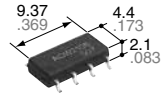
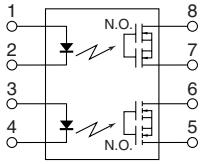
Panasonic
ideas for life

SOP (2 Form A) 8-pin type. 250V load voltage, lower output capacitance and on-resistance. (C×R)

RF PhotoMOS (AQW223R2S)



mm inch



RoHS Directive compatibility information
http://www.mew.co.jp/ac/e/environment/

FEATURES

1. With a load voltage of 250 V, low output capacitance between output terminals and low on-resistance.
Output capacitance (Cout): 33 pF (typ.)
On-resistance (Ron): 11Ω (typ.)
2. 2-channel (Form A) in super miniature design
The device comes in a super-miniature SO package measuring (W) 4.4 × (L) 9.37 ×(H) 2.1 mm (W).173× (L) .369× (H) .083 inch.
3. Low-level off-state leakage current:
The SSR has an off-state leakage current of several milliamperes, whereas the PhotoMOS relay has typ. 30 pA even with the rated load voltage of 250 V
4. Controls low-level analog signals

TYPICAL APPLICATIONS

Measuring and testing equipment
1. Testing equipment for semiconductor performance
IC tester, Liquid crystal driver tester, semiconductor performance tester
2. Board tester
Bear board tester, In-circuit tester, function tester
3. Multi-point recorder (warping, thermo couple)

TYPES

Type	Output rating*		Package size	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style		Tube	Tape and reel
AC/DC type	250V	0.14A	SOP8pin	AQW223R2S	AQW223R2SX (Picked from the 1/2/3/4-pin side)	AQW223R2SZ (Picked from the 5/6/7/8-pin side)	1 tube contains: 50 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.

* Indicate the peak AC and DC values.
Note: For space reasons, the package style indicator "X" or "Z" is not marked on the relay.

RATING

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

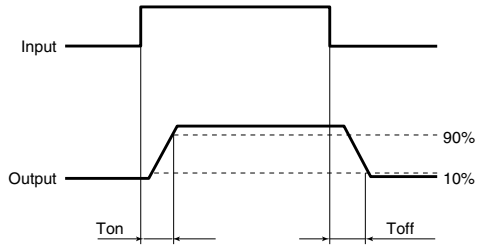
Item		Symbol	AQW223R2S	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	250 V	
	Continuous load current	I_L	0.14 A (0.17 A)	A connection: Peak AC, DC ( ): in case of using only 1a (1 channel)
	Peak load current	I_{peak}	0.42 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	600 mW	
Total power dissipation		P_T	650 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	AQW223R2S	Condition
Input	LED operate current		Typical	I_{Fon}	0.5mA	I_L=Max.
			Maximum		3.0mA	
	LED turn off current		Minimum	I_{Foff}	0.1mA	I_L=Max.
			Typical		0.45mA	
	LED dropout voltage		Typical	V_F	1.32V (1.14V at I_F=5mA)	I_F=50mA
			Maximum		1.5V	
Output	On resistance		Typical	R_{on}	11Ω	I_F=5mA I_L=Max.
			Maximum		15Ω	
	Output capacitance		Typical	C_{out}	33pF	I_F=0mA f=1 MHz V_B=0V
			Maximum		40pF	
	Off state leakage current		Typical	I_{Leak}	0.03nA	I_F=0mA V_L=Max.
			Maximum		10nA	
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	0.15ms	I_F=5mA I_L=Max.
			Maximum		0.5ms	
		Turn off time*	Typical	T_{off}	0.05ms	I_F=5mA or 10mA I_L=Max.
			Maximum		0.2ms	
	I/O capacitance		Typical	C_{iso}	0.8pF	f=1MHz V_B=0V
			Maximum		1.5pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000MΩ	500V DC

Note: Recommendable LED forward current I_F = 5mA. For type of connection, see page 4.

*Turn on/Turn off time

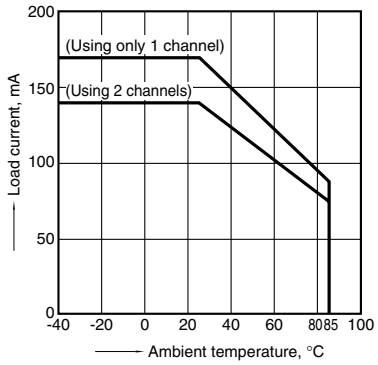


■ For Dimensions, see Page 4.
■ For Schematic and Wiring Diagrams, see Page 4.
■ For Cautions for Use, see Page 5.

REFERENCE DATA

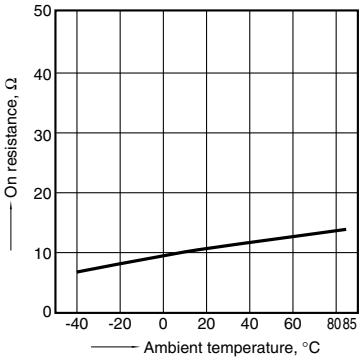
1. Load current vs. ambient temperature characteristics

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



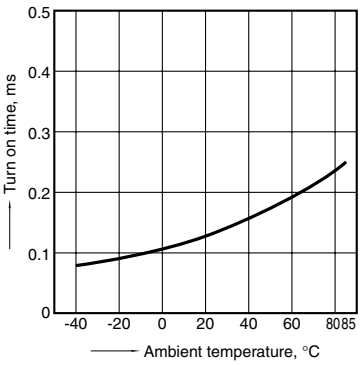
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8:
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



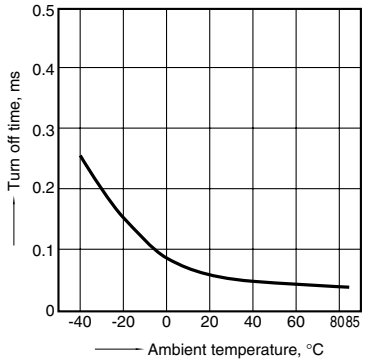
3. Turn on time vs. ambient temperature characteristics

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



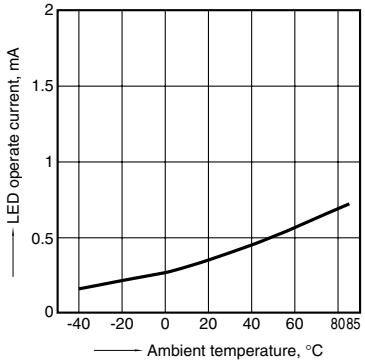
4. Turn off time vs. ambient temperature characteristics

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



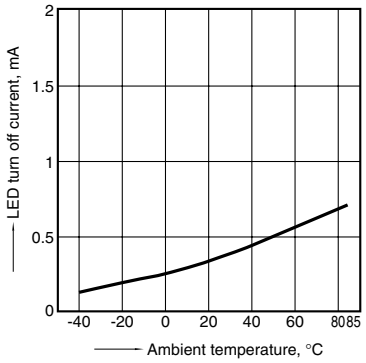
5. LED operate current vs. ambient temperature characteristics

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



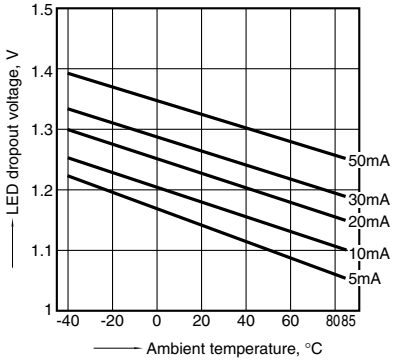
6. LED turn off current vs. ambient temperature characteristics

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



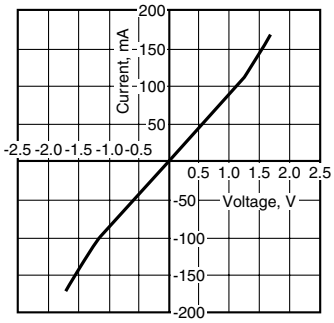
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



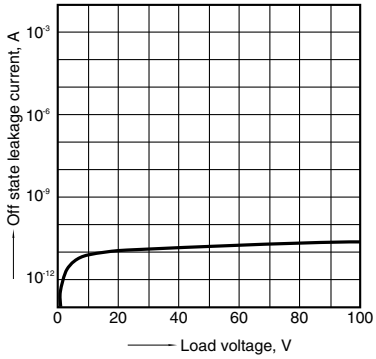
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



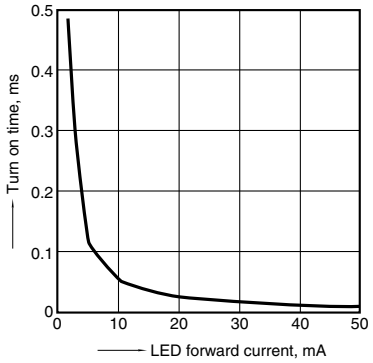
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



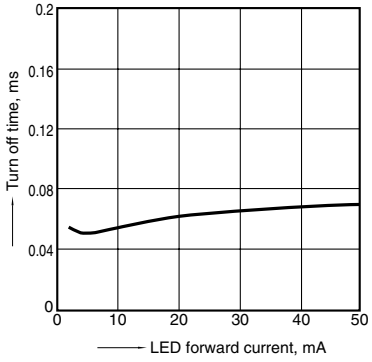
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



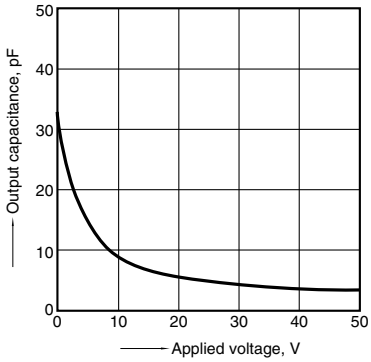
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



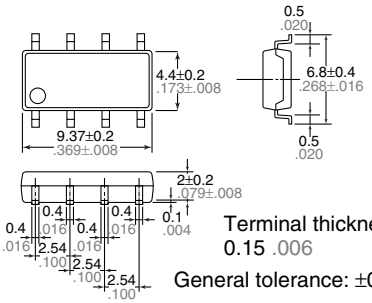
12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F

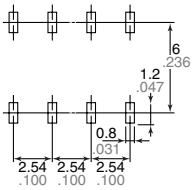


PhotoMOS Relay Dimensions

mm inch

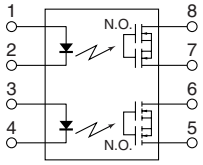
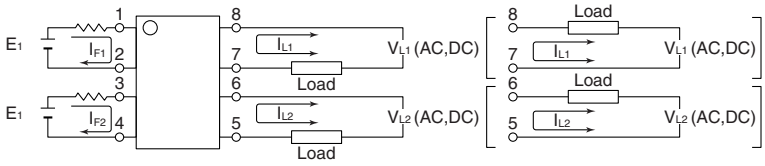
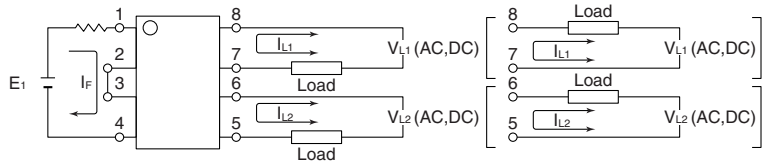
Type	Dimensions
AQW223R2S	  Terminal thickness = 0.15 .006 General tolerance: ±0.1 ±.004

Recommended mounting pad (Top view)



Tolerance: ±0.1 ±.004

PhotoMOS Relay Schematic and Wiring Diagrams

Type	Schematic	Output configuration	Load	Connection	Wiring diagram
AQW223R2S		2a	AC/DC	—	(1) Two independent 1 Form A use  (2) 2 Form A use 

Note: 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.

PhotoMOS Relay Cautions for Use

SAFETY WARNINGS

• Do not use the product under conditions that exceed the range of its specifications. It may cause overheating, smoke, or fire.

• Do not touch the recharging unit while the power is on. There is a danger of electrical shock. Be sure to turn off the power when performing mounting, maintenance, or repair operations on the relay (including connecting parts such as the terminal board and socket).

• Check the connection diagrams in the catalog and be sure to connect the terminals correctly. Erroneous connections could lead to unexpected operating errors, overheating, or fire.

1. Please refer to our general catalog (ASCT1B329E) for further information including cautions and explanations of terminology.

2. Short across terminals

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

3. Deterioration and destruction caused by discharge of static electricity (RF C×R type)

This phenomenon is generally called static electricity destruction, and occurs when static electricity generated by various factors is discharged while the relay terminals are in contact, producing internal destruction of the element.

To prevent problems from static electricity, the following precautions and measures should be taken when using your device.

1) Employees handling relays should wear anti-static clothing and should be grounded through protective resistance of 500 kΩ to 1 MΩ.

2) A conductive metal sheet should be placed over the work table. Measuring instruments and jigs should be grounded.

3) When using soldering irons, either use irons with low leakage current, or ground the tip of the soldering iron. (Use of low-voltage soldering irons is also recommended.)

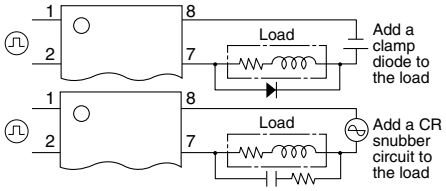
4) Devices and equipment used in assembly should also be grounded.

5) When packing printed circuit boards and equipment, avoid using high-polymer materials such as foam styrene, plastic, and other materials which carry an electrostatic charge.

6) When storing or transporting relays, the environment should not be conducive to generating static electricity (for instance, the humidity should be between 45 and 60%), and relays should be protected using conductive packing materials.

4. 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.



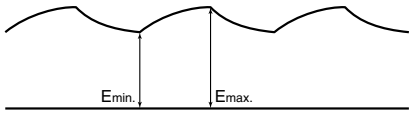
2) Even if spike voltages generated at the load are limited with a clamp diode if the circuit wires are long, spike voltages will occur by inductance. Keep wires as short as possible to minimize inductance.

5. Ripple in the input power supply

If ripple is present in the input power supply, observe the following:

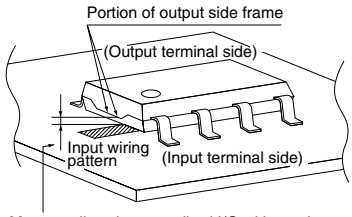
1) For LED operate current at E_{min}, maintain min. 5 mA

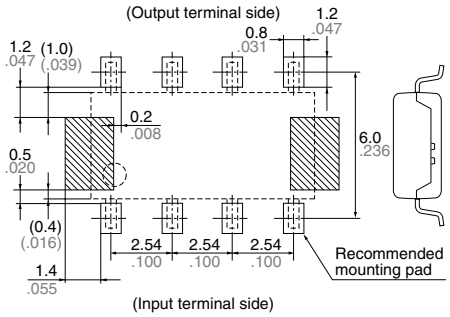
2) Keep the LED operate current at 50 mA or less at E_{max}.



6. Input wiring pattern

With AQW types avoid installing the input (LED side) wiring pattern to the bottom side of the package if you require the specified I/O isolation voltage (V_{iso}) after mounting the PC board. Since part of the frame on the output side is exposed, it may cause fluctuations in the I/O isolation voltage.





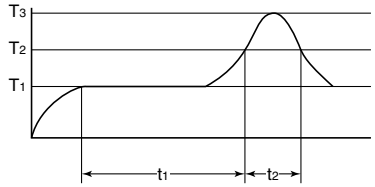
Do not perform wiring for the input side in the shaded area of the above figure.

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, SO package type the following conditions are recommended.

(1) IR (Infrared reflow) soldering method



T1 = 150 to 180°C 302 to 356°F
T2 = 230°C 446°F
T3 = 250°C 482°F or less
t1 = 60 to 120 s or less
t2 = 30 s or less

(2) Soldering iron method

Tip temperature: 350 to 400°C 662 to 752°F

Wattage: 30 to 60 W

Soldering time: within 3 s

(3) Others

Check mounting conditions before using other soldering methods (DWS, VPS, hot-air, hot plate, laser, pulse heater, etc.)

• When using lead-free solder, we recommend a type with an alloy composition of Sn 3.0 Ag 0.5 Cu. Please inquire about soldering conditions and other details.

• 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.

8. Notes for mounting

1) If many different packages are combined on a single substrate, then lead temperature rise is highly dependent on package size. For this reason, please make sure that the temperature of the terminal solder area of the PhotoMOS relay falls within the temperature conditions of item 9 before mounting.

2) If the mounting conditions exceed the recommended solder conditions in item 9, resin strength will fall and the nonconformity of the heat expansion coefficient of each constituent material will increase markedly, possibly causing cracks in the package, severed bonding wires, and the like. For this reason, please inquire with us about whether this use is possible.

9. Cleaning solvents compatibility

The PhotoMOS relay forms an optical path by coupling a light-emitting diode (LED) and photodiode via transparent silicon resin. For this reason, unlike other directory element molded resin products (e.g., MOS transistors and bipolar transistors), avoid ultrasonic cleansing if at all possible. We recommend cleaning with an organic solvent. If you cannot avoid using ultrasonic cleansing, please ensure that the following conditions are met, and check beforehand for defects.

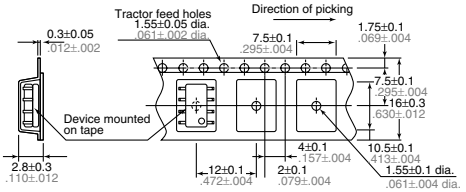
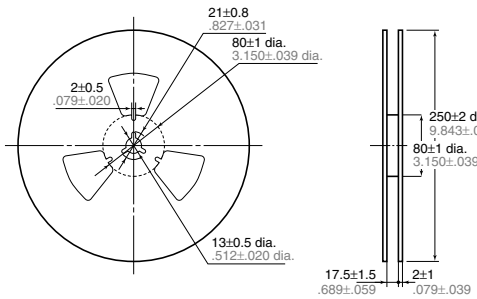
- Frequency: 27 to 29 kHz
- Ultrasonic output: No greater than 0.25W/cm²
- Cleaning time: No longer than 30 s
- Cleanser used: Asahiklin AK-225
- Other: Submerge in solvent in order to prevent the PCB and elements from being contacted directly by the ultrasonic vibrations.

Note: Applies to unit area ultrasonic output for ultrasonic baths.

10. The following shows the packaging format

1) Tape and reel

mm inch

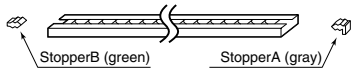
Type	Tape dimensions	Dimensions of paper tape reel
SO package 8-pin type		

(1) When picked from 1/2/3/4-pin side: Part No. AQW○○○SX (Shown above)
(2) When picked from 5/6/7/8-pin side: Part No. AQW○○○SZ

2) Tube

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

(SOP type)



2) Storage

PhotoMOS relays implemented in SSOP, 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).

11. 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.
- Atmosphere: No harmful gasses such as sulfurous acid gas, minimal dust.

Please contact .....

Matsushita Electric Works, Ltd.

Automation Controls Business Unit
■ Head Office: 1048, Kadoma, Kadoma-shi, Osaka 571-8686, Japan
■ Telephone: +81-6-6908-1050 ■ Facsimile: +81-6-6908-5781
http://www.mew.co.jp/ac/e/

Panasonic®