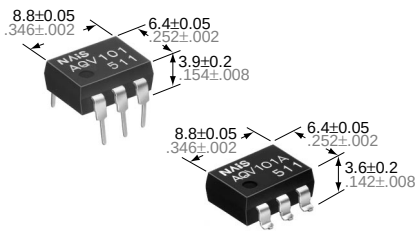
NAiS

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

PhotoMOS RELAYS



mm inch

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 μV)

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)

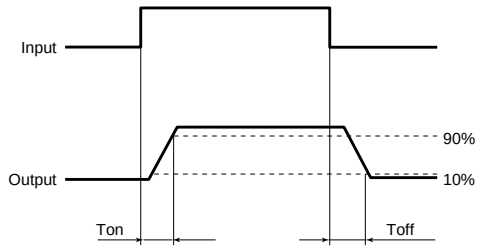
Item		Symbol	AQV101(A)	AQV102(A)	AQV103(A)	AQV104(A)	Remarks
Input	LED forward current	I_F	50 mA				
	LED reverse voltage	V_R	6 V				
	Peak forward current	I_{FP}	1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	150 mW				
Output	Load voltage (DC)	V_L	40 V	60 V	250 V	400 V	
	Continuous 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= 5 to 10 mA.

*Turn on/Turn off time



2. AC/DC type (AQV20 types)

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

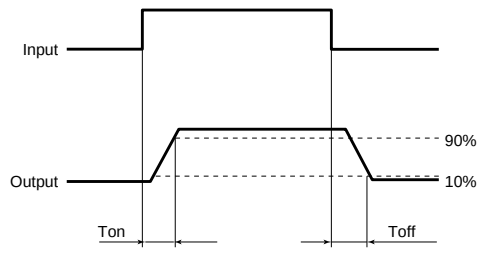
Item		Symbol	Type of connection	AQV201(A)	AQV202(A)	AQV203(A)	AQV204(A)	Remarks
Input	LED forward current	I_F		50 mA				
	LED reverse voltage	V_R		6 V				
	Peak forward current	I_{FP}		1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		150 mW				
Output	Load voltage (peak AC)	V_L		40 V	60 V	250 V	400 V	
	Continuous load current	I_L	A	0.5 A	0.4 A	0.2 A	0.15 A	A connection: Peak AC, DC 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_{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	I_F = 10 mA I_L = Max.
			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= 5 to 10 mA. **type of connection

*Turn on/Turn off time

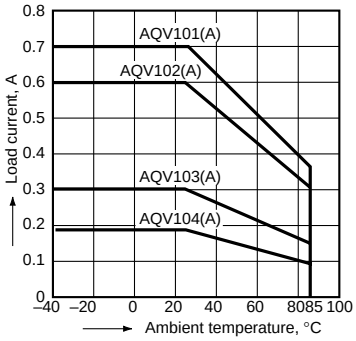


■ For Dimensions, see Page 440.
■ For Schematic and Wiring Diagrams, see Page 444.
■ For Cautions for Use, see Page 449.

REFERENCE DATA

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

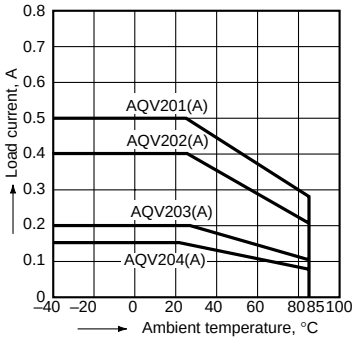
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



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

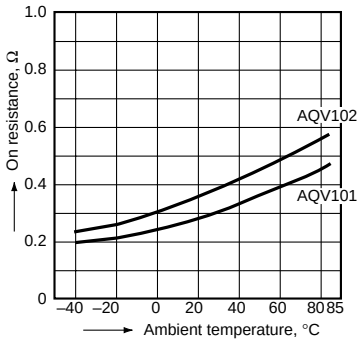
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection: A



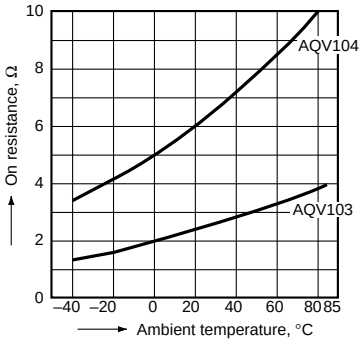
2.-(1) On resistance vs. ambient temperature characteristics (DC type: AQV101, AQV102)

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



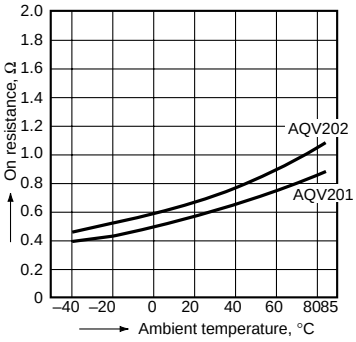
2.-(2) On resistance vs. ambient temperature characteristics (DC type: AQV103, AQV104)

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



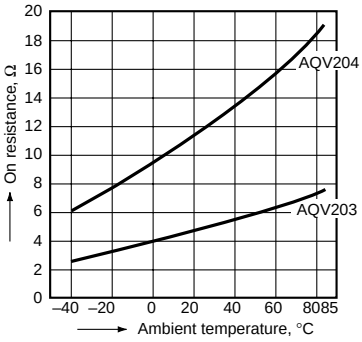
2.-(3) On resistance vs. ambient temperature characteristics
(AC/DC type: AQV201, AQV202)

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



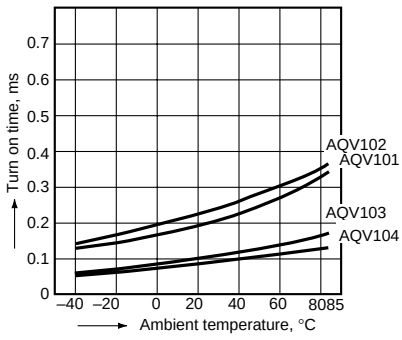
2.-(4) On resistance vs. ambient temperature characteristics
(AC/DC type: AQV203, AQV204)

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



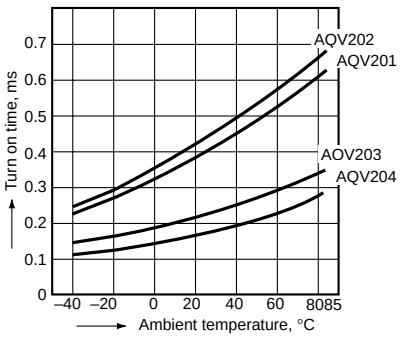
3.-(1) Turn on time vs. ambient temperature characteristics (DC type)

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



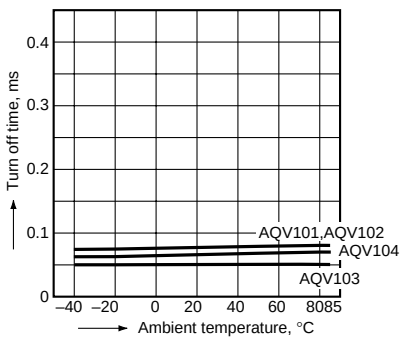
3.-(2) Turn on time vs. ambient temperature characteristics (AC/DC type)

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



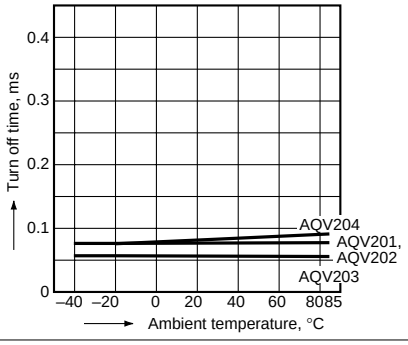
4.-(1) Turn off time vs. ambient temperature characteristics (DC type)

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



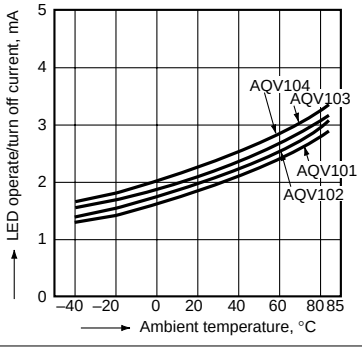
4.-(2) Turn off time vs. ambient temperature characteristics (AC/DC type)

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



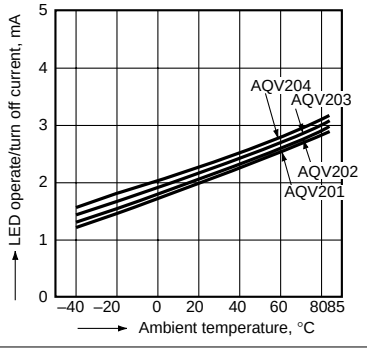
5.-(1) LED operate/turn off current vs. ambient temperature characteristics (DC type)

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

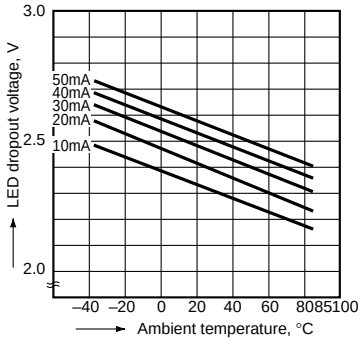


5.-(2) LED operate/turn off current vs. ambient temperature characteristics (AC/DC type)

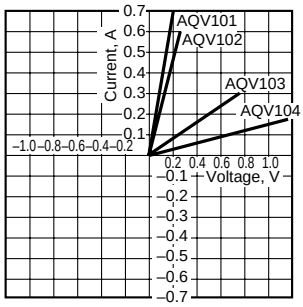
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



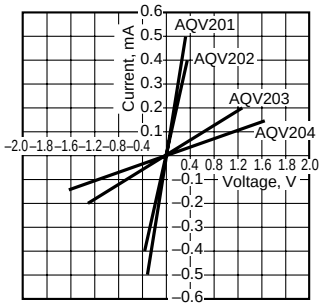
6. LED dropout voltage vs. ambient temperature characteristics
Sample: AQV202
LED current: 10 to 50 mA



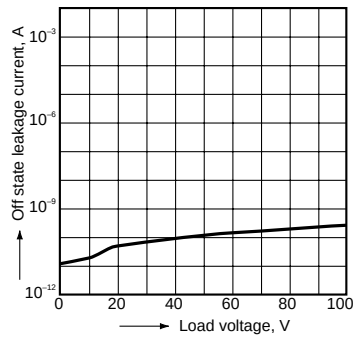
7.-(1) Voltage vs. current characteristics of output at MOS portion (DC type)
Ambient temperature: 25°C 77°F



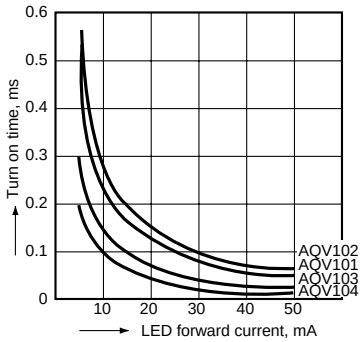
7.-(2) Voltage vs. current characteristics of output at MOS portion (AC/DC type)
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



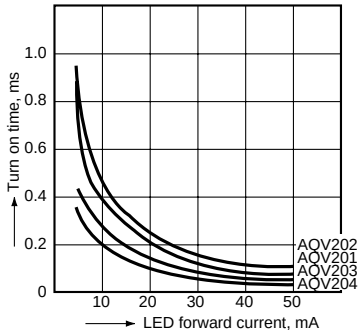
8. Off state leakage current
Sample: AQV204;
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



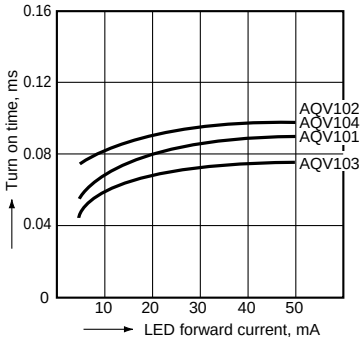
9.-(1) LED forward current vs. turn on time characteristics (DC type)
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



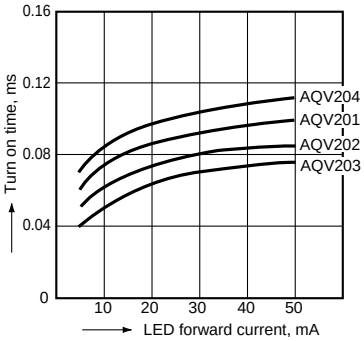
9.-(2) LED forward current vs. turn on time characteristics (AC/DC type)
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



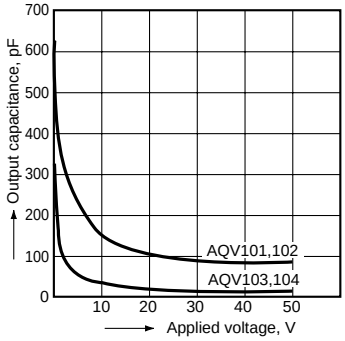
10.-(1) LED forward current vs. turn off time characteristics (DC type)
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



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