

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

**PhotoMOS<sup>®</sup>  
HF 1 Form A  
(AQV100, 200)**

## FEATURES

- Controls low-level analog signals**  
PhotoMOS feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
- Controlled with low-level input signals**
- AC/DC dual use type and DC only type available.**

## TYPICAL APPLICATIONS

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



**RoHS compliant**

## TYPES

### 1. DC type (AQV10 series)

|         | Output rating* |              | Package  | Part No.              |                                |                                |          | Packing quantity   |           |
|---------|----------------|--------------|----------|-----------------------|--------------------------------|--------------------------------|----------|--|-----------|
|         |                |              |          | Through hole terminal | Surface-mount terminal         |                                | Tube     | Tape and reel  |           |
|         | Load voltage   | Load current |          |                       | Tube packing style             | Tape and reel packing style    |          |  |           |
|         |                |              |          |                       | 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         |                                | Tube     | Tape and reel  |           |
|                | Load voltage   | Load current |          |                       | 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 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          | 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 (DC)            | V <sub>L</sub>    | 40 V                            | 60 V      | 250 V     | 400 V     |                                    |
|                         | Continuous load current (DC) | I <sub>L</sub>    | 0.7 A                           | 0.6 A     | 0.3 A     | 0.18 A    |                                    |
|                         | Peak load current            | I <sub>peak</sub> | 1.8 A                           | 1.5 A     | 0.6 A     | 0.5 A     | 100 ms (1 shot)                    |
|                         | 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 V (AC)                    |           |           |           |                                    |
| Temperature limits      | Operating                    | T <sub>opr</sub>  | -40°C to +85°C -40°F to +185°F  |           |           |           | Non-condensing at low temperatures |
|                         | Storage                      | T <sub>stg</sub>  | -40°C to +100°C -40°F 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 on time |
|                                  |                           | Maximum          |                   | 0.5 Ω     | 0.7 Ω     | 4 Ω       | 8 Ω                    |   |
|                                  | Off state leakage current | Maximum          | I <sub>Leak</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   |           |           |                        | 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>    |                                 | A         | 0.5 A     | 0.4 A     | 0.2 A                             | 0.15 A  | A connection: Peak AC, DC<br>B, C connection: DC |
|                         |                         |                   |                                 | B         | 0.7 A     | 0.6 A     | 0.3 A                             | 0.18 A  |  |
|                         |                         |                   |                                 | C         | 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 V AC                      |           |           |           |                                   |   |  |
| Temperature limits      | Operating               | T <sub>opr</sub>  | -40°C to +85°C -40°F to +185°F  |           |           |           | Non-condensing at low temperature |   |  |
|                         | Storage                 | T <sub>stg</sub>  | -40°C to +100°C -40°F to +212°F |           |           |           |                                   |   |  |

# HF 1 Form A (AQV100, 200)

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

| Item                             |                           | Symbol           | Type of connection | AQV201(A)       | AQV202(A) | AQV203(A) | AQV204(A)              | Remarks               |   |
|----------------------------------|---------------------------|------------------|--------------------|-----------------|-----------|-----------|------------------------|-----------------------|---|
| 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 on time |
|                                  |                           | 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                 |   |
|                                  |                           | 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 on time |
|                                  |                           | Maximum          |                    |                 | 0.25 Ω    | 0.35 Ω    | 2 Ω                    | 4 Ω                   |   |
|                                  | Off state leakage current | Maximum          | I <sub>Leak</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   |
| 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



## RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper device operation and resetting.

| Item              | Symbol         | Recommended value | Unit |
|-------------------|----------------|-------------------|------|
| Input LED current | I <sub>F</sub> | 10                | mA   |

■ For Dimensions.

■ For Schematic and Wiring Diagrams.

■ For Cautions for Use.

■ 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.

For more information.

## REFERENCE DATA

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

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



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

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



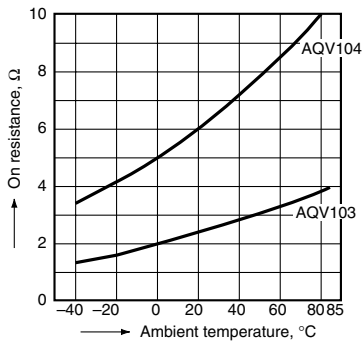
2.-(1) On resistance vs. ambient temperature characteristics (DC type: AQV101, AQV102)

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)



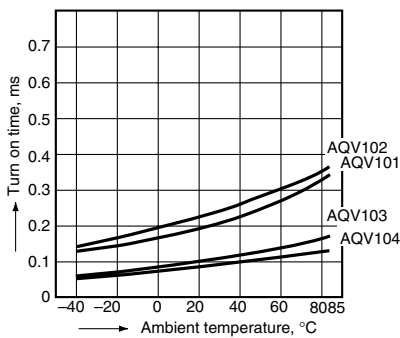
2.-(4) On resistance vs. ambient temperature characteristics (AC/DC type: AQV203, AQV204)

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)



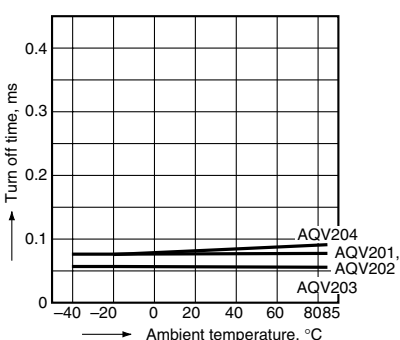
4.-(1) Turn off time vs. ambient temperature characteristics (DC type)

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)



# HF 1 Form A (AQV100, 200)

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

Sample: AQV202  
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



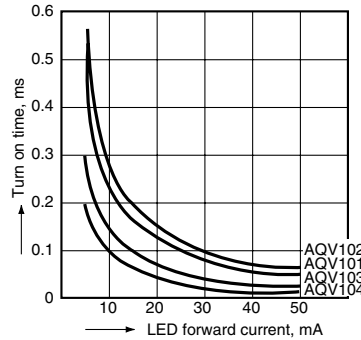
## 8. Off state leakage current vs. load voltage characteristics

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



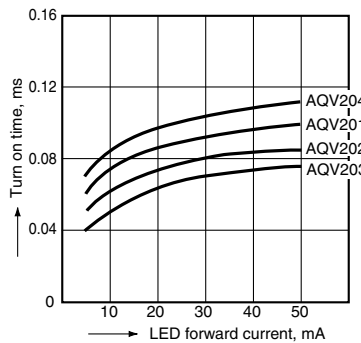
## 10.-(1) Turn off time vs. LED forward current characteristics (DC type)

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



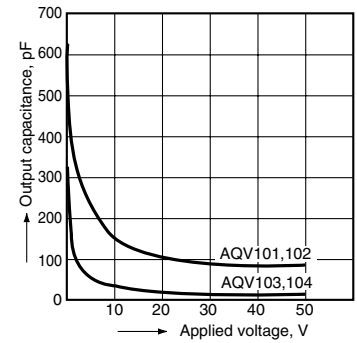
## 10.-(2) Turn off time vs. LED forward current characteristics (AC/DC type)

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



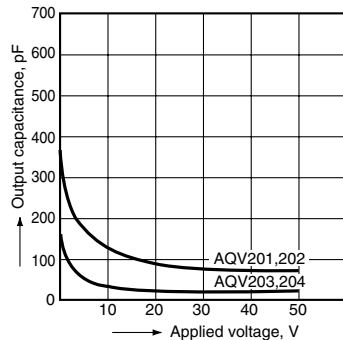
## 11.-(1) Output capacitance vs. applied voltage characteristics (DC type)

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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