

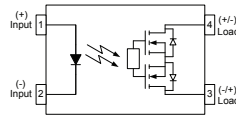
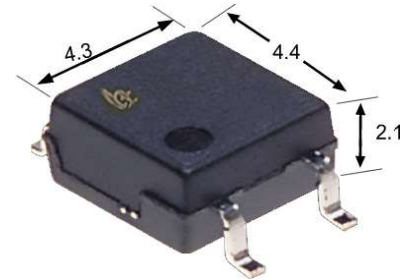


| Parameter       | Symbol     | Rating | Units    |
|-----------------|------------|--------|----------|
| Load Voltage    | $V_L$      | 60     | V        |
| Load Current    | $I_L$      | 0.25   | A        |
| On-Resistance   | $R_{on}$   | 3      | $\Omega$ |
| Leakage Current | $I_{Leak}$ | 5      | nA       |



E534710

(Unit: mm)



## APSEMI PhotoRelays

APSEMI 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 have voltaic arc, bounce, and noise
- More resistant to vibration and impact
- AC or DC load switching
- Small package size

## Function

APSEMI 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.

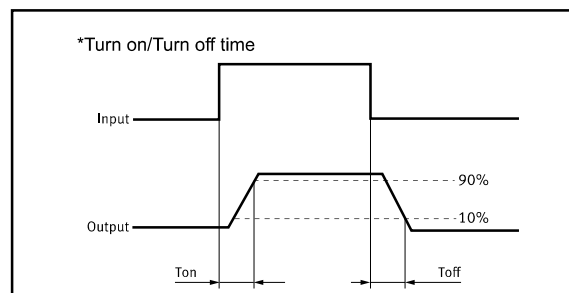
## Applications

These advantages make APSEMI Photorelays the ideal choice for:

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

## TPYES

| Category | Output Rating |              | Package | Part No.  | Packing Quantity |
|----------|---------------|--------------|---------|-----------|------------------|
|          | Load Voltage  | Load Current |         |           |                  |
| AC/DC    | 60V           | 0.25A        | SOP-4   | APY221R2S | 2000pcs /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,<br>duty=1% |
|                           | LED Reverse Voltage      | $V_R$      | 5          | V                |                     |
|                           | Input Power Dissipation  | $P_{In}$   | 75         | mW               |                     |
| Output                    | Load Voltage             | $V_L$      | 60         | V(AC peak or DC) |                     |
|                           | Load Current             | $I_L$      | 0.25       | A                |                     |
|                           | Peak Load Current        | $I_{Peak}$ | 0.60       | A                | 100ms(1 pulse)      |
|                           | Output Power Dissipation | $P_{out}$  | 300        | mW               |                     |
| Total Power Dissipation   |                          | $P_T$      | 350        | mW               |                     |
| I/O Breakdown Voltage     |                          | $V_{I/O}$  | 2500       | 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.         |

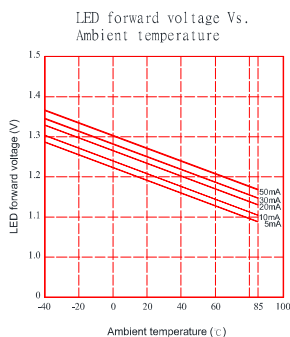
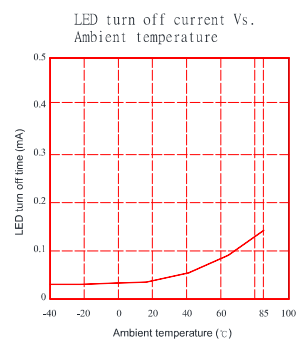
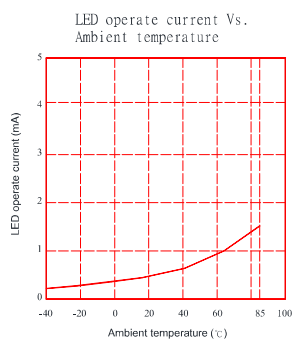
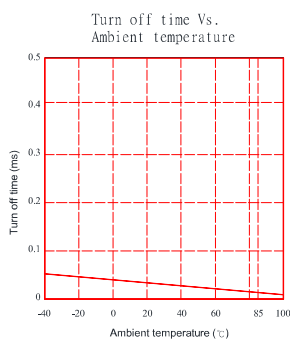
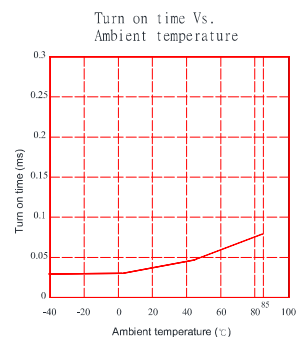
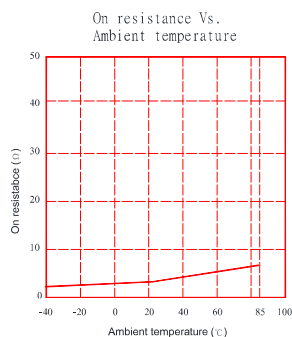
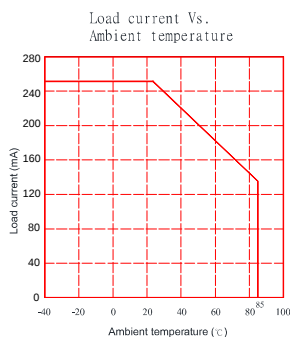
## Electrical Characteristics (Ta = 25°C)

| Item             |                           | Symbol     | MIN.      | TYP.  | MAX. | Units    | Conditions                                              |
|------------------|---------------------------|------------|-----------|-------|------|----------|---------------------------------------------------------|
| Input            | LED Forward Voltage       | $V_F$      |           | 1.2   | 1.4  | V        | $I_F=10mA$                                              |
|                  | Operation LED Current     | $I_{Fon}$  |           | 0.5   | 2.0  | mA       |                                                         |
|                  | Recovery LED Current      | $I_{Foff}$ |           | 0.35  | 0.5  | mA       |                                                         |
|                  | Recovery LED Voltage      | $V_{Foff}$ | 0.7       |       |      | V        |                                                         |
| Output           | On-Resistance             | $R_{on}$   |           | 1.5   | 3.5  | $\Omega$ | $I_F=5mA, I_L=100mA$ ,<br>Time to flow is within 1 sec. |
|                  | Off-State Leakage Current | $I_{Leak}$ |           | 0.005 | 0.01 | $\mu A$  | $V_L=Rating$                                            |
|                  | Output Capacitance        | $C_{out}$  |           | 7.50  |      | pF       | $V_L=0, f=1MHz$                                         |
| Transmis<br>sion | Turn-On Time              | $T_{on}$   |           | 0.05  | 0.10 | ms       | $I_F=5mA, I_L=100mA$ ,                                  |
|                  | Turn-Off Time             | $T_{off}$  |           | 0.04  | 0.08 | ms       |                                                         |
| Coupled          | I/O Isolation Resistance  | $R_{I/O}$  | $10^{10}$ |       |      | $\Omega$ | DC500V                                                  |
|                  | I/O Capacitance           | $C_{I/O}$  |           | 0.8   | 1.5  | pF       | f=1MHz                                                  |

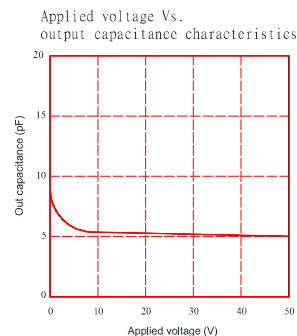
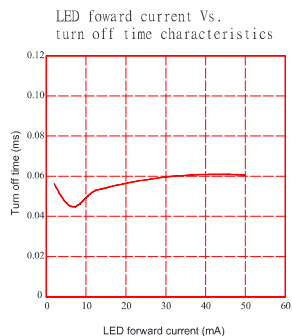
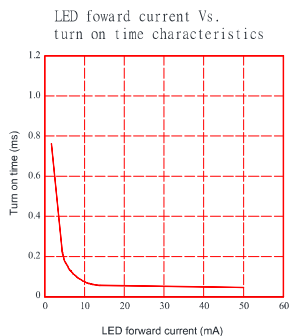
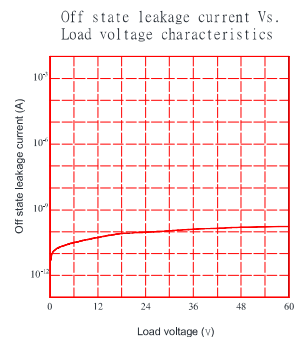
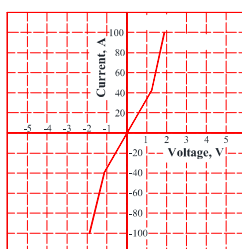
Please obey the following conditions to ensure proper device operation and resetting. Input LED current (Recommended value):  $I_F \geq 5mA$  and  $\leq 30mA$



## Engineering Data



Voltage Vs. current characteristics of output at MOS portion



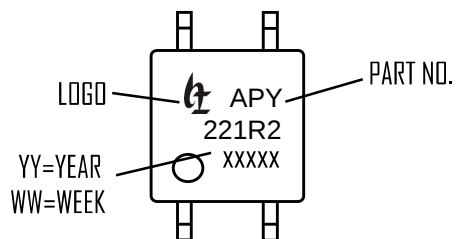


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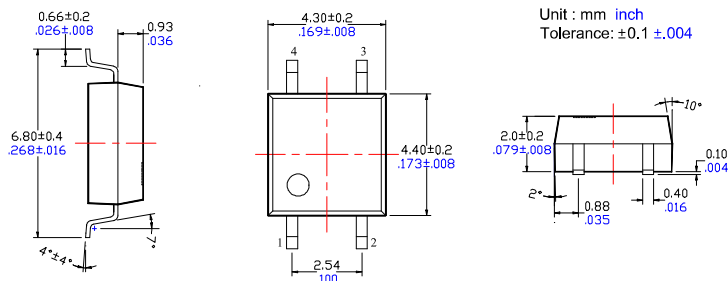
1 Form A APY221R2S  
SOP-4 Load Voltage:60V Load Current:250mA

## Dimensions and Package

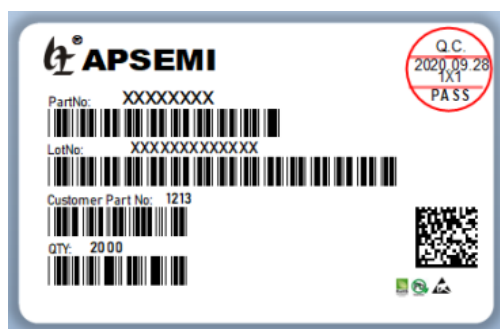
Marking



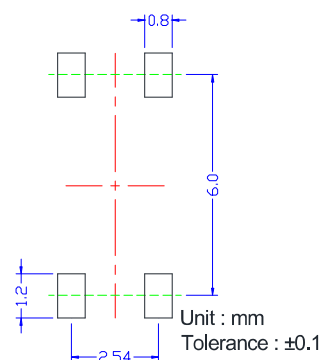
Surface mount terminal type



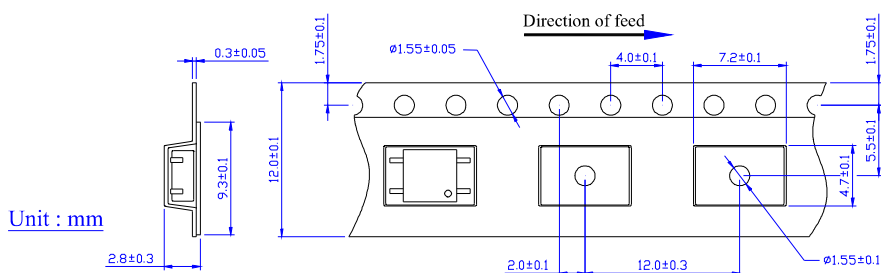
Label



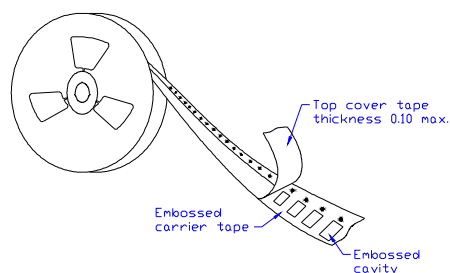
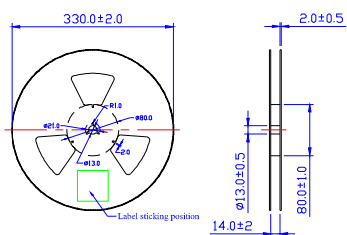
Recommended mounting pad (Top view)



## Tape dimensions



Dimensions of tape reel





## Using Methods

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



| E1   | R1 (Approx)   |
|------|---------------|
| 3.3V | 300 $\Omega$  |
| 5.0V | 600 $\Omega$  |
| 12V  | 1.9K $\Omega$ |
| 24V  | 4.1K $\Omega$ |

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

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