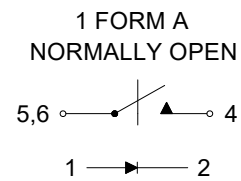
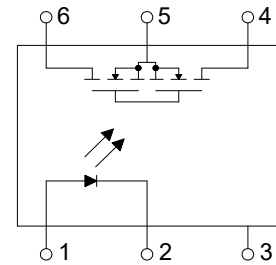


## ● Description

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



## ● 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 5KV (DIP / SMD)
8. Pb free and RoHS compliant
9. MSL class 1
10. Agency Approvals :
  - UL Approved (No. E169586, E108430): UL1577, UL508
  - c-UL Approved (No. E169586, E108430)
  - VDE Approved (No. 40053989): EN60747-5-5

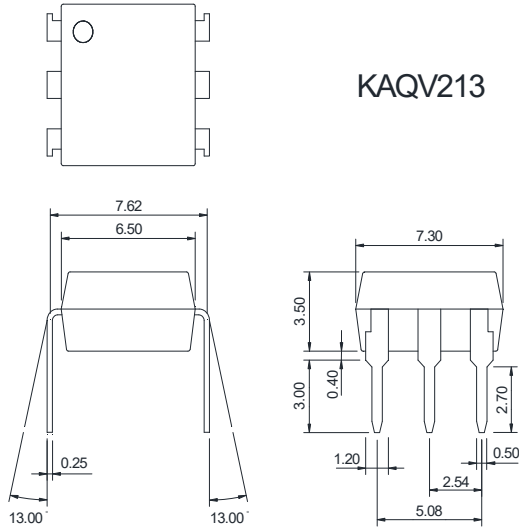
## ● Application

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

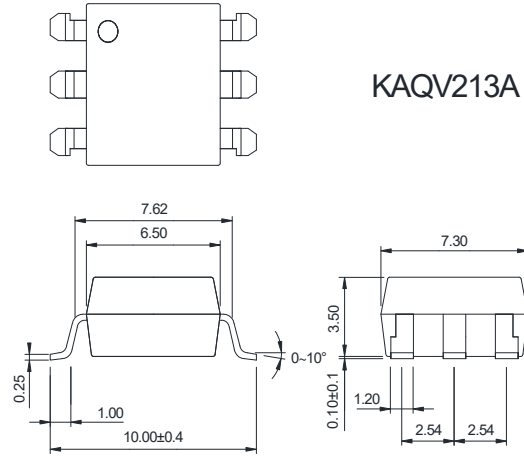
● **Outside Dimension**

Unit : mm

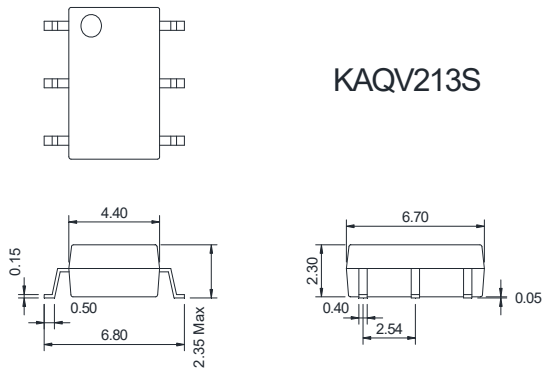
1. Dual-in-line type.



2. Surface mount type.

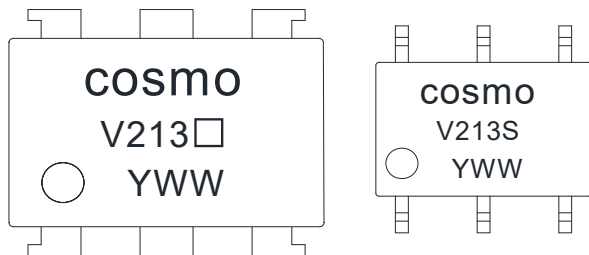


3. Small outline for surface mount type.



TOLERANCE : ±0.2mm

● **Device Marking**



**Notes :**

- cosmo**  
 V213 □ □ (Blank): DIP or SMD  
 V213S S : SOP  
 YWW Y : Year code / W : Week code

● **Absolute Maximum Ratings**

(Ta=25°C)

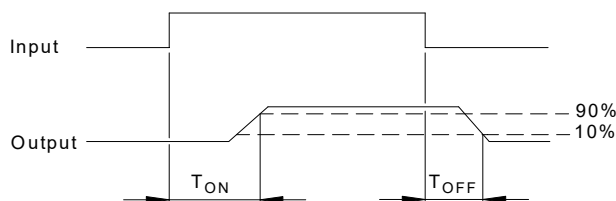
Item		Symbol	Rating	Unit
Input	Continuous forward current	$I_F$	50	mA
	Peak forward current	$I_{FP}$	1	A
	Reverse voltage	$V_R$	5	V
	Power dissipation	$P_{in}$	100	mW
	Derate linearly from 25°C	-	1.3	mW/°C
Output	Breakdown voltage	$V_B$	250	V
	Continuous load current	$I_L$	200	mA
	Power dissipation	$P_{out}$	500	mW
Isolation voltage		$V_{iso}$	<b>KAQV213S</b> 1500Vrms	<b>KAQV213</b> 5000Vrms
Isolation resistance (Vio=500V)			$R_{iso}$	$\geq 10^{10}$
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**

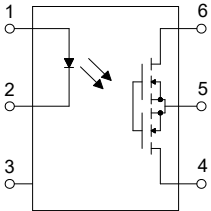
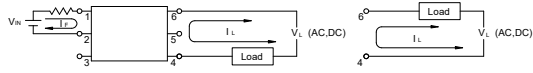
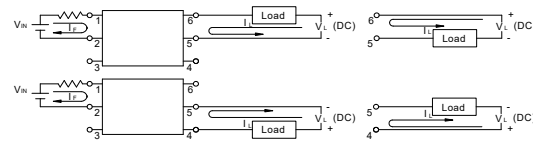
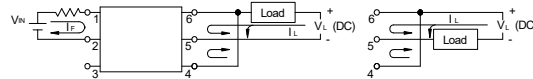
(Ta=25°C)

Parameter			Symbol	Conditions	Min.	Typ.	Max.	Unit
Input	Forward voltage		$V_F$	$I_F=10mA$	-	1.2	1.5	V
	Operation input current		$I_{FON}$	$V_L=20V, I_L=100mA$	-	-	3.0	mA
	Recovery input current		$I_{FOFF}$	$V_L=20V, I_L \leq 5\mu A$	0.2	-	-	mA
Output	Breakdown voltage		$V_B$	$I_B=50\mu A$	250	-	-	V
	Off-state leakage current		$I_{LEAK}$	$V_L=250V, I_F=0mA$	-	0.2	1.0	$\mu A$
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	$\Omega$
		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

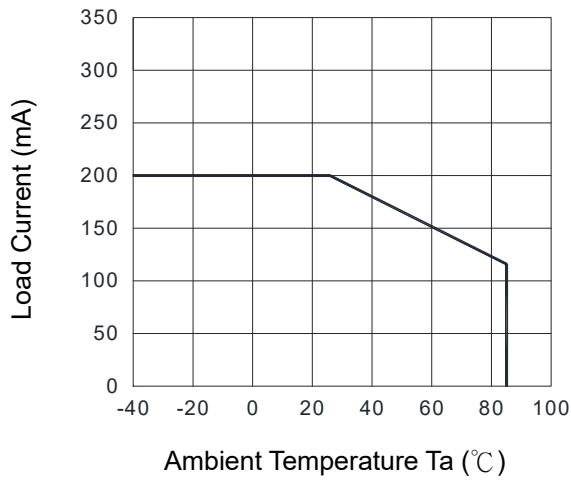
● **Turn-on / Turn-off Time**



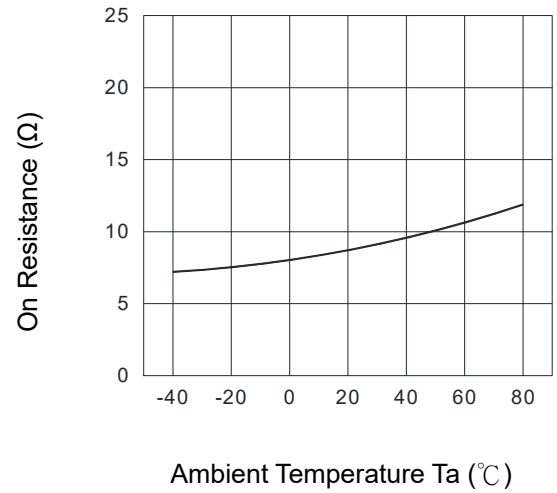
● Schematic and Wiring Diagrams

Schematic	Output Configuration	Load	Connection	Wiring Diagrams
	1a	AC DC	A	
		DC	B	
		DC	C	

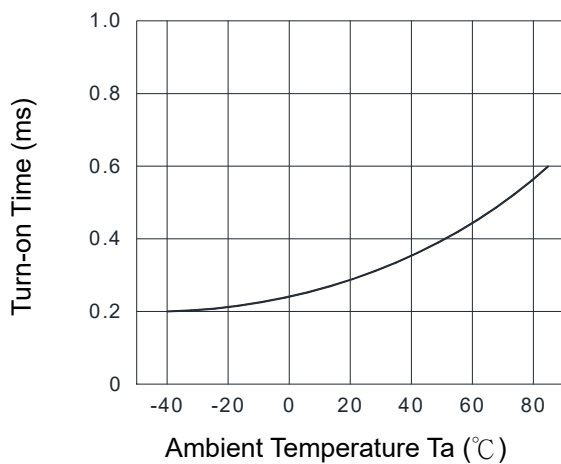
**Fig.1 Load Current vs. Ambient Temperature**



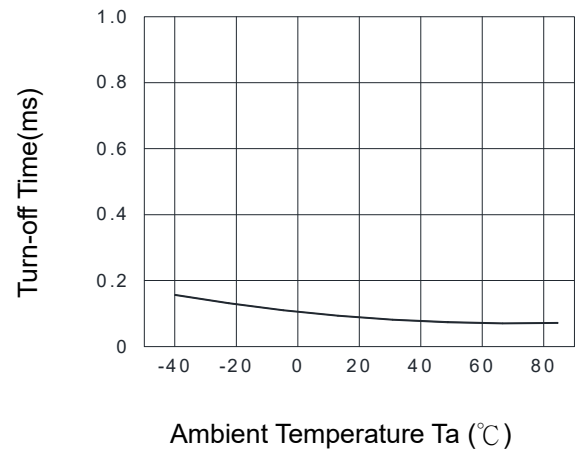
**Fig.2 On Resistance vs. Ambient Temperature**



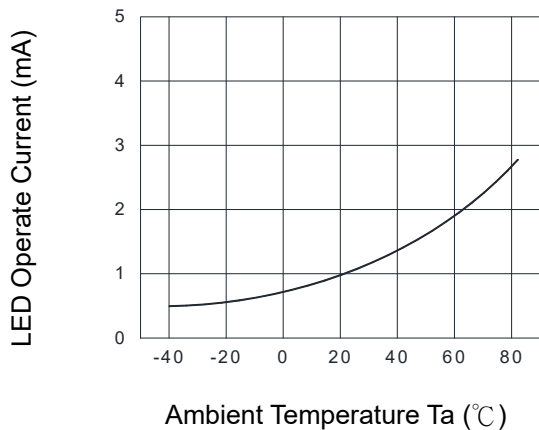
**Fig.3 Turn-on Time vs. Ambient Temperature**



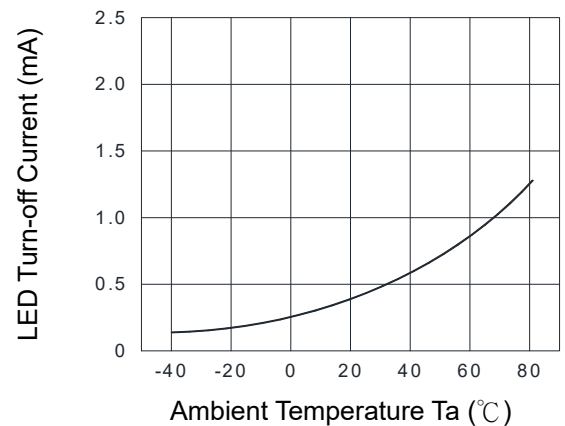
**Fig.4 Turn-off Time vs. Ambient Temperature**



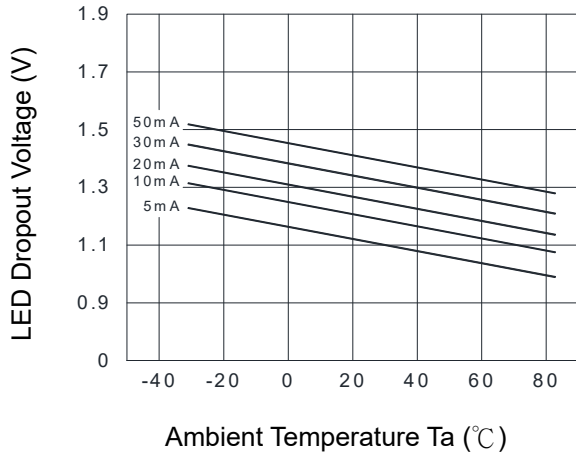
**Fig.5 LED Operate Current vs. Ambient Temperature**



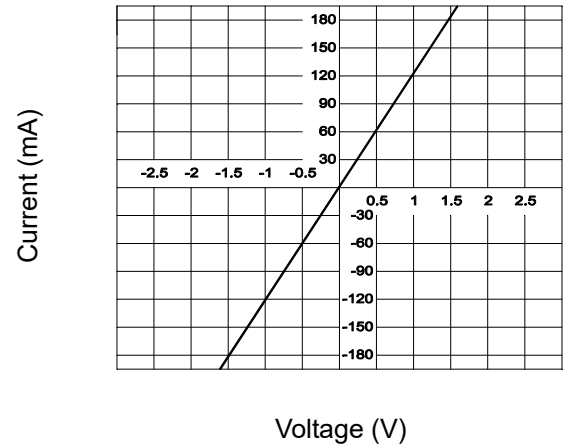
**Fig.6 LED Turn-off Current vs. Ambient Temperature**



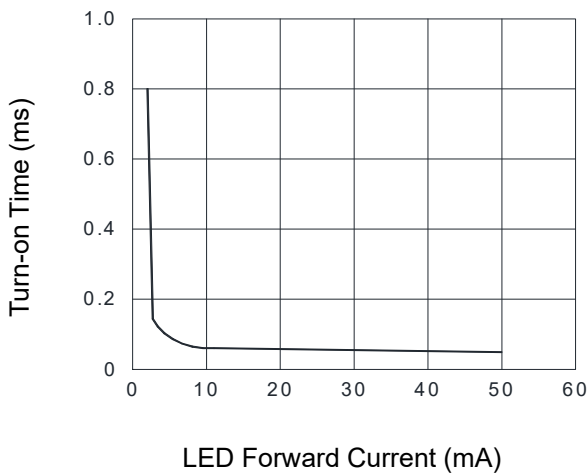
**Fig.7 LED Dropout Voltage vs. Ambient Temperature**



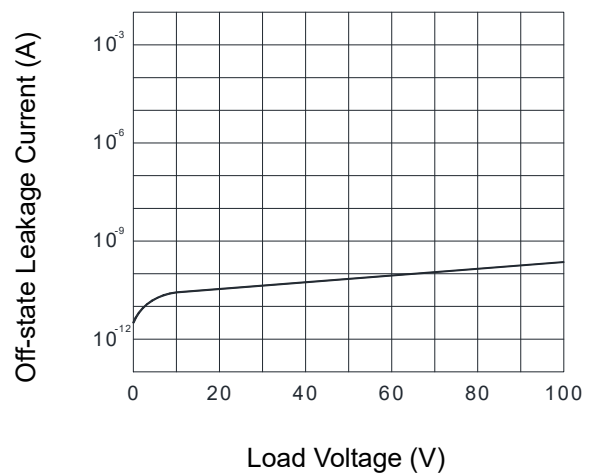
**Fig.8 Voltage vs. Current Characteristics of Output at MOSFET Portion**



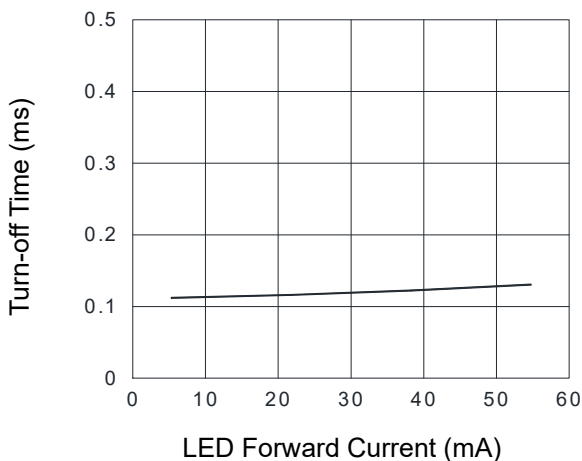
**Fig.9 Turn-on Time vs. LED Forward Current**



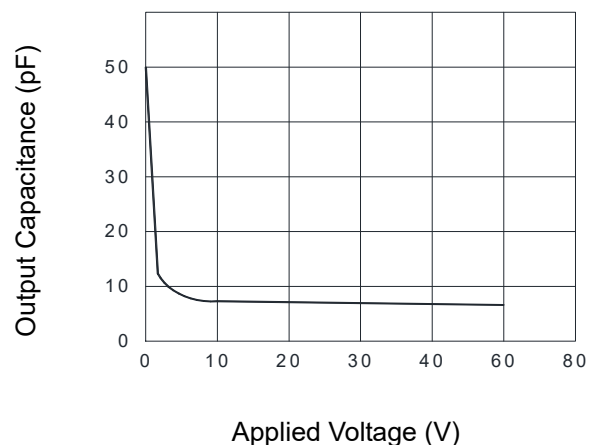
**Fig.10 Off-state Leakage Current vs. Load Voltage**



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

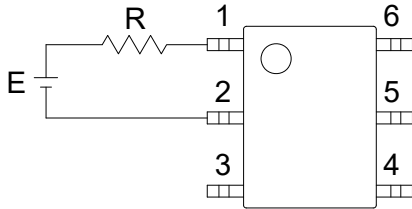


**Fig.12 Output Capacitance vs. Applied Voltage**



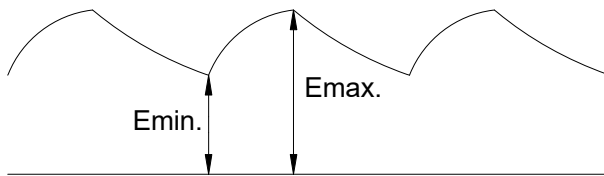
## ● Using Methods

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

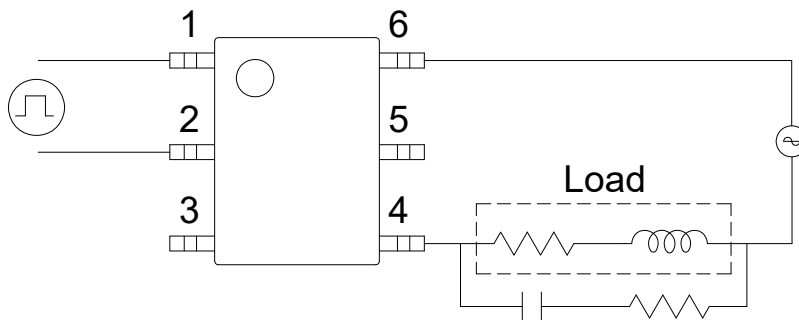
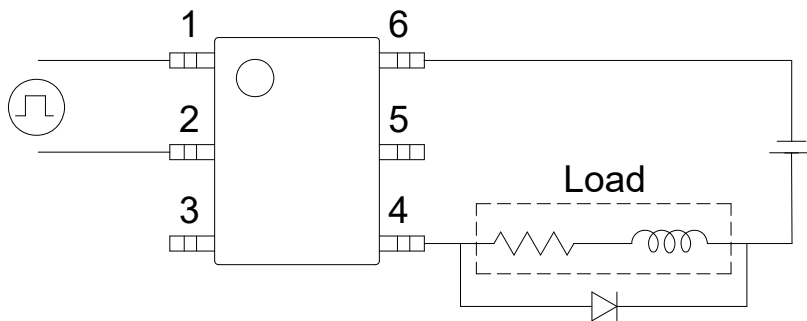


E	R
3.3V	Approx. 330 $\Omega$
5V	Approx. 640 $\Omega$
12V	Approx. 1.9K $\Omega$
15V	Approx. 2.5K $\Omega$
24V	Approx. 4.1K $\Omega$

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



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



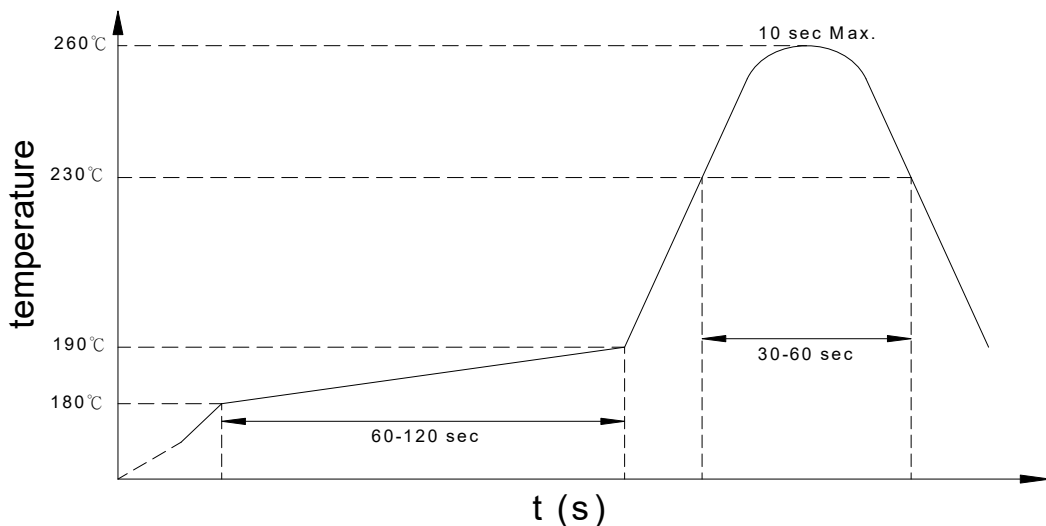
R-C Snubber

● **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 : 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)
- 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 or A )

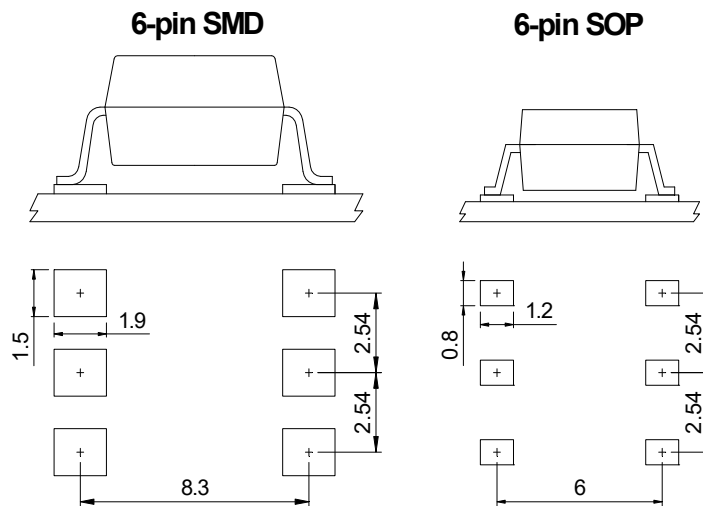
Y = Tape and reel option ( TL · TR )

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**

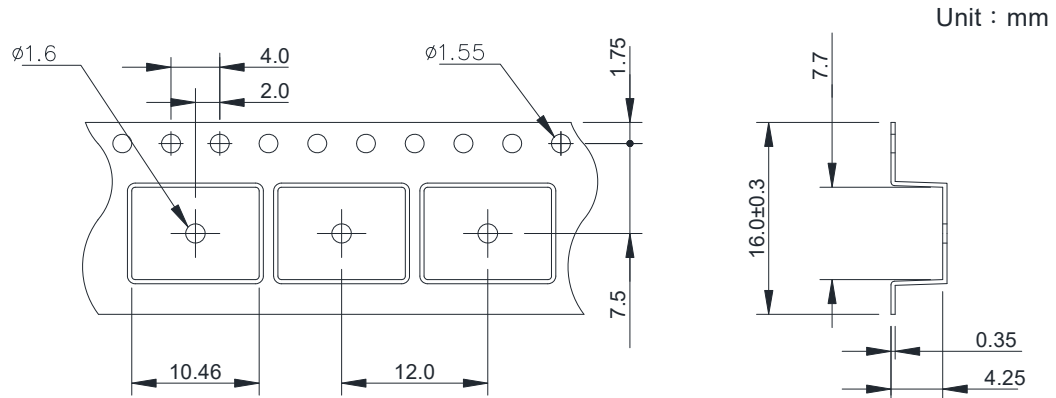
**1. Surface mount type.**

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

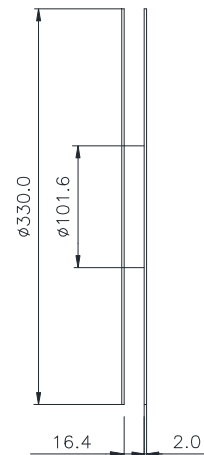
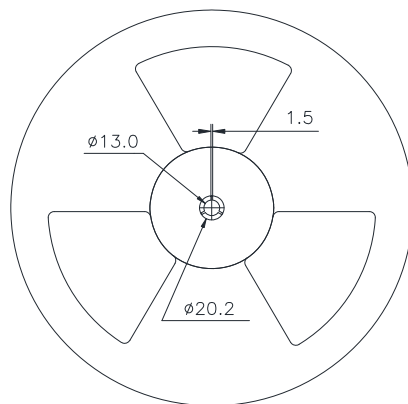
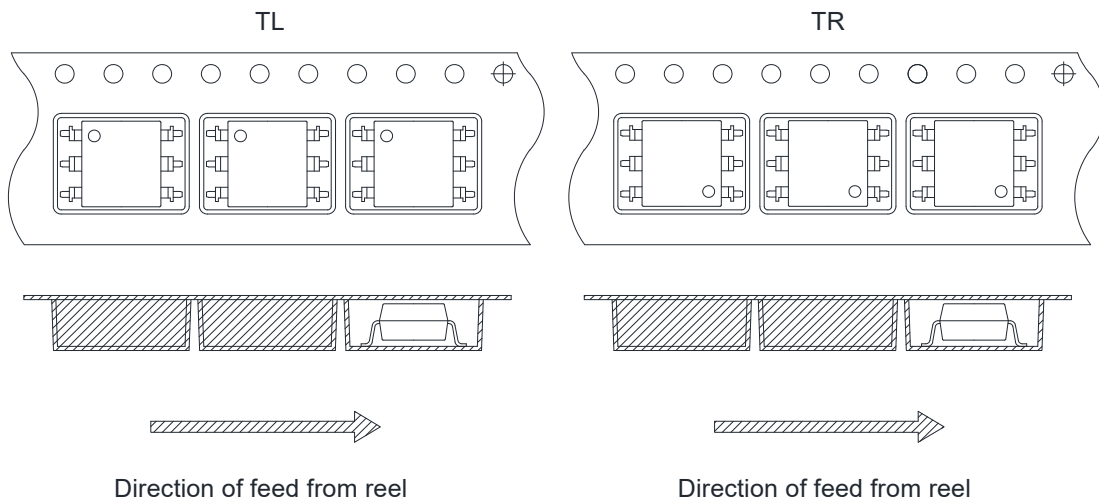


Unit : mm

● 6-pin SMD Carrier Tape & Reel

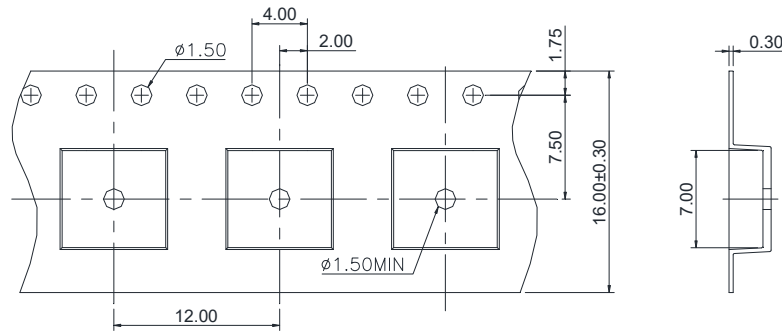


TOLERANCE : ±0.2mm



● 6-pin SOP Carrier Tape & Reel

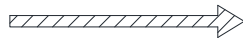
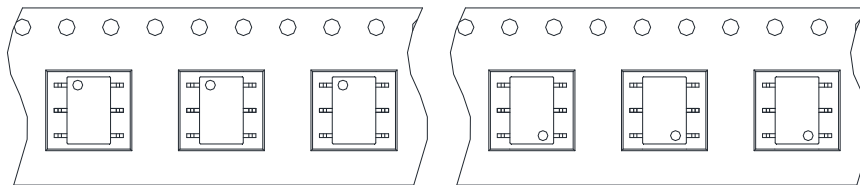
Unit : mm



TOLERANCE : ±0.2mm

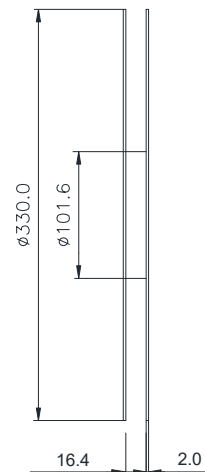
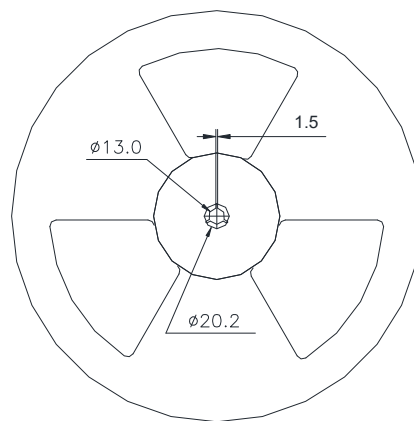
TL

TR



Direction of feed from reel

Direction of feed from reel



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