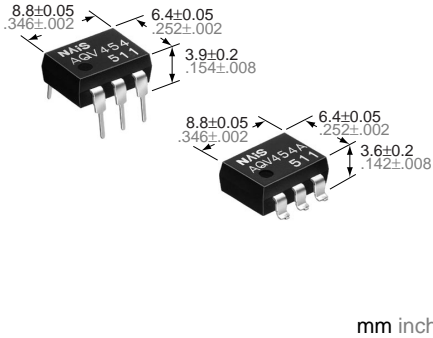


# NAiS

## HE (High-function Economy) Type 1- Channel (Form B) Type

# PhotoMOS RELAYS

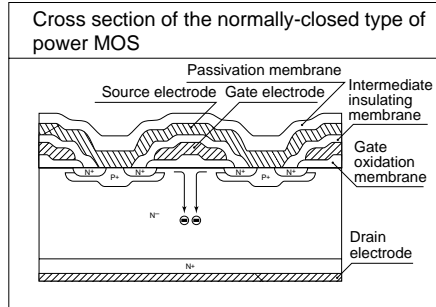


mm inch

### FEATURES

#### 1. Form B (Normally-closed) type

Has been realized thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.



#### 2. Controls low-level analog signals

PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

#### 3. High sensitivity, low ON resistance

Can control a maximum 0.15 A load current with a 5 mA input current. Low ON resistance of  $16 \Omega$  (AQV454). Stable operation because there are no metallic contact parts.

#### 4. Controls various types of load such as relays, motors, lamps and solenoids.

#### 5. Eliminates the need for a power supply to drive the power MOSFET

A power supply used to drive the power MOSFET is unnecessary because of the built-in optoelectronic device. This results in easy circuit design and small PC board area.

#### 6. Low thermal electromotive force (Approx. $1 \mu\text{V}$ ) (Basic insulation)

#### 7. Reinforced insulation 5,000 V type also available.

More than 0.4 mm .016 inch internal insulation distance between inputs and outputs. Conforms to IEC950 (reinforced insulation).

### TYPICAL APPLICATIONS

- Security equipment
- High-speed inspection machines
- Measuring instruments
- Telephone equipment
- Sensors

### TYPES

| Type  | I/O isolation         | Output rating* |              | Part No.              |                                |                                |           | Packing quantity                                     |            |
|-------|-----------------------|----------------|--------------|-----------------------|--------------------------------|--------------------------------|-----------|--|------------|
|       |                       | Load voltage   | Load current | Through hole terminal | Surface-mount terminal         |                                | Tube      | Tape and reel  |            |
|       |                       |                |              |                       | Tube packing style             | Tape and reel packing style    |           |  |            |
|       |                       |                |              |                       | Picked from the 1/2/3-pin side | Picked from the 4/5/6-pin side |           |  |            |
| AC/DC | 1,500 V AC            | 250 V          | 200 mA       | AQV453                | AQV453A                        | AQV453AX                       | AQV453AZ  | 1 tube contains 50 pcs.<br>1 batch contains 500 pcs. | 1,000 pcs. |
|       |                       |                |              | AQV454                | AQV454A                        | AQV454AX                       | AQV454AZ  |  |            |
|       | Reinforced 5,000 V AC | 400 V          | 150 mA       | AQV454H               | AQV454HA                       | AQV454HAX                      | AQV454HAZ |  |            |

\* Indicate the peak AC and DC values.

Note: For space reasons, the package type indicator "X" and "Z" are omitted from the seal.

## RATING

### 1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

| Item                    |                         | Symbol     | Type of connection              | AQV453(A) | AQV454(A)  | AQV454H(A) | Remarks   |  |
|-------------------------|-------------------------|------------|---------------------------------|-----------|------------|------------|---|--|
| Input                   | LED forward current     | $I_F$      |                                 | 50 mA     |            |            | f = 100 Hz, Duty factor = 0.1%                  |  |
|                         | LED reverse voltage     | $V_R$      |                                 | 3 V       |            |            |   |  |
|                         | Peak forward current    | $I_{FP}$   |                                 | 1 A       |            |            |   |  |
|                         | Power dissipation       | $P_{in}$   |                                 | 75 mW     |            |            |   |  |
| Output                  | Load voltage (peak AC)  | $V_L$      |                                 | 250 V     | 400 V      |            | A connection: Peak AC, DC<br>B,C connection: DC |  |
|                         | Continuous load current | $I_L$      |                                 | A         | 0.2 A      | 0.15 A     |   |  |
|                         |                         |            |                                 | B         | 0.3 A      | 0.18 A     |   |  |
|                         |                         |            |                                 | C         | 0.4 A      | 0.25 A     |   |  |
|                         | Peak load current       | $I_{PEAK}$ |                                 |           | 0.6 A      | 0.5 A      |   | A connection: 100 ms (1 shot),<br>$V_L = DC$ |
| Power dissipation       | $P_{OUT}$               | 360 mW     |                                 |           |            |            |   |  |
| Total power dissipation |                         | $P_T$      | 410 mW                          |           |            |            |   |  |
| I/O isolation voltage   |                         | $V_{iso}$  | 1,500 V AC                      |           | 5,000 V AC |            |   |  |
| Temperature limits      | Operating               | $T_{opr}$  | -40°C to +85°C -40°F to +185°F  |           |            |            | Non-condensing at low temperatures              |  |
|                         | Storage                 | $T_{stg}$  | -40°C to +100°C -40°F to +212°F |           |            |            |   |  |

### 2. Electrical characteristics (Ambient temperature: 25°C 77°F)

| Item                             |                           |                     | Symbol     | Type of connection                     | AQV453(A)        | AQV454(A)        | AQV454H(A)                                  | Remarks   |  |
|----------------------------------|---------------------------|---------------------|------------|--|------------------|------------------|---|---|--|
| Input                            | LED operate (OFF) current | Typical             | $I_{Foff}$ | —                                      | 1 mA             | 0.9 mA           | 1.4 mA                                      | $I_L = \text{Max.}$   |  |
|                                  |                           | Maximum             |            |  | 3 mA             |                  |   |   |  |
|                                  | LED reverse (ON) current  | Minimum             | $I_{Fon}$  | —                                      | 0.4 mA           |                  |   | $I_L = \text{Max.}$   |  |
|                                  |                           | Typical             |            |  | 0.9 mA           | 0.8 mA           | 1.3 mA                                      |   |  |
| LED dropout voltage              | Typical                   | $V_F$               | —          | 1.14 V (1.25V at $I_F=50 \text{ mA}$ ) |                  |                  | $I_F = 5 \text{ mA}$                        |   |  |
|                                  | Maximum                   |                     |            | 1.5 V                                  |                  |                  |   |   |  |
| Output                           | On resistance             | Typical             | $R_{on}$   | A                                      | 5.5 $\Omega$     | 10.5 $\Omega$    | 10.5 $\Omega$                               | $I_F = 0 \text{ mA}$<br>$I_L = \text{Max.}$<br>Within 1 s on time |  |
|                                  |                           | Maximum             |            |  | 8 $\Omega$       | 16 $\Omega$      | 16 $\Omega$                                 |   |  |
|                                  |                           | Typical             | $R_{on}$   | B                                      | 2.7 $\Omega$     | 6.3 $\Omega$     | 6.3 $\Omega$                                | $I_F = 0 \text{ mA}$<br>$I_L = \text{Max.}$<br>Within 1 s on time |  |
|                                  |                           | Maximum             |            |  | 4 $\Omega$       | 8 $\Omega$       | 8 $\Omega$                                  |   |  |
|                                  |                           | Typical             | $R_{on}$   | C                                      | 1.4 $\Omega$     | 3.1 $\Omega$     | 3.1 $\Omega$                                | $I_F = 0 \text{ mA}$<br>$I_L = \text{Max.}$<br>Within 1 s on time |  |
|                                  |                           | Maximum             |            |  | 2 $\Omega$       | 4 $\Omega$       | 4 $\Omega$                                  |   |  |
| Off state leakage current        | Maximum                   | $I_{Leak}$          | —          | 1 $\mu\text{A}$                        | 10 $\mu\text{A}$ | 10 $\mu\text{A}$ | $I_F = 5 \text{ mA}$<br>$V_L = \text{Max.}$ |   |  |
| Transfer characteristics         | Switching speed           | Operate (OFF) time* | Typical    | $T_{off}$                              | —                | 1.52 ms          | 1.2 ms                                      | 1.8 ms  | $I_F = 0 \text{ mA} \rightarrow 5 \text{ mA}$<br>$I_L = \text{Max.}$ |
|                                  |                           |                     | Maximum    |  |                  | 3 ms             | 2.0 ms                                      | 3.0 ms  |  |
|                                  |                           | Reverse (ON) time*  | Typical    | $T_{on}$                               | —                | 0.4 ms           | 0.36 ms                                     | 0.4 ms  | $I_F = 5 \text{ mA} \rightarrow 0 \text{ mA}$<br>$I_L = \text{Max.}$ |
|                                  |                           |                     | Maximum    |  |                  | 1 ms             | 1.0 ms                                      | 1.0 ms  |  |
|                                  | I/O capacitance           |                     | Typical    | $C_{iso}$                              | —                | 1.3 pF           |   |   | f = 1 MHz<br>$V_B = 0$   |
|                                  |                           | Maximum             | 3 pF       |  |                  |                  |   |   |  |
| Initial I/O isolation resistance |                           | Minimum             | $R_{iso}$  | —                                      | 1,000 M $\Omega$ |                  |   | 500 V DC  |  |

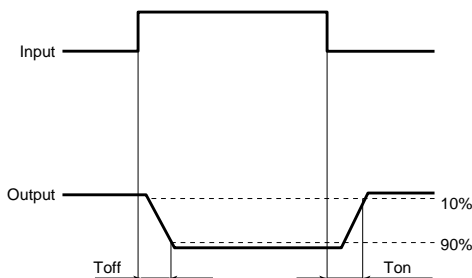
Note: Recommendable LED forward current.

For type of connection, see Page 445.

Standard type:  $I_F = 5 \text{ mA}$

Reinforced type:  $I_F = 5 \text{ to } 10 \text{ mA}$

\*Operate/Reverse time



■ For Dimensions, see Page 440.

■ For Schematic and Wiring Diagrams, see Page 445.

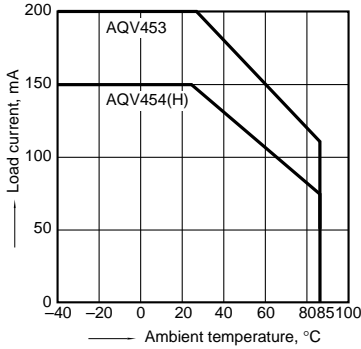
■ For Cautions for Use, see Page 449.

# REFERENCE DATA

## 1. Load current vs. ambient temperature characteristics

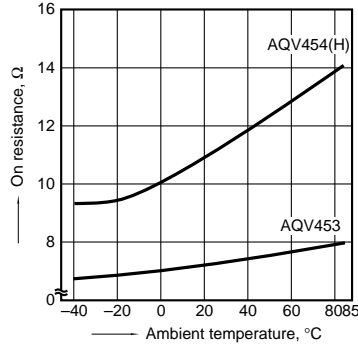
Allowable ambient temperature:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$   
 $-40^{\circ}\text{F}$  to  $+185^{\circ}\text{F}$

Type of connection: A



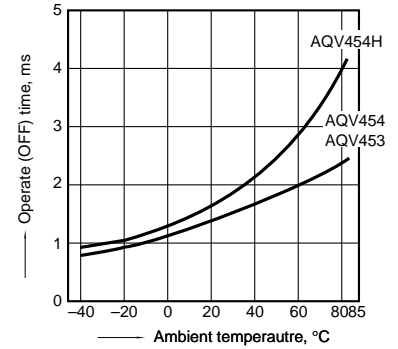
## 2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;  
 LED current: 0 mA; Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



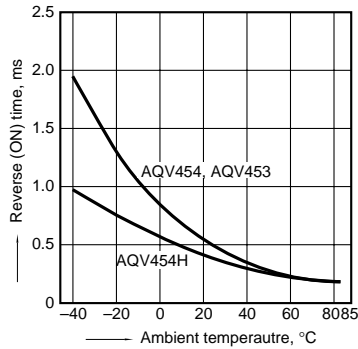
## 3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



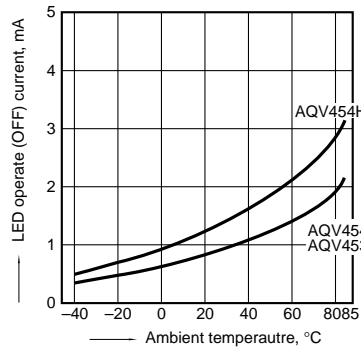
## 4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



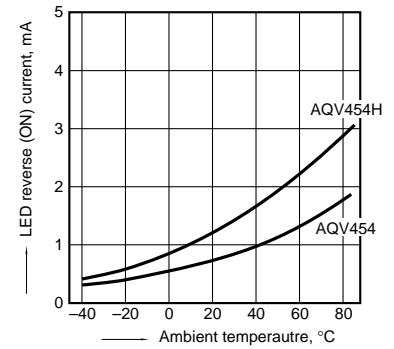
## 5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



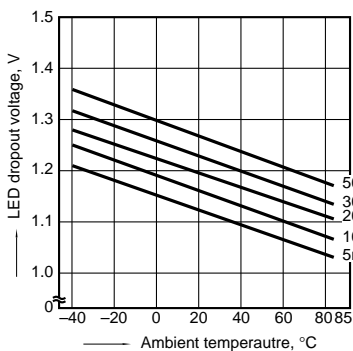
## 6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



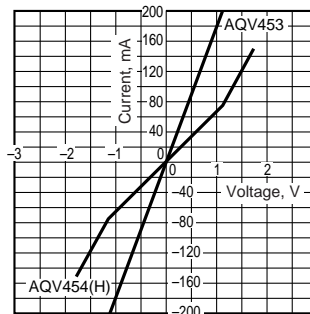
## 7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



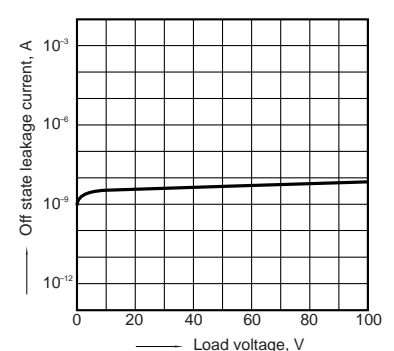
## 8. Voltage vs. current characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;  
 Ambient temperature:  $25^{\circ}\text{C}$   $77^{\circ}\text{F}$



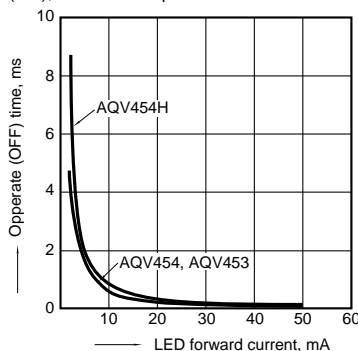
## 9. Off state leakage current

Sample: AQV454;  
 Measured portion: between terminals 4 and 6;  
 Ambient temperature:  $25^{\circ}\text{C}$   $77^{\circ}\text{F}$



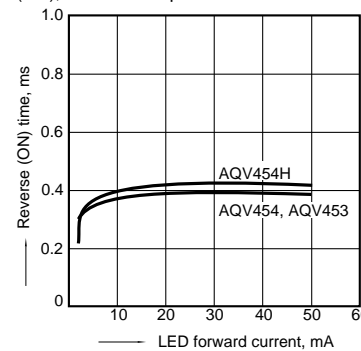
## 10. LED forward current vs. operate (OFF) time characteristics

Measured portion: between terminals 4 and 6;  
 Load voltage: Max. (DC); Continuous load current:  
 Max. (DC); Ambient temperature:  $25^{\circ}\text{C}$   $77^{\circ}\text{F}$



## 11. LED forward current vs. reverse (ON) time characteristics

Measured portion: between terminals 4 and 6;  
 Load voltage: Max. (DC); Continuous load current:  
 Max. (DC); Ambient temperature:  $25^{\circ}\text{C}$   $77^{\circ}\text{F}$



## 12. Applied voltage vs. output capacitance characteristics

Measured portion: between terminals 4 and 6;  
 Frequency: 1 MHz; Ambient temperature:  $25^{\circ}\text{C}$   $77^{\circ}\text{F}$

