KT060L Series

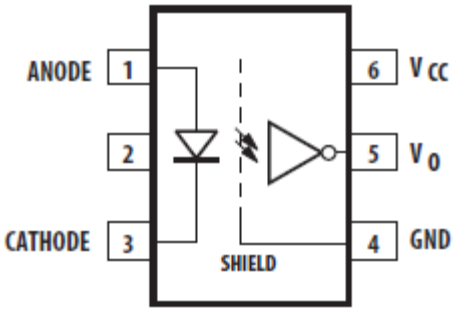
LSOP 6 High Speed 10MBit/s PHOTOCOUPLER

Description

The KT060L is an optically coupled gate that combines a light emitting diode and an integrated high gain photo detector. The output of the detector IC is an open collector Schottky clamped transistor. The internal shield provides a guaranteed common mode transient immunity specification of 10,000 V/μs for the KT060L.

This unique design provides maximum AC and DC circuit isolation while achieving TTL compatibility. The KT060L is suitable for high-speed logic interfacing, input/output buffering, as line receivers in environments that conventional line receivers cannot tolerate and are recommended for use in extremely high ground or induced noise environments.

Schematic



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

Features

1. 10 kV/μs minimum Common Mode Rejection (CMR) at VCM = 1000V
2. High speed: 10 MBd typical
3. Guaranteed ac and dc performance over -40°C ~+110°C

Applications

- Isolated line receiver
- Computer-peripheral interfaces
- Digital isolation for A/D, D/A conversion
- Isolation of high speed logic systems
- 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

Truth Table

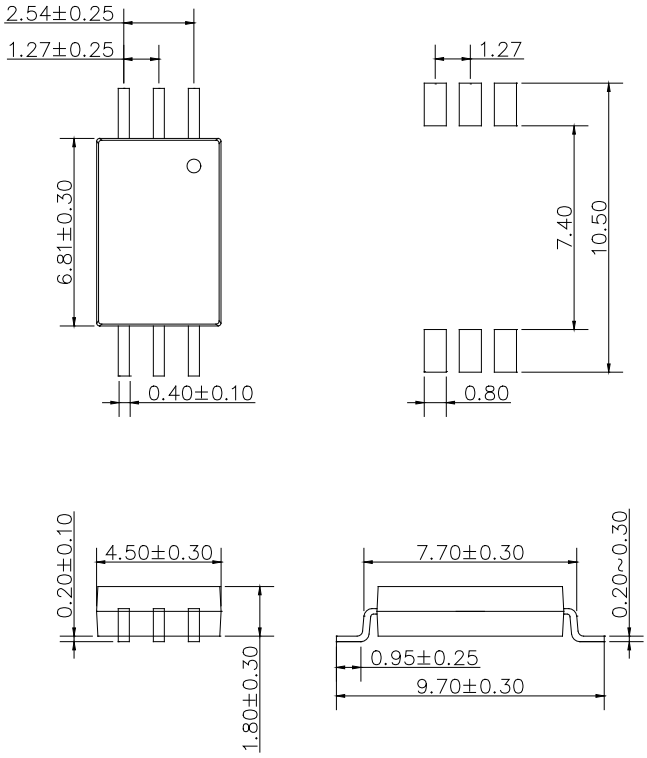
LED	OUT
ON	L
OFF	H

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

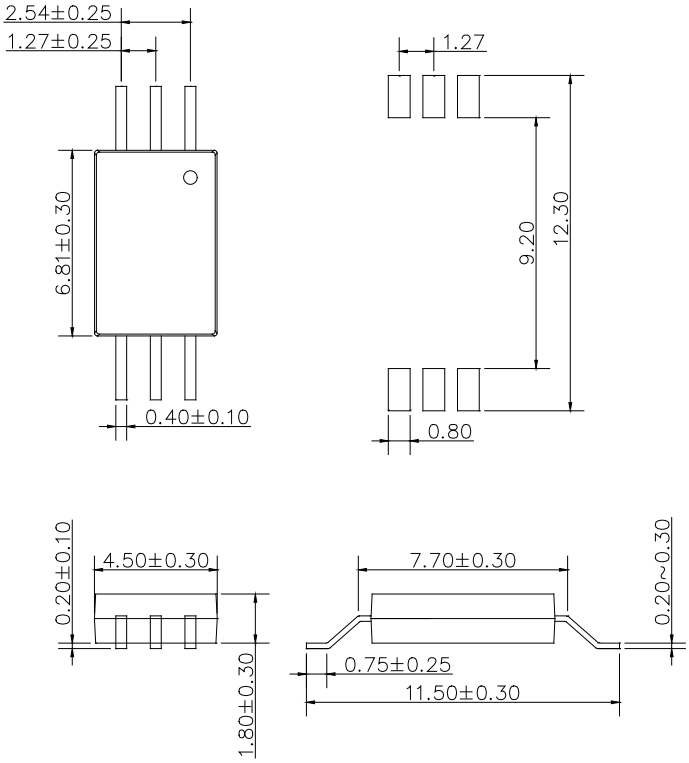
Outside Dimension

Unit : mm

P Type



W Type



Device Marking

Notes:

cosmo
060L
YWW — Y: Year code / WW: Week code
□ — 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	7	V
	Supply Voltage		Vcc	7	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	130	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	TA	-40	110	°C
Supply Voltage	VCC	2.7	3.6	V
		4.5	5.5	
Input Current High Level	IFLH	5	15	mA
Input Voltage Low Level	VFHL	-3.0	0.8	V
Fan Out (at RL = 1 KΩ)	N	-	5	TTL Loads
Output Pull-up Resistor	RL	330	4K	Ω

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

Over recommended operating conditions unless otherwise specified. (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 Reverse Voltage		BV_R	I_R = 10μA	5	-	-	V
Input Threshold Current		I_{TH}	VCC = 3.3V, VO = 0.6V, IOL > 13 mA	-	1.0	5.0	mA
Input Capacitance		C_{IN}	f = 1 MHz, V_F = 0 V	-	60	-	pF
Supply Current	High Level	I_{CCH}	VCC = 3.3V, IF = 0 mA	-	4.8	7	mA
	Low Level	I_{CCL}	VCC = 3.3V, IF = 10 mA	-	4.4	10	
Output current	High level	I_{OH}	VCC = 3.3V, VO = 3.3V, VF = 0.8V	-	0.2	100	uA
Output voltage	Low level	V_{OL}	VCC = 5.5V, IF = 5 mA, IOL(Sinking) = 13 mA	-	0.28	0.6	V

Over recommended operating conditions unless otherwise specified. (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 Reverse Voltage		BV_R	I_R = 10μA	5	-	-	V
Input Threshold Current		I_{TH}	VCC = 5.5V, VO = 0.6V, IOL > 13 mA	-	1.0	5.0	mA
Input Capacitance		C_{IN}	f = 1 MHz, V_F = 0 V	-	60	-	pF
Supply Current	High Level	I_{CCH}	VCC = 5.5V, IF = 0 mA	-	5.6	7.5	mA
	Low Level	I_{CCL}	VCC = 5.5V, IF = 10 mA	-	5.2	10.5	
Output current	High level	I_{OH}	VCC = 5.5V, VO = 5.5V, VF = 0.8V	-	0.35	100	uA
Output voltage	Low level	V_{OL}	VCC = 5.5V, IF = 5 mA, IOL(Sinking) = 13 mA	-	0.25	0.6	V

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 100°C, VCC = 3.3V, IF = 7.5 mA unless otherwise specified.

(Ta = 25°C)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Propagation Delay Time to Output Low Level	t_{PHL}	VCC = 3.3V, IF = 7.5 mA, RL = 350Ω, CL = 15 pF	-	35	75	ns
Propagation Delay Time to Output High Level	t_{PLH}		-	60	90	
Pulse Width Distortion	PWD		-	25	40	
Propagation Delay Skew	tPSK		-	-	50	
Rise Time	t_r		-	30	-	
Fall Time	t_f		-	3	-	
Common mode transient immunity at high level output	$\|C_{MH}\|$	VCC = 3.3V, IF = 0 mA, VO(MIN) = 2V,RL = 350Ω, VCM = 1000V	10	15	-	KV / μs
Common mode transient immunity at low level output	$\|C_{ML}\|$	VCC = 3.3V, IF = 7.5 mA, VO(MAX) = 0.8V,RL = 350Ω, VCM = 1000V	10	15	-	KV / μs

Over recommended operating conditions TA = –40°C to 100°C, VCC = 5V, IF = 7.5 mA unless otherwise specified.

(Ta = 25°C)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Propagation Delay Time to Output Low Level	t_{PHL}	VCC = 5V, IF = 7.5 mA, RL = 350Ω, CL = 15 pF	-	35	75	ns
Propagation Delay Time to Output High Level	t_{PLH}		-	55	75	
Pulse Width Distortion	PWD		-	20	40	
Propagation Delay Skew	tPSK		-	-	50	
Rise Time	t_r		-	30	-	
Fall Time	t_f		-	3	-	
Common mode transient immunity at high level output	$\|C_{MH}\|$	VCC = 5V, IF = 0 mA, VO(MIN) = 2V,RL = 350Ω, VCM = 1000V	10	15	-	KV / μs
Common mode transient immunity at low level output	$\|C_{ML}\|$	VCC = 5V, IF = 7.5 mA, VO(MAX) = 0.8V,RL = 350Ω, VCM = 1000V	10	15	-	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.

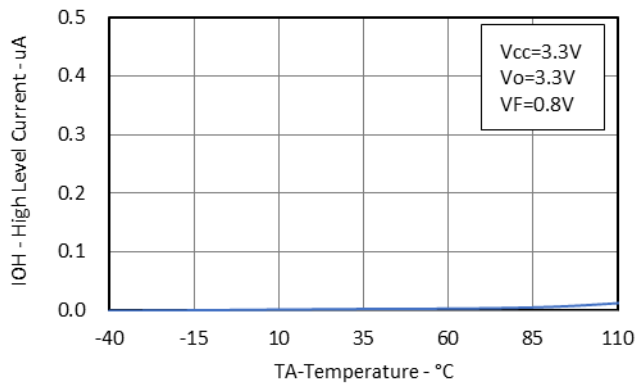
Note 2: Pulse Width Distortion (PWD) is defined as |tPHL - tPLH | for any given device.

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.

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

Fig.1 High Level Output Current vs. Temp



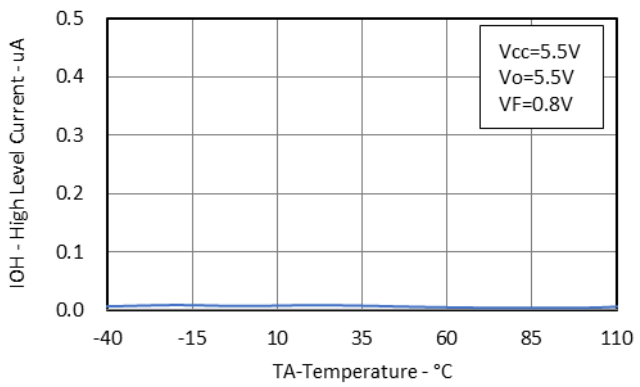
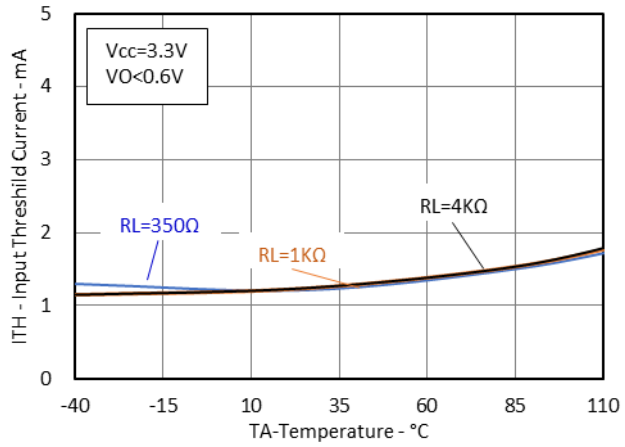


Fig.2 Input Threshold Current vs. Temp



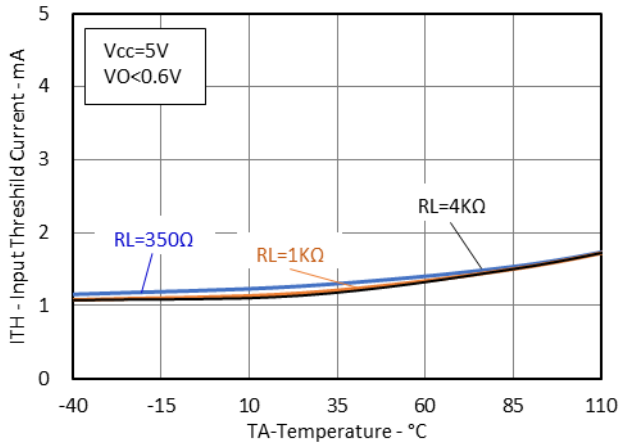
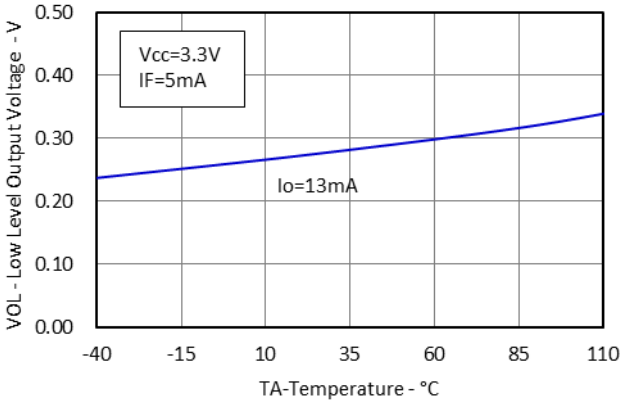


Fig.3 Low Level Output Voltage vs. Temp



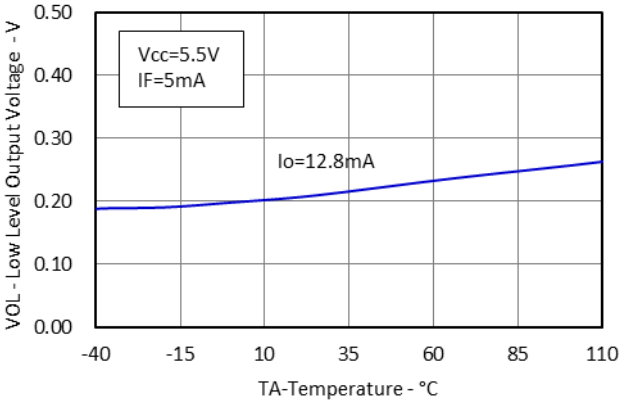
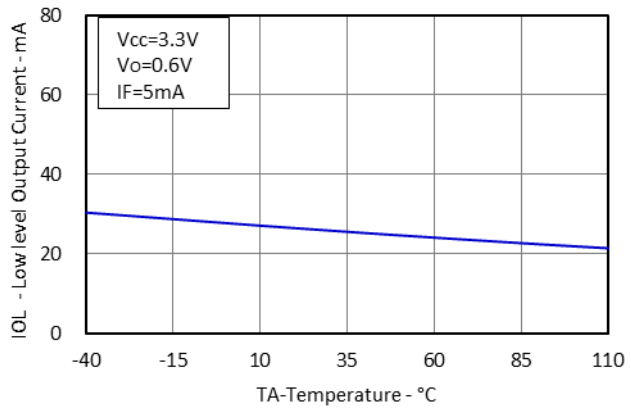


Fig.4 Low Level Output Current vs. Temp



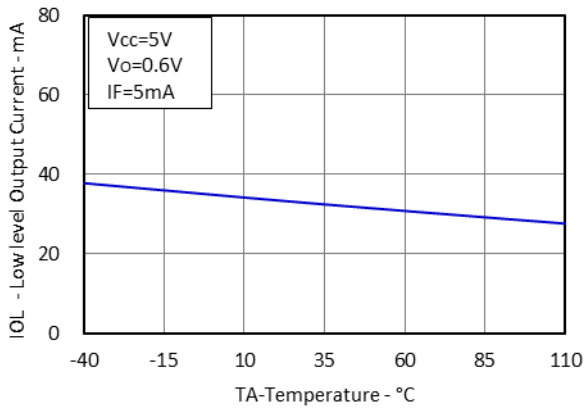
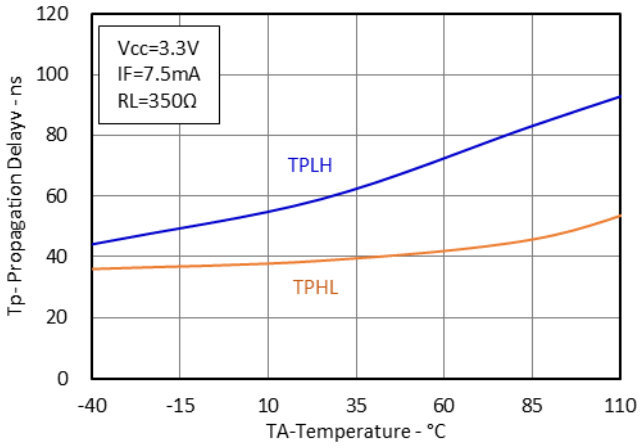


Fig.5 Propagation Delay vs. Temperature



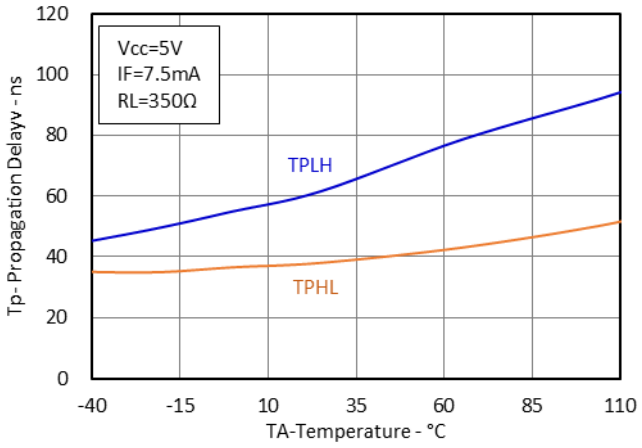
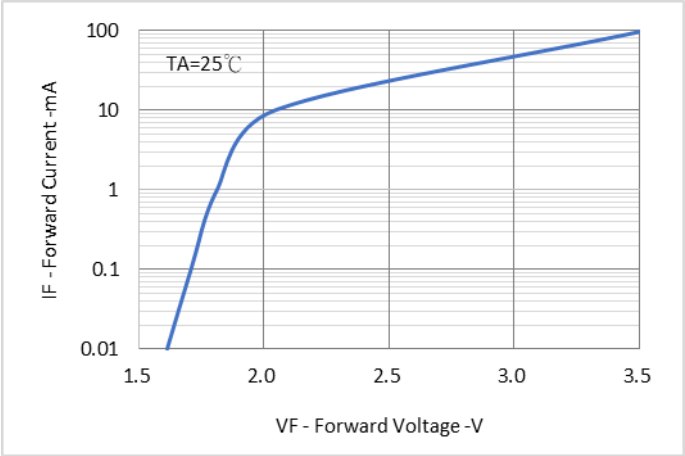
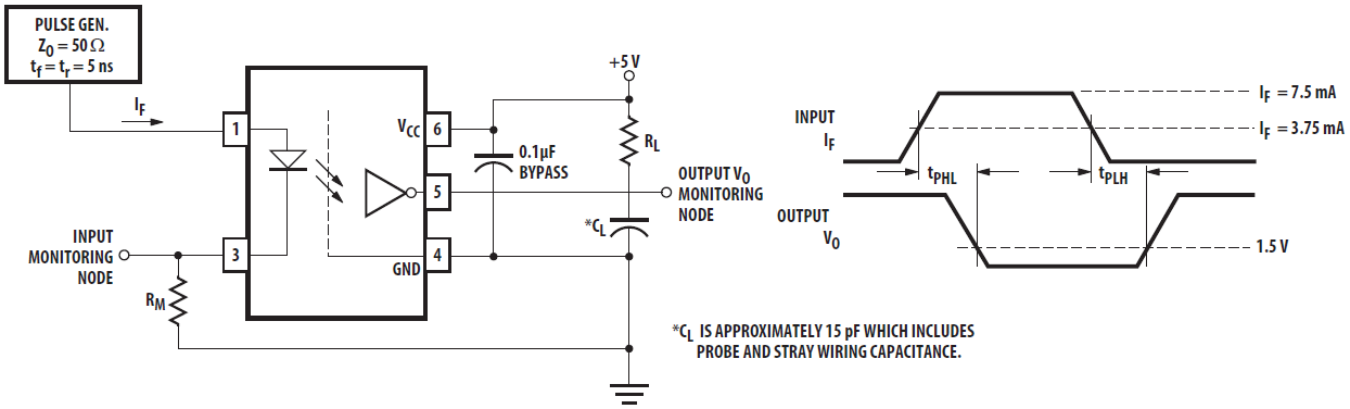


Fig.6 Input Diode Forward Characteristic

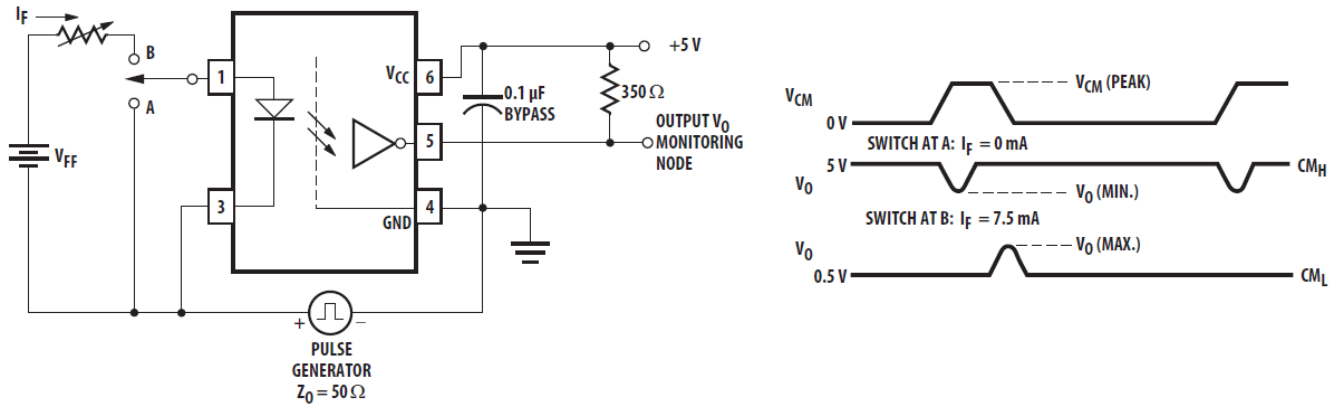


- **Test Circuit**

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



Common Mode Transient Immunity Test Circuit and Typical Waveforms



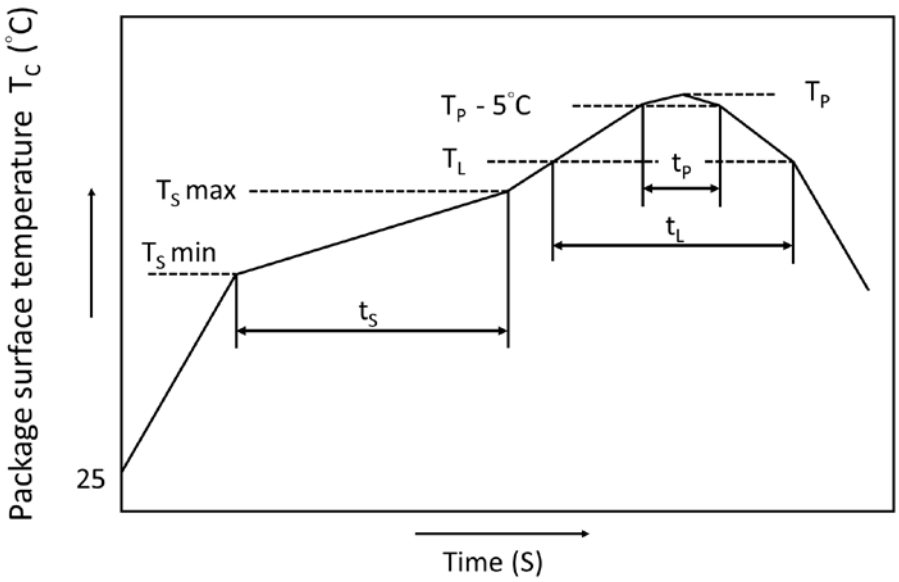
*C_{ML}(C_{MH}) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.

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

KT060L X (Y)-(Z)

Notes:

KT060 = Part No.

X = Lead form option (P or W)

Y = Tape and reel option (TLD or TRU)

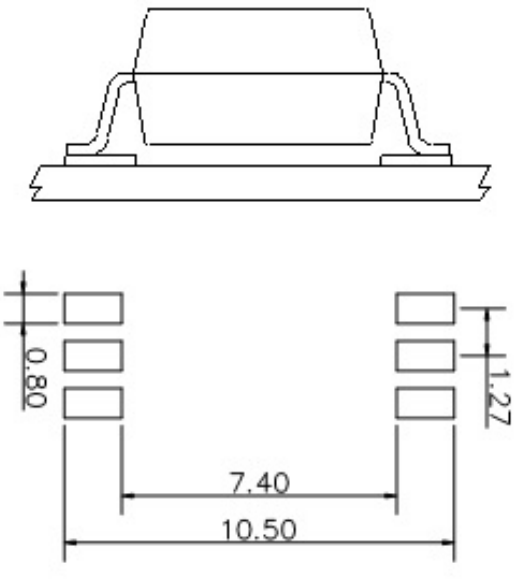
Z = VDE option (V or None)

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

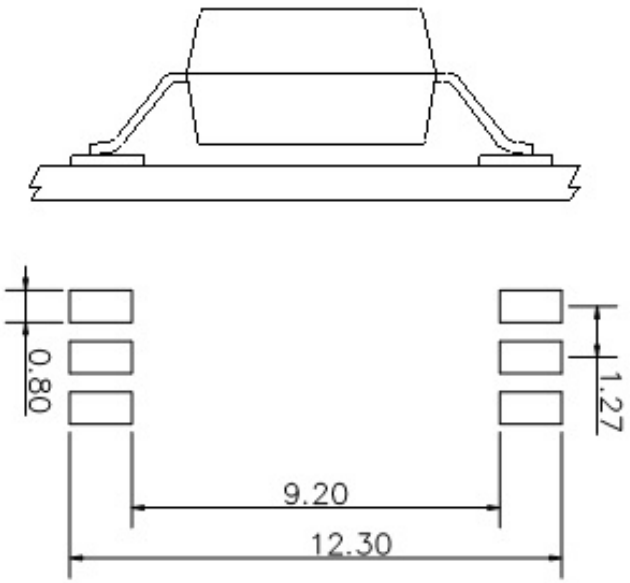
1. Surface mount type

6LSOP-P type



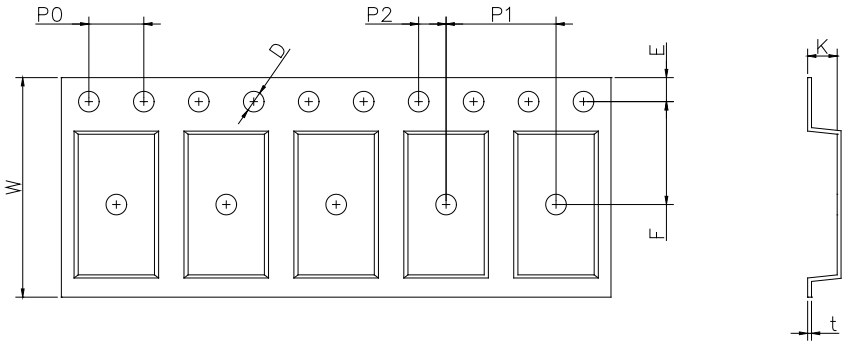
2.Long creepage distance for surface mount type

6LSOP-W type



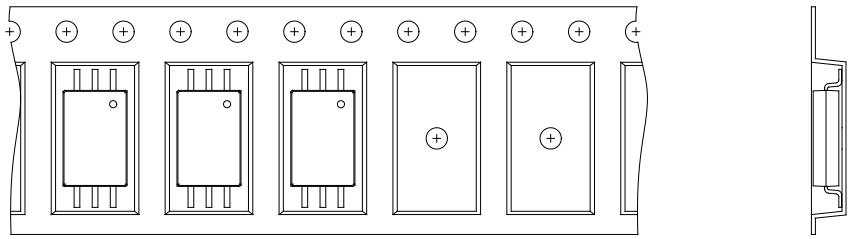
Unit :mm

● LSOP 6 Carrier Tape & Reel

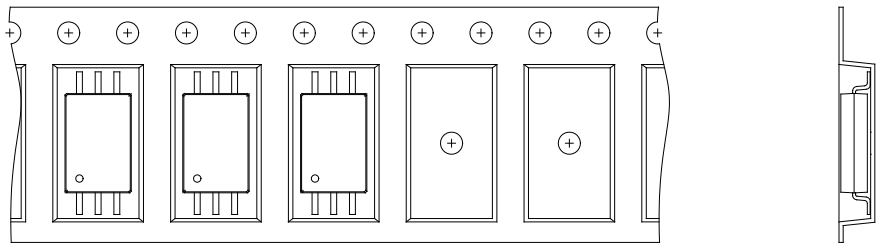


Dimension Symbol	D	E	F	P0	P1	P2	t	W	K
P type Dimension (mm)	1.5±0.1	1.75±0.1	7.5±0.1	4.0±0.1	8.0±0.1	2.0±0.1	0.3±0.1	16.0±0.3	2.15±0.1
W type Dimension (mm)	1.5±0.1	1.75±0.1	11.5±0.1	4.0±0.1	8.0±0.1	2.0±0.1	0.3±0.1	24.0±0.3	2.52±0.1

TRU



TLD



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