

### FEATURES

- **Two types available: Non zero-cross type and Zero-cross type**  
Non zero-cross type permits phase control and Zero-cross type suppresses occurrence of noise.
- **Slim type**  
The small-sized slim type (43 mm long × 9 mm wide × 24 mm high) (1.693×.354×.945 inch) permits high density mounting to PC board.
- **High dielectric strength: 1,500 V AC (between input and output)**  
4,000 V AC (between input and output)

### TYPICAL APPLICATIONS

- Copying equipment
- NC machines, sequencers, robots
- Air conditioners

RoHS Directive compatibility information  
<http://www.nais-e.com/>

### TYPES

| Type               | Load voltage   | Input voltage | Standard type (1,500 V AC) | Reinforced type (4,000 V AC) |
|--------------------|----------------|---------------|----------------------------|------------------------------|
|                    |                |               | Part No.                   | Part No.                     |
| Zero-cross 1 A     | 75 to 125 V AC | 3 to 6 V DC   | AQB1A1-ZT3/6VDC            | —                            |
|                    |                | 7 to 14 V DC  | AQB1A1-ZT7/14VDC           | —                            |
|                    |                | 10 to 18 V DC | AQB1A1-ZT10/18VDC          | —                            |
|                    |                | 18 to 30 V DC | AQB1A1-ZT18/30VDC          | —                            |
|                    | 75 to 250 V AC | 3 to 6 V DC   | AQB1A2-ZT3/6VDC            | AQB1A2-ZV3/6VDC              |
|                    |                | 7 to 14 V DC  | AQB1A2-ZT7/14VDC           | AQB1A2-ZV7/14VDC             |
|                    |                | 10 to 18 V DC | AQB1A2-ZT10/18VDC          | AQB1A2-ZV10/18VDC            |
|                    |                | 18 to 30 V DC | AQB1A2-ZT18/30VDC          | AQB1A2-ZV18/30VDC            |
| Zero-cross 2 A     | 75 to 125 V AC | 3 to 6 V DC   | AQB2A1-ZT3/6VDC            | —                            |
|                    |                | 7 to 14 V DC  | AQB2A1-ZT7/14VDC           | —                            |
|                    |                | 10 to 18 V DC | AQB2A1-ZT10/18VDC          | —                            |
|                    |                | 18 to 30 V DC | AQB2A1-ZT18/30VDC          | —                            |
|                    | 75 to 250 V AC | 3 to 6 V DC   | AQB2A2-ZT3/6VDC            | AQB2A2-ZV3/6VDC              |
|                    |                | 7 to 14 V DC  | AQB2A2-ZT7/14VDC           | AQB2A2-ZV7/14VDC             |
|                    |                | 10 to 18 V DC | AQB2A2-ZT10/18VDC          | AQB2A2-ZV10/18VDC            |
|                    |                | 18 to 30 V DC | AQB2A2-ZT18/30VDC          | AQB2A2-ZV18/30VDC            |
| Non zero-cross 1 A | 75 to 125 V AC | 3 to 6 V DC   | AQB1A1-T3/6VDC             | —                            |
|                    |                | 7 to 14 V DC  | AQB1A1-T7/14VDC            | —                            |
|                    |                | 10 to 18 V DC | AQB1A1-T10/18VDC           | —                            |
|                    |                | 18 to 30 V DC | AQB1A1-T18/30VDC           | —                            |
|                    | 75 to 250 V AC | 3 to 6 V DC   | AQB1A2-T3/6VDC             | AQB1A2-V3/6VDC               |
|                    |                | 7 to 14 V DC  | AQB1A2-T7/14VDC            | AQB1A2-V7/14VDC              |
|                    |                | 10 to 18 V DC | AQB1A2-T10/18VDC           | AQB1A2-V10/18VDC             |
|                    |                | 18 to 30 V DC | AQB1A2-T18/30VDC           | AQB1A2-V18/30VDC             |
| Non zero-cross 2 A | 75 to 125 V AC | 3 to 6 V DC   | AQB2A1-T3/6VDC             | —                            |
|                    |                | 7 to 14 V DC  | AQB2A1-T7/14VDC            | —                            |
|                    |                | 10 to 18 V DC | AQB2A1-T10/18VDC           | —                            |
|                    |                | 18 to 30 V DC | AQB2A1-T18/30VDC           | —                            |
|                    | 75 to 250 V AC | 3 to 6 V DC   | AQB2A2-T3/6VDC             | AQB2A2-V3/6VDC               |
|                    |                | 7 to 14 V DC  | AQB2A2-T7/14VDC            | AQB2A2-V7/14VDC              |
|                    |                | 10 to 18 V DC | AQB2A2-T10/18VDC           | AQB2A2-V10/18VDC             |
|                    |                | 18 to 30 V DC | AQB2A2-T18/30VDC           | AQB2A2-V18/30VDC             |

# AQ-B

## ORDERING INFORMATION

Ex. AQB 1A 1 — ZT 3/6VDC

| Load current | Load voltage                           | Type  |   | Input voltage                   |
|--------------|--|---|---|---------------------------------|
| 1A<br>2A     | 1: 75 to 125 V AC<br>2: 75 to 250 V AC | ZT: Zero-cross type: 1,500 V<br>T: Non zero-cross type: 1,500 V | ZV: Zero-cross type: 4,000 V<br>V: Non zero-cross type: 4,000 V | 3/6, 7/14, 10/18,<br>18/30 V DC |

## SPECIFICATIONS

**Ratings** (at 20°C 68°F, Input voltage ripple: 1% or less)

1. Zero-cross type

1 A type

| Item       | Part No.                      | 1 A type             |                      |                       |                       | 2 A type             |                      |                       |                       | Remarks      |                          |
|------------|-------------------------------|----------------------|----------------------|-----------------------|-----------------------|----------------------|----------------------|-----------------------|-----------------------|--------------|--------------------------|
|            |                               | AQB1A1-ZT<br>3/6VDC  | AQB1A1-ZT<br>7/14VDC | AQB1A1-ZT<br>10/18VDC | AQB1A1-ZT<br>18/30VDC | AQB2A1-ZT<br>3/6VDC  | AQB2A1-ZT<br>7/14VDC | AQB2A1-ZT<br>10/18VDC | AQB2A1-ZT<br>18/30VDC |              |                          |
| Input side | Input voltage                 | 3 to 6 V DC          | 7 to 14 V DC         | 10 to 18 V DC         | 18 to 30 V DC         | 3 to 6 V DC          | 7 to 14 V DC         | 10 to 18 V DC         | 18 to 30 V DC         |              |                          |
|            | Input impedance               | Approx. 0.18 kΩ      | Approx. 0.75 kΩ      | Approx. 1.2 kΩ        | Approx. 2.15 kΩ       | Approx. 0.18 kΩ      | Approx. 0.75 kΩ      | Approx. 1.2 kΩ        | Approx. 2.15 kΩ       |              |                          |
|            | Drop-out voltage, min.        | 1 V                  |                      |                       |                       |                      |                      |                       |                       |              |                          |
| Load side  | Max. load current             | 1 A                  |                      |                       |                       | 2 A                  |                      |                       |                       | See "DATA 1" |                          |
|            | Load voltage                  | 75 to 125 V AC       |                      |                       |                       | 75 to 250 V AC       |                      |                       |                       |              |                          |
|            | Frequency                     | 45 to 65 Hz          |                      |                       |                       |                      |                      |                       |                       |              |                          |
|            | Repetitive peak voltage, max. | 400 V                |                      |                       |                       | 600 V                |                      |                       |                       |              |                          |
|            | Non-repetitive surge current  | 10A                  |                      |                       |                       |                      |                      |                       |                       |              | In one cycle at 60 Hz    |
|            | "OFF-state" leakage current   | 0.6 mA/100 V applied |                      |                       |                       | 1.1 mA/200 V applied |                      |                       |                       | at 60 Hz     |                          |
|            | Max. "ON-state" voltage drop  | 1.6 V                |                      |                       |                       |                      |                      |                       |                       |              | at max. carrying current |
|            | Min. load current             | 10 mA                |                      |                       |                       | 20 mA                |                      |                       |                       |              |                          |
|            | OFF state dV/dt               | 100 V/μs             |                      |                       |                       |                      |                      |                       |                       |              |                          |

2 A type

| Item       | Part No.                      | 1 A type             |                      |                       |                       | 2 A type             |                      |                       |                       | Remarks      |                          |
|------------|-------------------------------|----------------------|----------------------|-----------------------|-----------------------|----------------------|----------------------|-----------------------|-----------------------|--------------|--------------------------|
|            |                               | AQB2A1-ZT<br>3/6VDC  | AQB2A1-ZT<br>7/14VDC | AQB2A1-ZT<br>10/18VDC | AQB2A1-ZT<br>18/30VDC | AQB2A2-ZT<br>3/6VDC  | AQB2A2-ZT<br>7/14VDC | AQB2A2-ZT<br>10/18VDC | AQB2A2-ZT<br>18/30VDC |              |                          |
| Input side | Input voltage                 | 3 to 6 V DC          | 7 to 14 V DC         | 10 to 18 V DC         | 18 to 30 V DC         | 3 to 6 V DC          | 7 to 14 V DC         | 10 to 18 V DC         | 18 to 30 V DC         |              |                          |
|            | Input impedance               | Approx. 0.18 kΩ      | Approx. 0.75 kΩ      | Approx. 1.2 kΩ        | Approx. 2.15 kΩ       | Approx. 0.18 kΩ      | Approx. 0.75 kΩ      | Approx. 1.2 kΩ        | Approx. 2.15 kΩ       |              |                          |
|            | Drop-out voltage, min.        | 1 V                  |                      |                       |                       |                      |                      |                       |                       |              |                          |
| Load side  | Max. load current             | 2 A                  |                      |                       |                       | 2 A                  |                      |                       |                       | See "DATA 1" |                          |
|            | Load voltage                  | 75 to 125 V AC       |                      |                       |                       | 75 to 250 V AC       |                      |                       |                       |              |                          |
|            | Frequency                     | 45 to 65 Hz          |                      |                       |                       |                      |                      |                       |                       |              |                          |
|            | Repetitive peak voltage, max. | 400 V                |                      |                       |                       | 600 V                |                      |                       |                       |              |                          |
|            | Non-repetitive surge current  | 20A                  |                      |                       |                       |                      |                      |                       |                       |              | In one cycle at 60 Hz    |
|            | "OFF-state" leakage current   | 0.6 mA/100 V applied |                      |                       |                       | 1.1 mA/200 V applied |                      |                       |                       | at 60 Hz     |                          |
|            | Max. "ON-state" voltage drop  | 1.6 V                |                      |                       |                       |                      |                      |                       |                       |              | at max. carrying current |
|            | Min. load current             | 10 mA                |                      |                       |                       | 20 mA                |                      |                       |                       |              |                          |
|            | OFF state dV/dt               | 100 V/μs             |                      |                       |                       |                      |                      |                       |                       |              |                          |

## 2. Non zero-cross type

## 1 A type

| Part No.   |                                  | AQB1A1-T<br>3/6VDC         | AQB1A1-T<br>7/14VDC        | AQB1A1-T<br>10/18VDC      | AQB1A1-T<br>18/30VDC       | AQB1A2-T<br>3/6VDC<br>AQB1A2-V<br>3/6VDC | AQB1A2-T<br>7/14VDC<br>AQB1A2-V<br>7/14VDC | AQB1A2-T<br>10/18VDC<br>AQB1A2-V<br>10/18VDC | AQB1A2-T<br>18/30VDC<br>AQB1A2-V<br>18/30VDC | Remarks                       |
|------------|----------------------------------|----------------------------|----------------------------|---------------------------|----------------------------|--|--|--|--|-------------------------------|
| Input side | Input voltage                    | 3 to<br>6 V DC             | 7 to<br>14 V DC            | 10 to<br>18 V DC          | 18 to<br>30 V DC           | 3 to<br>6 V DC                           | 7 to<br>14 V DC                            | 10 to<br>18 V DC                             | 18 to<br>30 V DC                             |                               |
|            | Input impedance                  | Approx.<br>0.18 k $\Omega$ | Approx.<br>0.75 k $\Omega$ | Approx.<br>1.2 k $\Omega$ | Approx.<br>2.15 k $\Omega$ | Approx.<br>0.18 k $\Omega$               | Approx.<br>0.75 k $\Omega$                 | Approx.<br>1.2 k $\Omega$                    | Approx.<br>2.15 k $\Omega$                   |                               |
| Load side  | Drop-out voltage,<br>min.        | 1 V                        |                            |                           |                            |  |  |  |  |                               |
|            | Max.load current                 | 1 A                        |                            |                           |                            |  |  |  |  | See "DATA 1"                  |
|            | Load voltage                     | 75 to 125 V AC             |                            |                           |                            | 75 to 250 V AC                           |  |  |  |                               |
|            | Frequency                        | 45 to 65 Hz                |                            |                           |                            |  |  |  |  |                               |
|            | Repetitive peak<br>voltage, max. | 400 V                      |                            |                           |                            | 600 V                                    |  |  |  |                               |
|            | Non-repetitive<br>surge current  | 10A                        |                            |                           |                            |  |  |  |  | In one cycle<br>at 60 Hz      |
|            | "OFF-state"<br>leakage current   | 0.6 mA/100 V applied       |                            |                           |                            | 1.1 mA/200 V applied                     |  |  |  | at 60 Hz                      |
|            | Max. "ON-state"<br>voltage drop  | 1.6 V                      |                            |                           |                            |  |  |  |  | at max. car-<br>rying current |
|            | Min. load current                | 10 mA                      |                            |                           |                            | 20 mA                                    |  |  |  |                               |
|            | OFF state dV/dt                  | 100 V/ $\mu$ s             |                            |                           |                            |  |  |  |  |                               |

## 2 A type

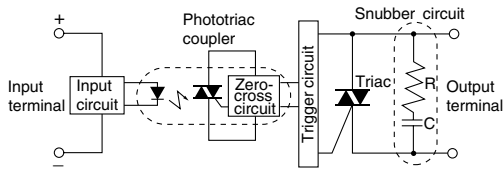
| Part No.   |                                  | AQB2A1-T<br>3/6VDC         | AQB2A1-T<br>7/14VDC        | AQB2A1-T<br>10/18VDC      | AQB2A1-T<br>18/30VDC       | AQB2A2-T<br>3/6VDC<br>AQB2A2-V<br>3/6VDC | AQB2A2-T<br>7/14VDC<br>AQB2A2-V<br>7/14VDC | AQB2A2-T<br>10/18VDC<br>AQB2A2-V<br>10/18VDC | AQB2A2-T<br>18/30VDC<br>AQB2A2-V<br>18/30VDC | Remarks                       |
|------------|----------------------------------|----------------------------|----------------------------|---------------------------|----------------------------|--|--|--|--|-------------------------------|
| Input side | Input voltage                    | 3 to<br>6 V DC             | 7 to<br>14 V DC            | 10 to<br>18 V DC          | 18 to<br>30 V DC           | 3 to<br>6 V DC                           | 7 to<br>14 V DC                            | 10 to<br>18 V DC                             | 18 to<br>30 V DC                             |                               |
|            | Input impedance                  | Approx.<br>0.18 k $\Omega$ | Approx.<br>0.75 k $\Omega$ | Approx.<br>1.2 k $\Omega$ | Approx.<br>2.15 k $\Omega$ | Approx.<br>0.18 k $\Omega$               | Approx.<br>0.75 k $\Omega$                 | Approx.<br>1.2 k $\Omega$                    | Approx.<br>2.15 k $\Omega$                   |                               |
| Load side  | Drop-out voltage,<br>min.        | 1 V                        |                            |                           |                            |  |  |  |  |                               |
|            | Max.load current                 | 2 A                        |                            |                           |                            |  |  |  |  | See "DATA 1"                  |
|            | Load voltage                     | 75 to 125 V AC             |                            |                           |                            | 75 to 250 V AC                           |  |  |  |                               |
|            | Frequency                        | 45 to 65 Hz                |                            |                           |                            |  |  |  |  |                               |
|            | Repetitive peak<br>voltage, max. | 400 V                      |                            |                           |                            | 600 V                                    |  |  |  |                               |
|            | Non-repetitive<br>surge current  | 20A                        |                            |                           |                            |  |  |  |  | In one cycle<br>at 60 Hz      |
|            | "OFF-state"<br>leakage current   | 0.6 mA/100 V applied       |                            |                           |                            | 1.1 mA/200 V applied                     |  |  |  | at 60 Hz                      |
|            | Max. "ON-state"<br>voltage drop  | 1.6 V                      |                            |                           |                            |  |  |  |  | at max. car-<br>rying current |
|            | Min. load current                | 10 mA                      |                            |                           |                            | 20 mA                                    |  |  |  |                               |
|            | OFF state dV/dt                  | 100 V/ $\mu$ s             |                            |                           |                            |  |  |  |  |                               |

## Characteristics (at 20°C 68°F, Input voltage ripple: less than 1%)

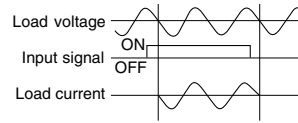
| Item                        | Zero-cross type                                   |   | Non zero-cross type                       |   | Remarks                     |
|-----------------------------|---|---|---|---|-----------------------------|
|                             | Standard type                                     | Reinforced type                           | Standard type                             | Reinforced type                           |                             |
| Operate time, max.          | (1/2 cycle of voltage sine wave) +1 ms            |   | 0.5 ms                                    |   |                             |
| Release time, max.          | (1/2 cycle of voltage sine wave) +1 ms            |   |   |   |                             |
| Insulation resistance, min. | 10 <sup>9</sup> $\Omega$ between input and output |   |   |   |                             |
| Breakdown voltage           | 1,500 V AC<br>between input<br>and output         | 4,000 V AC<br>between input<br>and output | 1,500 V AC<br>between input<br>and output | 4,000 V AC<br>between input<br>and output | For 1 minute                |
| Vibration resistance        | Functional  | 10 to 55 Hz at double amplitude of 3 mm   |   |   | 10 minutes for X, Y, Z axes |
|                             | Destructive                                       | 10 to 55 Hz at double amplitude of 3 mm   |   |   | 1 hour for X, Y, Z axes     |
| Shock resistance            | Functional  | Min. 980 m/s <sup>2</sup> {100 G}         |   |   | 4 times for X, Y, Z axes    |
|                             | Destructive                                       | Min. 980 m/s <sup>2</sup> {100 G}         |   |   | 5 times for X, Y, Z axes    |
| Ambient temperature         | -20°C to +80°C -4°F to +176°F                     |   |   |   |                             |
| Storage temperature         | -25°C to +85°C -13°F to +185°F                    |   |   |   |                             |
| Operational method          | Zero-cross Turn-ON<br>Zero-cross Turn-OFF         |   | Random Turn-ON<br>Zero-cross Turn-OFF     |   |                             |

# OPERATING PRINCIPLE

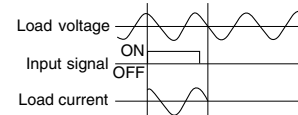
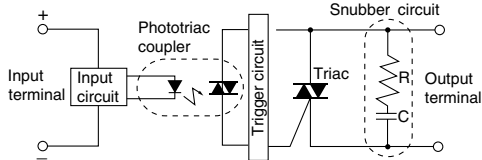
Internal circuit  
Zero-cross type



Wave form of input and output (Resistive load)



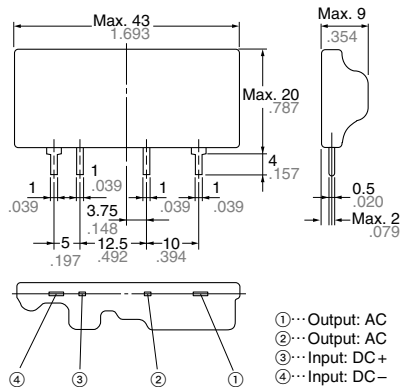
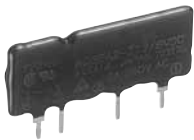
Non zero-cross type



# DIMENSIONS

mm inch

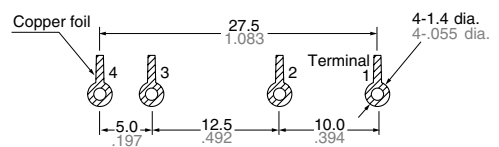
(Common for zero-cross and Non zero-cross type)



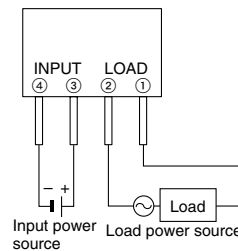
- ①···Output: AC
- ②···Output: AC
- ③···Input: DC+
- ④···Input: DC-

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

PC board pattern (BOTTOM VIEW)

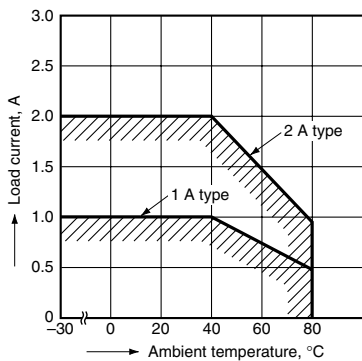


Terminal connection diagram

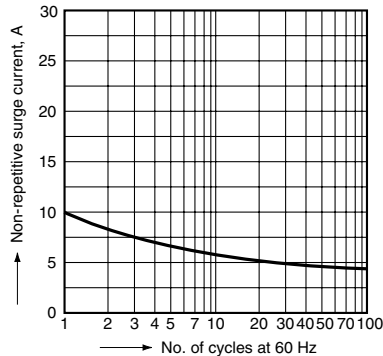


# REFERENCE DATA

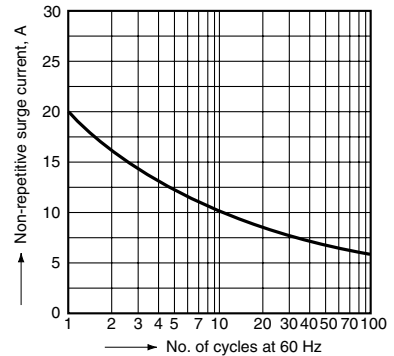
1. Load current vs. ambient temperature



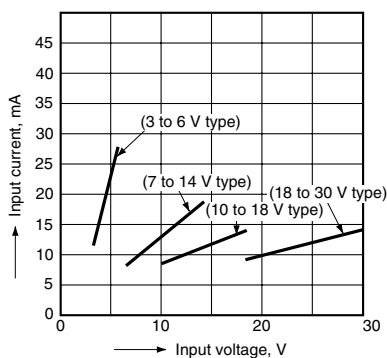
2-1. Non-repetitive surge current vs. carrying time (1 A type)



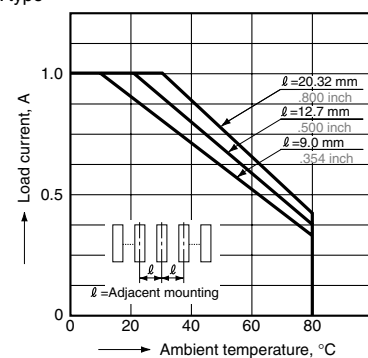
2-2. Non-repetitive surge current vs. carrying time (2 A type)



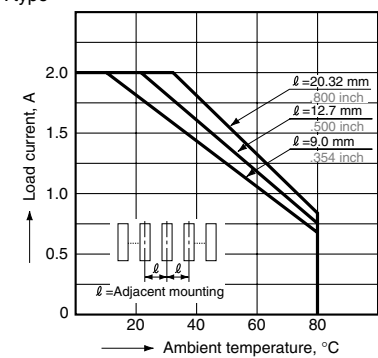
3. Input current vs. input voltage



4. Load current vs. ambient temperature for adjacent mounting  
1 A type



2 A type



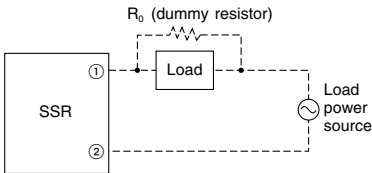
**NOTE**

**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.

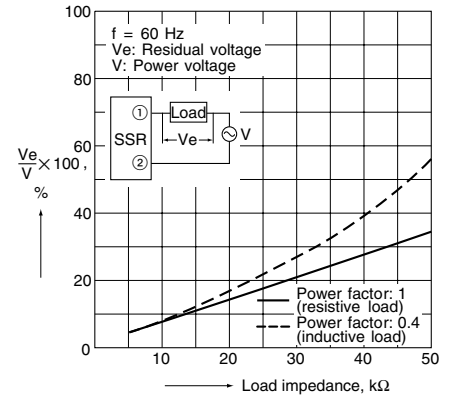


In case the dummy resistor is not used, keep in mind that the residual voltage becomes as follows:

Example:

For the inductive load by the 5 mA load current and the 200 V AC load voltage, the load impedance becomes 40 kΩ and  $V_e/V = 16\%$  is estimated from the right above graph. Accordingly, the 32 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



**For Cautions for Use**