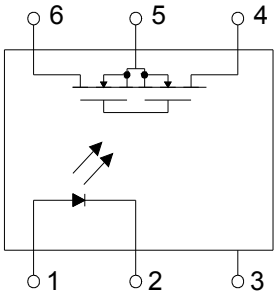
# KAQV414 Series

## 6PIN 400V N.C. TYPE
## SOLID STATE RELAY-MOSFET OUTPUT

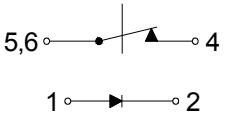
## Description

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 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: EN60950

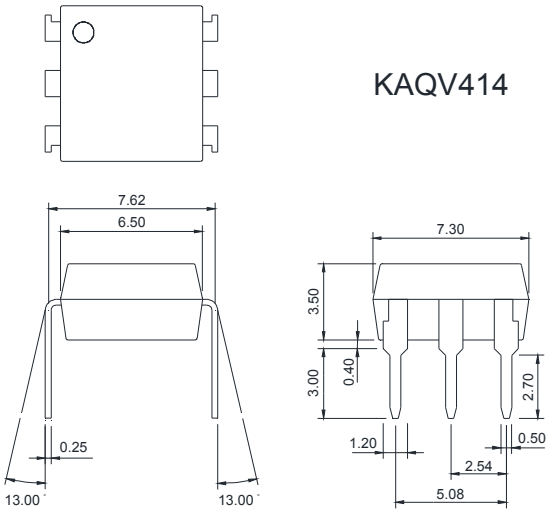
## Application

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

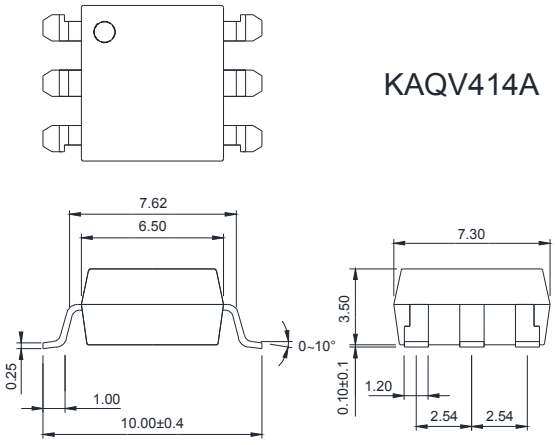
## ● Outside Dimension

Unit：mm

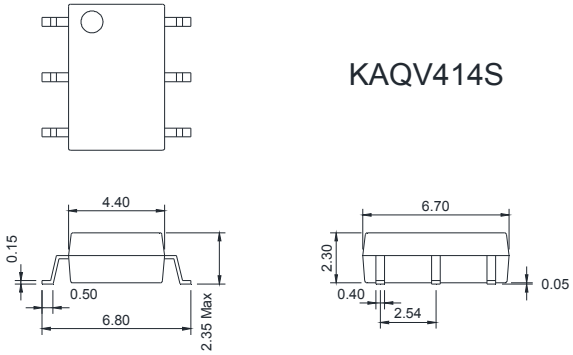
1. Dual-in-line type.




2. Surface mount type.

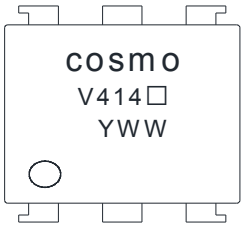



3. Small outline for surface mount type.




TOLERANCE：±0.2mm

## ● Device Marking




**Notes：**

cosmo

V414□ □：Pin forming

YWW Y：Year code / W：Week code

## ● Absolute Maximum Ratings

(Ta=25℃)

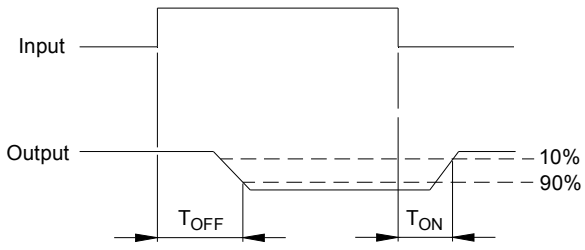
| Item | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Input | Continuous forward current | $I_F$ | 50 | mA |
| | Peak forward current | $I_{FP}$ | 1 | A |
| | Reverse voltage | $V_R$ | 5 | V |
| | Power dissipation | $P_{in}$ | 100 | mW |
| | Derate linearly from 25℃ | - | 1.3 | mW/℃ |
| Output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

## ● Electro-optical Characteristics

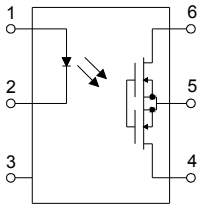
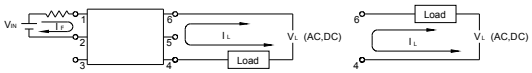
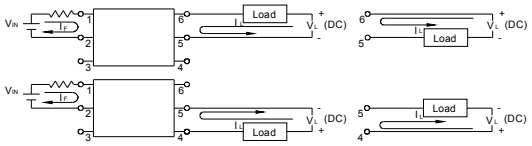
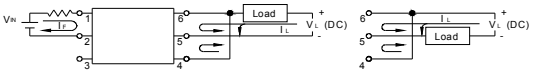
(Ta=25℃)

| Parameter | | | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Input | Forward voltage | | $V_F$ | $I_F$=10mA | - | 1.2 | 1.5 | V |
| | Operation input current | | $I_{FOFF}$ | $V_L$=20V, $I_L \leqq$5μA | - | - | 3.0 | mA |
| | Recovery input current | | $I_{FON}$ | $V_L$=20V, $I_L$=100mA | 0.2 | - | - | mA |
| Output | Breakdown voltage | | $V_B$ | $I_B$=50μA, $I_F$=10mA | 400 | - | - | V |
| | Off-state leakage current | | $I_{LEAK}$ | $V_L$=100V, $I_F$=5mA | - | 1.0 | 2.0 | μA |
| I/O capacitance | | | $C_{iso}$ | $V_B$=0V, f=1MHz | - | 6 | - | pF |
| ON resistance | Connection | A | $R_{ON}$ | $I_F$=0mA, $I_L$=100mA | - | 25 | 50 | Ω |
| | | B | | | - | 13 | 25 | |
| | | C | | | - | 7 | 12.5 | |
| Reverse (ON) time | | | $T_{ON}$ | $I_F$=10mA, $V_L$=20V | - | 0.6 | 1.5 | ms |
| Operate (OFF) time | | | $T_{OFF}$ | $I_L$=100mA, t=10ms | - | 0.3 | 1.0 | ms |

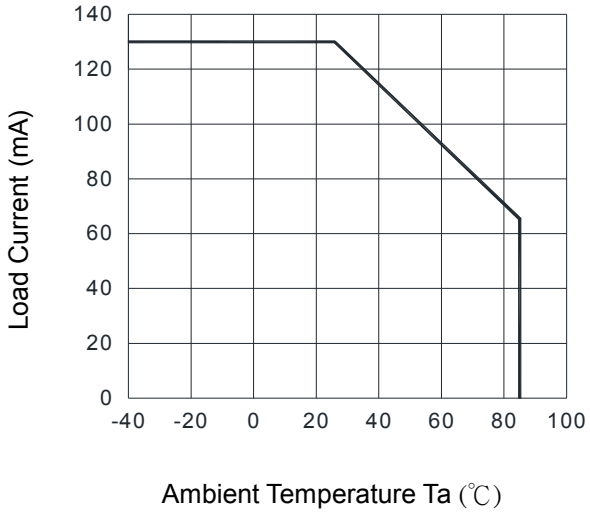
## ● Turn-on / Turn-off Time



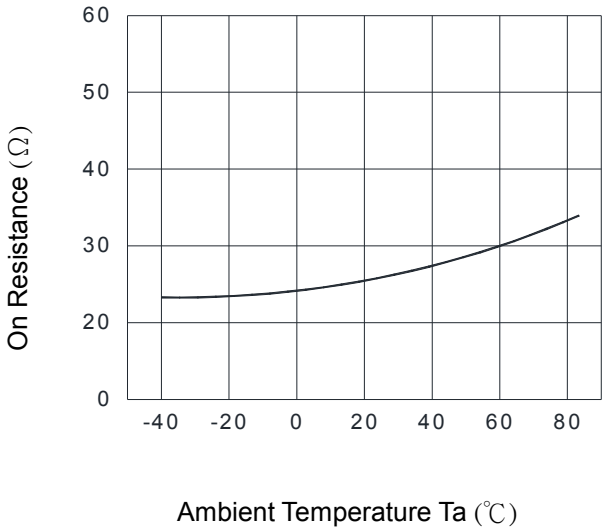
## ● Schematic and Wiring Diagrams

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

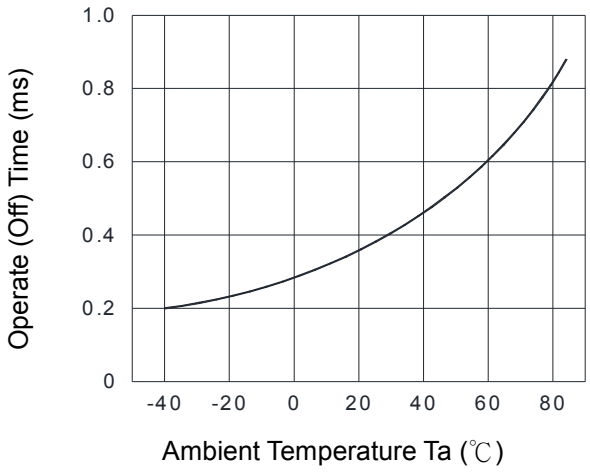
## Fig.1 Load Current vs. Ambient Temperature



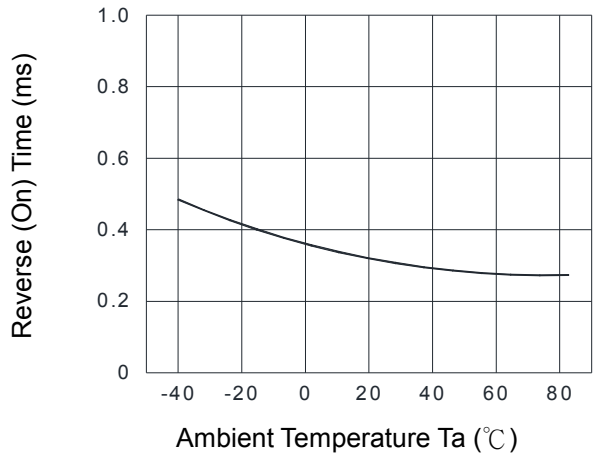

## Fig.2 On Resistance vs. Ambient Temperature



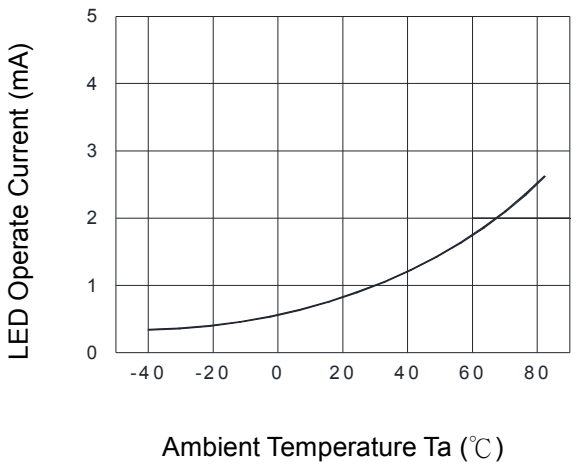

## Fig.3 Operate (OFF) Time vs. Ambient Temperature




## 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

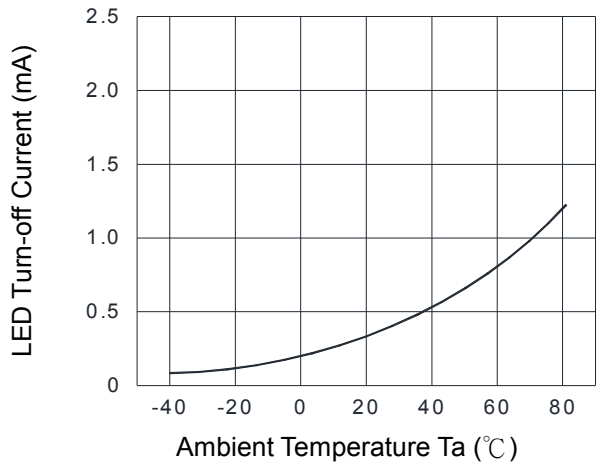


**Fig.7 LED Dropout Voltage vs. Ambient Temperature**

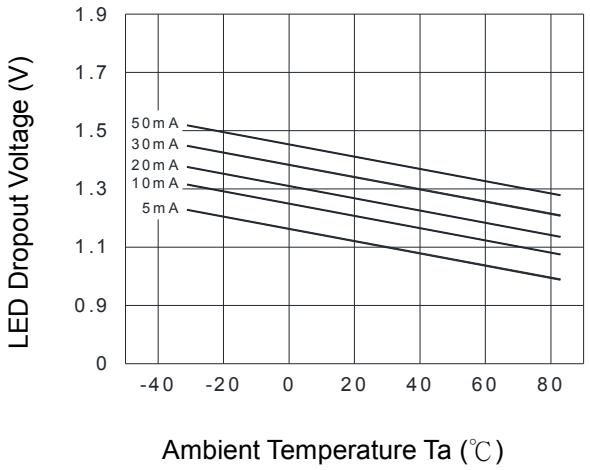



**Fig.8 Voltage vs. Current Characteristics of Output at MOSFET Portion**

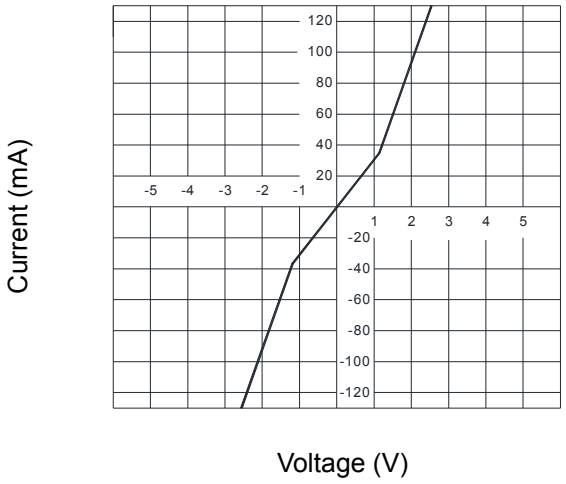



**Fig.9 Operate (OFF) Time vs. LED Forward Current**

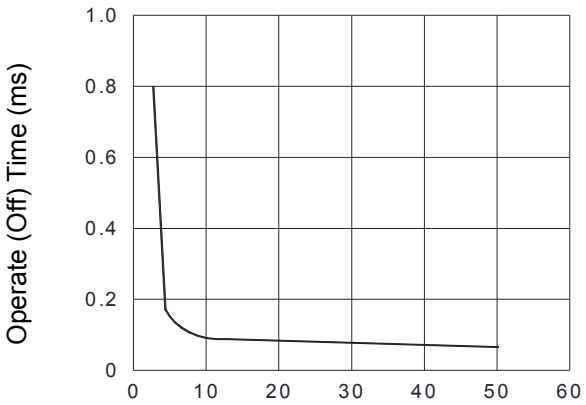



**Fig.10 Off-state Leakage Current vs. Load Voltage**

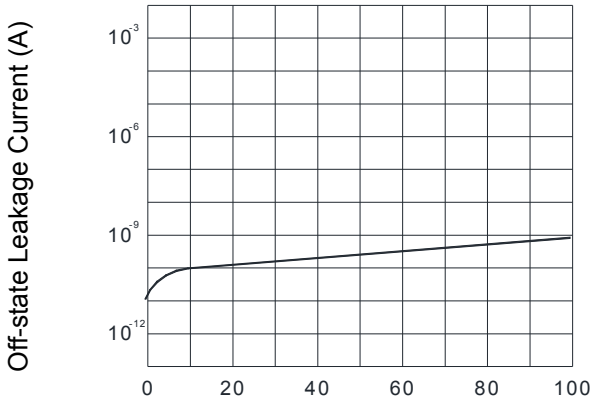



**Fig.11 Reverse (ON) Time vs. LED Forward Current**

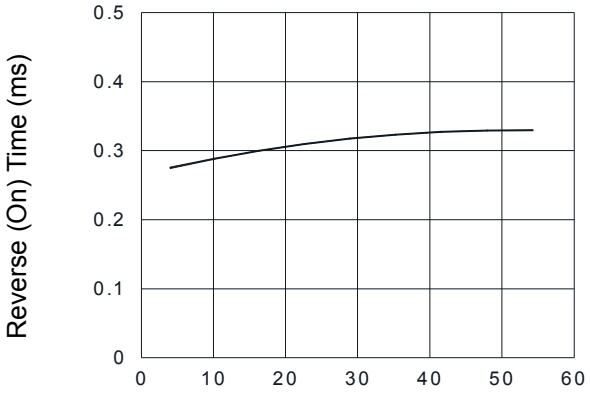
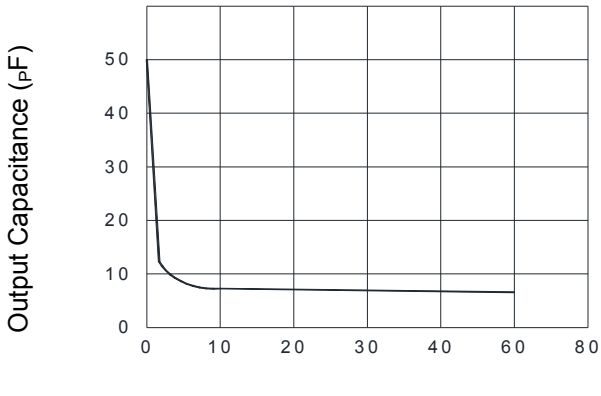
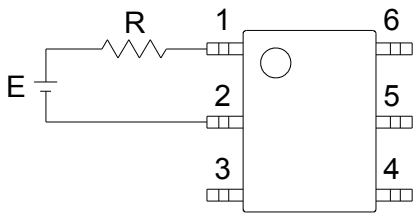



**Fig.12 Output Capacitance vs. Applied Voltage**



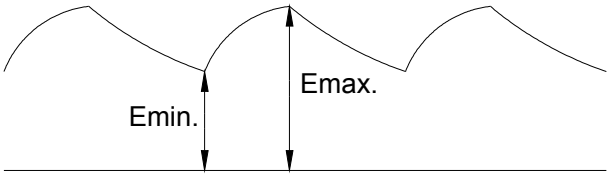
## ● Using Methods

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

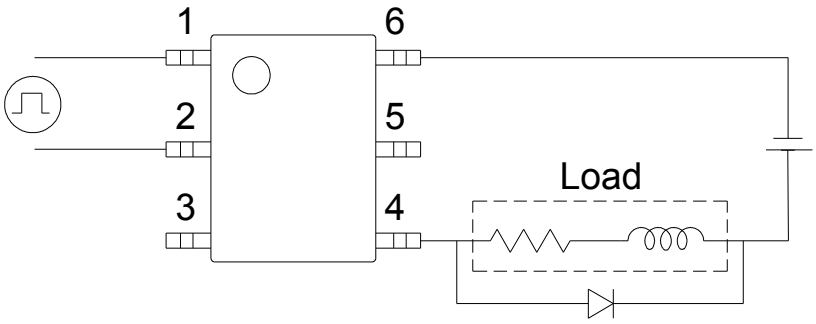


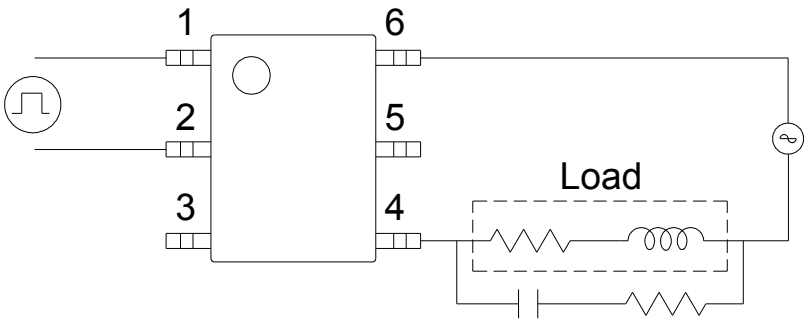

| E | R |
|---|---|
| 3.3V | Approx. 330 Ω |
| 5V | Approx. 640 Ω |
| 12V | Approx. 1.9K Ω |
| 15V | Approx. 2.5K Ω |
| 24V | Approx. 4.1K Ω |

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：



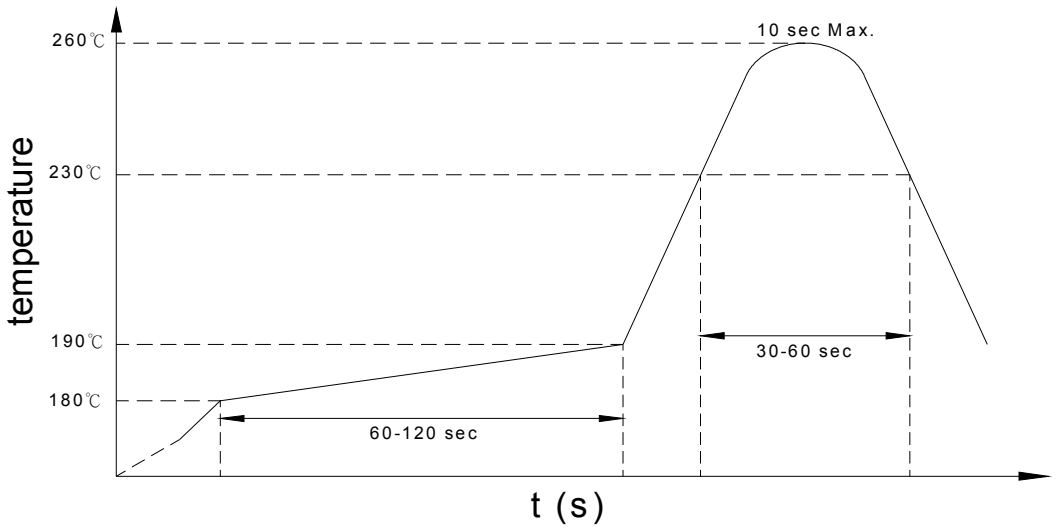

R-C Snubber

## Recommended Soldering Conditions

**(a) Infrared reflow soldering：**

- Peak reflow soldering： 260℃ 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
- Number of reflows： 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)
- 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 or A )

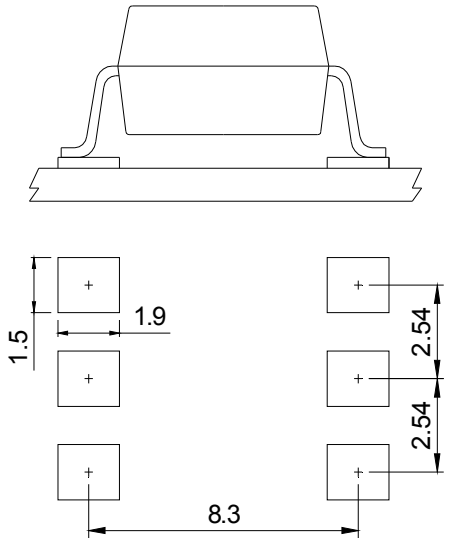
Y = Tape and reel option ( TL、TR )

| 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 |
| 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**

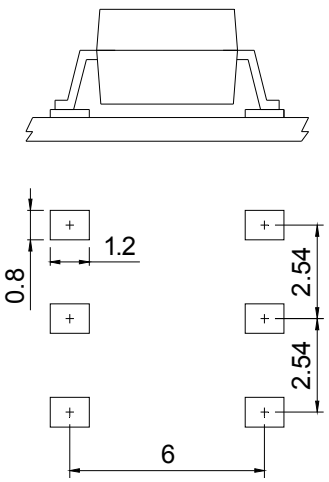
**1. Surface mount type.**

**6-pin SMD**




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

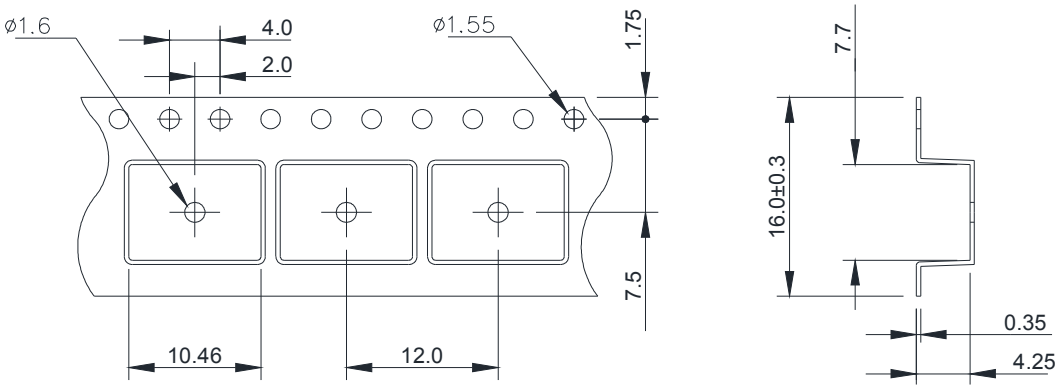
**6-pin SOP**




Unit：mm

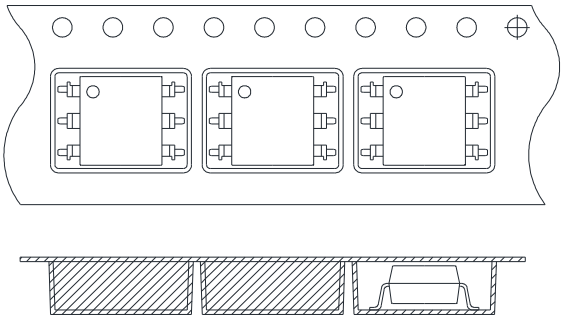
## ● 6-pin SMD Carrier Tape & Reel

Unit：mm



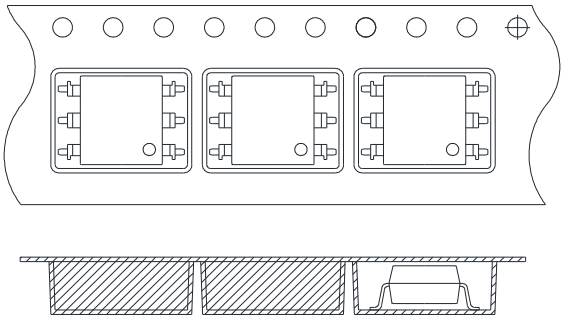

TOLERANCE：±0.2mm

TL

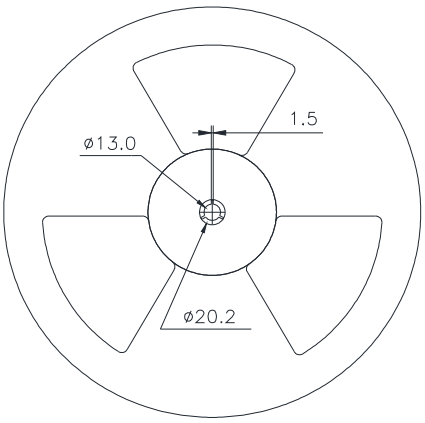


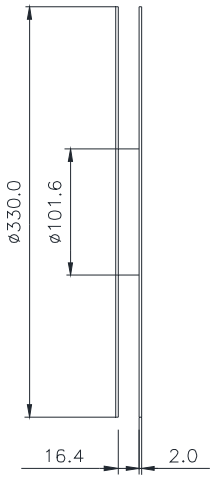
Direction of feed from reel

TR



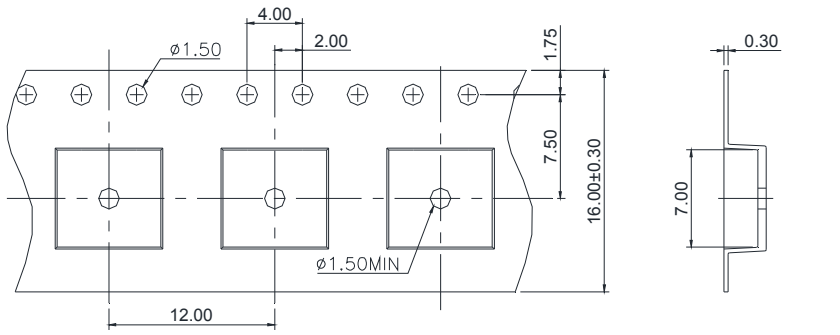
Direction of feed from reel



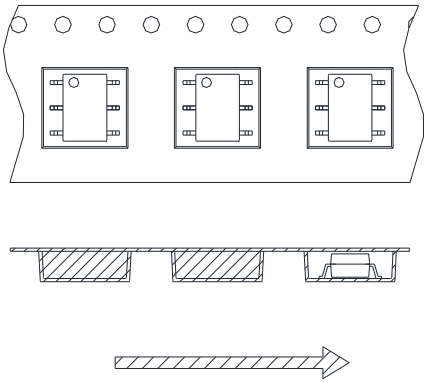
## ● 6-pin SOP Carrier Tape & Reel

Unit：mm



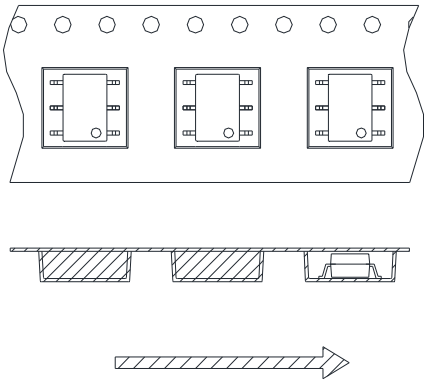

TOLERANCE：±0.2mm

TL

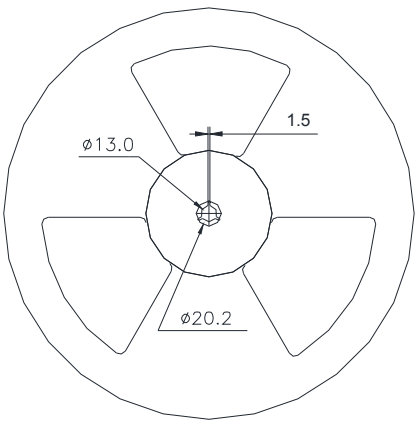


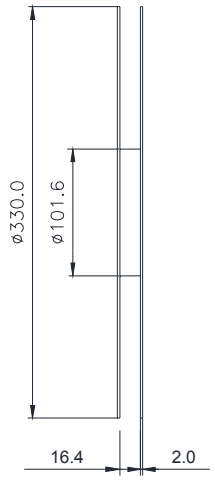
Direction of feed from reel

TR



Direction of feed from reel



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It would be required to comply with the absolute maximum ratings listed in the specification. cosmo has no liability and responsibility to the damage caused by improper use of the products.

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

cosmo devices shall not be used or related with equipment requiring higher level of quality / reliability, or malfunction, or failure which may cause loss of human life, bodily injury, includes, without limitation:
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b. Space application
c. Telecommunication equipment (trunk lines)
d. Nuclear power control
e. Equipment used for automotive vehicles, trains, ships...etc.

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