

NAIS

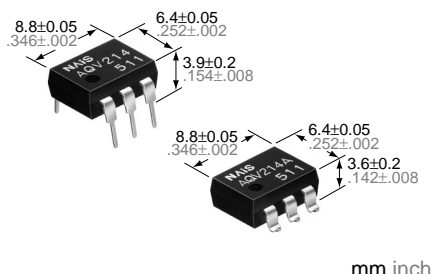
GU (General Use) Type [1-Channel (Form A) Type]

PhotoMOS RELAYS

FEATURES

- 1. Controls low-level analog signals**
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
- 2. Control with low-level input signals**
- 3. Controls various types of loads such as relays, motors, lamps and solenoids.**
- 4. Optical coupling for extremely high isolation**
Unlike mechanical relays, the PhotoMOS relay combines LED and optoelectronic device to transfer signals using light for extremely high isolation.
- 5. Eliminates the need for a counter electromotive force protection diode in the drive circuits on the input side**

- 6. Stable on resistance**
- 7. Low-level off state leakage current**
- 8. 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.
- 9. Low thermal electromotive force (Approx. 1 μV)**



mm inch

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Data communication equipment
- Computer

TYPES

| Type | I/O isolation | Output rating* | | Part No. | | | | Packing quantity | |
|--------------------|---------------------|----------------|---------|-----------------------|------------------------|--------------------|----------|--|------------|
| | | | | Through hole terminal | Surface-mount terminal | | | | |
| | | | | Load voltage | Load current | Tube packing style | | Tape and reel packing style | |
| AC/DC | Standard 1,500 V AC | 60 V | 400 mA | AQV212 | AQV212A | AQV212AX | AQV212AZ | 1 tube contains 50 pcs. 1 batch contains 500 pcs. | 1,000 pcs. |
| | | 100 V | 320 mA | AQV215 | AQV215A | AQV215AX | AQV215AZ | | |
| | | 200 V | 180 mA | AQV217 | AQV217A | AQV217AX | AQV217AZ | | |
| | | 350 V | 130 mA | AQV210 | AQV210A | AQV210AX | AQV210AZ | | |
| | | 400 V | 120 mA | AQV214 | AQV214A | AQV214AX | AQV214AZ | | |
| | 600 V | 50 mA | AQV216 | AQV216A | AQV216AX | AQV216AZ | | | |
| Reinforced 5,000 V | 400 V | 120 mA | AQV214H | AQV214HA | AQV214HAX | AQV214HAZ | | | |

*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 | | Sym- bol | Type of connec- tion | AQV212(A) | AQV215(A) | AQV217(A) | AQV210(A) | AQV214(A) | AQV216(A) | AQV214H(A) | Remarks |
|-------------------------|-------------------------|-------------------|----------------------------|---------------------------------|-----------|-----------|-----------|-----------|-----------|------------|--|
| Input | LED forward current | I _F | | 50 mA | | | | | | | |
| | LED reverse voltage | V _R | | 3 V | | | | | | | |
| | Peak forward current | I _{FP} | | 1 A | | | | | | | f = 100 Hz, Duty factor = 0.1% |
| | Power dissipation | P _{in} | | 75 mW | | | | | | | |
| Output | Load voltage (peak AC) | V _L | | 60 V | 100 V | 200 V | 350 V | 400 V | 600 V | 400 V | |
| | Continuous load current | I _L | A | 0.40 A | 0.32 A | 0.18 A | 0.13 A | 0.12 A | 0.05 A | 0.12 A | A connection: Peak AC, DC; B, C connection: DC |
| | | | B | 0.60 A | 0.42 A | 0.22 A | 0.15 A | 0.13 A | 0.06 A | 0.13 A | |
| | | | C | 0.80 A | 0.60 A | 0.30 A | 0.17 A | 0.15 A | 0.08 A | 0.15 A | |
| | Peak load current | I _{peak} | | 1.2 A | 0.96 A | 0.54 A | 0.4 A | 0.3 A | 0.15 A | 0.3 A | A connection: 100 ms (1 shot), V _L =DC |
| Power dissipation | P _{out} | | 500 mW | | | | | | | | |
| Total power dissipation | | P _T | | 550 mW | | | | | | | |
| I/O isolation voltage | | V _{iso} | | 1,500 V AC | | | | | | | |
| Temperature limits | Operating | T _{opr} | | -40°C to +85°C -40°F to +185°F | | | | | | | Non-condensing at low temp. |
| | Storage | T _{stg} | | -40°C to +100°C -40°F to +212°F | | | | | | | |

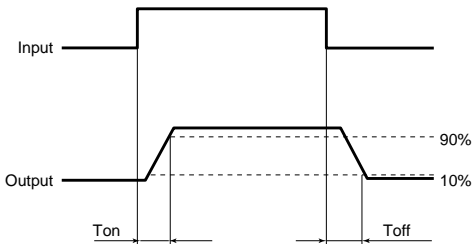
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

| Item | | Symbol | Type of connection** | AQV212(A) | AQV215(A) | AQV217(A) | AQV210(A) | AQV214(A) | AQV216(A) | AQV214H(A) | Condition | | |
|----------------------------------|----------------------|------------------|----------------------|---|-----------|-----------|-----------|-----------|-----------|------------|---|--|--|
| Input | LED operate current | Typical | — | 1 mA | 1 mA | 1 mA | 1 mA | 1 mA | 1 mA | 1.3 mA | I _L = Max. | | |
| | | Maximum | | 3 mA | 3 mA | 3 mA | 3 mA | 3 mA | 3 mA | 3 mA | | | |
| | LED turn off current | Minimum | — | 0.4 mA | 0.4 mA | 0.4 mA | 0.4 mA | 0.4 mA | 0.4 mA | 0.4 mA | 0.4 mA | I _L = Max. | |
| Typical | | 0.79 mA | | 0.79 mA | 0.79 mA | 0.79 mA | 0.79 mA | 0.79 mA | 0.79 mA | 1.2 mA | | | |
| LED dropout voltage | Typical | V _F | — | 1.14 V (1.25 V at I _F = 50 mA) | | | | | | | I _F = 5 mA | | |
| | Maximum | | | 1.5 V | | | | | | | | | |
| Output | On resistance | Typical | R _{on} | A | 0.83 Ω | 2.3 Ω | 11.0 Ω | 23 Ω | 30 Ω | 70 Ω | 30 Ω | I _F = 5 mA I _L = Max. Within 1 s on time | |
| | | Maximum | | | 2.5 Ω | 4.0 Ω | 15.0 Ω | 35 Ω | 50 Ω | 120 Ω | 50 Ω | | |
| | On resistance | Typical | R _{on} | B | 0.44 Ω | 1.15 Ω | 5.5 Ω | 11.5 Ω | 22.5 Ω | 55 Ω | 22.5 Ω | I _F = 5 mA I _L = Max. Within 1 s on time | |
| | | Maximum | | | 1.25 Ω | 2.0 Ω | 7.5 Ω | 17.5 Ω | 25 Ω | 100 Ω | 25 Ω | | |
| | On resistance | Typical | R _{on} | C | 0.25 Ω | 0.6 Ω | 2.8 Ω | 6.0 Ω | 11.3 Ω | 28 Ω | 11.3 Ω | I _F = 5 mA I _L = Max. Within 1 s on time | |
| | | Maximum | | | 1.63 Ω | 1.0 Ω | 3.8 Ω | 8.8 Ω | 12.5 Ω | 50 Ω | 12.5 Ω | | |
| Output capacitance | Typical | C _{out} | A | 150 pF | 110 pF | 70 pF | 45 pF | 45 pF | 45 pF | 45 pF | I _F = 0 V _B = 0 f = 1 MHz | | |
| Off state leakage current | Maximum | — | — | 1 μA | | | | | | | I _F = 0 V _L = Max. | | |
| Transfer characteristics | Switching speed | Turn on time* | Typical | T _{on} | — | 0.65 ms | 0.6 ms | 0.25 ms | 0.25 ms | 0.21 ms | 0.28 ms | 0.6 ms | I _F = 5 mA** I _L = Max. |
| | | | | | | Maximum | 2 ms | 2 ms | 1.0 ms | 0.5 ms | 0.5 ms | 0.5 ms | |
| | Switching speed | Turn off time* | Typical | T _{off} | — | 0.08 ms | 0.06 ms | 0.05 ms | 0.05 ms | 0.05 ms | 0.04 ms | 0.05 ms | I _F = 5 mA I _L = Max. |
| | | | | | | Maximum | 0.2 ms | 0.2 ms | 0.2 ms | 0.2 ms | 0.2 ms | 0.2 ms | |
| I/O capacitance | Typical | C _{iso} | — | 0.8 pF | | | | | | | f = 1 MHz V _B = 0 | | |
| | Maximum | | | 1.5 pF | | | | | | | | | |
| Initial I/O isolation resistance | Minimum | R _{iso} | — | 1,000 MΩ | | | | | | | 500 V DC | | |

Note: Recommendable LED forward current
 Standard type: 5 mA
 Reinforced type: 5 to 10 mA

*Turn on/Turn off time

< >: Value for high I/O isolation voltage type
 **Type of connection, see Page 444.



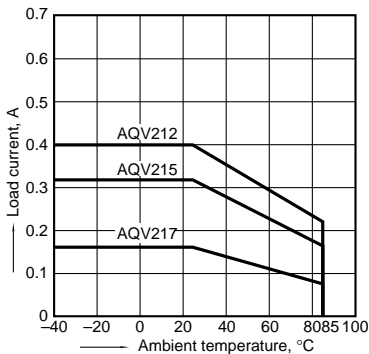
- For Dimensions, see Page 440.
- For Schematic and Wiring Diagrams, see Page 444.
- For Cautions for Use, see Page 449.

REFERENCE DATA

1-(1). Load current vs. ambient temperature characteristics

Allowable ambient temperature: -40°C to +85°C
 -40°F to +185°F

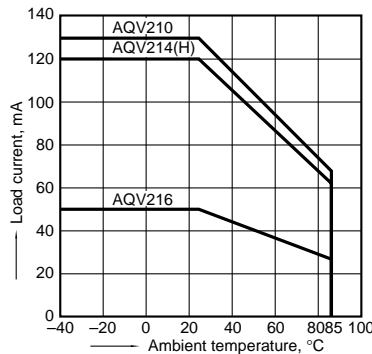
Type of connection: A



1-(2). Load current vs. ambient temperature characteristics

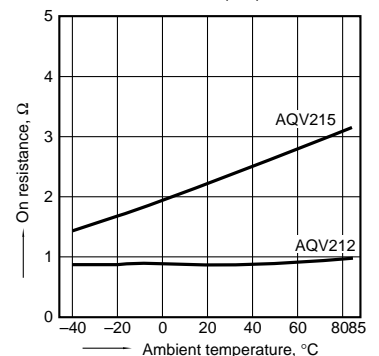
Allowable ambient temperature: -40°C to +85°C
 -40°F to +185°F

Type of connection: A



2-(1). On resistance vs. ambient temperature characteristics

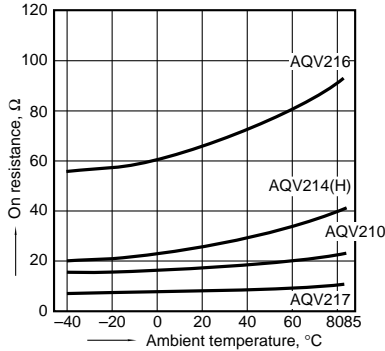
Measured portion: between terminals 4 and 6;
 LED current: 5 mA; Load voltage: Max. (DC)
 Continuous load current: Max. (DC)



AQV210

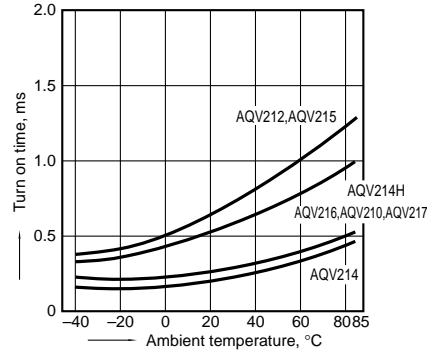
2-(2). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max. (DC)



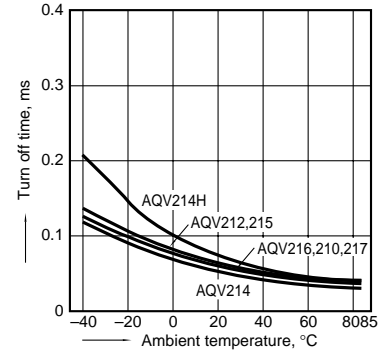
3. Turn on time vs. ambient temperature characteristics

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



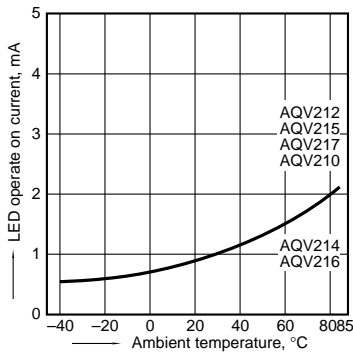
4. Turn off time vs. ambient temperature characteristics

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



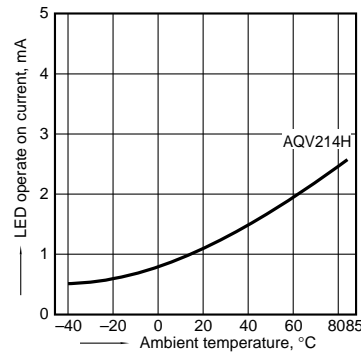
5-(1). LED operate current vs. ambient temperature characteristics

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



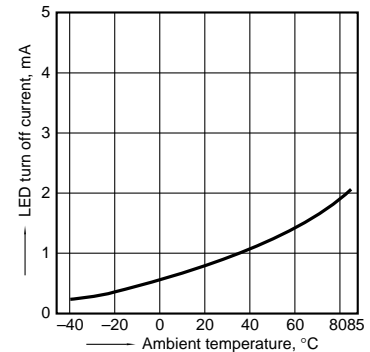
5-(2). LED operate current vs. ambient temperature characteristics

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



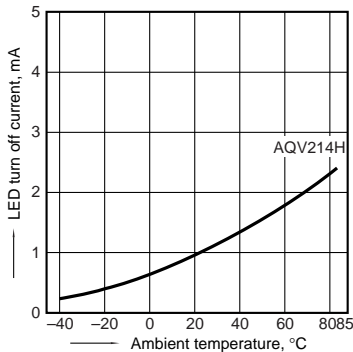
6-(1). LED turn off current vs. ambient temperature characteristics

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



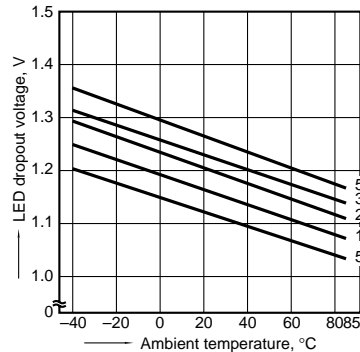
6-(2). LED turn off current vs. ambient temperature characteristics

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



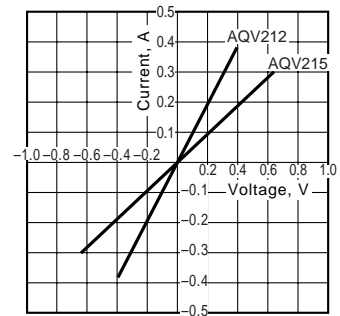
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types
LED current: 5 to 50 mA



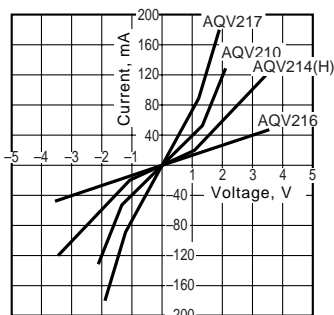
8-(1). Voltage vs. current characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



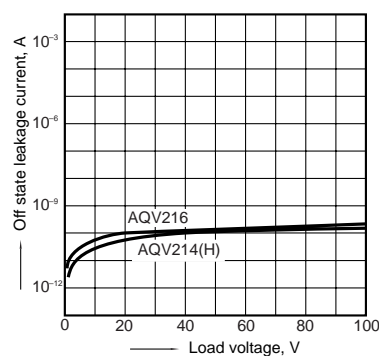
8-(2). Voltage vs. current characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



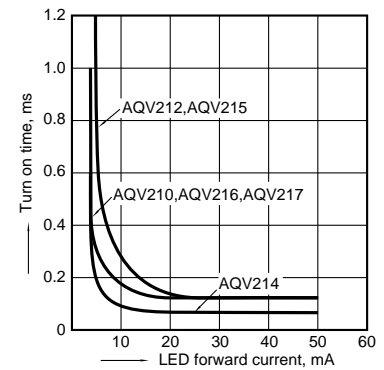
9. Off state leakage current

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



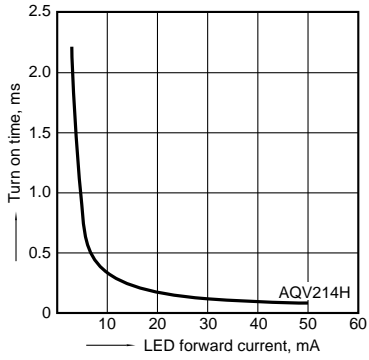
10-(1). LED forward current vs. turn on time characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



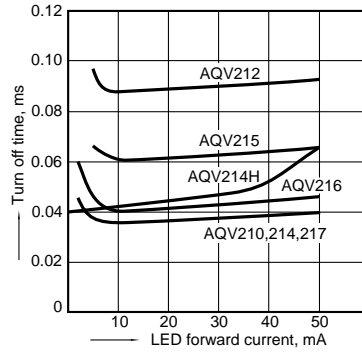
10-(2). LED forward current vs. turn on time characteristics

Measured portion: between terminals 4 and 6;
 Load voltage: 400 V (DC); Continuous load current:
 120 mA (DC); Ambient temperature: 25°C 77°F



11. LED forward current vs. turn off time characteristics

Measured portion: between terminals 4 and 6;
 Load voltage: Max. (DC); Continuous load current:
 Max. (DC); Ambient temperature: 25°C 77°F



12. Applied voltage vs. output capacitance characteristics

Measured portion: between terminals 4 and 6;
 Frequency: 1 MHz; Ambient temperature: 25°C 77°F

