Panasonic
ideas for life

SMALL, HIGHLY RELIABLE TIP SENSOR CONTAINING A PHOTO SENSOR

AHF2 (TIP) SWITCHES

http://panasonic-denko.co.jp/ac/e/service/environment

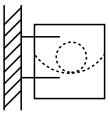
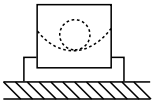
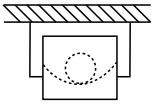
FEATURES

- Realizes miniaturization of equipment and spaces saving. Size of body: 9.5×9.5×9.3 mm
- The contact type is equivalent to normally closed contacts, which satisfies the PL Act.
- The internal sphere can be used over an operation angle of 360 degrees in the circumferential direction.
- There are three standard terminal profiles which can be selected according to the mounting direction of the PCB.
- The terminals are tin-plated for long-term solderability.

TYPICAL APPLICATIONS

- Gas heaters
- Electric fans
- Water vallet
- Infrared treatment device
- Electric pots with warming function

ORDERING INFORMATION

Mounting direction	Vertical mounting	Horizontal mounting	Reverse mounting
Part No.	AHF21	AHF22	AHF23
PCB mounting condition			

Remark: Standard Packaging: Tube 50 pcs.

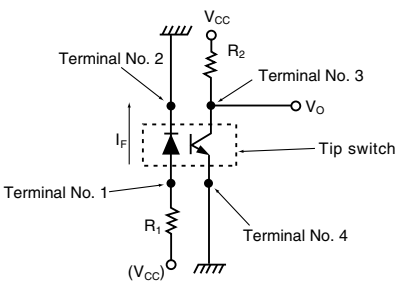
CONTACT TYPE

Normally closed type (The photo transistor is ON when the sensor is being used.)

APPLICABLE CIRCUIT

Refer to the dimensional diagram for the terminal Nos.

- V_{CC} = 5 V
- R_2 = 100 kΩ
- Forward current,
I_F, of the LED: 19 mA
(V_{CC} = 5 V, R_1 = 200 Ω)
- Forward voltage,
V_F, of the LED: Typ = 1.2 V

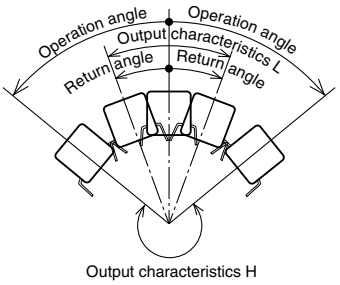


BASIC CHARACTERISTICS

For T_a = 25°C and applicable circuit conditions

1) Operation characteristics
(Operation speed 6 degrees/second)

- Operation angle (Output: V_{OL} → V_{OH}): 25 to 60 degrees
- Return angle (Output: V_{OH} → V_{OL}): Min. 20 degrees



2) Output (V_O) characteristics (The sphere must be stationary.)

- V_{OL} (photo transistor ON): Max. 1.0 V (horizontal)
- V_{OH} (photo transistor OFF): Min. 4.0 V (inclined at an angle of at least 60 degrees)

SPECIFICATIONS

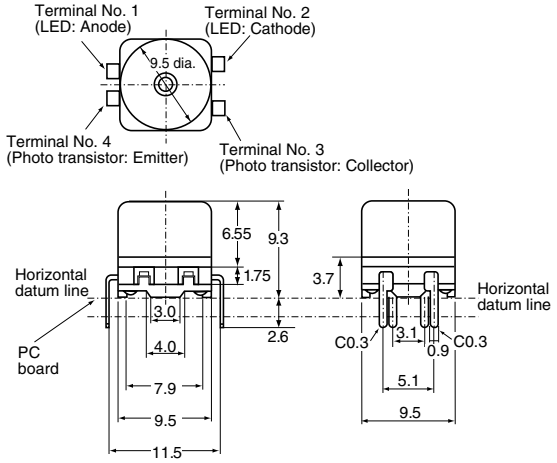
Item	Specificaitons
Electrical and mechanical life	Min. 10^5 (Using the applicable circuit) At 6 cpm; Opening and closing position: 0 deg. ↔ 90 deg. (The internal shpere must be stationary for at least 500 ms at angles of 0 and 90 deg. respectively.)
Vibration resistance	10 to 400 Hz acceleration 2.9 m/s^2 applied for 7 days
	5 to 10 Hz at half amplitude of 5 mm, 5×10^5 cycles
Shock resistance	588 m/s^2 applied 3 times in each of 6 directions
Terminal strength	Min. 9.8 N (each direction)
Dropping individual part	Three times from height of 100 cm
High temperature, high humidity storage ability	Leave for 500 hours at 85°C and 85% RH (No freezing at low temperature)
High temperature storage ability	Leave for 500 hours at 85°C
Low temperature storage ability	Leave for 500 hours at –25°C (No freezing at low temperature)
Shock and heat resistance	Subject to 100 cycles each consisting of 30 minutes at –25°C and 30 minutes at 85°C.
Resistance to hydrogen sulfide	Leave for 500 hours in an atmosphere containing 3 ppm of hydrogen sulfide at 40°C and 75% RH.
Resistance to sulfur dioxide gas	Leave for 500 hours in an atmosphere containing 10 ppm of sulfur dioxide at 40°C and 95% RH
Resistance to ammonia gas	Leave for 96 hours in an atmosphere containing 3% of ammonia gas at normal temperature and humidity.
Resistance to dust	Mix with 2 kg/m^3 talcum powder or fly ash and leave to stand for 8 hours
Ambient temperature	–20 to +80°C (No freezing nor condensation at low temperature)

Notes:
1.Without any indications, specifications are measured at following conditions
• Temperature: 15 to 35°C
• Humidity: 25 to 85% RH
• Atmospheric pressure: 86 to 106 kpa.
2.The evaluation criteria for performance are as follows:
Basic characteristics – T_a = 25°C and applicable circuit conditions
1) Operation characteristics (operation speed 6 degrees/sec.)
• Operation angle (Output: $V_{OL} \rightarrow V_{OH}$): 25 to 60 degrees
• Return angle (Output: $V_{OH} \rightarrow V_{OL}$): 20 degrees min.
2) Output (V_O) characteristics (The sphere must be stationary.)
• V_{OL} (photo transistor ON): 1.2 V max. (horizontal)
• V_{OH} (photo transistor OFF): 3.8 V min. (inclined at an angle of at least 60 degrees)

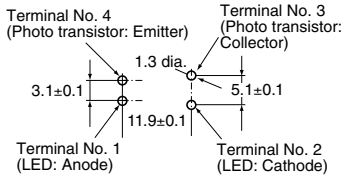
DIMENSIONS

mm

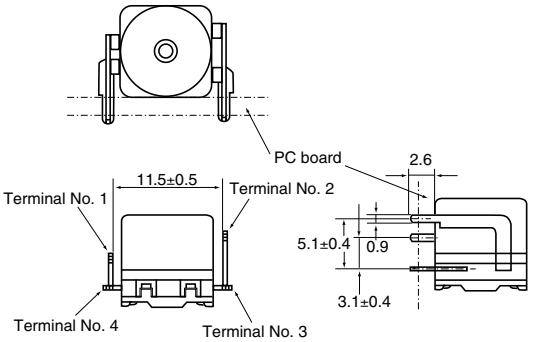
• Horizontal mounting type



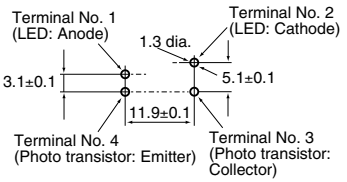
PC board pattern (Bottom view)



• Vertical mounting type

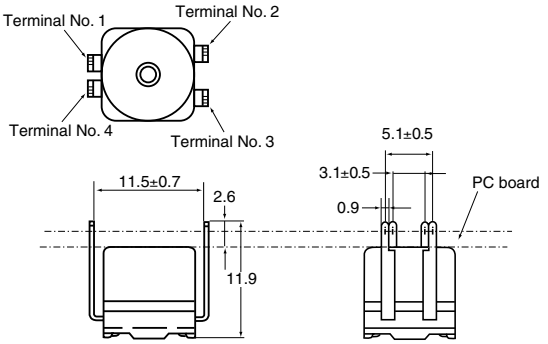


PC board pattern (Bottom view)

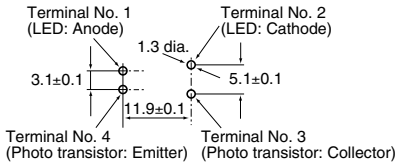


• Reverse mounting type

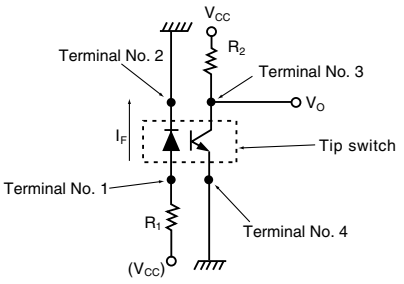
mm



PC board pattern (Bottom view)



[Internal circuit and applicable circuit]



NOTES

1. Handling

1) In the enent that a voltage or current that exceeds the maximum rating is applied to, or passed between the terminals, the photo-transistor will no longer function normally. In such a case, do not reuse the photo-transistor but discard it.

2) Be careful not to apply an excessively large load to the terminals because this may damage the photo-transistor.

2. Soldering

1) When soldering by hand, use a 18W soldering iron that has a temperature regulator (iron tip temperature must be no more than 350°C) and apply the tip to the joint for no more than 3 seconds.

2) When performing automatic soldering, ensure that the board does not remain in the solder bath for more than 10 seconds at 260°C, or more than 3 seconds at 350°C.

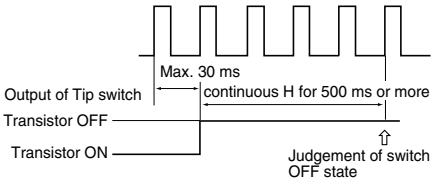
3) Be careful not to move the terminals for one minute after soldering them.

3. Environment

This product is a non-contact type tip detection switch containing a photo-interrupter. It is intended for installation in equipment. Because of the nature of a semiconductor, if this product is used continuously for a long period in a high temperature, low temperature and/or humid environment, according to the optic quantities decrease of luminescent diode output characteristics may be significantly affected. In such a case, take suitable measures, such as inserting a comparator at the output side, to provide a greater degree of margin with respect to change in the output characteristics, and thereby improve the reliability of the product.

4. Preventing a malfunction

1) The tip sensor uses an internal sphere, hence chattering occurs if it is subjected to vibration or shock. To prevent chattering, continuously read pulses of 30 ms max. using a microprocessor, and set the microprocessor so that the switch goes L (ON) or H (OFF) if the output level exceeds 500 ms continuously. Also, take steps to keep induction and RF noise away from the sensor.



2) The switch should be mounted keeping away from the vibration generator such as motor. Fix the PC board firmly in order to prevent resonance with the vibration generator, or the contact chattering of a switch may occur by the movement of a ball inside. The allowable vibration level which the chattering does not occur would be less than {0.3G} at 10 to 260Hz and 320 to 400Hz. The range 260 to 320Hz may have a resonance point and the level should be less than 0.1G.

5. Others

1) Depending on the circuitry and the environmental conditions, solder migration may occur and short a circuit. Please confirm that the insulation distance is large enough in the actual application.

2) To prevent a malfunction, the switch should be kept away from the direct sunlight and any other light sources.

3) The noises caused by electrostatics, surge voltage and inductives may break the photo-interruptor.

4) The reflow soldering and cleaning are not allowed.

5) The switch should be mounted with the tolerance ±3 degree.

6. Confirmations in the actual use.

Each items in this spec sheet was tested and confirmed independently at a certain duration. To get a higher reliability of the equipment, please confirm the switch quality with the actual load and environmental conditions before using.

Standards Chart

With more and more electrical devices and machines being exported overseas, most of the control devices incorporated into those devices and machines now meet international standards. We are is in the process of achieving international standards certification for all of our products. The table below indicates which products have already been certified, for quick reference.

Notes) 1. Some items in a product group may not meet certification requirements in some cases.
2. Snap-action switches and detection switches are certified based on their product numbers.

Item			UL (Recognized)		CSA (Certified)		VDE (Certified)		SEMKO (Certified)		Remarks
			File No.	Rating (Recognized)	File No.	Rating (Certified)	File No.	Rating (Certified)	File No.	Rating	
Turquiose switches J type (ABJ1, ABJ2, ABJ3)	Silver alloy contact type		E35901	6×10^3 times rating O.F. 125g: 1A 125V AC O.F. 200g: 2A 125V AC	LR23413	6×10^3 times rating O.F. 125g: 1A 125V AC O.F. 200g: 2A 125V AC	—	—	—	—	Excluding ABJ2 long stroke type, ABJ4 and ABJ5 types
	Gold-clad contact type		E35901	6×10^3 times rating 10^5 times rating 0.1A 125V AC	LR23413	6×10^3 times rating 10^5 times rating 0.1A 125V AC	—	—	—	—	
Turquiose switches S type (ABS1, ABS4, ABS5)	Silver alloy contact type		E35901	6×10^3 times rating 2A 250V AC	LR23413	6×10^3 times rating 2A 250V AC	90446	5×10^4 times rating 2A 250V AC (T85)	9421091	5×10^4 times rating 2A 250V AC (T85)	
	Gold-clad double layer type		E35901	6×10^3 times rating 10^5 times rating 0.1A 30V DC	LR23413	6×10^3 times rating 10^5 times rating 0.1A 30V DC	—	—	—	—	
	Gold-clad triple layer type		E35901	6×10^3 times rating 10^5 times rating 0.1A 250V AC	LR23413	6×10^3 times rating 10^5 times rating 0.1A 250V AC	90446	5×10^4 times rating 0.1A 250V AC (T85)	415647	5×10^4 times rating 0.1A 250V AC (T85)	
Turquiose switches V type (ABV1)	Gold alloy contact type		E35901	6×10^3 times rating O.F. 0.98N type: 1A 250V AC O.F. 1.96N, 2.94N type: 3A 250V AC	LR23413	6×10^3 times rating O.F. 0.98N type: 1A 250V AC O.F. 1.96N, 2.94N type: 3A 250V AC	090421	10^4 times rating O.F. 0.98N type: 1A 250V AC O.F. 1.96N, 2.94N type: 3A 250V AC	415646	10^4 times rating O.F. 0.98N type: 1A 250V AC O.F. 1.96N, 2.94N type: 3A 250V AC	
				10^5 times rating 0.1A 250V AC		10^5 times rating 0.1A 250V AC		5×10^4 times rating 0.1A 250V AC		5×10^4 times rating 0.1A 250V AC	
	Silver alloy contact type			6×10^3 times rating O.F. 0.98N type: 3A 250V AC O.F. 1.96N, 2.94N type: 5A 250V AC		6×10^3 times rating O.F. 0.98N type: 3A 250V AC O.F. 1.96N, 2.94N type: 5A 250V AC		10^4 times rating O.F. 0.98N type: 3A 250V AC O.F. 1.96N, 2.94N type: 5A 250V AC		10^4 times rating O.F. 0.98N type: 3A 250V AC O.F. 1.96N, 2.94N type: 5A 250V AC	
				10^5 times rating 0.5A 250V AC		10^5 times rating O.F. 1.96N, 2.94N type: 0.5A 250V AC		5×10^4 times rating 0.5A 250V AC		5×10^4 times rating 0.5A 250V AC	
NZ basic switches (AM1)			E35901	10A 125, 250V AC or 1A 480V AC 1/8 HP 125V AC, 1/4 HP 250V AC 1/2 A 125V DC, 1/4 A 250V DC	C-UL certified	10A 125, 250V AC or 1A 480V AC 1/8 HP 125V AC, 1/4 HP 250V AC 1/2 A 125V DC, 1/4 A 250V DC	—	—	—	—	
QV switches (AM5)	Silver alloy contact type	6A type	E35901	6×10^3 times rating 6A 250V AC (T105) 10^5 times rating 6A 250V AC 3A 30V DC (T105)	LR23413	6×10^3 times rating 6A 250V AC (T105) 10^5 times rating 6A 250V AC 3A 30V DC (T105)	109234	6(1) A 250V ~AC (T105) ENEC certified	—	—	C-UL certified
		11A type	E35901	6×10^3 times rating 11A 250V AC (T105) 10^5 times rating 6A 250V AC 4A 30V DC (T105)	LR23413	6×10^3 times rating 11A 250V AC (T105) 10^5 times rating 6A 250V AC (T105) 4A 30V DC (T105)		11(2) A 250V ~AC (T105) ENEC certified	—	—	C-UL certified
		16A type	E35901	6×10^3 times rating 16A 250V AC 10^5 times rating 12A 250V AC 6A 30V DC (T105) ※	LR23413	6×10^3 times rating 16A 250V AC 10^5 times rating 12A 250V AC 6A 30V DC (T105) ※		16(3) A 250V ~AC (T105) 6A 30V⎓DC ENEC certified	—	—	※ For the OF=3.92N (pin plunger) type with a UL and CSA 10^5 times rating, the values are as follows: 12 A 250 V AC 8 A 30 V DC C-UL certified
	Gold-clad contact type	0.1A type	E35901	6×10^3 times rating 0.1A 250V AC (T105) 10^5 times rating 0.1A 250V AC (T105)	LR23413	6×10^3 times rating 0.1A 250V AC (T105) 10^5 times rating 0.1A 250V AC (T105)		0.1A 250V~AC (T105) ENEC certified	—	—	C-UL certified
FS•FS-T switches (AV3, AVM3/ AVT3, AVL3)	Standard version	Silver alloy contact type	E35901	6×10^3 times rating 3A 250V AC 10^5 times rating 2A 250V AC 2A 30V DC	LR23413	6×10^3 times rating 3A 250V AC 10^5 times rating 2A 250V AC 2A 30V DC	6168	10^4 times rating (T85) O.F. 50g: 3A 250V 5×10^4 times rating (T85) O.F. 100g: 3A 250V~	9711097 9750138	10^4 times rating (T85) O.F. 50g: 3A 250V~ 5×10^4 times rating (T85) O.F. 100g: 3A 250V~	
		Gold-clad double layer type	E35901	6×10^3 times rating 0.1A 30V DC 10^5 times rating 0.1A 30V DC	LR23413	6×10^3 times rating 0.1A 30V DC 10^5 times rating 0.1A 30V DC	—	—	—	—	
		Gold-clad triple layer type	E35901	6×10^3 times rating 0.1A 250V AC 10^5 times rating 0.1A 250V AC	LR23413	6×10^3 times rating 0.1A 250V AC 10^5 times rating 0.1A 250V AC	6168	5×10^4 times rating 0.1A 250V	9711097 9750138	5×10^4 times rating 0.1A 250V	
	Long life version	Silver alloy contact type	E35901	6×10^3 times rating 5A 250V AC 10^5 times rating 2A 250V AC 2A 30V DC	LR23413	6×10^3 times rating 5A 250V AC 10^5 times rating 2A 250V AC 2A 30V DC	6168	10^4 times rating (T85) 5A 250V~	9711097 9750138	10^4 times rating (T85) 5A 250V~	
		Gold-clad double layer type	E35901	6×10^3 times rating 0.1A 30V DC 10^5 times rating 0.1A 30V DC	LR23413	6×10^3 times rating 0.1A 250V DC 10^5 times rating 0.1A 250V DC	—	—	—	—	
		Gold-clad triple layer type	E35901	6×10^3 times rating 0.1A 250V AC 10^5 times rating 0.1A 250V AC	LR23413	6×10^3 times rating 0.1A 30V AC 10^5 times rating 0.1A 30V AC	6168	5×10^4 times rating 0.1A 250V	9711097 9750138	5×10^4 times rating (T85) 0.1A 250V	
FS switches (Contact gap: more than 1mm type)			E35901	3A 30V DC 10^4 times rating	LR23413	3A 30V DC 10^4 times rating	—	(TÜV approved)	9711097	3A 30V DC 10^4 times rating	

Standards Chart

Item			UL (Recognized)		CSA (Certified)		VDE (Certified)		SEMKO (Certified)		Remarks
			File No.	Rating (Recognized)	File No.	Rating (Certified)	File No.	Rating (Certified)	File No.	Rating	
PS switches (AVM3)			E35901	6×10^3 times rating 10.1A 250V AC	LR23413	6×10^3 times rating 10.1A 250V AC	—	—	—	—	
FJ switches (AH1)	Standard type	M1, 2 mounting hole type	E35901	3A 125V AC	LR23413	3A 125V AC	—	—	—	—	
		M2 mounting hole type	E35901	O.F. 75g: 1A 125V AC O.F. 150g: 3A 125V AC	LR23413	O.F. 75g: 1A 125V AC O.F. 150g: 3A 125V AC	—	—	—	—	
	Low-level circuit type	M1, 2 mounting hole type	E35901	3A 125V AC	LR23413	3A 125V AC	—	—	—	—	
		M2 mounting hole type	E35901	6×10^3 times rating 0.1A 125V AC 10^5 times rating 0.1A 125V AC	LR23413	6×10^3 times rating 0.1A 125V AC 10^5 times rating 0.1A 125V AC	—	—	—	—	
GX switches 1a, 2a, 3a (AGX1, 2, 3~7)	Standard type		E35901	10^5 times rating 10.1A 250V AC 6A 30V DC	LR23413	10^5 times rating 10.1A 250V AC 6A 30V DC	88838	5×10^4 times rating 10(3) A 250V~(T85) ENEC certified	—	—	C-UL certified
GW switches (AV1)			E35901	Interlock rating 10^5 times rating 10.1A 250V AC	LR23413	Interlock rating 10^5 times rating 10.1A 250V AC	—	ENEC/VDE 40014475	—	—	C-UL certified

Notes) 1. Some product numbers for VDE standard and SEMKO standard products of the NV type marked with an asterisk have not yet been certified. Please contact us for specific information.
2. In the table above, if the UL/CSA standard has not been indicated as either a 6×10^3 times rating or a 10^5 times rating, it means that the standard is a 6×10^3 times rating.
3. In the table above, if the VDE or SEMKO standard has not been indicated as either a 10^4 times rating or a 5×10^4 times rating, it means that the standard is a 5×10^4 times rating.
4. In cases where products are indicated as meeting all of the standards, the standard versions of GX switches and FS contact gap min. 1mm type have been certified for all of the standards, but for snap-action switches such as the QV, FS, and FS-T, the product number suffix will be either 3 or 31. Please contact us for specific information.