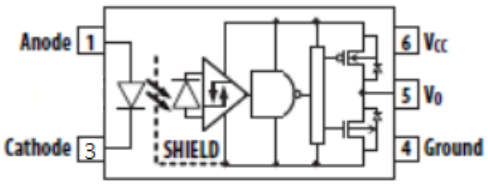
# KPC615 Series

**5PIN SOP High Speed PHOTOCOUPLER**

## Description

The KPC615 series photo coupler contains a LED and photo detector with built-in Schmitt trigger to provide logic-compatible waveforms, eliminating the need for additional wave shaping. The totem pole output eliminates the need for a pull up resistor and allows for direct drive Intelligent Power Module or gate drive. Minimized propagation delay difference between devices makes these photo couplers excellent solutions for improving inverter efficiency through reduced switching dead time.

## Schematic




1. Anode
3. Cathode
4. GND
5. Vo (Voltage Output)
6. Vcc

## Features

1. Inverter output type (totem pole output)
2. Operating temperature: -40 to 110°C ☐
3. Supply voltage: 2.7 to 5.5 V
4. Data transfer rate: 15 MBd (typ.) (NRZ)
5. Threshold input current: 3.5 mA (max)
6. Supply current: 6.5 mA (max)
7. Common-mode transient immunity: ±10 kV/μs (min)
8. Isolation voltage: 3750 Vrms (min)
9. Safety approval

   CQC GB4943.1-2022

## Applications

- Communication interfaces:RS485, CANBus and $I^2C$
- Microprocessor system interfaces
- Line receive – eliminate noise and transient problems
- PLC, ATE input / output isolation
- High speed A/D and D/A conversion
- Digital control power supply

## Truth Table

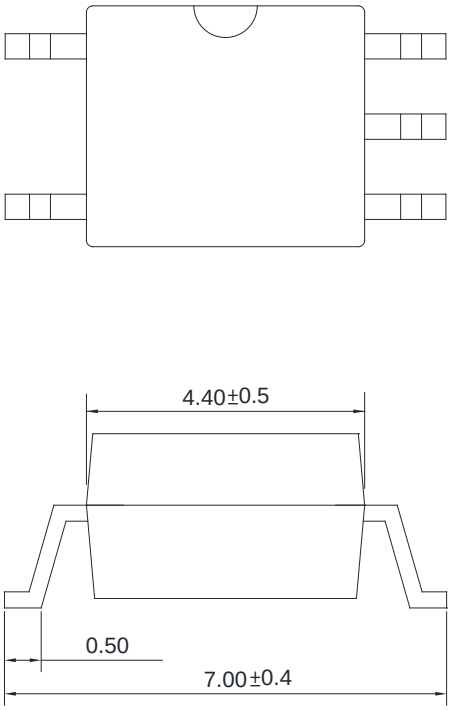
| LED | OUT |
|---|---|
| ON | L |
| OFF | H |

Note: A 0.1μF bypass capacitor must be connected between Pin 4 and 6.

.

## Outside Dimension

Unit : mm




TOLERANCE: ±0.2mm

## Device Marking


**Notes:**

cosmo
615
YWW Y: Year code / WW: Week code

## ● Absolute Maximum Ratings

(Ta = 25°C)

| Parameter | | | Symbol | Rating | Unit |
|---|---|---|---|---|---|
| Input | Forward current | | $I_F$ | 30 | mA |
| | Reverse voltage | | $V_R$ | 5 | V |
| Output | Output current | | $I_O$ | 10 | mA |
| | Output voltage | | $V_O$ | 6 | V |
| | Supply Voltage | | Vcc | 6 | V |
| Storage Temperature | | | $T_{stg}$ | -50~125 | °C |
| Operating Temperature | | | $T_{opr}$ | -40~110 | °C |
| Total Package Power Dissipation | | | $P_T$ | 250 | mW |
| Lead soldering temperature(10s) | | (Note 1) | $T_{sol}$ | 260 | °C |
| Isolation voltage (AC,1min.,R.H≦60%) | | (Note 2) | BVs | 3750 | Vrms |
| Input-Output Resistance ($V_{I-O}$ = 500V DC) | | (Note 2) | $R_{I-O}$ | $10^{12}$ | Ω |

Note 1: It is 2 mm or more from a lead root.
Note 2: Device is considered as a two terminal device: Pin1 and 3 shorted together, and pins 4,5 and 6 shorted together.

## ● Recommend Operation Conditions

| Parameter | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Operating Temperature | $T_A$ | -40 | 110 | °C |
| Supply Voltage | $V_{CC}$ | 2.7 | 5.5 | V |
| Input Current (ON) | $I_{F(ON)}$ | 4 | 8 | mA |
| Input Voltage (OFF) | $V_{F(OFF)}$ | - | 0.8 | V |

## ● Electrical Characteristics

TA = -40°C to +110°C, Vcc = 2.7 V to 5.5V, unless otherwise specified. All typical values at TA = 25°C.

| Parameter | | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Input Forward Voltage | | $V_F$ | $I_F$=10mA | - | 1.35 | 1.6 | V |
| Input Forward Voltage Temperature Coefficient | | $\triangle V_F / \Delta T$ | $I_F$=10mA | - | -1.25 | - | mV/°C |
| Input Reverse Voltage | | $BV_R$ | $I_R$ = 10μA | 5 | - | - | V |
| Input Threshold Current (High to Low) | | $I_{FHL}$ | $V_O$ < 0.4V | - | 2 | 3.5 | mA |
| Input Capacitance | | $C_{IN}$ | f = 1 MHz, $V_F$ = 0 V | - | 60 | - | pF |
| Supply Current | High Level | $I_{CCH}$ | IF = 0 mA | - | 5 | 6.5 | mA |
| | Low Level | $I_{CCL}$ | IF = 7.5mA | - | 5 | 6.5 | |
| Output voltage | High level | $V_{OH}$ | IF=0mA, IO = -10mA | VCC -0.8 | VCC -0.5 | - | V |
| | | | IF=0mA, IO = -20uA | VCC -0.5 | VCC -0.1 | - | |
| | Low level | $V_{OL}$ | IF=7.5mA, IOL = 10mA | - | 0.3 | 0.6 | |
| | | | IF=7.5mA, IOL = 20uA | | 0.03 | 0.1 | |

Note 1: Duration of output short circuit time should not exceed 10 μs.
Note 2: Input capacitance Cin is measured between pin 1 and pin 3.

## ● Switching Characteristics

TA = -40°C to +110°C, Vcc = 4.5V to 5.5V, unless otherwise specified. All typical values at TA = 25°C.

| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Propagation Delay Time to Output Low Level | $t_{PHL}$ | f = 5MHz, Duty Cycle = 50%, $I_F$ = 7.5mA, $V_{CC}$ = 5V | - | 40 | 60 | ns |
| Propagation Delay Time to Output High Level | $t_{PLH}$ | | - | 45 | 90 | |
| Pulse Width Distortion | PWD | | - | 5 | - | |
| Propagation Delay Difference Between Any Two Parts | PDD ($t_{PHL}$ - $t_{PLH}$) | | -30 | - | +30 | |
| Rise Time | $t_r$ | | - | 4 | - | |
| Fall Time | $t_f$ | | - | 3 | - | |
| Common mode transient immunity at high level output | $\|C_{MH}\|$ | $I_F$=0 mA $V_{CC}$= 5V,Vo>4.0V $T_A$= 25 °C,$V_{CM}$= 1.0KV | 10 | - | - | KV / μs |
| Common mode transient immunity at low level output | $\|C_{ML}\|$ | $I_F$=7.5mA $V_{CC}$= 5V, Vo<0.4V $T_A$= 25 °C, $V_{CM}$= 1.0KV | 10 | - | - | KV / μs |

TA = -40°C to +110°C, Vcc = 2.7 V to 3.6V, unless otherwise specified. All typical values at TA = 25°C.

| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Propagation Delay Time to Output Low Level | $t_{PHL}$ | f = 5MHz, Duty Cycle = 50%, $I_F$ = 7.5mA, $V_{CC}$ = 3.3V | - | 40 | 60 | ns |
| Propagation Delay Time to Output High Level | $t_{PLH}$ | | - | 50 | 90 | |
| Pulse Width Distortion | PWD | | - | 12 | - | |
| Propagation Delay Difference Between Any Two Parts | PDD ($t_{PHL}$ - $t_{PLH}$) | | -30 | - | +30 | |
| Rise Time | $t_r$ | | - | 5 | - | |
| Fall Time | $t_f$ | | - | 4 | - | |
| Common mode transient immunity at high level output | $\|C_{MH}\|$ | $I_F$=0 mA $V_{CC}$= 3.3V,Vo>2.0V $T_A$= 25 °C,$V_{CM}$= 1.0KV | 10 | - | - | KV / μs |
| Common mode transient immunity at low level output | $\|C_{ML}\|$ | $I_F$=7.5mA $V_{CC}$= 3.3V, Vo<0.4V $T_A$= 25 °C, $V_{CM}$= 1.0KV | 10 | - | - | KV / μs |

Note 1: The tPLH propagation delay is measured from the 50% point on the leading edge of the input pulse to the 1.5 V point on the leading edge of the output pulse. The tPHL propagation delay is measured from the 50% point on the trailing edge of the input pulse to the 1.5 V point on the trailing edge of the output pulse.

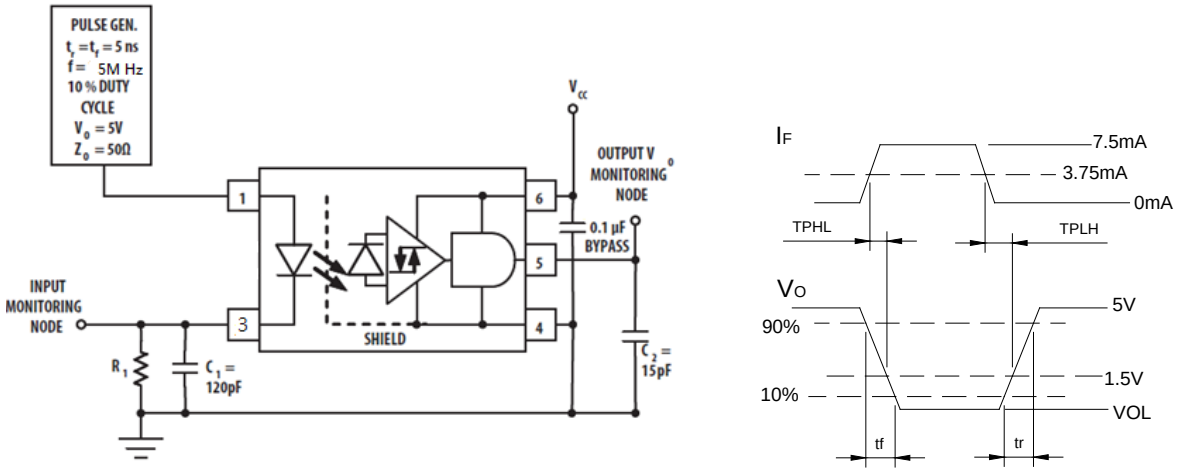
Note 2: Pulse Width Distortion (PWD) is defined as |tPHL - tPLH | for any given device.

Note 3: The difference of tPLH and tPHL between any two devices under the same test condition.

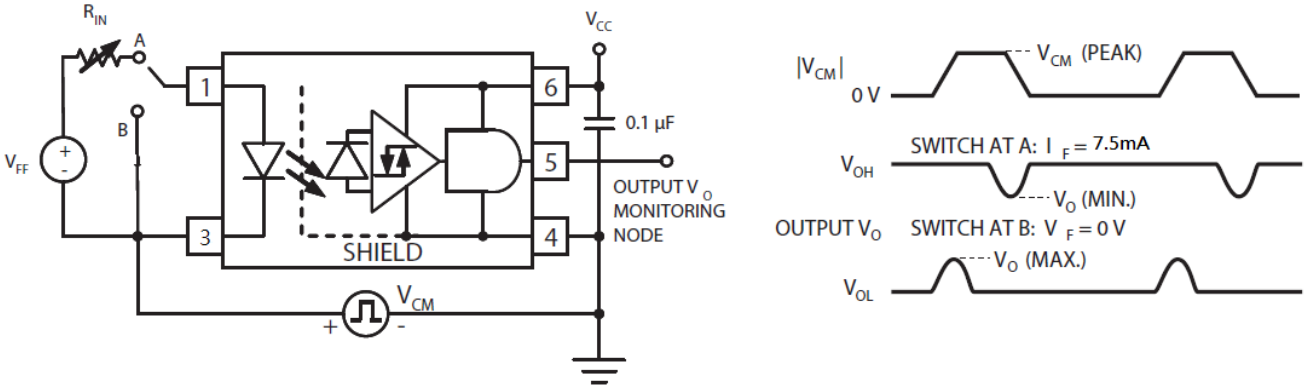
Note 4: CMH is the maximum slew rate of the common mode voltage that can be sustained with the output voltage in the logic high state, VO > 2.0 V. CML is the maximum slew rate of the common mode voltage that can be sustained with the output voltage in the logic low state, VO < 0.8 V. Note: Equal value split resistors (Rin/2) must be used at both ends of the LED.

## ● Test Circuit

### Propagation delay time tPLH、tPHL、and rise time tr, fall time tf




### Common Mode Transient Immunity Test Circuit and Typical Waveforms




*$C_{ML}$($C_{MH}$) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.

## Characteristics curves

Fig.1.Input Forward Current V.S. Input Forward Voltage

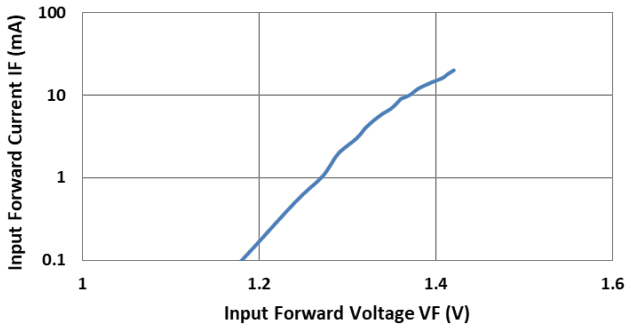



Fig.2.Low-Level Output Voltage V.S. Ambient temperature TA (℃)

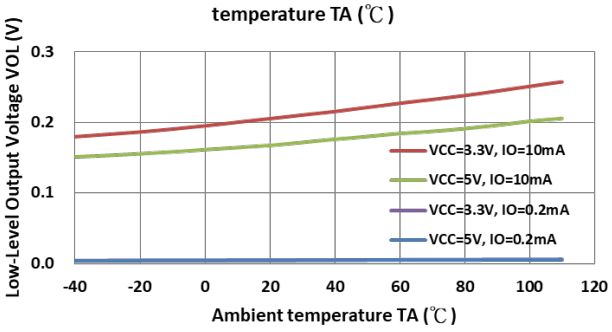



Fig.3.High-Level Output Voltage V.S. Ambient temperature TA (℃)

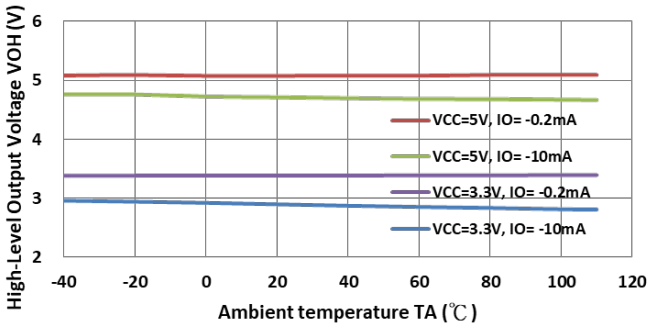



Fig.4.Supply Current V.S. Ambient Temperature

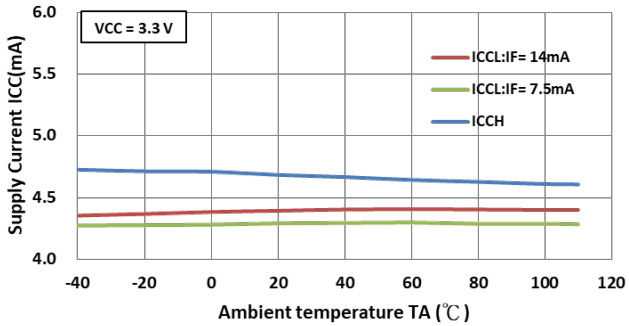



Fig.5.Supply Current V.S. Ambient Temperature

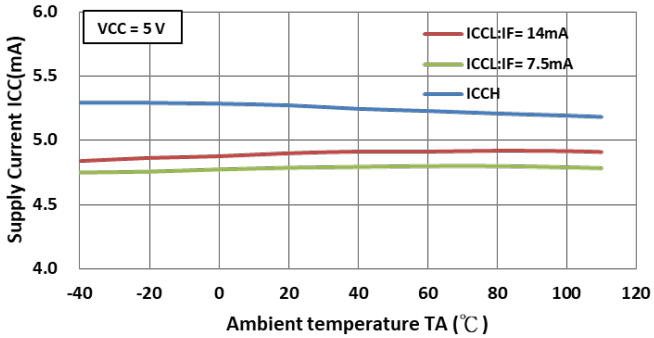



Fig.6.Typical Switching Speed V.S. Forward Current

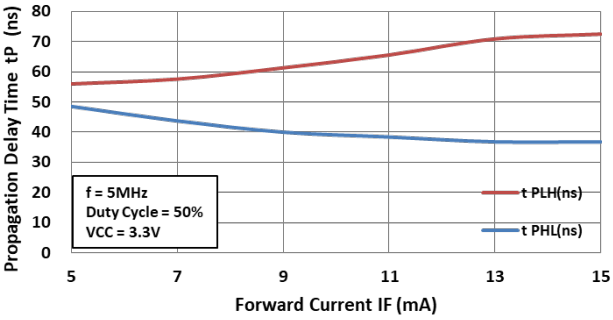



Fig.7.Typical Switching Speed V.S. Forward Current

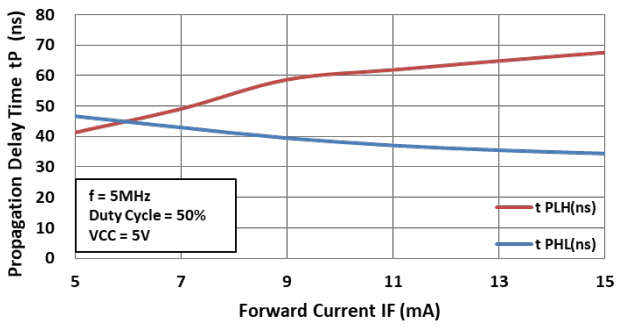



Fig.8.Typical Switching Speed V.S. Supply Voltage

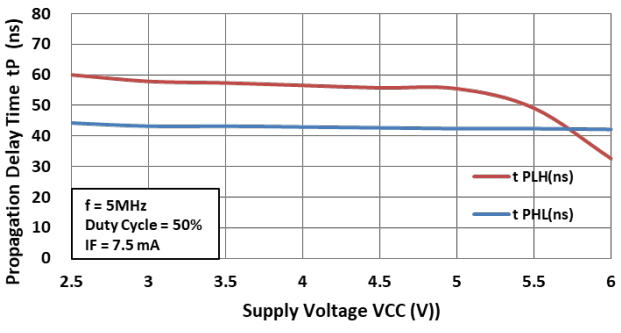


Fig.9.Pulse Width Distortion V.S. Forward Current

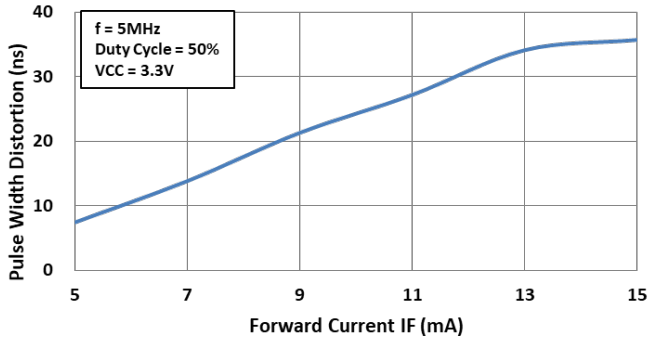



Fig.10.Pulse Width Distortion V.S. Forward Current

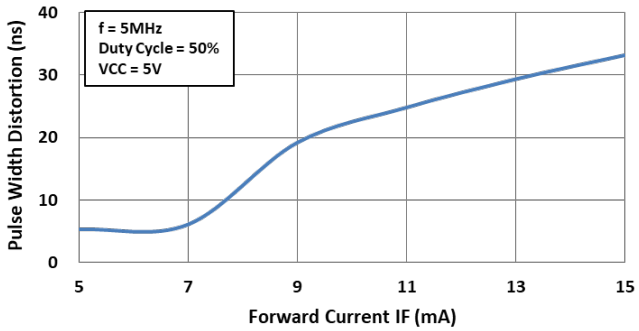



Fig.11.Pulse Width Distortion V.S. Supply Voltage

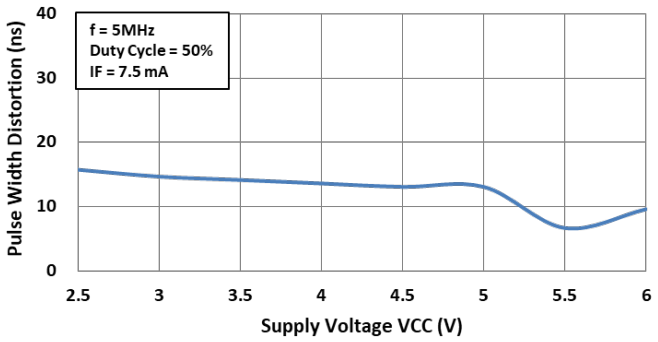



Fig.12.Input Threshold Current V.S. Ambient temperature

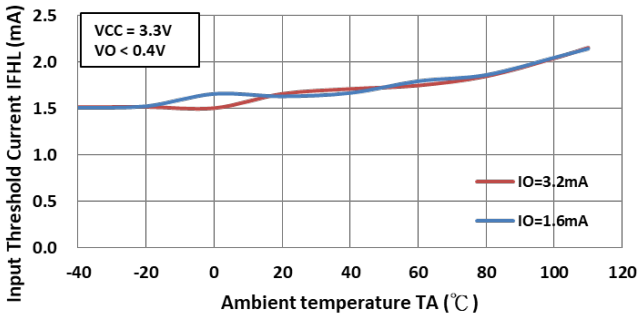



Fig.13.Input Threshold Current V.S. Ambient temperature

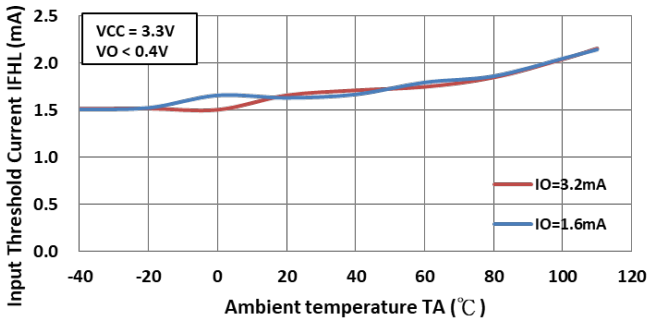



Fig.14.Propagation Delay Time V.S. Ambient temperature

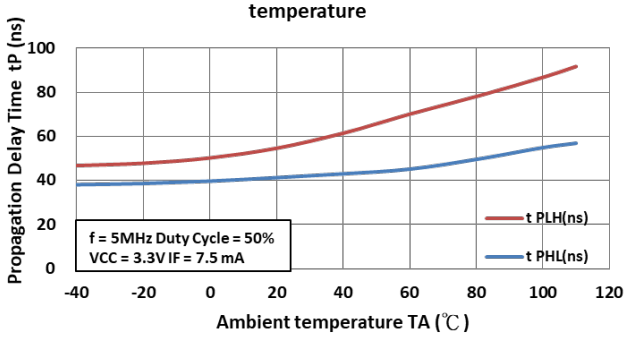



Fig.15.Propagation Delay Time V.S. Ambient temperature

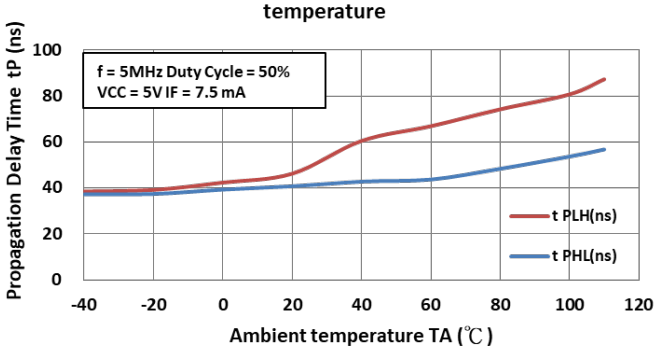



Fig.16.Pulse Width Distortion V.S. Ambient temperature

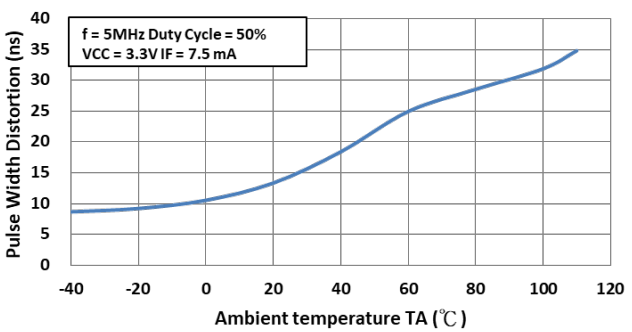
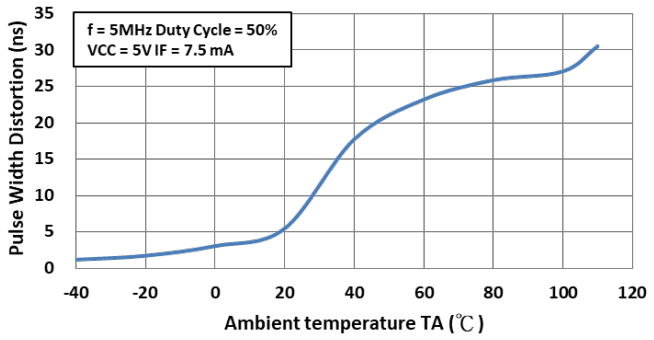


Fig.17.Pulse Width Distortion V.S. Ambient temperature

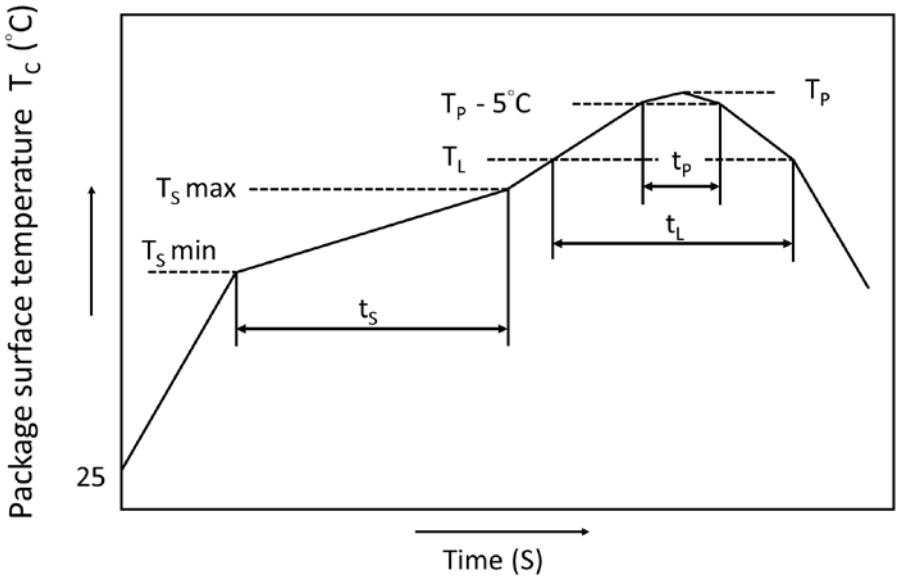


## Recommended Soldering Conditions

IR Reflow soldering

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

**Recommended Temperature Profile of Infrared Reflow**




| | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Preheat temperature | $T_S$ | 150 | 200 | °C |
| Preheat time | $t_S$ | 60 | 120 | s |
| Ramp-up rate ($T_L$ to $T_P$) | | | 3 | °C/s |
| Liquidus temperature | $T_L$ | 217 | | °C |
| Time above $T_L$ | $t_L$ | 60 | 100 | s |
| Peak Temperature | $T_P$ | | 260 | °C |
| Time during which $T_C$ is between ($T_P$ - 5) and $T_P$ | $t_P$ | | 20 | s |
| Ramp-down rate | | | 6 | °C/s |

- **Numbering System**

## KPC615 (Y)

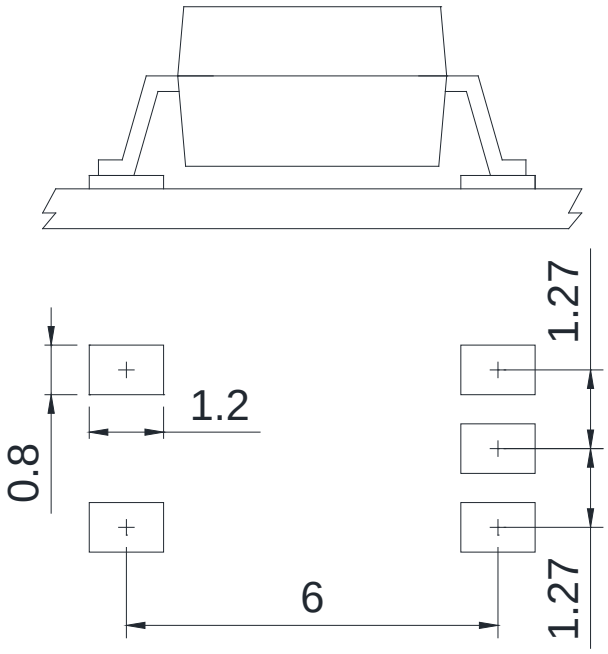
**Notes:**

KPC615 = Part No.

Y = Tape and reel option (TLD or TRU)

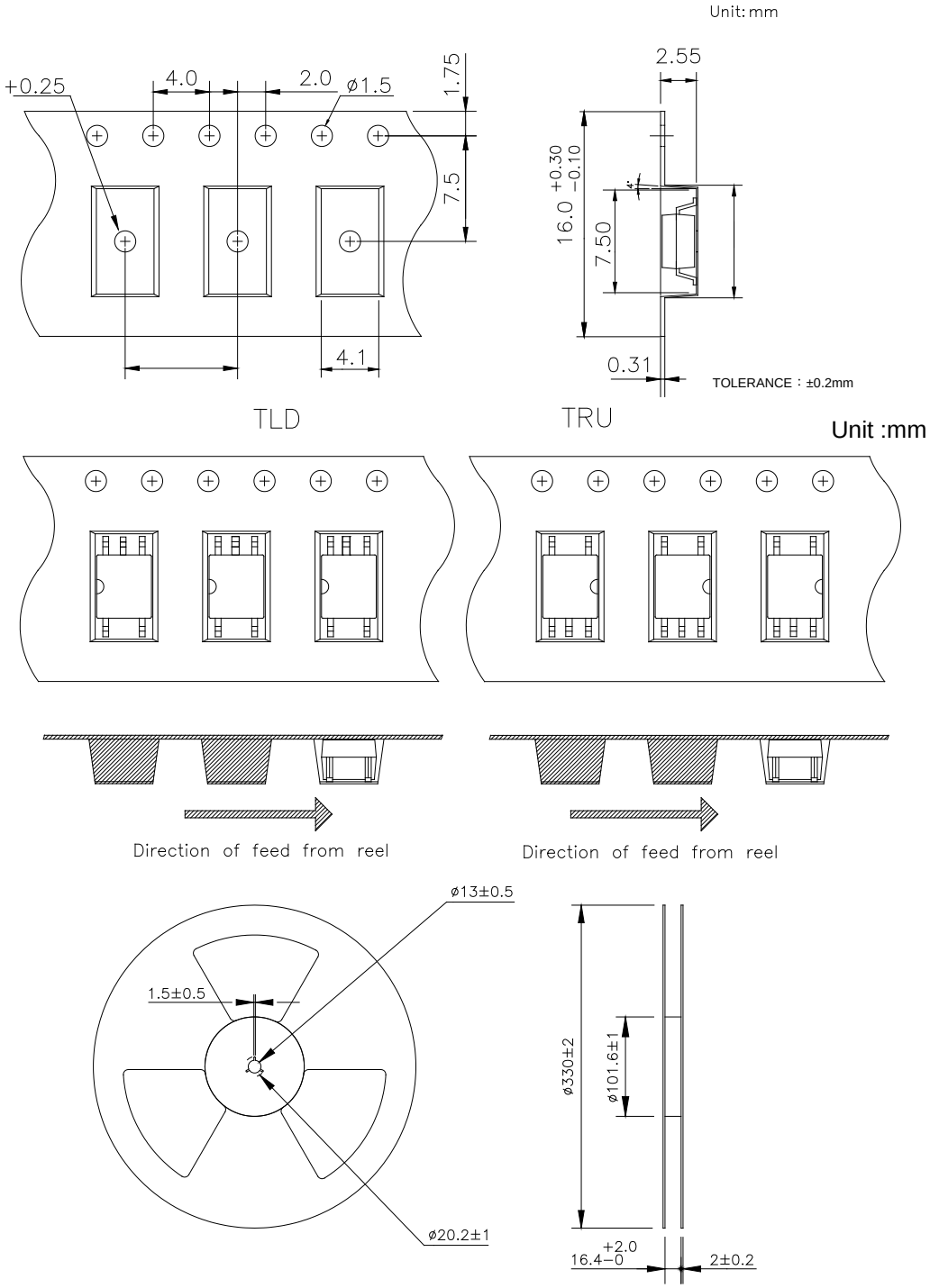
| Option | Description | Packing quantity |
|---|---|---|
| (TLD) | surface mount type package + TL tape & reel option | 3000 units per reel |
| (TRU) | surface mount type package + TR tape & reel option | 3000 units per reel |

- **Recommended Pad Layout for Surface Mount Lead Form**

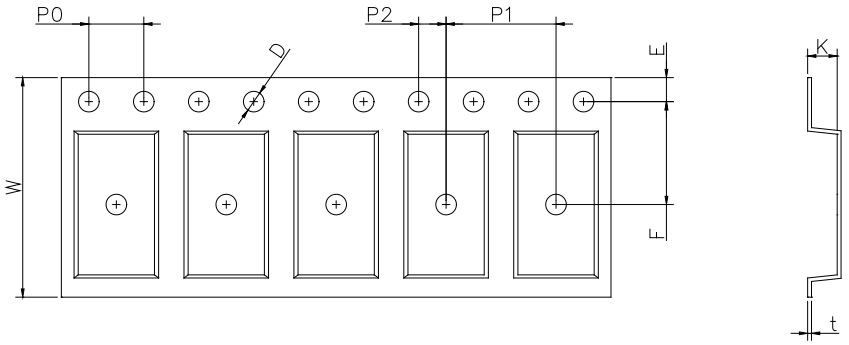



Unit : mm

## SOP Carrier Tape & Reel

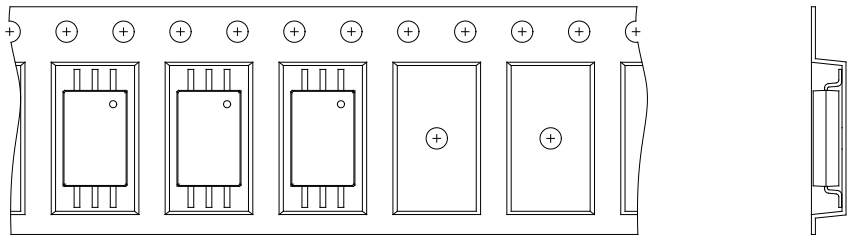


## ● LSOP 6 Carrier Tape & Reel

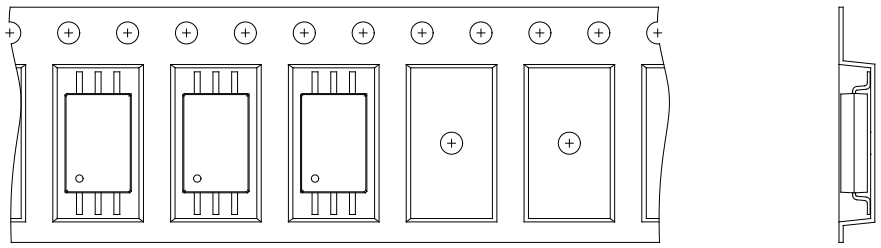



| Dimension Symbol | D | E | F | P0 | P1 | P2 | t | W | K |
|---|---|---|---|---|---|---|---|---|---|
| P type Dimension (mm) | 1.5±0.1 | 1.75±0.1 | 7.5±0.1 | 4.0±0.1 | 8.0±0.1 | 2.0±0.1 | 0.3±0.1 | 16.0±0.3 | 2.15±0.1 |
| W type Dimension (mm) | 1.5±0.1 | 1.75±0.1 | 11.5±0.1 | 4.0±0.1 | 8.0±0.1 | 2.0±0.1 | 0.3±0.1 | 24.0±0.3 | 2.52±0.1 |

TRU



TLD



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