EN2-2N4ST     | 12                    | 180                                   | 67.0                 | 8.0                             | 0.6                             | 0.8                       |
| EN2-3N4S      | EN2-3N4ST     | 12                    | 250                                   | 53.0                 | 8.0                             | 0.9                             | 0.64                      |
| EN2-3N5S      | EN2-3N5ST     | 12                    | 250                                   | 53.0                 | 8.5                             | 0.9                             | 0.64                      |

### ■ PART NUMBER SYSTEM

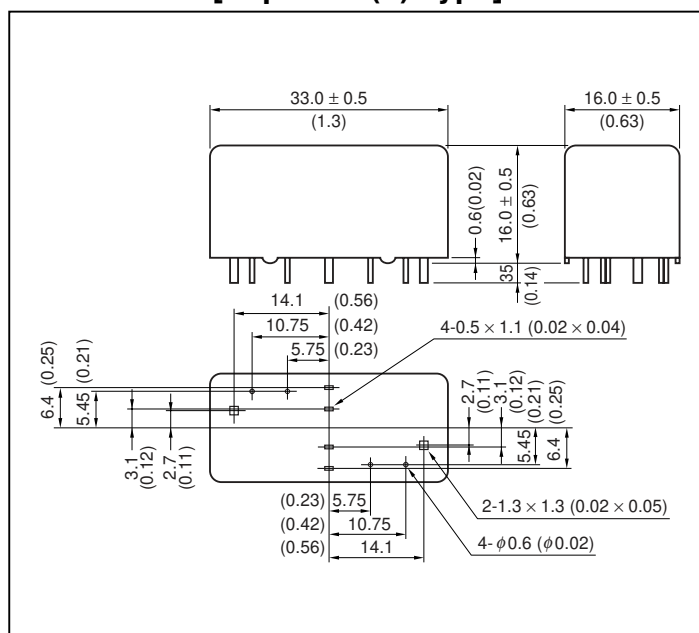


## ■ DIMENSIONS mm (inch)

### [H Bridge Type]

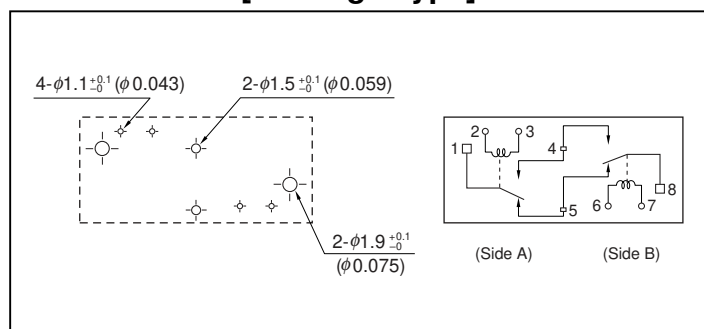


### [Separate (T) Type]

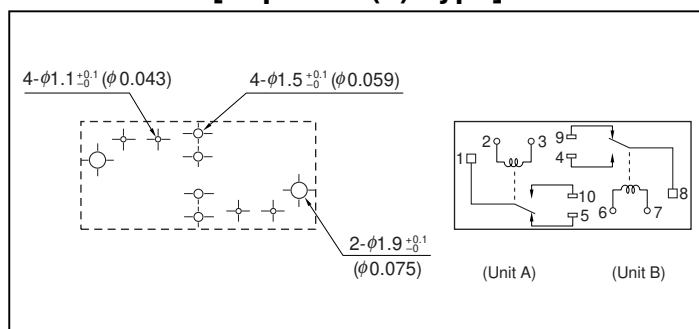


## ■ PCB PAD LAYOUT and SCHEMATICS (bottom view) mm (inch)

### [H Bridge Type]



### [Separate (T) Type]



## SPECIFICATIONS

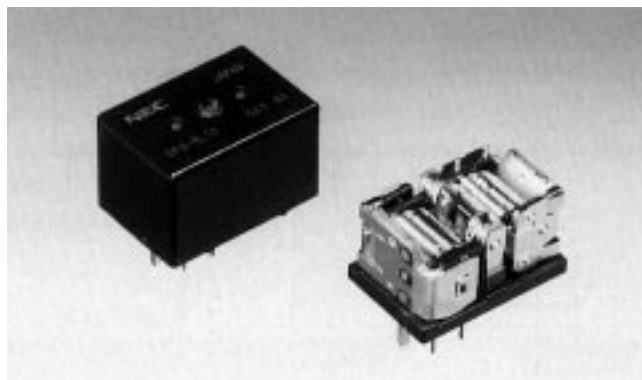
at 25°C (77°F)

| Items                     |            | Specification  |
|---------------------------|------------|--|
| Contact Form              |            | 1 form C × 2 [H Bridge Type & Separate Type]                           |
| Contact Material          |            | Silver oxide complex alloy (Special types available)                   |
| Contact Resistance        |            | 50 mΩ max. (measured at 7 A) initial                                   |
| Contact Switching Voltage |            | 30 Vdc max. 5 Vdc min.   |
| Contact Switching Current |            | 35 A max. (at 16 Vdc) 1 A min.   |
| Contact Carrying Current  | Standard   | 25 A max. (2 minutes max.) (at 12 Vdc, 85°C)                           |
|                           | High       | 35 A max. (2 minutes max.) (at 12 Vdc, 85°C)                           |
| Operate Time              |            | Approx. 5 ms max. (at 12 Vdc, excluding bounce) initial                |
| Release Time              |            | Approx. 2 ms max. (at 12 Vdc, excluding bounce) initial, without diode |
| Nominal Operate Power     |            | 0.64 W/0.8 W/1.15 W (at 12 Vdc)  |
| Insulation Resistance     |            | 100 MΩ min. (at 500 Vdc) initial                                       |
| Breakdown Voltage         |            | 500 Vdc min. (for 1 minute) initial                                    |
| Shock Resistance          |            | 98 m/s <sup>2</sup> [Approx. 10 G] min. (misoperating)                 |
| Vibration Resistance      |            | 10 to 300 Hz, 43 m/s <sup>2</sup> [Approx. 4.4 G] min. (misoperating)  |
| Ambient Temperature       |            | −40°C to +85°C (−40°F to +185 °F)                                      |
| Coil Temperature Rise     |            | 50°C/W (contact carrying current 0 A)                                  |
| Life Expectancy           | Mechanical | 1 × 10 <sup>6</sup> operations   |
|                           | Electrical | 1 × 10 <sup>5</sup> operations (at 14 Vdc, Motor Load 25 A/7 A)        |
| Weight                    |            | Approx. 18 gr.   |

## EP2 Series

### FEATURES

- Twin relay for motor and solenoid reversible control
- 50% less relay space than conventional two relays
- Contact switching current of 25 A max.
- High performance and productivity by unique symmetrical structure
- Flux tight housing
- Delivered in stick-tube for automatic insertion machine
- Washable type available

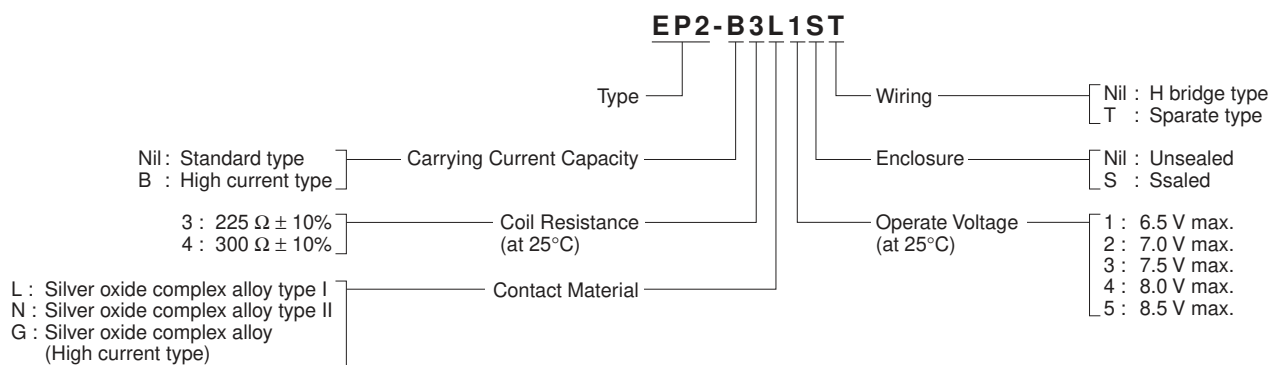


### PART NUMBERS AND COIL RATINGS

at 25°C (77°F)

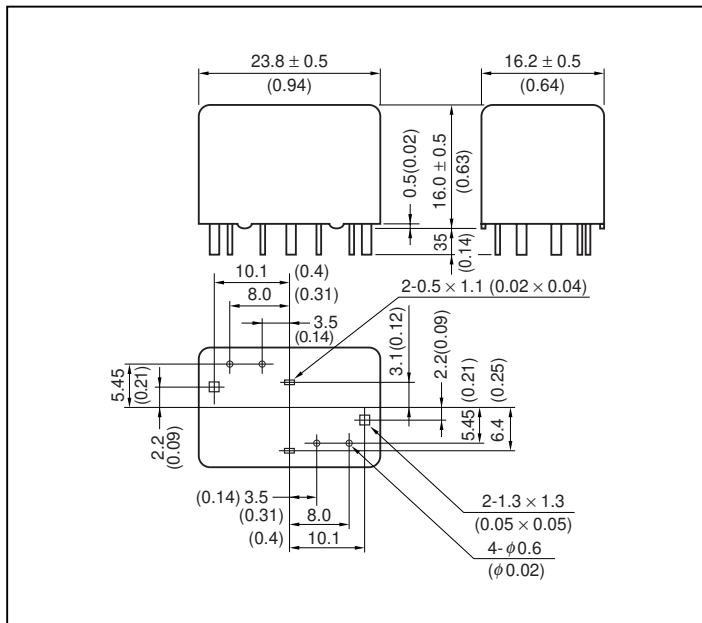
| Part Numbers  |               | Nominal Voltage (Vdc) | Coil Resistance ( $\Omega \pm 10\%$ ) | Nominal Current (mA) | Must Operate Voltage (Vdc max.) | Must Release Voltage (Vdc min.) | Nominal Operate Power (W) |
|---------------|---------------|-----------------------|---------------------------------------|----------------------|---------------------------------|---------------------------------|---------------------------|
| H Bridge Type | Separate Type |                       |                                       |                      |                                 |                                 |                           |
| EP2-3N1S      | EP2-3N1ST     | 12                    | 225                                   | 53.3                 | 6.5                             | 0.9                             | 0.64                      |
| EP2-3N2S      | EP2-3N2ST     | 12                    | 225                                   | 53.3                 | 7.0                             | 0.9                             | 0.64                      |
| EP2-3N3S      | EP2-3N3ST     | 12                    | 225                                   | 53.3                 | 7.5                             | 0.9                             | 0.64                      |
| EP2-4N3S      | EP2-4N3ST     | 12                    | 300                                   | 40.0                 | 7.5                             | 0.9                             | 0.48                      |
| EP2-4N4S      | EP2-4N4ST     | 12                    | 300                                   | 40.0                 | 8.0                             | 0.9                             | 0.48                      |
| EP2-4N5S      | EP2-4N5ST     | 12                    | 300                                   | 40.0                 | 8.5                             | 0.9                             | 0.48                      |

### ■ PART NUMBER SYSTEM

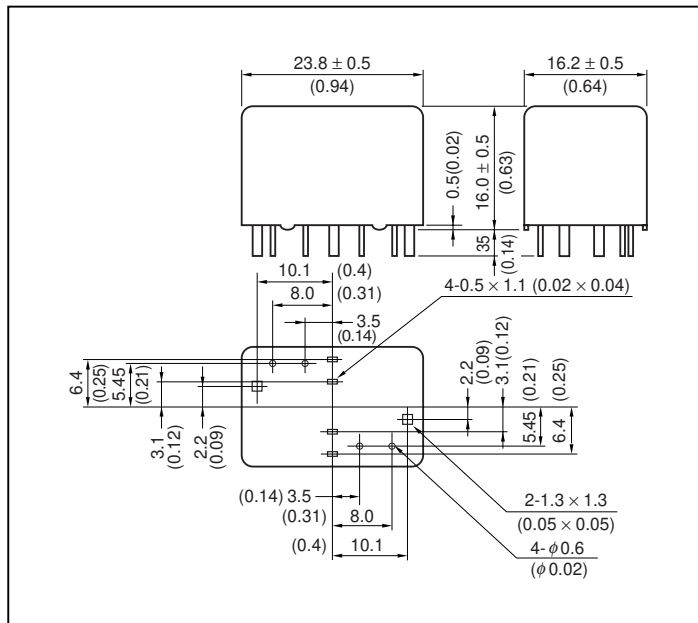


## ■ DIMENSIONS mm (inch)

### [H Bridge Type]

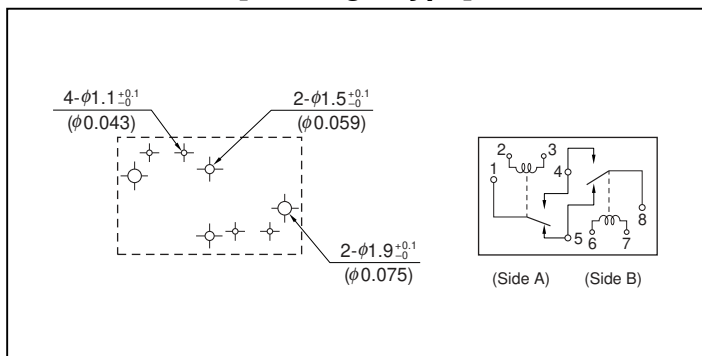


**[Separate (T) Type]**

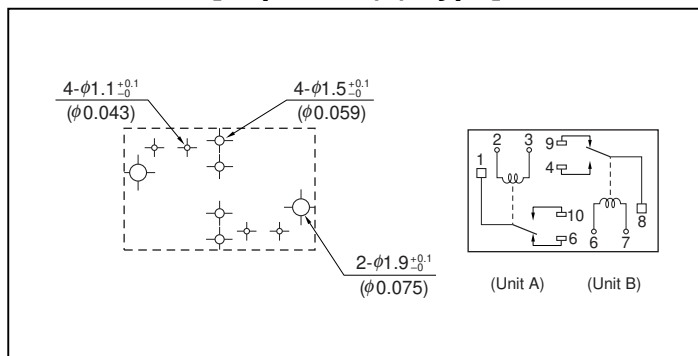


## ■ PCB PAD LAYOUT and SCHEMATICS (bottom view) mm (inch)

### [H Bridge Type]



**[Separate (T) Type]**



## SPECIFICATIONS

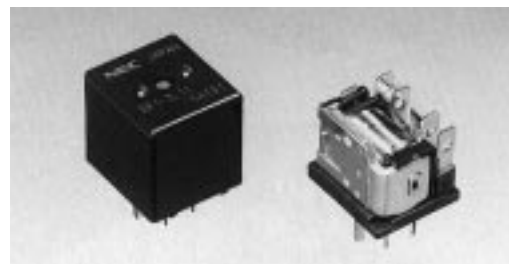
at 25°C (77°F)

| Items                     |            | Specification  |
|---------------------------|------------|--|
| Contact Form              |            | 1 form C × 2 [H Bridge Type & Separate Type]                           |
| Contact Material          |            | Silver oxide complex alloy (Special types available)                   |
| Contact Resistance        |            | 50 mΩ max. (measured at 7 A) initial                                   |
| Contact Switching Voltage |            | 30 Vdc max. 5 Vdc min.   |
| Contact Switching Current |            | 25 A max. (at 16 Vdc) 1 A min.   |
| Contact Carrying Current  | Standard   | 20 A max. (2 minutes max.) (at 12 Vdc, 85°C)                           |
|                           | High       | 25 A max. (2 minutes max.) (at 12 Vdc, 85°C)                           |
| Operate Time              |            | Approx. 5 ms max. (at 12 Vdc, excluding bounce) initial                |
| Release Time              |            | Approx. 2 ms max. (at 12 Vdc, excluding bounce) initial, without diode |
| Nominal Operate Power     |            | 0.48 W/0.64 W (at 12 Vdc)  |
| Insulation Resistance     |            | 100 MΩ min. (at 500 Vdc) initial                                       |
| Breakdown Voltage         |            | 500 Vdc min. (for 1 minute) initial                                    |
| Shock Resistance          |            | 98 m/s <sup>2</sup> [Approx. 10 G] min. (misoperating)                 |
| Vibration Resistance      |            | 10 to 300 Hz, 43 m/s <sup>2</sup> [Approx. 4.4 G] min. (misoperating)  |
| Ambient Temperature       |            | −40°C to +85°C (−40° F to +185°F)                                      |
| Coil Temperature Rise     |            | 50°C/W (contact carrying current 0 A)                                  |
| Life Expectancy           | Mechanical | 1 × 10 <sup>6</sup> operations   |
|                           | Electrical | 1 × 10 <sup>5</sup> operations (at 14 Vdc, Motor Load 20 A/3 A)        |
| Weight                    |            | Approx. 15 gr.   |

## EP1 Series

### FEATURES

- 33% less relay space than conventional relays (MR301 Series)
- High performance & productivity by unique structure
- Flux tight housing
- Delivered in stick-tube for automatic insertion machine
- Washable type available

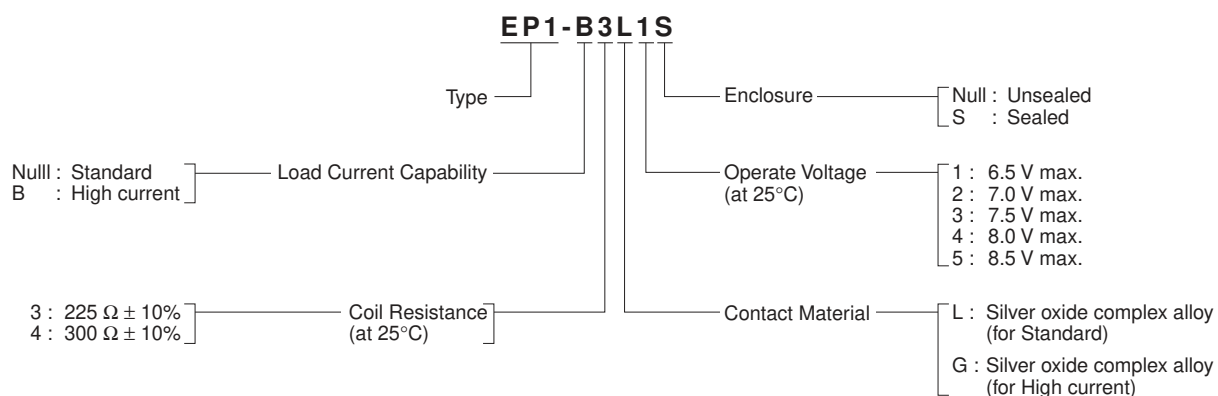


### PART NUMBERS AND COIL RATINGS

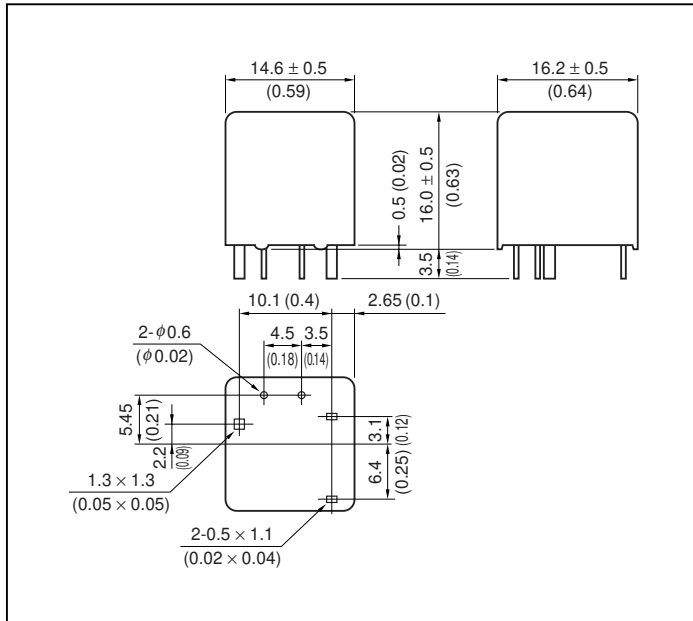
at 25°C (77°F)

| Part Numbers  |                   | Nominal Voltage (Vdc) | Coil Resistance ( $\Omega \pm 10\%$ ) | Nominal Current (mA) | Must Operate Voltage (Vdc max.) | Must Release Voltage (Vdc min.) | Nominal Operate Power (W) |
|---------------|-------------------|-----------------------|---------------------------------------|----------------------|---------------------------------|---------------------------------|---------------------------|
| Standard Type | High Current Type |                       |                                       |                      |                                 |                                 |                           |
| EP1-3L1       | EP1-B3G1          | 12                    | 225                                   | 53.3                 | 6.5                             | 0.9                             | 0.64                      |
| EP1-3L2       | EP1-B3G2          | 12                    | 225                                   | 53.3                 | 7.0                             | 0.9                             | 0.64                      |
| EP1-3L3       | EP1-B3G3          | 12                    | 225                                   | 53.3                 | 7.5                             | 0.9                             | 0.64                      |
| EP1-4L3       | EP1-B4G3          | 12                    | 300                                   | 40.0                 | 7.5                             | 0.9                             | 0.48                      |
| EP1-4L4       | EP1-B4G4          | 12                    | 300                                   | 40.0                 | 8.0                             | 0.9                             | 0.48                      |
| EP1-4L5       | EP1-B4G5          | 12                    | 300                                   | 40.0                 | 8.5                             | 0.9                             | 0.48                      |

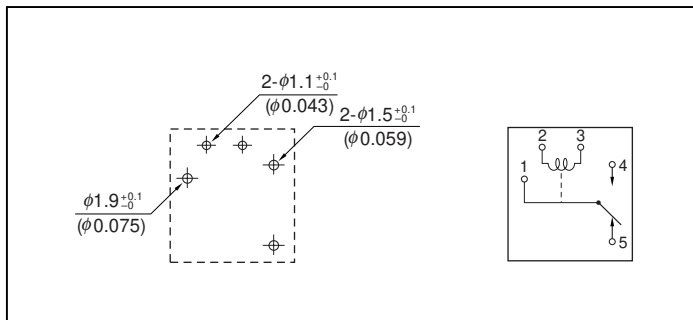
### ■ PART NUMBER SYSTEM



## ■ DIMENSIONS mm (inch)



## ■ PCB PAD LAYOUT and SCHEMATICS (bottom view) mm (inch)



## SPECIFICATIONS

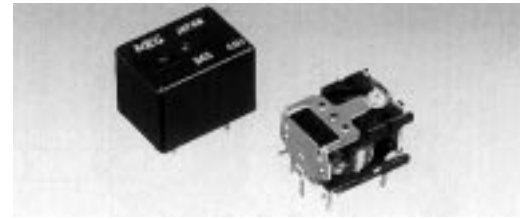
at 25°C (77°F)

| Items                           |            | Specification   |
|---------------------------------|------------|---|
| Contact Form                    |            | 1 form C  |
| Contact Material                |            | Silver oxide complex alloy  |
| Contact Resistance              |            | 50 MΩ max. (measured at 7 A) initial                                  |
| Contact Switching Voltage       |            | 30 Vdc max. 5 Vdc min.  |
| Contact Switching Current       |            | 25 A max. (at 16 Vdc) 1 A min.  |
| Contact Carrying Current        | Standard   | 25 A max. (2 minutes max.) (at 12 Vdc, 85°C)                          |
|                                 | High       | 30 A max. (2 minutes max.) (at 12 Vdc, 85°C)                          |
| Operate Time (Excluding bounce) |            | Approx. 5 ms max. (at 12 Vdc) initial                                 |
| Release Time (Excluding bounce) |            | Approx. 2 ms max. (at 12 Vdc) initial, without diode                  |
| Nominal Operate Power           |            | 0.48 W/0.64 W (at 12 Vdc)   |
| Insulation Resistance           |            | 100 MΩ min. (at 500 Vdc) initial                                      |
| Breakdown Voltage               |            | 500 Vdc min. (for 1 minute) initial                                   |
| Shock Resistance                |            | 98 m/s <sup>2</sup> [Approx. 10 G] min. (misoperating)                |
| Vibration Resistance            |            | 10 to 300 Hz, 43 m/s <sup>2</sup> [Approx. 4.4 G] min. (misoperating) |
| Coil Temperature Rise           |            | 50°C/W (Contact Carrying Current: 0 A)                                |
| Ambient Temperature             |            | -40 to +85°C (-40 to +185°F)  |
| Life Expectancy                 | Mechanical | 10 <sup>6</sup> operations  |
|                                 | Electrical | 10 <sup>5</sup> operations (at 14 Vdc, Motor Load 20 A/3 A)           |
| Weight                          |            | Approx. 8 g   |

# MR301 Series

## FEATURES

- Medium load applications such as interval wipers and stereo
- Delivered in stick-tube for automatic insertion machine
- Flux tight housing
- Washable type available
- High standoff type (0.8 mm) available ("L" suffix)

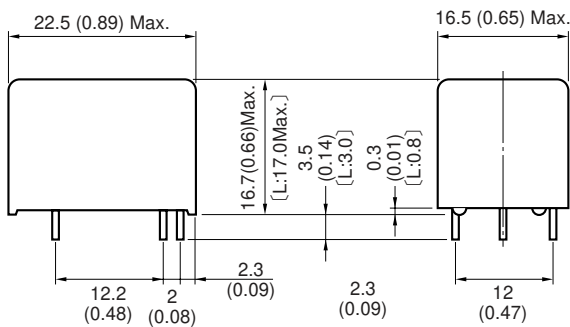


## PART NUMBERS AND COIL RATINGS

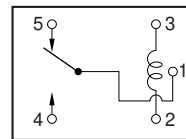
at 25°C (77°F)

| Part Numbers |             |             | Nominal Voltage (Vdc) | Coil Resistance ( $\Omega \pm 10\%$ ) | Nominal Current (mA) | Must Operate Voltage (Vdc max.) | Must Release Voltage (Vdc min.) | Nominal Operate Power (W) |
|--------------|-------------|-------------|-----------------------|---------------------------------------|----------------------|---------------------------------|---------------------------------|---------------------------|
| 5 A Type     | 10 A Type   | 15 A Type   |                       |                                       |                      |                                 |                                 |                           |
| MR301-6SL    | MR301-6HSL  | MR301-6ESL  | 6                     | 100                                   | 60                   | 4.2                             | 0.6                             | 0.36                      |
| MR301-9SL    | MR301-9HSL  | MR301-9ESL  | 9                     | 225                                   | 40                   | 6.3                             | 0.9                             | 0.36                      |
| MR301-N39L   | MR301-N40L  | MR301-N40EL | 12                    | 320                                   | 38                   | 8.0                             | 1.2                             | 0.45                      |
| MR301-12SL   | MR301-12HSL | MR301-12ESL | 12                    | 400                                   | 30                   | 8.4                             | 1.2                             | 0.36                      |

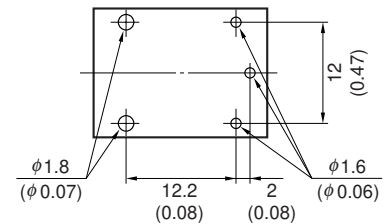
## DIMENSIONS mm (inch)



## SCHEMATIC (BOTTOM VIEW)

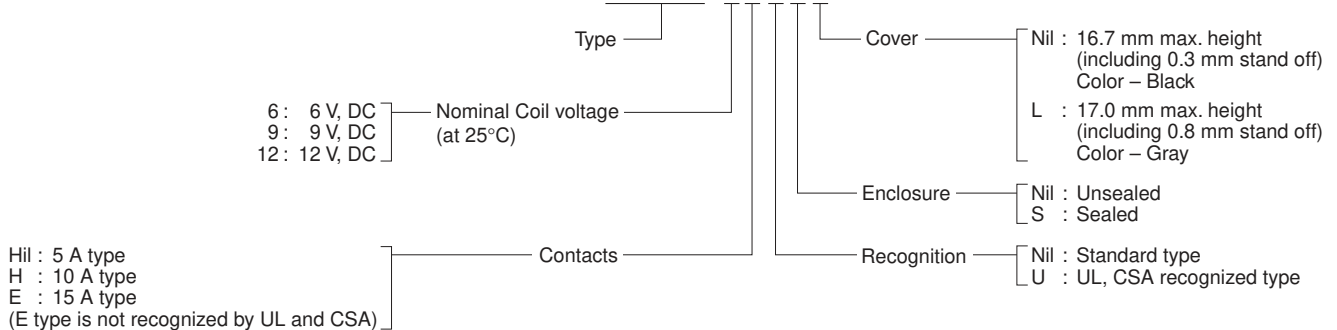


## PCB PAD LAYOUT mm (inch)

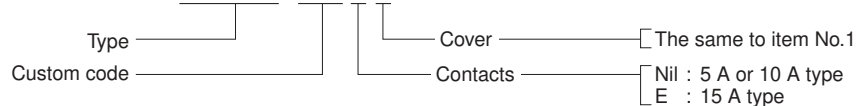


## NUMBERING SYSTEM

### 1. MR301-6HUSL



### 2. MR301-N \* EL



## SPECIFICATIONS

at 25°C (77°F)

| Items                     |            | 5 A Type  | 10/15 A Type                          |
|---------------------------|------------|---|---------------------------------------|
| Contact Form              |            | 1 form C  |                                       |
| Contact Material          |            | Silver nickel alloy   | Silver oxide complex alloy            |
| Contact Resistance        |            | 100 mΩ max. (measured at 0.5 A) initial                                     | 100 mΩ max. (measured at 2 A) initial |
| Contact Switching Voltage |            | 30 Vdc max. 5 Vdc min.  |                                       |
| Contact Switching Current |            | 5 A max. (at 16 Vdc) 0.1 A min.   | 15/20 A max. (at 16 vdc) 1 A min.     |
| Contact Carrying Current  |            | 20 A max. (at 12 Vdc)   |                                       |
| Operate Time              |            | Approx. 5 ms max. (at 12 Vdc, excluding bounce) initial                     |                                       |
| Release Time              |            | Approx. 2 ms max. (at 12 Vdc, excluding bounce) initial, without diode      |                                       |
| Nominal Operate Power     |            | 0.36 W/0.45 W (Nominal Voltage)   |                                       |
| Insulation Resistance     |            | 100 MΩ min. (at 500 Vdc) initial  |                                       |
| Breakdown Voltage         |            | 500 Vdc min. (for 1 minute) initial   |                                       |
| Shock Resistance          |            | 98 m/s <sup>2</sup> [Approx. 10 G] min. (misoperating)                      |                                       |
| Vibration Resistance      |            | 10 to 300 Hz, 43 m/s <sup>2</sup> [Approx. 4.4 G] min. (misoperating)       |                                       |
| Ambient Temperature       |            | -40°C to +85°C (-40°F to +185°F)  |                                       |
| Coil Temperature Rise     |            | 50°C/W (contact carrying current 0 A)                                       |                                       |
| Life Expectancy           | Mechanical | 1 x 10 <sup>6</sup> operations  |                                       |
|                           | Electrical | 1 x 10 <sup>5</sup> operations (at 14 Vdc, Motor Load 20 A/3 A) (E-Contact) |                                       |
| Weight                    |            | Approx. 13 gr   |                                       |

## ■ NOTICE

### (1) Capacitive load

If the load is capacitive, an inrush current to charge the load with poses a problem. In this case, a current-limiting resistor or surge suppressor coil is connected in series to the contacts to suppress the peak current.

### (2) Clinching terminals

To secure the relay temporarily to a printed circuit board for soldering, particular terminals are allowed to be clinched within a particular angle. Other terminals, never clinched.

The terminal numbers and the angle for clinching of each series are as follows.

- 1) No.4 and no.5 terminals to 45° maximum for H bridge type of EN2 and EP2
- 2) No.5 and no.9 terminals to 45° maximum for separate type of EN2 and EP2
- 3) No.4 and no.5 terminals to 45° maximum for EP1
- 4) No.1, 4 and no.5 terminals to 45° maximum for MR301

### (3) Drive circuit

Since the coil of a relay has an inductive impedance, a counter electromotive force is generated when the circuit is opened. This voltage may damage the relay driver IC. Therefore, a diode is connected in parallel with the coil, as shown in figure 1.

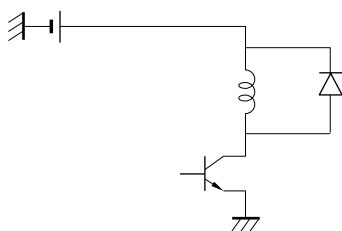
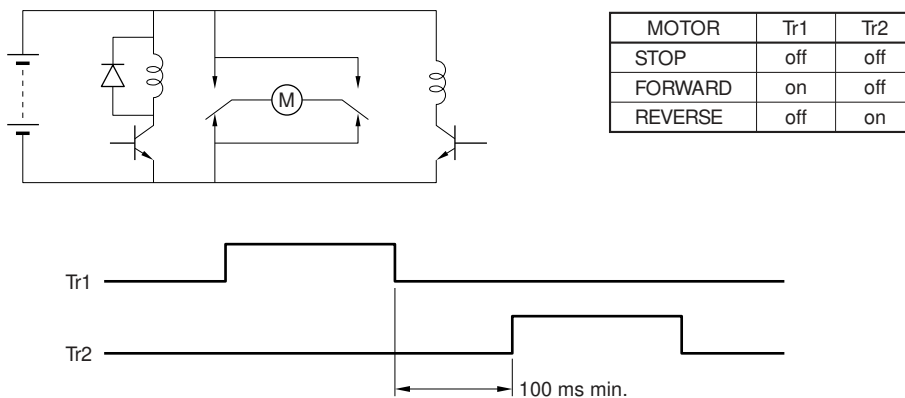
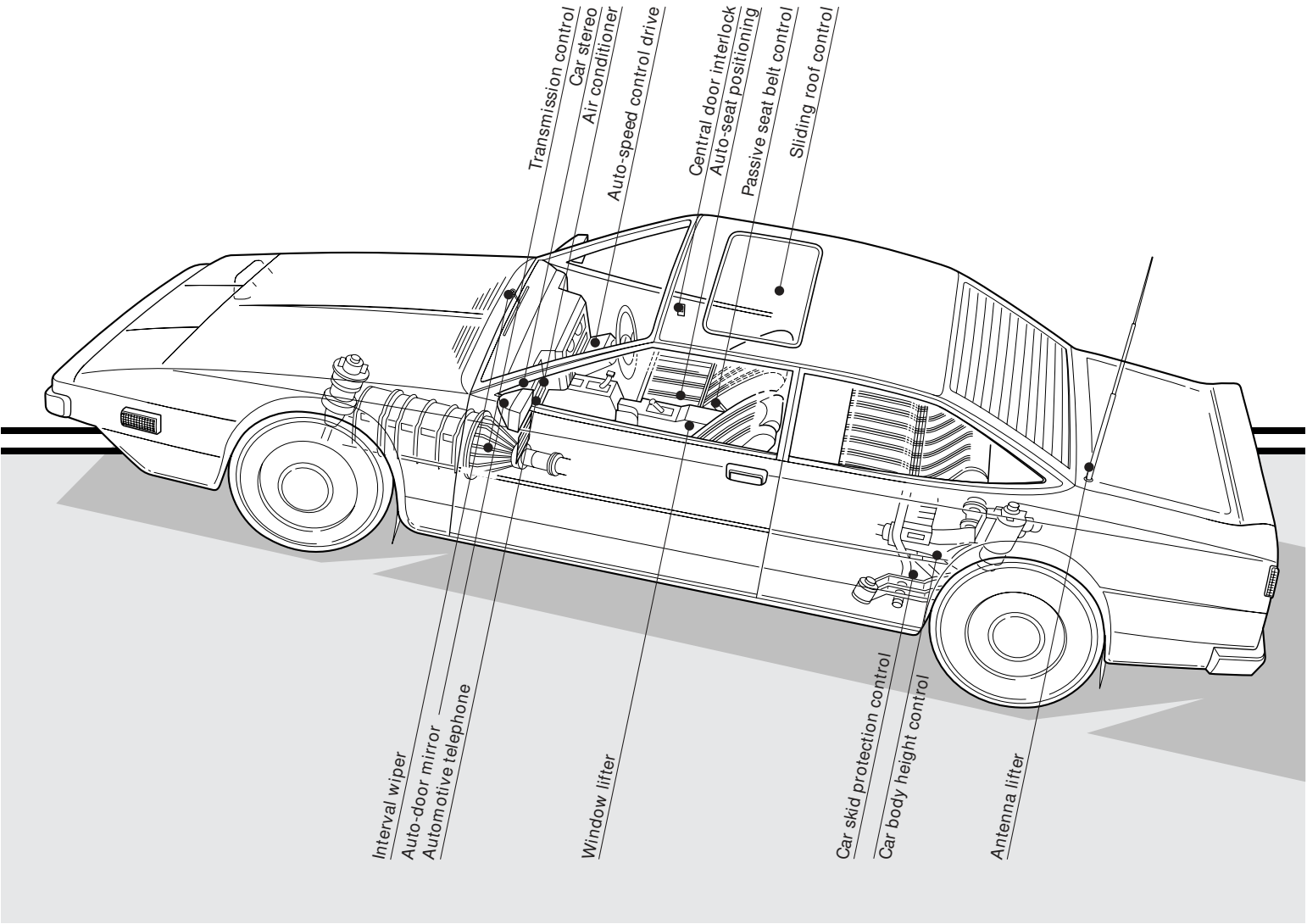


Figure 1

### (4) Typical application for EN2/EP2 relays (H bridge type)



# APPLICATIONS



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