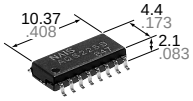
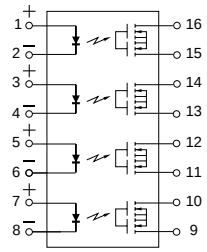
Panasonic
ideas for life

High capacity and low on resistance. RF in SOP 4 Form A type

RF PhotoMOS (AQS225R2S)



mm inch



FEATURES

1. High-level functions (high capacity and low on resistance)

Features: Compared to predecessor (AQS225S)

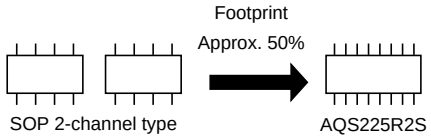
Type	AQS225S	AQS225R2S
C×R	*1 94.5pF·Ω (typ.)	*2 47.25pF·Ω (typ.)
Load current value	50mA	70mA

*1 4.5pF × 21Ω
*2 4.5pF × 10.5Ω

2. 4-channel (4 Form A) of RF PhotoMOS Relays

3. SO package 16-pin type in super miniature design

The device comes in a super-miniature SO package measuring (W)10.37 × (L)4.4 × (H)2.1mm (W) .408×(L).173×(H).083inch— approx. 50% of the footprint size of 8-pin(2-channel) type.



4. Applicable for 4 Form A use, as well as 4 independent 1 Form A

5. Low capacitance between output terminals ensure high response speed:

The capacitance between output terminals is small, typically 4.5pF. This enables for a fast operation speed of 0.04ms(typ.).

6. Low-level off state leakage current

7. Controls low-level analog signals

PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion

TYPICAL APPLICATIONS

For multi-circuit switching

1. Measuring instruments
   (probe cards, etc.)
2. Test equipment
   IC tester, Liquid crystal driver tester, semiconductor performance tester
3. Board tester
   Bear board tester, In-circuit tester, function tester
4. Medical equipment
   Ultrasonic wave diagnostic machine
5. Multi-point recorder
   Warping, thermo couple

TYPES

Type	Output rating*		Part No.		Packing quantity in tape and reel
	Load voltage	Load current	Picked from the 1/2/3/4/5/6/7/8-pin side	Picked from the 9/10/11/12/13/14/15/16-pin side	
AC/DC type	80 V	70 mA	AQS225R2SX	AQS225R2SZ	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: 50 pcs.; Case: 1,000 pcs.)
(2) 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	AQS225R2S	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	80 V	
	Continuous load current (peak AC)	I_L	0.07 A	
	Peak load current	I_{peak}	0.2 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	600 mW	
Total power dissipation		P_T	650 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	

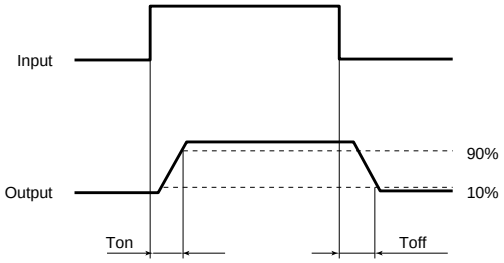
RF PhotoMOS (AQS225R2S)

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

Item			Symbol	AQS225R2S	Condition
Input	LED operate current	Typical	I_{Fon}	0.9 mA	I_L = Max.
		Maximum		3 mA	
	LED turn off current	Minimum	I_{Foff}	0.3 mA	I_L = Max.
		Typical		0.85 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	10.5Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		15Ω	
	Output capacitance	Typical	C_{out}	4.5 pF	I_F = 0 V_B = 0 V f = 1 MHz
		Maximum		6 pF	
	Off state leakage current	Typical	I_{Leak}	0.01 nA	I_F = 0 V_L = Max.
		Maximum		10 nA	
Transfer characteristics	Turn on time*	Typical	T_{on}	0.04 ms	I_F = 5 mA I_L = Max.
		Maximum		0.3 ms	
	Turn off time*	Typical	T_{off}	0.07 ms	I_F = 5 mA I_L = Max.
		Maximum		0.2 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 4.

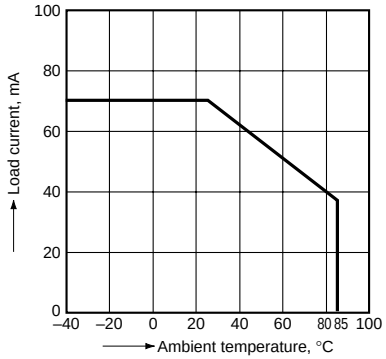
*Turn on/Turn off time



REFERENCE DATA

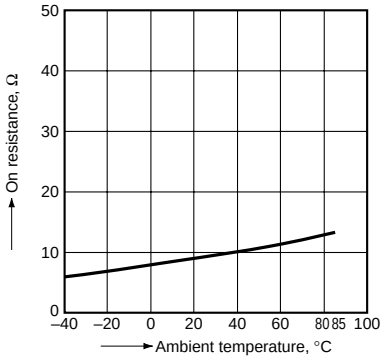
1. Load current vs. ambient temperature characteristics

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



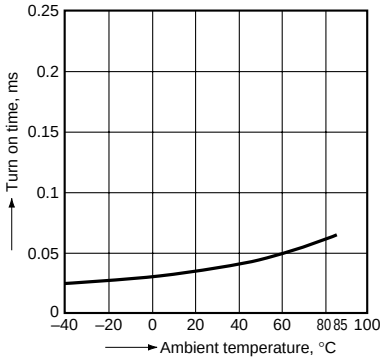
2. On resistance vs. ambient temperature characteristics

LED current: 5 mA;
Continuous load current: 70 mA (DC)



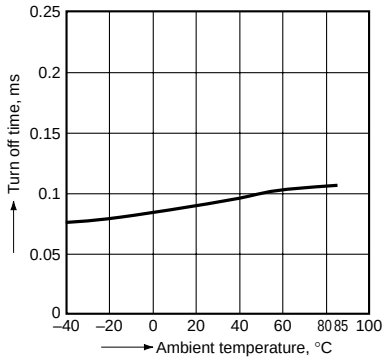
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 80 V (DC);
Continuous load current: 70 mA (DC)



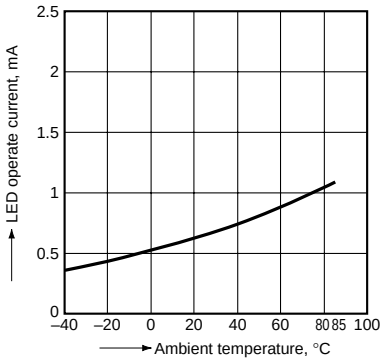
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 80 V (DC);
Continuous load current: 70 mA (DC)



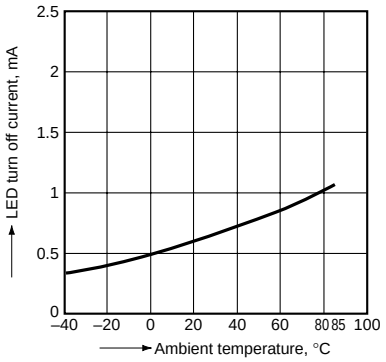
5. LED operate current vs. ambient temperature characteristics

Continuous load current: 70 mA (DC)

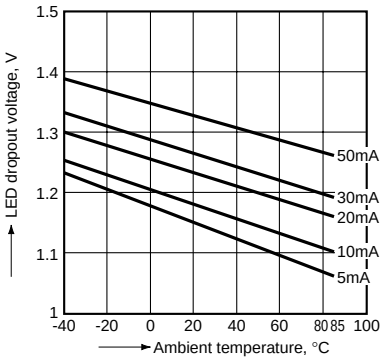


6. LED turn off current vs. ambient temperature characteristics

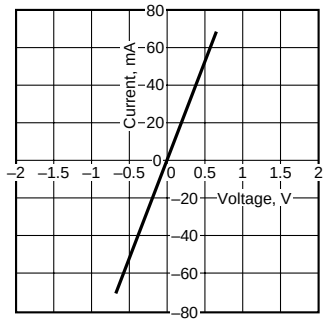
Continuous load current: 70 mA (DC)



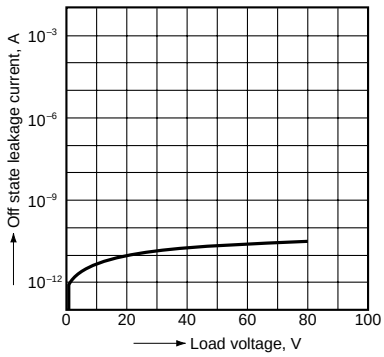
7. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



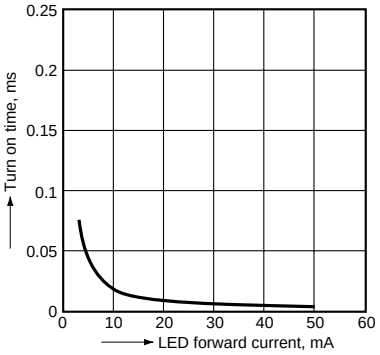
8. Current vs. voltage characteristics of output at MOS portion
Ambient temperature: 25°C 77°F



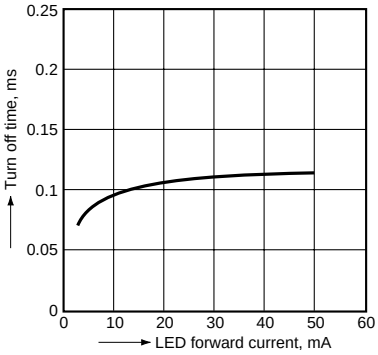
9. Off state leakage current vs. load voltage characteristics
Ambient temperature: 25°C 77°F



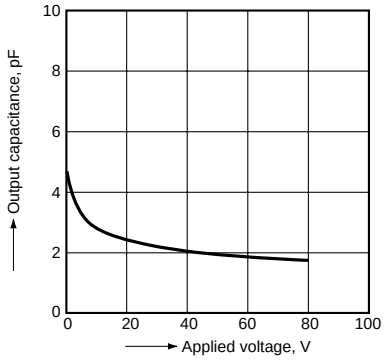
10. Turn on time vs. LED forward current characteristics
Load voltage: 80 V (DC); Continuous load current: 70 mA (DC); Ambient temperature: 25°C 77°F



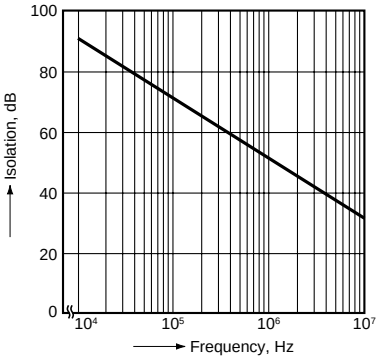
11. Turn off time vs. LED forward current characteristics
Load voltage: 80 V (DC); Continuous load current: 70 mA (DC); Ambient temperature: 25°C 77°F



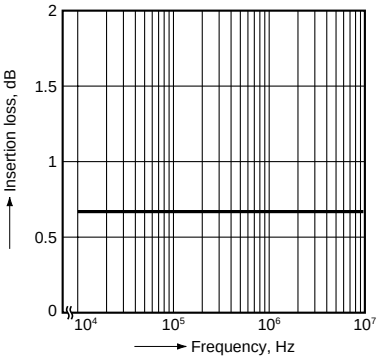
12. Output capacitance vs. applied voltage characteristics
Frequency: 1 MHz, 30 m Vrms;
Ambient temperature: 25°C 77°F



13. Isolation vs. frequency characteristics (50Ω impedance)
Ambient temperature: 25°C 77°F



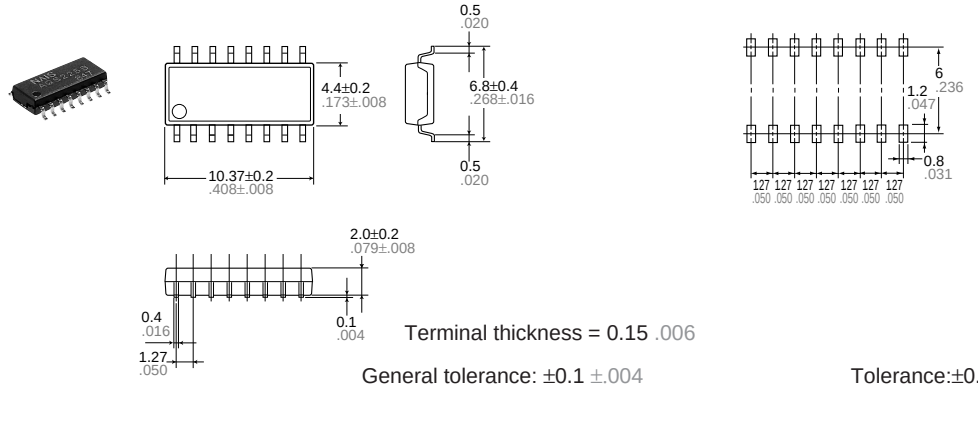
14. Insertion loss vs. frequency characteristics (50Ω impedance)
Ambient temperature: 25°C 77°F



DIMENSIONS

mm inch

Recommended mounting pad (Top view)



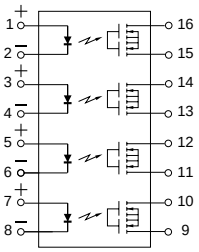
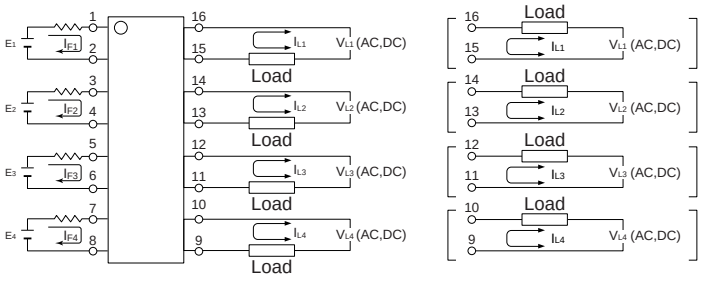
Terminal thickness = 0.15 .006

General tolerance: ±0.1 ±.004

Tolerance:±0.1 ±.004

SCHEMATIC AND WIRING DIAGRAM

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

Type	Schematic	Output configu-ration	Load	Connec-tion	Wiring diagram
AQS225R2S		4a	AC/DC	—	

CAUTIONS FOR USE

1. 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.

2. Deterioration and destruction caused by discharge of static electricity

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.

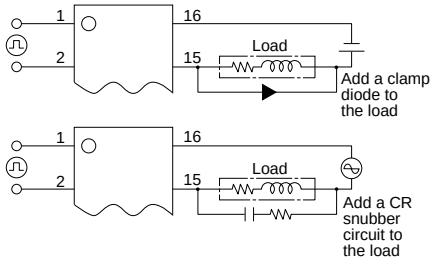
6) When storing or transporting relays, the environment should not be conducive to generating static electricity (for instance, the humidity should be between 45 and 60%), and relays should be protected using conductive packing materials.

4. Short across terminals

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

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.



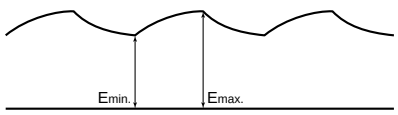
2) Even if spike voltages generated at the load are limited with a clamp diode if the circuit wires are long, spike voltages will occur by inductance. Keep wires as short as possible to minimize inductance.

6. 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}.



7. 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.

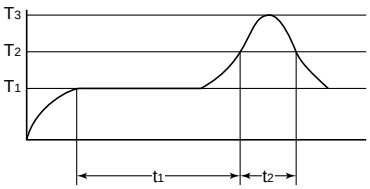
- Frequency: 27 to 29 kHz
- Ultrasonic output:
  No greater than 0.25W/cm^2
- Cleaning time:
  No longer than 30 s
- Cleanser used: Asahiklin AK-225
- Other:
  Submerge in solvent in order to prevent the PCB and elements from being contacted directly by the ultrasonic vibrations.

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

8. Soldering

When soldering this 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) Soldering iron method

Tip temperature: 280 to 300°C 536 to 572°F
Wattage: 30 to 60 W
Soldering time: within 5 s

(3) Others

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

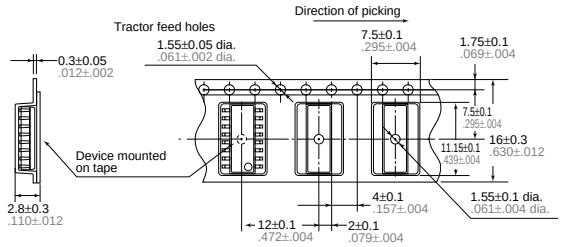
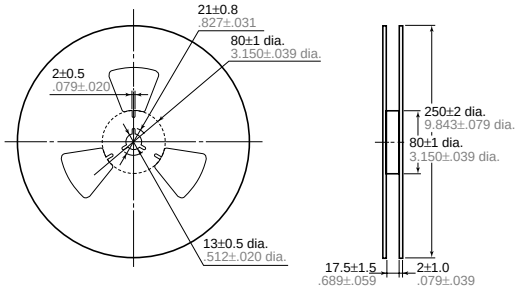
• The temperature profile indicates the temperature of the soldered terminal on the surface of the PC board. The ambient temperature may increase excessively. Check the temperature under mounting conditions.

• The conditions for the infrared reflow soldering apply when preheating using the VPS method.

9. The following shows the packaging format

1) Tape and reel

mm inch

Type	Tape dimensions	Dimensions of paper tape reel
SO package 16-pin type		

(1) When picked from 1/2/3/4/5/6/7/8-pin side: Part No. AQS225R2SX (Shown above)
(2) When picked from 9/10/11/12/13/14/15/16-pin side: Part No. AQS225R2SZ

10. 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).

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

12. 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 8 before mounting.

2) If the mounting conditions exceed the recommended solder conditions in item 8, 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.