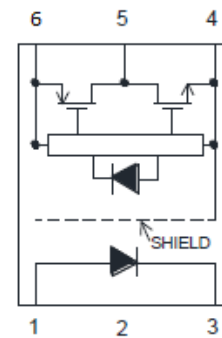


### ● Description

The KT0314 series Photocoupler is ideally suited for driving power IGBTs and MOSFETs used in motor control inverter applications and inverters in power supply system. It contains an LED optically coupled to an integrated circuit with a power output stage.

The Photocoupler operational parameters are guaranteed over the temperature range from  $-40^{\circ}\text{C} \sim +110^{\circ}\text{C}$ .

### ● Schematic



- |            |                   |
|------------|-------------------|
| 1. Anode   | 4. $V_{SS}$       |
| 2. N.C.    | 5. $V_o$ (Output) |
| 3. Cathode | 6. $V_{CC}$       |

### ● Features

1. 1 A maximum peak output current
  2. Rail-to-rail output voltage
  3. 110 ns maximum propagation delay
  4. Under Voltage Lock-Out protection (UVLO) with hysteresis
  5. Wide operating range: 10 to 30 Volts ( $V_{CC}$ )
  6. Guaranteed performance over temperature  $-40^{\circ}\text{C} \sim +110^{\circ}\text{C}$ .
  7. MSL class 1
  8. Agency Approvals:
    - UL Approved : UL1577
    - VDE Approved : DIN EN60747-5-5
- $V_{IORM} = 891\text{Vpeak}$  for KT0314P  
 $V_{IORM} = 1140\text{Vpeak}$  for KT0314W

### ● Applications

- Industrial inverter
- Isolated IGBT/Power MOSFET gate drive
- AC brushless and DC motor drives
- Induction Heating

### ● Truth Table

| LED | $V_{CC}-V_{SS}$ (Turn-ON, +ve going) | $V_{CC}-V_{SS}$ (Turn-OFF, -ve going) | $V_o$      |
|-----|--------------------------------------|---------------------------------------|------------|
| OFF | 0V to 30V                            | 0V to 30V                             | Low        |
| ON  | 0V to 6.9V                           | 0V to 5.9V                            | Low        |
| ON  | 6.9V to 8.7V                         | 5.9V to 7.5V                          | Transition |
| ON  | 8.7V to 30V                          | 7.5V to 30V                           | High       |

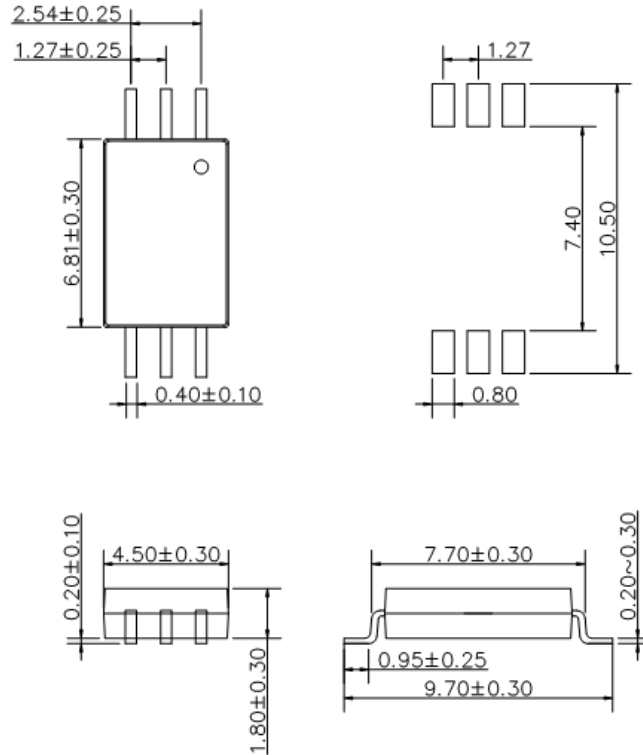
Note: A 0.1 $\mu\text{F}$  bypass capacitor must be connected between Pin 4 and Pin 6.

● Outside Dimension

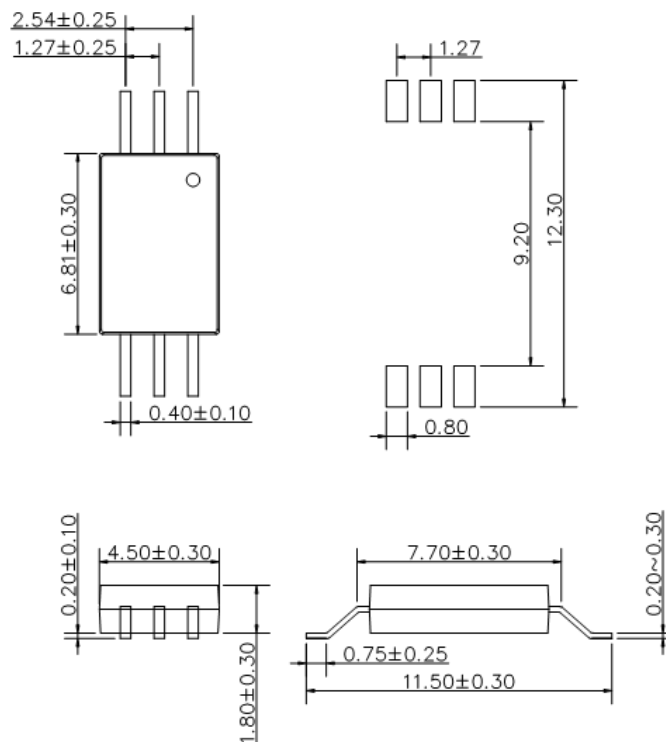
### Surface Mount Lead Forming

1. P type

(Unit : mm)



2. W type



### ● Device Marking



#### Notes:

**COSMO**  
0314  
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  | “H” peak output current (*Note 2)        | $I_{OH(PEAK)}$  | 1                    | A    |
|   | “L” peak output current (*Note 2)        | $I_{OL(PEAK)}$  | 1                    | A    |
|   | Output voltage                           | $V_{O(PEAK)}$   | -0.5~V <sub>CC</sub> | V    |
|   | Total output supply voltage              | $V_{CC}-V_{SS}$ | 0~35                 | V    |
|   | Junction temperature                     | $T_J$           | 125                  | °C   |
| Power Dissipation                                       |  | $P_I$           | 45                   | mW   |
| Output IC Power Dissipation                             |  | $P_O$           | 250                  | mW   |
| Operating temperature range                             |  | $T_{opr}$       | -40~110              | °C   |
| Storage temperature range                               |  | $T_{stg}$       | -55~125              | °C   |
| Lead soldering temperature(10s)                         |  | $T_{sol}$       | 260                  | °C   |
| Isolation voltage (t=1min.,R.H ≤ 40%~60%) (*Note 3,4,5) |  | $V_{ISO}$       | 5000                 | V    |

Note: Ambient temperature = 25°C, unless otherwise specified. Stresses exceeding the absolute maximum ratings can cause permanent damage to the device. Exposure to absolute maximum ratings for long periods of time can adversely affect reliability.

\*Note1: Pulse width  $P_w \leq 1\mu s, 300pps$ .

\*Note2: Exponential waveform. Pulse width  $\leq 10\mu s, f \leq 15kHz$

\*Note3:  $V_{CC} - V_{SS} = 30V$ , unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

\*Note4: Device is considered a two terminal device: pins 1, 2, 3 are shorted together and pins 4, 5, 6 are shorted together.

\*Note5: According to UL1577, each photocoupler is tested by applying an insulation test voltage 6000VRMS for one second. This test is performed before the 100% production test for partial discharge.

**● Electrical Characteristics**

(Ta = 25°C)

| Parameter                                  | Symbol                  | Test Condition                 | Min.  | Typ.                                | Max.      | Unit  |          |
|--|-------------------------|--------------------------------|---|-------------------------------------|-----------|-------|----------|
| Input forward voltage                      | $V_F$                   | $I_F=10\text{mA}$              | 1.6   | 1.9                                 | 2.4       | V     |          |
| Temperature coefficient of forward voltage | $\Delta V_F/\Delta T_a$ | $I_F=10\text{mA}$              | —   | -1.237                              | —         | mV/°C |          |
| Input reverse voltage                      | $BV_R$                  | $I_R=10\mu\text{A}$            | 5   | —                                   | —         | V     |          |
| Input capacitance                          | $C_{IN}$                | $V_F=0\text{V}, f=1\text{MHz}$ | —   | 60                                  | —         | pF    |          |
| Output current<br>(*Note 1)                | “H” level               | $I_{OH}$                       | $V_{CC}=30\text{V}$   | $I_F=10\text{mA}$<br>$V_O=V_{CC}-4$ | 1         | —     | A        |
|  | “L” level               | $I_{OL}$                       |   | $I_F=0\text{mA}$<br>$V_O=V_{SS}+4$  | 1         | —     |          |
| Output voltage<br>(*Note 2,3)              | “H” level               | $V_{OH}$                       | $I_F=10\text{mA}, I_O=-100\text{mA}$  | 29.4                                | 29.69     | —     | V        |
|  | “L” level               | $V_{OL}$                       | $I_F=0\text{mA}, I_O=100\text{mA}$  | —                                   | 0.17      | 0.4   |          |
| Supply current                             | “H” level               | $I_{CCH}$                      | $V_{CC}=30\text{V}, I_F=10\text{mA},$<br>$V_O=\text{Open}, R_g=30\Omega,$<br>$C_g=3\text{nF}$ | —                                   | 1.55      | 3     | mA       |
|  | “L” level               | $I_{CCL}$                      | $V_{CC}=30\text{V}, I_F=0\text{mA},$<br>$V_O=\text{Open}, R_g=30\Omega,$<br>$C_g=3\text{nF}$  | —                                   | 1.92      | 3     |          |
| Threshold input current                    | “Output<br>L→H”         | $I_{FLH}$                      | $V_O > 5\text{V}, I_O=0\text{A}$  | —                                   | 0.6       | 2     | mA       |
| Threshold input voltage                    | “Output<br>H→L”         | $V_{FHL}$                      | $V_{CC}=30\text{V}, V_O < 5\text{V}$  | 0.8                                 | —         | —     | V        |
| Under Voltage Lockout Threshold            |                         | $V_{UVLO+}$                    | $V_O > 5\text{V}, I_F = 10\text{mA}$  | 6.9                                 | 7.8       | 8.7   | V        |
|  |                         | $V_{UVLO-}$                    | $V_O < 5\text{V}, I_F = 10\text{mA}$  | 5.9                                 | 6.9       | 7.5   | V        |
| UVLO Hysteresis                            |                         | $UVLO_{HYS}$                   | —   | 0.9                                 | —         | V     |          |
| Supply voltage                             |                         | $V_{CC}$                       | 10  | —                                   | 35        | V     |          |
| Resistance (input-output)                  |                         | $R_{I-O}$                      | $V_{I-O}=500\text{VDC}$   | —                                   | $10^{12}$ | —     | $\Omega$ |

All Typical values at Ta = 25°C and  $V_{CC} - V_{SS} = 30\text{V}$ , unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Note 1: Maximum pulse width = 10  $\mu\text{s}$ .

Note 2: In this test  $V_{OH}$  is measured with a DC load current. When driving capacitive loads,  $V_{OH}$  will approach  $V_{CC}$  as  $I_{OH}$  approaches zero amps.

Note 3: Maximum pulse width = 1 ms.

● **Recommend Operation Conditions**

| Parameter             | Symbol       | Min. | Max. | Unit |
|-----------------------|--------------|------|------|------|
| Operating Temperature | $T_A$        | -40  | 110  | °C   |
| Supply Voltage        | $V_{CC}$     | 10   | 30   | V    |
| Input Current (ON)    | $I_{F(ON)}$  | 7    | 16   | mA   |
| Input Voltage (OFF)   | $V_{F(OFF)}$ | -3.0 | 0.8  | V    |

● **Switching Characteristics**

(Ta = 25°C)

| Parameter   | Symbol                         | Test Condition  | Min.   | Typ. | Max. | Unit               |
|---|--------------------------------|---|--|------|------|--------------------|
| Propagation delay time  | “L→H”                          | $R_g = 47 \Omega$ , $C_g = 3 \text{ nF}$ ,<br>$I_F = 10 \text{ mA}$ , $f = 10 \text{ kHz}$ ,<br>Duty Cycle = 50%<br>$V_{CC} = 30 \text{ V}$ | —  | 69   | 110  | ns                 |
|   | “H→L”                          |   | —  | 54   | 110  |                    |
| Pulse Width Distortion  | PWD                            |   | —  | 22   | 70   |                    |
| Propagation Delay Difference Between Any Two Parts              | PDD<br>( $t_{PHL} - t_{PLH}$ ) |   | -100   | —    | +100 |                    |
| Output rise time  | $t_r$                          |   | —  | 35   | —    |                    |
| Output fall time  | $t_f$                          |   | —  | 25   | —    |                    |
| Common mode transient immunity at high level output (*Note 1,2) | $CM_H$                         |   | $V_{CM} = 1 \text{ KV}$ , $I_F = 7 \sim 16 \text{ mA}$<br>$V_{CC} = 30 \text{ V}$ , $T_a = 25^\circ \text{ C}$ | 20   | 40   | —                  |
| Common mode transient immunity at low level output (*Note 1,3)  | $CM_L$                         | $V_{CM} = 1 \text{ KV}$ , $I_F = 0 \text{ mA}$<br>$V_{CC} = 30 \text{ V}$ , $T_a = 25^\circ \text{ C}$                                      | 20   | 40   | —    | KV / $\mu\text{s}$ |

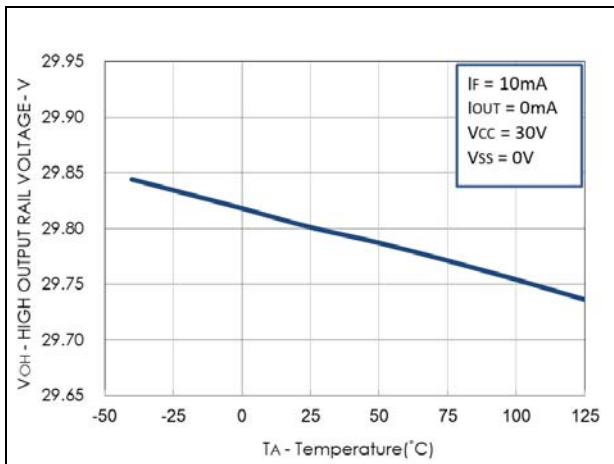
All Typical values at  $T_a = 25^\circ \text{ C}$  and  $V_{CC} - V_{SS} = 30 \text{ V}$ , unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Note 1: Pin 2 needs to be connected to LED common.

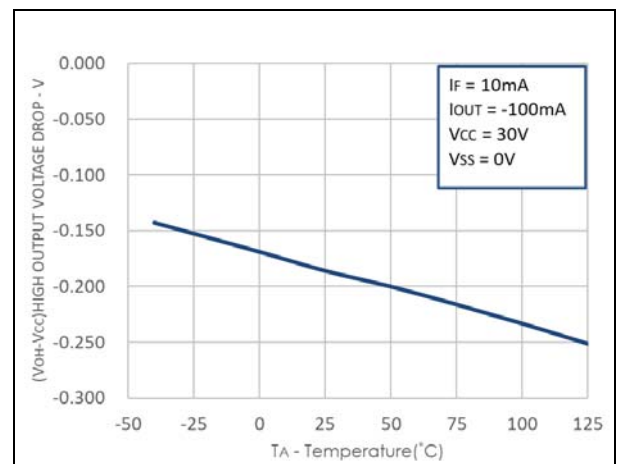
Note 2: Common mode transient immunity in the high state is the maximum tolerable  $dV_{CM}/dt$  of the common mode pulse,  $V_{CM}$ , to assure that the output will remain in the high state (meaning  $V_O > 10.0 \text{ V}$ ).

Note 3: Common mode transient immunity in a low state is the maximum tolerable  $dV_{CM}/dt$  of the common mode pulse,  $V_{CM}$ , to assure that the output will remain in a low state (meaning  $V_O < 1.0 \text{ V}$ ).

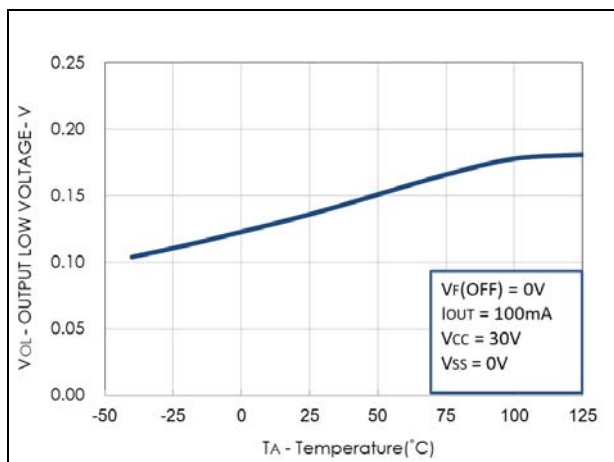
**Fig.1 High output rail voltage vs. Temperature**



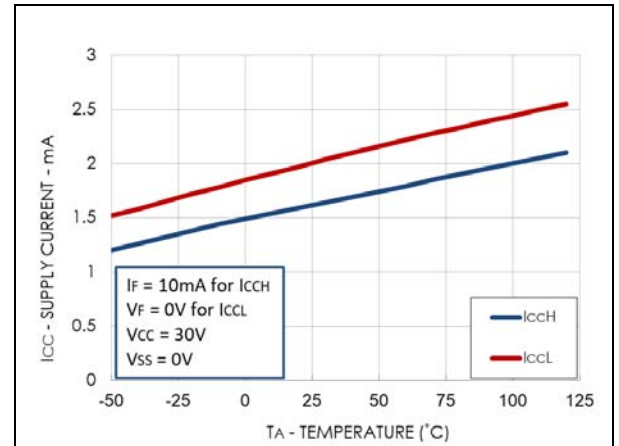
**Fig.2 V<sub>OH</sub> vs. Temperatures**



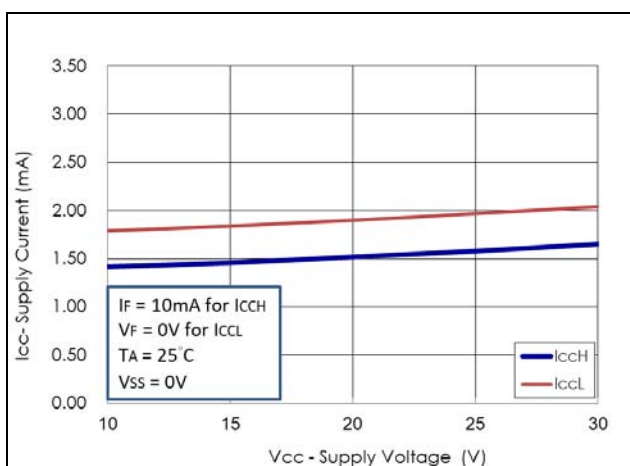
**Fig.3 V<sub>OL</sub> vs. Temperature**



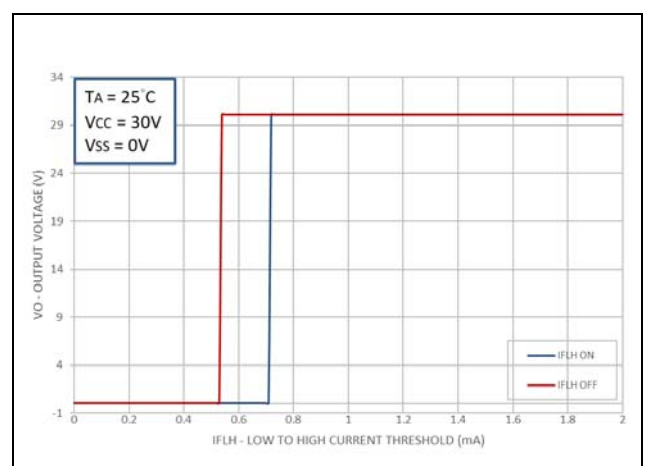
**Fig.4 I<sub>CC</sub> vs. Temperature**



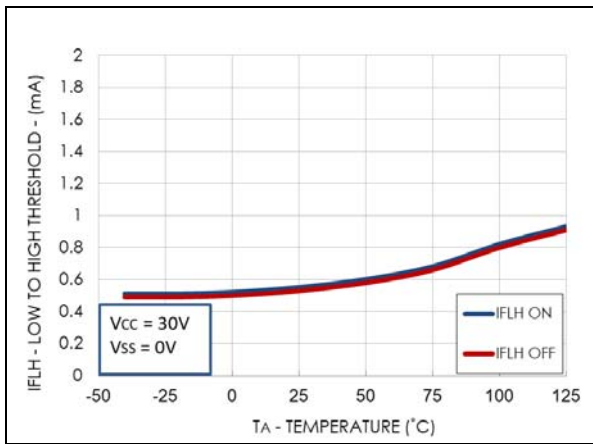
**Fig.5 I<sub>CC</sub> vs. V<sub>CC</sub>**



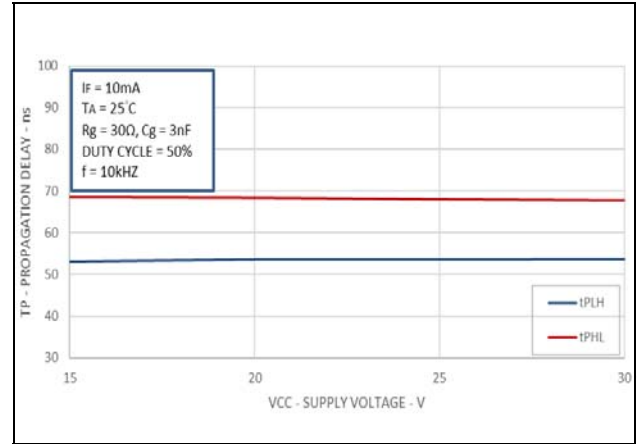
**Fig.6 I<sub>FLH</sub> vs. Hysteresis**



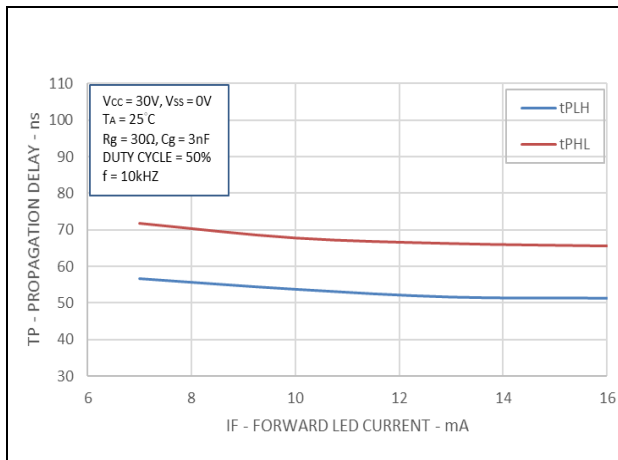
**Fig.7 I<sub>FH</sub> vs. Temperature**



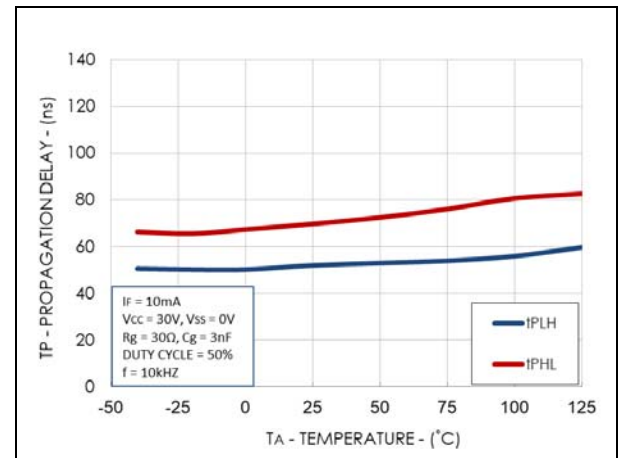
**Fig.8 Propagation Delays vs. V<sub>CC</sub>**



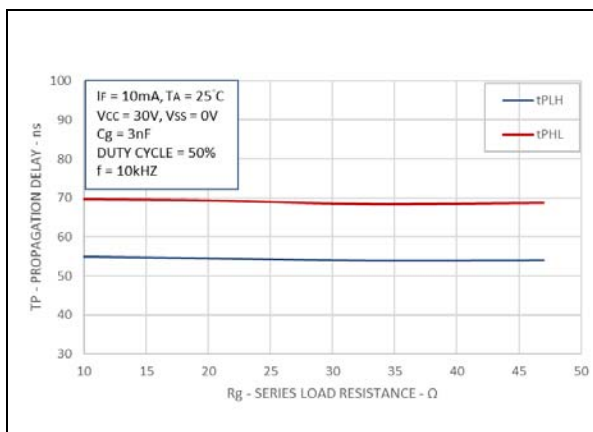
**Fig.9 Propagation Delays vs. I<sub>F</sub>**



**Fig.10 Propagation Delays vs. Temperature**



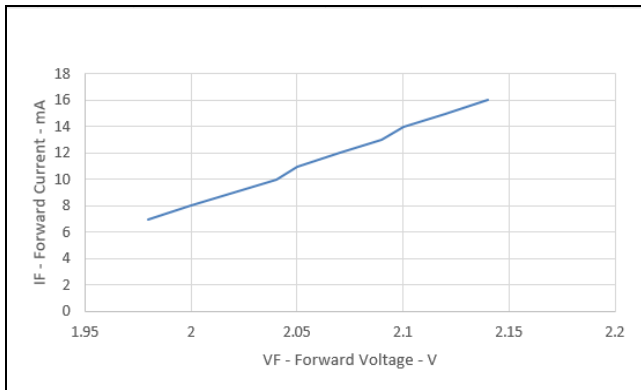
**Fig.11 Propagation Delays vs. R<sub>g</sub>**



**Fig.12 Propagation Delays vs. C<sub>g</sub>**

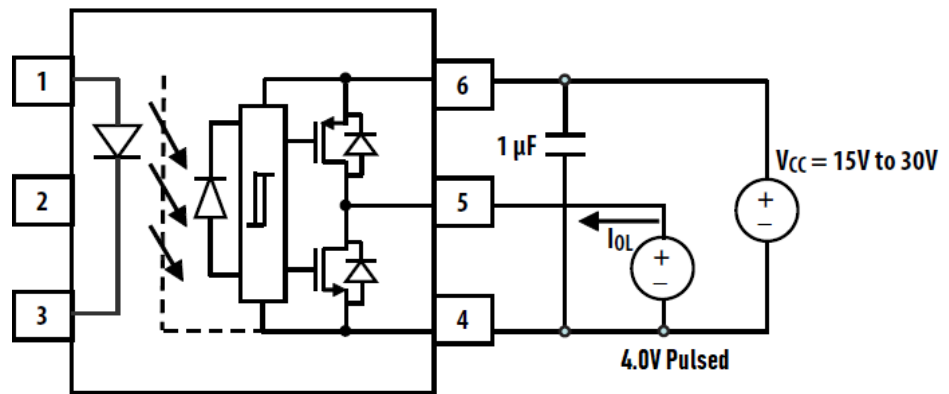


**Fig.13 Input Current vs. Forward Voltage**

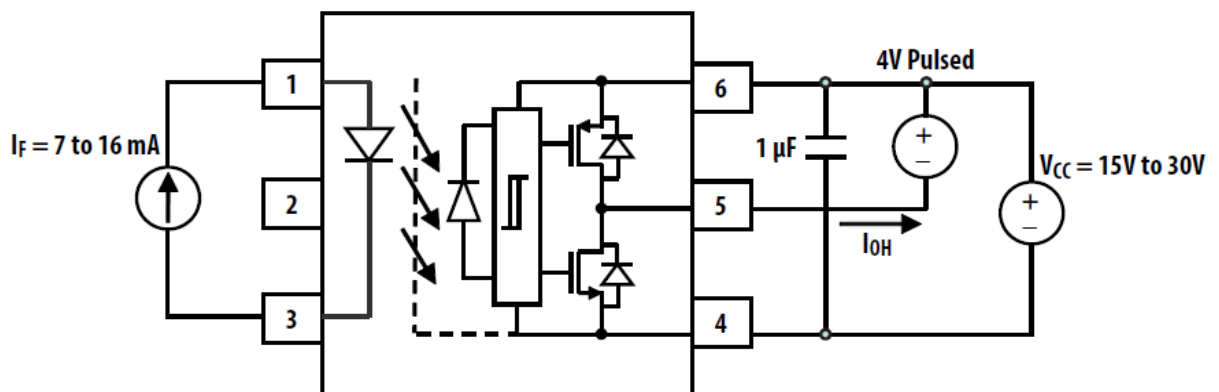


● **Test Circuit**

1.  **$I_{OL}$  Measure**

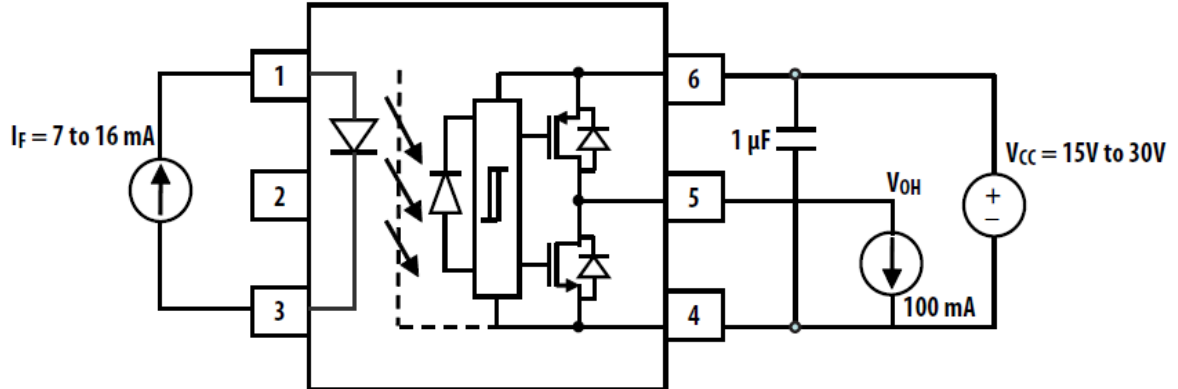


2.  **$I_{OH}$  Measure**

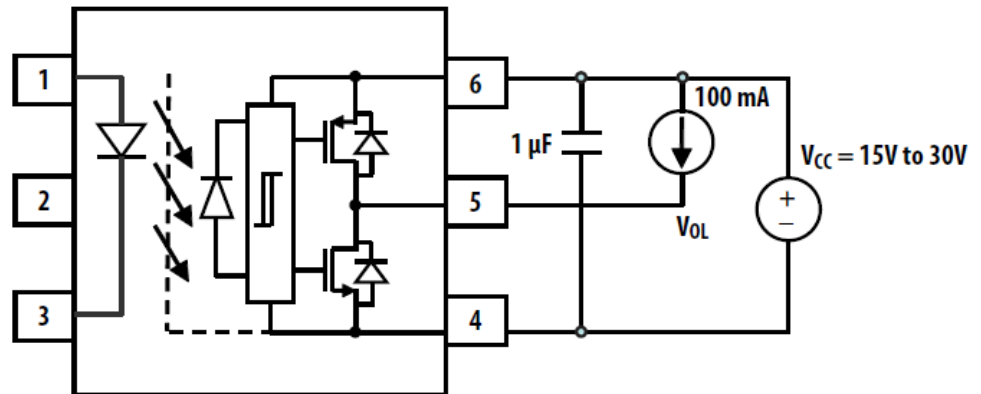




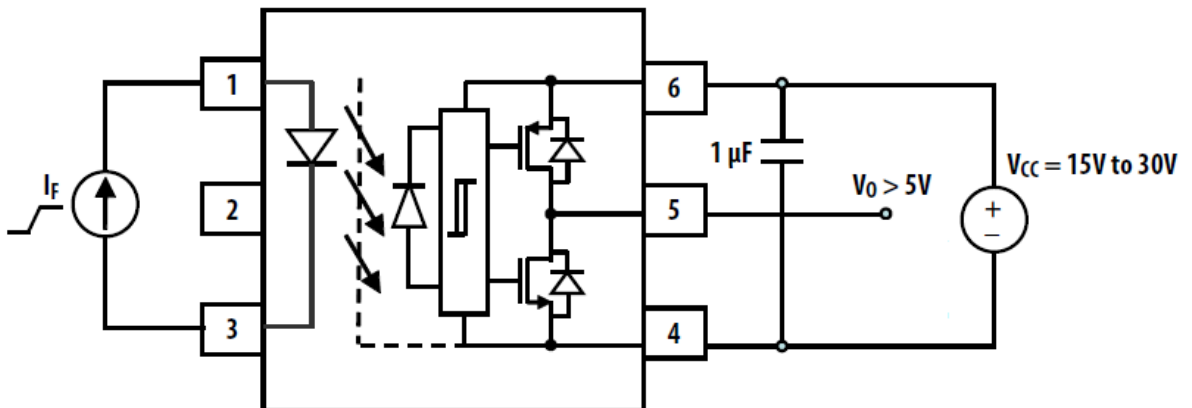
**3.  $V_{OH}$  Measure**



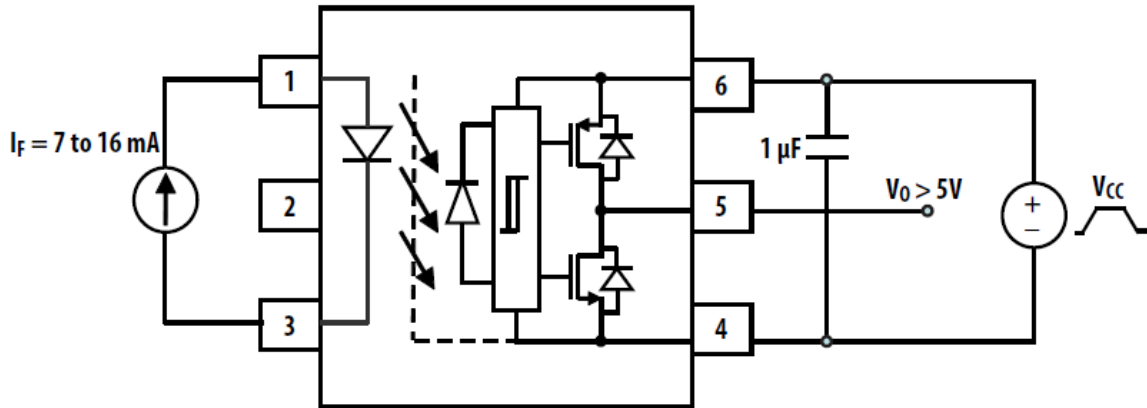
**4.  $V_{OL}$  Measure**



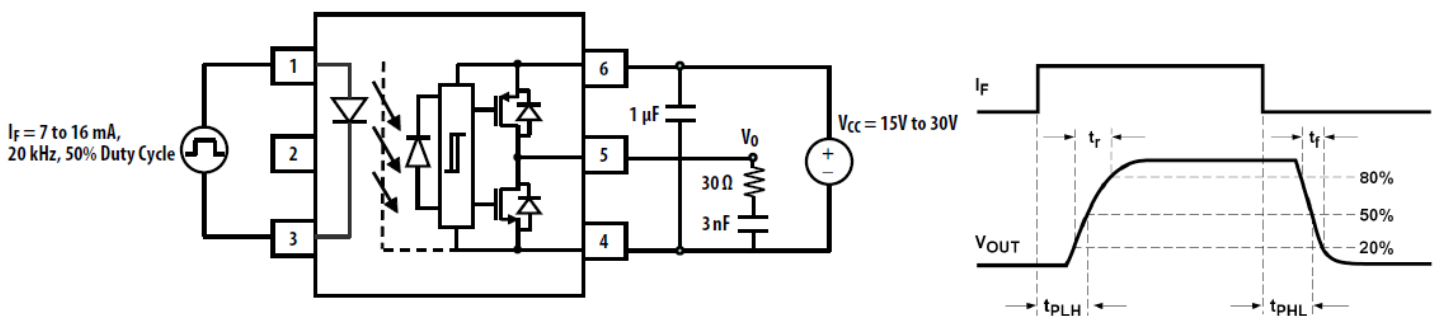
**5.  $I_{FLH}$  Measure**



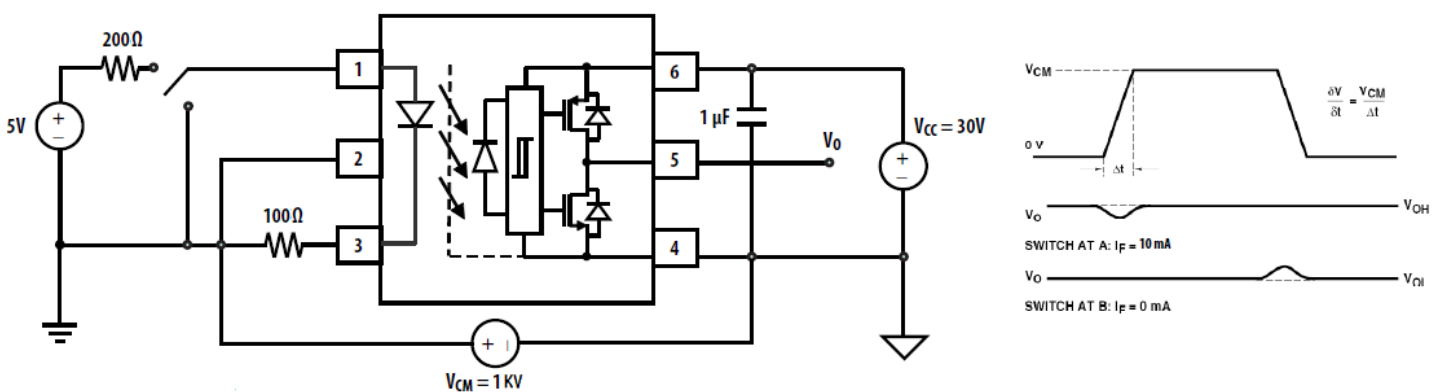
**6. UVLO Measure**



**7.  $t_{PHL}$ ,  $t_{PLH}$ ,  $t_r$  and  $t_f$  Measure and Waveforms**



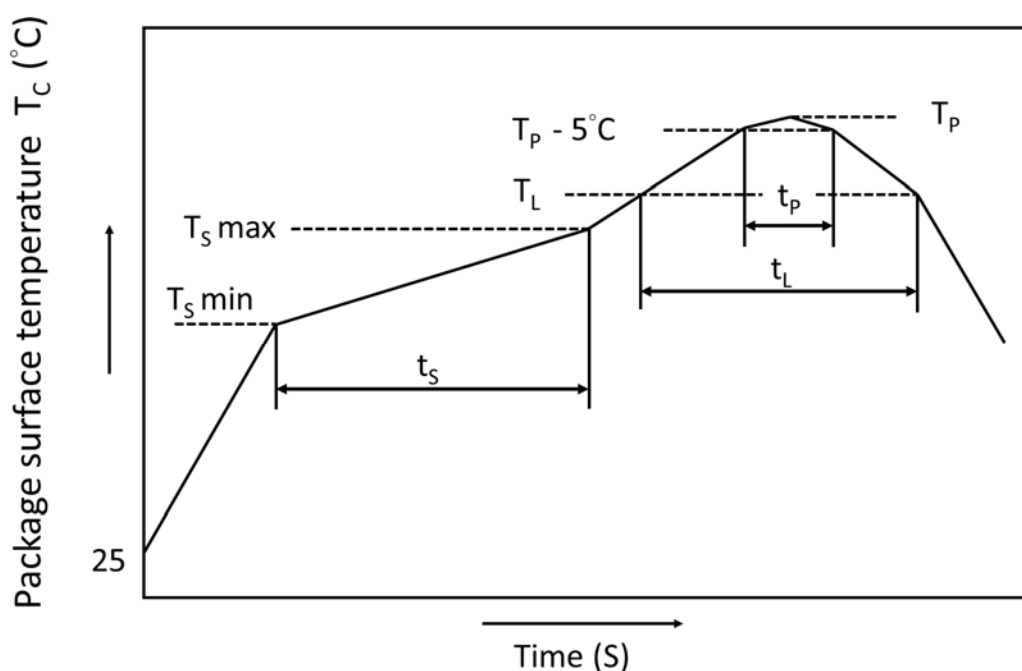
**8. CMR Measure with Split Resistors Network and Waveforms**



- **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**



| Profile Item   | 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**

### KT0314 X (Y)-(Z)

**Notes:**

KT0314 = Part No.

X = Lead form option (P · W )

Y = Tape and reel option (TLD · TRU)

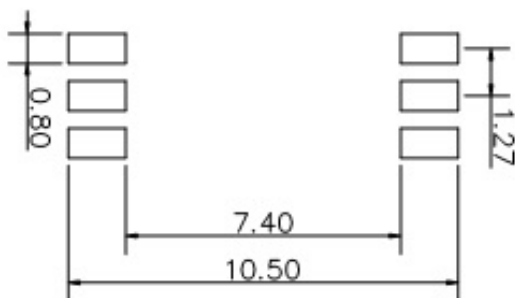
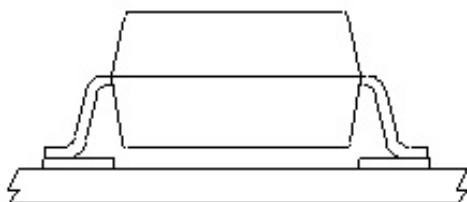
Z = VDE option (V · None)

| Option  | Description  | Packing quantity    |
|---------|--|---------------------|
| P (TLD) | surface mount type package + TLD tape & reel option<br>(9mm clearance)                             | 3000 units per reel |
| P (TRU) | surface mount type package + TRU tape & reel option<br>(9mm clearance)                             | 3000 units per reel |
| W (TLD) | long creepage distance for surface mount type package +<br>TLD tape & reel option (11mm clearance) | 3000 units per reel |
| W (TRU) | long creepage distance for surface mount type package +<br>TRU tape & reel option (11mm clearance) | 3000 units per reel |

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

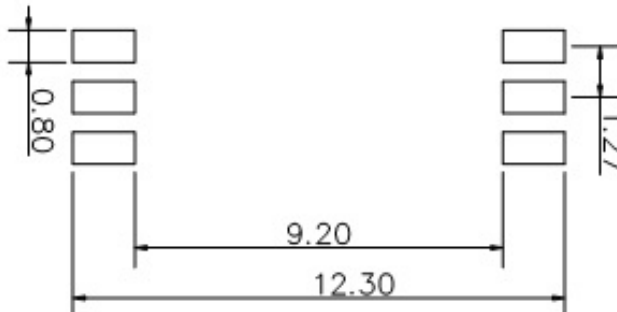
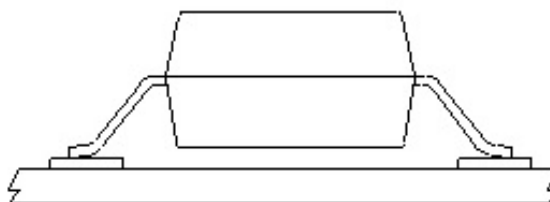
#### 1. Surface mount type

6LSOP-P type



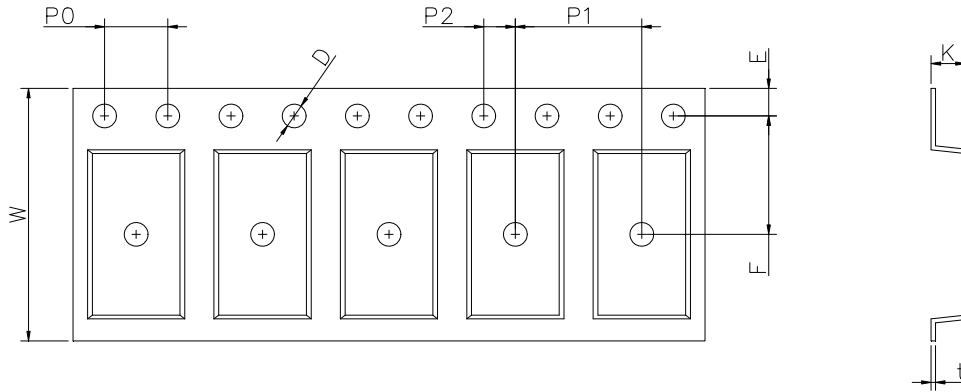
#### 2. Long creepage distance for surface mount type

6LSOP-W type



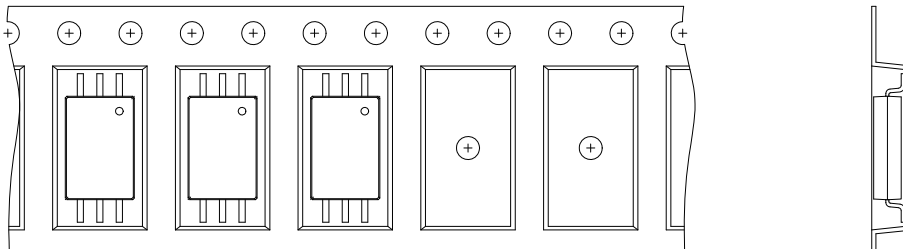
Unit :mm

● LSOP6 Carrier Tape & Reel

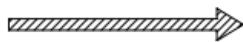
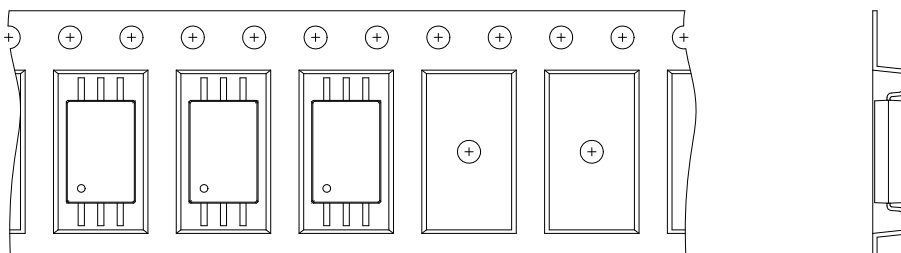


| Dimension Symbol         | D       | E        | F        | P0      | P1      | P2      | t       | W        | K        |
|--------------------------|---------|----------|----------|---------|---------|---------|---------|----------|----------|
| P type<br>Dimension (mm) | 1.5±0.1 | 1.75±0.1 | 7.5±0.1  | 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<br>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**



Direction of feed from reel

- **Application Notice**

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