

Standard type:  (AQV258) / Reinforced type:  (AQV253H, AQV254H)   (AQV256H)

**DIP6-pin type with  
low on-resistance and  
reinforced insulation**

**PhotoMOS<sup>®</sup>  
HE 1 Form A  
(AQV250, AQV250H)**



**RoHS compliant**

### FEATURES

1. Wide variation of 40V, 60V, 100V, 200V, 250V, 400V, 600V, 1,000V and 1,500V load voltage
2. Low on-resistance of Typ. 0.6Ω (AQV251)
3. Reinforced insulation type of 5,000Vrms I/O isolation available

### TYPICAL APPLICATIONS

- Measuring instruments
- Data communication equipment
- Telephone equipment
- Automatic meter reading device

### TYPES

|                | I/O isolation        | Output rating* |              | Package  | Part No.              |                                |                                |                             | Packing quantity   |               |
|----------------|----------------------|----------------|--------------|----------|-----------------------|--------------------------------|--------------------------------|-----------------------------|--|---------------|
|                |                      |                |              |          | Through hole terminal | Surface-mount terminal         |                                |                             | Tube   | Tape and reel |
|                |                      |                |              |          |                       | Tube packing style             |                                | Tape and reel packing style |  |               |
|                |                      | Load voltage   | Load current |          |                       | Picked from the 1/2/3-pin side | Picked from the 4/5/6-pin side |                             |  |               |
| AC/DC dual use | 1,500Vrms            | 40 V           | 500 mA       | DIP6-pin | AQV251                | AQV251A                        | AQV251AX                       | AQV251AZ                    | 1 tube contains:<br>50 pcs.<br>1 batch contains:<br>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                    |  |               |
|                | Reinforced 5,000Vrms | 250 V          | 200 mA       | AQV253H  | AQV253HA              | AQV253HAX                      | AQV253HAZ                      |                             |  |               |
|                |                      | 400 V          | 150 mA       | AQV254H  | AQV254HA              | AQV254HAX                      | AQV254HAZ                      |                             |  |               |
|                |                      | 600 V          | 130 mA       | AQV256H  | AQV256HA              | AQV256HAX                      | AQV256HAZ                      |                             |  |               |

\*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

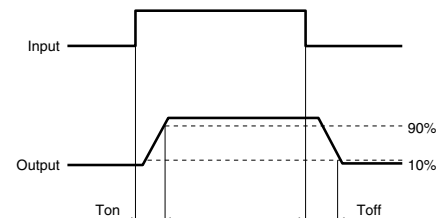
### 1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

| Item                    |                         | Sym-<br>bol | Type of<br>connec-<br>tion  | AQV251(A) | AQV252(A) | AQV255(A) | AQV257(A) | AQV253(A) | AQV254(A)  | AQV259(A) | AQV258(A) | AQV253H(A) | AQV254H(A) | AQV256H(A)                      | Remarks   |                                  |
|-------------------------|-------------------------|-------------|-----------------------------|-----------|-----------|-----------|-----------|-----------|------------|-----------|-----------|------------|------------|---------------------------------|---|----------------------------------|
| Input                   | LED forward current     | $I_F$       |                             | 50 mA     |           |           |           |           |            |           |           |            |            |                                 |   |                                  |
|                         | LED reverse voltage     | $V_R$       |                             | 5 V       |           |           |           |           |            |           |           |            |            |                                 |   |                                  |
|                         | Peak forward current    | $I_{FP}$    |                             | 1 A       |           |           |           |           |            |           |           |            |            |                                 |   | f = 100 Hz,<br>Duty factor +0.1% |
|                         | Power dissipation       | $P_{in}$    |                             | 75 mW     |           |           |           |           |            |           |           |            |            |                                 |   |                                  |
| Load voltage (peak AC)  | $V_L$                   |             | 40V                         | 60V       | 100V      | 200V      | 250V      | 400V      | 1,000V     | 1,500V    | 250V      | 400V       | 600V       |                                 |   |                                  |
| Output                  | Continuous load current | $I_L$       | A                           | 0.5A      | 0.4A      | 0.35A     | 0.25A     | 0.2A      | 0.15A      | 0.03A     | 0.02A     | 0.2A       | 0.15A      | 0.13A                           | A connection:<br>Peak AC, DC<br>B, C connection: DC |                                  |
|                         |                         |             | B                           | 0.7A      | 0.6A      | 0.45A     | 0.35A     | 0.3A      | 0.18A      | 0.04A     | 0.025A    | 0.3A       | 0.18A      | 0.14A                           |   |                                  |
|                         |                         |             | C                           | 1.0A      | 0.8A      | 0.70A     | 0.5A      | 0.4A      | 0.25A      | 0.05A     | 0.04A     | 0.4A       | 0.25A      | 0.16A                           |   |                                  |
|                         | Peak load current       | $I_{peak}$  |                             | 1.8A      | 1.5A      | 1.0A      | 0.75A     | 0.6A      | 0.5A       | 0.09A     | 0.06A     | 0.6A       | 0.5A       | 0.4A                            | A connection: 100 ms<br>(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 Vrms                  |           |           |           |           |           | 5,000 Vrms |           |           |            |            |                                 |   |                                  |
| Ambient temperature     | Operating               | $T_{opr}$   | -40 to +85°C -40 to +185°F  |           |           |           |           |           |            |           |           |            |            | (Non-icing at low temperatures) |   |                                  |
|                         | Storage                 | $T_{stg}$   | -40 to +100°C -40 to +212°F |           |           |           |           |           |            |           |           |            |            |                                 |   |                                  |

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

| Item                             |                      | Sym-<br>bol | Type of<br>connec-<br>tion | AQV251(A)                                | AQV252(A) | AQV255(A) | AQV257(A) | AQV253(A) | AQV254(A) | AQV259(A) | AQV258(A) | AQV253H(A) | AQV254H(A) | AQV256H(A)                                  | Condition   |   |
|----------------------------------|----------------------|-------------|----------------------------|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|---|---|---|
| Input                            | LED operate current  | Typical     | —                          | 0.9 mA                                   |           |           |           |           |           |           |           | 1.4 mA     |            |   |   | $I_L = \text{Max.}$                                       |
|                                  |                      | Maximum     |                            | 3 mA                                     |           |           |           |           |           |           |           |            |            |   |   |   |
|                                  | LED turn off current | Minimum     | —                          | 0.4 mA                                   |           |           |           |           |           |           |           |            |            |   |   | $I_L = \text{Max.}$                                       |
|                                  |                      | Typical     |                            | 0.8 mA                                   |           |           |           |           |           | 1.3 mA    |           |            |            |   |   |   |
| LED dropout voltage              | Typical              | $V_F$       | —                          | 1.25 V (1.14 V at $I_F = 5 \text{ mA}$ ) |           |           |           |           |           |           |           |            |            |   |   | $I_F = 50 \text{ mA}$                                     |
|                                  | 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                                      | 20 Ω  | $I_F = 5 \text{ mA}$<br>$I_L = \text{Max.}$<br>Within 1 s |
|                                  |                      |             |                            |  | 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                                       | 15 Ω  |   |
|                                  |                      |             |                            |  | 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      | 7.5 Ω                                       | $I_F = 5 \text{ mA}$<br>$I_L = \text{Max.}$<br>Within 1 s |   |
|                                  |                      |             |                            | Maximum                                  | 0.25 Ω    | 0.35 Ω    | 0.63 Ω    | 1 Ω       | 2 Ω       | 4 Ω       | 50 Ω      | 250 Ω      | 2 Ω        | 4 Ω   |   | 10 Ω  |
| Off state leakage current        | Maximum              | $I_{Leak}$  | —                          | 1 μA                                     |           |           |           |           |           | 10 μA     |           | 1 μA       |            |   |   | $I_F = 0 \text{ mA}$<br>$V_L = \text{Max.}$               |
| Transfer characteristics         | Turn on time*        | Typical     | $T_{on}$                   | —  | 1.7 ms    | 1.4 ms    | 0.9 ms    | 1.5 ms    | 0.8 ms    | 0.6 ms    | 0.35 ms   | 2.4 ms     | 1.8 ms     | 1.2 ms                                      | $I_F = 5 \text{ mA}$<br>$I_L = \text{Max.}$               |   |
|                                  |                      | Maximum     |                            |  | 3 ms      | 2 ms      | 3 ms      | 2 ms      | 1 ms      | 4 ms      | 3ms       |            |            |   |   |   |
|                                  | 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    | 0.06 ms    | $I_F = 5 \text{ mA}$<br>$I_L = \text{Max.}$ |   |   |
|                                  |                      | Maximum     |                            |  | 0.2 ms    |           |           |           |           |           |           |            |            |   |   |   |
|                                  | I/O capacitance      | Typical     | $C_{iso}$                  | —  | 1.3 pF    |           |           |           |           |           |           |            |            |   |   | f = 1 MHz<br>$V_B = 0 \text{ V}$                          |
|                                  |                      | Maximum     |                            |  | 3 pF      |           |           |           |           |           |           |            |            |   |   |   |
| Initial I/O isolation resistance | Minimum              | $R_{iso}$   | —                          | 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                            | $I_F$  | 5    | 30   | mA   |
| AQV251(A)  | Load voltage (Peak AC)                 | $V_L$  | —    | 32   | V    |
|            | Continuous load current (A connection) | $I_L$  | —    | 0.5  | A    |
| AQV252(A)  | Load voltage (Peak AC)                 | $V_L$  | —    | 48   | V    |
|            | Continuous load current (A connection) | $I_L$  | —    | 0.4  | A    |
| AQV255(A)  | Load voltage (Peak AC)                 | $V_L$  | —    | 80   | V    |
|            | Continuous load current (A connection) | $I_L$  | —    | 0.35 | A    |
| AQV257(A)  | Load voltage (Peak AC)                 | $V_L$  | —    | 160  | V    |
|            | Continuous load current (A connection) | $I_L$  | —    | 0.25 | A    |
| AQV253(A)  | Load voltage (Peak AC)                 | $V_L$  | —    | 200  | V    |
|            | Continuous load current (A connection) | $I_L$  | —    | 0.2  | A    |
| AQV254(A)  | Load voltage (Peak AC)                 | $V_L$  | —    | 320  | V    |
|            | Continuous load current (A connection) | $I_L$  | —    | 0.15 | A    |
| AQV259(A)  | Load voltage (Peak AC)                 | $V_L$  | —    | 800  | V    |
|            | Continuous load current (A connection) | $I_L$  | —    | 0.03 | A    |
| AQV258(A)  | Load voltage (Peak AC)                 | $V_L$  | —    | 1200 | V    |
|            | Continuous load current (A connection) | $I_L$  | —    | 0.02 | A    |
| AQV253H(A) | Load voltage (Peak AC)                 | $V_L$  | —    | 200  | V    |
|            | Continuous load current (A connection) | $I_L$  | —    | 0.2  | A    |
| AQV254H(A) | Load voltage (Peak AC)                 | $V_L$  | —    | 320  | V    |
|            | Continuous load current (A connection) | $I_L$  | —    | 0.15 | A    |
| AQV256H(A) | Load voltage (Peak AC)                 | $V_L$  | —    | 480  | V    |
|            | Continuous load current (A connection) | $I_L$  | —    | 0.13 | 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.

■ **Continual DC bias (for AQV258\*\*, AQV259\*\*)**

In cases in which a continual DC bias is applied between the input and output, the output-side MOS-FET may deteriorate due to the voltage. Therefore, please verify operation of the actual design before using. An example of a circuit that might undergo MOS-FET deterioration due to voltage is given below.

**REFERENCE DATA**

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

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

Type of connection: A



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

Allowable ambient temperature: -40 to +85°C  
-40 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;  
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)



# HE 1 Form A (AQV250, AQV250H)

## 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, AQV256H  
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, AQV255, AQV257, AQV258, AQV259; Load voltage: Max. (DC); Continuous load current: Max. (DC)



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

Sample: AQV253H, AQV254H, AQV256H; Load voltage: Max. (DC); Continuous load current: Max. (DC)



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

Sample: AQV251, AQV252, AQV253, AQV254, AQV255, AQV257, AQV258, AQV259; Load voltage: Max. (DC); Continuous load current: Max. (DC)



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

Sample: AQV253H, AQV254H, AQV256H; 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) Current vs. voltage characteristics of output at MOS portion

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



## 8.-(2) Current vs. voltage characteristics of output at MOS portion

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



## 9.-(1) Off state leakage current vs. load voltage characteristics

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



## 9.-(2) Off state leakage current vs. load voltage characteristics

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



## 10-(1). Turn on time vs. LED forward current 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). Turn on time vs. LED forward current 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). Turn off time vs. LED forward current 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). Turn off time vs. LED forward current 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) Output capacitance vs. applied voltage characteristics

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



## 12-(2) Output capacitance vs. applied voltage characteristics

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



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Please contact .....

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**Panasonic Corporation**

Electromechanical Control Business Division

■ 1006, Oaza Kadoma, Kadoma-shi, Osaka 571-8506, Japan  
[industrial.panasonic.com/ac/e/](http://industrial.panasonic.com/ac/e/)

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Тел: +7 (812) 336 43 04 (многоканальный)  
Email: [org@lifeelectronics.ru](mailto:org@lifeelectronics.ru)