

KAQV412 Series

6PIN 60V N.C. TYPE

SOLID STATE RELAY-MOSFET OUTPUT

● Description

The KAQV412 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.

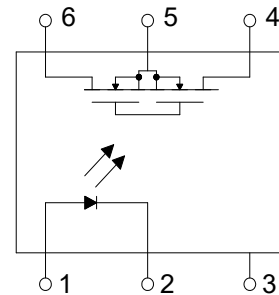
● Features

1. Normally close, single pole single throw
2. Control 60V 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

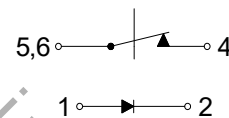
● Application

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

● Schematic



1 FORM B
NORMALLY CLOSE



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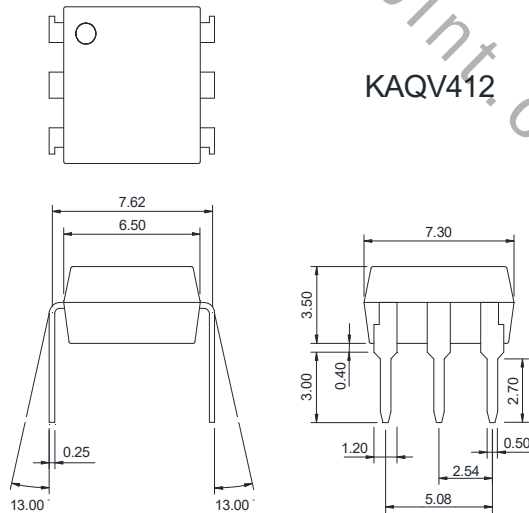
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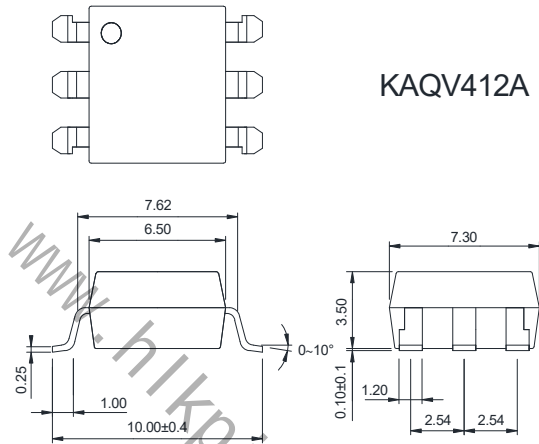
● Outside Dimension

Unit : mm

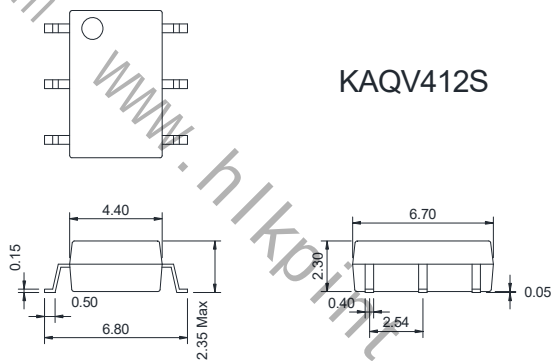
1. Dual-in-line type.



2. Surface mount type.

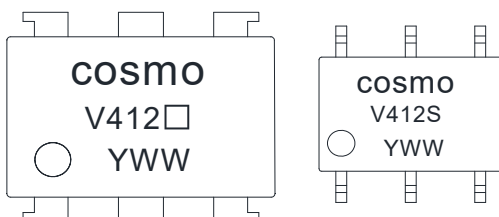


3. Small outline for surface mount type.



TOLERANCE : ±0.2mm

● Device Marking



Notes :

cosmo
V412□
V412S
YWW

□ (Blank): DIP or SMD
S : SOP
Y : Year code / W : Week code

KAQV412 Series

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● Absolute Maximum Ratings

(Ta=25°C)

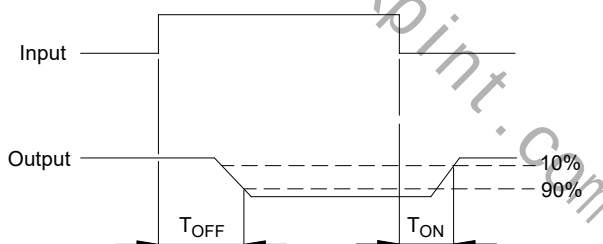
Item	Symbol	Rating	Unit
Input	Continuous forward current	I _F	50
	Peak forward current	I _{FP}	1
	Reverse voltage	V _R	5
	Power dissipation	P _{in}	100
	Derate linearly from 25°C	-	1.3
Output	Breakdown voltage	V _B	60
	Continuous load current	I _L	200
	Power dissipation	P _{out}	500
Isolation voltage		V _{iso}	KAQV412S 1500Vrms
Isolation resistance (Vio=500V)		R _{iso}	≥ 10 ¹⁰ 5000Vrms
Total power dissipation		P _t	550
Derate linearly from 25°C		-	2.5
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°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 _F OFF	V _L =20V, I _L ≤5μA	-	-	3.0	mA
	Recovery input current		I _F ON	V _L =20V, I _L =100mA	0.2	-	-	mA
Output	Breakdown voltage		V _B	I _B =50μA, I _F =10mA	60	-	-	V
	Off-state leakage current		I _{LEAK}	V _L =60V, 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	-	2.5	5	Ω
		B			-	1.25	2.5	
		C			-	0.63	1.25	
Reverse (ON) time			T _{ON}	I _F =10mA, V _L =20V I _L =100mA, t=10ms	-	0.6	1.5	ms
Operate (OFF) time			T _{OFF}		-	0.3	1.5	ms

● Turn-on / Turn-off Time



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● Schematic and Wiring Diagrams

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

KAQV412 Series

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Fig.1 Load Current vs. Ambient Temperature

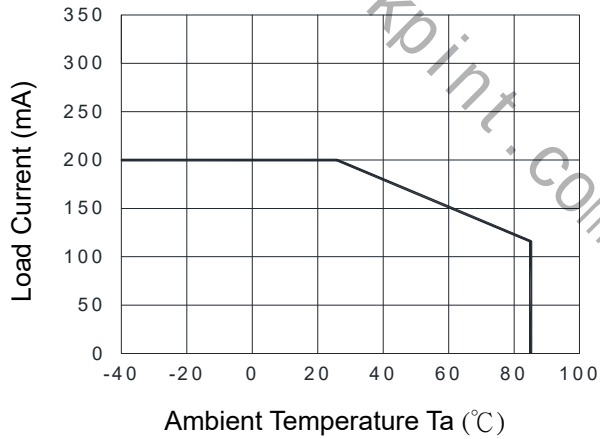


Fig.2 On Resistance vs. Ambient Temperature

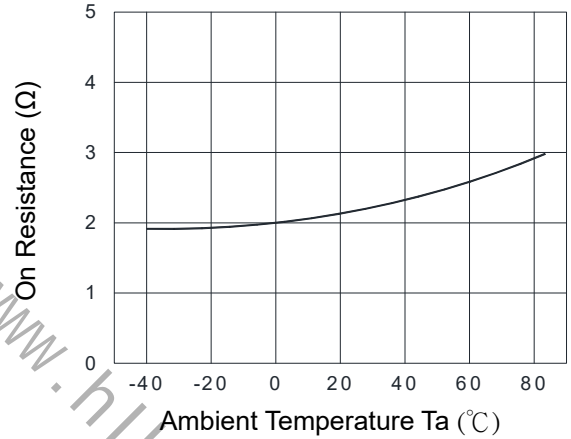


Fig.3 Operate (OFF) Time vs. Ambient Temperature

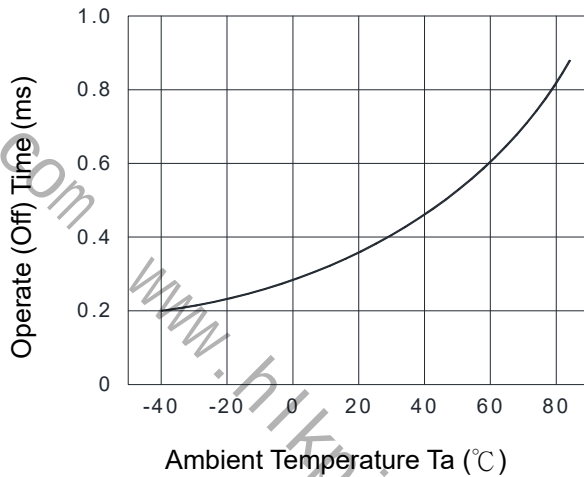


Fig.4 Reverse (ON) Time vs. Ambient Temperature

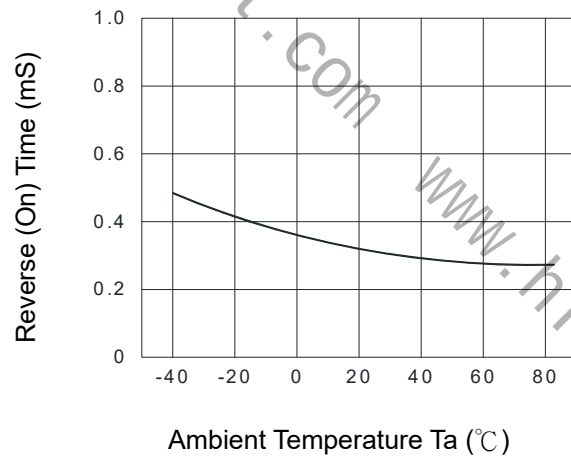


Fig.5 LED Operate Current vs. Ambient Temperature

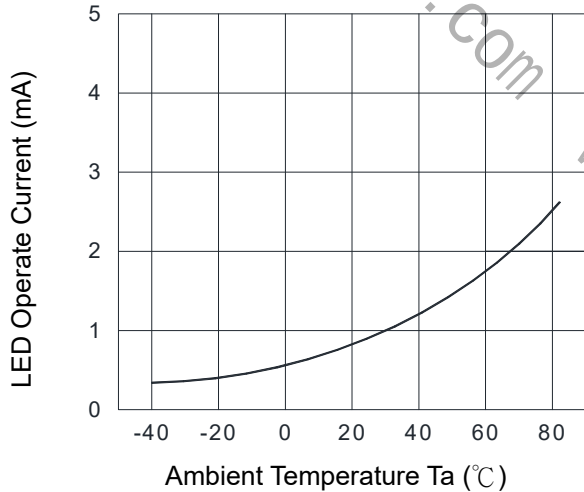
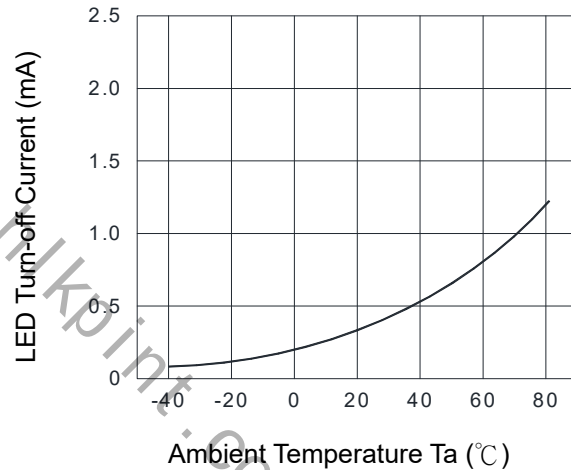


Fig.6 LED Turn-off Current vs. Ambient Temperature



KAQV412 Series

6PIN 60V N.C. TYPE
SOLID STATE RELAY-MOSFET OUTPUT

Fig.7 LED Dropout Voltage vs. Ambient Temperature

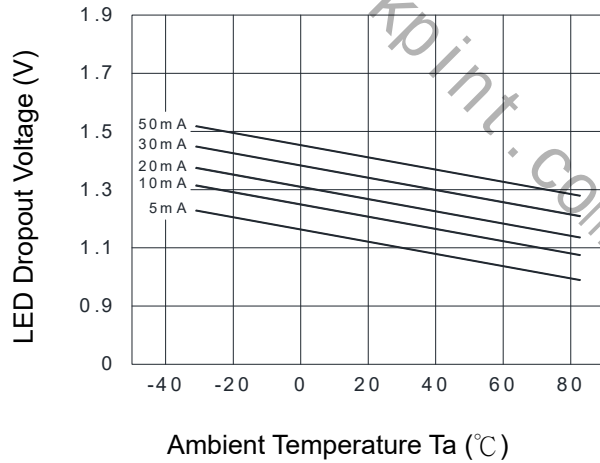


Fig.8 Voltage vs. Current Characteristics of Output at MOSFET Portion

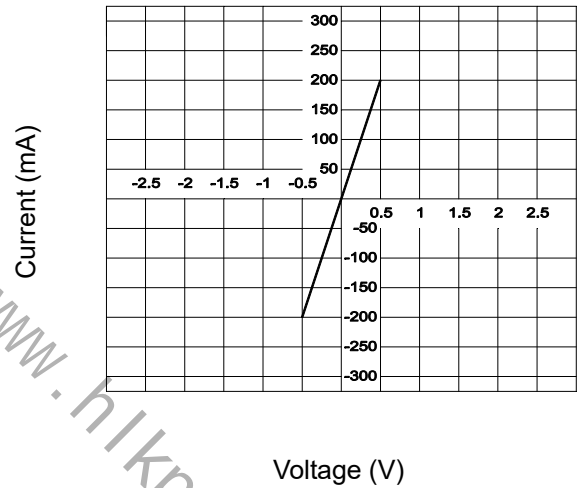


Fig.9 Operate (OFF) Time vs. LED Forward Current

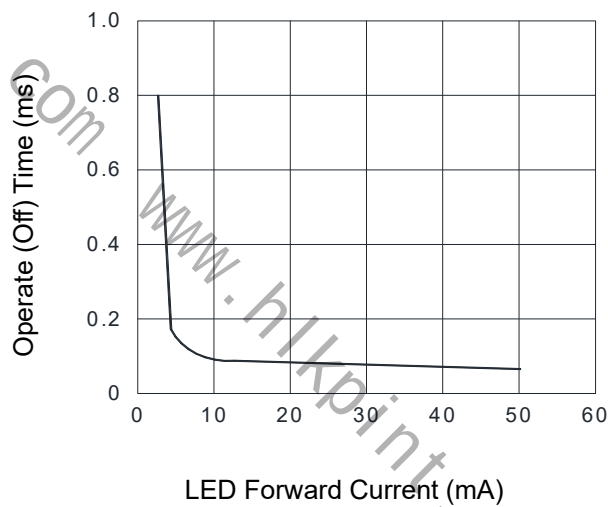


Fig.10 Off-state Leakage Current vs. Load Voltage

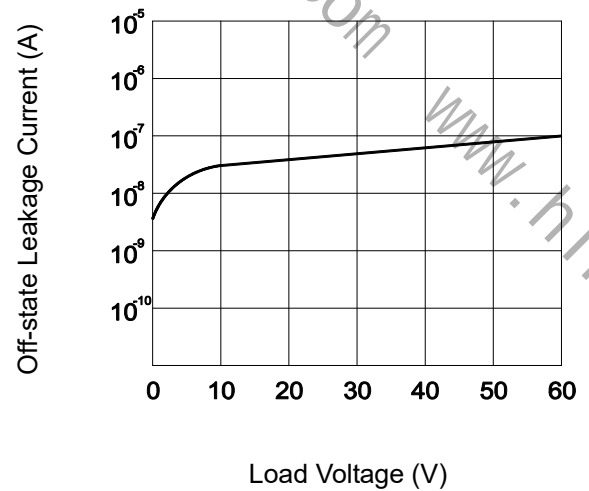


Fig.11 Reverse (ON) Time vs. LED Forward Current

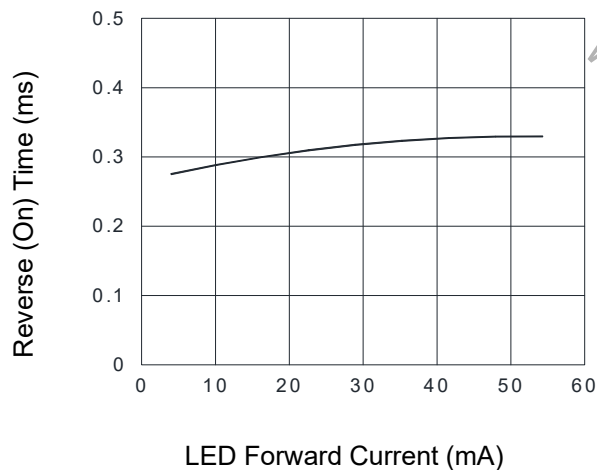
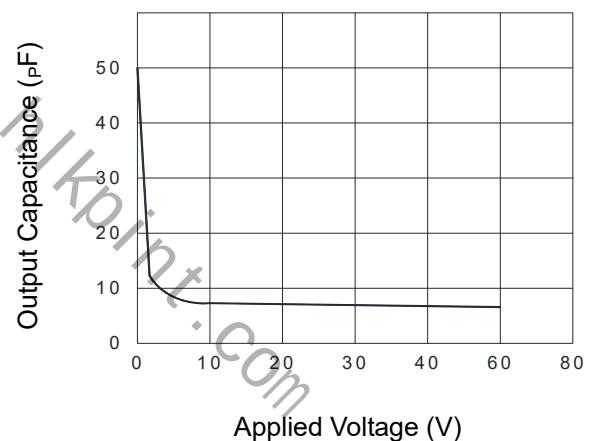


Fig.12 Output Capacitance vs. Applied Voltage

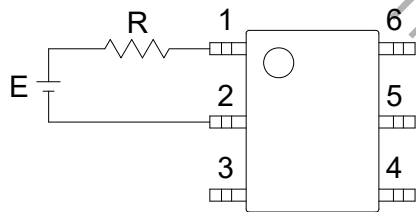


KAQV412 Series

6PIN 60V N.C. TYPE
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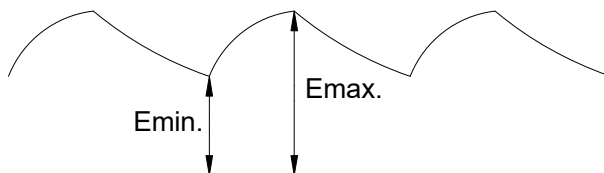
● Using Methods

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

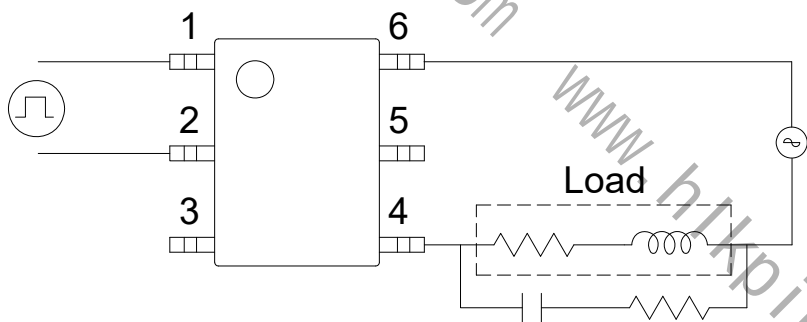
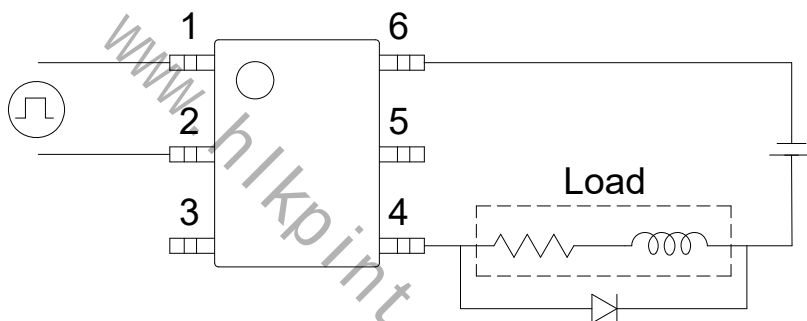


E	R
3.3V	Approx. 330 Ω
5V	Approx. 640 Ω
12V	Approx. 1.9K Ω
15V	Approx. 2.5K Ω
24V	Approx. 4.1K Ω

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

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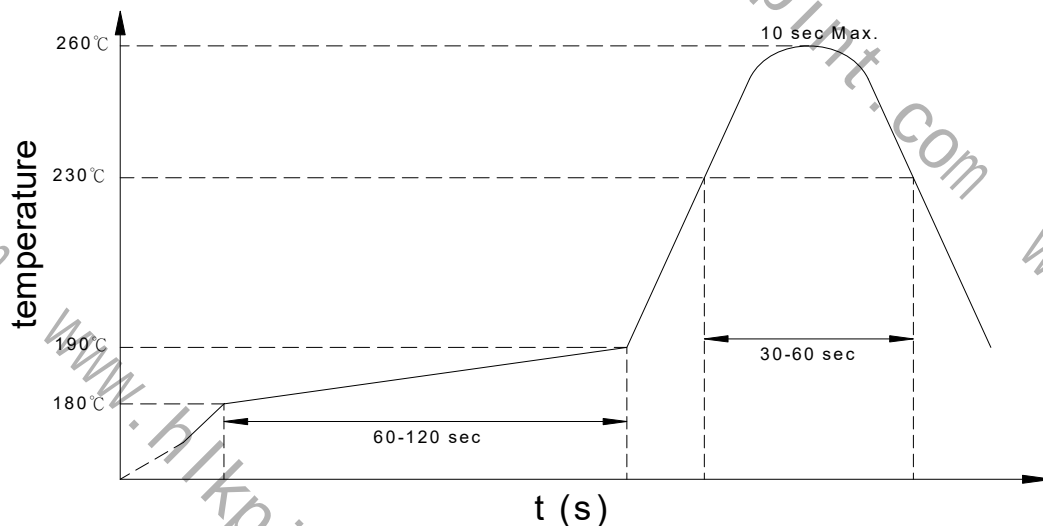
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● Recommended Soldering Conditions

(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 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

KAQV412 X (Y)

Note :

KAQV412 = Part No.

X = Lead form option (blank 、 S or A)

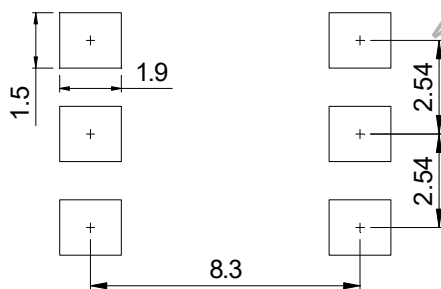
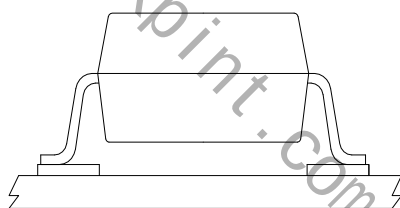
Y = Tape and reel option (TL 、 TR)

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

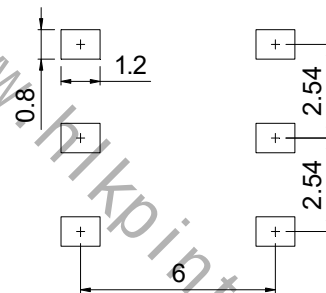
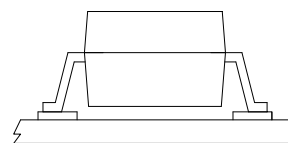
1. Surface mount type.

6-pin SMD



2. Small outline for surface mount type.

6-pin SOP



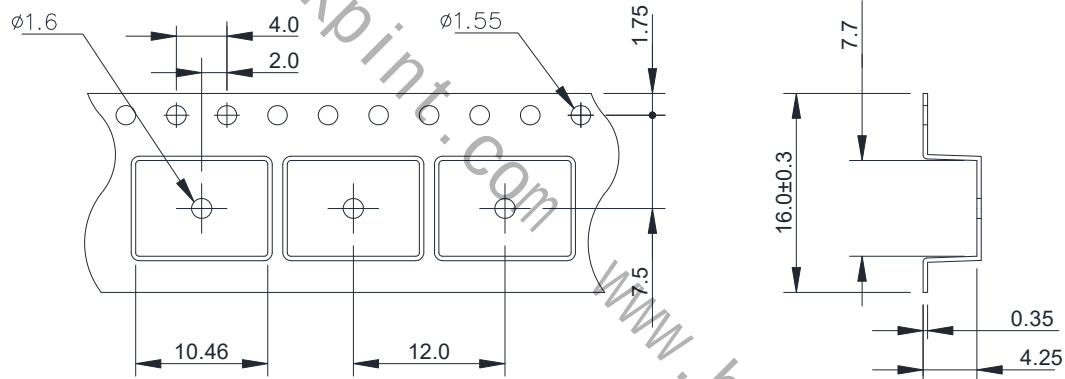
Unit : mm

KAQV412 Series

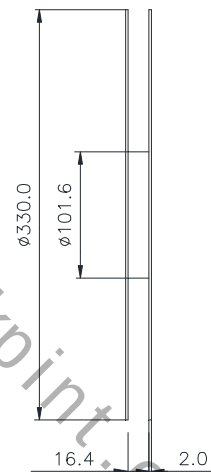
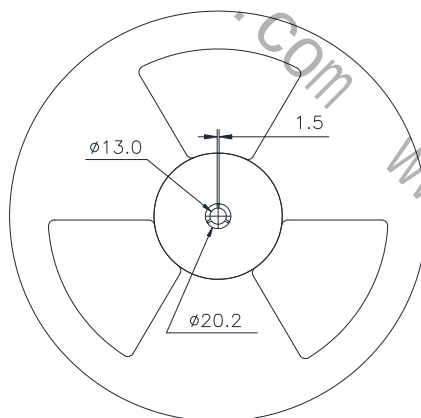
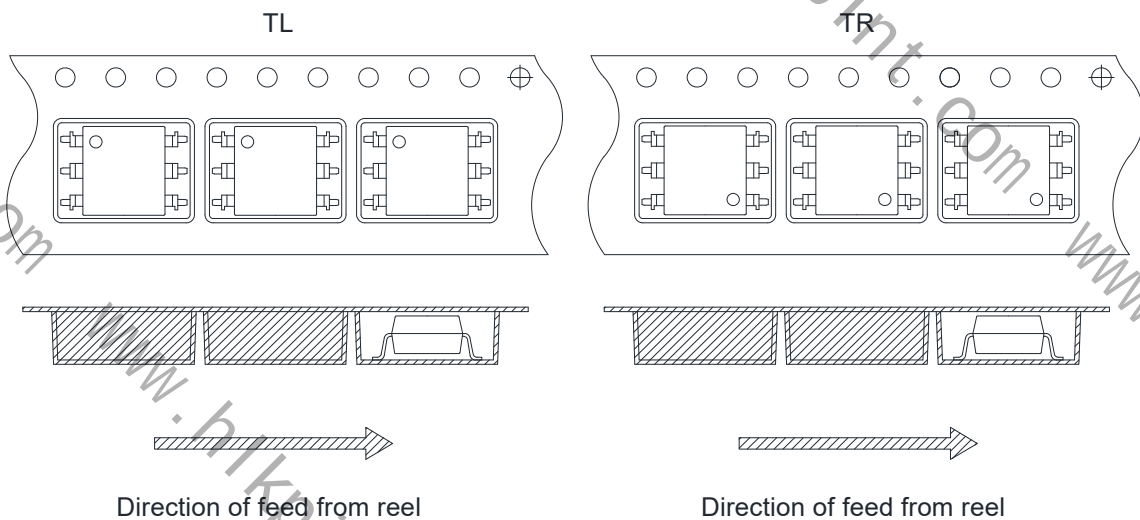
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● 6-pin SMD Carrier Tape & Reel

Unit : mm



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

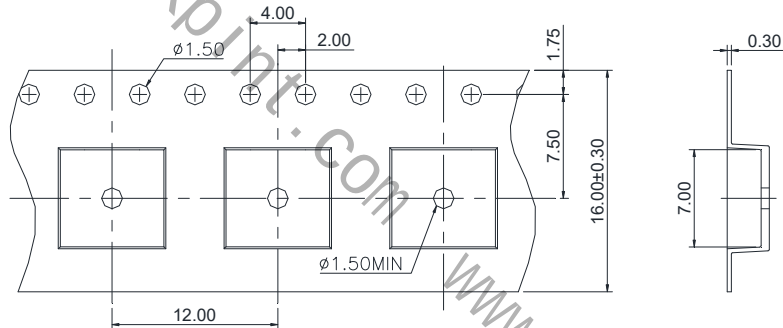


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● 6-pin SOP Carrier Tape & Reel

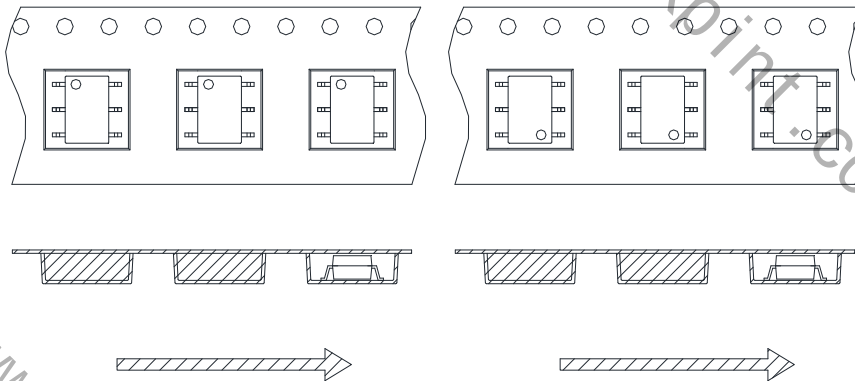
Unit : mm



TOLERANCE : ± 0.2 mm

TL

TR



Direction of feed from reel

Direction of feed from reel

