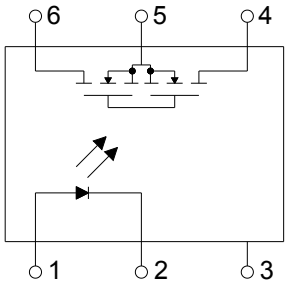
# KAQV213 Series

## 6PIN 250V N.O TYPE
## SOLID STATE RELAY-MOSFET OUTPUT

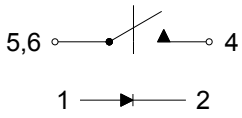
## Description

The KAQV213 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.

## Schematic




1 FORM A
NORMALLY OPEN




## Features

1. Normally open, single pole single throw
2. Control 250V AC or DC voltage
3. Switch 200mA 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：
   - UL1577 / CUL C22.2 No.1 & NTC No.5, File No. E169586
   - UL 508 / CUL C22.2 No.14-M91, File No. E108430
   - VDE EN60747-5-2 , File No. 40020973

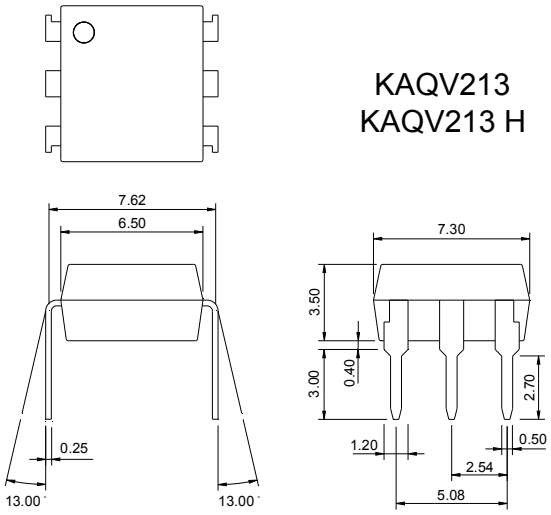
## Application

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

## ● Outside Dimension

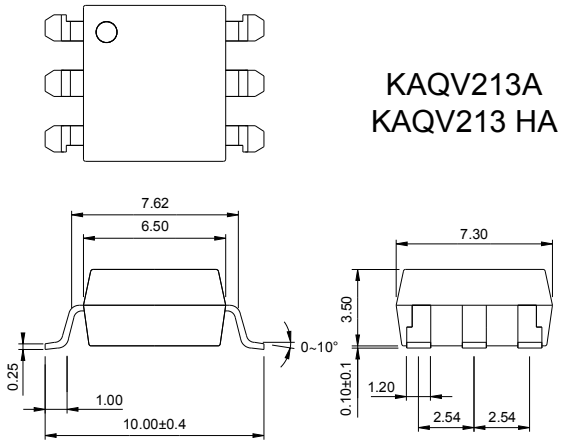
Unit：mm

1. Dual-in-line type.



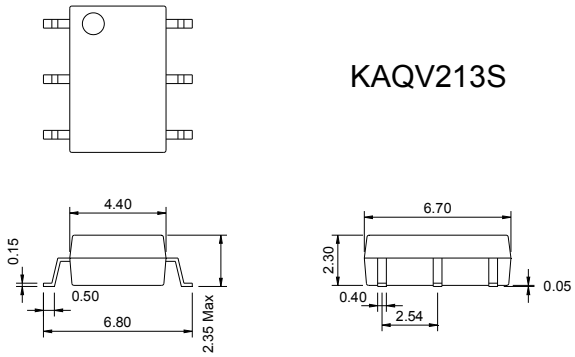

KAQV213
KAQV213 H

2. Surface mount type.




KAQV213A
KAQV213 HA

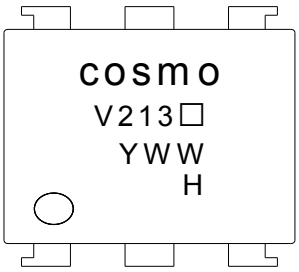
3. Small outline for surface mount type.




KAQV213S

TOLERANCE：±0.2mm

## ● Device Marking




**Notes：**

cosmo
V213□ □：Pin forming
YWW Y：Year code / W：Week code
H High isolation voltage series only

## ● Absolute Maximum Ratings

(Ta=25℃)

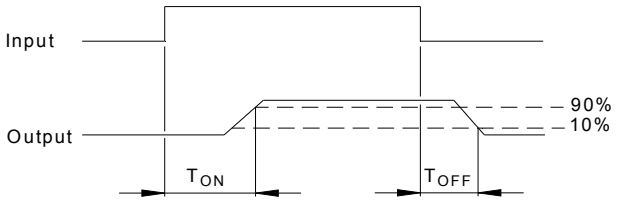
| Item | | Symbol | Rating | | Unit |
|---|---|---|---|---|---|
| Input | Continuous forward current | $I_F$ | 50 | | mA |
| | Peak forward current | $I_{FP}$ | 1 | | A |
| | Reverse voltage | $V_R$ | 5 | | V |
| | Power dissipation | $P_{in}$ | 100 | | mW |
| | Derate linearly from 25℃ | - | 1.3 | | mW/℃ |
| Output | Breakdown voltage | $V_B$ | 250 | | V |
| | Continuous load current | $I_L$ | 200 | | mA |
| | Power dissipation | $P_{out}$ | 500 | | mW |
| Isolation voltage | | $V_{iso}$ | **KAQV213S** | **KAQV213** | **KAQV213H** |
| | | | 1500Vrms | 3750Vrms | 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

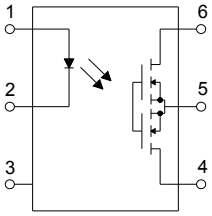
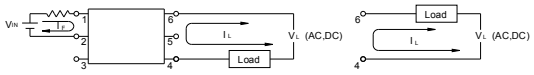
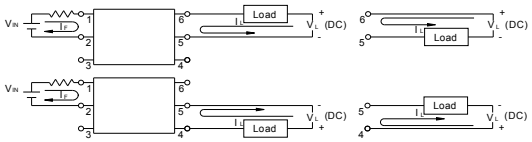
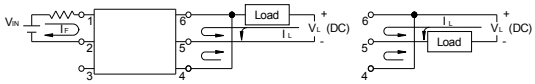
(Ta=25℃)

| Parameter | | | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Input | Forward voltage | | $V_F$ | $I_F$=10mA | - | 1.2 | 1.5 | V |
| | Operation input current | | $I_{FON}$ | $V_L$=20V, $I_L$=100mA | - | - | 3.0 | mA |
| | Recovery input current | | $I_{FOFF}$ | $V_L$=20V, $I_L \leqq$ 5μA | 0.2 | - | - | mA |
| Output | Breakdown voltage | | $V_B$ | $I_B$=50μA | 250 | - | - | V |
| | Off-state leakage current | | $I_{LEAK}$ | $V_L$=250V, $I_F$=0mA | - | 0.2 | 1.0 | μA |
| I/O capacitance | | | $C_{iso}$ | $V_B$=0V, f=1MHz | - | 6 | - | pF |
| ON resistance | Connection | A | $R_{ON}$ | $I_F$=10mA, $I_L$=100mA | - | 8 | 16 | Ω |
| | | B | | | - | 4 | 8 | |
| | | C | | | - | 2 | 4 | |
| Turn-on time | | | $T_{ON}$ | $I_F$=10mA, $V_L$=20V | - | 0.3 | 1.0 | ms |
| Turn-off time | | | $T_{OFF}$ | $I_L$=100mA, t=10ms | - | 0.1 | 1.5 | ms |

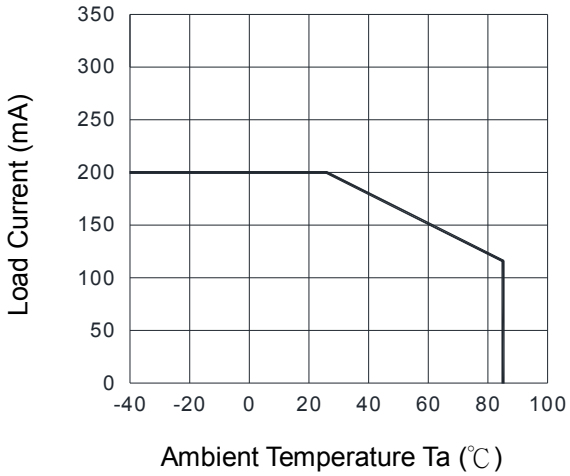
## ● Turn-on / Turn-off Time



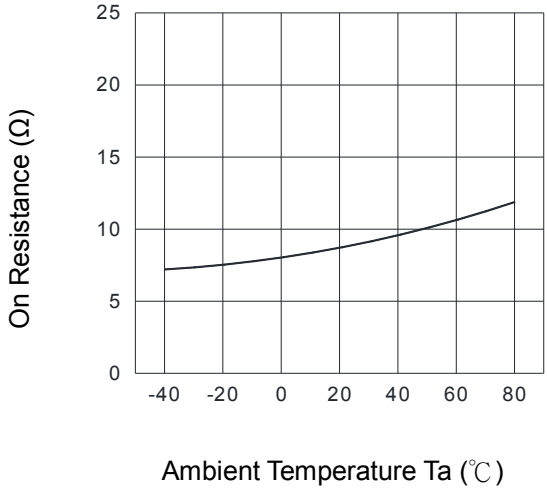
## ● Schematic and Wiring Diagrams

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

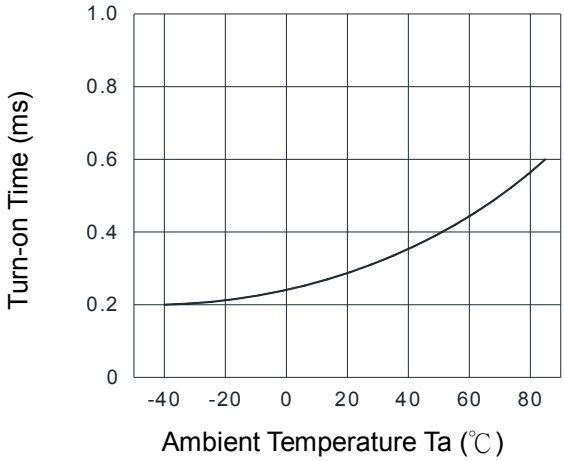
## Fig.1 Load Current vs. Ambient Temperature



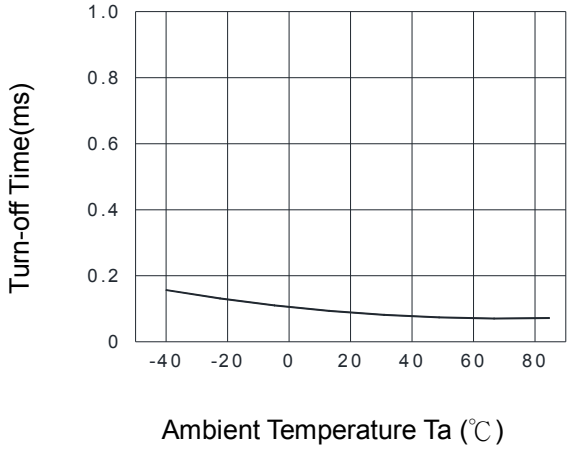

## Fig.2 On Resistance vs. Ambient Temperature



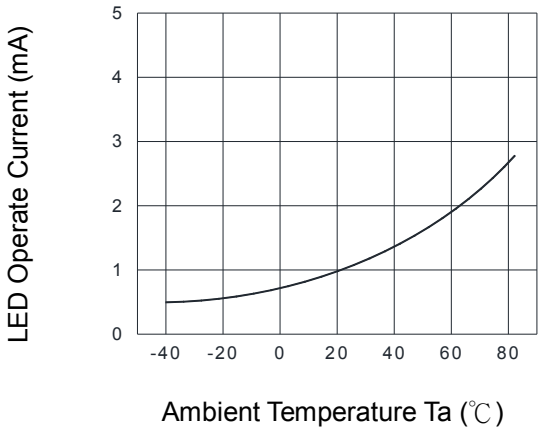

## Fig.3 Turn-on Time vs. Ambient Temperature




## 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

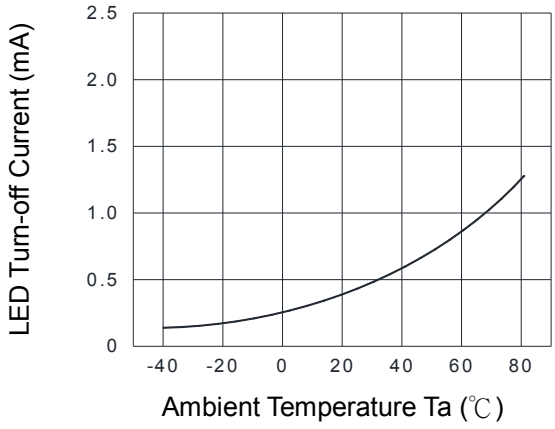


**Fig.7 LED Dropout Voltage vs. Ambient Temperature**

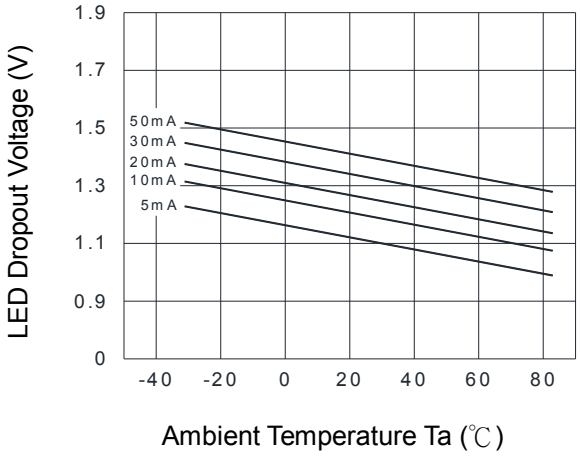



**Fig.8 Voltage vs. Current Characteristics of Output at MOSFET Portion**

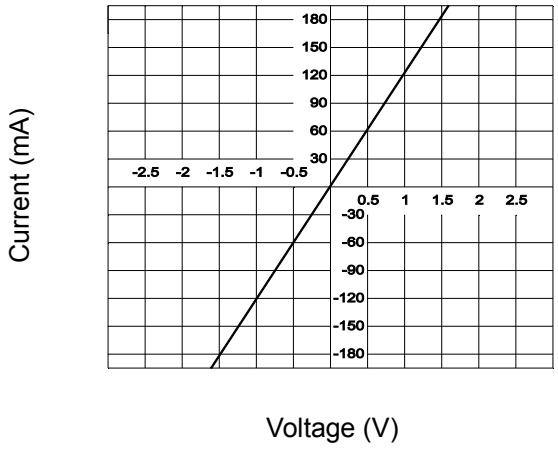



**Fig.9 Turn-on Time vs. LED Forward Current**

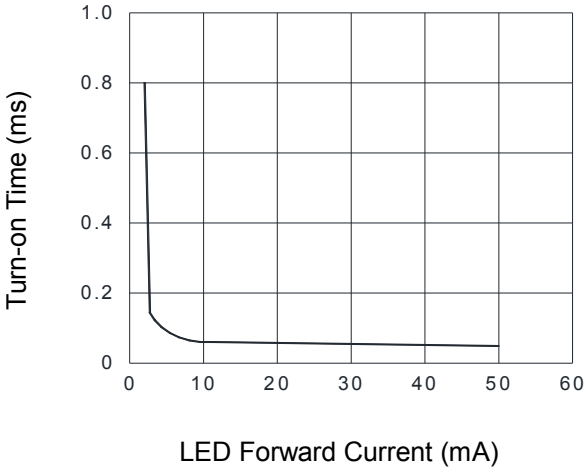



**Fig.10 Off-state Leakage Current vs. Load Voltage**

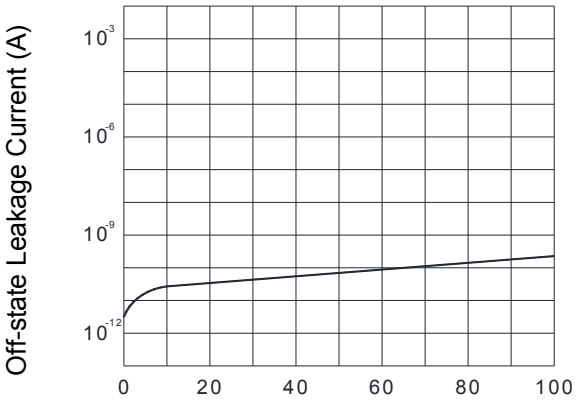



**Fig.11 Turn-off Time vs. LED Forward Current**

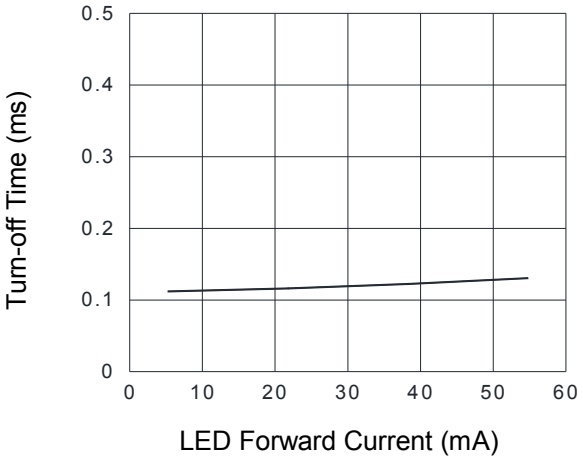
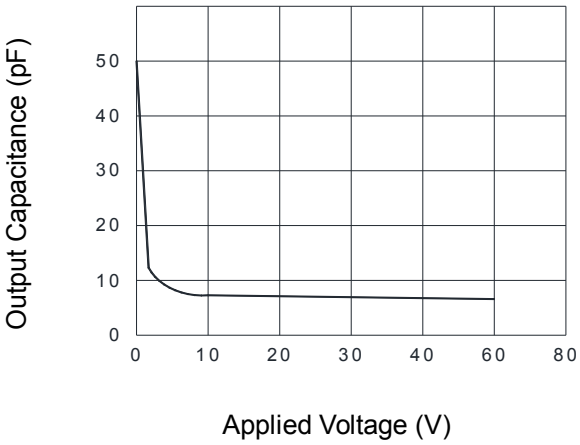
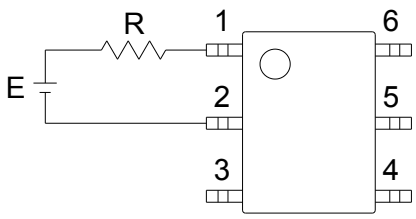



**Fig.12 Output Capacitance vs. Applied Voltage**



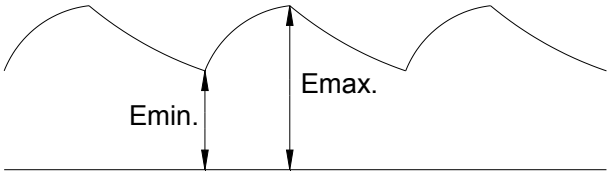
## Using Methods

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

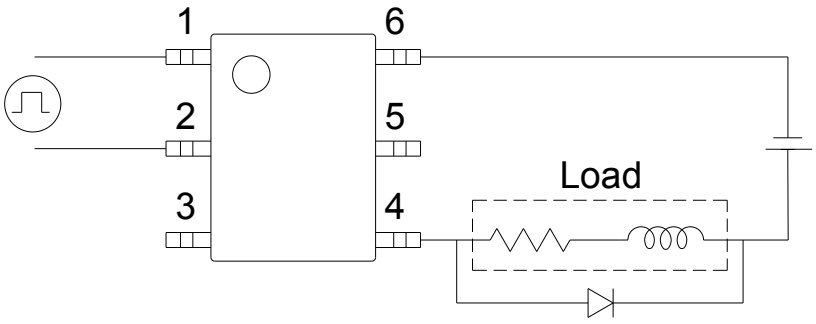


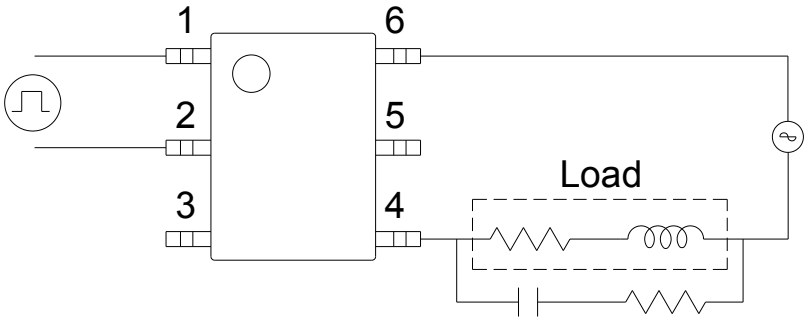

| E | R |
|---|---|
| 3.3V | Approx. 330 Ω |
| 5V | Approx. 640 Ω |
| 12V | Approx. 1.9K Ω |
| 15V | Approx. 2.5K Ω |
| 24V | Approx. 4.1K Ω |

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：



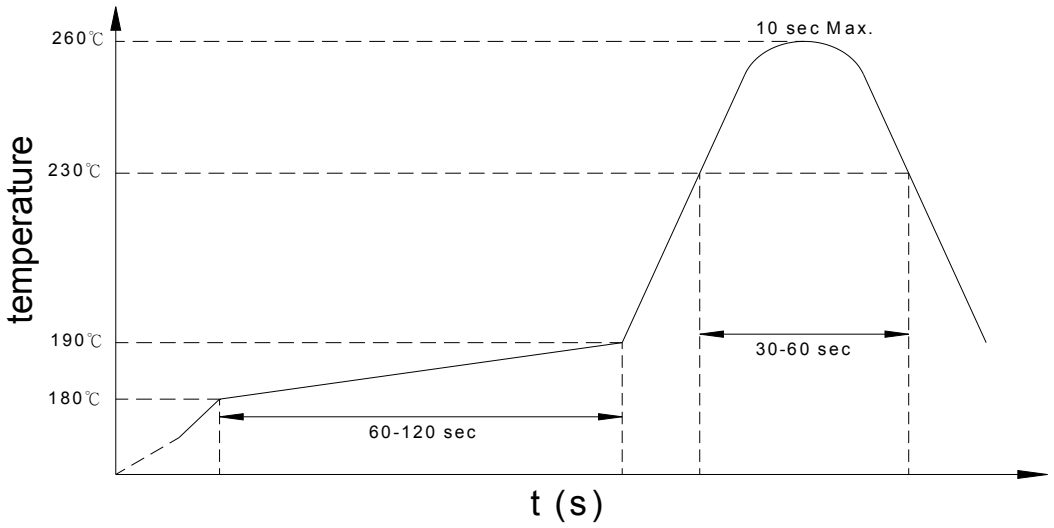

R-C Snubber

## 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**

## KAQV213 X (Y)

**Note：**

KAQV213 = Part No.

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

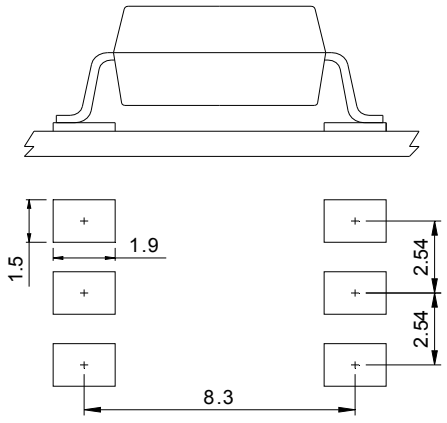
Y = Tape and reel option ( TL、TR )

| 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 + TL 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**

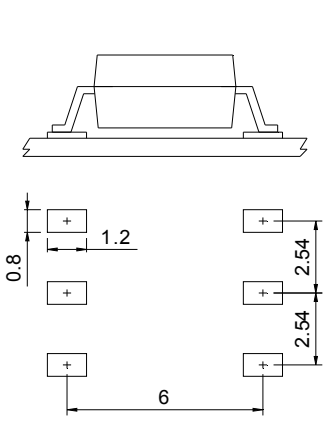
**1. Surface mount type.**

**6-pin SMD**




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

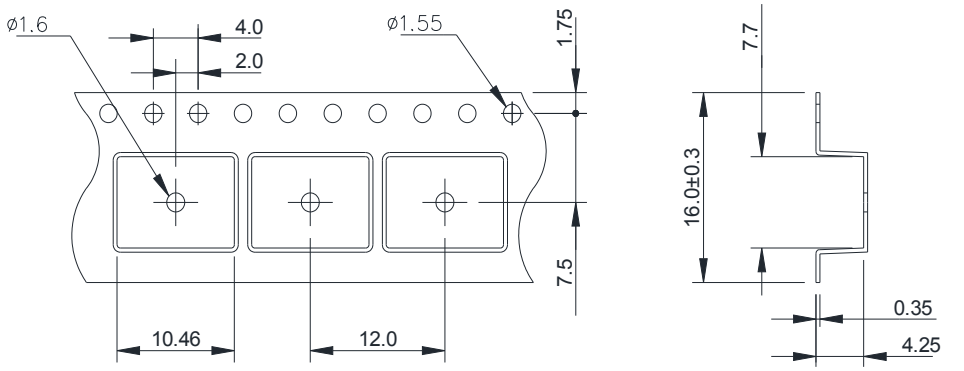
**6-pin SOP**



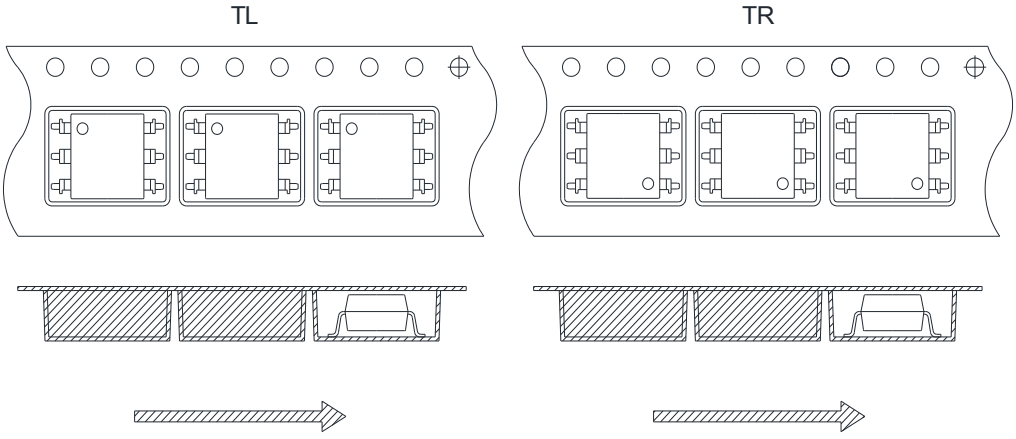

Unit：mm

## ● 6-pin SMD Carrier Tape & Reel

Unit：mm

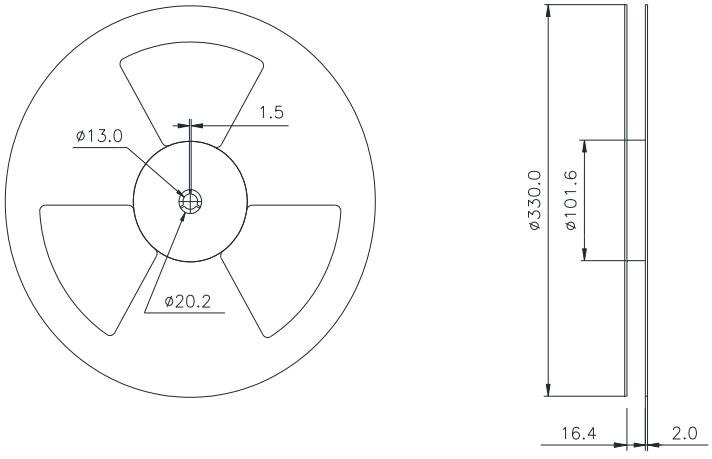



TOLERANCE：±0.2mm



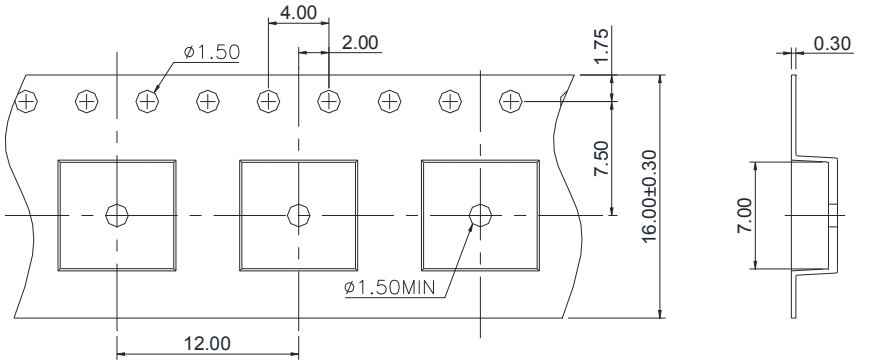

Direction of feed from reel

Direction of feed from reel



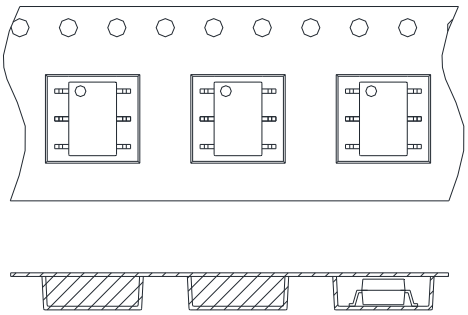
## ● 6-pin SOP Carrier Tape & Reel

Unit：mm



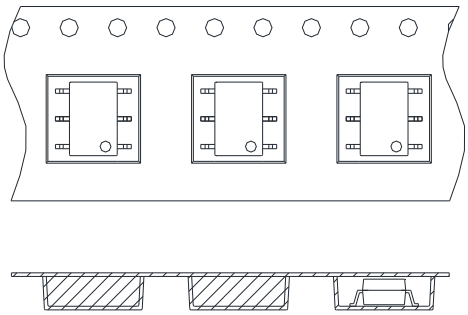

TOLERANCE：±0.2mm

TL

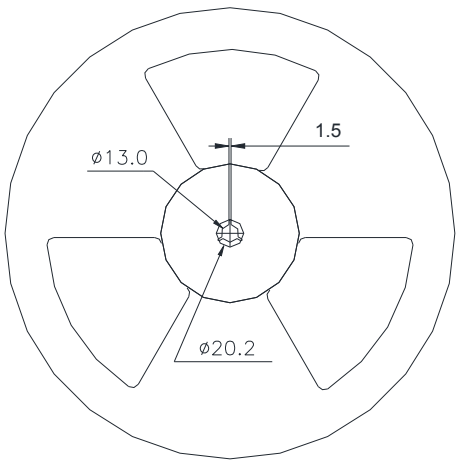


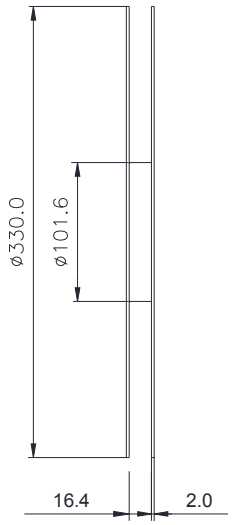
Direction of feed from reel

TR



Direction of feed from reel



## Application Notice

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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.

cosmo products are intended to be designed for use in general electronics application list below:
a. Personal computer
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:
a. Medical and other life supporting equipments
b. Space application
c. Telecommunication equipment (trunk lines)
d. Nuclear power control
e. Equipment used for automotive vehicles, trains, ships...etc.