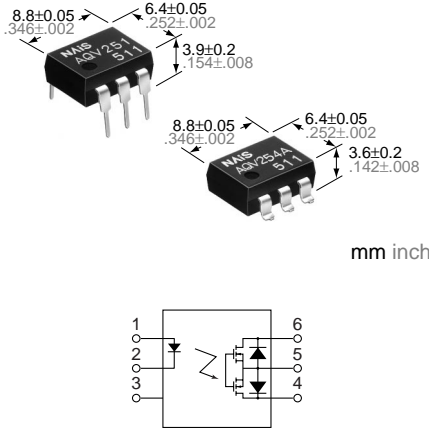


| | | |
|------|--|--------------------|
| NAIS | HE (High-function Economy) Type [1-Channel (Form A) Type] | PhotoMOS RELAYS |
|------|--|--------------------|



FEATURES

- 1. Highly sensitive and low on-resistance**
- 2. Controls various types of loads such as relays, motors, lamps and solenoids.**
- 3. Optical coupling for extremely high isolation**
5,000 Vrms I/O isolation available.
- 4. Low-level off state leakage current**
- 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 μV)**

TYPICAL APPLICATIONS

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

TYPES

1. I/O isolation voltage: 1,500 V AC

| Output rating* | | Part No. | | | | Packing quantity | |
|----------------|--------------|-----------------------|--------------------------------|--------------------------------|----------|--|------------|
| | | Through hole terminal | Surface-mount terminal | | | | |
| Load voltage | Load current | Tube packing style | Tape and reel packing style | | Tube | Tape and reel | |
| | | | Picked from the 1/2/3-pin side | Picked from the 4/5/6-pin side | | | |
| 40 V | 500 mA | AQV251 | AQV251A | AQV251AX | AQV251AZ | 1 tube contains 50 pcs. 1 batch contains 500 pcs. | 1,000 pcs. |
| 60 V | 400 mA | AQV252 | AQV252A | AQV252AX | AQV252AZ | | |
| 100 V | 350 mA | AQV255 | AQV255A | AQV255AX | AQV255AZ | | |
| 200 V | 250 mA | AQV257 | AQV257A | AQV257AX | AQV257AZ | | |
| 250 V | 200 mA | AQV253 | AQV253A | AQV253AX | AQV253AZ | | |
| 400 V | 150 mA | AQV254 | AQV254A | AQV254AX | AQV254AZ | | |
| 1,000 V | 30 mA | AQV259 | AQV259A | AQV259AX | AQV259AZ | | |
| 1,500 V | 20 mA | AQV258 | AQV258A | AQV258AX | AQV258AZ | | |

2. I/O isolation voltage: Reinforced 5,000 V

| Output rating* | | Part No. | | | | Packing quantity | |
|----------------|--------------|-----------------------|--------------------------------|--------------------------------|-----------|--|------------|
| | | Through hole terminal | Surface-mount terminal | | | | |
| Load voltage | Load current | Tube packing style | Tape and reel packing style | | Tube | Tape and reel | |
| | | | Picked from the 1/2/3-pin side | Picked from the 4/5/6-pin side | | | |
| 250 V | 200 mA | AQV253H | AQV253HA | AQV253HAX | AQV253HAZ | 1 tube contains 50 pcs. 1 batch contains 500 pcs. | 1,000 pcs. |
| 400 V | 150 mA | AQV254H | AQV254HA | AQV254HAX | AQV254HAZ | | |

*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 | AQV251(A) | AQV252(A) | AQV255(A) | AQV257(A) | AQV253(A) | AQV254(A) | AQV259(A) | AQV258(A) | AQV253H(A) | AQV254H(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 | | 40 V | 60 V | 100 V | 200 V | 250 V | 400 V | 1,000 V | 1,500 V | 250 V | 400 V | |
| | Continuous load current | I_L | A | 0.5 A | 0.4 A | 0.35 A | 0.25 A | 0.2 A | 0.15 A | 0.03 A | 0.02 A | 0.2 A | 0.15 A | A connection: Peak AC, DC B, C connection: DC |
| | | | B | 0.7 A | 0.6 A | 0.45 A | 0.35 A | 0.3 A | 0.18 A | 0.04 A | 0.025 A | 0.3 A | 0.18 A | |
| | | | C | 1.0 A | 0.8 A | 0.70 A | 0.5 A | 0.4 A | 0.25 A | 0.05 A | 0.04 A | 0.4 A | 0.25 A | |
| | Peak load current | I_{peak} | | 1.8 A | 1.5 A | 1.0 A | 0.75 A | 0.6 A | 0.5 A | 0.09 A | 0.06 A | 0.6 A | 0.5 A | A connection: 100 ms (1 shot) $V_L = DC$ |
| 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 | | | | | | | | | | |

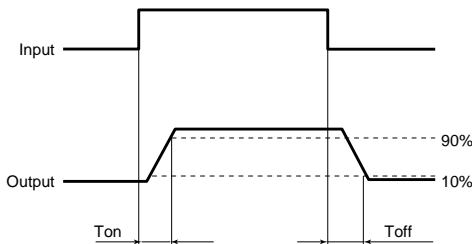
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

| Item | | Symbol | Type of connection | AQV251(A) | AQV252(A) | AQV255(A) | AQV257(A) | AQV253(A) | AQV254(A) | AQV259(A) | AQV258(A) | AQV253H(A) | AQV254H(A) | Condition | |
|----------------------------------|----------------------|---------------|--------------------|-----------------------------------|---------------|---------------|---------------|--------------|--------------|---------------|--------------|--------------|---------------------------|--|--|
| Input | LED operate current | Typical | I_{Fon} | 0.9 mA | | | | | | | | 1.4 mA | | $I_L = Max.$ | |
| | | Maximum | | 3 mA | | | | | | | | | | | |
| | LED turn off current | Minimum | I_{Foff} | 0.4 mA | | | | | | | | | | $I_L = Max.$ | |
| | | Typical | | 0.8 mA | | | | | | | 1.3 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 | 0.6 Ω | 0.74 Ω | 1.8 Ω | 2.6 Ω | 5.5 Ω | 12.4 Ω | 85 Ω | 345 Ω | 5.5 Ω | 12.4 Ω | $I_F = 5 mA$ $I_L = Max.$ Within 1 s on time |
| | | Maximum | | | 1 Ω | 1.4 Ω | 2.5 Ω | 4 Ω | 8 Ω | 16 Ω | 200 Ω | 500 Ω | 8 Ω | 16 Ω | |
| | | Typical | R_{on} | B | 0.3 Ω | 0.37 Ω | 0.9 Ω | 1.4 Ω | 2.7 Ω | 6.2 Ω | 60 Ω | 345 Ω | 2.7 Ω | 6.2 Ω | $I_F = 5 mA$ $I_L = Max.$ Within 1 s on time |
| | | Maximum | | | 0.5 Ω | 0.7 Ω | 1.25 Ω | 2 Ω | 4 Ω | 8 Ω | 100 Ω | 500 Ω | 4 Ω | 8 Ω | |
| | Typical | R_{on} | C | 0.15 Ω | 0.18 Ω | 0.45 Ω | 0.7 Ω | 1.4 Ω | 3.1 Ω | 30 Ω | 160 Ω | 1.4 Ω | 3.1 Ω | $I_F = 5 mA$ $I_L = Max.$ Within 1 s on time | |
| | Maximum | | | 0.25 Ω | 0.35 Ω | 0.63 Ω | 1 Ω | 2 Ω | 4 Ω | 50 Ω | 250 Ω | 2 Ω | 4 Ω | | |
| Off state leakage current | Maximum | — | — | 1 μA | | | | | 10 μA | | 1 μA | | $I_F = 0$ $V_L = Max.$ | | |
| Transfer characteristics | Switching speed | Turn on time* | T_{on} | — | 1.7 ms | 1.4 ms | 0.9 ms | 1.5 ms | 0.8ms | 0.8ms | 0.6ms | 0.35 ms | 2.4ms | 1.8ms | $I_F = 5 mA$ $I_L = Max.$ |
| | | Maximum | | | 3 ms | | 2 ms | 3 ms | 2 ms | | 1 ms | | 4 ms | 3 ms | |
| | Turn off time* | Typical | T_{off} | — | 0.07 ms | | 0.09 ms | 0.1 ms | 0.06 ms | 0.05 ms | 0.04 ms | | 0.06 ms | 0.05 ms | $I_F = 5 mA$ $I_L = Max.$ |
| | | Maximum | | | 0.2 ms | | | | | | | | | | |
| I/O capacitance | Typical | C_{iso} | — | 1.3 pF | | | | | | | | | | f = 1 MHz $V_B = 0$ | |
| Maximum | 3 pF | | | | | | | | | | | | | | |
| Initial I/O isolation resistance | Minimum | R_{iso} | — | 1,000 M Ω | | | | | | | | | | 500 V DC | |

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

For type of connection, see Page 31.

*Turn on/Turn off time



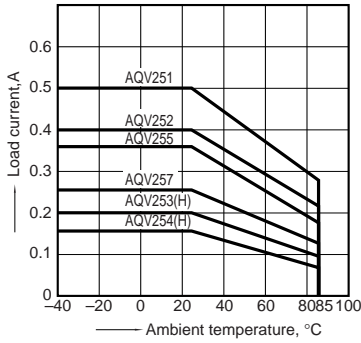
- For Dimensions, see Page 27.
- For Schematic and Wiring Diagrams, see Page 31.
- For Cautions for Use, see Page 36.

REFERENCE DATA

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

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

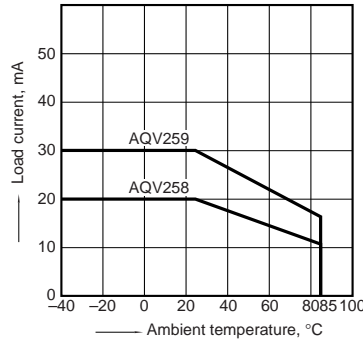
Type of connection: A



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

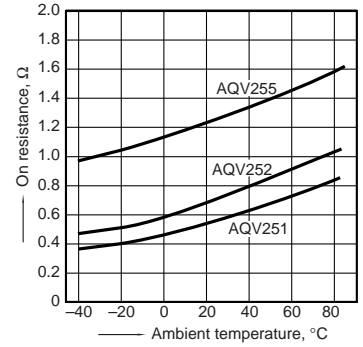
Allowable ambient temperature: -40°C to $+85^{\circ}\text{C}$
 -40°F to $+185^{\circ}\text{F}$;

Type of connection: A



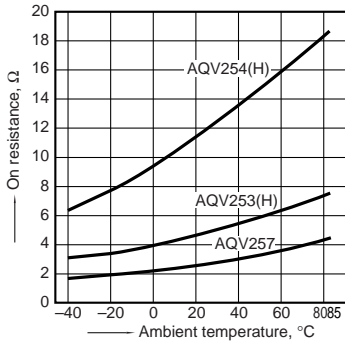
2.-(1) On resistance vs. ambient temperature characteristics

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



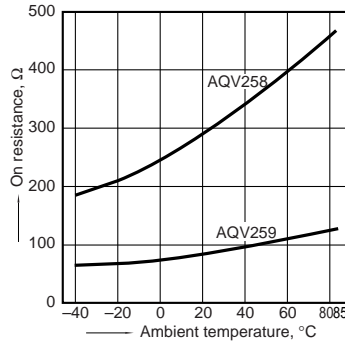
2.-(2) On resistance vs. ambient temperature characteristics

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



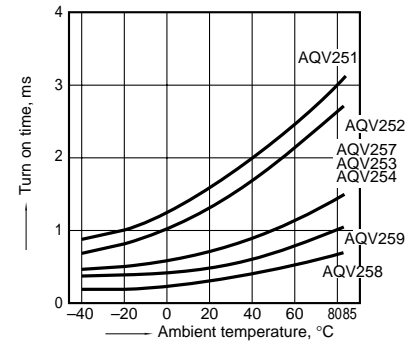
2.-(3) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
 LED current: 5 mA;
 Continuous load current: 30 mA (DC)



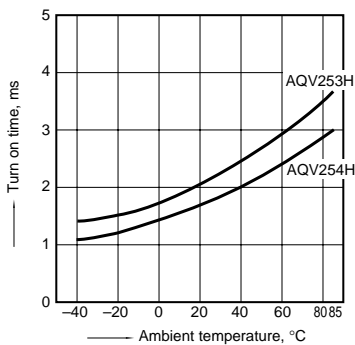
3.-(1) Turn on time vs. ambient temperature characteristics

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



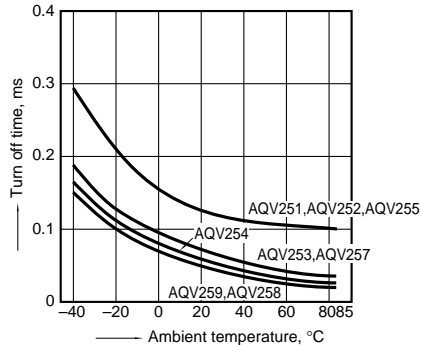
3.-(2) Turn on time vs. ambient temperature characteristics

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



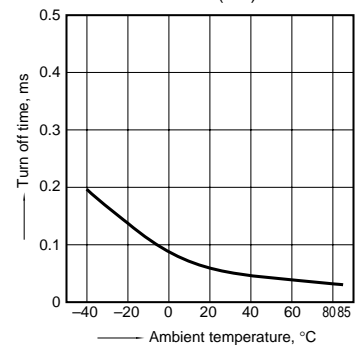
4.-(1) Turn off time vs. ambient temperature characteristics

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



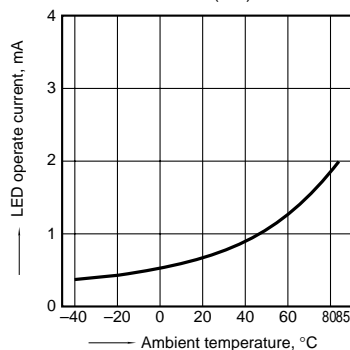
4.-(2) Turn off time vs. ambient temperature characteristics

Sample: AQV253H, AQV254H
 LED current: 5 mA; Load voltage: Max. (DC);
 Continuous load current: Max. (DC)



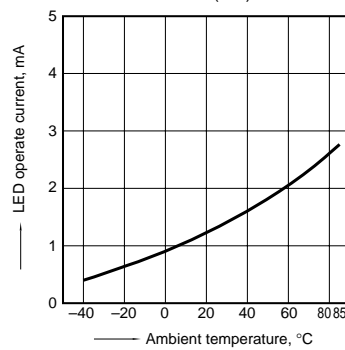
5.-(1) LED operate current vs. ambient temperature characteristics

Sample: AQV251, AQV252, AQV253, AQV254, AQV259;
 Load voltage: Max. (DC);
 Continuous load current: Max. (DC)



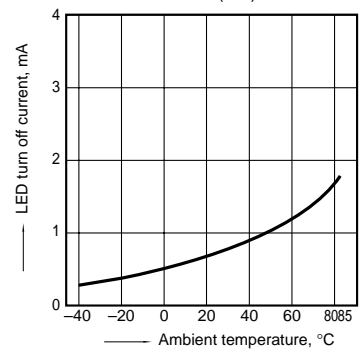
5.-(2) LED operate current vs. ambient temperature characteristics

Sample: AQV253H, AQV254H;
 Load voltage: Max. (DC);
 Continuous load current: Max. (DC)



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

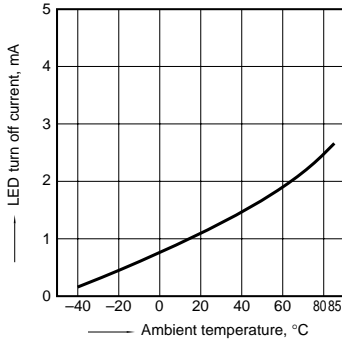
Sample: AQV251, AQV252, AQV253, AQV254, AQV259;
 Load voltage: Max. (DC);
 Continuous load current: Max. (DC)



AQV250

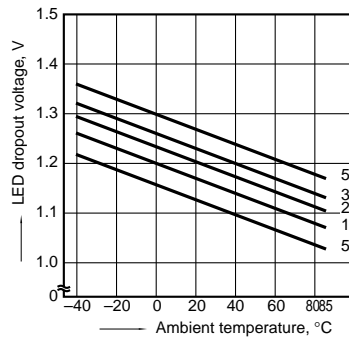
6.-(2) LED turn off current vs. ambient temperature characteristics

Sample: AQV251, AQV252, AQV253, AQV254, AQV259; Load voltage: Max. (DC); Continuous load current: Max. (DC)



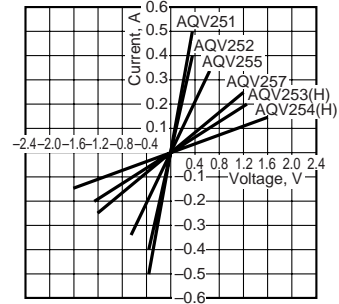
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



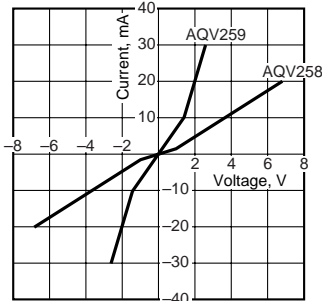
8.-(1) Voltage vs. current characteristics of output at MOS portion

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



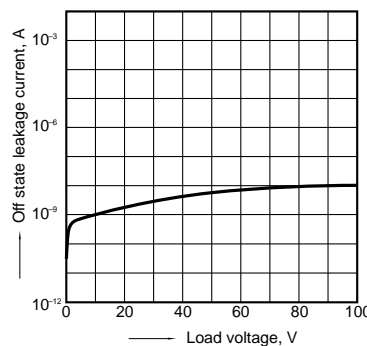
8.-(2) Voltage vs. current characteristics of output at MOS portion

Sample: AQV259; Measured portion: between terminals 4 and 6; Ambient temperature: 25°C 77°F



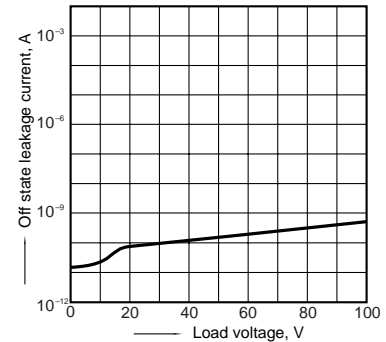
9.-(1). Off state leakage current

Sample: AQV259; Measured portion: between terminals 4 and 6; Ambient temperature: 25°C 77°F



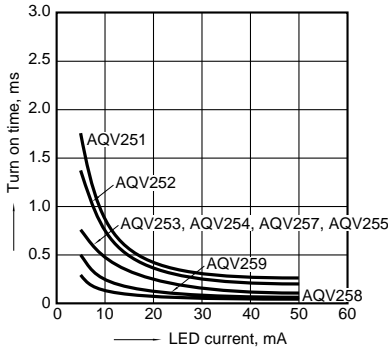
9.-(2). Off state leakage current

Sample: AQV254H; Measured portion: between terminals 4 and 6; Ambient temperature: 25°C 77°F



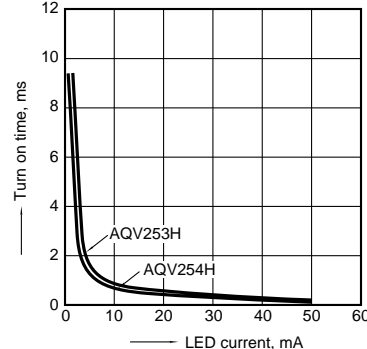
10.-(1). LED forward current vs. turn on time characteristics

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



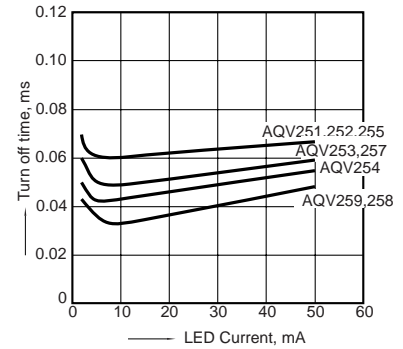
10.-(2). LED forward current vs. turn on time characteristics

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



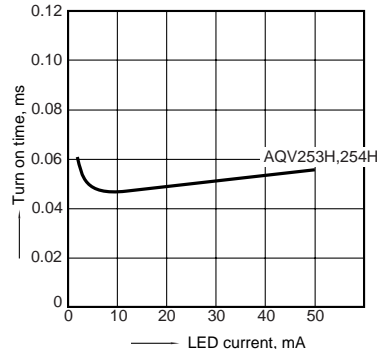
11.-(1). LED forward current vs. turn off time characteristics

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



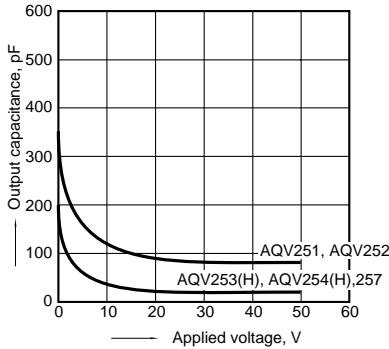
11.-(2). LED forward current vs. turn off time characteristics

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



12.-(1) Applied voltage vs. output capacitance characteristics

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



12.-(2) Applied voltage vs. output capacitance characteristics

Sample: AQV259; Measured portion: between terminals 4 and 6; Frequency: 1 MHz; Ambient temperature: 25°C 77°F

