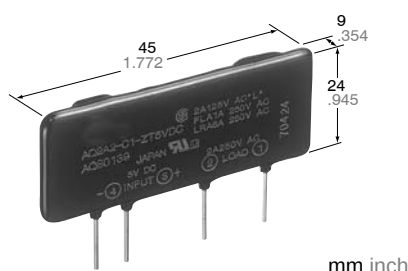


# Panasonic

ideas for life

## 2A and 3A space saving PC board terminal type

# AQ8 RELAYS



## FEATURES

**1. Slim with 9 mm .354 inch thickness**  
The thin type (45 mm long × 24 mm high × 9 mm wide) (1.772×.945×.354 inch) permits high density mounting.

**2. Excellent in noise resistance**  
Since the input and output are insulated by the phototriac coupler, the noise on the output side is not fed back to the input side.

**3. Snubber circuit integrated**  
The snubber circuit is integrated to prevent malfunction caused by the rapid rise of the voltage on the output side, such as inductive load and noise.

**4. Zero-cross and Non zero-cross types are available.**  
The zero-cross type generates minimal noise by suppressing occurrence of radio frequency interference (RFI) and electro-magnetic interference (EMI).  
The non zero-cross type features a short operation time which permits phase control.

**5. High dielectric strength: 3,000 V AC (between input and output)**

**6. Two kinds of terminals distance are available. (5.08 mm and 7.62 mm) (.200 and .300 inch)**

**7. High reliability, long life and maintenance-free**

## TYPICAL APPLICATIONS

Most suitable as drivers for small size AC motors, solenoids, solenoid valves and so on.

1. Copying equipment
2. Air conditioners
3. Industrial equipment such as NC machines, sequencers, robots and so on

## TYPES

### 1. Zero-cross type

| Input terminals distance     | Max. load current | Load voltage   | Input voltage | Part No.         |
|------------------------------|-------------------|----------------|---------------|------------------|
| 5.08 mm<br>.200 inch<br>type | 2 A               | 75 to 125 V AC | 5 V DC        | AQ2A1-C1-ZT5VDC  |
|                              |                   |                | 12 V DC       | AQ2A1-C1-ZT12VDC |
|                              |                   |                | 24 V DC       | AQ2A1-C1-ZT24VDC |
|                              |                   | 75 to 250 V AC | 5 V DC        | AQ2A2-C1-ZT5VDC  |
|                              |                   |                | 12 V DC       | AQ2A2-C1-ZT12VDC |
|                              |                   |                | 24 V DC       | AQ2A2-C1-ZT24VDC |
|                              | 3 A               | 75 to 125 V AC | 5 V DC        | AQ3A1-C1-ZT5VDC  |
|                              |                   |                | 12 V DC       | AQ3A1-C1-ZT12VDC |
|                              |                   |                | 24 V DC       | AQ3A1-C1-ZT24VDC |
|                              |                   | 75 to 250 V AC | 5 V DC        | AQ3A2-C1-ZT5VDC  |
|                              |                   |                | 12 V DC       | AQ3A2-C1-ZT12VDC |
|                              |                   |                | 24 V DC       | AQ3A2-C1-ZT24VDC |
| 7.62 mm<br>.300 inch<br>type | 2 A               | 75 to 125 V AC | 5 V DC        | AQ2A1-C2-ZT5VDC  |
|                              |                   |                | 12 V DC       | AQ2A1-C2-ZT12VDC |
|                              |                   |                | 24 V DC       | AQ2A1-C2-ZT24VDC |
|                              |                   | 75 to 250 V AC | 5 V DC        | AQ2A2-C2-ZT5VDC  |
|                              |                   |                | 12 V DC       | AQ2A2-C2-ZT12VDC |
|                              |                   |                | 24 V DC       | AQ2A2-C2-ZT24VDC |
|                              | 3 A               | 75 to 125 V AC | 5 V DC        | AQ3A1-C2-ZT5VDC  |
|                              |                   |                | 12 V DC       | AQ3A1-C2-ZT12VDC |
|                              |                   |                | 24 V DC       | AQ3A1-C2-ZT24VDC |
|                              |                   | 75 to 250 V AC | 5 V DC        | AQ3A2-C2-ZT5VDC  |
|                              |                   |                | 12 V DC       | AQ3A2-C2-ZT12VDC |
|                              |                   |                | 24 V DC       | AQ3A2-C2-ZT24VDC |

### 2. Non zero-cross type

| Input terminals distance     | Max. load current | Load voltage   | Input voltage | Part No.        |
|------------------------------|-------------------|----------------|---------------|-----------------|
| 5.08 mm<br>.200 inch<br>type | 2 A               | 75 to 125 V AC | 5 V DC        | AQ2A1-C1-T5VDC  |
|                              |                   |                | 12 V DC       | AQ2A1-C1-T12VDC |
|                              |                   |                | 24 V DC       | AQ2A1-C1-T24VDC |
|                              |                   | 75 to 250 V AC | 5 V DC        | AQ2A2-C1-T5VDC  |
|                              |                   |                | 12 V DC       | AQ2A2-C1-T12VDC |
|                              |                   |                | 24 V DC       | AQ2A2-C1-T24VDC |
|                              | 3 A               | 75 to 125 V AC | 5 V DC        | AQ3A1-C1-T5VDC  |
|                              |                   |                | 12 V DC       | AQ3A1-C1-T12VDC |
|                              |                   |                | 24 V DC       | AQ3A1-C1-T24VDC |
|                              |                   | 75 to 250 V AC | 5 V DC        | AQ3A2-C1-T5VDC  |
|                              |                   |                | 12 V DC       | AQ3A2-C1-T12VDC |
|                              |                   |                | 24 V DC       | AQ3A2-C1-T24VDC |
| 7.62 mm<br>.300 inch<br>type | 2 A               | 75 to 125 V AC | 5 V DC        | AQ2A1-C2-T5VDC  |
|                              |                   |                | 12 V DC       | AQ2A1-C2-T12VDC |
|                              |                   |                | 24 V DC       | AQ2A1-C2-T24VDC |
|                              |                   | 75 to 250 V AC | 5 V DC        | AQ2A2-C2-T5VDC  |
|                              |                   |                | 12 V DC       | AQ2A2-C2-T12VDC |
|                              |                   |                | 24 V DC       | AQ2A2-C2-T24VDC |
|                              | 3 A               | 75 to 125 V AC | 5 V DC        | AQ3A1-C2-T5VDC  |
|                              |                   |                | 12 V DC       | AQ3A1-C2-T12VDC |
|                              |                   |                | 24 V DC       | AQ3A1-C2-T24VDC |
|                              |                   | 75 to 250 V AC | 5 V DC        | AQ3A2-C2-T5VDC  |
|                              |                   |                | 12 V DC       | AQ3A2-C2-T12VDC |
|                              |                   |                | 24 V DC       | AQ3A2-C2-T24VDC |

Remark: Standard packing Carton: 20 pcs.; Case: 200 pcs.

## RATINGS

**1. Rating** (Ambient temperature: 20°C, 68°F; Voltage ripple on the input side: 1% or less)

1) Zero-cross type

• 2 A type

| Part No.   |                                  | AQ2A1-C1-ZT5VDC<br>AQ2A1-C2-ZT5VDC | AQ2A1-C1-ZT12VDC<br>AQ2A1-C2-ZT12VDC | AQ2A1-C1-ZT24VDC<br>AQ2A1-C2-ZT24VDC | AQ2A2-C1-ZT5VDC<br>AQ2A2-C2-ZT5VDC | AQ2A2-C1-ZT12VDC<br>AQ2A2-C2-ZT12VDC | AQ2A2-C1-ZT24VDC<br>AQ2A2-C2-ZT24VDC | Remarks                                                         |
|------------|----------------------------------|------------------------------------|--------------------------------------|--------------------------------------|------------------------------------|--------------------------------------|--------------------------------------|-----------------------------------------------------------------|
| Item       |                                  |                                    |                                      |                                      |                                    |                                      |                                      |                                                                 |
| Input side | Control voltage                  | 5 V DC<br>(4 to 6V)                | 12 V DC<br>(9.6 to 14.4V)            | 24 V DC<br>(21.6 to 26.4V)           | 5 V DC<br>(4 to 6V)                | 12 V DC<br>(9.6 to 14.4V)            | 24 V DC<br>(21.6 to 26.4V)           | The parenthesized values represent the allowable voltage ranges |
|            | Input impedance                  | Approx.<br>0.18 k Ω                | Approx.<br>0.55 k Ω                  | Approx.<br>1.4 k Ω                   | Approx.<br>0.18 k Ω                | Approx.<br>0.55 k Ω                  | Approx.<br>1.4 k Ω                   |                                                                 |
|            | Drop-out voltage                 | min. 0.5 V                         | min. 1.2 V                           | min. 2.4 V                           | min. 0.5 V                         | min. 1.2 V                           | min. 2.4 V                           |                                                                 |
| Load side  | Max. load current                | 2 A*1                              |                                      |                                      |                                    |                                      |                                      | At ambient temperature of 30°C or less                          |
|            | Load voltage                     | 75 to 125 V AC                     |                                      |                                      | 75 to 250 V AC                     |                                      |                                      |                                                                 |
|            | Frequency                        | 45 to 65 Hz                        |                                      |                                      |                                    |                                      |                                      |                                                                 |
|            | Repetitive peak OFF voltage      | 400 V                              |                                      |                                      | 600 V                              |                                      |                                      |                                                                 |
|            | Non-repetitive surge current     | 30 A*2                             |                                      |                                      |                                    |                                      |                                      | In one cycle at 60 Hz                                           |
|            | Max. “OFF-state” leakage current | 2.5 mA/100 V applied               |                                      |                                      | 5 mA/200 V applied                 |                                      |                                      |                                                                 |
|            | Max. “ON-state” voltage drop     | 1.6 V                              |                                      |                                      |                                    |                                      |                                      | at max. carrying current                                        |
|            | Min. load current                | 25 mA*3                            |                                      |                                      | 50 mA*3                            |                                      |                                      |                                                                 |
|            | OFF state dV/dt                  | 50 V/μs                            |                                      |                                      |                                    |                                      |                                      | At ambient temperature of 80°C                                  |

• 3 A type

| Part No.   |                                  | AQ3A1-C1-ZT5VDC<br>AQ3A1-C2-ZT5VDC | AQ3A1-C1-ZT12VDC<br>AQ3A1-C2-ZT12VDC | AQ3A1-C1-ZT24VDC<br>AQ3A1-C2-ZT24VDC | AQ3A2-C1-ZT5VDC<br>AQ3A2-C2-ZT5VDC | AQ3A2-C1-ZT12VDC<br>AQ3A2-C2-ZT12VDC | AQ3A2-C1-ZT24VDC<br>AQ3A2-C2-ZT24VDC | Remarks                                                         |
|------------|----------------------------------|------------------------------------|--------------------------------------|--------------------------------------|------------------------------------|--------------------------------------|--------------------------------------|-----------------------------------------------------------------|
| Item       |                                  |                                    |                                      |                                      |                                    |                                      |                                      |                                                                 |
| Input side | Control voltage                  | 5 V DC<br>(4 to 6V)                | 12 V DC<br>(9.6 to 14.4V)            | 24 V DC<br>(21.6 to 26.4V)           | 5 V DC<br>(4 to 6V)                | 12 V DC<br>(9.6 to 14.4V)            | 24 V DC<br>(21.6 to 26.4V)           | The parenthesized values represent the allowable voltage ranges |
|            | Input impedance                  | Approx.<br>0.18 k Ω                | Approx.<br>0.55 k Ω                  | Approx.<br>1.4 k Ω                   | Approx.<br>0.18 k Ω                | Approx.<br>0.55 k Ω                  | Approx.<br>1.4 k Ω                   |                                                                 |
|            | Drop-out voltage                 | min. 0.5 V                         | min. 1.2 V                           | min. 2.4 V                           | min. 0.5 V                         | min. 1.2 V                           | min. 2.4 V                           |                                                                 |
| Load side  | Max. load current                | 3 A*1                              |                                      |                                      |                                    |                                      |                                      | At ambient temperature of 30°C or less                          |
|            | Load voltage                     | 75 to 125 V AC                     |                                      |                                      | 75 to 250 V AC                     |                                      |                                      |                                                                 |
|            | Frequency                        | 45 to 65 Hz                        |                                      |                                      |                                    |                                      |                                      |                                                                 |
|            | Repetitive peak OFF voltage      | 400 V                              |                                      |                                      | 600 V                              |                                      |                                      |                                                                 |
|            | Non-repetitive surge current     | 80 A*2                             |                                      |                                      |                                    |                                      |                                      | In one cycle at 60 Hz                                           |
|            | Max. "OFF-state" leakage current | 2.5 mA/100 V applied               |                                      |                                      | 5 mA/200 V applied                 |                                      |                                      |                                                                 |
|            | Max. "ON-state" voltage drop     | 1.6 V                              |                                      |                                      |                                    |                                      |                                      | at max. carrying current                                        |
|            | Min. load current                | 25 mA*3                            |                                      |                                      | 50 mA*3                            |                                      |                                      |                                                                 |
|            | OFF state dV/dt                  | 50 V/μs                            |                                      |                                      |                                    |                                      |                                      | At ambient temperature of 80°C                                  |

Notes: \*1) Refer REFERENCE DATA 1, characteristics of load current vs. ambient temperature.

\*2) Refer to REFERENCE DATA 2, characteristics of non-repetitive surge current vs. carrying time.

\*3) When the load current is less than the min. load current, refer to "NOTES (Page 6)".

## 2) Non zero-cross type

## • 2 A type

| Part No.   |                                  | AQ2A1-C1-T5VDC            | AQ2A1-C1-T12VDC           | AQ2A1-C1-T24VDC            | AQ2A2-C1-T5VDC            | AQ2A2-C1-T12VDC           | AQ2A2-C1-T24VDC            | Remarks                                                         |
|------------|----------------------------------|---------------------------|---------------------------|----------------------------|---------------------------|---------------------------|----------------------------|-----------------------------------------------------------------|
|            |                                  | AQ2A1-C2-T5VDC            | AQ2A1-C2-T12VDC           | AQ2A1-C2-T24VDC            | AQ2A2-C2-T5VDC            | AQ2A2-C2-T12VDC           | AQ2A2-C2-T24VDC            |                                                                 |
| Item       |                                  |                           |                           |                            |                           |                           |                            |                                                                 |
| Input side | Control voltage                  | 5 V DC<br>(4 to 6V)       | 12 V DC<br>(9.6 to 14.4V) | 24 V DC<br>(21.6 to 26.4V) | 5 V DC<br>(4 to 6V)       | 12 V DC<br>(9.6 to 14.4V) | 24 V DC<br>(21.6 to 26.4V) | The parenthesized values represent the allowable voltage ranges |
|            | Input impedance                  | Approx.<br>0.3 k $\Omega$ | Approx.<br>0.8 k $\Omega$ | Approx.<br>1.8 k $\Omega$  | Approx.<br>0.3 k $\Omega$ | Approx.<br>0.8 k $\Omega$ | Approx.<br>1.8 k $\Omega$  |                                                                 |
|            | Drop-out voltage                 | min. 0.5 V                | min. 1.2 V                | min. 2.4 V                 | min. 0.5 V                | min. 1.2 V                | min. 2.4 V                 |                                                                 |
| Load side  | Max. load current                | 2 A*1                     |                           |                            |                           |                           |                            | At ambient temperature of 30°C or less                          |
|            | Load voltage                     | 75 to 125 V AC            |                           |                            | 75 to 250 V AC            |                           |                            |                                                                 |
|            | Frequency                        | 45 to 65 Hz               |                           |                            |                           |                           |                            |                                                                 |
|            | Repetitive peak OFF voltage      | 400 V                     |                           |                            | 600 V                     |                           |                            |                                                                 |
|            | Non-repetitive surge current     | 30 A*2                    |                           |                            |                           |                           |                            | In one cycle at 60 Hz                                           |
|            | Max. "OFF-state" leakage current | 2.5 mA/100 V applied      |                           |                            | 5 mA/200 V applied        |                           |                            |                                                                 |
|            | Max. "ON-state" voltage drop     | 1.6 V                     |                           |                            |                           |                           |                            | at max. carrying current                                        |
|            | Min. load current                | 25 mA*3                   |                           |                            | 50 mA*3                   |                           |                            |                                                                 |
|            | OFF state dV/dt                  | 50 V/ $\mu$ s             |                           |                            |                           |                           |                            | At ambient temperature of 80°C                                  |

## • 3 A type

| Item \ Part No. |                                  | AQ3A1-C1-T5VDC<br>AQ3A1-C2-T5VDC | AQ3A1-C1-T12VDC<br>AQ3A1-C2-T12VDC | AQ3A1-C1-T24VDC<br>AQ3A1-C2-T24VDC | AQ3A2-C1-T5VDC<br>AQ3A2-C2-T5VDC | AQ3A2-C1-T12VDC<br>AQ3A2-C2-T12VDC | AQ3A2-C1-T24VDC<br>AQ3A2-C2-T24VDC | Remarks                                                         |
|-----------------|----------------------------------|----------------------------------|------------------------------------|------------------------------------|----------------------------------|------------------------------------|------------------------------------|-----------------------------------------------------------------|
|                 |                                  |                                  |                                    |                                    |                                  |                                    |                                    |                                                                 |
| Input side      | Control voltage                  | 5 V DC<br>(4 to 6V)              | 12 V DC<br>(9.6 to 14.4V)          | 24 V DC<br>(21.6 to 26.4V)         | 5 V DC<br>(4 to 6V)              | 12 V DC<br>(9.6 to 14.4V)          | 24 V DC<br>(21.6 to 26.4V)         | The parenthesized values represent the allowable voltage ranges |
|                 | Input impedance                  | Approx.<br>0.3 k $\Omega$        | Approx.<br>0.8 k $\Omega$          | Approx.<br>1.8 k $\Omega$          | Approx.<br>0.3 k $\Omega$        | Approx.<br>0.8 k $\Omega$          | Approx.<br>1.8 k $\Omega$          |                                                                 |
|                 | Drop-out voltage                 | min. 0.5 V                       | min. 1.2 V                         | min. 2.4 V                         | min. 0.5 V                       | min. 1.2 V                         | min. 2.4 V                         |                                                                 |
| Load side       | Max. load current                | 3 A*1                            |                                    |                                    |                                  |                                    |                                    | At ambient temperature of 30°C or less                          |
|                 | Load voltage                     | 75 to 125 V AC                   |                                    |                                    | 75 to 250 V AC                   |                                    |                                    |                                                                 |
|                 | Frequency                        | 45 to 65 Hz                      |                                    |                                    |                                  |                                    |                                    |                                                                 |
|                 | Repetitive peak OFF voltage      | 400 V                            |                                    |                                    | 600 V                            |                                    |                                    |                                                                 |
|                 | Non-repetitive surge current     | 80 A*2                           |                                    |                                    |                                  |                                    |                                    | In one cycle at 60 Hz                                           |
|                 | Max. "OFF-state" leakage current | 2.5 mA/100 V applied             |                                    |                                    | 5 mA/200 V applied               |                                    |                                    |                                                                 |
|                 | Max. "ON-state" voltage drop     | 1.6 V                            |                                    |                                    |                                  |                                    |                                    | at max. carrying current                                        |
|                 | Min. load current                | 25 mA*3                          |                                    |                                    | 50 mA*3                          |                                    |                                    |                                                                 |
|                 | OFF state dV/dt                  | 50 V/ $\mu$ s                    |                                    |                                    |                                  |                                    |                                    | At ambient temperature of 80°C                                  |

Notes: \*1) Refer REFERENCE DATA 1, characteristics of load current vs. ambient temperature.

\*2) Refer to REFERENCE DATA 2, characteristics of non-repetitive surge current vs. carrying time.

\*3) When the load current is less than the min. load current, refer to "NOTES (Page 6)".

AQ8

2. Characteristics (Ambient temperature: 20°C 68°F; Input voltage ripple: 1% or less)

| Item                        |             | Type | Zero-cross type                            | Non zero-cross type                         | Remarks                       |
|-----------------------------|-------------|------|--------------------------------------------|---------------------------------------------|-------------------------------|
| Operate time, max.          |             |      | 1/2 cycle of voltage sine wave + 1 ms      | 1 ms                                        |                               |
| Release time, max.          |             |      | 1/2 cycle of voltage sine wave + 1 ms      |                                             |                               |
| Insulation resistance, min. |             |      | 10 <sup>9</sup> Ω between input and output |                                             | at 500 V DC                   |
| Breakdown voltage           |             |      | 3,000 V AC between input and output        |                                             | For 1 minute                  |
| Vibration resistance        | Functional  |      | 10 to 55 Hz at double amplitude of 3 mm    |                                             | 10 min. for X, Y, Z axis      |
|                             | Destructive |      | 10 to 55 Hz at double amplitude of 3 mm    |                                             | 1 hour for X, Y, Z axis       |
| Shock resistance            | Functional  |      | Min. 980 m/s <sup>2</sup> {100 G}          |                                             | 4 times each for X, Y, Z axis |
|                             | Destructive |      | Min. 980 m/s <sup>2</sup> {100 G}          |                                             | 5 times each for X, Y, Z axis |
| Ambient temperature         |             |      | -30°C to +80°C -22°F to +176°F             |                                             |                               |
| Storage temperature         |             |      | -30°C to +100°C -22°F to +212°F            |                                             |                               |
| Operational method          |             |      | Zero-cross (Turn ON and Turn OFF)          | Non zero-cross turn ON, zero-cross turn OFF |                               |

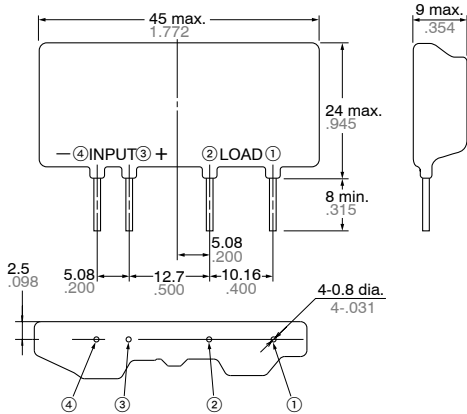
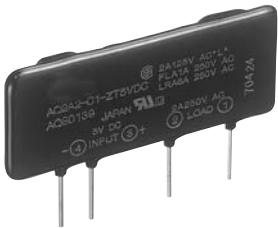
DIMENSIONS

mm inch

(Common for zero-cross and non zero-cross types)

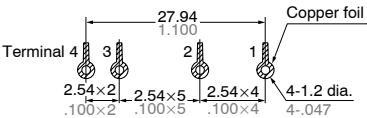
1. Input terminals distance 5.08 mm .200 inch

1) 2 A type



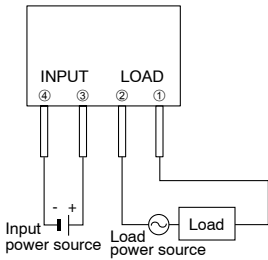
General tolerance: ±0.5 ±.020

Mounting hole location (Bottom view)

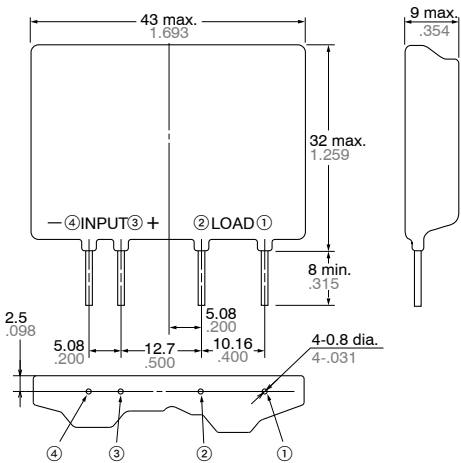


Tolerance: ±0.1 ±.004

Schematic

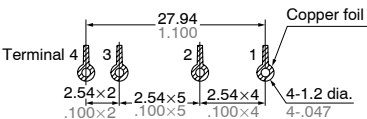


2) 3 A type



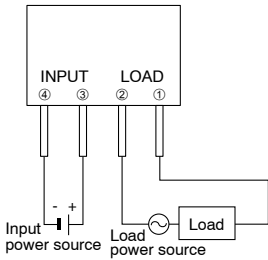
General tolerance: ±0.5 ±.020

Mounting hole location (Bottom view)



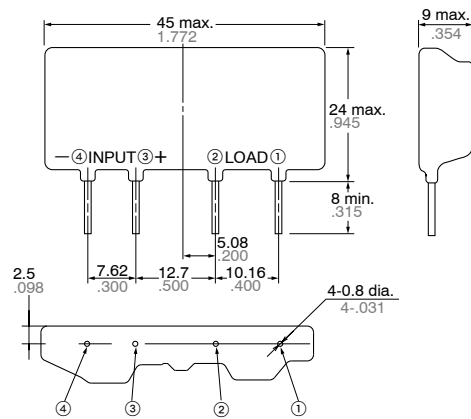
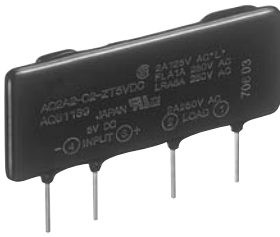
Tolerance: ±0.1 ±.004

Schematic



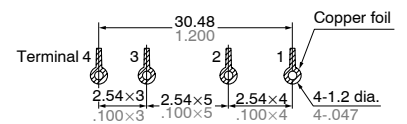
## 2. Input terminals distance 7.62 mm .300 inch

### 1) 2A type



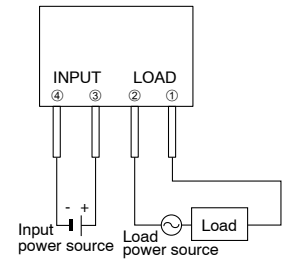
General tolerance:  $\pm 0.5 \pm .020$

### Mounting hole location (Bottom view)

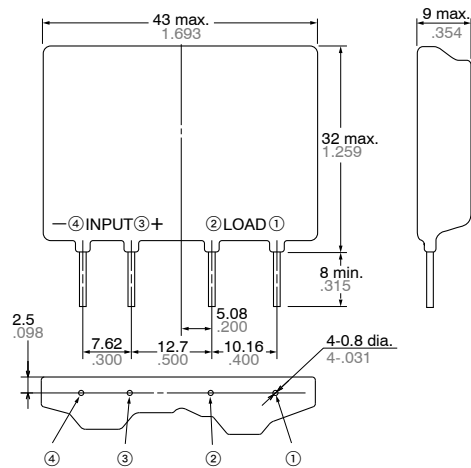


Tolerance:  $\pm 0.1 \pm .004$

### Schematic

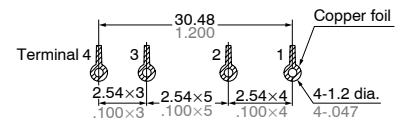


### 2) 3A type



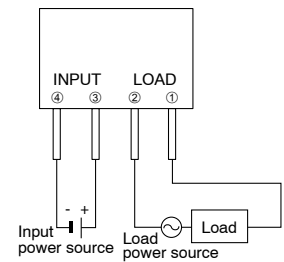
General tolerance:  $\pm 0.5 \pm .020$

### Mounting hole location (Bottom view)



Tolerance:  $\pm 0.1 \pm .004$

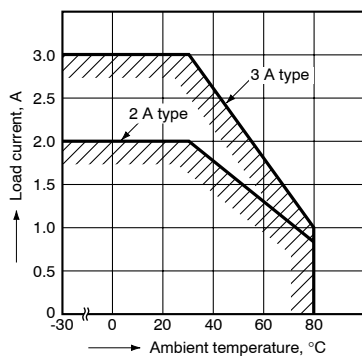
### Schematic



## REFERENCE DATA

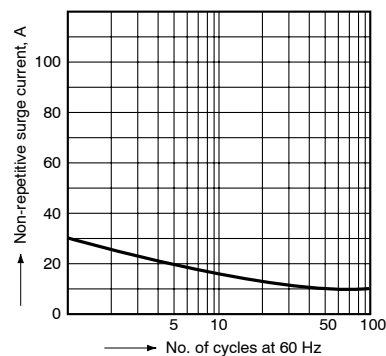
### 1. Characteristics of load current vs. ambient temperature

Conditions: Natural cooling

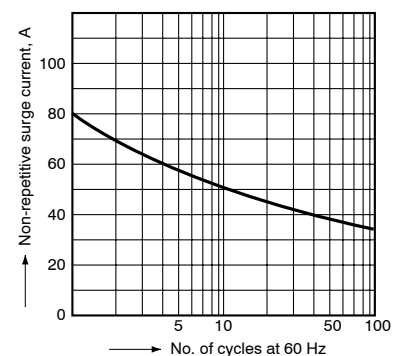


### 2. Characteristics of non-repetitive surge current vs. carrying time

(2 A type)

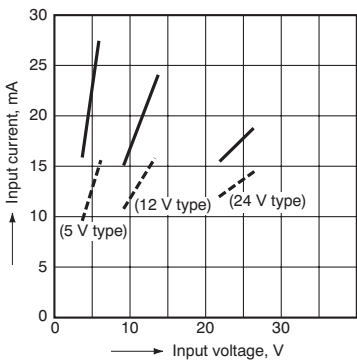


(3 A type)

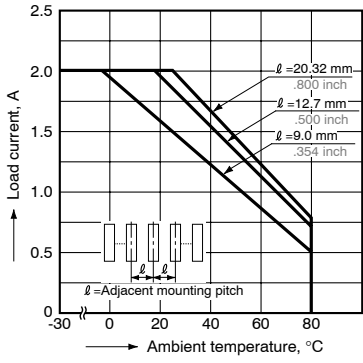


AQ8

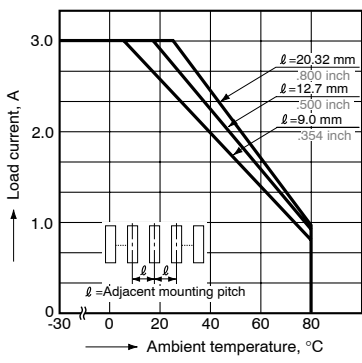
3. Characteristics of input current vs. input voltage  
—zero-cross type ---non zero-cross type



4. Characteristics of load current vs. ambient temperature for adjacent mounting  
Conditions: Natural cooling  
(2 A type)



(3 A type)



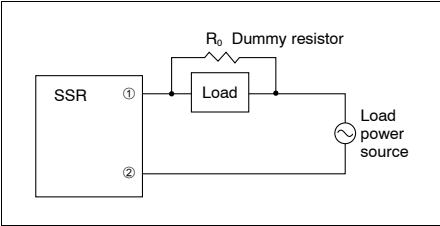
Approved standards list

| Product name | File No.    | Qualified ratings                                                                         |
|--------------|-------------|-------------------------------------------------------------------------------------------|
| AQ8          | UL E95895   | 2A type: 2 A 125, 250 V AC<br>2 A 125 V AC (Tungsten)<br>FLA 1 A, LRA 6 A 125, 250 V AC   |
|              | CSA LR26550 | 3A type: 3 A 125, 250 V AC<br>3 A 125 V AC (Tungsten)<br>FLA 1.5 A, LRA 9 A 125, 250 V AC |

NOTES

1. When used for the load less than rated

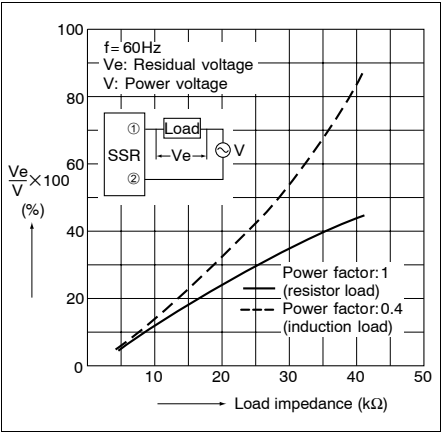
In case of the load current less than rated, malfunction may result from the residual voltage across the both ends of the load even if the solid state relay is turned off. Use a dummy resistor as a countermeasure.  
The total of the current through the resistor and the load current must exceed the min. rated load current.



In case the dummy resistor is not used, keep in mind that the residual voltage becomes as follows:

Example:  
For the inductive load by the 20 mA load current and the 200 V AC load voltage, the load impedance becomes 10 kΩ and  $V_e/V = 14\%$  is estimated from the right above graph. Accordingly, the 28 V voltage remains across the both ends of the load when the solid state relay is turned off.

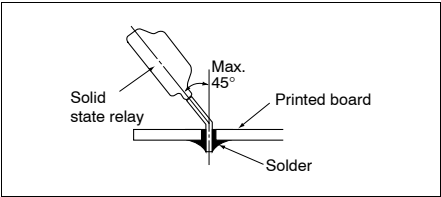
• Characteristics of residual voltage vs. load impedance



2. Solder the terminals within 5 seconds at 260°C 500°F.

3. When the terminal is bent

Care shall be taken neither to apply mechanical stresses to the mold area of the solid state relay nor to bend the terminal 45 degrees or more.



Cautions for Use