

# KAQY212 Series

4PIN 60V N.O TYPE

SOLID STATE RELAY-MOSFET OUTPUT

## ● Description

The KAQY212 series is robust, ideal for telecom and ground fault applications. It is a SPST normally open switch (1 Form A) that replaces electromechanical relays in many applications. It is constructed using a GaAlAs LED for actuation control and an integrated monolithic die for the switch output. The die, fabricated in a high-voltage dielectrically isolated technology, is comprised of a photodiode array, switch control circuitry and MOSFET switches.

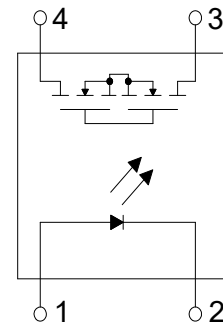
## ● Features

1. Normally open, single pole single throw
2. Control 60V AC or DC voltage
3. Switch 400mA loads
4. Controls low-level analog signals
5. High sensitivity, low ON resistance
6. Low-level off-state leakage current
7. High isolation voltage 5KV (DIP / SMD)
8. Pb free and RoHS compliant
9. MSL class 1
10. Agency Approvals :
  - UL Approved (No. E108430): UL508
  - c-UL Approved (No. E108430)
  - FIMKO Approved: EN62368-1, EN60601-1
  - VDE Approved (No. 40053989): EN60747-5-5

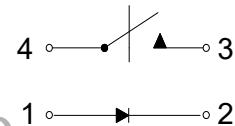
## ● Application

- Telecommunications (PC, electronic notepad)
- Modem
- Telephone equipment
- Security equipment
- Sensors
- Measuring and testing equipment
- Factory automation equipment
- High speed inspection machines

## ● Schematic



1 FORM A  
NORMALLY OPEN



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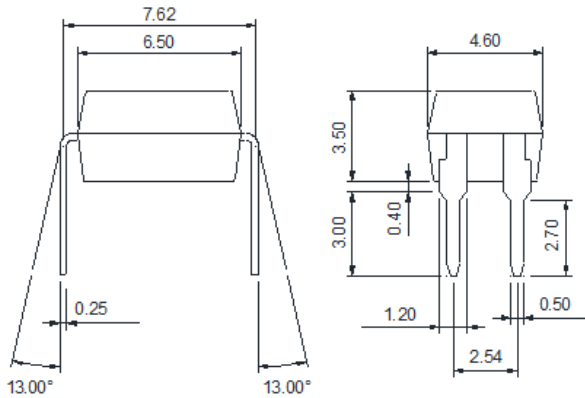
## ● Outside Dimension

Unit : mm

### 1. Dual-in-line type.



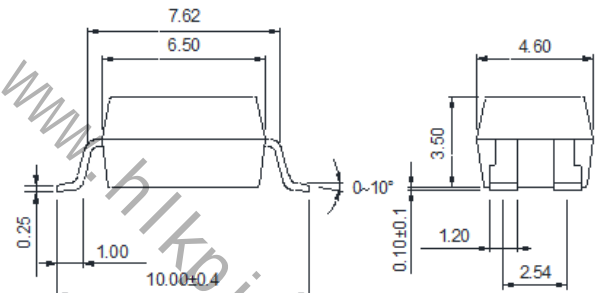
KAQY212



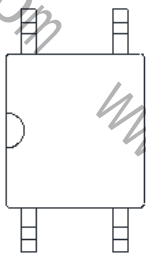
### 2. Surface mount type.



KAQY212A



### 3. Small outline for surface mount type.

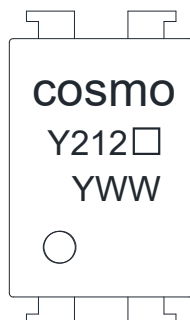


KAQY212S



TOLERANCE : ±0.2mm

## ● Device Marking



## Notes :

cosmo

Y212□ □ (Blank) : DIP or SMD

Y212S S : SOP

YWW Y : Year code / W : Week code

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## ● Absolute Maximum Ratings

(Ta=25°C)

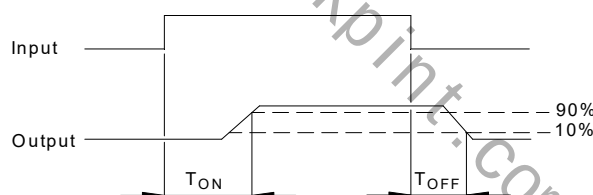
| Item                             | Symbol                     | Rating           | Unit                    |
|----------------------------------|----------------------------|------------------|-------------------------|
| Input                            | Continuous forward current | I <sub>F</sub>   | 50                      |
|                                  | Peak forward current       | I <sub>FP</sub>  | 1                       |
|                                  | Reverse voltage            | V <sub>R</sub>   | 5                       |
|                                  | Power dissipation          | P <sub>in</sub>  | 100                     |
|                                  | Derate linearly from 25°C  | -                | 1.3                     |
| Output                           | Breakdown voltage          | V <sub>B</sub>   | 60                      |
|                                  | Continuous load current    | I <sub>L</sub>   | 400                     |
|                                  | Power dissipation          | P <sub>out</sub> | 500                     |
| Isolation voltage                |                            | V <sub>iso</sub> | KAQY212S<br>1500Vrms    |
| Isolation resistance (Vio=500V)  |                            | R <sub>iso</sub> | KAQY212<br>5000Vrms     |
| Total power dissipation          |                            | P <sub>t</sub>   | ≥ 10 <sup>10</sup><br>Ω |
| Derate linearly from 25°C        |                            | -                | 550                     |
| Operating temperature            |                            | T <sub>opr</sub> | 2.5                     |
| Storage temperature              |                            | T <sub>stg</sub> | mW/°C                   |
| Junction temperature             |                            | T <sub>j</sub>   | -40 to +85              |
| Soldering temperature 10 seconds |                            | T <sub>sot</sub> | °C                      |
|                                  |                            |                  | -40 to +125             |
|                                  |                            |                  | 100                     |
|                                  |                            |                  | °C                      |
|                                  |                            |                  | 260                     |
|                                  |                            |                  | °C                      |

## ● Electro-optical Characteristics

(Ta=25°C)

| Parameter       | Symbol                    | Conditions                                  | Min.                                       | Typ. | Max. | Unit |
|-----------------|---------------------------|---------------------------------------------|--------------------------------------------|------|------|------|
| Input           | Forward voltage           | V <sub>F</sub>                              | I <sub>F</sub> =10mA                       | -    | 1.2  | 1.5  |
|                 | Operation input current   | I <sub>FON</sub>                            | V <sub>L</sub> =20V, I <sub>L</sub> =100mA | -    | -    | 3.0  |
|                 | Recovery input current    | I <sub>FOFF</sub>                           | V <sub>L</sub> =20V, I <sub>L</sub> ≤5μA   | 0.2  | -    | -    |
| Output          | Breakdown voltage         | V <sub>B</sub>                              | I <sub>B</sub> =50μA                       | 60   | -    | -    |
|                 | Off-state leakage current | I <sub>LEAK</sub>                           | V <sub>L</sub> =60V, I <sub>F</sub> =0mA   | -    | 0.2  | 1.0  |
| I/O capacitance | C <sub>iso</sub>          | V <sub>B</sub> =0V, f=1MHz                  | -                                          | 6    | -    | pF   |
| ON resistance   | R <sub>ON</sub>           | I <sub>F</sub> =10mA, I <sub>L</sub> =100mA | -                                          | 0.83 | 2.5  | Ω    |
| Turn-on time    | T <sub>ON</sub>           | I <sub>F</sub> =10mA, V <sub>L</sub> =20V   | -                                          | 0.3  | 1.5  | ms   |
| Turn-off time   | T <sub>OFF</sub>          | I <sub>L</sub> =100mA, t=10ms               | -                                          | 0.1  | 1.5  | ms   |

## ● Turn-on / Turn-off Time

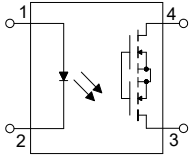
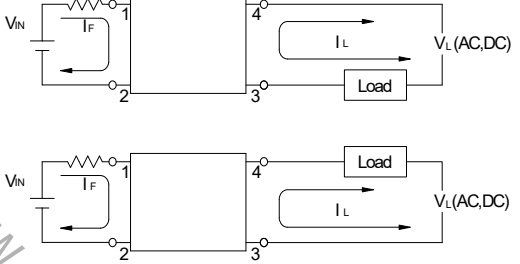


# KAQY212 Series

4PIN 60V N.O TYPE

SOLID STATE RELAY-MOSFET OUTPUT

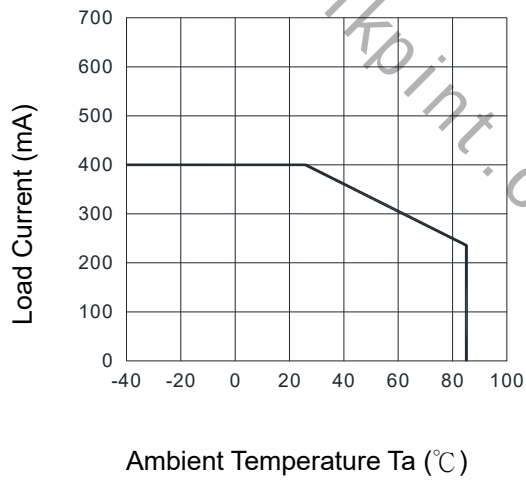
## ● Schematic and Wiring Diagrams

| Schematic                                                                         | Output Configuration | Load     | Connection | Wiring Diagrams                                                                    |
|-----------------------------------------------------------------------------------|----------------------|----------|------------|------------------------------------------------------------------------------------|
|  | 1a                   | AC<br>DC | -          |  |

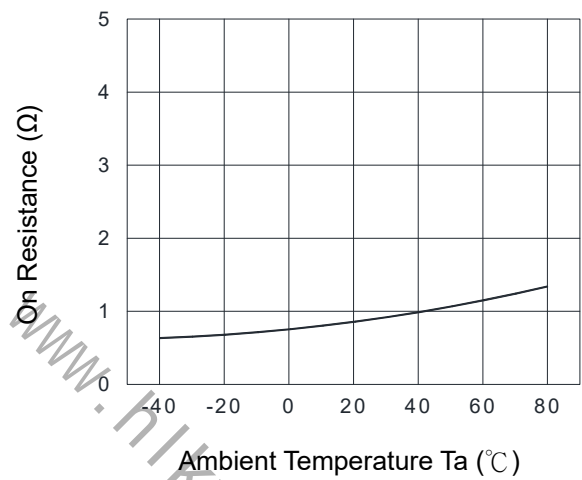
# KAQY212 Series

4PIN 60V N.O TYPE  
SOLID STATE RELAY-MOSFET OUTPUT

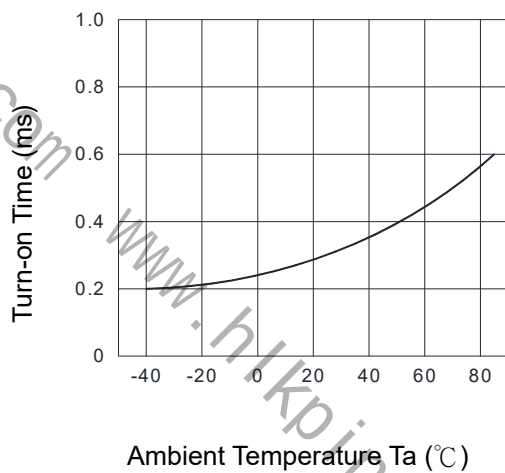
**Fig.1 Load Current vs. Ambient Temperature**



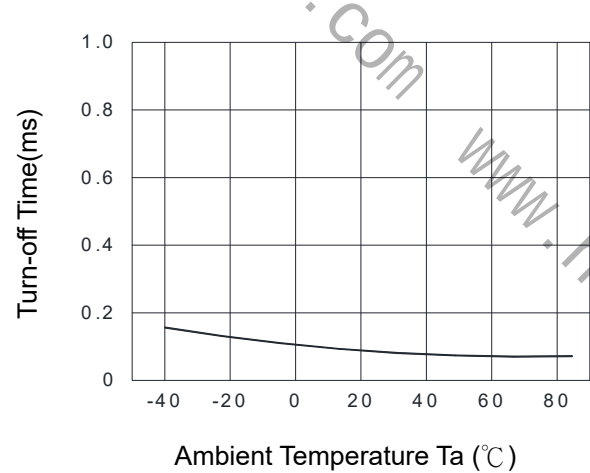
**Fig.2 On Resistance vs. Ambient Temperature**



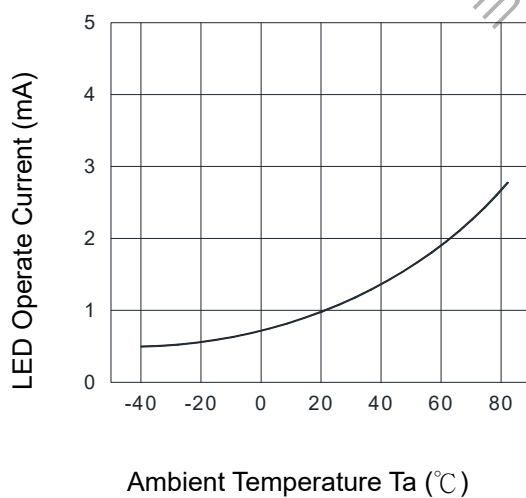
**Fig.3 Turn-on Time vs. Ambient Temperature**



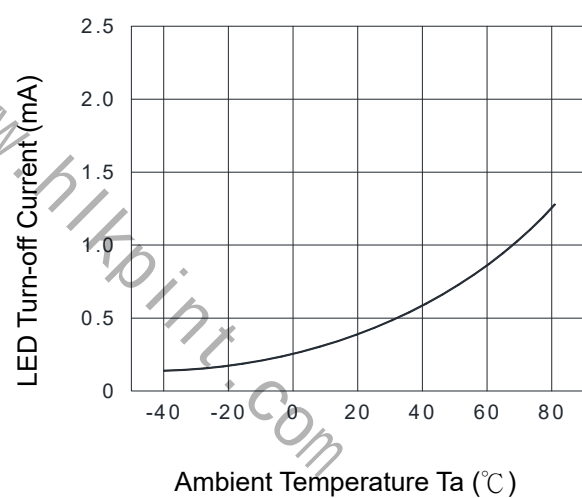
**Fig.4 Turn-off Time vs. Ambient Temperature**



**Fig.5 LED Operate Current vs. Ambient Temperature**



**Fig.6 LED Turn-off Current vs. Ambient Temperature**

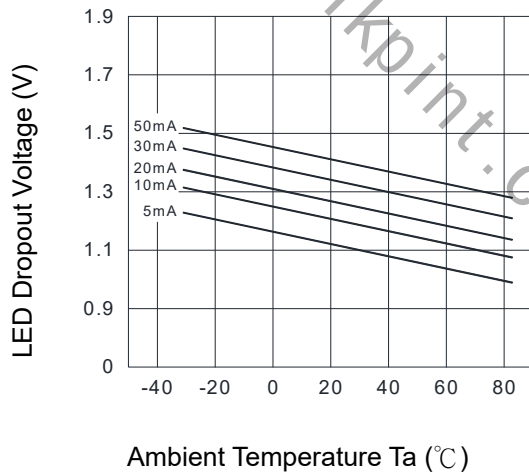


# KAQY212 Series

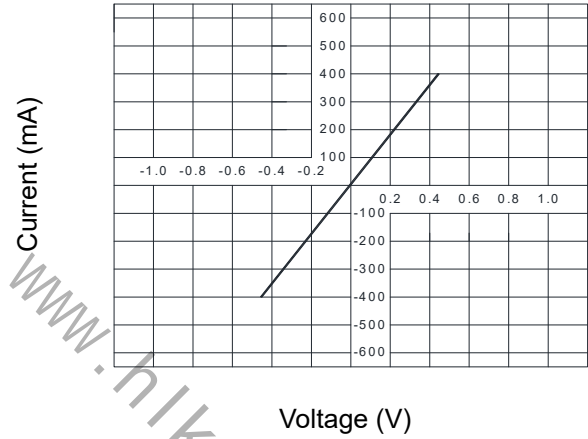
## 4PIN 60V N.O TYPE

### SOLID STATE RELAY-MOSFET OUTPUT

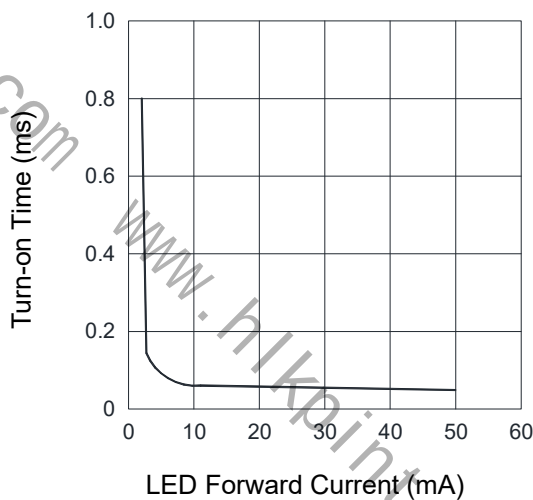
**Fig.7 LED Dropout Voltage vs. Ambient Temperature**



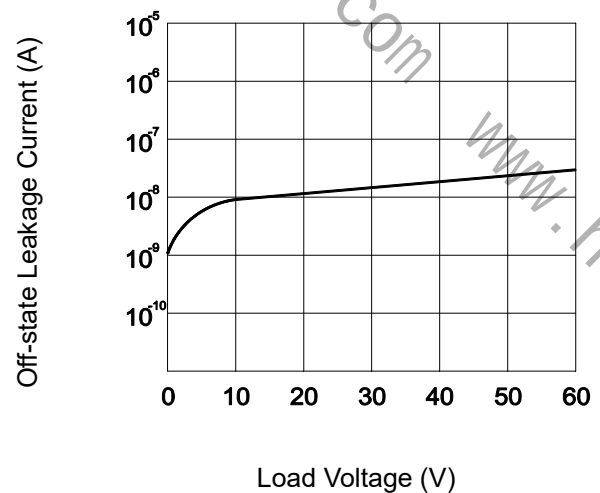
**Fig.8 Voltage vs. Current Characteristics of Output at MOSFET Portion**



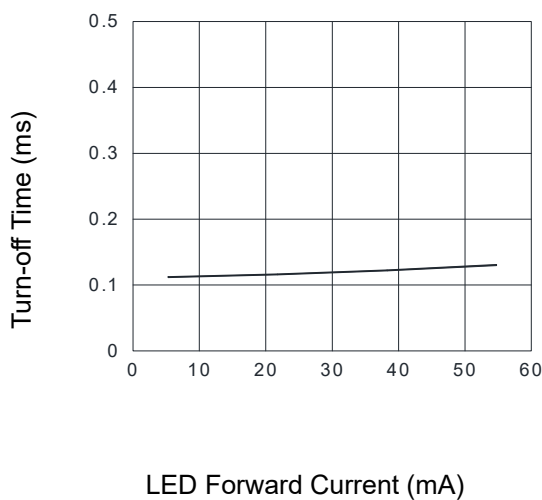
**Fig.9 Turn-on Time vs. LED Forward Current**



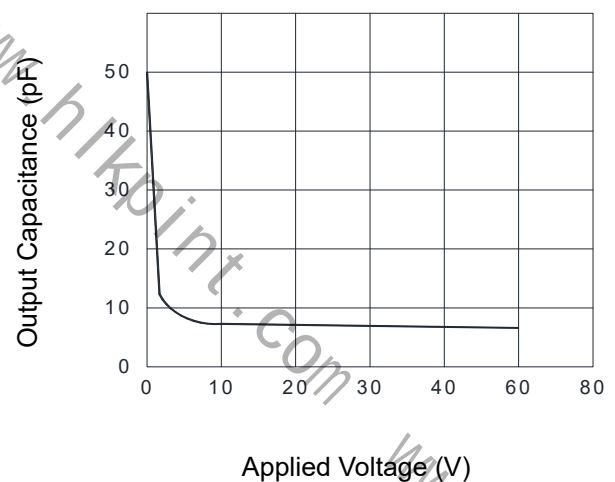
**Fig.10 Off-state Leakage Current vs. Load Voltage**



**Fig.11 Turn-off Time vs. LED Forward Current**



**Fig.12 Output Capacitance vs. Applied Voltage**



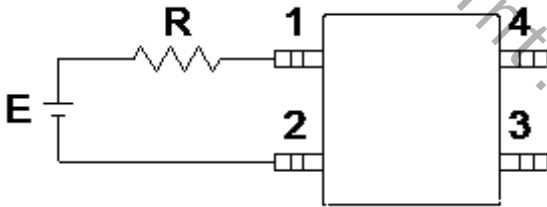
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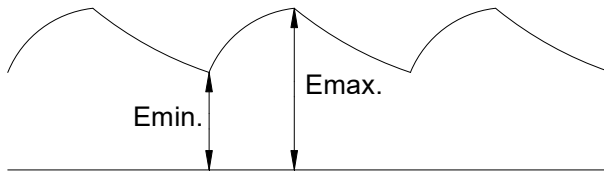
## ● Using Methods

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

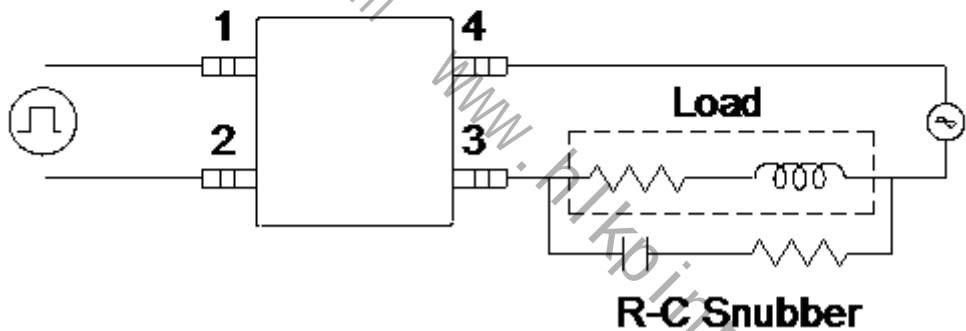
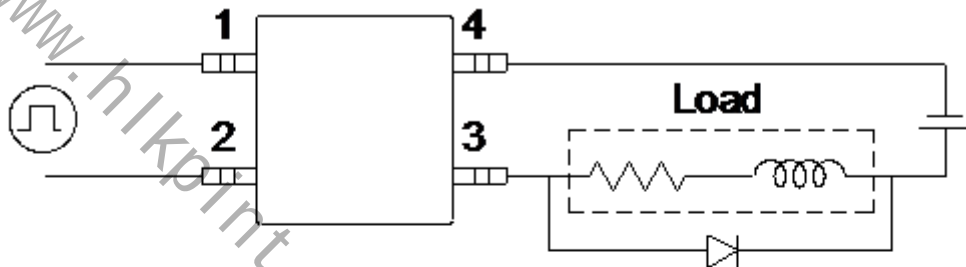


| E    | R                     |
|------|-----------------------|
| 3.3V | Approx. 330 $\Omega$  |
| 5V   | Approx. 640 $\Omega$  |
| 12V  | Approx. 1.9K $\Omega$ |
| 15V  | Approx. 2.5K $\Omega$ |
| 24V  | Approx. 4.1K $\Omega$ |

1. LED forward current must be more than 5mA , at E min.
2. LED forward current must be less than 50mA , at E max.



Regulate the spike voltage generated on the inductive load as follows :

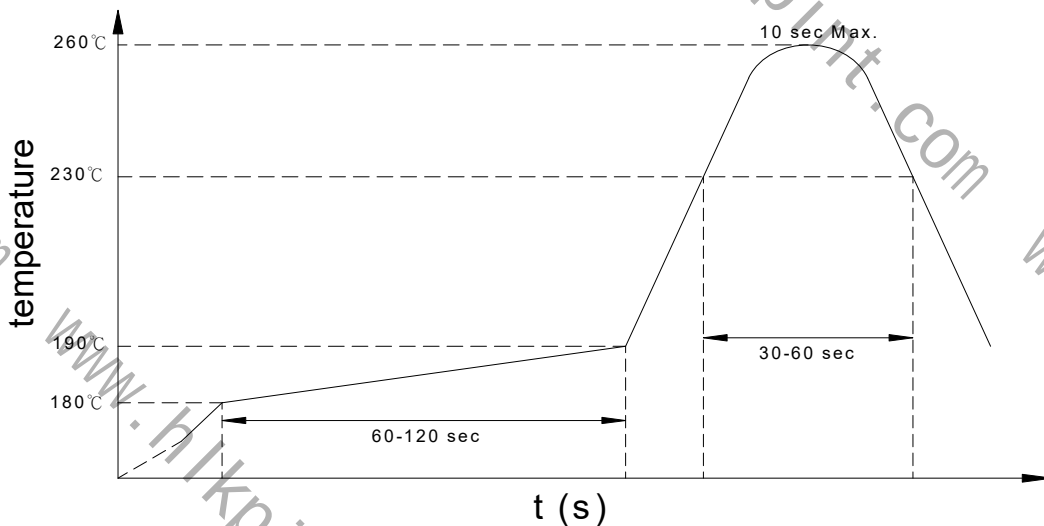


● **Recommended Soldering Conditions**

(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                                                                                                              |
| ■ Number of reflows :                          | Two                                                                                                                     |
| ■ Flux :                                       | Rosin flux containing small amount of chlorine<br>(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)                                                                         |
| ■ Number of times :      | 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.                                     |

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## ● Numbering System

**KAQY212 X (Y)**

### Note :

KAQY212 = Part No.

X = Lead form option ( blank 、 S or A )

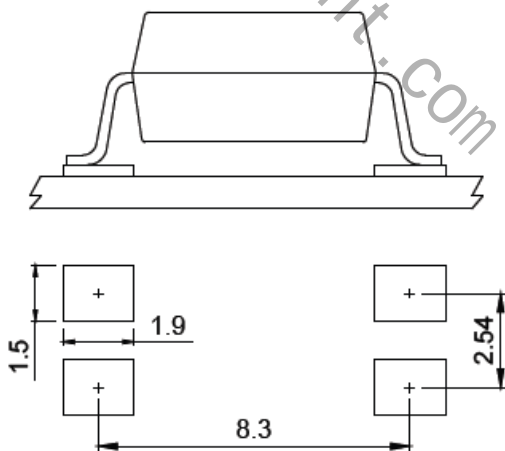
Y = Tape and reel option ( TLD 、 TRU )

| Option  | Description                                                              | Packing quantity    |
|---------|--------------------------------------------------------------------------|---------------------|
| A (TLD) | surface mount type package + TLD tape & reel option                      | 2000 units per reel |
| A (TRU) | surface mount type package + TRU tape & reel option                      | 2000 units per reel |
| S (TLD) | small outline for surface mount type package +<br>TLD tape & reel option | 3000 units per reel |
| S (TRU) | small outline for surface mount type package +<br>TRU tape & reel option | 3000 units per reel |

## ● Recommended Pad Layout for Surface Mount Lead Form

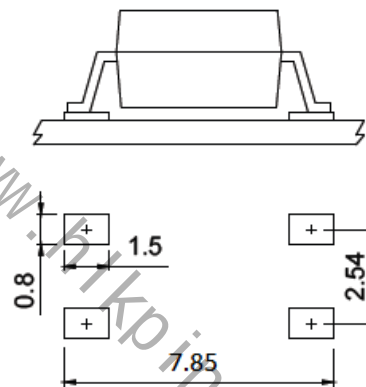
### 1. Surface mount type.

**4-pin SMD**



### 2. Small outline for surface mount type.

**4-pin SOP**



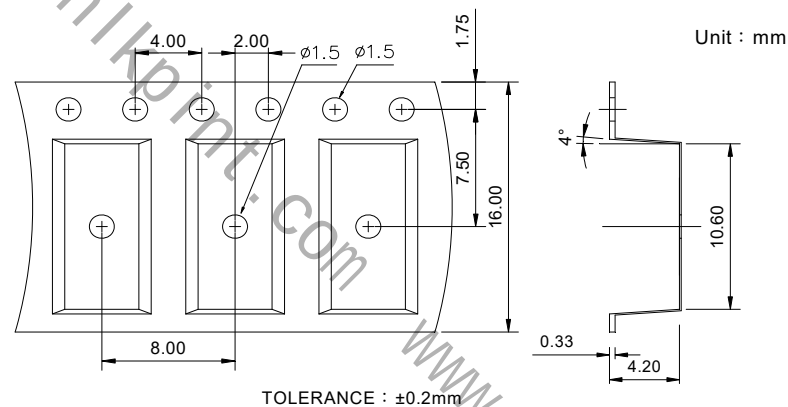
Unit : mm

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4PIN 60V N.O TYPE

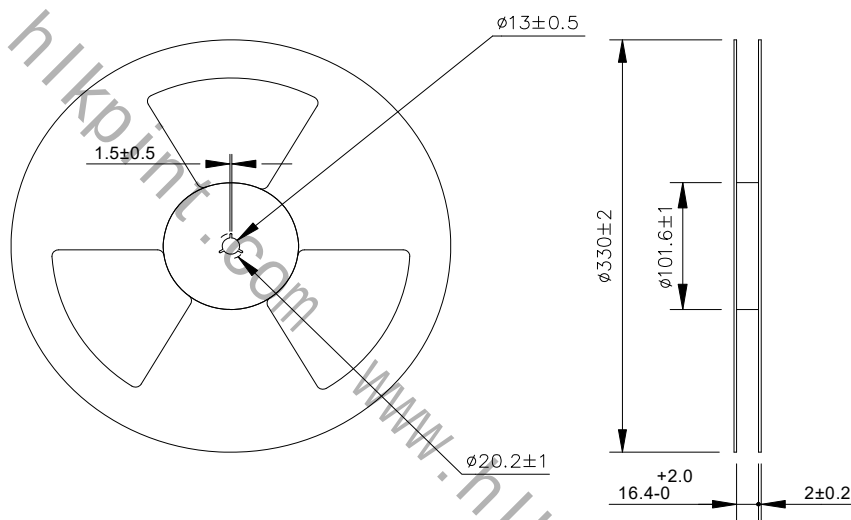
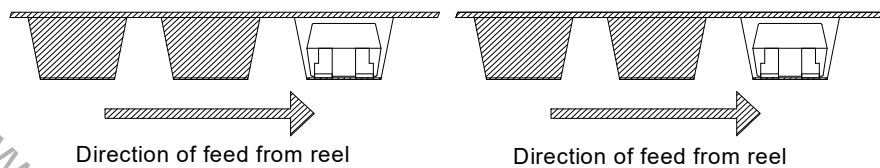
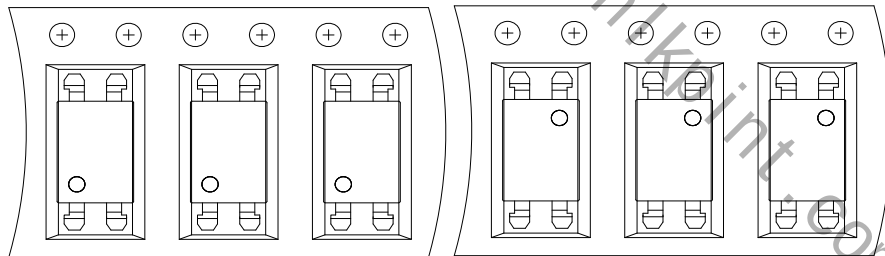
SOLID STATE RELAY-MOSFET OUTPUT

## ● 4-pin SMD Carrier Tape & Reel



TLD

TRU



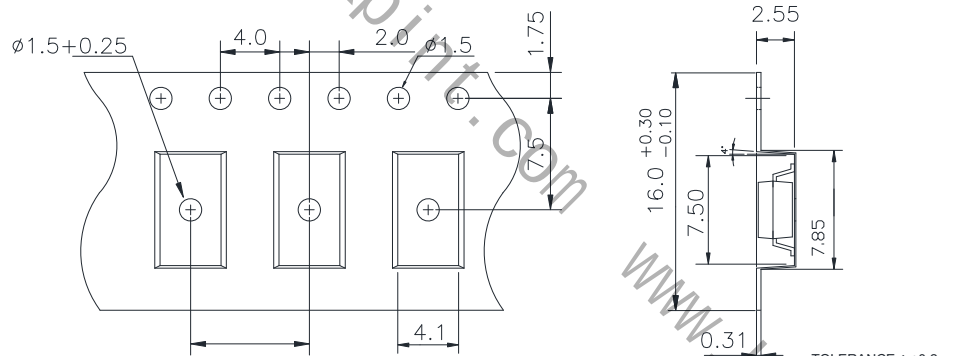
# KAQY212 Series

4PIN 60V N.O TYPE

SOLID STATE RELAY-MOSFET OUTPUT

## ● 4-pin SOP Carrier Tape & Reel

Unit: mm



TLD

TRU

