

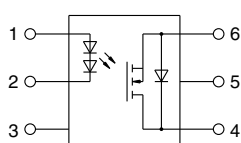
**DIP6-pin type  
with wide variation  
Low on-resistance**

**PhotoMOS®  
HF 1 Form A  
(AQV10○, 20○)**

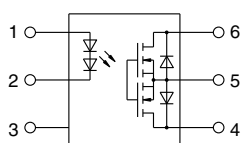


(Height includes standoff)

mm inch



DC type



AC/DC type

**RoHS compliant**

### FEATURES

- 1. Controls low-level analog signals**  
PhotoMOS feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
- 2. Controlled with low-level input signals**
- 3. AC/DC dual use type and DC only type available.**
- 4. Wide variation of 40V, 60V, 250V, 400V load voltage**

### TYPICAL APPLICATIONS

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

## TYPES

### 1. DC type (AQV10 series)

|         | Output rating* |                                | Package                        | 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 |                       |                        |                             |          |                                                              |               |
| DC only | 40 V           | 700 mA                         | DIP6-pin                       | AQV101                | AQV101A                | AQV101AX                    | AQV101AZ | 1 tube contains:<br>50 pcs.<br>1 batch contains:<br>500 pcs. | 1,000 pcs     |
|         | 60 V           | 600 mA                         |                                | AQV102                | AQV102A                | AQV102AX                    | AQV102AZ |                                                              |               |
|         | 250 V          | 300 mA                         |                                | AQV103                | AQV103A                | AQV103AX                    | AQV103AZ |                                                              |               |
|         | 400 V          | 180 mA                         |                                | AQV104                | AQV104A                | AQV104AX                    | AQV104AZ |                                                              |               |

\*Indicate the peak AC and DC values.

Note: The surface mount terminal indicator "A" and the packing style indicator "X" or "Z" are not marked on the device.

### 2. AC/DC type (AQV20 series)

|                | Output rating* |              | Package  | 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 |                             |          |                                                              |               |
| AC/DC dual use | 40 V           | 500 mA       | DIP6-pin | AQV201                         | AQV201A                        | AQV201AX                    | AQV201AZ | 1 tube contains:<br>50 pcs.<br>1 batch contains:<br>500 pcs. | 1,000 pcs     |
|                | 60 V           | 400 mA       |          | AQV202                         | AQV202A                        | AQV202AX                    | AQV202AZ |                                                              |               |
|                | 250 V          | 200 mA       |          | AQV203                         | AQV203A                        | AQV203AX                    | AQV203AZ |                                                              |               |
|                | 400 V          | 150 mA       |          | AQV204                         | AQV204A                        | AQV204AX                    | AQV204AZ |                                                              |               |

\*Indicate the peak AC and DC values.

Note: The surface mount terminal indicator "A" and the packing style indicator "X" or "Z" are not marked on the device.

## RATING

### 1. DC type

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

| Item                    | Symbol                       | AQV101(A)                   | AQV102(A) | AQV103(A) | AQV104(A) | Remarks                         |
|-------------------------|------------------------------|-----------------------------|-----------|-----------|-----------|---------------------------------|
| Input                   | LED forward current          | 50 mA                       |           |           |           |                                 |
|                         | LED reverse voltage          | 10 V                        |           |           |           |                                 |
|                         | Peak forward current         | 1 A                         |           |           |           | f = 100 Hz, Duty factor = 0.1%  |
|                         | Power dissipation            | 150 mW                      |           |           |           |                                 |
| Output                  | Load voltage (DC)            | 40 V                        | 60 V      | 250 V     | 400 V     |                                 |
|                         | Continuous load current (DC) | 0.7 A                       | 0.6 A     | 0.3 A     | 0.18 A    |                                 |
|                         | Peak load current            | 1.8 A                       | 1.5 A     | 0.6 A     | 0.5 A     | 100 ms (1 shot)                 |
|                         | Power dissipation            | 360 mW                      |           |           |           |                                 |
| Total power dissipation |                              | 410 mW                      |           |           |           |                                 |
| I/O isolation voltage   |                              | 1,500 Vrms                  |           |           |           |                                 |
| Ambient temperature     | Operating                    | -40 to +85°C -40 to +185°F  |           |           |           | (Non-icing at low temperatures) |
|                         | Storage                      | -40 to +100°C -40 to +212°F |           |           |           |                                 |

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

| Item                             |                           |         | Symbol             | AQV101(A) | AQV102(A) | AQV103(A) | AQV104(A) | Condition                                                     |
|----------------------------------|---------------------------|---------|--------------------|-----------|-----------|-----------|-----------|---------------------------------------------------------------|
| Input                            | LED operate current       | Typical | I <sub>Fon</sub>   | 2.3 mA    |           |           |           | I <sub>L</sub> = Max.                                         |
|                                  |                           | Maximum |                    | 5 mA      |           |           |           |                                                               |
|                                  | LED turn off current      | Minimum | I <sub>Foff</sub>  | 0.8 mA    |           |           |           | I <sub>L</sub> = Max.                                         |
|                                  |                           | Typical |                    | 2.2 mA    |           |           |           |                                                               |
|                                  | LED dropout voltage       | Typical | V <sub>F</sub>     | 2.3 V     |           |           |           | I <sub>F</sub> = 10 mA                                        |
|                                  |                           | Maximum |                    | 3 V       |           |           |           |                                                               |
| Output                           | On resistance             | Typical | R <sub>on</sub>    | 0.3 Ω     | 0.37 Ω    | 2.7 Ω     | 6.3 Ω     | I <sub>F</sub> = 10 mA<br>I <sub>L</sub> = Max.<br>Within 1 s |
|                                  |                           | Maximum |                    | 0.5 Ω     | 0.7 Ω     | 4 Ω       | 8 Ω       |                                                               |
|                                  | Off state leakage current | Maximum | I <sub>LLeak</sub> | 1 μA      |           |           |           | I <sub>F</sub> = 0 mA,<br>V <sub>L</sub> = Max.               |
| Transfer characteristics         | Turn on time*             | Typical | T <sub>on</sub>    | 0.23 ms   | 0.22 ms   | 0.13 ms   | 0.09 ms   | I <sub>F</sub> = 10 mA<br>I <sub>L</sub> = Max.               |
|                                  |                           | Maximum |                    | 1 ms      |           |           |           |                                                               |
|                                  | Turn off time*            | Typical | T <sub>off</sub>   | 0.07 ms   |           |           | 0.08 ms   | I <sub>F</sub> = 10 mA<br>I <sub>L</sub> = Max.               |
|                                  |                           | Maximum |                    | 1 ms      |           |           |           |                                                               |
|                                  | I/O capacitance           | Typical | C <sub>iso</sub>   | 1.3 pF    |           |           |           | f = 1 MHz<br>V <sub>B</sub> = 0 V                             |
|                                  |                           | Maximum |                    | 3 pF      |           |           |           |                                                               |
| Initial I/O isolation resistance |                           | Minimum | R <sub>iso</sub>   | 1,000 MΩ  |           |           |           | 500 V DC                                                      |

### 2. AC/DC type

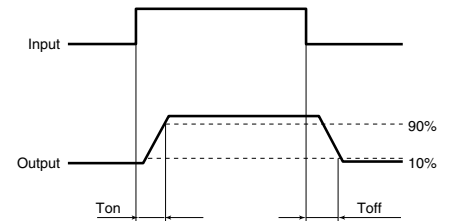
#### 1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

| Item                    |                         | Symbol            | Type of connection | AQV201(A)                   |  | AQV202(A) |  | AQV203(A) |  | AQV204(A) |  | Remarks                                             |
|-------------------------|-------------------------|-------------------|--------------------|-----------------------------|--|-----------|--|-----------|--|-----------|--|-----------------------------------------------------|
| Input                   | LED forward current     | I <sub>F</sub>    |                    | 50 mA                       |  |           |  |           |  |           |  |                                                     |
|                         | LED reverse voltage     | V <sub>R</sub>    |                    | 10 V                        |  |           |  |           |  |           |  |                                                     |
|                         | Peak forward current    | I <sub>FP</sub>   |                    | 1 A                         |  |           |  |           |  |           |  | f = 100 Hz, Duty factor = 0.1%                      |
|                         | Power dissipation       | P <sub>in</sub>   |                    | 150 mW                      |  |           |  |           |  |           |  |                                                     |
| Output                  | Load voltage (peak AC)  | V <sub>L</sub>    |                    | 40 V                        |  | 60 V      |  | 250 V     |  | 400 V     |  |                                                     |
|                         | Continuous load current | I <sub>L</sub>    |                    | 0.5 A                       |  | 0.4 A     |  | 0.2 A     |  | 0.15 A    |  | A connection: Peak AC, DC<br>B, C connection: DC    |
|                         |                         |                   |                    | 0.7 A                       |  | 0.6 A     |  | 0.3 A     |  | 0.18 A    |  |                                                     |
|                         |                         |                   |                    | 1.0 A                       |  | 0.8 A     |  | 0.4 A     |  | 0.25 A    |  |                                                     |
|                         | Peak load current       | I <sub>peak</sub> |                    | 1.8 A                       |  | 1.5 A     |  | 0.6 A     |  | 0.5 A     |  | A connection 100 ms (1 shot)<br>V <sub>L</sub> = DC |
|                         | Power dissipation       | P <sub>out</sub>  |                    | 360 mW                      |  |           |  |           |  |           |  |                                                     |
| Total power dissipation |                         | P <sub>T</sub>    |                    | 410 mW                      |  |           |  |           |  |           |  |                                                     |
| I/O isolation voltage   |                         | V <sub>iso</sub>  |                    | 1,500 Vrms                  |  |           |  |           |  |           |  |                                                     |
| Ambient temperature     | Operating               | T <sub>opr</sub>  |                    | −40 to +85°C −40 to +185°F  |  |           |  |           |  |           |  | (Non-icing at low temperatures)                     |
|                         | Storage                 | T <sub>stg</sub>  |                    | −40 to +100°C −40 to +212°F |  |           |  |           |  |           |  |                                                     |

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

| Item                             |                           |                  | Symbol             | Type of connection | AQV201(A) | AQV202(A) | AQV203(A) | AQV204(A) | Condition                                                     |                                                 |
|----------------------------------|---------------------------|------------------|--------------------|--------------------|-----------|-----------|-----------|-----------|---------------------------------------------------------------|-------------------------------------------------|
| Input                            | LED operate current       | Typical          | I <sub>Fon</sub>   | —                  | 2.4 mA    |           |           |           | I <sub>L</sub> = Max.                                         |                                                 |
|                                  |                           | Maximum          |                    |                    | 5 mA      |           |           |           |                                                               |                                                 |
|                                  | LED turn off current      | Minimum          | I <sub>Foff</sub>  | —                  | 0.8 mA    |           |           |           | I <sub>L</sub> = Max.                                         |                                                 |
|                                  |                           | Typical          |                    |                    | 2.2 mA    |           |           |           |                                                               |                                                 |
|                                  | LED dropout voltage       | Typical          | V <sub>F</sub>     | —                  | 2.3 V     |           |           |           | I <sub>F</sub> = 10 mA                                        |                                                 |
|                                  |                           | Maximum          |                    |                    | 3 V       |           |           |           |                                                               |                                                 |
| Output                           | On resistance             | Typical          | R <sub>on</sub>    | A                  | 0.6 Ω     | 0.74 Ω    | 5.5 Ω     | 12.4 Ω    | I <sub>F</sub> = 10 mA<br>I <sub>L</sub> = Max.<br>Within 1 s |                                                 |
|                                  |                           | Maximum          |                    |                    | 1 Ω       | 1.4 Ω     | 8 Ω       | 16 Ω      |                                                               |                                                 |
|                                  |                           | Typical          | R <sub>on</sub>    | B                  | 0.3 Ω     | 0.37 Ω    | 2.7 Ω     | 6.2 Ω     | I <sub>F</sub> = 10 mA<br>I <sub>L</sub> = Max.<br>Within 1 s |                                                 |
|                                  |                           | Maximum          |                    |                    | 0.5 Ω     | 0.7 Ω     | 4 Ω       | 8 Ω       |                                                               |                                                 |
|                                  |                           | Typical          | R <sub>on</sub>    | C                  | 0.15 Ω    | 0.18 Ω    | 1.4 Ω     | 3.1 Ω     | I <sub>F</sub> = 10 mA<br>I <sub>L</sub> = Max.<br>Within 1 s |                                                 |
|                                  |                           | Maximum          |                    |                    | 0.25 Ω    | 0.35 Ω    | 2 Ω       | 4 Ω       |                                                               |                                                 |
|                                  | Off state leakage current | Maximum          | I <sub>LLeak</sub> | —                  | 1 μA      |           |           |           | I <sub>F</sub> = 0 mA,<br>V <sub>L</sub> = Max.               |                                                 |
|                                  | Transfer characteristics  | Turn on time*    | Typical            | T <sub>on</sub>    | —         | 0.38 ms   | 0.41 ms   | 0.21 ms   | 0.18 ms                                                       | I <sub>F</sub> = 10 mA<br>I <sub>L</sub> = Max. |
|                                  |                           |                  | Maximum            |                    |           | 1 ms      |           |           |                                                               |                                                 |
| Turn off time*                   |                           | Typical          | T <sub>off</sub>   | —                  | 0.08 ms   |           | 0.07 ms   |           | I <sub>F</sub> = 10 mA<br>I <sub>L</sub> = Max.               |                                                 |
|                                  |                           | Maximum          |                    |                    | 1 ms      |           |           |           |                                                               |                                                 |
| I/O capacitance                  |                           | Typical          | C <sub>iso</sub>   | —                  | 1.3 pF    |           |           |           | f = 1 MHz<br>V <sub>B</sub> = 0 V                             |                                                 |
|                                  |                           | Maximum          |                    |                    | 3 pF      |           |           |           |                                                               |                                                 |
| Initial I/O isolation resistance | Minimum                   | R <sub>iso</sub> | —                  | 1,000 MΩ           |           |           |           | 500 V DC  |                                                               |                                                 |

\*Turn on/Turn off time



## 3. Recommended operating conditions (Ambient temperature: 25°C 77°F)

Please use under recommended operating conditions to obtain expected characteristics.

| Item        |                                        | Symbol | Min. | Max. | Unit |
|-------------|----------------------------------------|--------|------|------|------|
| LED current |                                        | $I_F$  | 10   | 30   | mA   |
| AQV101(A)   | Load voltage (Peak AC)                 | $V_L$  | —    | 32   | V    |
|             | Continuous load current                | $I_L$  | —    | 0.7  | A    |
| AQV102(A)   | Load voltage (Peak AC)                 | $V_L$  | —    | 48   | V    |
|             | Continuous load current                | $I_L$  | —    | 0.6  | A    |
| AQV103(A)   | Load voltage (Peak AC)                 | $V_L$  | —    | 200  | V    |
|             | Continuous load current                | $I_L$  | —    | 0.3  | A    |
| AQV104(A)   | Load voltage (Peak AC)                 | $V_L$  | —    | 320  | V    |
|             | Continuous load current                | $I_L$  | —    | 0.18 | A    |
| AQV201(A)   | Load voltage (Peak AC)                 | $V_L$  | —    | 32   | V    |
|             | Continuous load current (A connection) | $I_L$  | —    | 0.5  | A    |
| AQV202(A)   | Load voltage (Peak AC)                 | $V_L$  | —    | 48   | V    |
|             | Continuous load current (A connection) | $I_L$  | —    | 0.4  | A    |
| AQV203(A)   | Load voltage (Peak AC)                 | $V_L$  | —    | 200  | V    |
|             | Continuous load current (A connection) | $I_L$  | —    | 0.2  | A    |
| AQV204(A)   | Load voltage (Peak AC)                 | $V_L$  | —    | 320  | V    |
|             | Continuous load current (A connection) | $I_L$  | —    | 0.15 | A    |

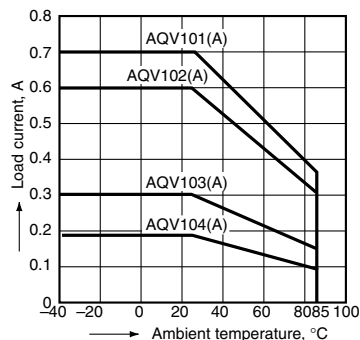
■ These products are not designed for automotive use.

If you are considering to use these products for automotive applications, please contact your local Panasonic Corporation technical representative.

## REFERENCE DATA

### 1.-(1) Load current vs. ambient temperature characteristics (DC type)

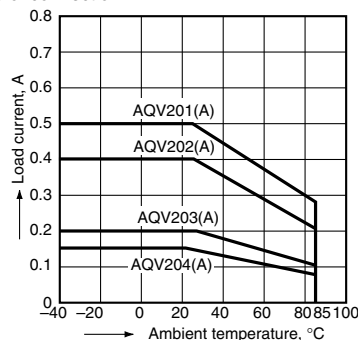
Allowable ambient temperature: -40 to +85°C  
-40 to +185°F



### 1.-(2) Load current vs. ambient temperature characteristics (AC/DC type)

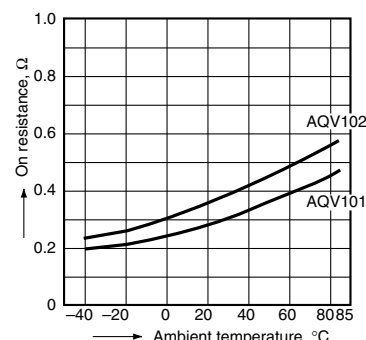
Allowable ambient temperature: -40 to +85°C  
-40 to +185°F

Type of connection: A



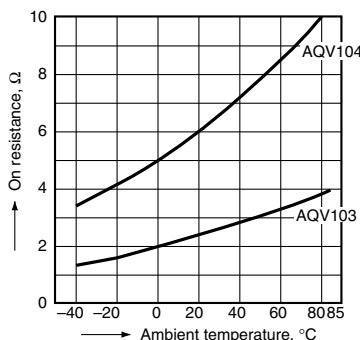
### 2.-(1) On resistance vs. ambient temperature characteristics (DC type: AQV101, AQV102)

LED current: 10 mA;  
Continuous load current: Max. (DC)



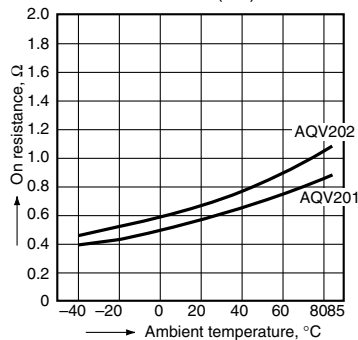
### 2.-(2) On resistance vs. ambient temperature characteristics (DC type: AQV103, AQV104)

LED current: 10 mA;  
Continuous load current: Max. (DC)



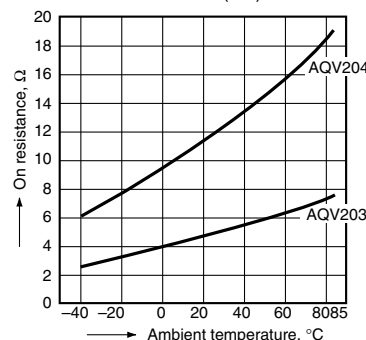
### 2.-(3) On resistance vs. ambient temperature characteristics (AC/DC type: AQV201, AQV202)

Measured portion: between terminals 4 and 6;  
LED current: 10 mA;  
Continuous load current: Max. (DC)



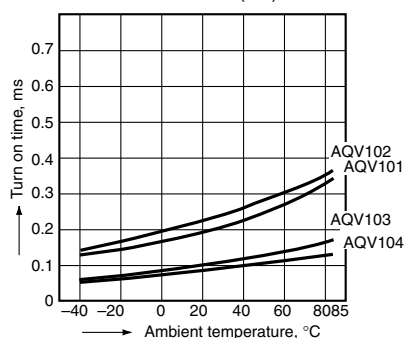
### 2.-(4) On resistance vs. ambient temperature characteristics (AC/DC type: AQV203, AQV204)

Measured portion: between terminals 4 and 6;  
LED current: 10 mA;  
Continuous load current: Max. (DC)



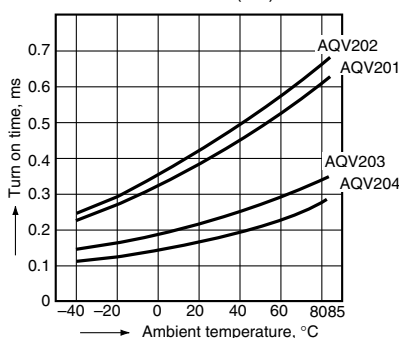
### 3.-(1) Turn on time vs. ambient temperature characteristics (DC type)

LED current: 10 mA;  
Load voltage: Max. (DC);  
Continuous load current: Max. (DC)



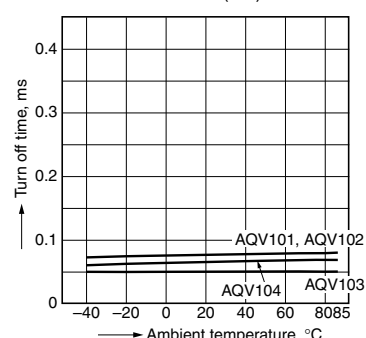
### 3.-(2) Turn on time vs. ambient temperature characteristics (AC/DC type)

LED current: 10 mA;  
Load voltage: Max. (DC);  
Continuous load current: Max. (DC)



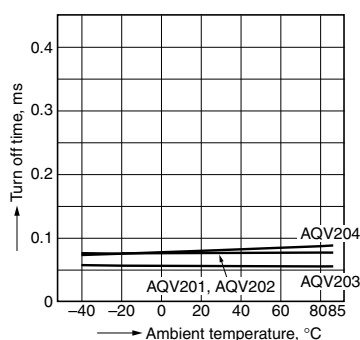
### 4.-(1) Turn off time vs. ambient temperature characteristics (DC type)

LED current: 10 mA;  
Load voltage: Max. (DC);  
Continuous load current: Max. (DC)



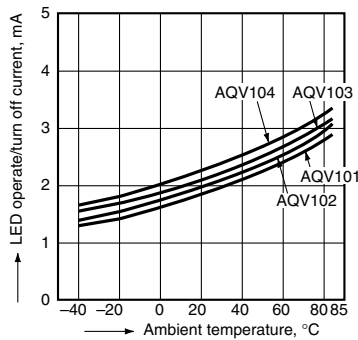
### 4.-(2) Turn off time vs. ambient temperature characteristics (AC/DC type)

LED current: 10 mA; Load voltage: Max. (DC);  
Continuous load current: Max. (DC)



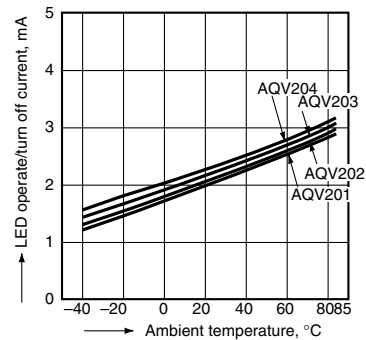
### 5.-(1) LED operate/turn off current vs. ambient temperature characteristics (DC type)

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



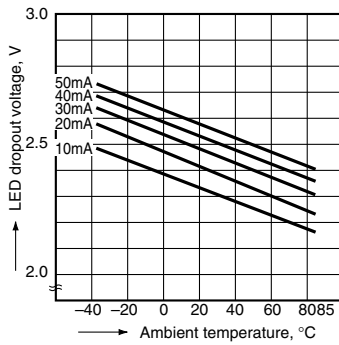
### 5.-(2) LED operate/turn off current vs. ambient temperature characteristics (AC/DC type)

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



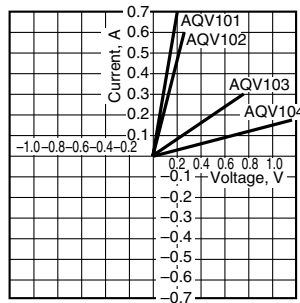
6. LED dropout voltage vs. ambient temperature characteristics

Sample: All types  
LED current: 10 to 50 mA



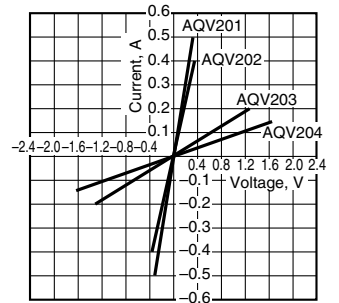
7.-(1) Current vs. voltage characteristics of output at MOS portion (DC type)

Ambient temperature: 25°C 77°F



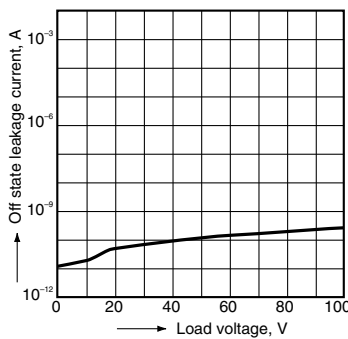
7.-(2) Current vs. voltage characteristics of output at MOS portion (AC/DC type)

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



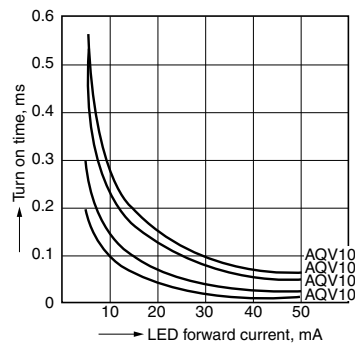
8. Off state leakage current vs. load voltage characteristics

Sample: AQV204;  
Measured portion: between terminals 4 and 6;  
Ambient temperature: 25°C 77°F



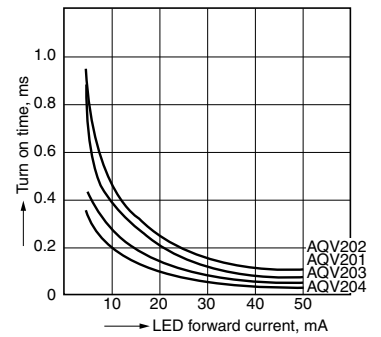
9.-(1) Turn on time vs. LED forward current characteristics (DC type)

Load voltage: Max. (DC);  
Continuous load current: Max. (DC);  
Ambient temperature: 25°C 77°F



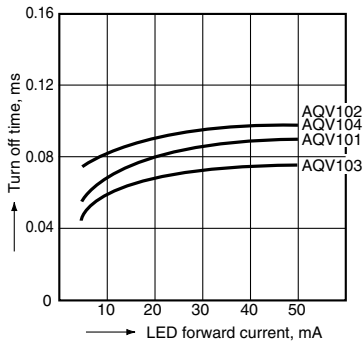
9.-(2) Turn on time vs. LED forward current characteristics (AC/DC type)

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



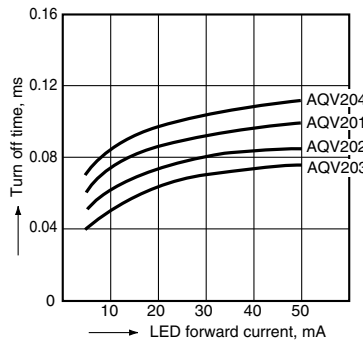
10.-(1) Turn off time vs. LED forward current characteristics (DC type)

Load voltage: Max. (DC);  
Continuous load current: Max. (DC);  
Ambient temperature: 25°C 77°F



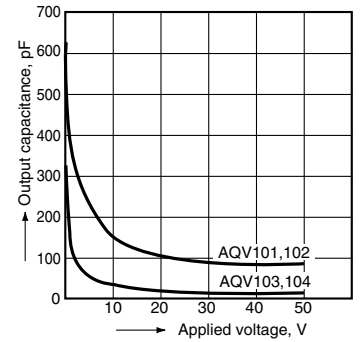
10.-(2) Turn off time vs. LED forward current characteristics (AC/DC type)

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



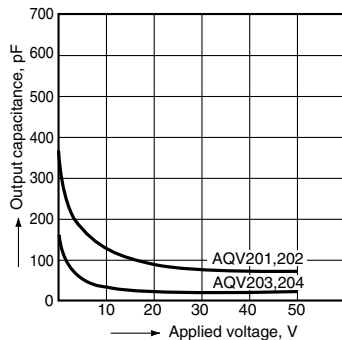
11.-(1) Output capacitance vs. applied voltage characteristics (DC type)

Frequency: 1 MHz;  
Ambient temperature: 25°C 77°F



11.-(2) Output capacitance vs. applied voltage characteristics (AC/DC type)

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



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