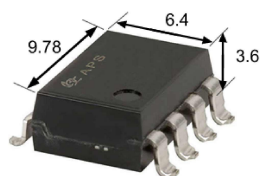


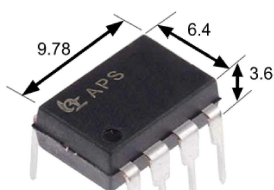


FEATURES

- Supports 0.3 A, 0.6 A, 0.9 A and 1.2 A ON-state RMS currents.
- Handles both 100 and 200 Vrms loads.
- High dielectric strength: 5,000 Vrms



SMD-7

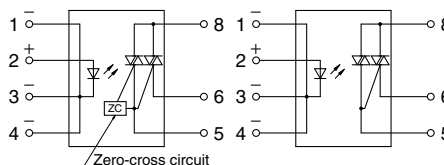


DIP-7

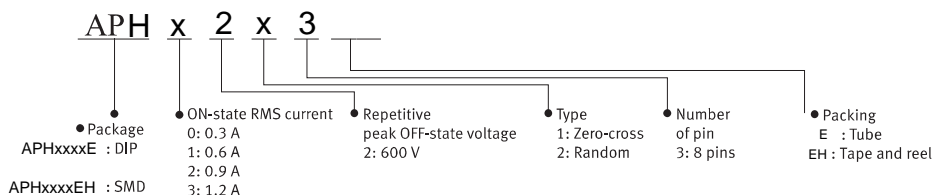
mm

TYPICAL APPLICATIONS

- Home appliances market:
air conditioner, microwave oven, washing machine, personal hygiene system, refrigerator, fan heater, inductive heating cooker, rice cooker and humidifier, etc.
- Industrial equipment market



ORDERING INFORMATION (PART NO.)



TYPES

Type	Output rating*		Type	Part No.		Packing quantity	
				Through hole terminal	Surface-mount terminal	Tube	Tape and reel
	Repetitive peak OFF-state voltage	ON-state RMS current		DIP7	SMD7		
AC type	600 V	0.3A	Zero-cross	APH0213E	APH0213EH	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
		0.6A		APH1213E	APH1213EH		
		0.9A		APH2213E	APH2213EH		
		1.2A		APH3213E	APH3213EH		
		0.3A	Random	APH0223E	APH0223EH		
		0.6A		APH1223E	APH1223EH		
		0.9A		APH2223E	APH2223EH		
		1.2A		APH3223E	APH3223EH		

* Indicate the repetitive peak OFF-state voltage and ON-state RMS current: peak AC.



RATING

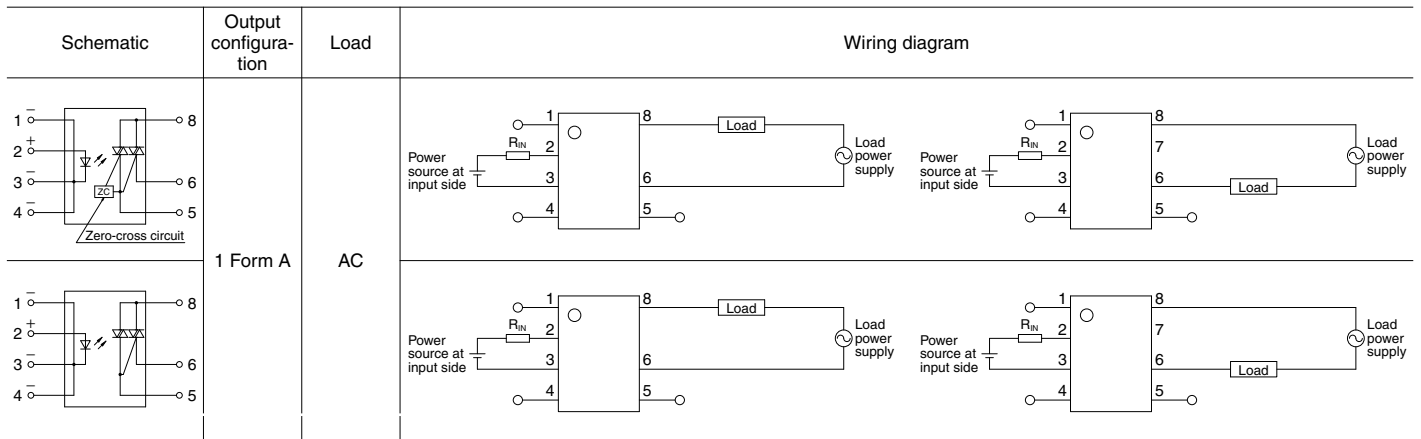
Absolute maximum ratings (Ambient temperature: 25°C)

Item	Symbol	APH0213, APH0223A	APH1213, APH1223A	APH2213, APH2223A	APH3213, APH3223A	Remarks
Input	LED forward current	I_F	50 mA			
	LED reverse voltage	V_R	6 V			
	Peak forward current	I_{FP}	1 A			
Output	Repetitive peak OFF-state voltage	V_{DRM}	600 V			
	ON-state RMS current	$I_T (RMS)$	0.3 A	0.6 A	0.9 A	1.2 A
	Non-repetitive surge current	I_{TSM}	3 A	6 A	9 A	12 A
I/O isolation voltage	V_{iso}	5,000 Vrms				
Operating temperature	T_{opr}	-30 to +85°C -22 to +185°F				Non-condensing at low temperatures
Storage temperature	T_{stg}	-40 to +125°C -40 to +257°F				

Characteristics (Ambient temperature: 25°C)

Item	Symbol	APH0213, APH1213, APH2213, APH3213	APH0223, APH1223, APH2223, APH3223	Remarks
Input	LED dropout voltage	Typical	1.21 V	$I_F = 20$ mA
		Maximum	1.3 V	
Input	LED reverse current	Typical	—	$V_R = 6$ V
		Maximum	10 μ A	
Output	Peak OFF-state current	Typical	—	$I_F = 0$ mA $V_{DRM} = 600$ V
		Maximum	100 μ A	
	Peak ON-state voltage	Typical	—	$I_F = 10$ mA $I_{TM} = \text{Max.}$
		Maximum	2.5 V	
Output	Holding current	Typical	—	
		Maximum	25 mA	
Output	Critical rate of rise of OFF-state voltage	Minimum	200 V/ μ s	$V_{DRM} = 600$ V $\times 1/\sqrt{2}$
Transfer characteristics	Trigger LED current	Maximum	I_{FT}	10 mA $V_D = 6$ V $R_L = 100 \Omega$
	Zero-cross voltage	Maximum	V_{ZC}	50 V $I_F = 10$ mA
	Turn on time*1	Maximum	T_{ON}	100 μ s $I_F = 20$ mA $V_D = 6$ V $R_L = 100 \Omega$
	I/O isolation resistance	Minimum	R_{iso}	50 G Ω 500 V DC

SCHEMATIC AND WIRING DIAGRAMS



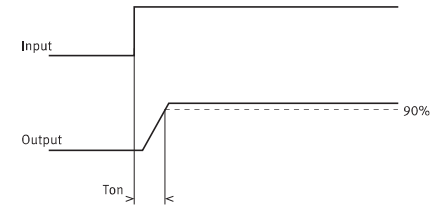
Please obey the following conditions to ensure proper device operation and resetting. Input LED current (Recommended value): $I_F \geq 5$ mA and ≤ 30 mA

Recommended operating conditions

Please use under recommended operating conditions to obtain expected characteristics.

Item	Symbol	Min.	Max.	Unit
Input LED current	I_F	15	25	mA

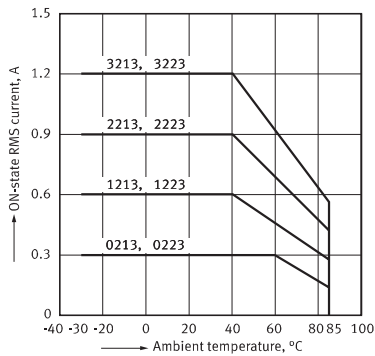
*Turn on/Turn off time



REFERENCE DATA

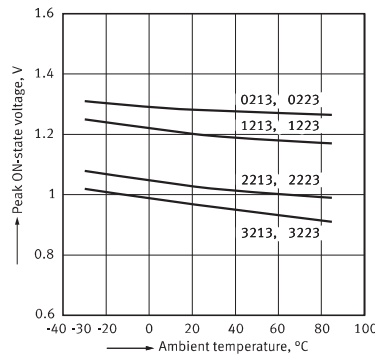
1.ON-state RMS current vs. ambient temperature characteristics

Allowable ambient temperature: -30 to +85°C



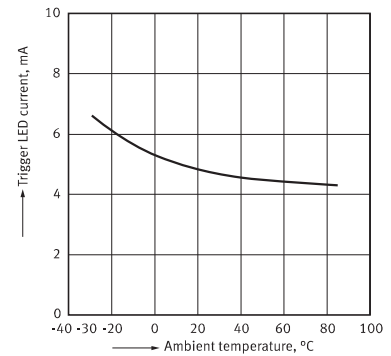
2.Peak ON-state voltage vs. ambient temperature characteristics

LED current: 10 mA; ON current: Max.
Measured portion: between terminals 6 and 8



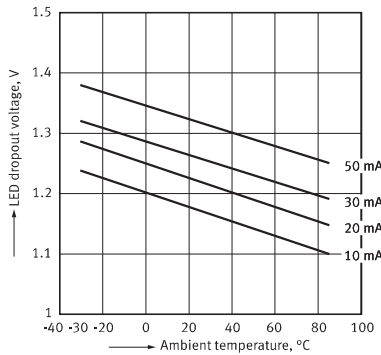
3.Trigger LED current vs. ambient temperature characteristics

Load voltage: 6 V DC;
Load resistance: 100 Ω



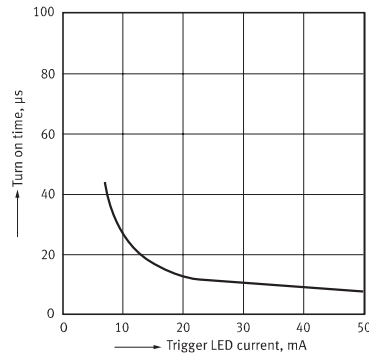
4.LED dropout voltage vs. ambient temperature characteristics

LED current: 10 to 50 mA



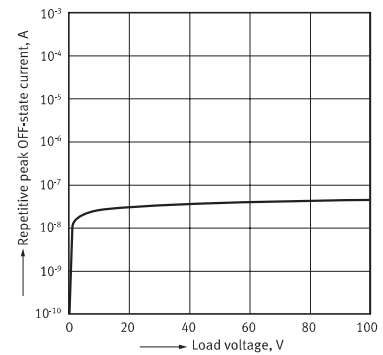
5.Turn on time vs. LED current characteristics

Load voltage: 6 V DC; Load resistance: 100 Ω
Measured portion: between terminals 6 and 8

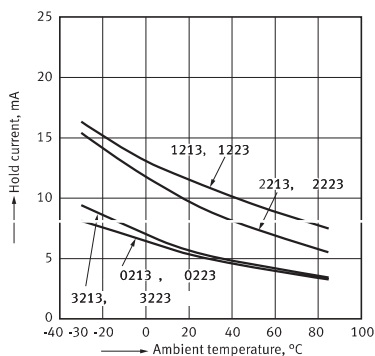


6.Repetitive peak OFF-state current vs. load voltage characteristics

Ambient temperature: 25°C
Measured portion: between terminals 6 and 8; LED current: 0 mA

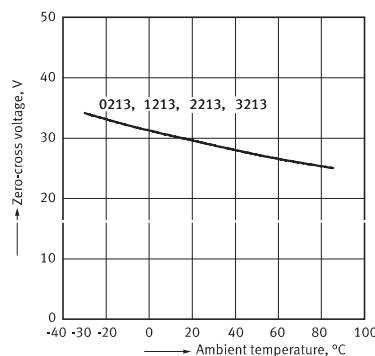


7.Holding current vs. ambient temperature characteristics



8.Zero-cross voltage vs. ambient temperature characteristics

LED current: 10 mA

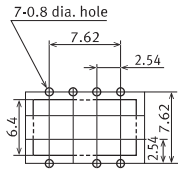


DIMENSIONS

Through hole terminal type

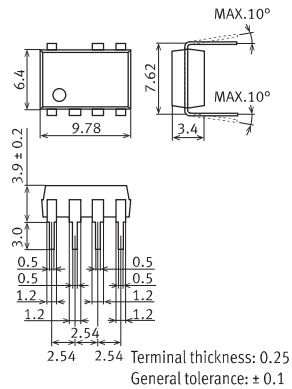


PC board pattern
(BOTTOM VIEW)



Tolerance: ± 0.1

External dimensions



Unit: mm

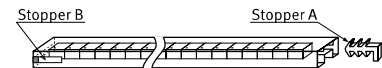
Tube

Phototriac coupler and AP-X SSR are packaged in a tube as pin No. 1 is on the stopper B side. Observe correct orientation when mounting them on PC boards.

<Phototriac coupler SOP type>



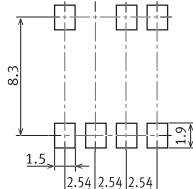
<Phototriac coupler DIP type and AP-H SSR>



Surface-mount terminal type

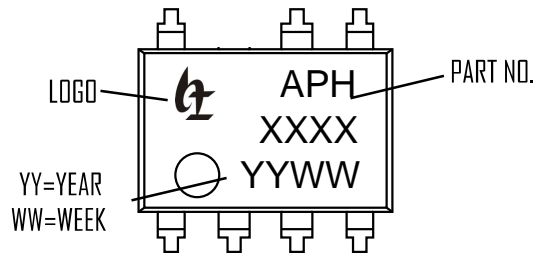
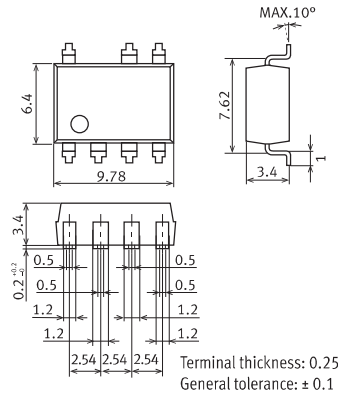


Recommended mounting pad
(TOP VIEW)

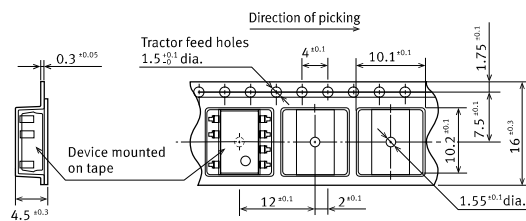


Tolerance: ± 0.1

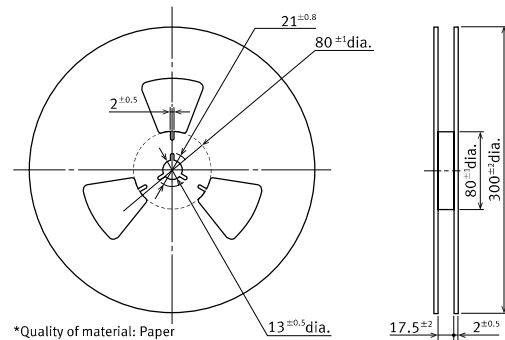
External dimensions



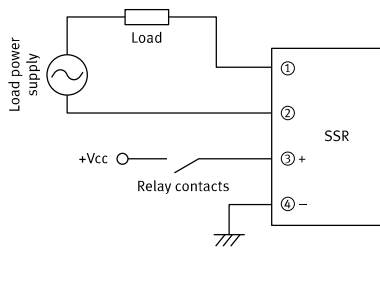
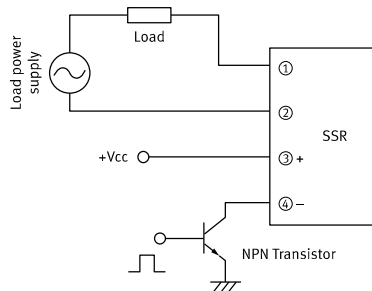
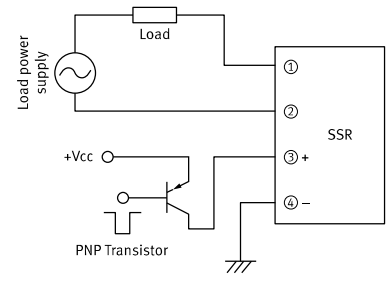
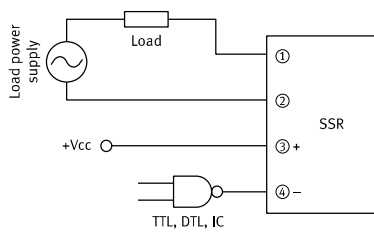
Tape dimensions (Unit: mm)



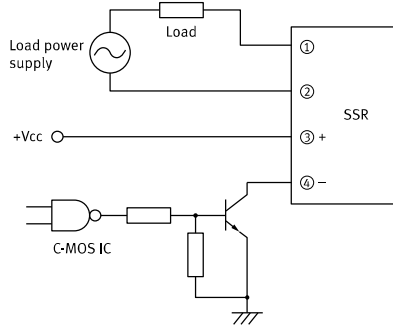
Dimensions of paper tape reel (Unit: mm)



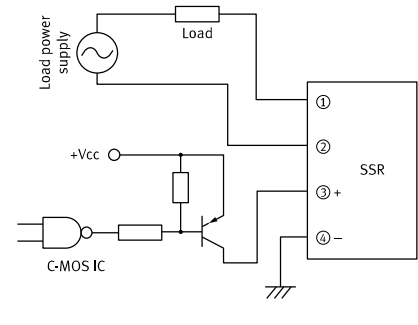
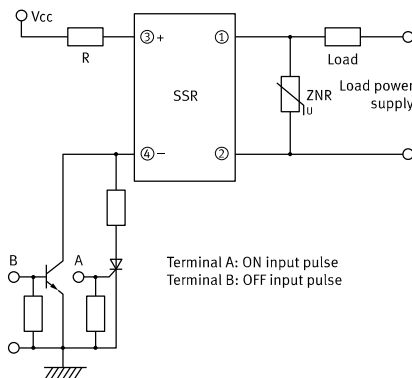
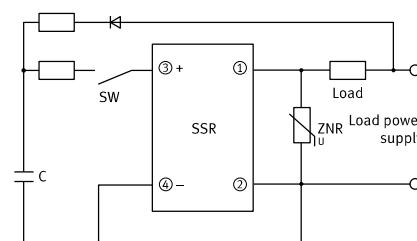
*Quality of material: Paper

SSR Driving Circuits
Relay Driver

NPN Transistor Driver

PNP Transistor Driver

TTL/DTL/IC Driver

C-MOS/IC Driver

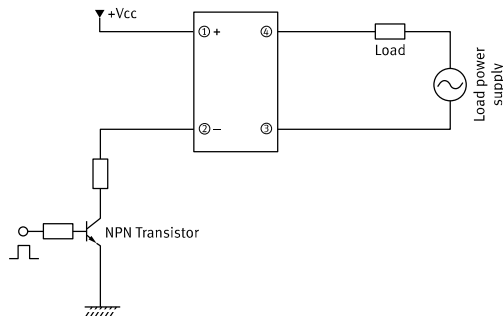
(1) SSR fires when IC output is HIGH:



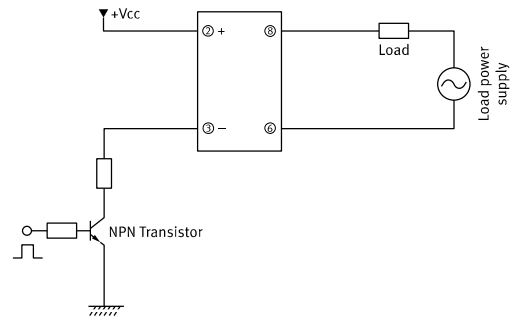
(2) SSR fires when IC output is LOW:


Relay Driver

NPN Transistor Driver

Phototriac Coupler, AP-H Solid State Relay Driving Circuits
NPN Transistor Driver

(1) Phototriac Coupler



(2) AP-H Solid State Relay





Using Methods

Examples of resistance value to control LED forward current ($I_F=5\text{mA}$)



E1	R1 (Approx)
3.3V	300 Ω
5.0V	600 Ω
12V	1.9K Ω
24V	4.1K Ω

LED forward current must be more than 5mA , at $I(\text{MIN})$,and less than 30mA , at $I(\text{MAX})$.



Recommended Operating Conditions

Please obey the following conditions to ensure proper device operation and resetting. Input LED current (Recommended value):

Characteristic	Symbol	Min	Typ.	Max	Unit
Forward current	I_F	5.0	7.0	30	mA

Protection Circuit

Output spike voltages:if an inductive load generates spike voltages which exceed heabsolute maximum rating, the spike voltage shall be limited.

Clamp diode is connected in parallel with the load.
Absorb capacity with external diode.

CR Snubber is connected in parallel with the load.
Absorb capacity with buffer capacity.



When adding diodes, buffer circuits (C-R), and other protections, they need to be installed near the MOS RELAY to be effective. Adding protection elements may result in a slow reset time, so adjust them according to the actual situation before use.

Note: When developing designs using this product, perform the expected performance of the equipment under the operating conditions recommended by the guidelines in this document. Continuous use under heavy loads (including, but not limited to, the application of high temperatures/current/voltage and significant changes in temperature, etc.) may result in deterioration of the reliability of this product.



Recommended Soldering Conditions

(a) Infrared reflow soldering :

- Peak reflow soldering : 260°C or below (package surface temperature)
- Time of peak reflow temperature : 10 sec
- Time of temperature higher than 230°C : 30-60 sec
- Time to preheat temperature from 180~190°C : 60-120 sec
- Time(s) of reflow : Two
- Flux : Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

Recommended Temperature Profile of Infrared Reflow



(b) Wave soldering :

- Temperature : 260°C or below (molten solder temperature)
- Time : 10 seconds or less
- Preheating conditions : 120°C or below (package surface temperature)
- Time(s) of reflow : One
- Flux : Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

(c) Cautions :

- Fluxes : Avoid removing the residual flux with freon-based and chlorine-based cleaning solvent.
- Avoid shorting between portion of frame and leads.



RESTRICTIONS ON PRODUCT USE

APSEMI Co. and its subsidiaries and affiliates (collectively "APSEMI") reserve the right to make changes to all information contained in this document relating to hardware, software, and systems (collectively "Products").

No information in this document may be reproduced without the prior written permission of APSEMI. Even with APSEMI's written permission, this document may only be reproduced if it is guaranteed to be unaltered or missing.

APSEMI assumes no responsibility for unintended uses of the product:

Unintended uses include, but are not limited to, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, automobiles, trains, ships, and other transportation equipment, traffic signaling equipment, equipment used for the control of combustion or explosions, safety devices, elevators and escalators, equipment used in electrical power-related applications, and equipment used in financial-related applications.

APSEMI assumes no responsibility for the product if you use it for any purpose other than the specific purpose described in this document.

- The information contained herein is provided only as a guide for the use of the product. APSEMI assumes no responsibility for infringement of third party patents or any other intellectual property rights that may result from the use of the product. This document does not grant any license, express or implied, estoppel or otherwise, to any intellectual property.

- GaAs (Gallium Arsenide) is used in products and is harmful to humans. Inadvertent ingestion or absorption of GaAs can harm the human body, so handle the product with care and do not break, cut, crush, grind, chemically dissolve, or otherwise expose GaAs in the product.

- Please be aware of environmental issues and use products in compliance with all applicable laws and regulations governing the inclusion or use of controlled substances, including but not limited to the EU RoHS Directive. APSEMI assumes no responsibility for damages or losses resulting from non-compliance with applicable laws and regulations.