

# NAIS

## HE (High-function Economy) Type [1-Channel (Form A) Type]

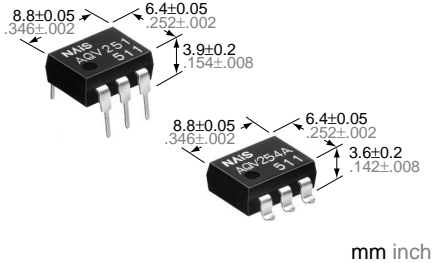
# PhotoMOS RELAYS

### FEATURES

- Highly sensitive and low on-resistance**
- Controls various types of loads such as relays, motors, lamps and solenoids.**
- Optical coupling for extremely high isolation**  
5,000 Vrms I/O isolation available.
- Low-level off state leakage current**
- 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.
- Low thermal electromotive force (Approx. 1  $\mu$ V)**

### TYPICAL APPLICATIONS

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



### TYPES

#### 1. I/O isolation voltage: 1,500 V AC

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	AQV251	AQV251A	AQV251AX	AQV251AZ	1 tube contains 50 pcs. 1 batch contains 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		

#### 2. I/O isolation voltage: Reinforced 5,000 V

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			
250 V	200 mA	AQV253H	AQV253HA	AQV253HAX	AQV253HAZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
400 V	150 mA	AQV254H	AQV254HA	AQV254HAX	AQV254HAZ		

\*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. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV251(A)	AQV252(A)	AQV255(A)	AQV257(A)	AQV253(A)	AQV254(A)	AQV259(A)	AQV258(A)	AQV253H(A)	AQV254H(A)	Remarks	
Input	LED forward current	$I_F$		50 mA											
	LED reverse voltage	$V_R$		3 V											
	Peak forward current	$I_{FP}$		1 A											f = 100 Hz, Duty factor +0.1%
	Power dissipation	$P_{in}$		75 mW											
Output	Load voltage (peak AC)	$V_L$		40 V	60 V	100 V	200 V	250 V	400 V	1,000 V	1,500 V	250 V	400 V		
	Continuous load current	$I_L$	A	0.5 A	0.4 A	0.35 A	0.25 A	0.2 A	0.15 A	0.03 A	0.02 A	0.2 A	0.15 A	A connection: Peak AC, DC	
			B	0.7 A	0.6 A	0.45 A	0.35 A	0.3 A	0.18 A	0.04 A	0.025 A	0.3 A	0.18 A	B, C connection: DC	
			C	1.0 A	0.8 A	0.70 A	0.5 A	0.4 A	0.25 A	0.05 A	0.04 A	0.4 A	0.25 A		
	Peak load current	$I_{peak}$		1.8 A	1.5 A	1.0 A	0.75 A	0.6 A	0.5 A	0.09 A	0.06 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								5,000 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											

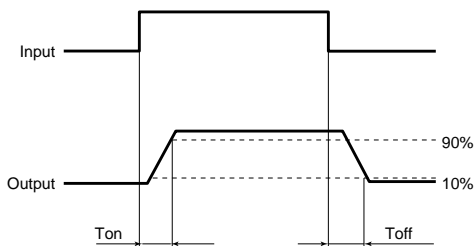
## 2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV251(A)	AQV252(A)	AQV255(A)	AQV257(A)	AQV253(A)	AQV254(A)	AQV259(A)	AQV258(A)	AQV253H(A)	AQV254H(A)	Condition		
Input	LED operate current	Typical	$I_{Fon}$	0.9 mA								1.4 mA				$I_L = Max.$
		Maximum		3 mA												
	LED turn off current	Minimum	$I_{Foff}$	0.4 mA												$I_L = Max.$
		Typical		0.8 mA								1.3 mA				
LED dropout voltage	Typical	$V_F$		1.14 V**										$I_F = 5 mA$		
	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	$I_F = 5 mA$ $I_L = Max.$ Within 1 s on time	
		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	$I_F = 5 mA$ $I_L = Max.$ Within 1 s on time	
		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	$I_F = 5 mA$ $I_L = Max.$ Within 1 s on time	
		Maximum			0.25 Ω	0.35 Ω	0.63 Ω	1 Ω	2 Ω	4 Ω	50 Ω	250 Ω	2 Ω	4 Ω		
Off state leakage current		Maximum			1 μA						10 μA		1 μA		$I_F = 0$ $V_L = Max.$	
Transfer characteristics	Switching speed	Turn on time*	$T_{on}$		1.7 ms	1.4 ms	0.9 ms	1.5 ms	0.8ms	0.8ms	0.6ms	0.35 ms	2.4ms	1.8ms	$I_F = 5 mA$ $I_L = Max.$	
		Maximum			3 ms		2 ms	3 ms	2 ms		1 ms		4 ms	3 ms		
	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	$I_F = 5 mA$ $I_L = Max.$	
		Maximum			0.2 ms											
I/O capacitance		Typical	$C_{iso}$		1.3 pF										f = 1 MHz $V_B = 0$	
		Maximum			3 pF											
Initial I/O isolation resistance		Minimum	$R_{iso}$		1,000 MΩ										500 V DC	

Note: Recommendable LED forward current  
 Standard type: 5 mA  
 Reinforced type: 5 to 10 mA

For type of connection, see Page 444.  
 \*\*1.25 V at  $I_F = 50 mA$

\*Turn on/Turn off time



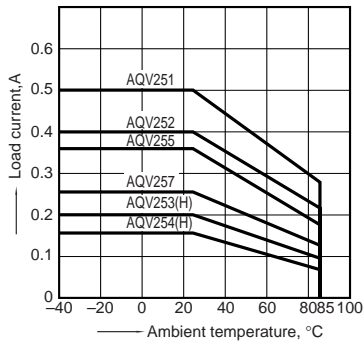
- For Dimensions, see Page 440.
- For Schematic and Wiring Diagrams, see Page 444.
- For Cautions for Use, see Page 449.

## REFERENCE DATA

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

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

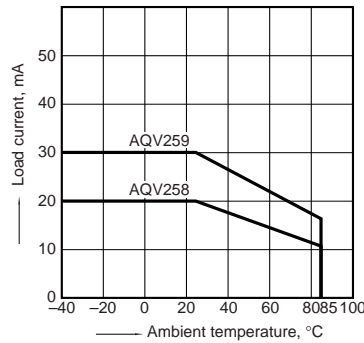
Type of connection: A



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

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

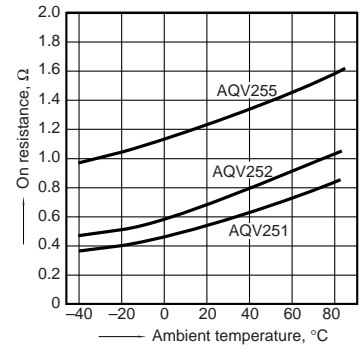
Type of connection: A



### 2.-(1) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;  
 LED current: 5 mA;

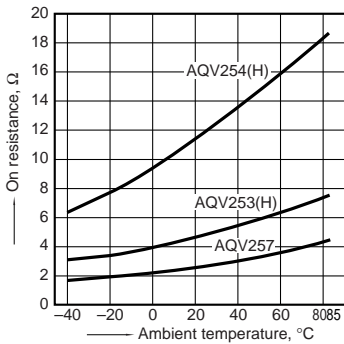
Continuous load current: Max. (DC)



### 2.-(2) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;  
 LED current: 5 mA;

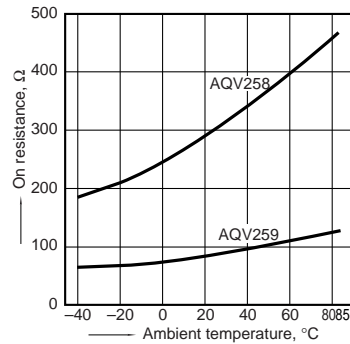
Continuous load current: Max. (DC)



### 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)

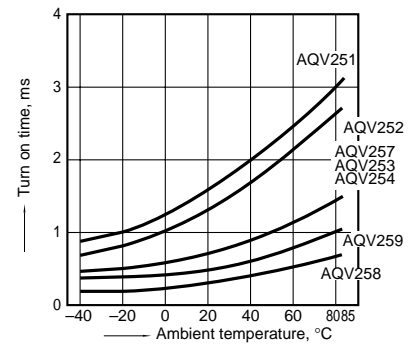


### 3.-(1) Turn on time vs. ambient temperature characteristics

LED current: 5 mA;

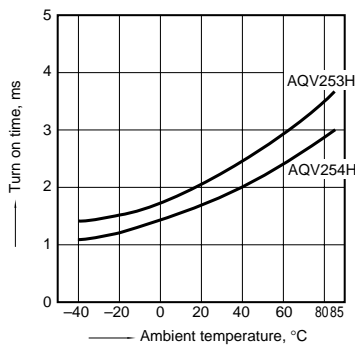
Load voltage: Max. (DC);

Continuous load current: Max. (DC)



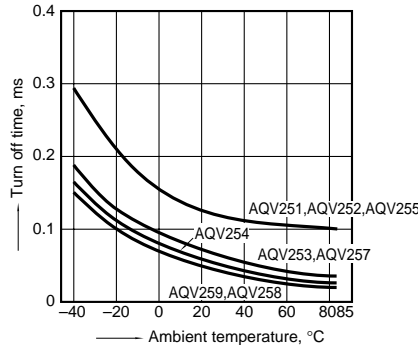
### 3.-(2) Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



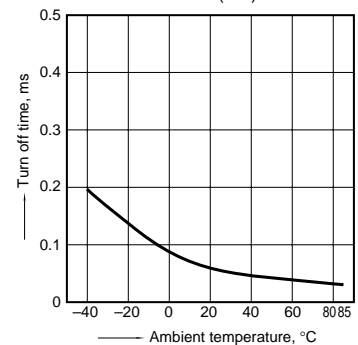
### 4.-(1) Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



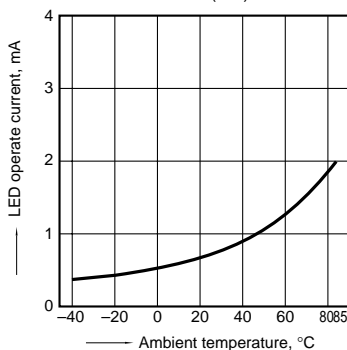
### 4.-(2) Turn off time vs. ambient temperature characteristics

Sample: AQV253H, AQV254H  
 LED current: 5 mA; Load voltage: Max. (DC);  
 Continuous load current: Max. (DC)



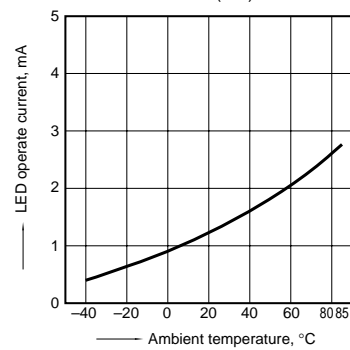
### 5.-(1) LED operate current vs. ambient temperature characteristics

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



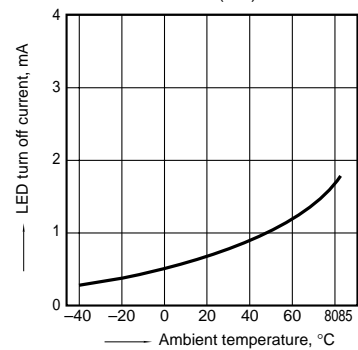
### 5.-(2) LED operate current vs. ambient temperature characteristics

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



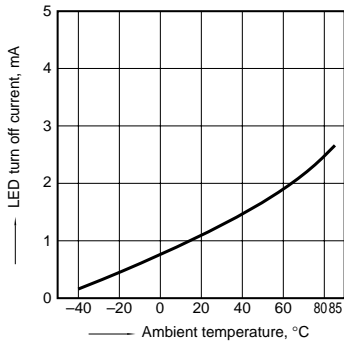
### 6.-(1) LED turn off current vs. ambient temperature characteristics

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



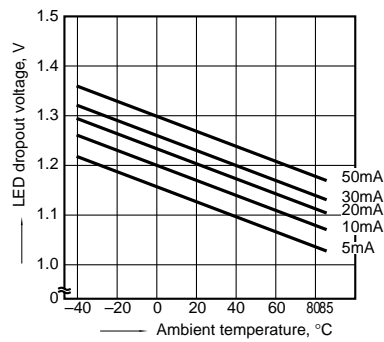
6.-(2) LED turn off current vs. ambient temperature characteristics

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



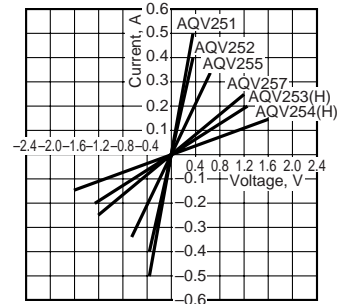
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



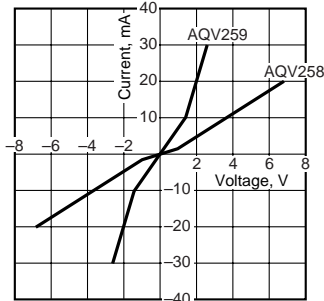
8.-(1) Voltage vs. current characteristics of output at MOS portion

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



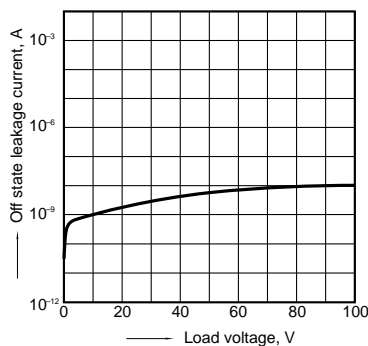
8.-(2) Voltage vs. current characteristics of output at MOS portion

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



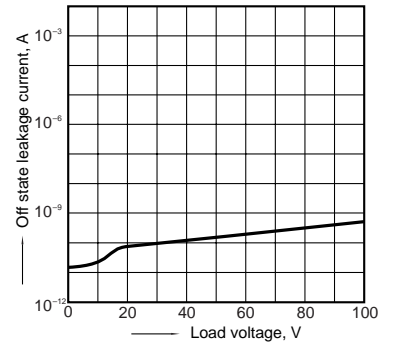
9.-(1). Off state leakage current

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



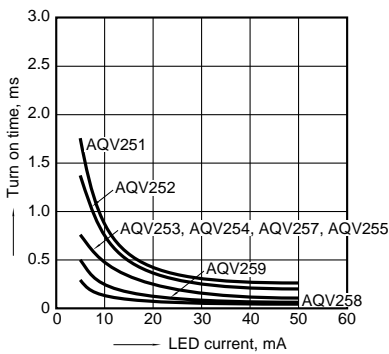
9.-(2). Off state leakage current

Sample: AQV254H; Measured portion: between terminals 4 and 6; Ambient temperature: 25°C 77°F



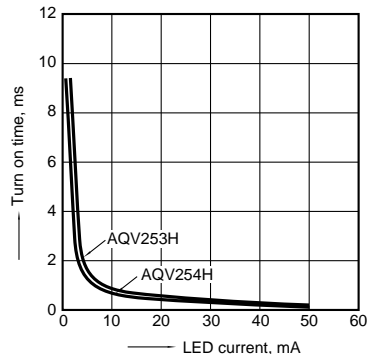
10.-(1). LED forward current vs. turn on time characteristics

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



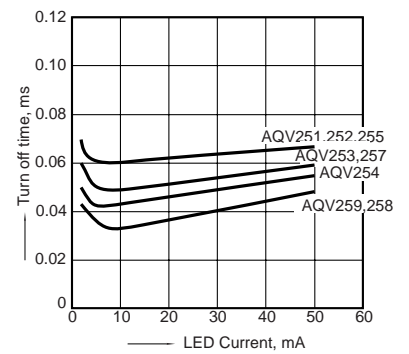
10.-(2). LED forward current vs. turn on time characteristics

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



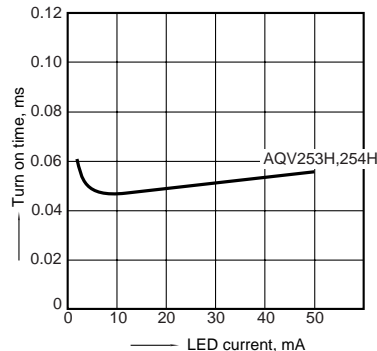
11.-(1). LED forward current vs. turn off time characteristics

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



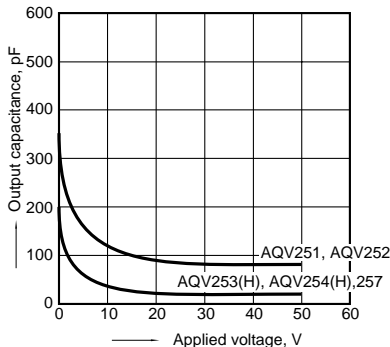
11.-(2). LED forward current vs. turn off time characteristics

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



12.-(1) Applied voltage vs. output capacitance characteristics

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



12.-(2) Applied voltage vs. output capacitance characteristics

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

