

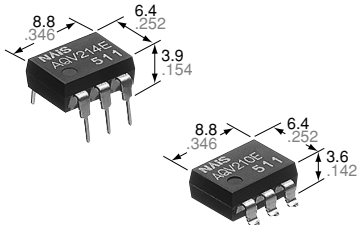
# NAIS

**General use and economy type.**  
**DIP (1 Form A) 6-pin type.**  
**Reinforced insulation 5,000V type.**

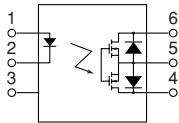
# GU-E PhotoMOS

(AQV210E, AQV210EH)

## FEATURES



mm inch



- 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

Type	I/O isolation	Output rating*		Part No.				Packing quantity	
		Load voltage	Load current	Through hole terminal	Surface-mount terminal		Tube	Tape and reel	
					Tube packing style				Tape and reel packing style
					Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side			
AC/DC	Standard 1,500 V AC	350 V	130 mA	AQV210E	AQV210EA	AQV210EAX	AQV210EAZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
		400 V	120 mA	AQV214E	AQV214EA	AQV214EAX	AQV214EAZ		
	Reinforced 5,000 V	350 V	130 mA	AQV210EH	AQV210EHA	AQV210EHAX	AQV210EHAZ		
		400 V	120 mA	AQV214EH	AQV214EHA	AQV214EHAX	AQV214EHAZ		

\*Indicate the peak AC and DC values.

Note: For space reasons, the SMD terminal shape indicator "A" and 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	AQV210E(A)	AQV214E(A)	AQV210EH(A)	AQV214EH(A)	Remarks	
Input	LED forward current	I <sub>F</sub>		50 mA					
	LED reverse voltage	V <sub>R</sub>		5 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>		350 V	400 V	350 V	400 V		
	Continuous load current	I <sub>L</sub>		A	0.13 A	0.12 A	0.13 A	0.12 A	A connection: Peak AC, DC; B, C connection: DC
				B	0.15 A	0.13 A	0.15 A	0.13 A	
				C	0.17 A	0.15 A	0.17 A	0.15 A	
	Peak load current	I <sub>peak</sub>		0.4 A	0.3 A	0.4 A	0.3 A	A connection: 100 ms (1 shot), V <sub>L</sub> =DC	
Power dissipation	P <sub>out</sub>	500 mW							
Total power dissipation		P <sub>T</sub>	550 mW						
I/O isolation voltage		V <sub>iso</sub>	1,500 V AC		5,000 V AC				
Temperature limits	Operating	T <sub>opr</sub>	-40°C to +85°C -40°F to +185°F				Non-condensing at low temp.		
	Storage	T <sub>stg</sub>	-40°C to +100°C -40°F to +212°F						

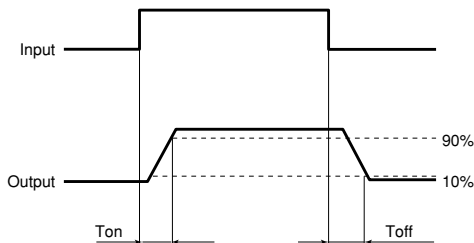
# GU-E PhotoMOS (AQV210E, AQV210EH)

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

Item			Symbol	Type of connection	AQV210E(A)	AQV214E(A)	AQV210EH(A)	AQV214EH(A)	Condition		
Input	LED operate current	Typical	$I_{Fon}$	—	1.1 mA		1.6 mA		$I_L = \text{Max.}$		
		Maximum			3 mA						
	LED turn off current	Minimum	$I_{Foff}$	—	0.3 mA		0.4 mA		$I_L = \text{Max.}$		
		Typical			1.0 mA		1.5 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	23 $\Omega$	30 $\Omega$	23 $\Omega$	30 $\Omega$	$I_F = 5 \text{ mA}$ $I_L = \text{Max.}$ Within 1 s on time		
					Maximum	35 $\Omega$	50 $\Omega$	35 $\Omega$		50 $\Omega$	
		Typical	$R_{on}$	B	11.5 $\Omega$	22.5 $\Omega$	11.5 $\Omega$	22.5 $\Omega$	$I_F = 5 \text{ mA}$ $I_L = \text{Max.}$ Within 1 s on time		
					Maximum	17.5 $\Omega$	25 $\Omega$	17.5 $\Omega$		25 $\Omega$	
		Typical	$R_{on}$	C	6.0 $\Omega$	11.3 $\Omega$	6.0 $\Omega$	11.3 $\Omega$	$I_F = 5 \text{ mA}$ $I_L = \text{Max.}$ Within 1 s on time		
					Maximum	8.8 $\Omega$	12.5 $\Omega$	8.8 $\Omega$		12.5 $\Omega$	
	Output capacitance	Typical	$C_{out}$	A	45 pF				$I_F = 0 \text{ mA}$ $V_B = 0 \text{ V}$ $f = 1 \text{ MHz}$		
	Off state leakage current	Maximum	—	—	1 $\mu\text{A}$				$I_F = 0 \text{ mA}$ $V_L = \text{Max.}$		
	Transfer characteristics	Switching speed	Turn on time*	Typical	$T_{on}$	—	0.5 ms		0.7 ms		$I_F = 0 \text{ mA} \rightarrow 5 \text{ mA}^{**}$ $I_L = \text{Max.}$
							Maximum	2.0 ms		—	
Turn off time*			Typical	$T_{off}$	—	0.05 ms		—		$I_F = 0 \text{ mA} \rightarrow 5 \text{ mA}$ $I_L = \text{Max.}$	
						Maximum	1.0 ms		—		
I/O capacitance		Typical	$C_{iso}$	—	0.8 pF		—		$f = 1 \text{ MHz}$ $V_B = 0 \text{ V}$		
		Maximum			1.5 pF		—				
Initial I/O isolation resistance	Minimum	$R_{iso}$	—	1,000 M $\Omega$				500 V DC			

\*Turn on/Turn off time

For type of connection, see page 34.



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

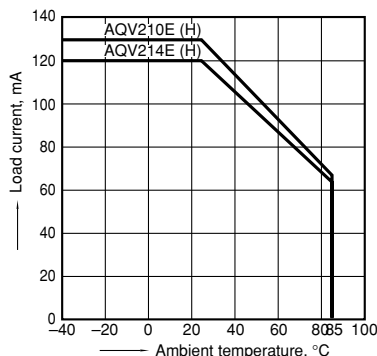
- For Dimensions, see Page 29.
- For Schematic and Wiring Diagrams, see Page 34.
- For Cautions for Use, see Page 38.

## REFERENCE DATA

### 1. Load current vs. ambient temperature characteristics

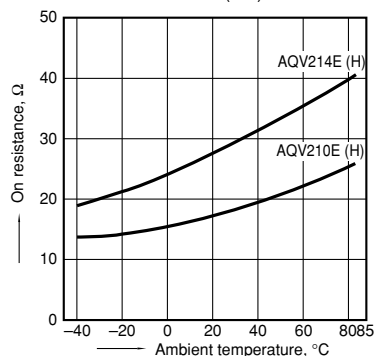
Allowable ambient temperature:  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$   
 $-40^\circ\text{F}$  to  $+185^\circ\text{F}$

Type of connection: A



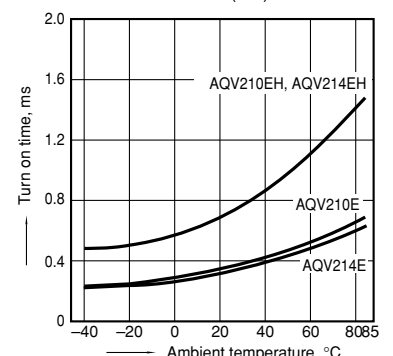
### 2. On resistance vs. ambient temperature characteristics

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



### 3. Turn on time vs. ambient temperature characteristics

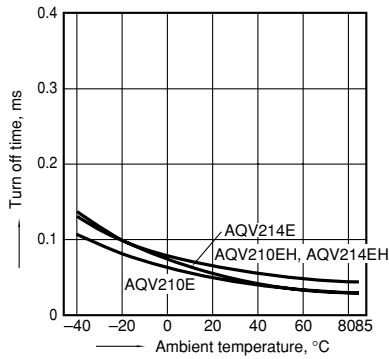
LED current: 5 mA;  
Load voltage: Max. (DC);  
Continuous load current: Max. (DC)



# GU-E PhotoMOS (AQV210E, AQV210EH)

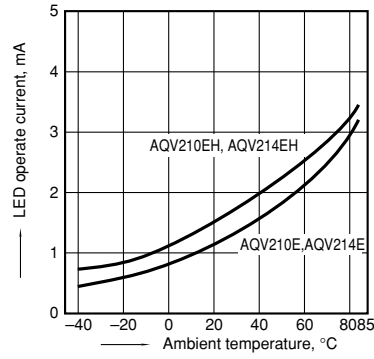
## 4. Turn off time vs. ambient temperature characteristics

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



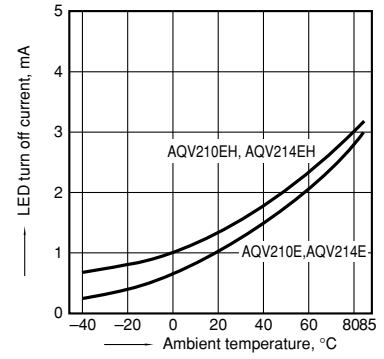
## 5. LED operate current vs. ambient temperature characteristics

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



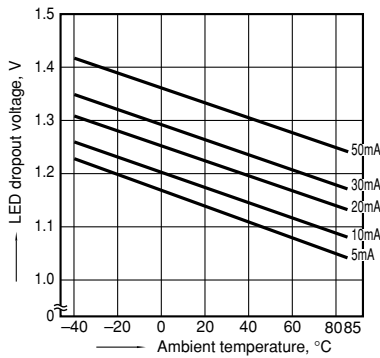
## 6. LED turn off current vs. ambient temperature characteristics

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



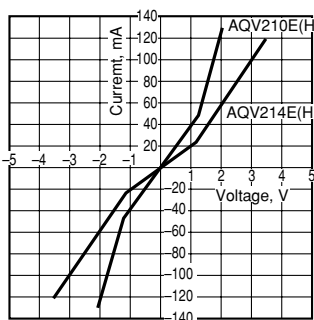
## 7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types  
LED current: 5 to 50 mA



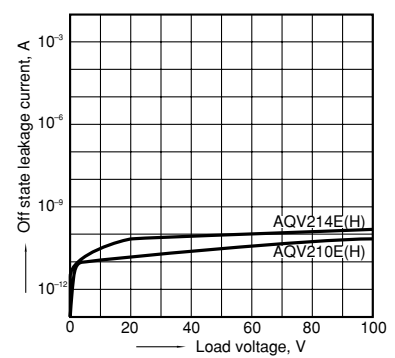
## 8. Current vs. voltage characteristics of output at MOS portion

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



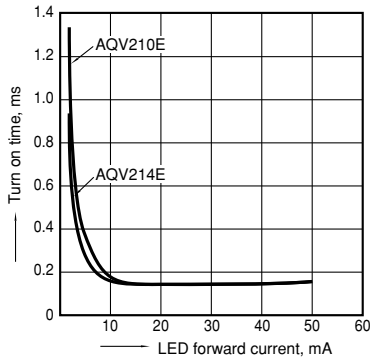
## 9. Off state leakage current vs. load voltage characteristics

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



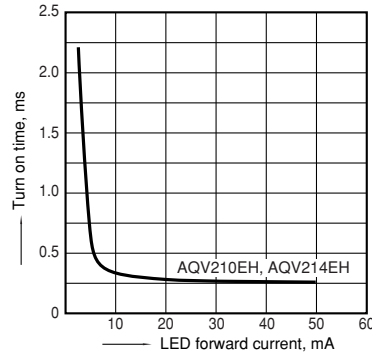
## 10-(1). Turn on time vs. LED forward current characteristics

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



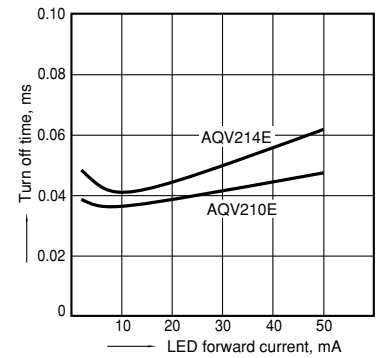
## 10-(2). Turn on time vs. LED forward current characteristics

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



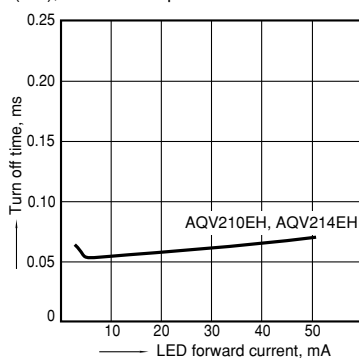
## 11-(1). Turn off time vs. LED forward current characteristics

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. Output capacitance vs. applied voltage characteristics

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

