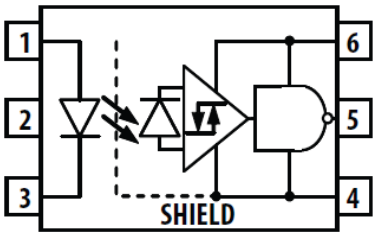
KT0481 Series

6PIN LSOP IPM DRIVE PHOTOCOUPLER

Description

The KT0481 series fast speed 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 phpto couplers excellent solutions for improving inverter efficiency through reduced switching dead time.

Schematic



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

Features

1. Inverter 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

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	L
OFF	H

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

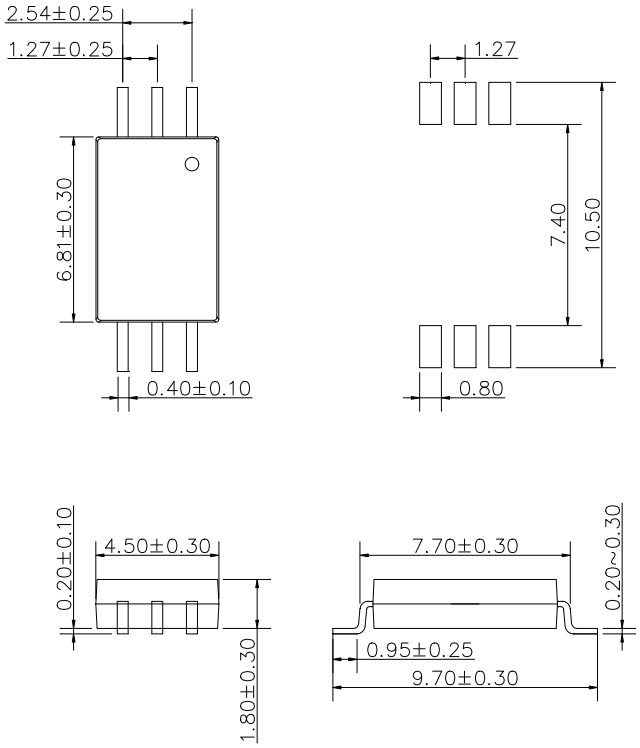
.

Outside Dimension

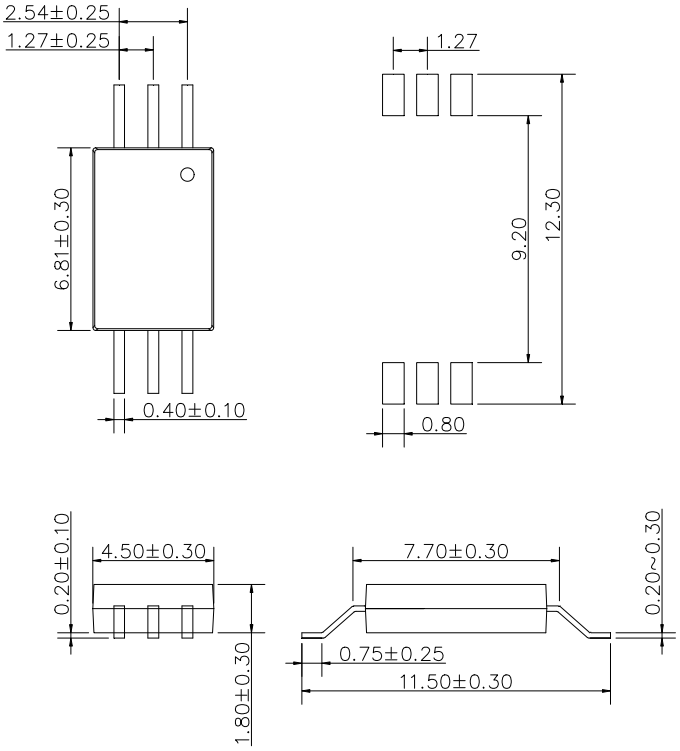
Surface Mount Lead Forming

1. P Type

Unit : mm



2. W Type



Device Marking

Notes:

cosmo
0481
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			Tstg	-55~125	°C
Operating Temperature			Topr	-40~110	°C
Total Package Power Dissipation			PT	145	mW
Lead soldering temperature(10s)		(Note 2)	T_{sol}	260	°C
Isolation voltage (AC,1min.,R.H≦60%)		(Note 3)	BVs	3750	Vrms
Input-Output Resistance (V_{I-O} = 500V DC)		(Note 3)	R_{I-O}	10^{12}	Ω

Note 1: Pulse width Pw ≦ 1μs,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

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.

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		$\triangle V_F / \Delta T$	I_F=10mA	-	-1.24	-	mV/°C
Input Reverse Voltage		BV_R	I_R = 10μA	5	-	-	V
Input Threshold Current (High to Low)		I_{FHL}	V_{CC} = 30 V, V_O < 5V	-	0.25	1.5	mA
Input Threshold Voltage (High to Low)		V_{FHL}	V_{CC} = 30 V, V_O > 5V	0.8	-	-	V
Input Capacitance[2]		C_{IN}	f = 1 MHz, V_F = 0 V	-	60	-	pF
Supply Current	High Level	I_{CCH}	VCC = 5.5 V, VF = 0V, IO = 0 mA	-	-	3.0	mA
			VCC = 30 V, VF = 0V, IO = 0 mA		1.9	3.0	
	Low Level	I_{CCL}	VCC = 5.5 V, IF = 5 mA, IO = 0 mA	-	-	3.0	
			VCC = 30 V, IF = 5 mA, IO = 0 mA		2.0	3.0	
Output current[1]	High level	I_{OH}	VCC = 5.5V, VF = 0V, VO = GND	-	-	-160	mA
			VCC = 20V, VF = 0V, VO = GND	-	-	-200	
	Low level	I_{OL}	VO =VCC = 5.5V, IF = 5 mA	160	-	-	
			VO =VCC = 20V, IF = 5 mA	200	-	-	
Output voltage	High level	V_{OH}	IOL = -6.5mA	VCC - 0.5	VCC - 0.05	-	V
	Low level	V_{OL}	IOL = 6.5mA	-	0.09	0.5	

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

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.

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	-	90	220	ns
Propagation Delay Time to Output High Level	t_{PLH}		-	110	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	$\|C_{MH}\|$	VF = 0V 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=4mA V_{CC}= 5V, T_A= 25 °C, V_{CM}= 1.5KV	20	-	-	KV / μs

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

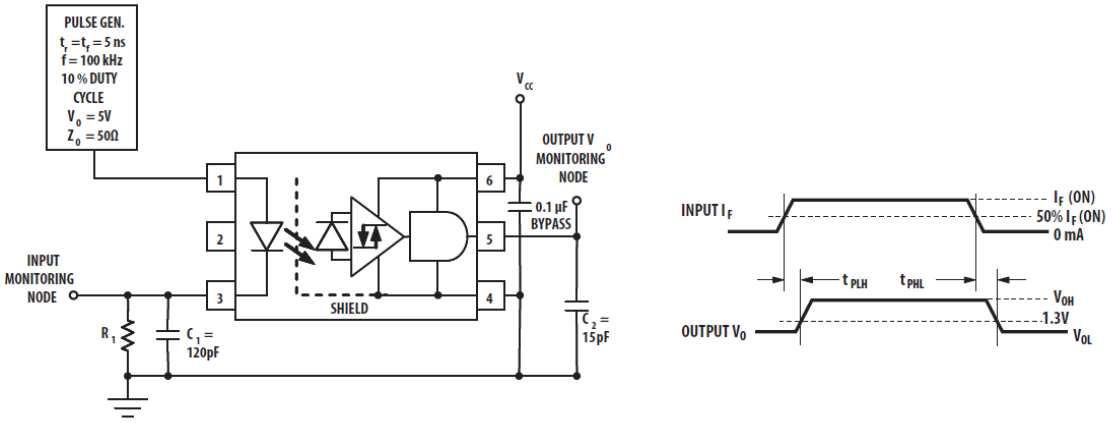
Note 2: Pulse Width Distortion (PWD) is defined as |tPHL - tPLH | for any given device.

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

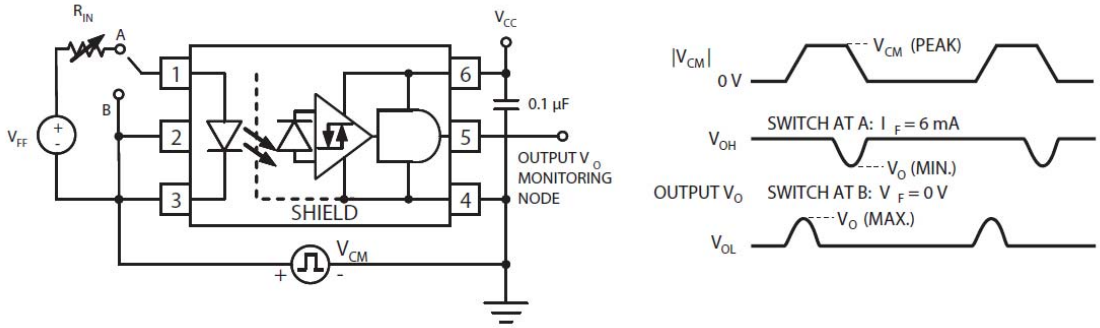
Note 4: CMH is the maximum slew rate of the common mode voltage that can be sustained with the output voltage in the logic high state, VO > 2.0 V. CML is the maximum slew rate of the common mode voltage that can be sustained with the output voltage in the logic low state, VO < 0.8 V. Note: Equal value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

- **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 VOL vs. Temperature

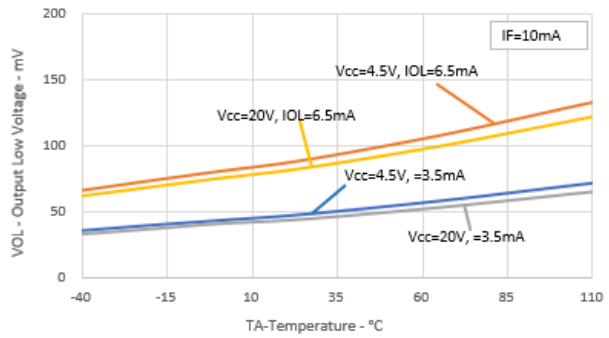


Fig.2 V_{OH} vs. Temperature

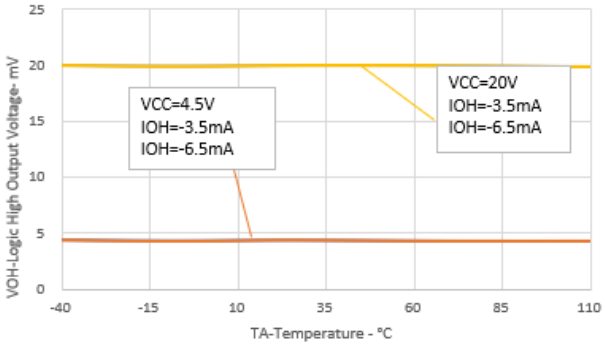


Fig.3 I_{FLH} Hysteresis

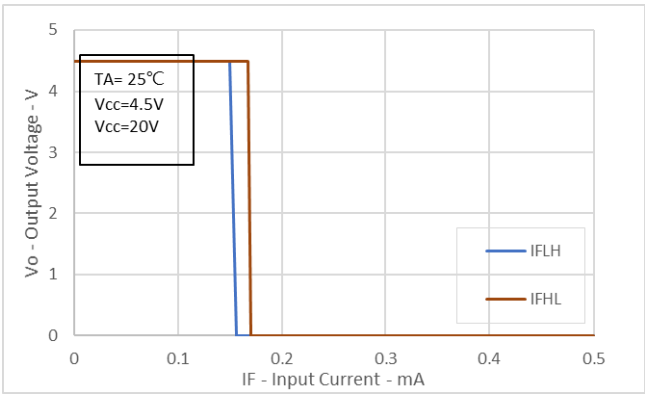


Fig.4 I_{FLH} vs. Temperature

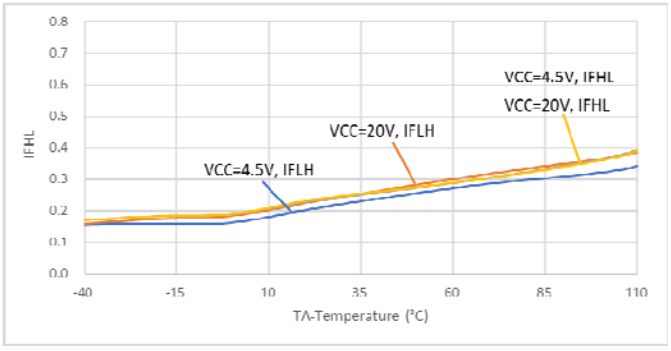


Fig.5 Input Current vs. Voltage

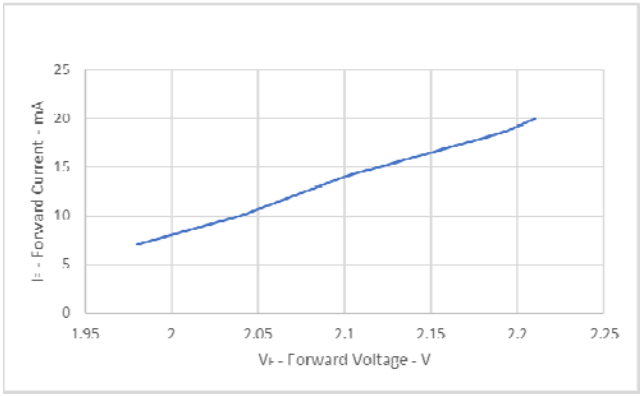


Fig. 6 Supply Voltage vs. Output Voltage

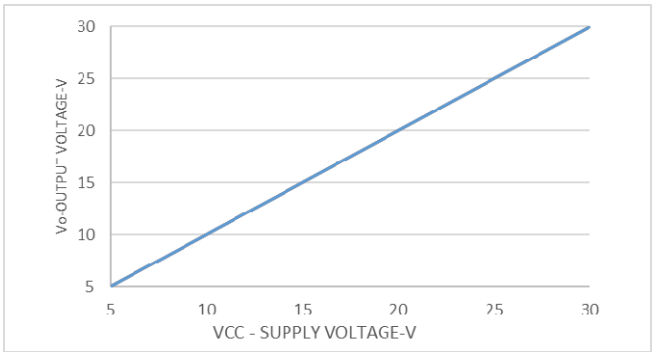


Fig.7 Propagation Delays vs. Temperature

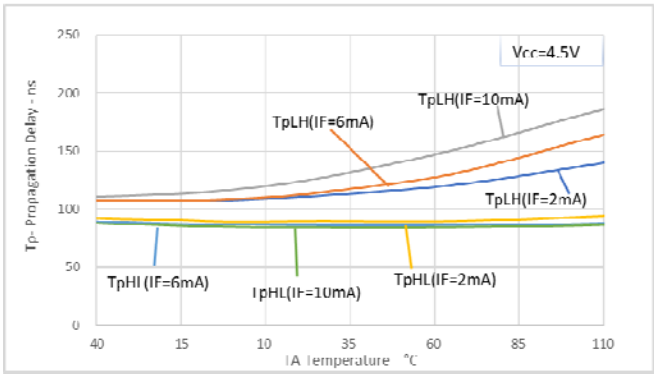


Fig.8 Propagation Delays vs. Temperature

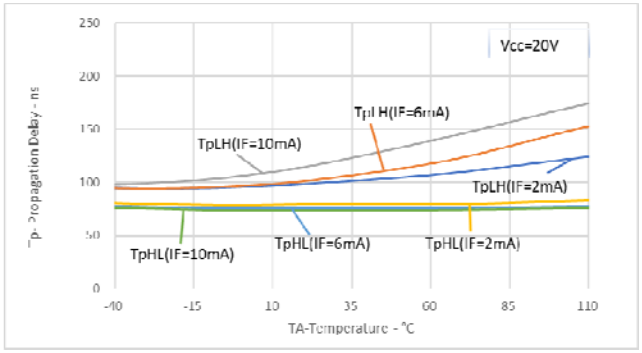
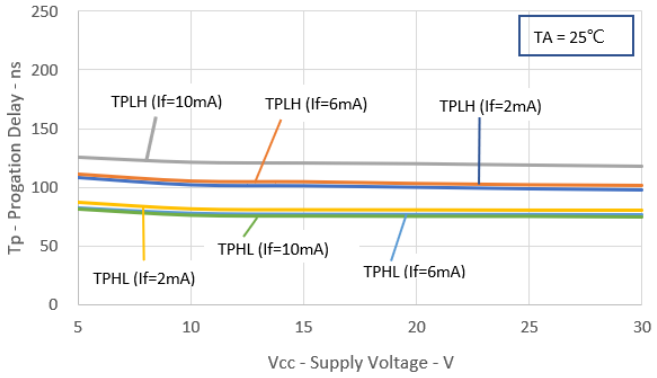


Fig.9 Propagation Delays vs. V_{CC}

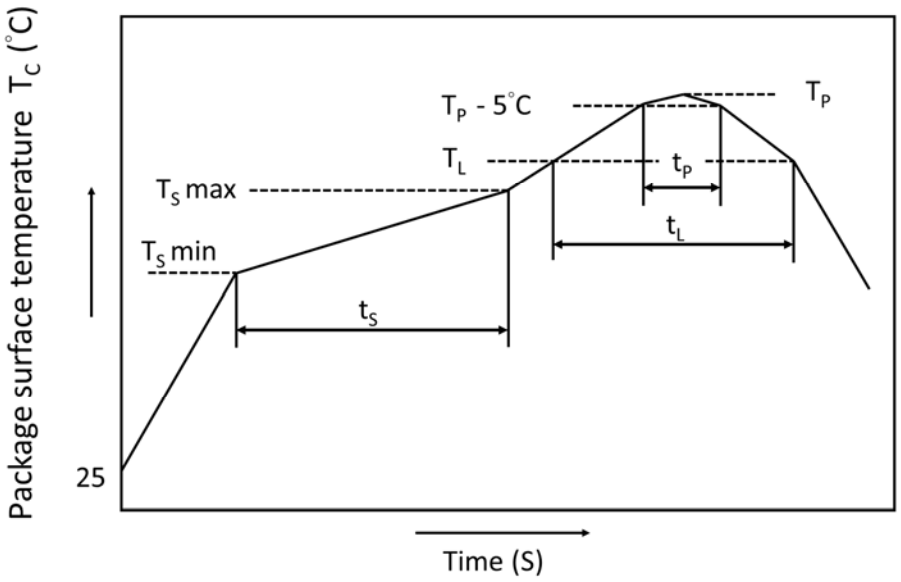


● Recommended Soldering Conditions

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**

KT0481X (Y)-(Z)

Notes:

KT0481 = Part No.

X = Lead form option (P or W)

Y = Tape and reel option (TLD or TRU)

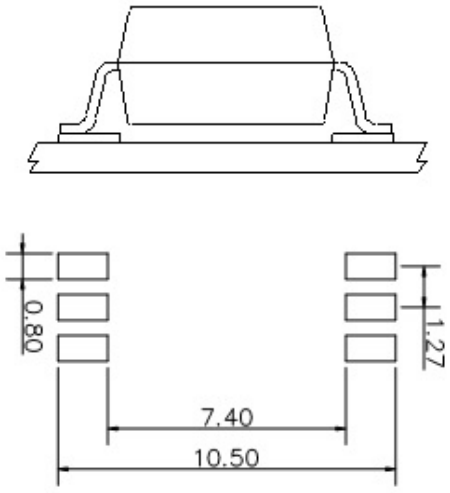
Z = VDE option (V or None)

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**

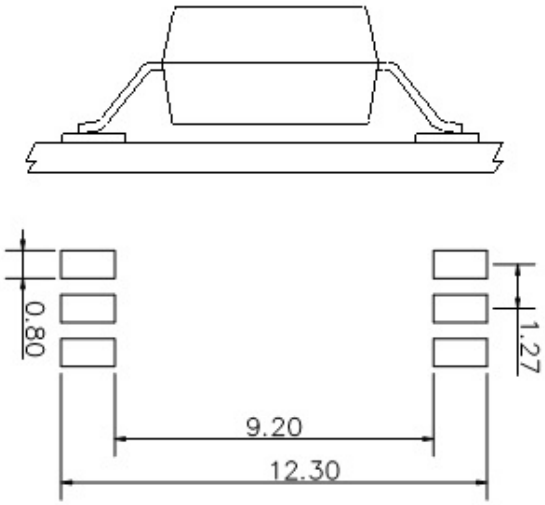
1. Surface mount type

6LSOP-P type



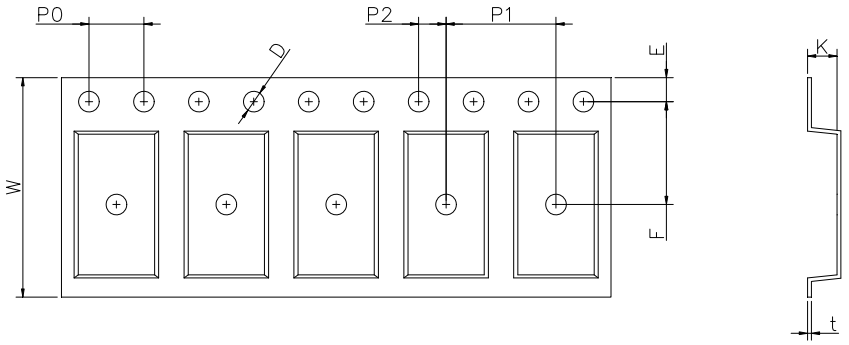
2. Long creepage distance for surface mount type

6LSOP-W type



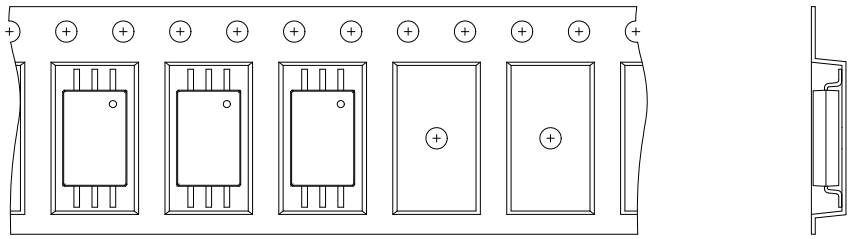
Unit :mm

● LSOP 6 Carrier Tape & Reel

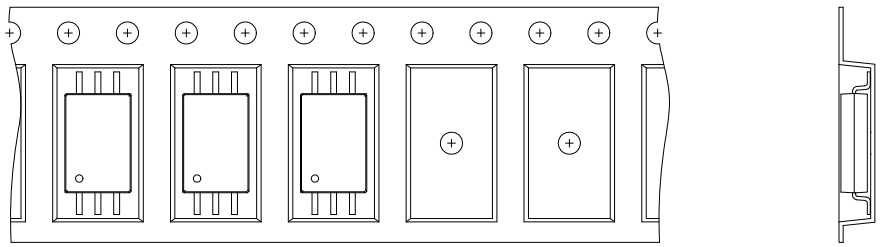


Dimension Symbol	D	E	F	P0	P1	P2	t	W	K
P type Dimension (mm)	1.5±0.1	1.75±0.1	7.5±0.1	4.0±0.1	8.0±0.1	2.0±0.1	0.3±0.1	16.0±0.3	2.15±0.1
W type Dimension (mm)	1.5±0.1	1.75±0.1	11.5±0.1	4.0±0.1	8.0±0.1	2.0±0.1	0.3±0.1	24.0±0.3	2.52±0.1

TRU



TLD



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