

# NAIS

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

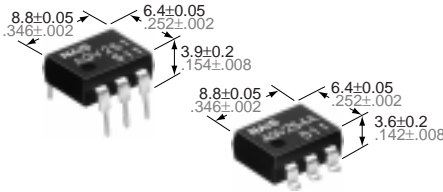
# PhotoMOS RELAYS

UL File No.: E43149  
CSA File No.: LR26550

## FEATURES

1. High sensitivity and low on-resistance
2. Controls various types of loads such as relays, motors, lamps and solenoids.
3. Optical coupling for extremely high isolation  
5,000 Vrms I/O isolation available.
4. Low-level off state leakage current

5. 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.
6. Low thermal electromotive force (Approx. 1  $\mu$ V)



mm inch

## TYPICAL APPLICATIONS

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

## TYPES

I/O isolation voltage	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				
1,500 V AC	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		
Reinforced 5,000 V	1,500 V	20 mA	AQV258	AQV258A	AQV258AX	AQV258AZ		
	250 V	200 mA	AQV253H	AQV253HA	AQV253HAX	AQV253HAZ		
	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	Sym- bol	Type of connec- tion	AQV251(A)	AQV252(A)	AQV255(A)	AQV257(A)	AQV253(A) AQV253H(A)	AQV254(A) AQV254H(A)	AQV259(A)	AQV258(A)	Remarks	
Input	LED forward current	I <sub>F</sub>	50 mA									
	LED reverse voltage	V <sub>R</sub>	3 V									
	Peak forward current	I <sub>FP</sub>	1 A									f = 100 Hz, Duty factor + 0.1%
	Power dissipation	P <sub>in</sub>	75 mW									
Output	Load voltage (peak AC)	V <sub>L</sub>	40 V	60 V	100 V	200 V	250 V	400 V	1,000 V	1,500 V		
	Continuous load current	I <sub>L</sub>	A 0.5 A B 0.7 A C 1.0 A	A 0.4 A B 0.6 A C 0.8 A	A 0.35 A B 0.45 A C 0.70 A	A 0.25 A B 0.35 A C 0.5 A	A 0.2 A B 0.3 A C 0.4 A	A 0.15 A B 0.04 A C 0.25 A	A 0.03 A B 0.025 A C 0.05 A	A 0.02 A B 0.04 A C 0.04 A	A connection: Peak AC, DC B, C connection: DC	
	Peak load current	I <sub>peak</sub>	1.8 A	1.5 A	1.0 A	0.75 A	0.6 A	0.5 A	0.09 A	0.06 A	A connection: 100 ms (1 shot) 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 (5,000 V AC)										
Temperature limits	Operating	T <sub>opr</sub>	-20°C to +80°C -4°F to +176°F									Non-condensing at low temperatures
	Storage	T <sub>stg</sub>	-40°C to +100°C -40°F to +212°F									

( ) : Value for reinforced 5,000 V type

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

Item			Sym- bol	Type of connec- tion	AQV251(A)	AQV252(A)	AQV255(A)	AQV257(A)	AQV253(A) AQV253H(A)	AQV254(A) AQV254H(A)	AQV259(A)	AQV258(A)	Condition
Input	LED operate current	Minimum Typical Maximum	$I_{Fon}$	—	0.9 mA 3 mA	0.9 mA 3 mA	0.9 mA 3 mA	0.9 mA 3 mA	(mA) 0.9 (1.4) 3 (3)	(mA) 0.9 (1.4) 3 (3)	0.9 mA 3 mA	0.9 mA 3 mA	$I_L = \text{Max.}$
	LED turn off current	Minimum Typical Maximum	$I_{Foff}$	—	0.4 mA 0.8 mA	0.4 mA 0.8 mA	0.4 mA 0.7 mA	0.4 mA 0.8 mA	(mA) 0.4 (0.4) 0.8 (1.3)	(mA) 0.4 (0.4) 0.8 (1.3)	0.4 mA 0.8 mA	0.4 mA 0.8 mA	$I_L = \text{Max.}$
	LED dropout voltage	Minimum Typical Maximum	$V_F$	—	1.14 V** 1.5 V	1.14 V** 1.5 V	1.14 V** 1.5 V	1.14 V** 1.5 V	1.14 V** (1.14) 1.5 V	1.14 V** (1.14) 1.5 V	1.14 V** 1.5 V	1.14 V** 1.5 V	$I_F = 5 \text{ mA}$
Output	On resistance	Minimum Typical Maximum	$R_{on}$	A	0.6 $\Omega$ 1 $\Omega$	0.74 $\Omega$ 1.4 $\Omega$	1.8 $\Omega$ 2.5 $\Omega$	2.6 $\Omega$ 4 $\Omega$	5.5 $\Omega$ 8 $\Omega$	12.4 $\Omega$ 16 $\Omega$	85 $\Omega$ 200 $\Omega$	345 $\Omega$ 500 $\Omega$	$I_F = 5 \text{ mA}$ $I_L = \text{Max.}$ Within 1 s on time
		Minimum Typical Maximum	$R_{on}$	B	0.3 $\Omega$ 0.5 $\Omega$	0.37 $\Omega$ 0.7 $\Omega$	0.9 $\Omega$ 1.25 $\Omega$	1.4 $\Omega$ 2 $\Omega$	2.7 $\Omega$ 4 $\Omega$	6.2 $\Omega$ 8 $\Omega$	60 $\Omega$ 100 $\Omega$	345 $\Omega$ 500 $\Omega$	$I_F = 5 \text{ mA}$ $I_L = \text{Max.}$ Within 1 s on time
		Minimum Typical Maximum	$R_{on}$	C	0.15 $\Omega$ 0.25 $\Omega$	0.18 $\Omega$ 0.35 $\Omega$	0.45 $\Omega$ 0.63 $\Omega$	0.7 $\Omega$ 1 $\Omega$	1.4 $\Omega$ 2 $\Omega$	3.1 $\Omega$ 4 $\Omega$	30 $\Omega$ 50 $\Omega$	160 $\Omega$ 250 $\Omega$	$I_F = 5 \text{ mA}$ $I_L = \text{Max.}$ Within 1 s on time
	Off state leakage current	Minimum Typical Maximum	—	—	1 $\mu\text{A}$ 1 $\mu\text{A}$	1 $\mu\text{A}$ 1 $\mu\text{A}$	1 $\mu\text{A}$ 1 $\mu\text{A}$	1 $\mu\text{A}$ 1 $\mu\text{A}$	1 $\mu\text{A}$ 1 $\mu\text{A}$	1 $\mu\text{A}$ 1 $\mu\text{A}$	10 $\mu\text{A}$ 10 $\mu\text{A}$	10 $\mu\text{A}$ 10 $\mu\text{A}$	$I_F = 0$ $V_L = \text{Max.}$
Transfer characteristics	Switching speed	Turn on time*	$T_{on}$	—	(ms) 1.7 3	(ms) 1.4 3	(ms) 0.9 2	(ms) 1.5 3	(ms) 0.8 (2.4) 2 (4)	(ms) 0.8 (1.8) 2 (3)	(ms) 0.6 1	(ms) 0.35 1	$I_F = 5 \text{ mA}$ $I_L = \text{Max.}$
		Turn off time*	$T_{off}$	—	(ms) 0.07 0.2	(ms) 0.07 0.2	(ms) 0.09 0.2	(ms) 0.1 0.2	(ms) 0.06 0.2	(ms) 0.05 0.2	(ms) 0.04 0.2	(ms) 0.04 0.2	$I_F = 5 \text{ mA}$ $I_L = \text{Max.}$
	I/O capacitance	Minimum Typical Maximum	$C_{iso}$	—	1.3 pF 3 pF	1.3 pF 3 pF	1.3 pF 3 pF	1.3 pF 3 pF	1.3 pF 3 pF	1.3 pF 3 pF	1.3 pF 3 pF	1.3 pF 3 pF	$f = 1 \text{ MHz}$ $V_B = 0$
	Initial I/O isolation resistance	Minimum Typical Maximum	$R_{iso}$	—	1,000 M $\Omega$ 1,000 M $\Omega$	1,000 M $\Omega$ 1,000 M $\Omega$	1,000 M $\Omega$ 1,000 M $\Omega$	1,000 M $\Omega$ 1,000 M $\Omega$	1,000 M $\Omega$ 1,000 M $\Omega$	1,000 M $\Omega$ 1,000 M $\Omega$	1,000 M $\Omega$ 1,000 M $\Omega$	1,000 M $\Omega$ 1,000 M $\Omega$	1,000 M $\Omega$ 1,000 M $\Omega$

Note: Recommendable LED forward current

Standard type: 5 mA

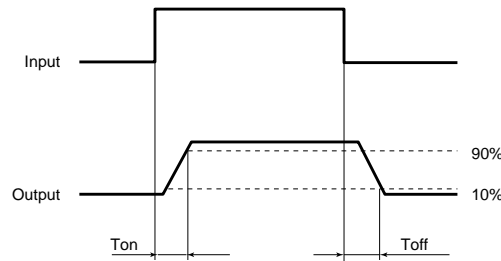
Reinforced type: 5 to 10 mA

\*Turn on/Turn off time

For type of connection, see Page 26.

< >: Value for reinforced 5,000 V type

\*\*1.25 V at  $I_F = 50 \text{ mA}$



### ■ For Dimensions

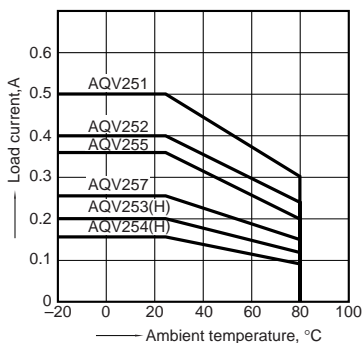
### ■ For Schematic and Wiring Diagrams

### ■ For Cautions for Use

## REFERENCE DATA

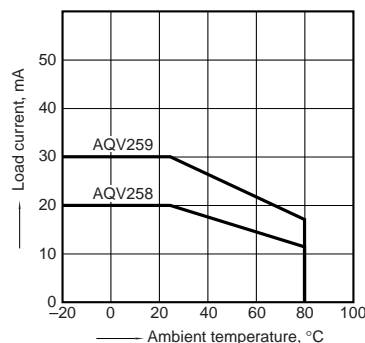
1.-(1) Load current vs. ambient temperature characteristics

Allowable ambient temperature:  $-20^\circ\text{C}$  to  $+80^\circ\text{C}$   
 $-4^\circ\text{F}$  to  $+176^\circ\text{F}$ ; Type of connection: A



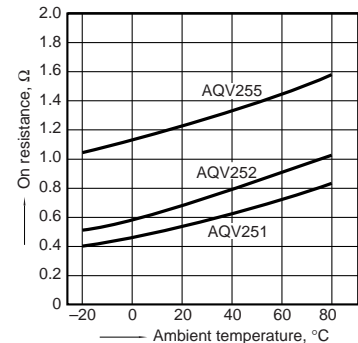
1.-(2) Load current vs. ambient temperature characteristics

Allowable ambient temperature:  $-20^\circ\text{C}$  to  $+80^\circ\text{C}$   
 $-4^\circ\text{F}$  to  $+176^\circ\text{F}$ ; Type of connection: A



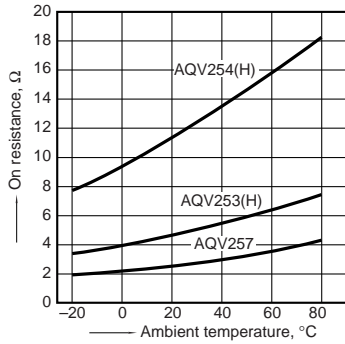
2.-(1) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6; LED current: 5 mA; Continuous load current: Max. (DC)



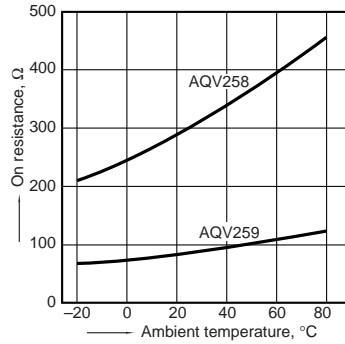
2.-(2) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6; LED current: 5 mA; Continuous load current: Max. (DC)



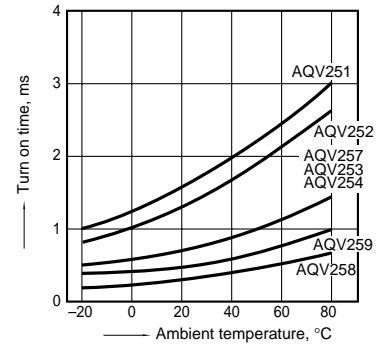
2.-(3) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6; LED current: 5 mA; Continuous load current: 30 mA (DC)



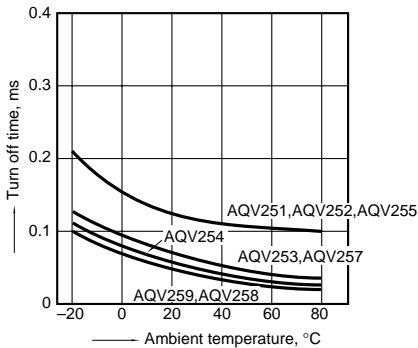
3. Turn on time vs. ambient temperature characteristics

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



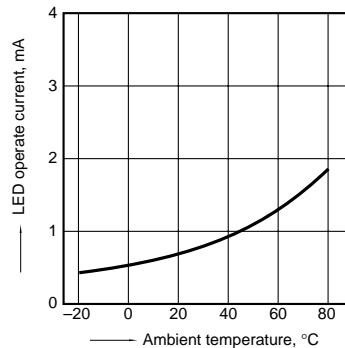
4. Turn off time vs. ambient temperature characteristics

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



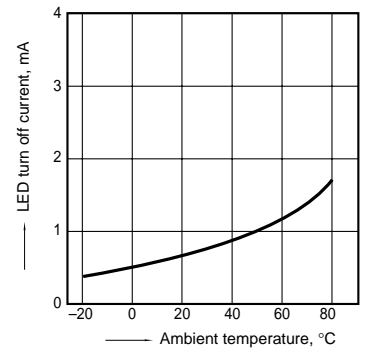
5. LED operate current vs. ambient temperature characteristics

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



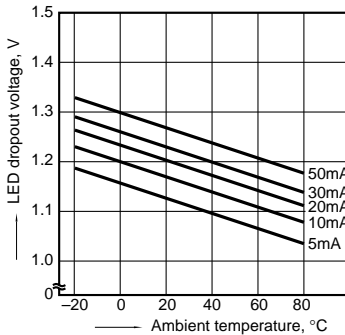
6. LED turn off current vs. ambient temperature characteristics

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



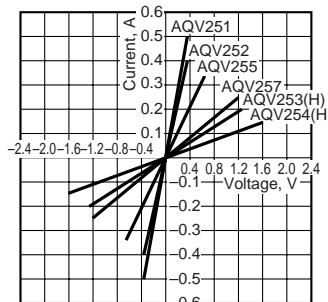
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



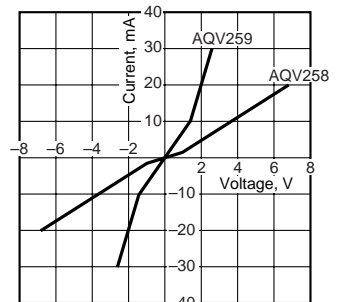
8.-(1) Voltage vs. current characteristics of output at MOS portion

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



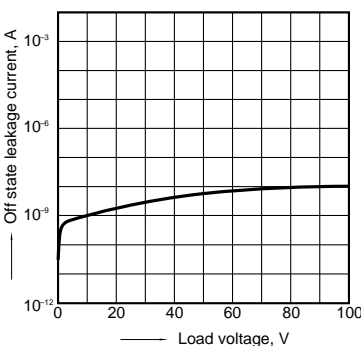
8.-(2) Voltage vs. current characteristics of output at MOS portion

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



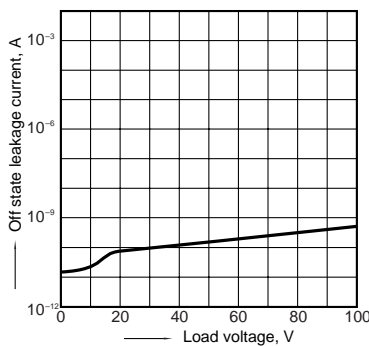
9.-(1) Off state leakage current

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



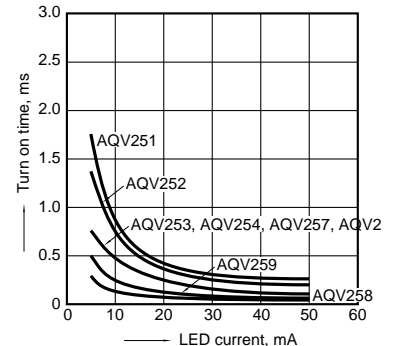
9.-(2) Off state leakage current

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



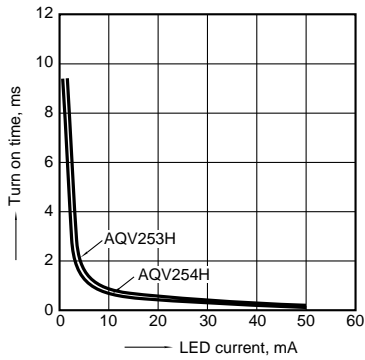
10.-(1) LED forward current vs. turn on time characteristics

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



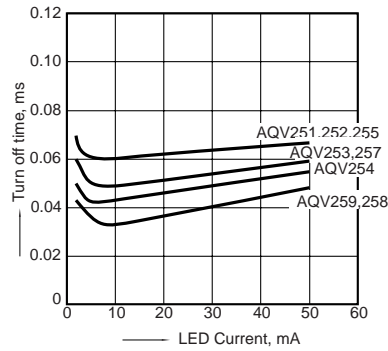
10.-(2) LED forward current vs. turn on time characteristics

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



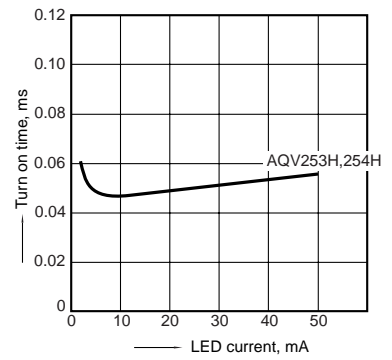
11.-(1) LED forward current vs. turn off time characteristics

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



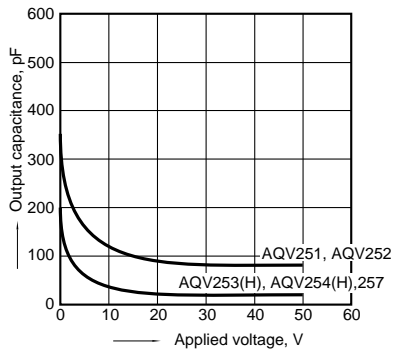
11.-(2) LED forward current vs. turn off time characteristics

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

