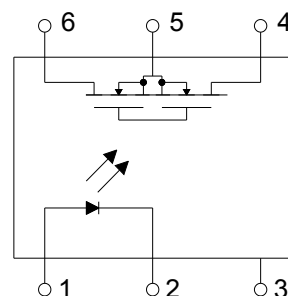


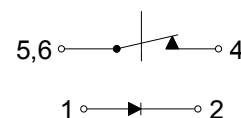
## ● Description

The KAQV414 series is robust, ideal for telecom and ground fault applications. It is a SPST normally close switch (1 Form B) 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.

## ● Schematic



1 FORM B  
NORMALLY CLOSE



## ● Features

1. Normally close, single pole single throw
2. Control 400V AC or DC voltage
3. Switch 130mA loads
4. Controls low-level analog signals
5. High sensitivity, low ON resistance
6. Low-level off-state leakage current
7. High isolation voltage
8. Pb free and RoHS compliant
9. Agency Approvals :
  - UL 508 / CUL C22.2 No.14-M91 , File No. E108430
  - FIMKO EN60950

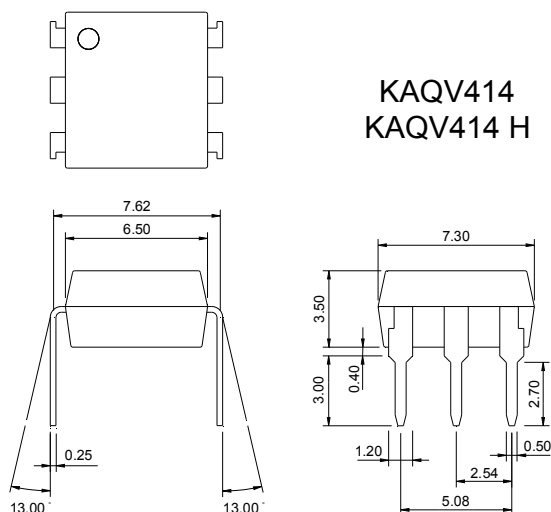
## ● Application

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

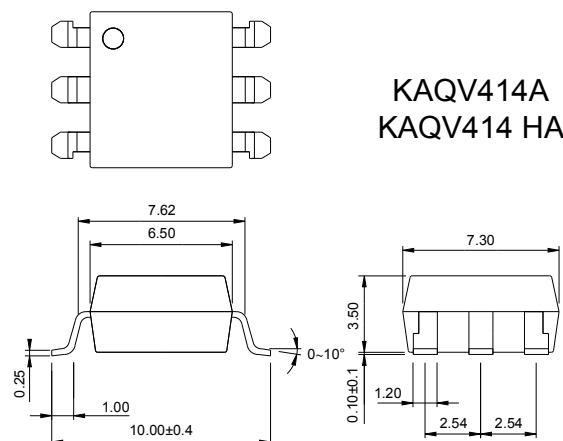
## ● Outside Dimension

Unit : mm

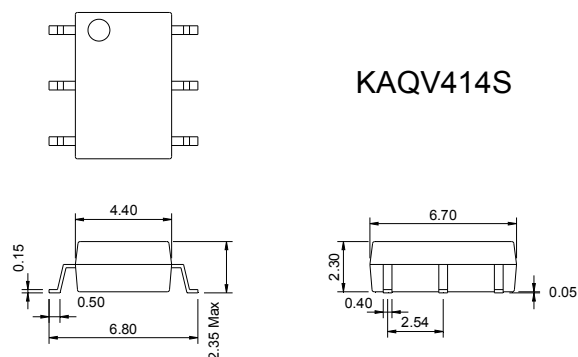
### 1. Dual-in-line type.



### 2. Surface mount type.

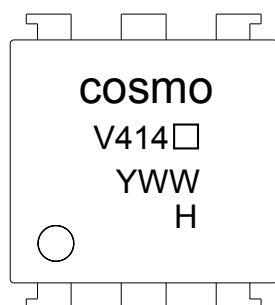


### 3. Small outline for surface mount type.



TOLERANCE : ±0.2mm

## ● Device Marking



### Notes :

cosmo

V414 □

□ : Pin forming

YWW

Y : Year code / W : Week code

H

High isolation voltage series only

## ● Absolute Maximum Ratings

(Ta=25°C)

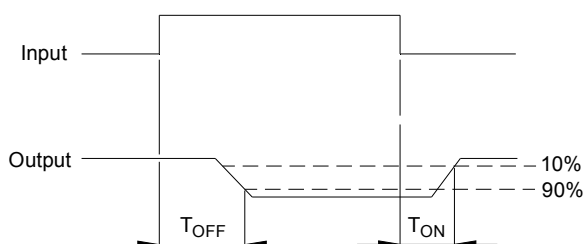
| Item                             |                            | Symbol    | Rating          |                | Unit            |
|----------------------------------|----------------------------|-----------|-----------------|----------------|-----------------|
| Input                            | Continuous forward current | $I_F$     | 50              |                | mA              |
|                                  | Peak forward current       | $I_{FP}$  | 1               |                | A               |
|                                  | Reverse voltage            | $V_R$     | 5               |                | V               |
|                                  | Power dissipation          | $P_{in}$  | 100             |                | mW              |
|                                  | Derate linearly from 25°C  | -         | 1.3             |                | mW/°C           |
| Output                           | Breakdown voltage          | $V_B$     | 400             |                | V               |
|                                  | Continuous load current    | $I_L$     | 130             |                | mA              |
|                                  | Power dissipation          | $P_{out}$ | 500             |                | mW              |
| Isolation voltage                |                            | $V_{iso}$ | <b>KAQV414S</b> | <b>KAQV414</b> | <b>KAQV414H</b> |
|                                  |                            |           | 1500Vrms        | 3750Vrms       | 5000Vrms        |
| Isolation resistance (Vio=500V)  |                            | $R_{iso}$ | $\geq 10^{10}$  |                | $\Omega$        |
| Total power dissipation          |                            | $P_t$     | 550             |                | mW              |
| Derate linearly from 25°C        |                            | -         | 2.5             |                | mW/°C           |
| Operating temperature            |                            | $T_{opr}$ | -40 to +85      |                | °C              |
| Storage temperature              |                            | $T_{stg}$ | -40 to +125     |                | °C              |
| Junction temperature             |                            | $T_j$     | 100             |                | °C              |
| Soldering temperature 10 seconds |                            | $T_{sot}$ | 260             |                | °C              |

## ● Electro-optical Characteristics

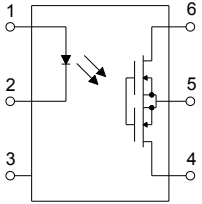
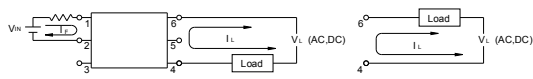
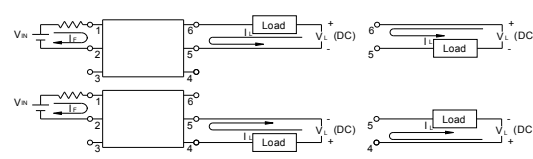
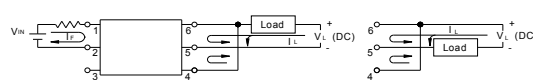
(Ta=25°C)

| Parameter          |                           |            |   | Symbol             | Conditions                                                                 | Min. | Typ. | Max. | Unit |
|--------------------|---------------------------|------------|---|--------------------|----------------------------------------------------------------------------|------|------|------|------|
| Input              | Forward voltage           |            |   | V <sub>F</sub>     | I <sub>F</sub> =10mA                                                       | -    | 1.2  | 1.5  | V    |
|                    | Operation input current   |            |   | I <sub>F</sub> OFF | V <sub>L</sub> =20V, I <sub>L</sub> ≤5μA                                   | -    | -    | 3.0  | mA   |
|                    | Recovery input current    |            |   | I <sub>F</sub> ON  | V <sub>L</sub> =20V, I <sub>L</sub> =100mA                                 | 0.2  | -    | -    | mA   |
| Output             | Breakdown voltage         |            |   | V <sub>B</sub>     | I <sub>B</sub> =50μA, I <sub>F</sub> =10mA                                 | 400  | -    | -    | V    |
|                    | Off-state leakage current |            |   | I <sub>LEAK</sub>  | V <sub>L</sub> =100V, I <sub>F</sub> =5mA                                  | -    | 1.0  | 2.0  | μA   |
| I/O capacitance    |                           |            |   | C <sub>ISO</sub>   | V <sub>B</sub> =0V, f=1MHz                                                 | -    | 6    | -    | pF   |
| ON resistance      |                           | Connection | A | R <sub>ON</sub>    | I <sub>F</sub> =0mA, I <sub>L</sub> =100mA                                 | -    | 25   | 50   | Ω    |
|                    |                           |            | B |                    |                                                                            | -    | 13   | 25   |      |
|                    |                           |            | C |                    |                                                                            | -    | 7    | 12.5 |      |
| Reverse (ON) time  |                           |            |   | T <sub>ON</sub>    | I <sub>F</sub> =10mA, V <sub>L</sub> =20V<br>I <sub>L</sub> =100mA, t=10ms | -    | 0.6  | 1.5  | ms   |
| Operate (OFF) time |                           |            |   | T <sub>OFF</sub>   |                                                                            | -    | 0.3  | 1.0  | ms   |

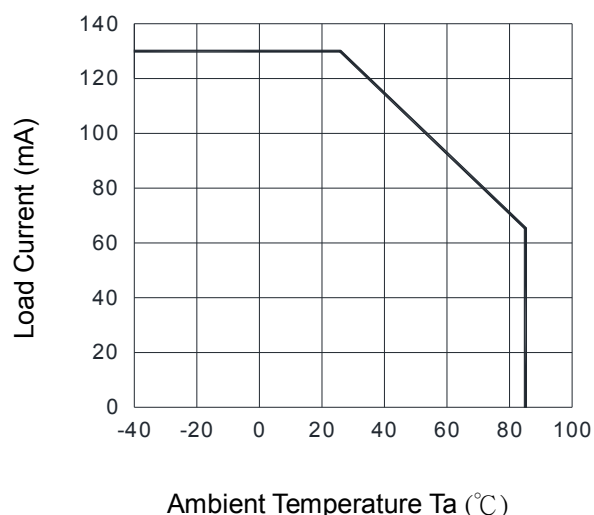
## ● Turn-on / Turn-off Time



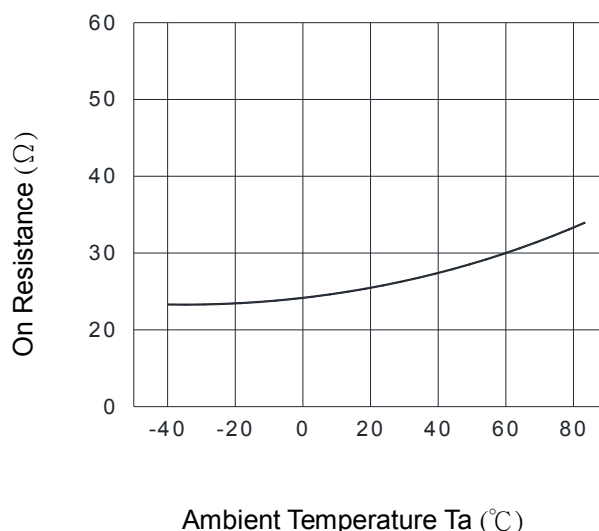
## ● Schematic and Wiring Diagrams

| Schematic                                                                         | Output Configuration | Load     | Connection | Wiring Diagrams                                                                     |
|-----------------------------------------------------------------------------------|----------------------|----------|------------|-------------------------------------------------------------------------------------|
|  | 1b                   | AC<br>DC | A          |   |
|                                                                                   |                      | DC       | B          |   |
|                                                                                   |                      | DC       | C          |  |

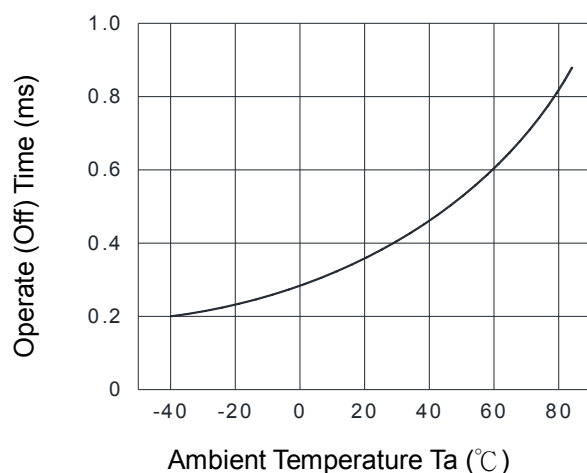
**Fig.1 Load Current vs. Ambient Temperature**



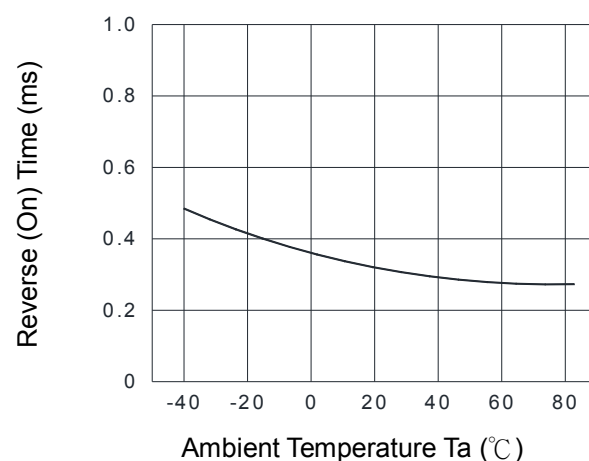
**Fig.2 On Resistance vs. Ambient Temperature**



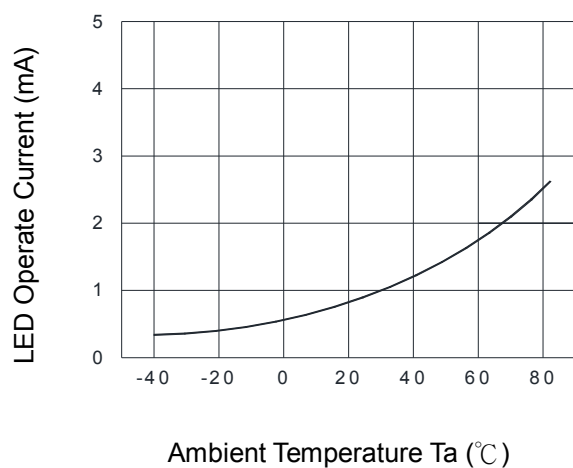
**Fig.3 Operate (OFF) Time vs. Ambient Temperature**



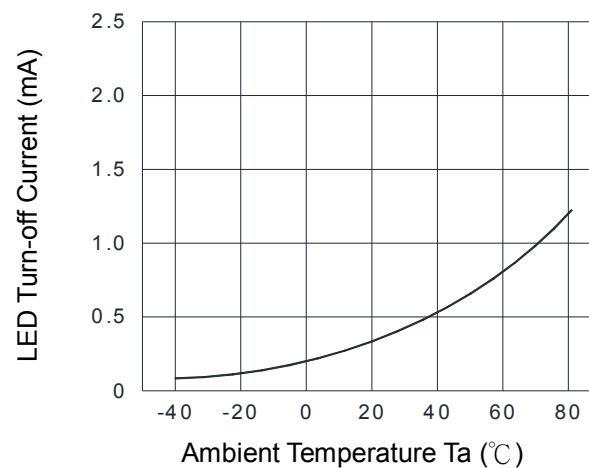
**Fig.4 Reverse (ON) Time vs. Ambient Temperature**



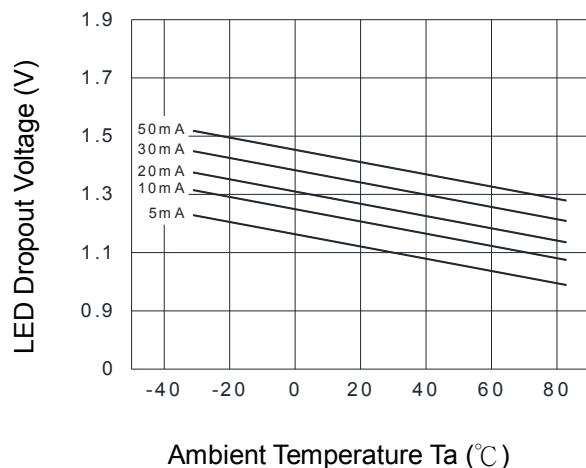
**Fig.5 LED Operate Current vs. Ambient Temperature**



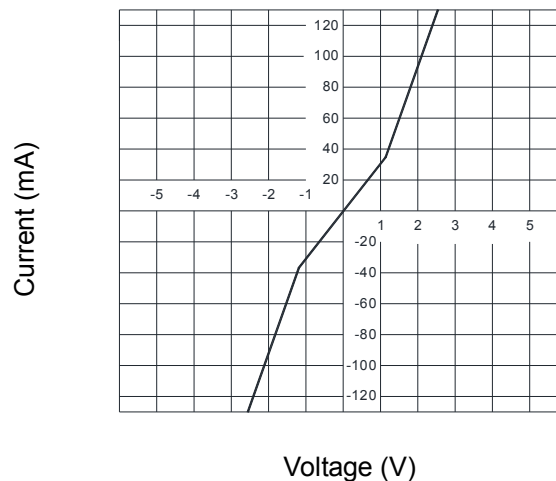
**Fig.6 LED Turn-off Current vs. Ambient Temperature**



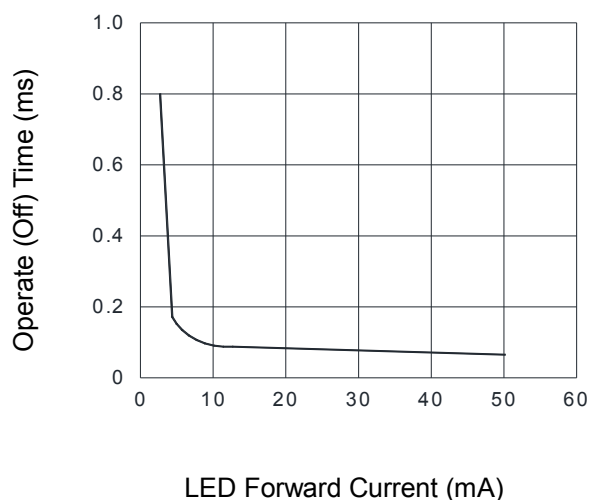
**Fig.7 LED Dropout Voltage vs. Ambient Temperature**



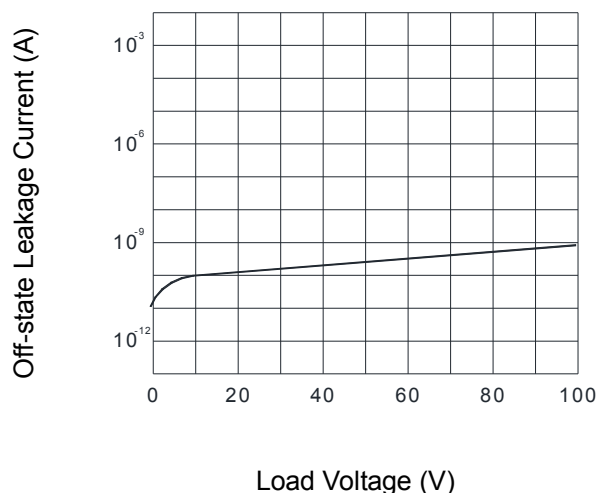
**Fig.8 Voltage vs. Current Characteristics of Output at MOSFET Portion**



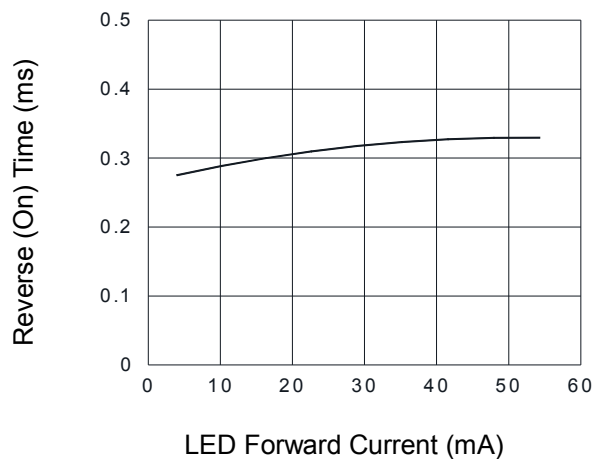
**Fig.9 Operate (OFF) Time vs. LED Forward Current**



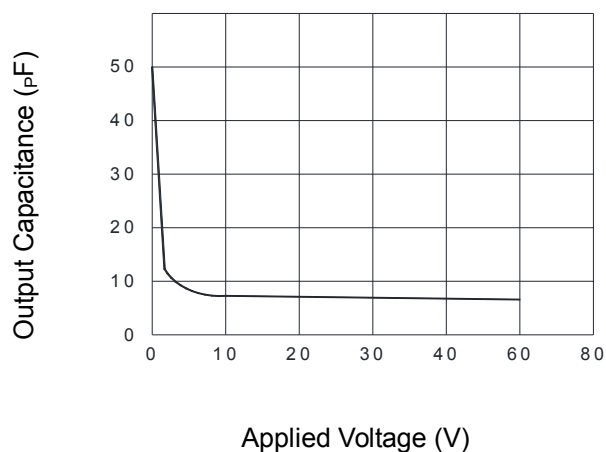
**Fig.10 Off-state Leakage Current vs. Load Voltage**



**Fig.11 Reverse (ON) Time vs. LED Forward Current**

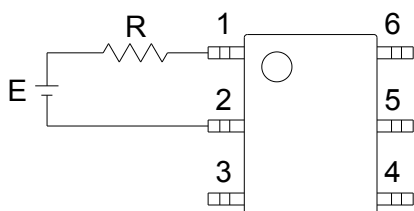


**Fig.12 Output Capacitance vs. Applied Voltage**



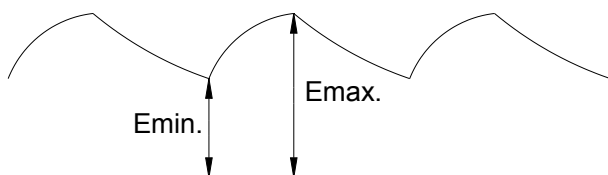
## ● Using Methods

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

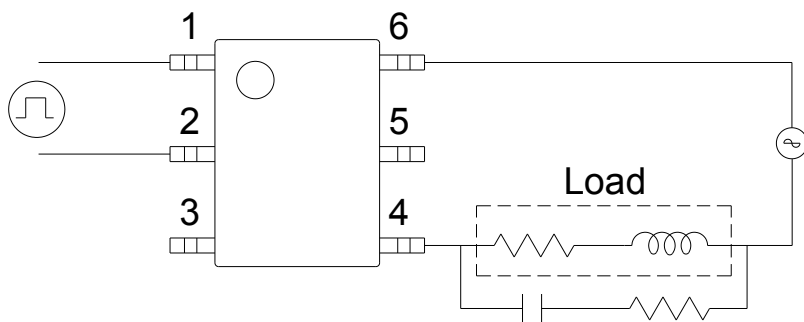
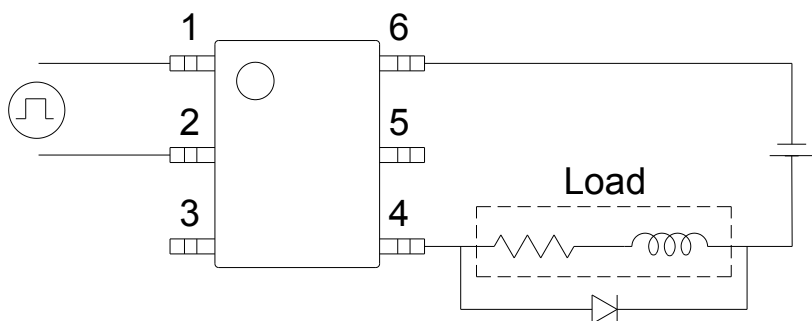


| E    | R                     |
|------|-----------------------|
| 3.3V | Approx. 330 $\Omega$  |
| 5V   | Approx. 640 $\Omega$  |
| 12V  | Approx. 1.9K $\Omega$ |
| 15V  | Approx. 2.5K $\Omega$ |
| 24V  | Approx. 4.1K $\Omega$ |

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 :



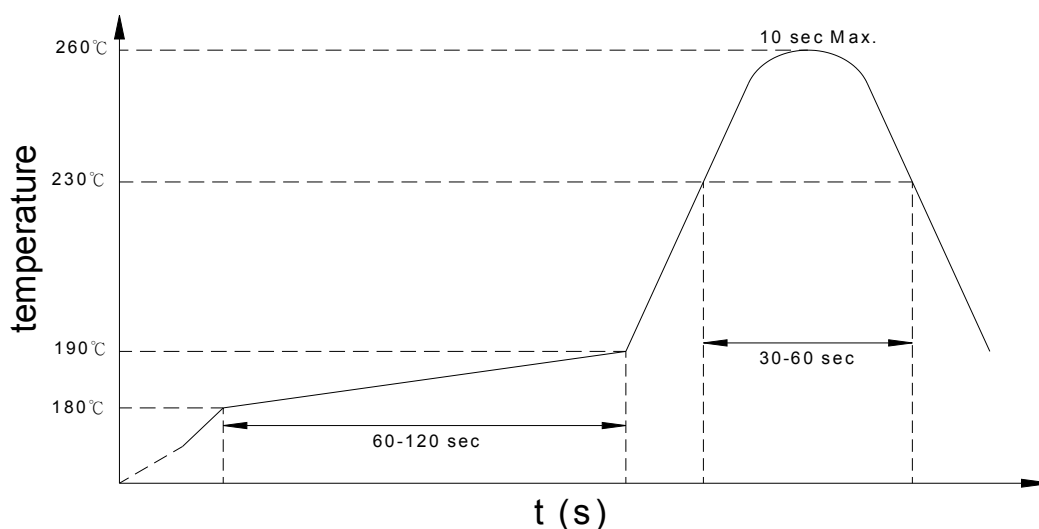
R-C Snubber

## ● 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 : Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)
- Flux :

### 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.

## ● Numbering System

### KAQV414 X (Y)

#### Note :

KAQV414 = Part No.

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

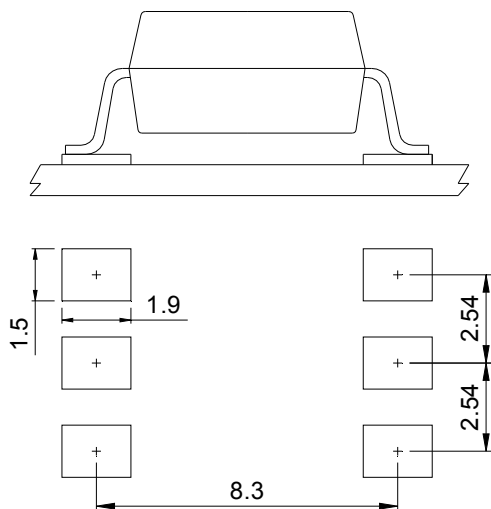
Y = Tape and reel option ( TL 、 TR )

| Option  | Description                                                          | Packing quantity    |
|---------|----------------------------------------------------------------------|---------------------|
| A (TL)  | surface mount type package + TL tape & reel option                   | 1000 units per reel |
| A (TR)  | surface mount type package + TR tape & reel option                   | 1000 units per reel |
| HA (TL) | surface mount type package + TL tape & reel option                   | 1000 units per reel |
| HA (TR) | surface mount type package + TR tape & reel option                   | 1000 units per reel |
| S (TL)  | small outline for surface mount type package + TL tape & reel option | 2000 units per reel |
| S (TR)  | small outline for surface mount type package + TR tape & reel option | 2000 units per reel |

## ● Recommended Pad Layout for Surface Mount Lead Form

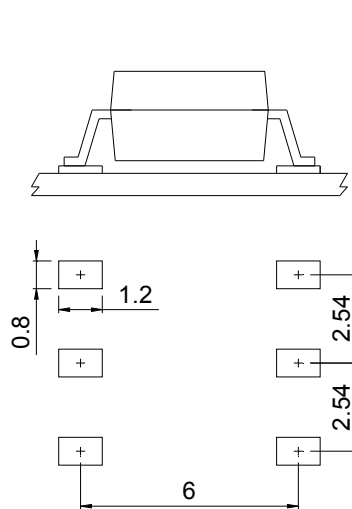
### 1. Surface mount type.

6-pin SMD



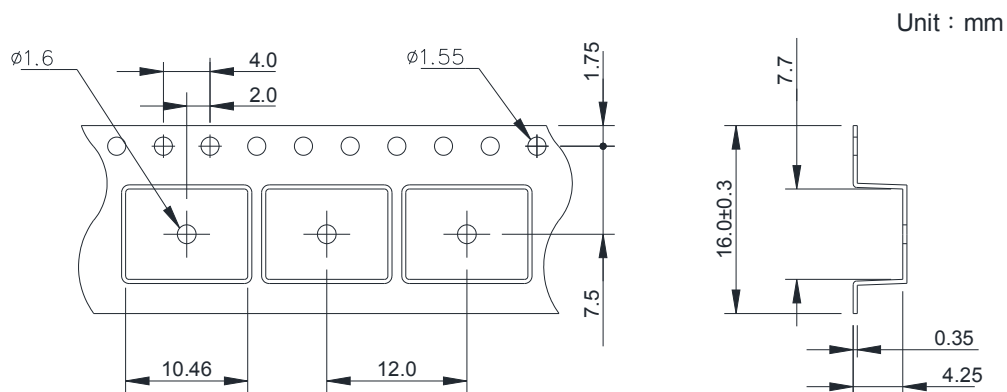
### 2. Small outline for surface mount type.

6-pin SOP

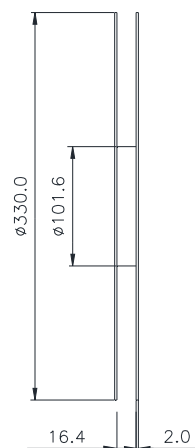
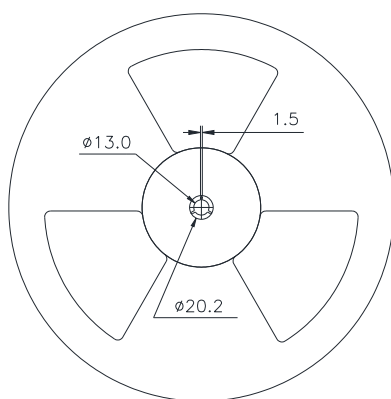
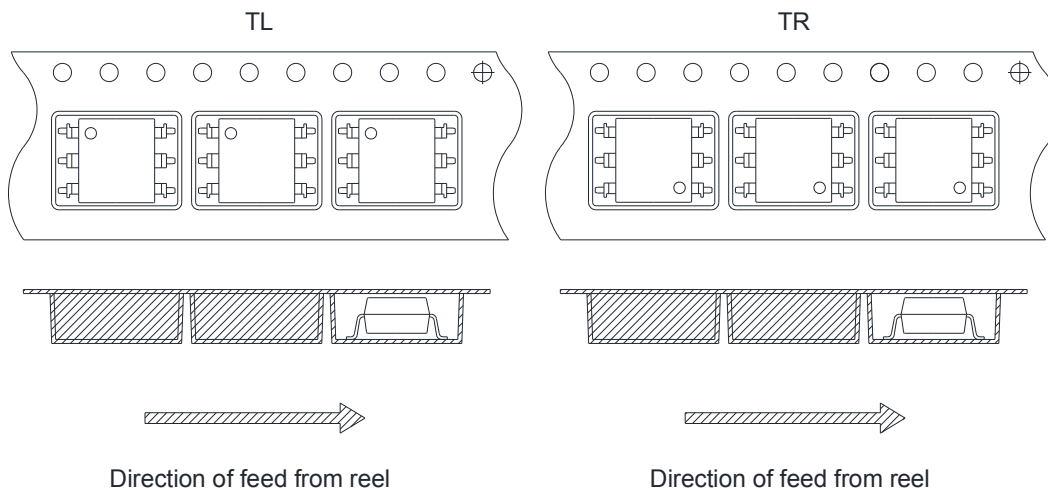


Unit : mm

● 6-pin SMD Carrier Tape & Reel

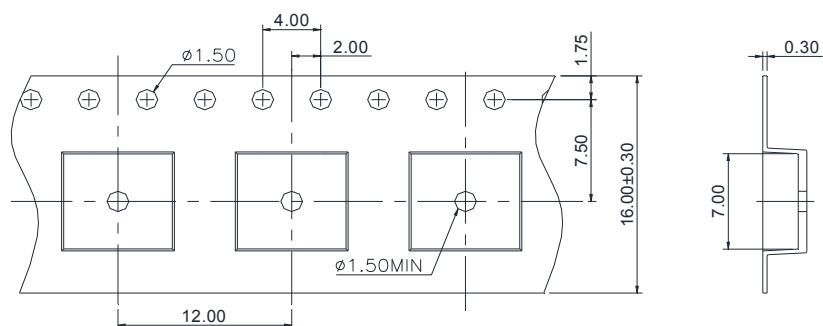


TOLERANCE :  $\pm 0.2\text{mm}$



## ● 6-pin SOP Carrier Tape & Reel

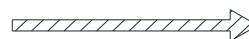
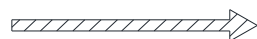
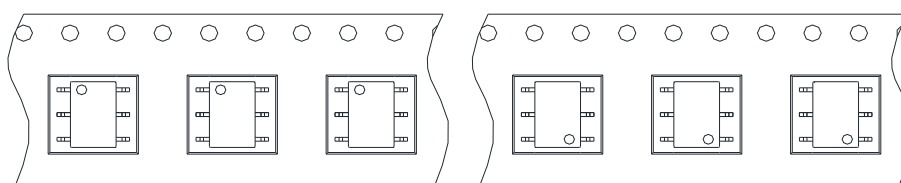
Unit : mm



TOLERANCE :  $\pm 0.2\text{mm}$

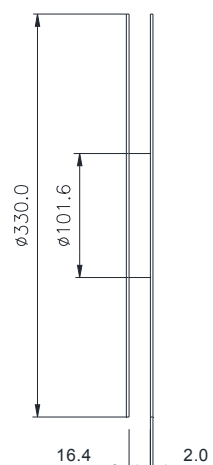
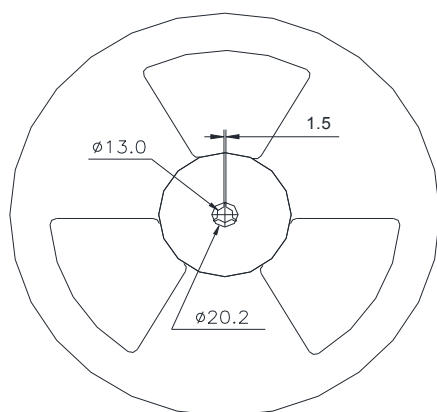
TL

TR



Direction of feed from reel

Direction of feed from reel



## ● Application Notice

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- b. OA machine
- c. Audio / Video
- d. Instrumentation
- e. Electrical application
- f. Measurement equipment
- g. Consumer electronics
- h. Telecommunication

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- d. Nuclear power control
- e. Equipment used for automotive vehicles, trains, ships...etc.

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