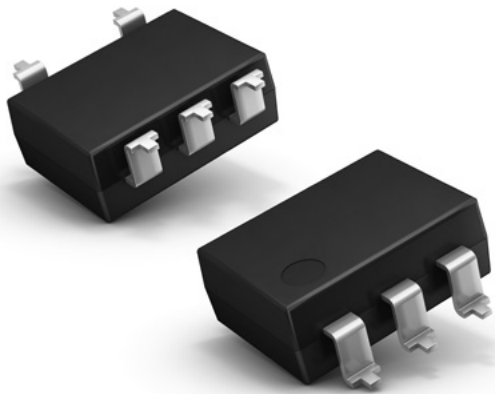


**Panasonic**  
INDUSTRY

# Automotive PhotoMOS<sup>®</sup> Relays

Overview



Your Committed Enabler

# IN Your Future



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## A spotlight on PhotoMOS®

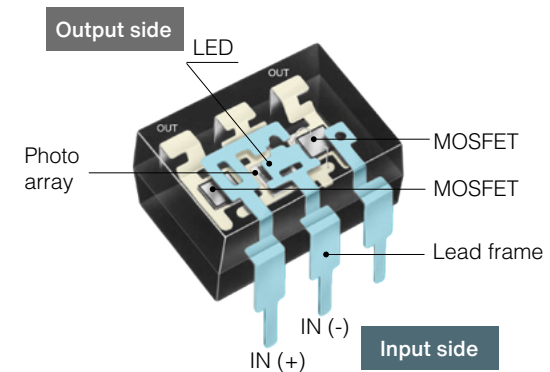
Panasonic Industry's range of photo coupled MOSFET relays for automotive applications

### A history of quality products and a long partnership with the automotive industry

For decades, the ever-increasing need for innovation in transportation electronics has motivated Panasonic to develop highly reliable, long-lasting devices for transportation safety, comfort, entertainment, and powertrain applications. The transportation industry is constantly striving to balance societal and economic pressures with measures to protect the environment. Panasonic continually supports these efforts with proven quality, a solid manufacturing organization and experienced engineering talent.

### Galvanic I/O isolation realized with PhotoMOS® technology

The basic construction of the PhotoMOS® relay can be seen in the illustration. Light emitted from a LED on the input side passes through an isolator permeable to light and is detected by a solar cell. Via a trigger circuit (DIC), the solar cell's output voltage controls the gates of two source-coupled MOSFETs at the output. This arrangement allows PhotoMOS® relays to switch both AC and DC loads. The integration of MOSFET technology in PhotoMOS® relays differentiates them significantly from semiconductor relays with triacs or transistors at the output.



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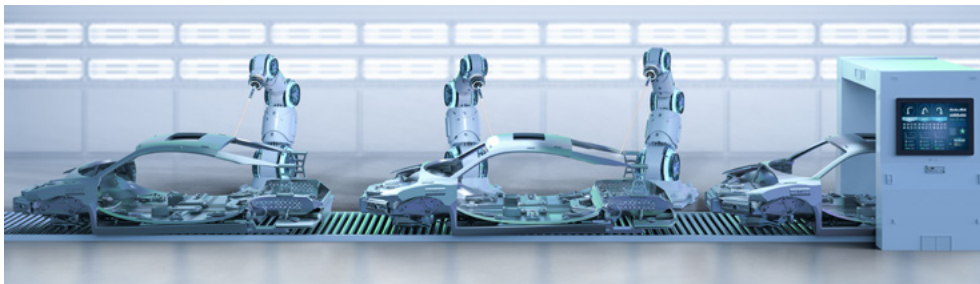
## What makes PhotoMOS® relays so successful?

Modern semiconductor technology enables fast, quiet, bounce-free switching even in miniature sizes.

Moreover, PhotoMOS® relays enjoy an almost unlimited lifetime if used according to the specifications. They are extremely reliable, unaffected by vibrations, and their ON-resistance remains stable throughout their entire lifetime.

The internal construction of an automotive-grade PhotoMOS® relay has added features such as double molding that make it more durable for harsh, everyday environments. Selecting the proper PhotoMOS® relay depends on its derated voltage. Derating is essential in any reliable design and is an important factor when considering product life.

- Successfully in the market for decades
- Tested according to AEC-Q101
- Available for high voltage up to 1,500V
- Minimal leakage current (typ. <1nA)
- Turn-on time: Max. 0.5ms - 1.0ms
- Turn-off time: Max. 0.5ms
- Input/output isolation up to 5kVrms
- Linear output characteristics
- No threshold voltage
- Stable ON-resistance over the entire lifetime
- Compact housing
- Highly shock and vibration resistant



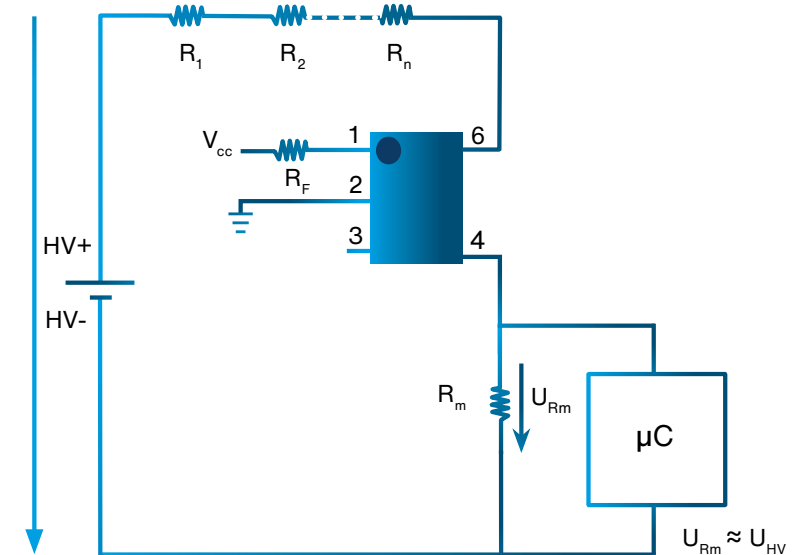


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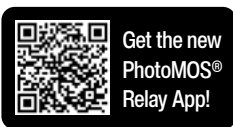
## Application: High voltage measurement

In a BEV or PHEV car several different high voltages must be measured.

PhotoMOS® are used as fast electronic switches to connect a high-impedance resistor chain to a shunt resistance. The corresponding voltage drop on this shunt resistor is direct proportional to the voltage which should be measured. An example of such a high voltage measurement with PhotoMOS® is to monitor the battery pack voltage as an indication to the actual state of charge (SoC), which in turn can extend battery life and prevent hazardous situations.



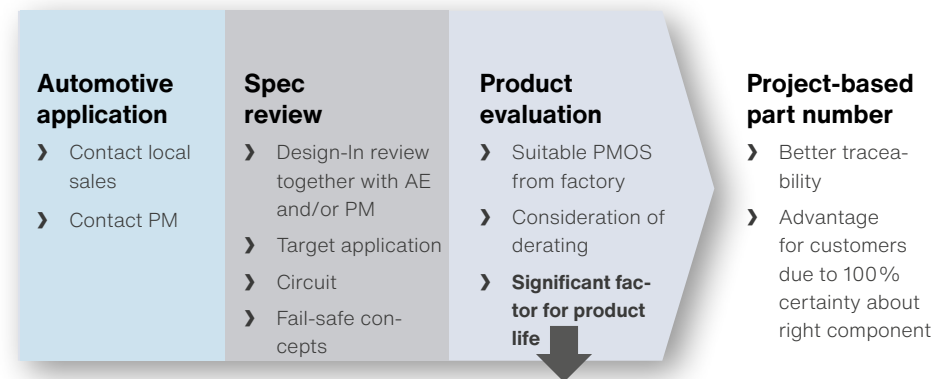
Simplified circuit



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## Selecting the best fitting PhotoMOS<sup>®</sup> relay for Automotive

Some changes in specification parameters are needed when PhotoMOS<sup>®</sup> are used in certain automotive applications. Automotive-grade PhotoMOS<sup>®</sup> are generally used in automotive environments since stricter quality controls are needed. The user is cautioned and asked to inquire with a Panasonic local sales representative before designing the products in such environments.



AE = Application engineer  
PM = Product manager

Example: AQV258HAXC\*\*  
Max. ratings: 1500V/20mA  
Derating 600V/10mA

### Automotive applications require specification reviews.

This is important and necessary to prevent performance, quality, and reliability problems. The following parameters should be reviewed with a Panasonic Corporation local sales representative:

- Targeted application
- Targeted levels of quality and reliability
- Circuits description of load level, driving methods, etc.
- Service conditions
- Influence at failure and fail-safe concepts, etc.

**Derating** is essential in any reliable design and a significant factor in consideration of product life. Sufficient derating is needed against maximum rating when designing a system. It is recommended using a derated voltage of 50% (or less) of absolute maximum load voltage rating, and 50% (or less) of absolute maximum load current ratings. Devices should be examined using a measurement equipment. Derated voltages must be considered according to the operating and environmental conditions the device will be subjected to. In case of automotive applications, more allowance should be given to maximum ratings and installation of safety measures (i.e. use of double circuits).

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## Most popular products: AQW, AQV Series

### Types

Output rating*1		Package	Contact configuration	Part No.*2	Packing quantity
Load voltage	Load current				
600V	40mA	DIP 8pin (SMD)	2 Form A	AQW216HAX□□□□	1000 pcs.
900V	15mA	DIP 6pin (SMD)	1 Form A	AQV219HAX□□□□	
1500V	20mA			AQV258HAX□□□□	

\*1 Indicates the peak AC and DC values.

\*2 For other products or applications, please contact us

### Electric characteristics (Ambient temperature: 25°C)

Item	Symbol		Part number			Test conditions		
			AQW216HAX□□□□	AQV219HAX□□□□	AQV258HAX□□□□			
Input	LED operate current	I <sub>Fon</sub>	Typ.	1mA	0.85mA	0.8mA	I <sub>L</sub> = Max.	
			Max.	3mA	3mA	3mA		
	LED turn-off voltage	I <sub>Foff</sub>	Min.	0.2mA	0.2mA	0.2mA		
			Typ.	0.8mA	0.8mA	0.7mA		
	LED dropout voltage	V <sub>F</sub>	Typ.	1.35V	1.35V	1.35V		I <sub>F</sub> = 50mA
			Max.	1.5V	1.5V	1.5V		
Output	On resistance	R <sub>on</sub>	Typ.	70Ω	310Ω	305Ω	I <sub>F</sub> = 10mA I <sub>L</sub> = Max.	
			Max.	150Ω	500Ω	500Ω		
	Off state leakage current	I <sub>Leak</sub>	Max.	1μA	1μA	10μA	I <sub>F</sub> = 0mA, V <sub>L</sub> = Max.	
Transfer characteristics	Turn-on time	T <sub>on</sub>	Typ.	0.1ms	0.05ms	0.15ms	I <sub>F</sub> = 10mA I <sub>L</sub> = Max.	
			Max.	0.5ms	0.5ms	1ms		
	Turn-off time	T <sub>off</sub>	Typ.	0.02ms	0.02ms	0.04ms		
			Max.	0.5ms	0.5ms	0.5ms		

\* For special electric characteristic requirements, please contact us

### Absolute maximum ratings (ambient temperature: 25°C)

Item	Symbol	AQW216HAX□□□□	AQV219HAX□□□□	AQV258HAX□□□□	Remarks	
Input	LED forward current	I <sub>F</sub>	50mA			
	LED reverse voltage	V <sub>R</sub>	5V			
	Peak forward current	I <sub>FP</sub>	1A			f = 100Hz, Duty factor = 0.1%
	Power dissipation	P <sub>in</sub>	75mW			
Output	Load voltage (peak AC)	V <sub>L</sub>	600V	900V	1500V	
	Continuous load current	I <sub>L</sub>	40mA (50mA)	15mA	20mA	Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I <sub>peak</sub>	120mA	45mA	60mA	100ms (1 shot), V <sub>L</sub> =DC
	Power dissipation	P <sub>out</sub>	800mW	360mW	360mW	
Total power dissipation		P <sub>T</sub>	850mW	410mW	410mW	
I/O isolation voltage		V <sub>iso</sub>	Up to 5,000 V <sub>rms</sub>			
Ambient temp.*	Operating	T <sub>opr</sub>	-40 to +85°C			(Non-iching at low temperatures)
	Storage	T <sub>stg</sub>	-40 to +100°C			

\* For ambient temperatures of -40 to 105°C, please contact us

**Note:** Using the products listed in this document in any other way than intended by us will be considered as misuse. Do so at your own risk.

# Panasonic

## INDUSTRY



We are dedicated to the highest standards of global sustainability as **Your Committed Enabler**. Find out more on our [website](#).

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