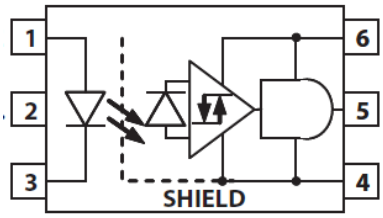
# KT0480 Series

**LOSP 6 IPM DRIVE PHOTOCOUPLER**

## Description

The KT0480 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
2. N.C.
3. Cathode
4. GND
5. Vo (Voltage Output)
6. Vcc

## Features

1. Positive output type (totem pole output)
2. Truth Table Guaranteed: VCC from 4.5V to 30V
3. Performance Specified for Common IPM Applications Over Industrial Temperature Range.
4. Short Maximum Propagation Delays
5. Minimized Pulse Width Distortion (PWD)
6. Very High Common Mode Rejection (CMR)
7. Hysteresis
8. Approved

   UL1577, File No.E169586

   DIN EN IEC 60747-5-5 (VDE 0884-5):2021-10; EN IEC 60747- 5-5:2020, Certificate No.40055228

   CQC GB4943.1-2022

## Applications

- IPM Interface Isolation
- Isolated IGBT/MOSFET Gate Drive
- AC and Brushless DC Motor Drives
- Industrial Inverters
- General Digital Isolation

## Truth Table

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

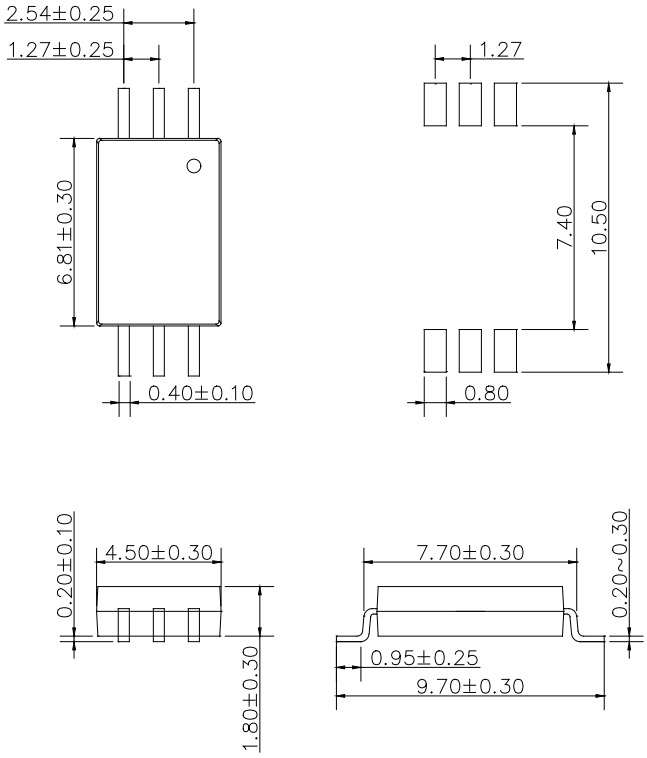
Note: A 0.1μF bypass capacitor must be connected between Pin 4 and 6.

.

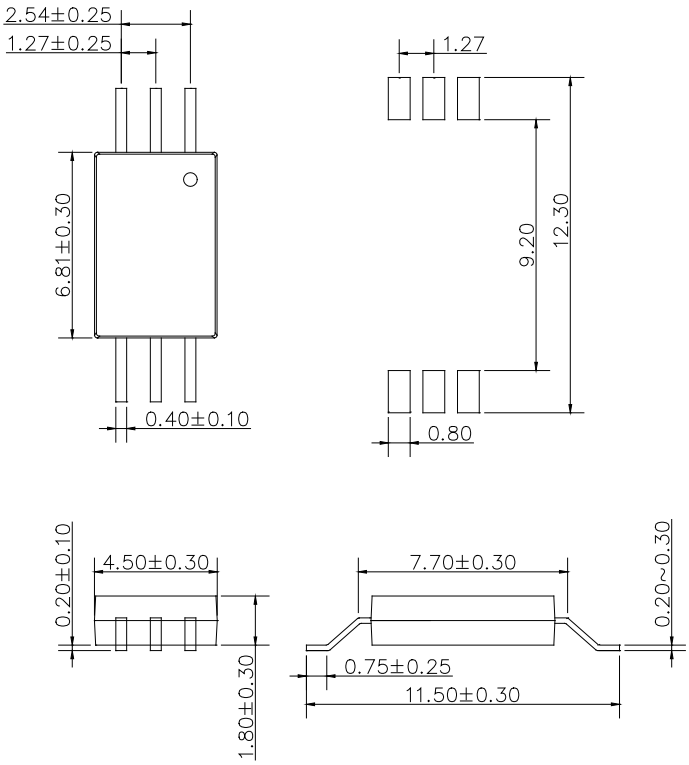
## Outside Dimension

Unit : mm

### P Type




### W Type



## ● Device Marking


**Notes:**

cosmo
0480
YWW  Y: Year code / WW: Week code
V  V or None : VDE option

## ● Absolute Maximum Ratings

(Ta = 25°C)

| Parameter | | | Symbol | Rating | Unit |
|---|---|---|---|---|---|
| Input | Forward current | | $I_F$ | 20 | mA |
| | Peak transient forward current | (Note 1) | $I_{FPT}$ | 1 | A |
| | Reverse voltage | | $V_R$ | 5 | V |
| Output | Output current | | $I_O$ | 50 | mA |
| | Output voltage | | $V_O$ | 35 | V |
| | Supply Voltage | | Vcc | 35 | V |
| Junction temperature | | | $T_j$ | 125 | °C |
| Storage Temperature | | | $T_{stg}$ | -55~125 | °C |
| Operating Temperature | | | $T_{opr}$ | -40~110 | °C |
| Total Package Power Dissipation | | | $P_T$ | 145 | mW |
| Lead soldering temperature(10s) | | (Note 2) | $T_{sol}$ | 260 | °C |
| Isolation voltage (AC,1min.,R.H≦60%) | | (Note 3) | BVs | 5000 | Vrms |
| Input-Output Resistance ($V_{I-O}$ = 500V DC) | | (Note 3) | $R_{I-O}$ | $10^{12}$ | Ω |

Note 1: Pulse width Pw ≦ 1 μs,300pps.
Note 2: It is 2 mm or more from a lead root.
Note 3: Device is considered as a two terminal device: Pin1,2 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[1] | $V_{CC}$ | 4.5 | 30 | V |
| Input Current (ON)[2] | $I_{F(ON)}$ | 1.6 | 5 | mA |
| Input Voltage (OFF) | $V_{F(OFF)}$ | - | 0.8 | V |

Note 1: Detector requires a VCC of 4.5 V or higher for stable operation as output might be unstable if VCC is lower than 4.5 V. Be sure to check the power ON/OFF operation other than the supply current.

Note 2: The initial switching threshold is 1.6 mA or less. It is recommended that 2.2 mA be used to permit at least a 20% LED degradation guard band.

## Electrical Characteristics

(Ta = 25℃)

| Parameter | | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Input Forward Voltage | | $V_F$ | $I_F$=10mA | 1.6 | 2.0 | 2.4 | V |
| Input Forward Voltage Temperature Coefficient | | $\Delta V_F/\Delta T$ | $I_F$=10mA | - | -1.237 | - | mV/°C |
| Input Reverse Voltage | | $BV_R$ | $I_R$ = 10μA | 5 | - | - | V |
| Input Threshold Current (Low to High) | | $I_{FLH}$ | $V_{CC}$ = 30 V, $V_O$ > 5V | - | 0.2 | 1.5 | mA |
| Input Threshold Voltage (High to Low) | | $V_{FHL}$ | $V_{CC}$ = 30 V, $V_O$ < 5V | 0.8 | - | - | V |
| Input Capacitance | | $C_{IN}$ | f = 1 MHz, $V_F$ = 0 V | - | 60 | - | pF |
| Supply Current | High Level | $I_{CCH}$ | VCC = 5.5 V, IF = 5 mA, IO = 0 mA | - | - | 3.0 | mA |
| | | | VCC = 30 V, IF = 5 mA, IO = 0 mA | | 1.9 | 3.0 | |
| | Low Level | $I_{CCL}$ | VCC = 5.5 V, VF = 0V, IO = 0 mA | - | - | 3.0 | |
| | | | VCC = 30 V, VF = 0 V, IO = 0 mA | | 2.0 | 3.0 | |
| Output current | High level | $I_{OH}$ | VCC = 5.5V, IF = 5mA, VO = GND | - | - | -160 | mA |
| | | | VCC = 20V, IF = 5mA, VO = GND | - | - | -200 | |
| | Low level | $I_{OL}$ | VO =VCC = 5.5V, VF = 0V | 160 | - | - | |
| | | | VO =VCC = 20V, VF = 0V | 200 | - | - | |
| Output voltage | High level | $V_{OH}$ | IOL = -6.5mA | VCC -0.5 | VCC -0.04 | - | V |
| | Low level | $V_{OL}$ | IOL = 6.5mA | - | 0.09 | 0.5 | |

Specified over recommended temperature (TA = -40°C to +110°C, +4.5V ≤ VCC ≤ 30V), IF(ON) = 1.6mA to 5mA, VF(OFF) = 0V to 0.8V, unless otherwise specified. All typicals at TA = 25°C.

Note 1: Duration of output short circuit time should not exceed 10 μs.

Note 2: Input capacitance is measured between pin 1 and pin 3.

## ● Switching Characteristics

(Ta = 25°C)

| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Propagation Delay Time to Output Low Level | $t_{PHL}$ | f = 10kHz, Duty Cycle = 50% $I_F$ = 2mA, $V_{CC}$ = 30V | - | 110 | 220 | ns |
| Propagation Delay Time to Output High Level | $t_{PLH}$ | | - | 90 | 220 | |
| Pulse Width Distortion | PWD | | - | 20 | 120 | |
| Propagation Delay Difference Between Any Two Parts | PDD ($t_{PHL}$ - $t_{PLH}$) | | -200 | - | +200 | |
| Rise Time | $t_r$ | | - | 6 | - | |
| Fall Time | $t_f$ | | - | 7 | - | |
| Common mode transient immunity at high level output | $\|C_{MH}\|$ | $I_F$=4.0 mA $V_{CC}$= 5V, $T_A$= 25 °C, $V_{CM}$= 1.5KV | 20 | — | — | KV / μs |
| Common mode transient immunity at low level output | $\|C_{ML}\|$ | $I_F$=0mA $V_{CC}$= 5V, $T_A$= 25 °C, $V_{CM}$= 1.5KV | 20 | — | — | KV / μs |

Over recommended operating conditions TA = -40° C to 105° C, VCC = +4.5 V to 30 V, IF(ON) = 1.6 mA to 5 mA, VF(OFF) = 0 V to 0.8 V,unless otherwise specified. All typicals at TA = 25°C.

Note 1: The tPLH propagation delay is measured from the 50% point on the leading edge of the input pulse to the 1.3 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 1.3 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.

## TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

**Fig.1 VOL vs. Temperature**

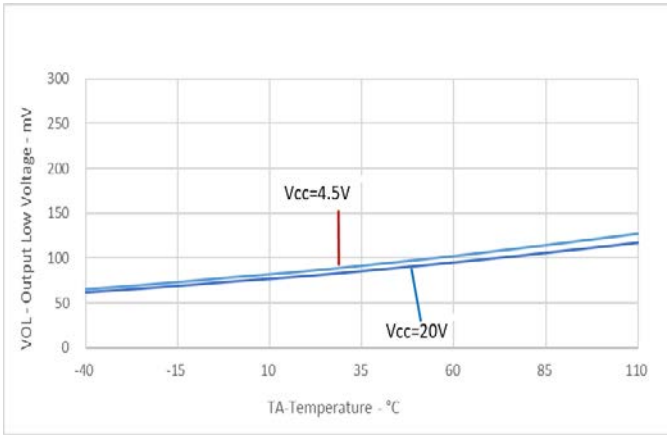



**Fig.2 $V_{OH}$ vs. Temperature**

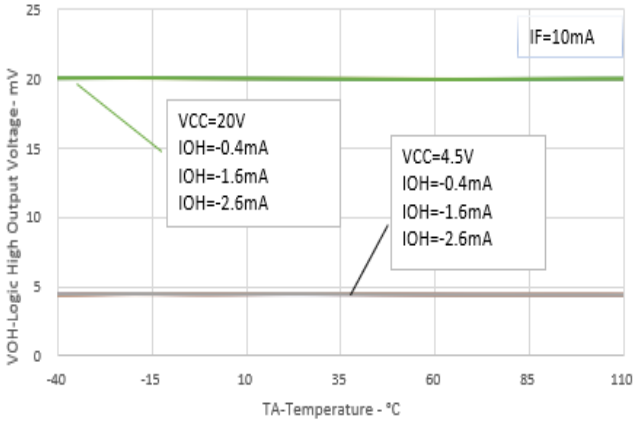



**Fig.3 $I_{FLH}$ Hysteresis**

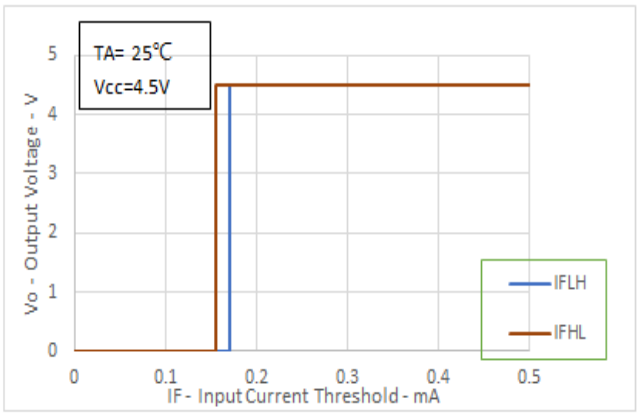



**Fig.4 $I_{FLH}$ vs. Temperature**

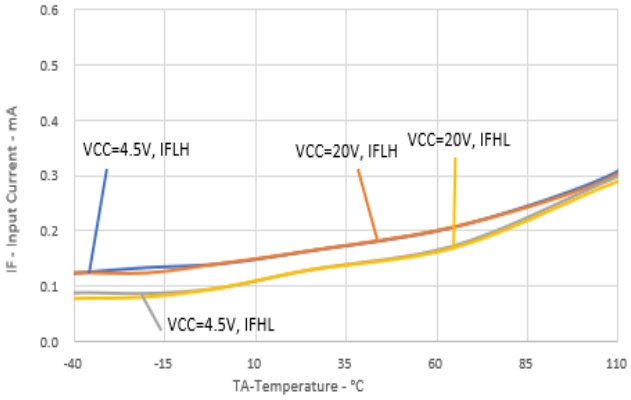



**Fig.5 Input Current vs. Voltage**

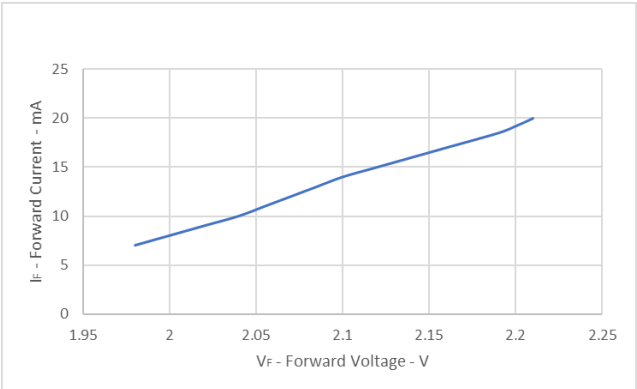



**Fig. 6 Supply Voltage vs. Output Voltage**

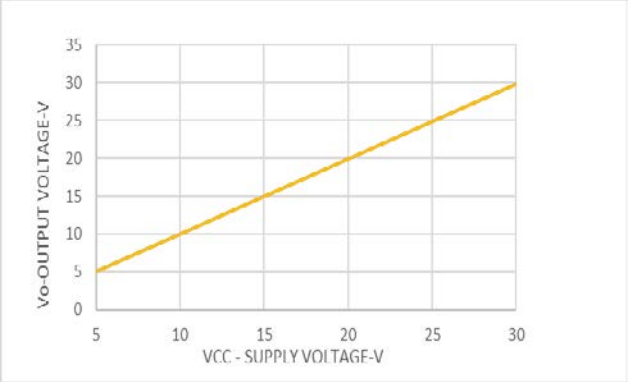


**Fig.7 Propagation Delays vs. Temperature**

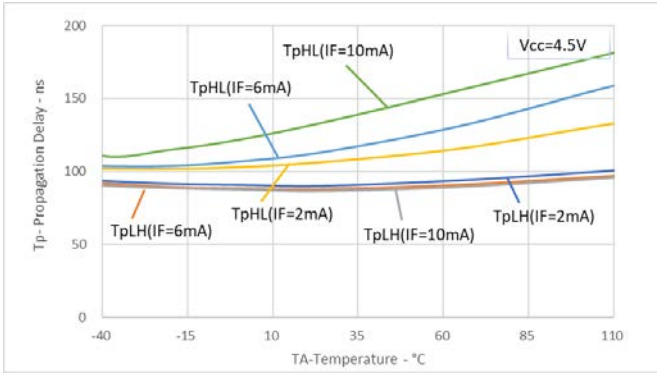



**Fig.8 Propagation Delays vs. Temperature**

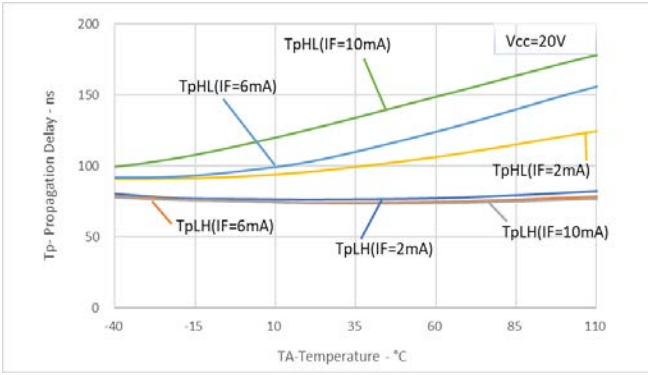
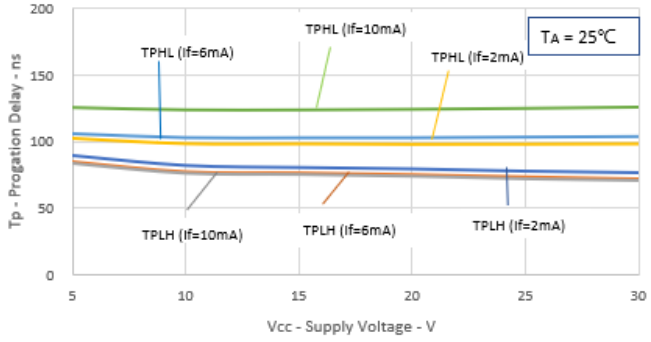
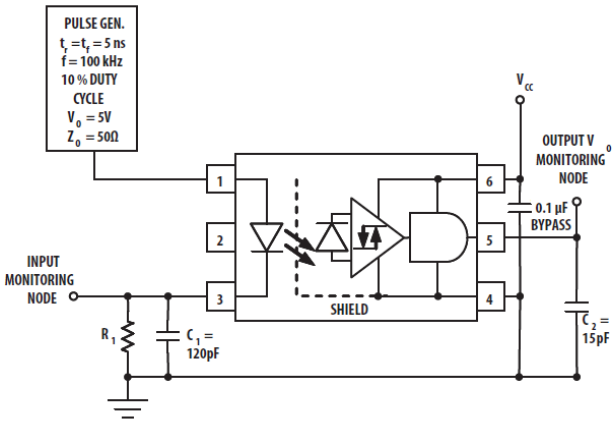


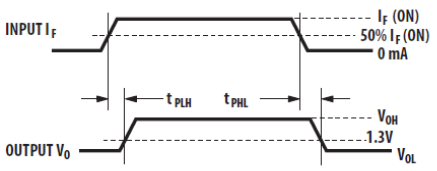

**Fig.9 Propagation Delays vs. $V_{CC}$**



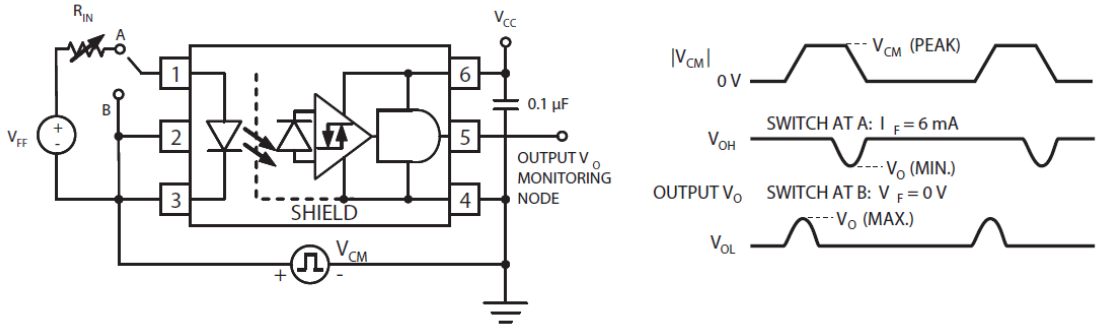

- **Test Circuit**

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



## Common Mode Transient Immunity Test Circuit and Typical Waveforms



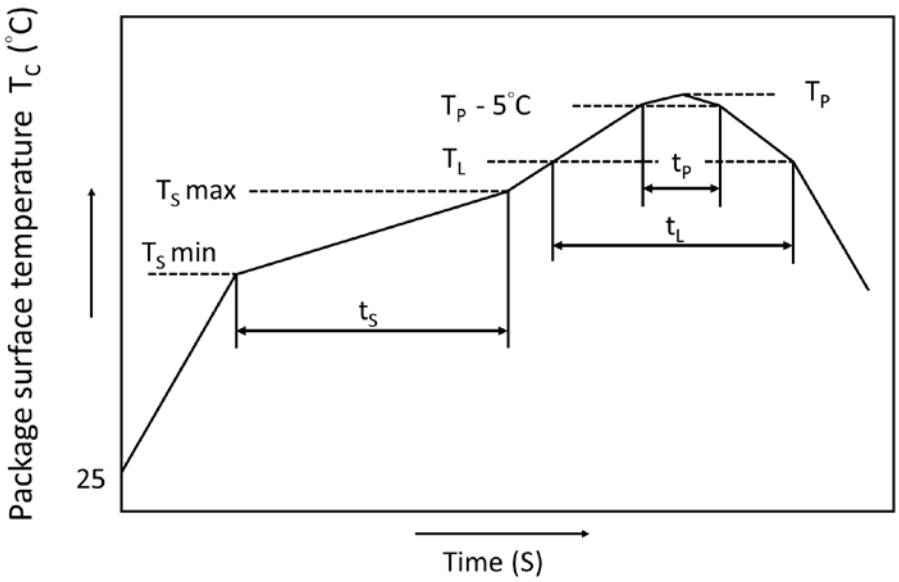

*$C_{ML}$($C_{MH}$) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.

## ● 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

**KT0480 X (Y)-(Z)**

**Notes:**

KT0480 = Part No.

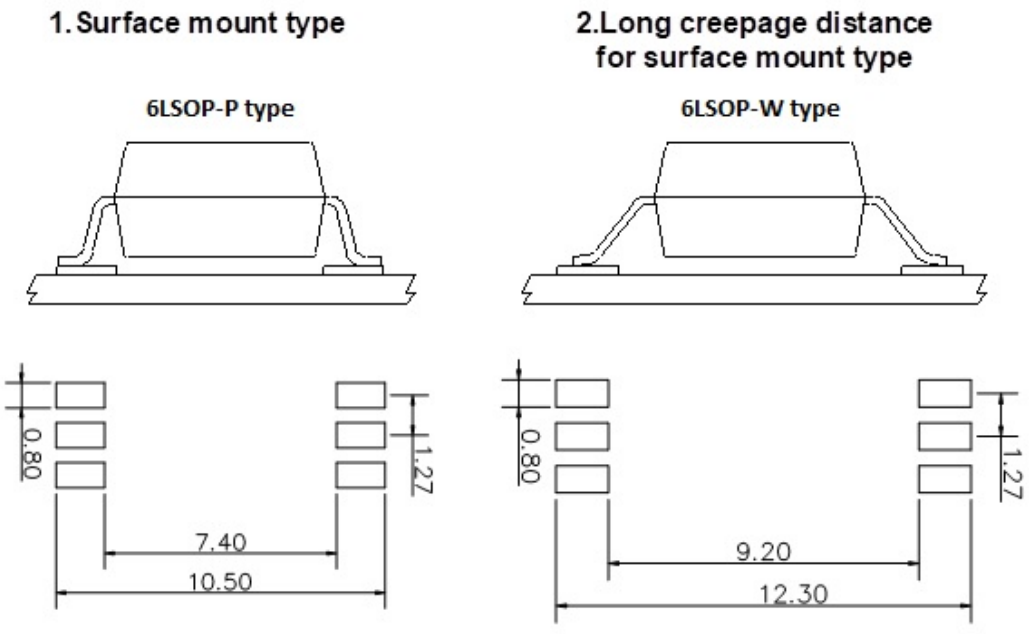
X = Lead form option (P or W )

Y = Tape and reel option (TLD or TRU)

Z = VDE option (V or None)

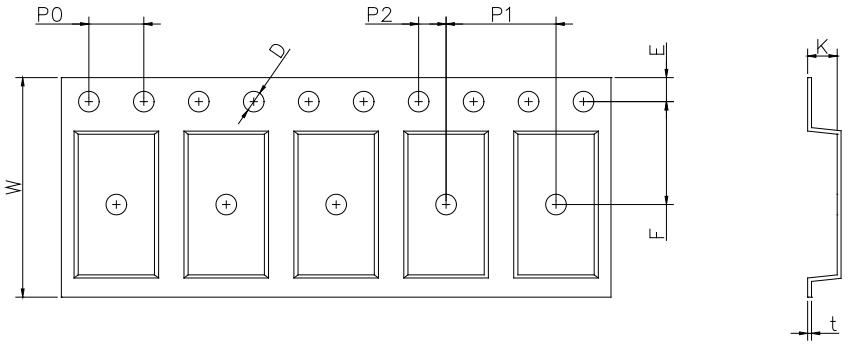
| Option | Description | Packing quantity |
|---|---|---|
| P (TLD) | surface mount type package + TL tape & reel option | 3000 units per reel |
| P (TRU) | surface mount type package + TR tape & reel option | 3000 units per reel |
| W (TLD) | long creepage distance for surface mount type package + TLD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

## Recommended Pad Layout for Surface Mount Lead Form



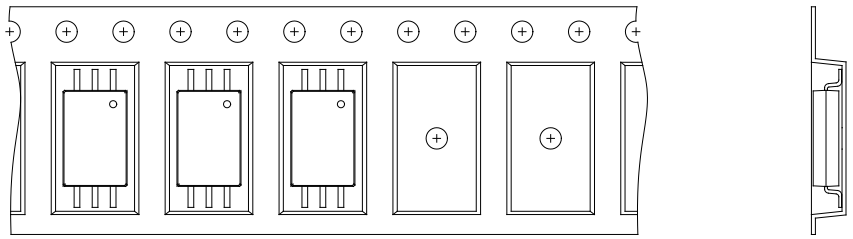

Unit :mm

## ● LSOP 6 Carrier Tape & Reel

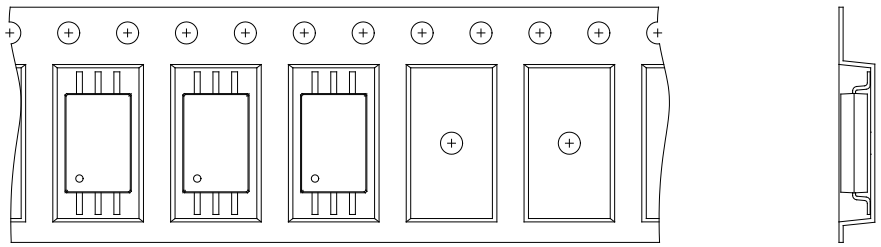



| Dimension Symbol | D | E | F | P0 | P1 | P2 | t | W | K |
|---|---|---|---|---|---|---|---|---|---|
| P type Dimension (mm) | 1.5±0.1 | 1.75±0.1 | 7.5±0.1 | 4.0±0.1 | 8.0±0.1 | 2.0±0.1 | 0.3±0.1 | 16.0±0.3 | 2.15±0.1 |
| W type Dimension (mm) | 1.5±0.1 | 1.75±0.1 | 11.5±0.1 | 4.0±0.1 | 8.0±0.1 | 2.0±0.1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

TRU



TLD



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