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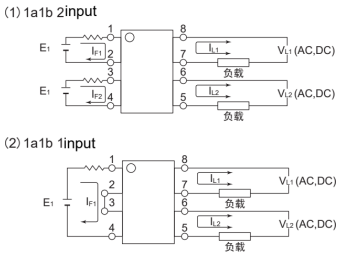
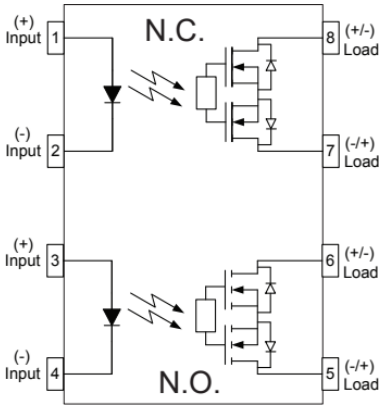
E534710

Parameter	Symbol	Rating	Units
Load Voltage	V_L	400	V
Load Current	I_L	0.12	A
On-Resistance	R_{on}	20	Ω
Output Capacitance	C_{out}	150	pF
I/O Breakdown Voltage	V_{ISO}	5000	Vrms

SMD-8

DIP-8





PhotoRelays

Photorelays are the most reliable,technically advanced logic-to-power interface devices.Their basic function is to take a low current signal from a microprocessor to control the switching of both AC and DC loads,while providing an isolation barrier between logic and power. While this function is common to all relays,Photorelays provide distinct advantages over their mechanical counterparts including:

- Long life (No limit on mechanical and electrical
- lifetime)Bounce-free switching
- Higher speed and high frequency switching
- Higher sensitivity (less power consumption)
- Immunity to EMI or RFI
- No arcing switch, bounce, and noise More
- resistant to vibration and impact AC or DC load
- switching
- Small package size

Function

PhotoRelays operate by taking a low level input current(<5mA)that energizes an input Infrared LED,which is optically-coupled to a Photo-diode array chip.This IC in turn generates a photo voltage that powers two MOSFETs typically connected in a source-to-source configuration, allowing for both AC and DC output loads.Photorelay basically move photons to accomplish their switching function,they incur no mechanical wear and tear,providing consistent reliable switching.

Applications

These advantages make Photorelays the ideal choice for:

- **Telecom/Datacom switching**
- **Multiplexers**
- **Meter reading systems**
- **Data acquisition**
- **Test & Measurement equipment**
- **Battery monitoring**
- **I/O Sub-Systems**
- **Robotics**
- **Automatic Test Equipment**
- **Home/Safety security systems**
- **Process Control**
- **Energy Management**
- **Reed Relay EMR Replacement**
- **Programmable Controllers**

TYPES

Category	Output Rating		Package	Part No.	Packing Quantity
	Load Voltage	Load Current			
AC / DC	400V	120mA	DIP-8	APW614E	50pcs /tube
			SMD-8	APW614EH	1000pcs /reel

Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Value	Units	Note
Input	Continuous LED Current	I_F	50	mA	
	Peak LED Current	I_{FP}	1000	mA	f=100Hz, duty=1%
	LED Reverse Voltage	V_R	5	V	
	Input Power Dissipation	P_{In}	75	mW	
Output	Load Voltage	V_L	400	V(AC peak or DC)	
	Load Current	I_L	120	mA	
	Peak Load Current	I_{Peak}	0.6	A	1ms (1 pulse)
	Output Power Dissipation	P_{out}	450	mW	
	Total Power Dissipation	P_T	500	mW	
	I/O Breakdown Voltage	$V_{I/O}$	5000	Vrms	RH=60%, 1min
	Operating Temperature	T_{opr}	-40 to +85	°C	
	Storage Temperature	T_{stg}	-40 to +100	°C	
	Pin Soldering Temperature	T_{sol}	260	°C	10 sec max.

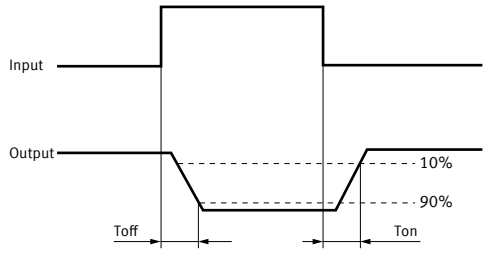
Electrical Characteristics (Ta = 25°C)

Item		Symbol	MIN.	TYP.	MAX.	Units	Conditions
Input *	LED Forward Voltage	V_F		1.2	1.5	V	I_F=10mA
	Operation LED Current	I_{Fon}		0.5	5.0	mA	
	Input Current (ON)	$I_{F(ON)}$		6.0	30.0	mA	
	Recovery LED Current	I_{Foff}		0.35	0.5	mA	
	Recovery LED Voltage	V_{Foff}	0.5			V	

** The threshold for device switching is IF ≥ 5.0 mA (MAX.); however, to ensure satisfactory performance of the device across the temperature range, taking into account both circuit loss and interference, it is recommended to operate when the working condition is: IF (input current) ≥ 5 mA and ≤ 30mA*

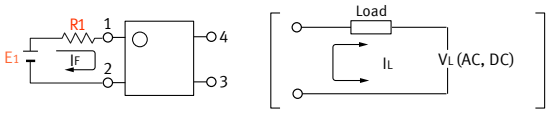
Item			Symbol	MIN.	TYP.	MAX.	Units	Conditions
Output	On-Resistance	(N.O.)	R_{on}		20	30	Ω	I_F=5mA (N.O.), I_F=0mA (N.C.), I_L=100mA, Time to flow is within 1 sec.
		(N.C.)			20	50		
	Off-State Leakage Current	(N.O.)	I_{Leak}			1	uA	I_F=0mA (N.O.), I_F=5mA (N.C.) V_L=Rating
		(N.C.)				10		
	Output Capacitance		C_{out}		150		pF	I_F=5mA, V_L=0, f=1MHz
Transmission*	Turn-On Time	(N.O.)	T_{on}		0.23	0.5	ms	I_F=5mA, I_L=50mA,
		(N.C.)			0.2	1.0		
	Turn-On Time	(N.O.)	T_{on}		0.14	0.4	ms	I_F=10mA, I_L=50mA,
		(N.C.)			0.12	0.8		
	Turn-Off Time	(N.O.)	T_{off}		0.03	0.2	ms	I_F=5mA, I_L=50mA,
		(N.C.)			0.5	3.0		
Coupled	I/O Isolation Resistance		$R_{I/O}$	10^{10}			Ω	DC500V
	I/O Capacitance		$C_{I/O}$		0.8		pF	f=1MHz

*Operate/Reverse time



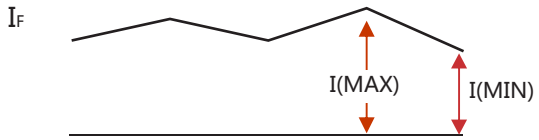
Using Methods

Examples of resistance value to control LED forward current (I_F=5mA)



E1	R1 (Approx)
3.3V	300 Ω
5.0V	600 Ω

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



Recommended Operating Conditions

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

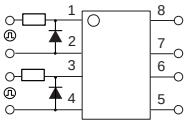
Characteristic	Symbol	Min	Typ.	Max	Unit
Forward current	I_F	5.0	7.0	30	mA

For usage with high reliability, Recommended Operation Conditions is a measure that takes into account the derating of Absolute Maximum Ratings and Electrical Characteristics.
Each item on this list is an independent condition, so it is not simultaneously satisfy several conditions.

Characteristic	Symbol	Min	Typ.	Max	Unit
Load voltage (Peak AC)	V_L	–	–	320	V

Surge voltages at the input

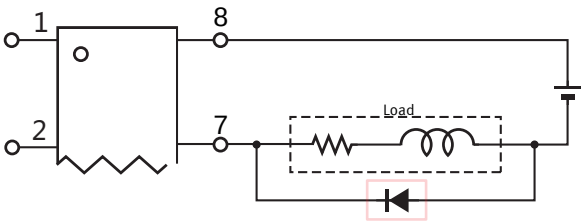
If reverse surge voltages are present at the input terminals, connect a diode in reverse parallel across the input terminals and keep the reverse voltages below the reverse breakdown voltage. Typical circuits are below shown.



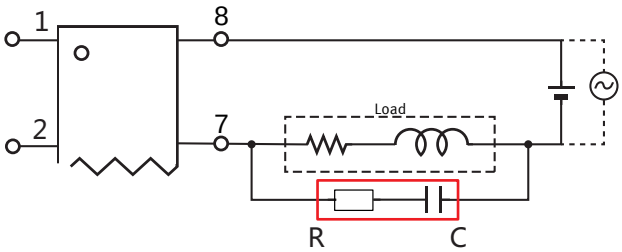
Protection Circuit

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.

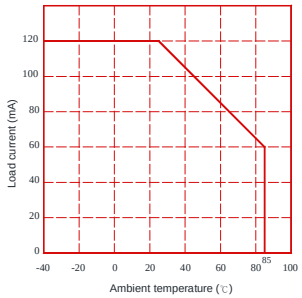


When adding diodes, buffer circuits (C-R), and other protections, they need to be installed near the MOS RELAY to be effective.
Adding protection elements may result in a slow reset time, so adjust them according to the actual situation before use.

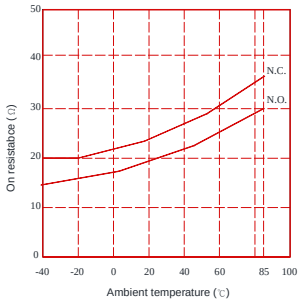
Note: When developing designs using this product, perform the expected performance of the equipment under the operating conditions recommended by the guidelines in this document. Continuous use under heavy loads (including, but not limited to, the application of high temperatures/current/voltage and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

Engineering Data

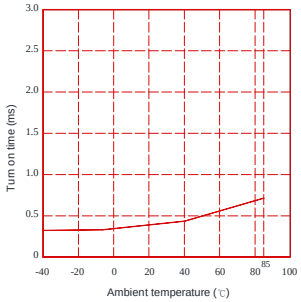
Load current Vs.
Ambient temperature



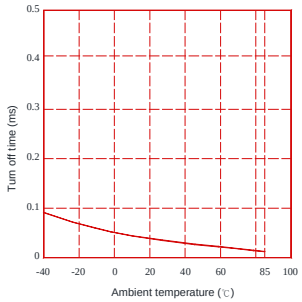
On resistance Vs.
Ambient temperature



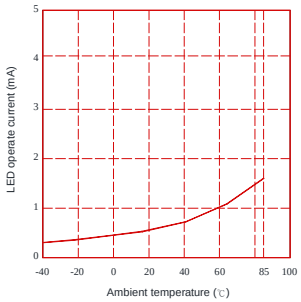
Turn off time Vs.
Ambient temperature



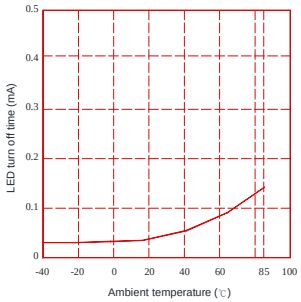
Turn on time Vs.
Ambient temperature



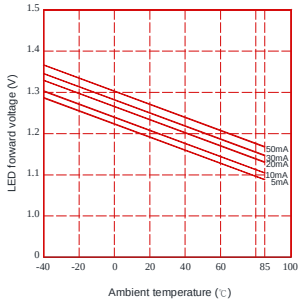
LED operate current Vs.
Ambient temperature



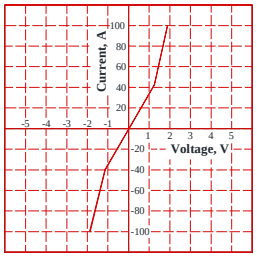
LED turn off current Vs.
Ambient temperature



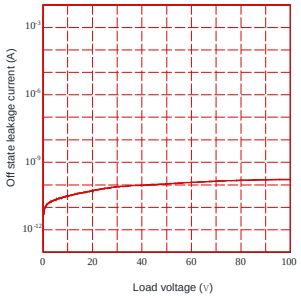
LED forward voltage Vs.
Ambient temperature



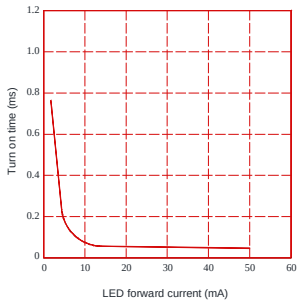
Voltage Vs. current characteristics
of output at MOS portion



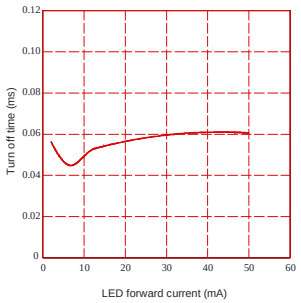
Off state leakage current



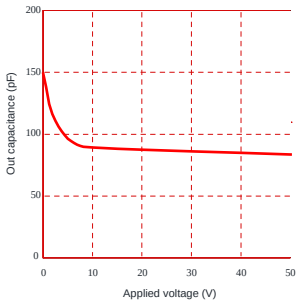
LED forward current Vs.
turn on time characteristics



LED forward current Vs.
turn off time characteristics



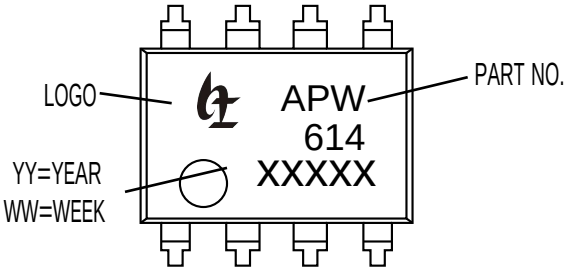
Applied voltage Vs.
output capacitance characteristics



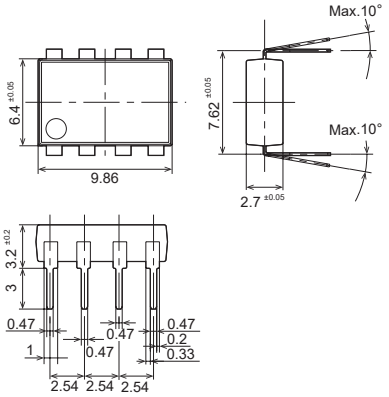
Dimensions and DIP-8 Package

Unit: mm

Marking

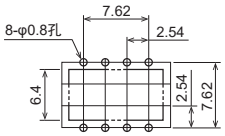


Through hole terminal type



Lable

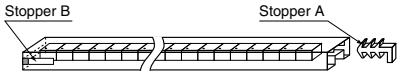
PC board pattern (Bottom view)



DIP Tape dimensions

Unit : mm

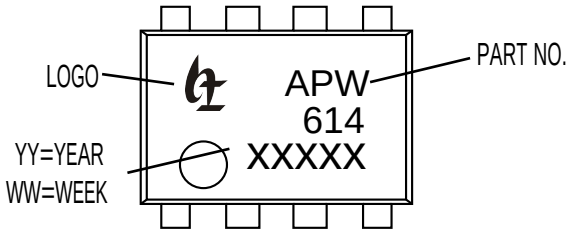
Devices are packaged in a tube so that pin No. 1 is on the stopper B side. Observe correct orientation when mounting them on PC boards.



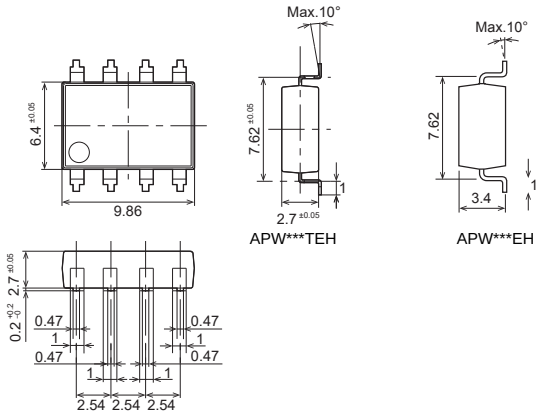
Dimensions and SMD-8 Package

Unit: mm

Marking



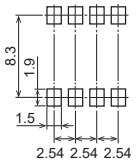
Surface mount terminal type



Lable

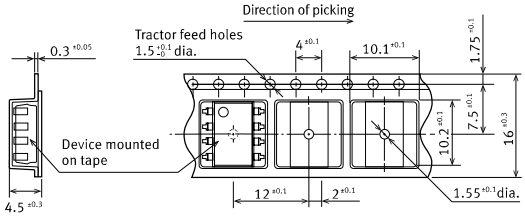
Recommended mounting pad

(Top view)

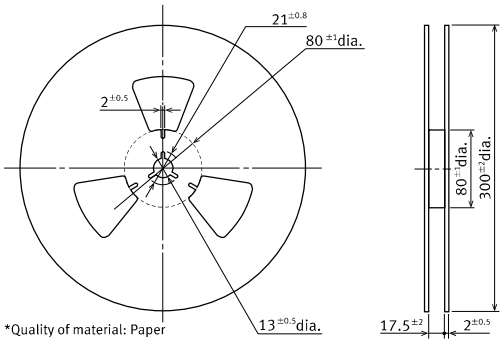


Tape dimensions (tape reel)

Tape dimensions (Unit: mm)



Dimensions of paper tape reel (Unit: mm)

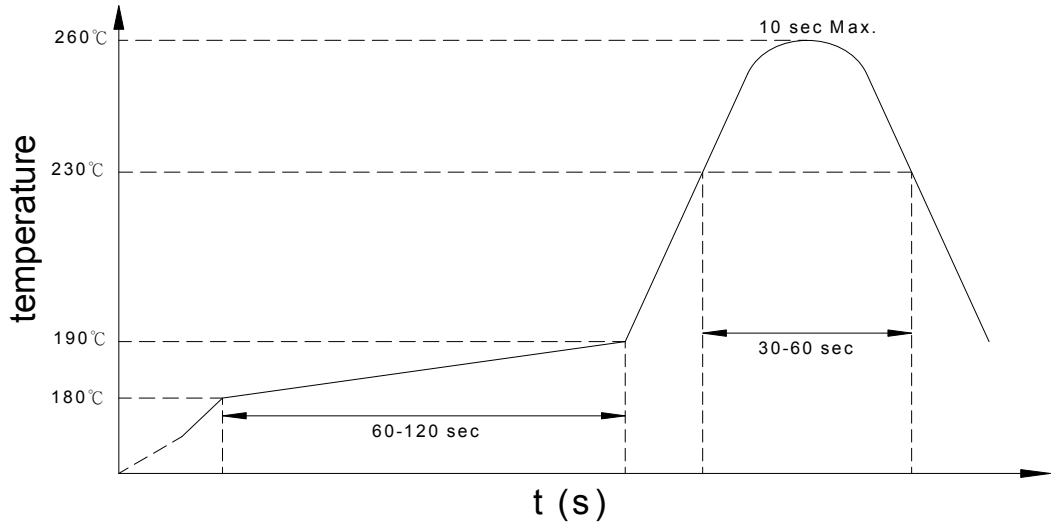


Recommended Soldering Conditions

(a) Infrared reflow soldering：

- Peak reflow soldering： 260℃ or below (package surface temperature)
- Time of peak reflow temperature： 10 sec
- Time of temperature higher than 230℃： 30-60 sec
- Time to preheat temperature from 180~190℃： 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℃ or below (molten solder temperature)
- Time： 10 seconds or less
- Preheating conditions： 120℃ 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.

Manufacturing Information

Moisture Sensitivity

All plastic encapsulated semiconductor packages are susceptible to moisture ingression. APSEMI classifes its plastic encapsulated devices for moisture sensitivity according to the latest revision of the joint industry standard, **IPC/JEDEC J-STD-020**, in force at the time of product evaluation. We test all of our products to the maximum conditions set forth in the standard, and guarantee proper operation of our devices when handled according to the limitations and information in that standard as well as to any limitations set forth in the information or standards referenced below.

Failure to adhere to the warnings or limitations as established by the listed specifications could result in reduced product performance, reduction of operable life, and/or reduction of overall reliability.

This product carries a **Moisture Sensitivity Level (MSL)** classification as shown below, and should be handled according to the requirements of the latest revision of the joint industry standard **IPC/JEDEC J-STD-033**.

Moisture Sensitivity Level (MSL) Classification
MSL 3

ESD Sensitivity

This product is ESD Sensitive, and should be handled according to the industry standard **JESD-625**.

Board Wash

APSEMI recommends the use of no-clean flux formulations. Board washing to reduce or remove flux residue following the solder reflow process is acceptable provided proper precautions are taken to prevent damage to the device. These precautions include but are not limited to: using a low pressure wash and providing a follow up bake cycle sufficient to remove any moisture trapped within the device due to the washing process. Due to the variability of the wash parameters used to clean the board, determination of the bake temperature and duration necessary to remove the moisture trapped within the package is the responsibility of the user (assembler). Cleaning or drying methods that employ ultrasonic energy may damage the device and should not be used. Additionally, the device must not be exposed to halide flux or solvents.

Post high-temperature welding, direct cleaning with dry ice is prohibited.

RESTRICTIONS ON PRODUCT USE

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▪ 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.

Revision History

Revision	Subjects (major changes since last revision)	Date
1.0	Initial release.	2016.12
1.1	I/O Breakdown Voltage Parameter Update	2024.05
1.2	Added circuit design guide	2024.12

Disclaimer

1. Operating conditions may differ from simulation assumptions in several aspects like level of DC-link voltage, applied gate-voltage and gate-resistor, case and junction temperatures as well as the power circuit stray-inductance. Therefore, deviations of parameters and assumptions used for the simulation and the real application may exist.
2. For these reasons we cannot take any responsibility or liability for the exactness or validity of the form's results. The form cannot replace a detailed reflection of the customers application with all of its operating conditions.
3. Accurate results depend on huge data, so with the measured data is increasing, we should be updated in real time and send it to the corresponding engineer so that he can know it in real time.