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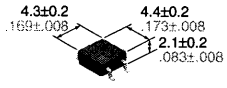
AQY210KS

NAiS

GU (General Use) Type SOP Series 1-Channel (Form A) with Short Circuit Protection 4-Pin Type

PhotoMOS RELAYS

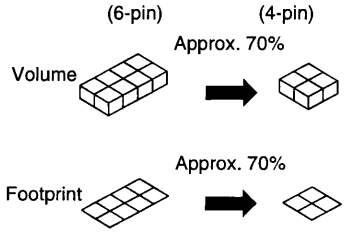


mm inch

FEATURES

1. Short circuit protection
When the output current exceeds a fixed amount, it is cut and the off state is maintained. The relay can be restored by turning off the input current and turning it back on.

2. SO package 4-Pin type in super miniature design
The device comes in a super-miniature SO package 4-Pin type measuring (W) 4.3×(L) 4.4×(H) 2.1 mm (W).169×(L) .173×(H) .083 inch—approx. 70% of the volume and 70% of the footprint size of SO package 6-pin type PhotoMOS Relays.



3. Tape and reel
The device comes standard in a tape and reel (1,000 pcs./reel) to facilitate automatic insertion machines.

4. Controls low-level analog signals

5. Low-level off state leakage current

TYPICAL APPLICATIONS

- Telephone equipment
- Modem
- Measuring and Testing equipment
- Security equipment
- Industrial equipment
- Traffic signal control

TYPES

Type	Output rating*		Part No.		Packing quantity in tape and reel
	Load voltage	Load current	Picked from the 1/2-pin side	Picked from the 3/4-pin side	
			1 Form A	1 Form A	
AC/DC type	350 V	120 mA	AQY210KSX	AQY210KSZ	1,000 pcs.

* Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix "X" or "Z" is not needed when ordering; Tube: 100 pcs.; Case: 2,000 pcs.)

(2) For space reasons, the initial letters of the product number "AQY" and "S" are ommited on the product seal. The package type indicator "X" and "Z" are omitted from the seal. (Ex. the label for product number AQY210KS is 210K).

RATING

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

Item		Symbol	AQY210KS	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	350 V	
	Continuous load current (peak AC)	I_L	0.12 A	
	Power dissipation	P_{out}	300 mW	
Total power dissipation		P_T	350 mW	
I/O isolatiom 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	

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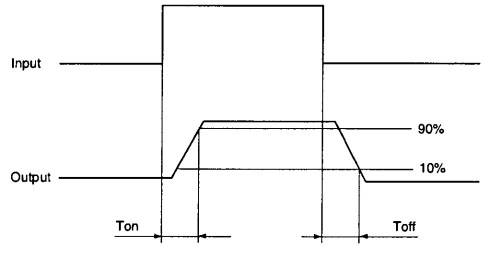
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQY210KS	Condition
Input	LED operate current		Typical	I_{Fon}	1.1 mA	I_L = 120 mA
			Maximum		3.0 mA	
	LED turn off current		Minimum	I_{Foff}	0.3 mA	I_L = 120 mA
			Typical		1.0 mA	
	LED dropout voltage		Typical	V_F	1.13 V (1.32 V at I_F = 50mA)	I_F = 5 mA
			Maximum		1.5 V	
Output	On resistance		Typical	R_{on}	23.5Ω	I_F = 5 mA I_L = 120 mA Within 1 s on time
			Maximum		35Ω	
	Off state leakage current		Maximum	I_{Leak}	1μA	I_F = 0 mA V_L = 350 V
	Over current protection	Cut off current	Minimum	I_{shut}	160 mA	I_F = 5 mA Within 20ms on time
			Typical		200 mA	
			Maximum		240 mA	
		Detection time	Typical	T_{shut}	50μs	I_F = 5 mA V_L = 350V DC short circuit
Transfer characteristics	Turn on time*		Typical	T_{on}	0.7 ms	I_F = 5 mA I_L = 120 mA
			Maximum		2 ms	
	Turn off time*		Typical	T_{off}	0.07 ms	I_F = 5 mA I_L = 120 mA
			Maximum		1 ms	
	I/O capacitance		Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0
			Maximum		1.5 pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F= 5 mA.

For type of connection, see Page 5.

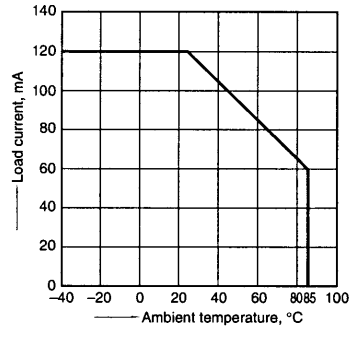
*Turn on/Turn off time



REFERENCE DATA

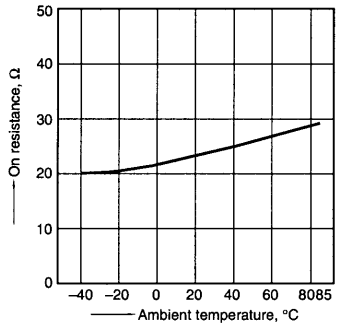
1. Load current vs. ambient temperature characteristics

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



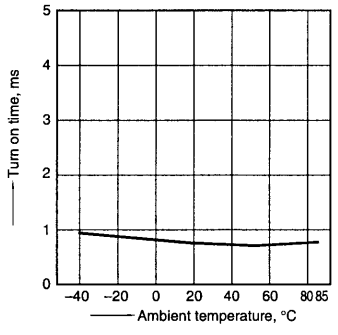
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC)
Load current: Max.(DC)



3. Turn on time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: Max.(DC)



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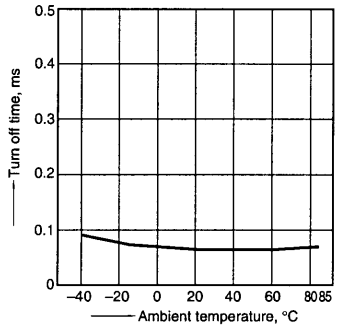
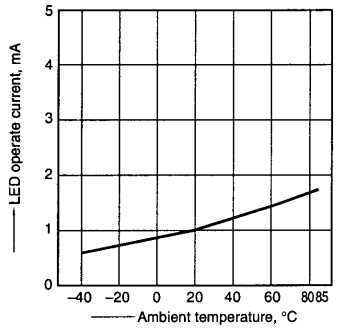
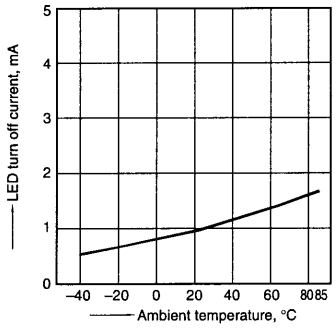
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



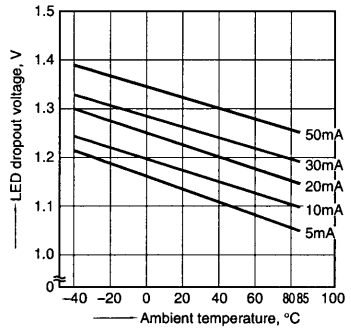
5. LED operate current vs. ambient temperature characteristics
Load voltage: Max.(DC);
Continuous load current: Max.(DC)



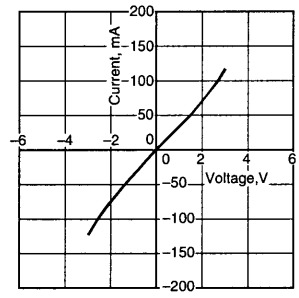
6. LED turn off current vs. ambient temperature characteristics
Load voltage: Max.(DC);
Continuous load current: Max.(DC)



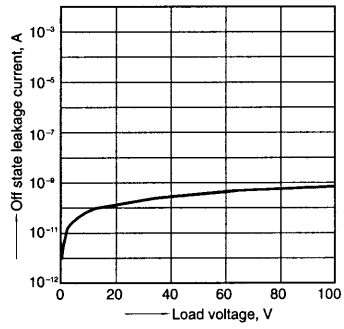
7. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



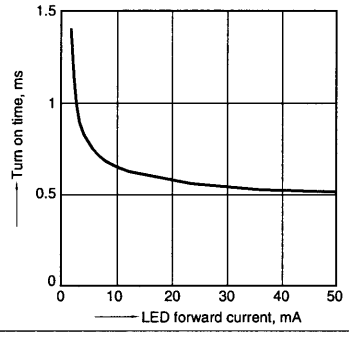
8. Voltage vs. current characteristics of output at MOS portion
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



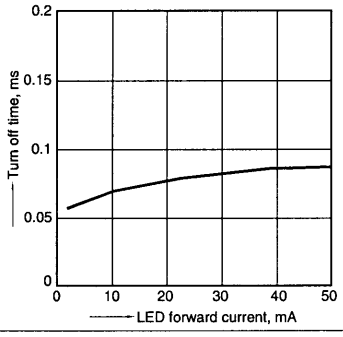
9. Off state leakage current
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



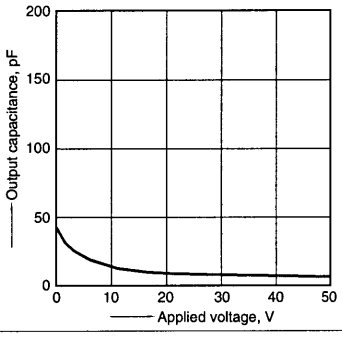
10. LED forward current vs. turn on time characteristics
Measured portion: between terminals 3 and 4; Load voltage: Max.(DC); Continuous load current:Max.(DC);
Ambient temperature: 25°C 77°F



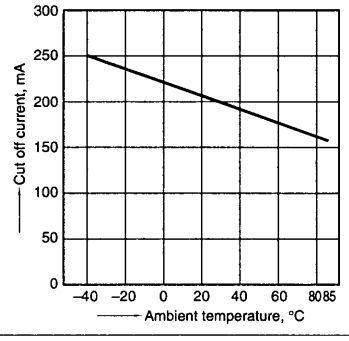
11. LED forward current vs. turn off time characteristics
Measured portion: between terminals 3 and 4; Load voltage: Max.(DC); Continuous load current:Max.(DC);
Ambient temperature: 25°C 77°F



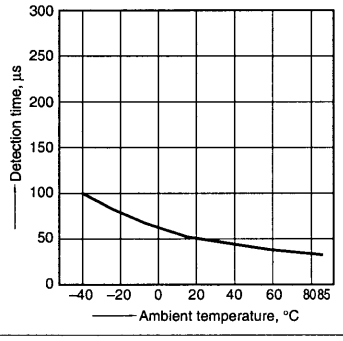
12. Applied voltage vs. output capacitance characteristics
Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



13. Cut off current vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4;
LED current: 5 mA, within 20ms on time



14. Detection time vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max.(DC);



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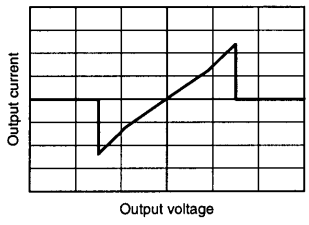
What is short circuit protection?

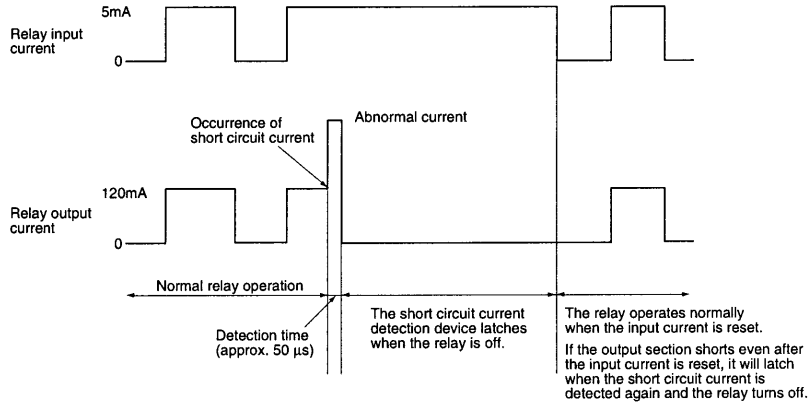
When the load current exceeds specifications, the short circuit protection function kicks in and completely cuts off the load current, thus turning off the relay.
The short circuit protection inside the PhotoMOS relay instantaneously (typ. 50 µs) and completely cuts of the load current.
This protects any circuits that follow the PhotoMOS relay from excess current.
There is almost no heating of the PhotoMOS relay, which prevents it from becoming damaged. To restore the function of the relay turn off the input current and then turn it back on.

Output voltage and output current characteristics

V-I characteristics of PhotoMOS relay with short circuit protection circuit

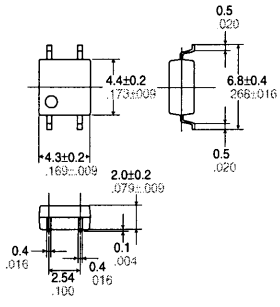


Operation chart

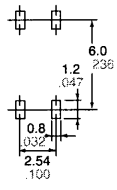


DIMENSIONS

mm inch



Recommended mounting pad (TOP VIEW)

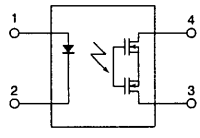
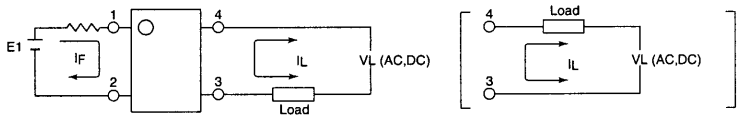


Terminal thickness = 0.15 .006
General tolerance: ±0.1 ±.004

Tolerance: ±0.1 ±.004

SCHEMATIC AND WIRING DIAGRAMS

Notes: E_1: Power source at input side; V_{IN}: Input voltage; I_F: LED forward current; I_{IN}: Input current; V_L: Load voltage; I_L: Load current;

Schematic	Output configuration	Load	Wiring diagram
	1a	AC/DC	

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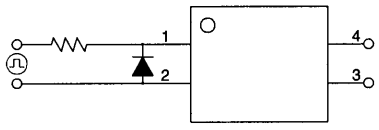
Cautions for Use

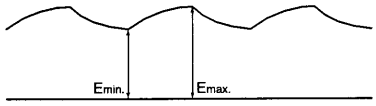
1. Short across terminals
Do not short circuit between terminals when relay is energized, since there is possibility of breaking of the internal IC.

2. Surge voltages at the input
If reverse surge voltages are present at the input terminals, connect a diode in reverse parallel across the input terminals and keep the reverse voltages be- low the reverse breakdown voltage.

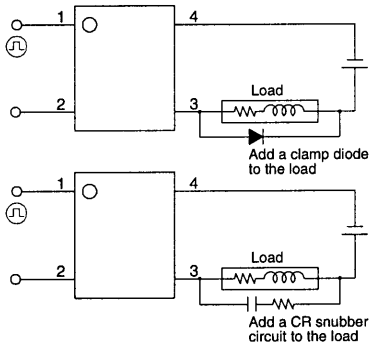


3. Recommended LED forward current (I_F)
It is recommended that the LED forward current (I_F) should be kept at 5mA.

4. Ripple in the input power supply
If ripple is present in the input power supply, observe the following:
1) For LED operate current at Emin, maintain the value mentioned in the table of "3. Recommended LED forward current (I_F)."
2) Keep the LED operate current at 50 mA (25 mA for PhotoMOS HE Relay with LED display type) or less at Emax.



5. Output spike voltages
1) If an inductive load generates spike voltages which exceed the absolute maximum rating, the spike voltage must be limited. Typical circuits are shown below.

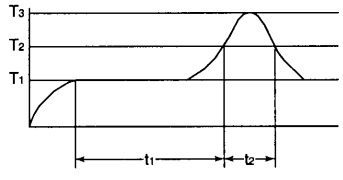


2) Even if spike voltages generated at the load are limited with a clamp diode if the circuit wires are long, spike voltages will occur by inductance. Keep wires as short as possible to minimize inductance.

6. Cleaning solvents compatibility
Dip cleaning with an organic solvent is recommended for removal of solder flux, dust, etc. Select a cleaning solvent from the following table. If ultrasonic cleaning must be used, the severity of factors such as frequency, output power and cleaning solvent selected may cause loose wires and other defects. Make sure these conditions are correct before use. For details, please consult us.

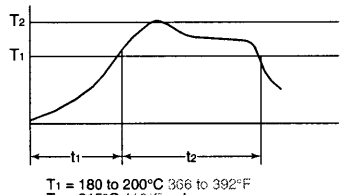
Cleaning solvent		Compatibility (○: Yes ×: No)
Chlorine base	• Trichlene • Chloroethlene	○
Adueous	• Indusco • Hollis • Lonco Terg	○
Alcohol base	• IPA • Ethanol	○
Others	• Thinner • Gasoline	×

7. Soldering
1) When soldering PC board terminals, keep soldering time to within 10 s at 260°C 500°F.
2) When soldering surface-mount terminals, the following conditions are recommended.
(1) IR (Infrared reflow) soldering method



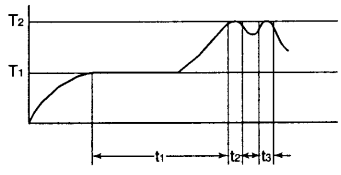
T1 = 155 to 165°C 311 to 329°F
T2 = 180°C 200°C 356 to 392°F
T3 = 245°C 473°F or less
t1 = 120 s or less
t2 = 30 s or less

(2) Vapor phase soldering method



T1 = 180 to 200°C 366 to 392°F
T2 = 215°C 419°F or less
t1 = 40 s
t2 = 40 s or less

(3) Double wave soldering method



T1 = 155 to 165°C 311 to 329°F
T2 = 260°C 500°F or less
t1 = 60 s or less
t2+t3 = 5 s or less

(4) Soldering iron method
Tip temperature: 280 to 300°C 536 to 572°F
Wattage: 30 to 60 W
Soldering time: within 5 s
(5) Others
Check mounting conditions before using other soldering methods (hot-air, hot plate, pulse heater, etc.)
• The temperature profile indicates the temperature of the soldered terminal on the surface of the PC board. The ambient temperature may increase excessively. Check the temperature under mounting conditions.
• The conditions for the infrared reflow soldering apply when preheating using the VPS method.

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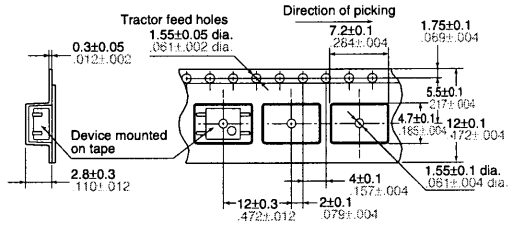
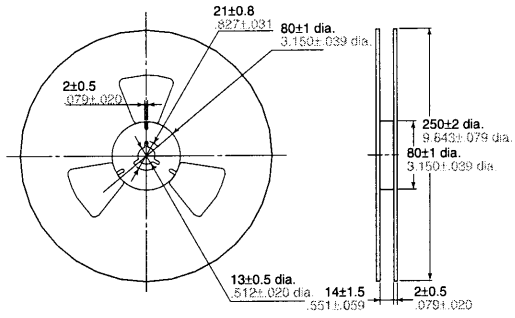
8. The following shows the packaging format

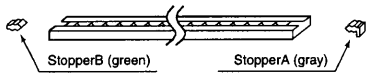
1) Tape and reel

mm inch

Type	Tape dimensions	Dimensions of paper tape reel
SO package 4-pin type	 (1) When picked from 1/2-pin side: Part No. AQYOOOSX (Shown adove) (2) When picked from 3/4-pin side: Part No. AQYOOOSZ	

2) Tube

(1) Devices are packaged in a tube so pin No. 1 is on the stopper B side. Observe correct orientation when mounting them on PC boards.



2) Storage

PhotoMOS relays implemented in SO packages are sensitive to moisture and come in sealed moisture-proof packages. Observe the following cautions on storage.

• After the moisture-proof package is unsealed, take the devices out of storage as soon as possible (within 1 month at the most).

• If the devices are to be left in storage for a considerable period after the moisture-proof package has been unsealed, it is recommended to keep them in another moisture-proof bag containing silica gel (within 3 months at the most).

9. Transportation and storage

1) Extreme vibration during transport will warp the lead or damage the relay. Handle the outer and inner boxes with care.

2) Storage under extreme conditions will cause soldering degradation, external appearance defects, and deterioration of the characteristics. The following storage conditions are recommended:

• Temperature: 0 to 45°C 32 to 113°F

• Humidity: Less than 70% R.H.

• Atomosphere: No harmful gasses such as sulfurous acid gas, minimal dust.

10. Applying stress that exceeds the absolute maximum rating

If the voltage or current value for any of the terminals exceeds the absolute maximum rating, internal elements will deteriorate because of the excessive voltage or current. In extreme cases, wiring may melt, or silicon P/N junctions may be destroyed.

As a result, the design should ensure that the absolute maximum ratings will never be exceeded, even momentarily.

11. Short circuit protection circuit

The short circuit protection circuit is designed to protect circuits from excess current. Therefore, surge current may be detected as current overload in which case the output current will be cut and the off state maintained. For this reason, please include the inrush current in the load current and keep it below the maximum load current. Also, in order to maintain stability of internal IC operation, maintain an input current of at least 5 mA.