

NAIS

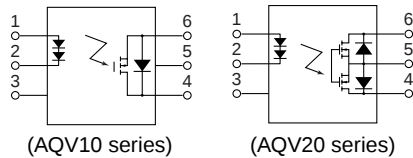
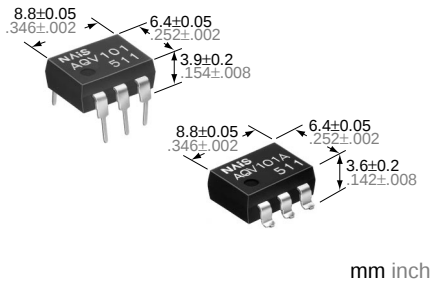
HF (High Function) Type [1-Channel (Form A) Type]

PhotoMOS RELAYS

FEATURES

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

- 7. Low-level off state leakage current**
- 8. Eliminates the need for a power supply to drive the power MOSFET**
A power supply used to drive the power MOSFET is unnecessary because of the built-in optoelectronic device. This results in easy circuit design and small PC board area.
- 9. Low thermal electromotive force (Approx. 1 μ V)**



TYPICAL APPLICATIONS

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

TYPES

1. DC type (AQV10 types)

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	700 mA	AQV101	AQV101A	AQV101AX	AQV101AZ	1 tube contains 50 pcs. 1 batch contains 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: For space reasons, the package type indicator "X" and "Z" are omitted from the seal.

2. AC/DC type (AQV20 types)

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	AQV201	AQV201A	AQV201AX	AQV201AZ	1 tube contains 50 pcs. 1 batch contains 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: For space reasons, the package type indicator "X" and "Z" are omitted from the seal.

RATING

1. DC type (AQV10 types)

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 _F	50 mA				
	LED reverse voltage	V _R	6 V				
	Peak forward current	I _{FP}	1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P _{in}	150 mW				
Output	Load voltage (DC)	V _L	40 V	60 V	250 V	400 V	
	Continuous load current (DC)	I _L	0.7 A	0.6 A	0.3 A	0.18 A	
	Peak load current	I _{peak}	1.8 A	1.5 A	0.6 A	0.5 A	100 ms (1 shot)
	Power dissipation	P _{out}	360 mW				
Total power dissipation		P _T	410 mW				
I/O isolation voltage		V _{iso}	1,500 V (AC)				
Temperature limits	Operating	T _{opr}	−40°C to +85°C −40°F to +185°F				Non-condensing at low temperatures
	Storage	T _{stg}	−40°C to +100°C −40°F to +212°F				

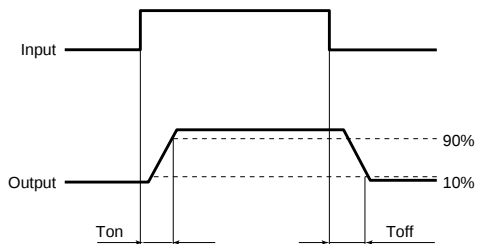
2) Electrical characteristics (Ambient temperature: 25°C 77°F)

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

Note: Recommendable LED forward current $I_F = 10 \text{ mA}$.

For type of connection, see page 31.

*Turn on/Turn off time



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2. AC/DC type (AQV20 types)

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 _F		50 mA				f = 100 Hz, Duty factor = 0.1%	
	LED reverse voltage	V _R		6 V					
	Peak forward current	I _{FP}		1 A					
	Power dissipation	P _{in}		150 mW					
Output	Load voltage (peak AC)	V _L		40 V	60 V	250 V	400 V	A connection: Peak AC, DC B, C connection: DC	
	Continuous load current	I _L		A	0.5 A	0.4 A	0.2 A		0.15 A
				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 _{peak}		1.8 A	1.5 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					
Temperature limits	Operating	T _{opr}		−40°C to +85°C −40°F to +185°F				Non-condensing at low temperature	
	Storage	T _{stg}		−40°C to +100°C −40°F to +212°F					

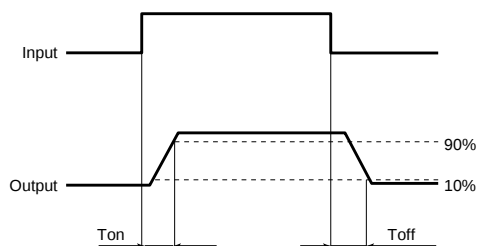
2) Electrical characteristics (Ambient temperature: 25°C 77°F)

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

Note: Recommendable LED forward current $I_F = 10 \text{ mA}$.

For type of connection, see page 31.

*Turn on/Turn off time

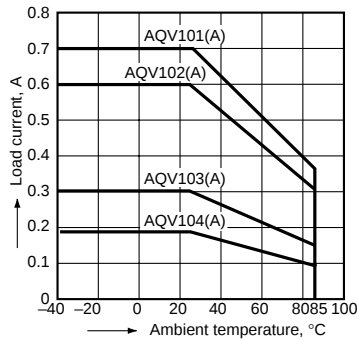


- For Dimensions, see Page 27.
- For Schematic and Wiring Diagrams, see Page 31.
- For Cautions for Use, see Page 36.

REFERENCE DATA

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

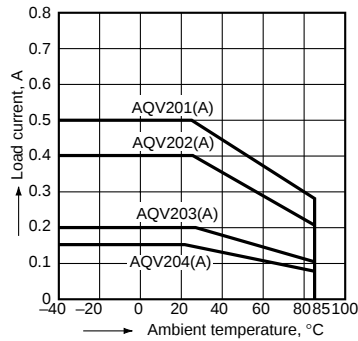
Allowable ambient temperature: -40°C to $+85^{\circ}\text{C}$
 -40°F to $+185^{\circ}\text{F}$



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

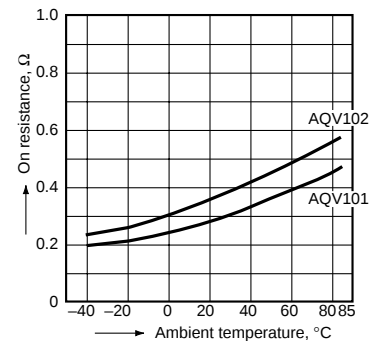
Allowable ambient temperature: -40°C to $+85^{\circ}\text{C}$
 -40°F to $+185^{\circ}\text{F}$

Type of connection: A



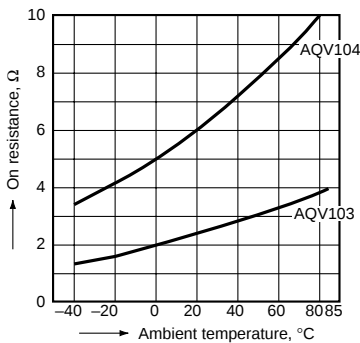
2.-(1) On resistance vs. ambient temperature characteristics (DC type: AQV101, AQV102)

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



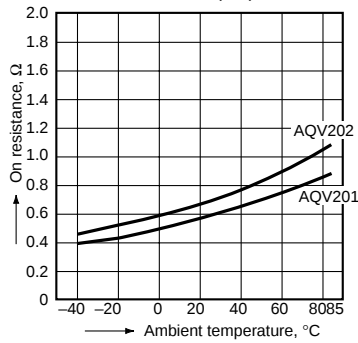
2.-(2) On resistance vs. ambient temperature characteristics (DC type: AQV103, AQV104)

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



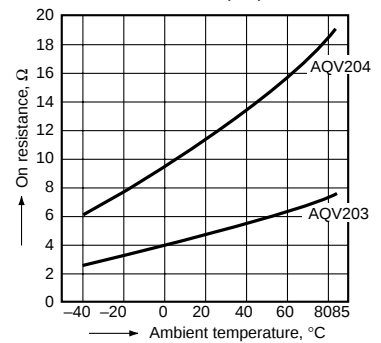
2.-(3) On resistance vs. ambient temperature characteristics (AC/DC type: AQV201, AQV202)

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



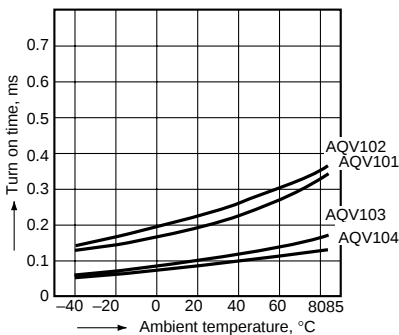
2.-(4) On resistance vs. ambient temperature characteristics (AC/DC type: AQV203, AQV204)

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



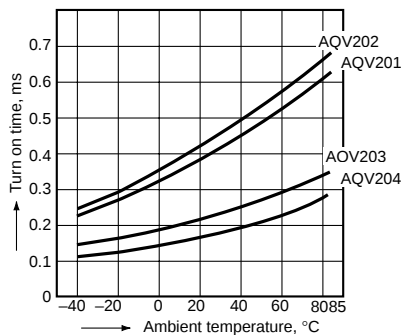
3.-(1) Turn on time vs. ambient temperature characteristics (DC type)

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



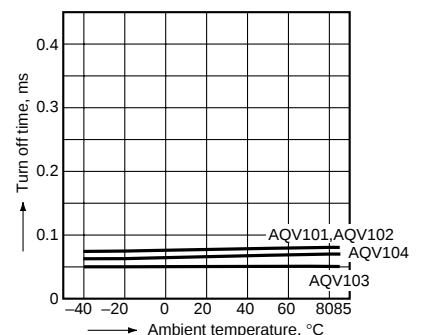
3.-(2) Turn on time vs. ambient temperature characteristics (AC/DC type)

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



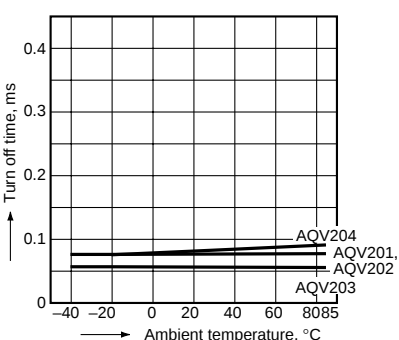
4.-(1) Turn off time vs. ambient temperature characteristics (DC type)

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



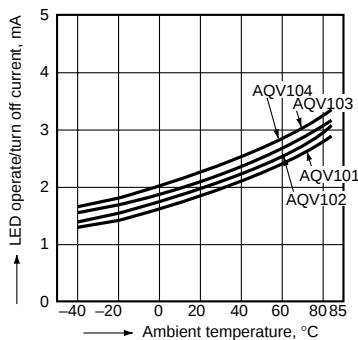
4.-(2) Turn off time vs. ambient temperature characteristics (AC/DC type)

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



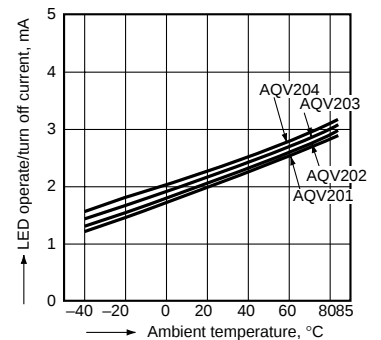
5.-(1) LED operate/turn off current vs. ambient temperature characteristics (DC type)

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)

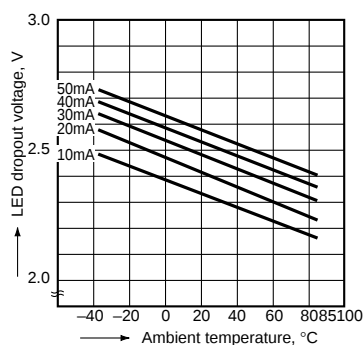


AQV10○, 20○

6. LED dropout voltage vs. ambient temperature characteristics

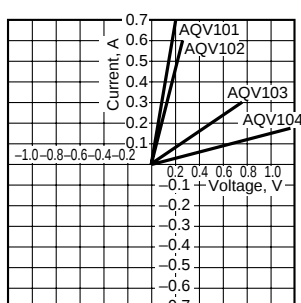
Sample: AQV202

LED current: 10 to 50 mA



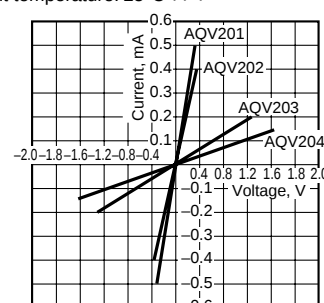
7.-(1) Voltage vs. current characteristics of output at MOS portion (DC type)

Ambient temperature: 25°C 77°F



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

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

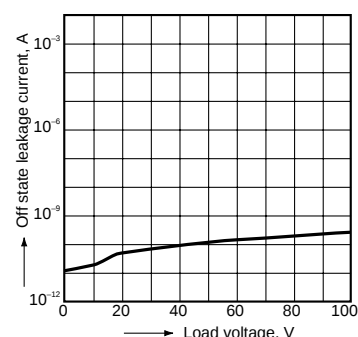


8. Off state leakage current

Sample: AQV204;

Measured portion: between terminals 4 and 6;

Ambient temperature: 25°C 77°F

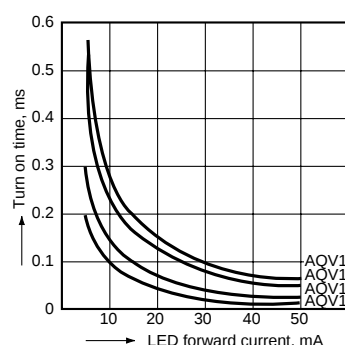


9.-(1) LED forward current vs. turn on time characteristics (DC type)

Load voltage: Max. (DC);

Continuous load current: Max. (DC);

Ambient temperature: 25°C 77°F



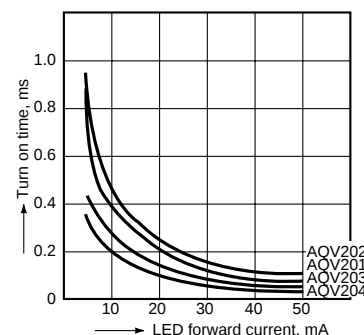
9.-(2) LED forward current vs. turn on time characteristics (AC/DC type)

Measured portion: between terminals 4 and 6;

Load voltage: Max. (DC);

Continuous load current: Max. (DC);

Ambient temperature: 25°C 77°F

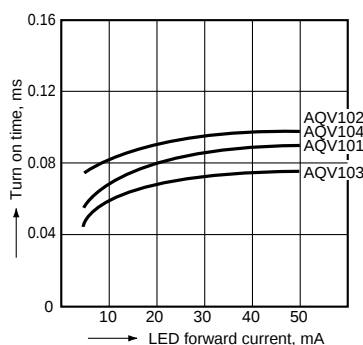


10.-(1) LED forward current vs. turn off time characteristics (DC type)

Load voltage: Max. (DC);

Continuous load current: Max. (DC);

Ambient temperature: 25°C 77°F



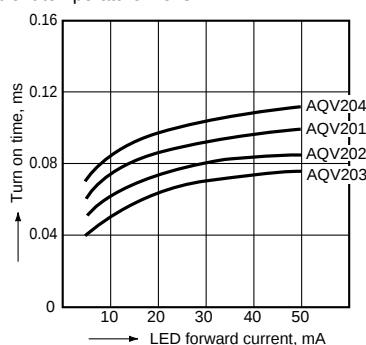
10.-(2) LED forward current vs. turn off time characteristics (AC/DC type)

Measured portion: between terminals 4 and 6;

Load voltage: Max. (DC);

Continuous load current: Max. (DC);

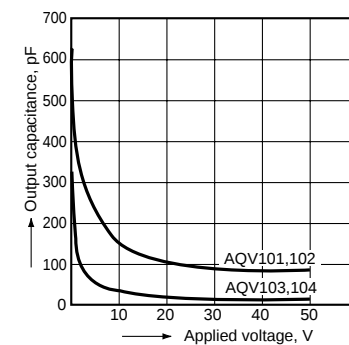
Ambient temperature: 25°C 77°F



11.-(1) Applied voltage vs. output capacitance characteristics (DC type)

Frequency: 1 MHz;

Ambient temperature: 25°C 77°F



11.-(2) Applied voltage vs. output capacitance characteristics (AC/DC type)

Measured portion: between terminals 4 and 6;

Frequency: 1 MHz;

Ambient temperature: 25°C 77°F

