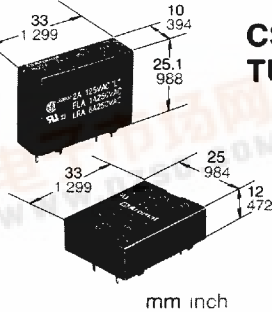
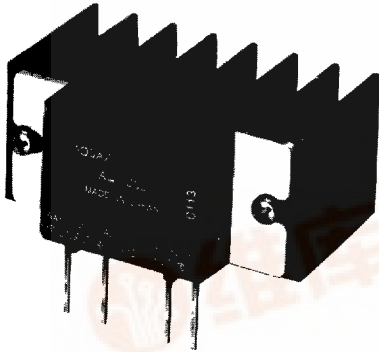


**NAIS**

**AQ1 SOLID STATE RELAY**

**AQ1-RELAYS**



UL File No.: E57521 (DC output type)  
E57520 (AC output type)

CSA File No.: LR26550

TÜV File No.: 85011645510

- Strong against high inrush current and long life  
Optical isolation:  $5 \times 10^7$  operations
- No chattering or bouncing and no arc generation
- Both slim and flat package available
- SIL (single in line) terminal layout
- Zero-voltage turn-ON and Zero-current turn-OFF for eliminating surge and reducing inrush currents and EMI

## TYPES

### 1. AQ1 Solid State Relays

| Load | Isolation                   | Zero-cross function | Type          |            | Input voltage | Load current<br>Load voltage                   | Part No.          |
|------|-----------------------------|---------------------|---------------|------------|---------------|------------------------------------------------|-------------------|
| AC   | Optically coupled isolation | Zero-cross          | Standard type | 2 A        | 3 to 28 V DC  | 2 A, 75 to 250 V AC                            | AQ2A2-ZP3/28VDC   |
|      |                             |                     |               | 2 A (flat) | 3 to 28 V DC  | 2 A, 75 to 250 V AC                            | AQ2A2-J-ZP3/28VDC |
|      |                             |                     |               | 5 A        | 3 to 28 V DC  | 5 A, 75 to 250 V AC<br>(3 A without heat sink) | AQ5A2-ZP3/28VDC   |
| DC   | Optically coupled isolation | —                   | 1 A           |            | 3 to 28 V DC  | 1 A, 10 to 200 V DC                            | AQ1AD2-3/28VDC    |
|      |                             |                     | 2 A           |            | 3 to 28 V DC  | 2 A, 3 to 60 V DC                              | AQ2AD1-3/28VDC    |

### 2. Heat sink for AQ1 solid state relay (for 5 A types): AQ-HS-5A

## ORDERING INFORMATION

| <p>AQ <span>2A</span> <span>2</span> — <span>J</span> — <span>ZP</span> <span>3/28 VDC</span></p> |                                                             |                                    |                                              |                         |
|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------|----------------------------------------------|-------------------------|
| Load current                                                                                      | Load voltage                                                | Shape                              | Type                                         | Input voltage           |
| 1 A<br>2 A<br>5 A                                                                                 | 2: 75 to 250 V AC<br>D1: 3 to 60 V DC<br>D2: 10 to 200 V DC | Nil: Vertical type<br>J: Flat type | Nil: DC output<br>ZP: AC output (Zero-cross) | 3/28 V DC: 3 to 28 V DC |

## APPLICATIONS

- Traffic signal control
- Terminal equipment of data processing
- Computer peripherals
- NC machines
- Automatic ticket punchers



# AQ1

## SPECIFICATIONS

Rating (at 20°C 68°F, Ripple factor: less than 1%)

### 1. AC output type

|            |                                  | Standard type                 |       | Remarks                                                      | UL/CSA rating                                                                                    |                                                                                                   |
|------------|----------------------------------|-------------------------------|-------|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
|            |                                  | 2 A                           | 5 A   |                                                              | AQ2A type                                                                                        | AQ5A type                                                                                         |
| Input side | Input voltage                    | 3 to 28 V DC                  |       |                                                              |                                                                                                  |                                                                                                   |
|            | Input impedance                  | Approx. 1.6 kΩ (3 to 28 V DC) |       |                                                              |                                                                                                  |                                                                                                   |
|            | Drop-out voltage, min.           | 0.8 V                         |       |                                                              |                                                                                                  |                                                                                                   |
| Load side  | Max. load current                | 2 A                           | 5 A*  | *5 A with heat sink<br>3 A without heat sink<br>See "Data 4" | 2 A 125 V AC, 250 V AC<br>2 A 125 V AC "L"<br>FLA 1 A 125 V, 250 V AC<br>LRA 6 A 125 V, 250 V AC | 5 A 125 V AC, 250 V AC<br>5 A 125 V AC "L"<br>FLA 2.5 A 125 V, 250 V AC<br>LRA 15 A 125, 250 V AC |
|            | Load voltage                     | 75 to 250 V AC                |       |                                                              |                                                                                                  |                                                                                                   |
|            | Non-repetitive surge current     | 80 A                          | 100 A | See "Data 1"<br>In one cycle at 60 Hz                        |                                                                                                  |                                                                                                   |
|            | Max. "OFF-state" leakage current | 5 mA                          |       | at 200 V AC 60 Hz                                            |                                                                                                  |                                                                                                   |
|            | Max. "ON-state" voltage drop     | 1.6 V                         |       | at Max. carrying current                                     |                                                                                                  |                                                                                                   |
|            | Min. load current                | 50 mA                         |       |                                                              |                                                                                                  |                                                                                                   |

### 2. DC output type

| DC output type |                                  | 1 A type       | 2 A type     | Remarks                              |
|----------------|----------------------------------|----------------|--------------|--------------------------------------|
| Input side     | Input voltage                    | 3 to 28 V DC   |              |                                      |
|                | Input impedance                  | Approx. 1.6 kΩ |              |                                      |
|                | Drop-out voltage, min.           | 0.8 V          |              |                                      |
| Load side      | Max. load current                | 1 A            | 2 A          | at ambient temperature<br>40°C 104°F |
|                | Load voltage                     | 10 to 200 V DC | 3 to 60 V DC |                                      |
|                | Non-repetitive surge current     | 5 A (1 sec.)   |              |                                      |
|                | Max. "OFF-state" leakage current | 1 mA           |              |                                      |
|                | Max. "ON-state" voltage drop     | 2.3 V          | 1.6 V        |                                      |
|                | Min. load current                | 5 mA           |              |                                      |

Characteristics (at 20°C 68°F, Ripple factor: less than 1%)

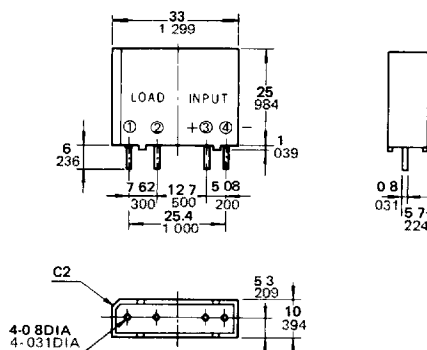
|                             |             | AC output                                     |                                                                  | DC output                         | Remarks                       |
|-----------------------------|-------------|-----------------------------------------------|------------------------------------------------------------------|-----------------------------------|-------------------------------|
|                             |             | Zero-cross                                    |                                                                  |                                   |                               |
|                             |             | Standard type                                 |                                                                  |                                   |                               |
|                             |             | 2 A                                           | 5 A                                                              |                                   |                               |
| Operate time, Max.          |             | (1/2 cycle of voltage sine wave) + 1 msec.    |                                                                  | 0.5 msec.                         |                               |
| Release time, Max.          |             | (1/2 cycle of voltage sine wave) + 1 msec.    |                                                                  | 2 msec.                           |                               |
| Insulation resistance, Min. |             | 100 MΩ for input, output and case             |                                                                  | 100 MΩ for input-output           | by 500 V DC                   |
| Breakdown voltage           |             | 3,000 Vrms for input-output                   | 3,000 Vrms for input-output<br>1,500 Vrms for input, output-case | 3,000 Vrms for input-output       |                               |
| Vibration resistance        | Destructive | 12 G, 10 to 55 Hz at double amplitude of 2 mm |                                                                  |                                   | 1 hour for X, Y, Z axis       |
|                             | Functional  | 12 G, 10 to 55 Hz at double amplitude of 2 mm |                                                                  |                                   | 10 minutes for X, Y, Z axis   |
| Shock resistance            | Destructive | 100 G                                         |                                                                  | 100 G                             | 5 times each for X, Y, Z axis |
|                             | Functional  | 100 G                                         |                                                                  | 100 G                             | 4 times each for X, Y, Z axis |
| Ambient temperature         |             | -30°C to +80°C -22°F to +176°F                |                                                                  | -30°C to +80°C<br>-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)             |                                                                  | —                                 |                               |

## DIMENSIONS

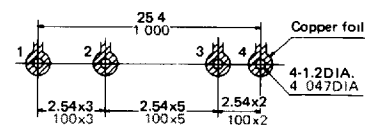
### 2 A type

Zero-cross (standard)

DC type (1 A, 2 A)

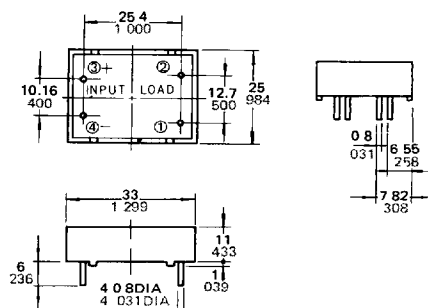
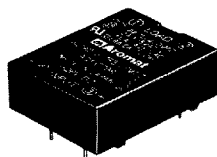


PC board pattern (Copper-side view)

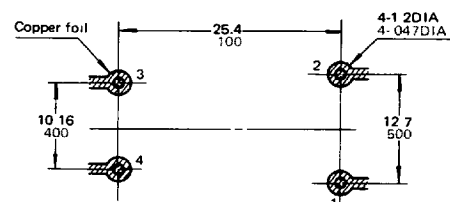
General tolerance:  $\pm 0.5 \pm 0.20$ Tolerance:  $\pm 0.1 \pm 0.04$ 

### 2 A type

Zero-cross (standard, flat)

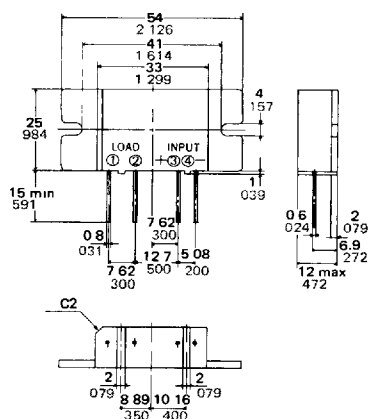
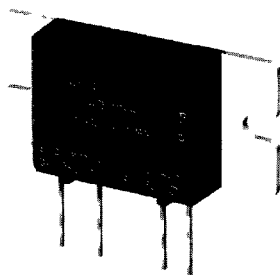


PC board pattern (Copper side view)

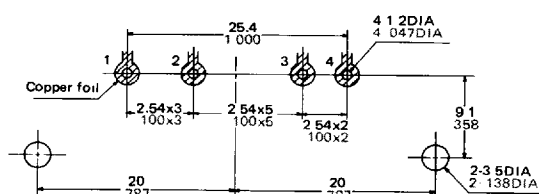
General tolerance:  $\pm 0.5 \pm 0.20$ Tolerance:  $\pm 0.1 \pm 0.04$ 

### 5A type

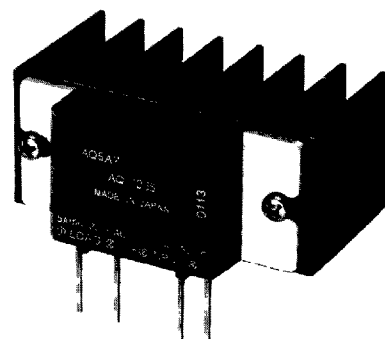
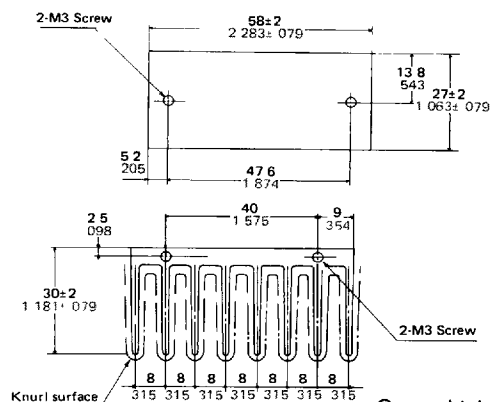
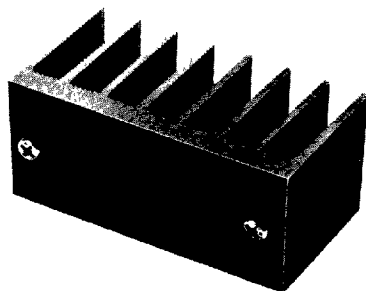
Zero-cross (low leakage, standard)



PC board pattern (Copper-side view)

General tolerance:  $\pm 0.50 \pm 0.20$ Tolerance:  $\pm 0.1 \pm 0.04$ 

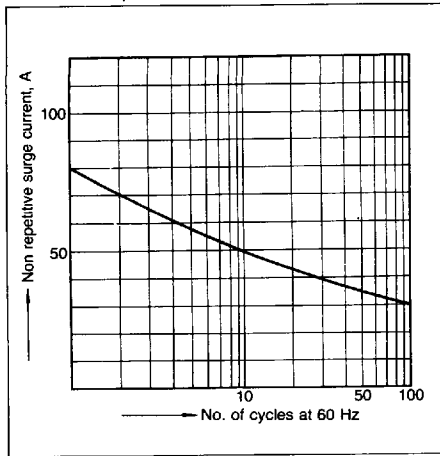
### Heat sink (for 5 A types)

General tolerance:  $\pm 0.5 \pm 0.20$

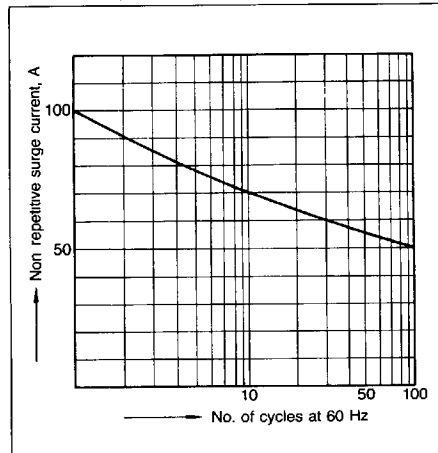
## DATA

## 1. Non-repetitive surge current vs carrying time

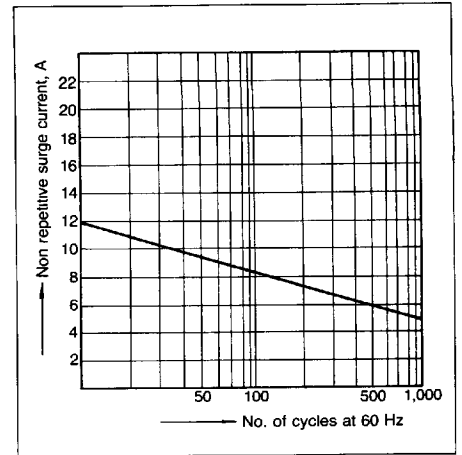
## 1-1. AC output zero-crossing type (2 A type)



## 1-2. AC output zero-cross type (5 A type)

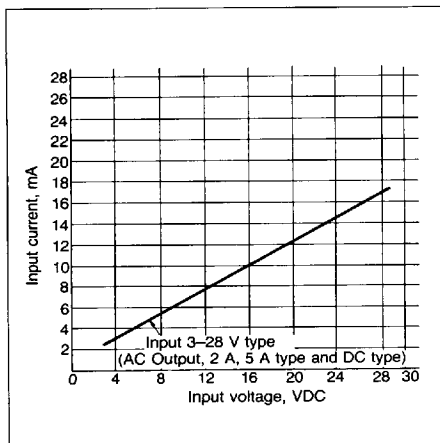


## 1-3. DC output type



## 2. Input characteristics

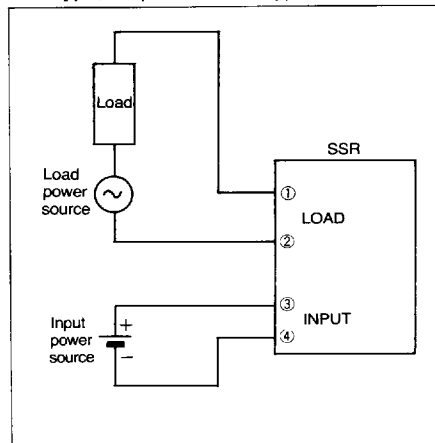
## 2-1. Input voltage vs input current



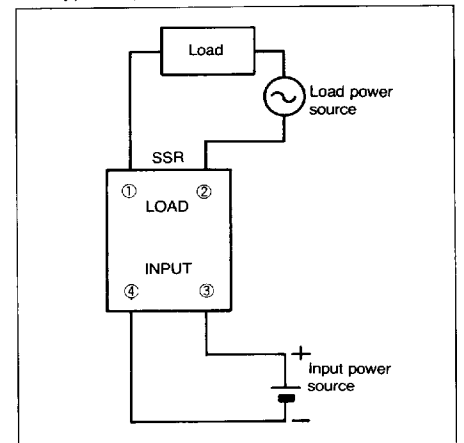
## 3. Schematic

## 1) When load is driven directly.

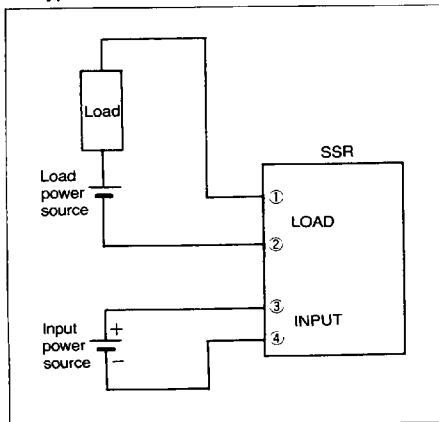
Slim type, output 2 A, 5 A types.



## Flat type output 2 A.

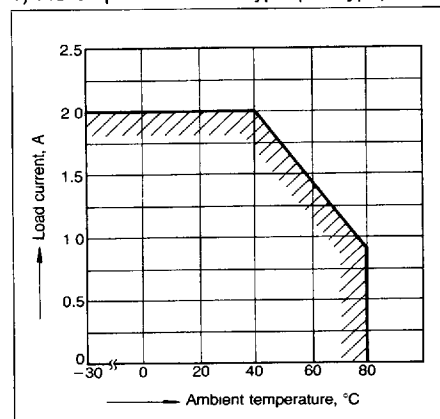


## DC type



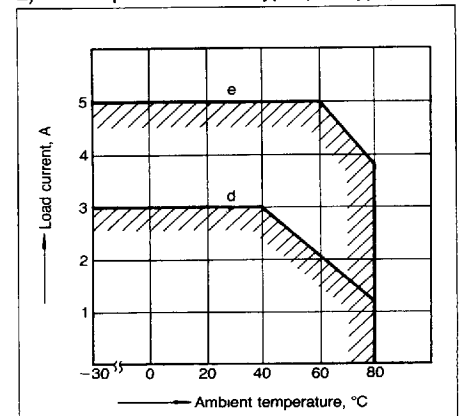
## 4. Load current vs. ambient temperature

## 1) AC output zero-cross type (2 A type)



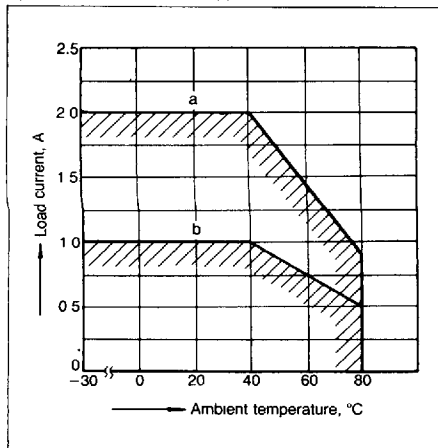
Allowable ambient temperature:  
 -30°C to +80°C -22°F to +176°F

## 2) AC output zero-cross type (5 A type)



- d. External heat sink is not used.  
 e. In the case of mounting on heat sink (AQ-HS-5A) or 66×66×2.0 thick aluminum plate. The AQ-HS-5A heat sink is mounted on the printed circuit board. The load current is improved compared with the unmounted condition as indicated in the diagram above. When the 5 A type heat sink (AQ-HS-5A) or a heat sink is not use, in order to provide good cooling conditions, the back surface plate should be exposed.

## 3) DC type (1 A, 2 A type)



## a. DC type (2 A type)

Allowable temperature range:

-30°C to +80°C -22°F to +176°F

## b. DC type (1 A type)

Allowable temperature range:

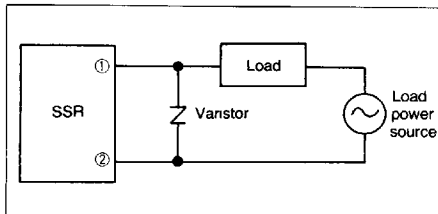
-30°C to +80°C -22°F to +176°F

## REMARKS

## 1. Regarding the output side

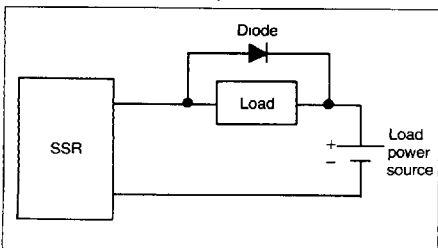
## 1) AC output type

When large noise and surge are impressed on the load side, there is the possibility of the occurrence of miscontact or damage. In such a case, a varistor should be inserted in the circuit.



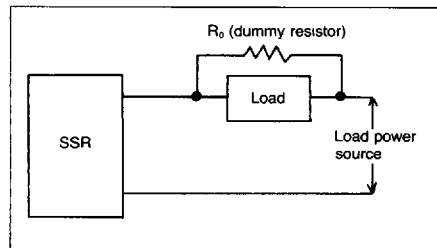
## 2) DC output type

In the case of solenoids, motors, electro-magnetic valves, etc., as inductive loads, a diode should be connected at both ends of the load to prevent counter EMF.



## 3) When loads lower than the rated value are used

Because there is the possibility of the occurrence of miscontact, a dummy resistor should be used.

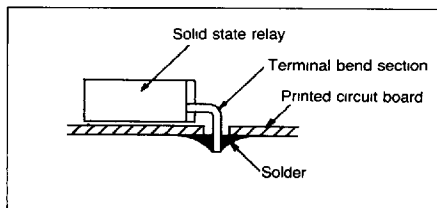


Rated value of load

|    | Type     | Rated value |
|----|----------|-------------|
| AC | 2 A, 5 A | Min. 50 mA  |
| DC | 1 A, 2 A | Min. 5 mA   |

## 2. When using bent output terminals

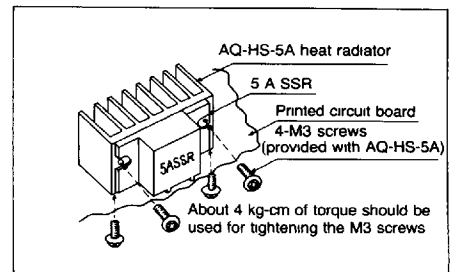
To avoid applying mechanical stress on the main unit and molded section of the solid state relay, radio pliers should be used to grasp the terminals between the point of bending and the molded case when making the bends.



## 3. When a heat sink is mounted on the 5 A type

The heat sink (AQ-HS-5A) or a heat sink which can make good contact should be used.

If a heat sink is used in which the contact condition is bad, a heat conducting compound should be used to improve the heat radiation. (A silicon compound is a typical example.) The compound should be coated on the heat sink and the AQ1.



## 4. Other points

1) With heat generating units or other SSR units mounted adjacent, because there can be a rise in the ambient temperature, consideration should be given to the layout and to circulation around the units.

2) Terminal soldering should be done at 260°C, 500°F within 5 seconds.