

## TLP705

Plasma Display Panel.

Industrial Inverter

IGBT/Power MOS FET Gate Drive

TLP705 consists of a GaAlAs light emitting diode and a integrated photodetector.

This unit is 6-lead SDIP package. TLP705 is 50% smaller than 8pin DIP and has suited the safety standard reinforced insulation class. So mounting area in safety standard required equipment can be reduced. TLP705 is suitable for gate driving circuit of IGBT or power MOS FET. Especially TLP705 is capable of "direct" gate drive of lowr Power IGBTs.

- Peak output current :  $\pm 0.45$  A (max)
- Operating frequency : 250kHz (max)
- Guaranteed performance over temperature :  $-40$  to  $100^{\circ}\text{C}$
- Supply current : 3mA (max)
- Power supply voltage : 10 to 20 V
- Threshold input current :  $I_{FLH} = 8$  mA (max)
- Switching time ( $t_{PLH} / t_{PHL}$ ) : 200 ns (max)
- Common mode transient immunity :  $\pm 10$  kV/ $\mu\text{s}$ (min)
- Isolation voltage : 5000 Vrms(min)
- UL Recognized : UL1577, File No.E67349
- Construction Mechanical Rating

|                      | 7.62-mm pitch<br>standard type | 10.16-mm pitch<br>TLPXXXF type |
|----------------------|--------------------------------|--------------------------------|
| Creepage Distance    | 7.0 mm (min)                   | 8.0 mm (min)                   |
| Clearance            | 7.0 mm (min)                   | 8.0 mm (min)                   |
| Insulation Thickness | 0.4 mm (min)                   | 0.4 mm (min)                   |

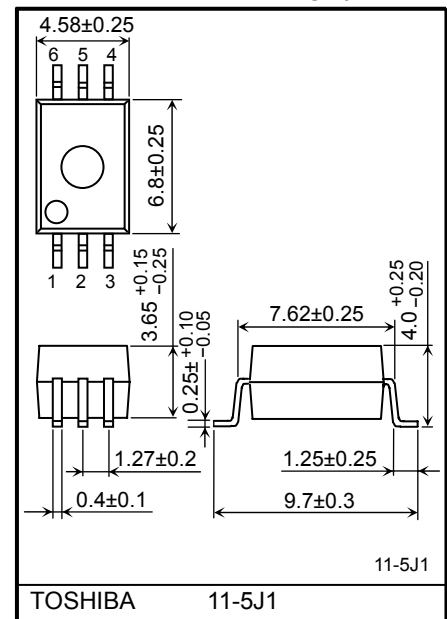
- Option (D4)  
TÜV approved : EN60747-5-2  
Certificate No. R50033433  
Maximum operating insulation voltage : 890 Vpk  
Highest permissible over voltage : 8000 Vpk

( Note ) When a EN60747-5-2 approved type is needed,  
please designate the "Option(D4)"

### Truth Table

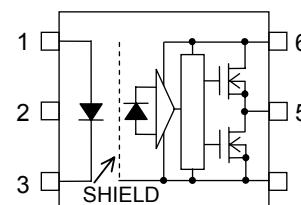
| Input | LED | Tr1 | Tr2 | Output |
|-------|-----|-----|-----|--------|
| H     | ON  | ON  | OFF | H      |
| L     | OFF | OFF | ON  | L      |

Unit in mm

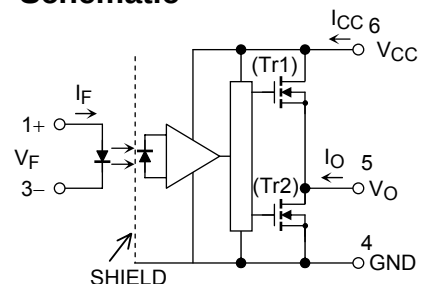


Weight : 0.26 g (typ.)

### Pin Configuration (Top View)



### Schematic



A 0.1  $\mu\text{F}$  bypass capacitor must be connected between pins 6 and 4. (See Note 6.)

## Maximum Ratings (Ta = 25°C)

| Characteristics                                       |                                         | Symbol               | Rating     | Unit             |
|-------------------------------------------------------|-----------------------------------------|----------------------|------------|------------------|
| LED                                                   | Forward current                         | I <sub>F</sub>       | 20         | mA               |
|                                                       | Forward current derating (Ta ≥ 85°C)    | ΔI <sub>F</sub> /ΔTa | -0.54      | mA/°C            |
|                                                       | Peak transient forward current (Note 1) | I <sub>FP</sub>      | 1          | A                |
|                                                       | Reverse voltage                         | V <sub>R</sub>       | 5          | V                |
|                                                       | Junction temperature                    | T <sub>j</sub>       | 125        | °C               |
| Detector                                              | "H" peak output current (Note 2)        | I <sub>OPH</sub>     | -0.45      | A                |
|                                                       | "L" peak output current (Note 2)        | I <sub>OPL</sub>     | 0.45       | A                |
|                                                       | Output voltage                          | V <sub>O</sub>       | 25         | V                |
|                                                       | Supply voltage                          | V <sub>CC</sub>      | 25         | V                |
|                                                       | Junction temperature                    | T <sub>j</sub>       | 125        | °C               |
| Operating frequency (Note 3)                          |                                         | f                    | 250        | kHz              |
| Storage temperature range                             |                                         | T <sub>stg</sub>     | -55 to 125 | °C               |
| Operating temperature range                           |                                         | T <sub>opr</sub>     | -40 to 100 | °C               |
| Lead soldering temperature (10 s) (Note 4)            |                                         | T <sub>sol</sub>     | 260        | °C               |
| Isolation voltage (AC, 1 minute, R.H. ≤ 60%) (Note 5) |                                         | BV <sub>S</sub>      | 5000       | V <sub>rms</sub> |

Note 1: Pulse width P<sub>W</sub> ≤ 1μs, 300 pps

Note 2: Exponential waveform pulse width P<sub>W</sub> ≤ 10 μs, f ≤ 15 kHz

Note 3: Exponential waveform I<sub>OPH</sub> ≤ -0.25 A (≤ 80 ns), I<sub>OPL</sub> ≤ +0.25 A (≤ 80 ns), Ta = 100 °C

Note 4: It is effective soldering area of Lead.

Note 5: Device considered a two terminal device: pins 1, 2 and 3 shorted together, and pins 4, 5 and 6 shorted together.

Note 6: A ceramic capacitor(0.1 μF) should be connected from pin 6 to pin 4 to stabilize the operation of the high gain linear amplifier. Failure to provide the bypassing may impair the switching property.  
The total lead length between capacitor and coupler should not exceed 1 cm.

## Recommended Operating Conditions

| Characteristics            | Symbol                              | Min  | Typ. | Max    | Unit |
|----------------------------|-------------------------------------|------|------|--------|------|
| Input current, ON (Note 7) | I <sub>F</sub> (ON)                 | 10   | —    | 15     | mA   |
| Input voltage, OFF         | V <sub>F</sub> (OFF)                | 0    | —    | 0.8    | V    |
| Supply voltage             | V <sub>CC</sub>                     | 10   | —    | 20     | V    |
| Peak output current        | I <sub>OPH</sub> / I <sub>OPL</sub> | —    | —    | ± 0.15 | A    |
| Operating temperature      | T <sub>opr</sub>                    | - 40 | —    | 100    | °C   |

Note 7: Input signal rise time (fall time) < 0.5 μs.

Note 8: If the rising slope of the supply voltage (V<sub>CC</sub>) for the detector is steep, stable operation of the internal circuits cannot be guaranteed.  
Be sure to set 3.0V/μs or less for a rising slope of the V<sub>CC</sub>.

## Electrical Characteristics (Ta = -40 to 100°C, unless otherwise specified)

| Characteristics                            |           | Symbol               | Test Circuit | Test Condition                                      |                                                     | Min   | Typ.* | Max | Unit  |
|--------------------------------------------|-----------|----------------------|--------------|-----------------------------------------------------|-----------------------------------------------------|-------|-------|-----|-------|
| Forward voltage                            |           | V <sub>F</sub>       | —            | I <sub>F</sub> = 10 mA, Ta = 25°C                   |                                                     | —     | 1.6   | 1.8 | V     |
| Temperature coefficient of forward voltage |           | ΔV <sub>F</sub> /ΔTa | —            | I <sub>F</sub> = 10 mA                              |                                                     | —     | -2.0  | —   | mV/°C |
| Input reverse current                      |           | I <sub>R</sub>       | —            | V <sub>R</sub> = 5 V, Ta = 25°C                     |                                                     | —     | —     | 10  | μA    |
| Input capacitance                          |           | C <sub>T</sub>       | —            | V = 0 V, f = 1 MHz, Ta = 25°C                       |                                                     | —     | 45    | —   | pF    |
| Output current<br>(Note 9)                 | “H” Level | I <sub>OPH1</sub>    | 1            | V <sub>CC</sub> = 15 V<br>I <sub>F</sub> = 10 mA    | V <sub>6-5</sub> = 4 V                              | -0.15 | -0.35 | —   | A     |
|                                            |           | I <sub>OPH2</sub>    |              |                                                     | V <sub>6-5</sub> = 10 V                             | -0.3  | -0.6  | —   |       |
|                                            | “L” Level | I <sub>OPL1</sub>    | 2            | V <sub>CC</sub> = 15 V<br>I <sub>F</sub> = 0 mA     | V <sub>5-4</sub> = 2 V                              | 0.15  | 0.36  | —   |       |
|                                            |           | I <sub>OPL2</sub>    |              |                                                     | V <sub>5-4</sub> = 10 V                             | 0.3   | 0.62  | —   |       |
| Output voltage                             | “H” Level | V <sub>OH</sub>      | 3            | V <sub>CC</sub> = 10 V                              | I <sub>O</sub> = -100 mA,<br>I <sub>F</sub> = 10 mA | 6.0   | 8.5   | —   | V     |
|                                            | “L” Level | V <sub>OL</sub>      | 4            |                                                     | I <sub>O</sub> = 100 mA,<br>V <sub>F</sub> = 0.8 V  | —     | 0.4   | 1.0 |       |
| Supply current                             | “H” Level | I <sub>CCH</sub>     | 5            | V <sub>CC</sub> = 10 to 20 V<br>V <sub>O</sub> open | I <sub>F</sub> = 10 mA                              | —     | 2.0   | 3.0 | mA    |
|                                            | “L” Level | I <sub>CCL</sub>     | 6            |                                                     | I <sub>F</sub> = 0 mA                               | —     | 2.0   | 3.0 |       |
| Threshold input current                    | L → H     | I <sub>FLH</sub>     | —            | V <sub>CC</sub> = 15 V, V <sub>O</sub> > 1 V        |                                                     | —     | 2.5   | 8   | mA    |
| Threshold input voltage                    | H → L     | V <sub>FHL</sub>     | —            | V <sub>CC</sub> = 15 V, V <sub>O</sub> < 1 V        |                                                     | 0.8   | —     | —   | V     |
| Supply voltage                             |           | V <sub>CC</sub>      | —            | —                                                   |                                                     | 10    | —     | 20  | V     |

\*: All typical values are at Ta = 25°C

Note 9: Duration of I<sub>O</sub> time ≤ 50 μs

Note10: This product is more sensitive than the conventional product to static electricity (ESD) because of a lowest power consumption design.

General precaution to static electricity (ESD) is necessary for handling this component.

## Isolation Characteristics (Ta = 25°C)

| Characteristic              | Symbol          | Test Condition                             | Min.               | Typ.             | Max. | Unit             |
|-----------------------------|-----------------|--------------------------------------------|--------------------|------------------|------|------------------|
| Capacitance input to output | C <sub>S</sub>  | V = 0 V, f = 1MHz (Note 5)                 | —                  | 1.0              | —    | pF               |
| Isolation resistance        | R <sub>S</sub>  | R.H. ≤ 60%, V <sub>S</sub> = 500V (Note 5) | 1×10 <sup>12</sup> | 10 <sup>14</sup> | —    | Ω                |
| Isolation voltage           | BV <sub>S</sub> | AC, 1 minute                               | 5000               | —                | —    | V <sub>rms</sub> |
|                             |                 | AC, 1 second, in oil                       | —                  | 10000            | —    |                  |
|                             |                 | DC, 1 minute, in oil                       | —                  | 10000            | —    | V <sub>dc</sub>  |

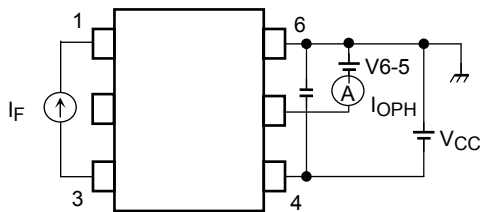
## Switching Characteristics (Ta = -40 to 100°C, unless otherwise specified)

| Characteristics                                     |       | Symbol                             | Test Circuit                                       | Test Condition                                                                                          |                                             | Min                                                               | Typ.*                                                | Max    | Unit |
|-----------------------------------------------------|-------|------------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------|--------|------|
| Propagation delay time                              | L → H | t <sub>pLH</sub>                   | 7                                                  | V <sub>CC</sub> = 20 V<br>R <sub>g</sub> = 30 Ω<br>C <sub>g</sub> = 1 nF<br>f=250kHz<br>Duty Cycle =50% | Ta= 25<br>I <sub>F</sub> = 0 → 10 mA        | 70                                                                | 95                                                   | 170    | ns   |
|                                                     | H → L | t <sub>pHL</sub>                   |                                                    |                                                                                                         | Ta= 25<br>I <sub>F</sub> = 10→ 0 mA         | 70                                                                | 105                                                  | 170    |      |
| Propagation delay time                              | L → H | t <sub>pLH</sub>                   |                                                    |                                                                                                         | Ta= -40 to100<br>I <sub>F</sub> = 0 → 10 mA | 50                                                                | —                                                    | 200    |      |
|                                                     | H → L | t <sub>pHL</sub>                   |                                                    |                                                                                                         | Ta= -40 to100<br>I <sub>F</sub> = 10 → 0 mA | 50                                                                | —                                                    | 200    |      |
| Propagation delay skew (Note11)                     |       | tpsk                               |                                                    |                                                                                                         | Ta= -40 to100<br>I <sub>F</sub> = 10 mA     | -90                                                               | —                                                    | 90     |      |
| Switching time dispersion between ON and OFF        |       | t <sub>pHL</sub> -t <sub>pLH</sub> |                                                    |                                                                                                         | Ta= -40 to100<br>I <sub>F</sub> = 10 mA     | -65                                                               | —                                                    | 65     |      |
| Output rise time (10-90%)                           |       | t <sub>r</sub>                     |                                                    |                                                                                                         | I <sub>F</sub> = 0 → 10 mA                  | —                                                                 | —                                                    | —      |      |
| Output fall time (90-10%)                           |       | t <sub>f</sub>                     |                                                    |                                                                                                         | I <sub>F</sub> = 10 → 0 mA                  | —                                                                 | —                                                    | —      |      |
| Common mode transient immunity at high level output |       | CM <sub>H</sub>                    |                                                    |                                                                                                         | 8                                           | V <sub>CM</sub> = 1000Vp-p<br>V <sub>CC</sub> = 20 V<br>Ta = 25°C | I <sub>F</sub> = 10 mA<br>V <sub>O</sub> (min)= 16 V | -10000 |      |
| Common mode transient immunity at low level output  |       | CM <sub>L</sub>                    | I <sub>F</sub> = 0 mA<br>V <sub>O</sub> (max)= 1 V | 10000                                                                                                   |                                             |                                                                   | —                                                    | —      |      |

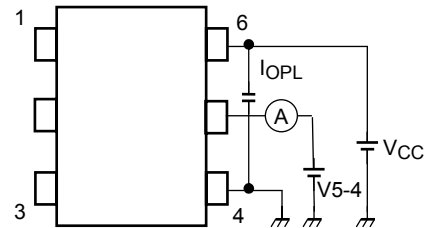
\*: All typical values are at Ta = 25°C

Note 11: Propagation delay difference between any two parts.

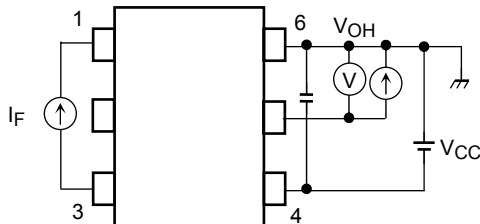
Test Circuit 1: I<sub>OPH</sub>



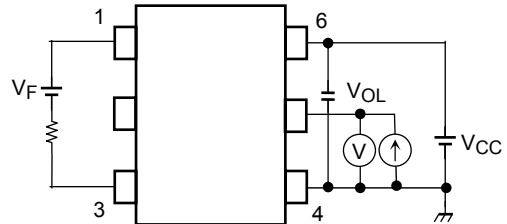
Test Circuit 2: I<sub>OPL</sub>



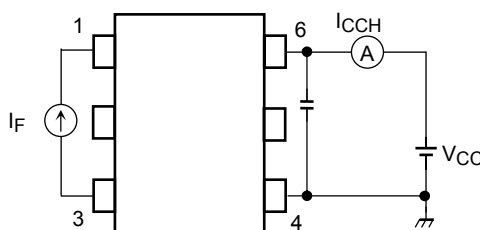
Test Circuit 3: V<sub>OH</sub>



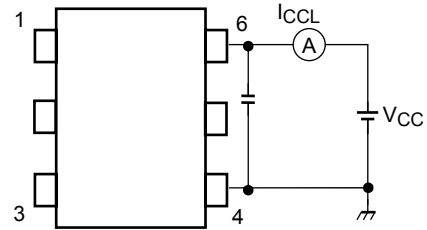
Test Circuit 4: V<sub>OL</sub>



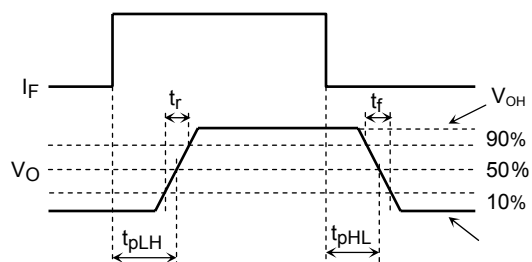
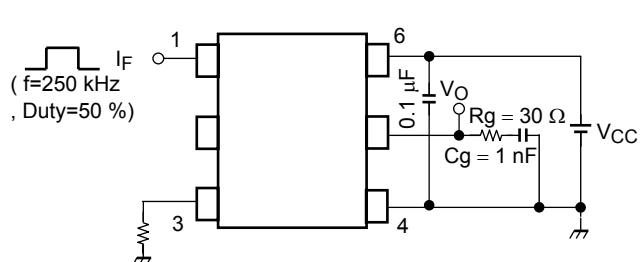
Test Circuit 5: I<sub>CCH</sub>



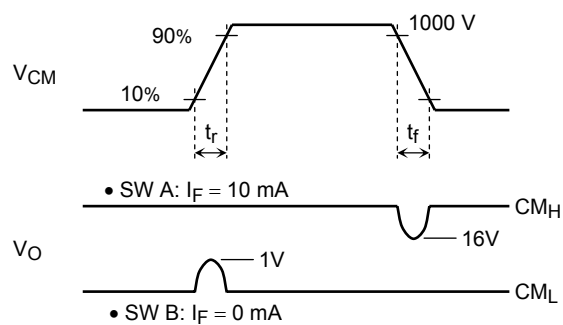
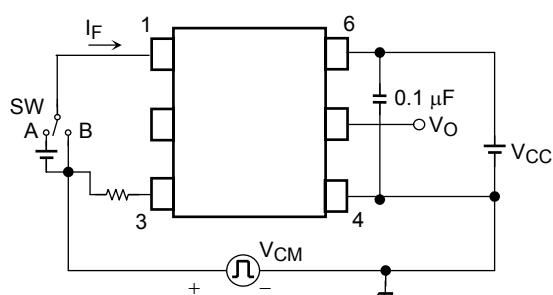
Test Circuit 6: I<sub>CCL</sub>



## Test Circuit 7 : $t_{pLH}$ , $t_{pHL}$ , $t_r$ , $t_f$ , PWD



## Test Circuit 8: $CM_H$ , $CM_L$



$$CM_L = \frac{800 \text{ V}}{t_r (\mu\text{s})}$$

$$CM_H = -\frac{800 \text{ V}}{t_f (\mu\text{s})}$$

$CM_L$  ( $CM_H$ ) 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.

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