

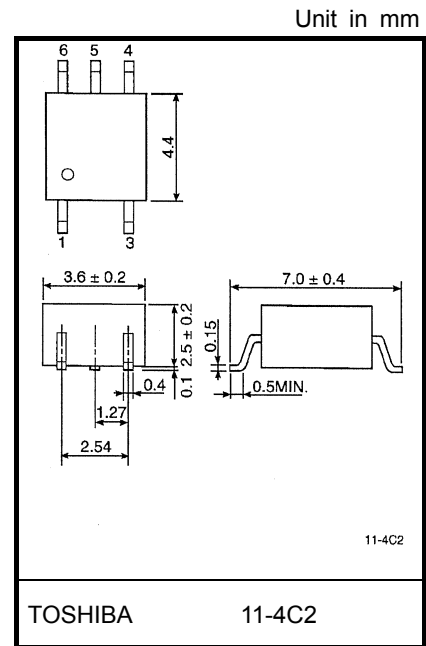
**Preliminary**

# TLP2066

FA (Factory Automation)  
 High Speed Interface  
 3.3V Supply Voltage

The Toshiba TLP2066 consists of a GaAlAs light-emitting diode and an integrated high-gain, high-speed photodetector. TLP2066 operates with 3.3 V supply voltage. Toshiba provides the TLP116 for supply voltage 5V type.

- Inverter logic (totem pole output)
- Package type : MFSOP6
- Guaranteed performance over temperature : -40~100°C
- Power supply voltage : 3.0~3.6V
- Input thresholds current:  $I_{FHL}=5\text{mA}$  (Max.)
- Propagation delay time (tpHL/tpLH): 60ns (Max.)
- Switching speed : 20MBd(TYP.)(NRZ)
- Common mode transient immunity : 15kV/us
- Isolation voltage : 3750Vrms
- UL recognition: UL1577 under application

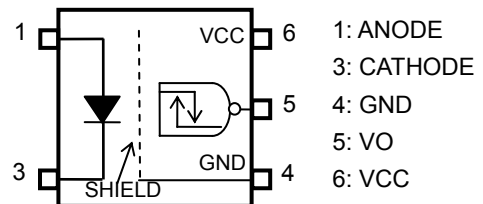


Weight: 0.09 g(Typ.)

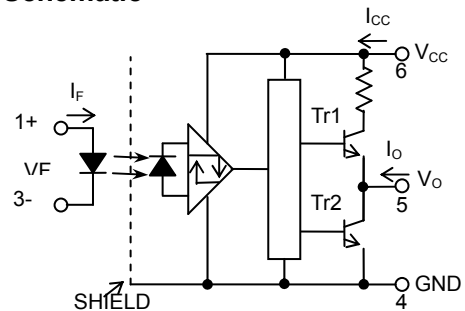
**Truth Table**

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

**Pin Configuration (Top View)**



**Schematic**



0.1uF bypass capacitor must be connected between pins 6 and 4

**Absolute Maximum Ratings (Ta=25°C)**

| Characteristic   |  | Symbol                  | Rating  | Unit  |
|--|--|-------------------------|---------|-------|
| LED  | Forward current                        | $I_F$                   | 25      | mA    |
|  | Forward current derating (Ta≥85°C)     | $\Delta I_F/\Delta T_a$ | -0.7    | mA/°C |
|  | Peak transient forward current (Note1) | $I_{FPT}$               | 1       | A     |
|  | Reverse voltage                        | $V_R$                   | 6       | V     |
| DETECTOR   | Output current                         | $I_O$                   | 10      | mA    |
|  | Output voltage                         | $V_O$                   | 6       | V     |
|  | Supply voltage                         | $V_{CC}$                | 6       | V     |
|  | Output power dissipation               | $P_O$                   | 40      | mW    |
| Operating temperature range                              |  | $T_{opr}$               | -40~100 | °C    |
| Storage temperature range                                |  | $T_{stg}$               | -55~125 | °C    |
| Lead solder temperature(10s)                             |  | $T_{sol}$               | 260     | °C    |
| Isolation voltage<br>(AC,1min.,R.H.≤60%,Ta=25°C) (Note2) |  | $BVs$                   | 3750    | Vrms  |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

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

Note2: This device is regarded as a two terminal device: pins 1 and 3 are shorted together, as are pins 4, 5 and 6.

**Recommended Operating Conditions**

| Characteristic            | Symbol       | Min | Typ. | Max | Unit |
|---------------------------|--------------|-----|------|-----|------|
| Input current , ON        | $I_{F(ON)}$  | 8   | —    | 18  | mA   |
| Input voltage , OFF       | $V_{F(OFF)}$ | 0   | —    | 0.8 | V    |
| Supply voltage(*) (Note3) | $V_{CC}$     | 3.0 | 3.3  | 3.6 | V    |

(\*) This item denotes operating ranges, not meaning of recommended operating conditions.

Note: Recommended operating conditions are given as a design guideline to obtain expected performance of the device. Additionally, each item is an independent guideline respectively. In developing designs using this product, please confirm specified characteristics shown in this document.

Note3: The detector of this product requires a power supply voltage (VCC) of 3.0 V higher for stable operation. If the VCC is lower than this value, an ICCH may increase, or an output may be unstable. Be sure to use the product after checking the supply current, and the operation of a power-on/-off.

Note 4: 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 bypass may impair the switching property. The total lead length between capacitor and coupler should not exceed 1 cm.

## Electrical Characteristics

(Unless otherwise specified, Ta=-40~100°C, VCC=3.0~3.6 V)

| Characteristic                             | Symbol               | Test Circuit | Conditions                                      | Min. | Typ. | Max. | Unit  |
|--|----------------------|--------------|---|------|------|------|-------|
| Input forward voltage                      | V <sub>F</sub>       | —            | I <sub>F</sub> =10mA, Ta=25°C                   | 1.45 | 1.6  | 1.85 | V     |
| Temperature coefficient of forward voltage | ΔV <sub>F</sub> /ΔTa | —            | I <sub>F</sub> =10mA                            | —    | 2    | —    | mV/°C |
| Input reverse current                      | I <sub>R</sub>       | —            | V <sub>R</sub> =6V, Ta=25°C                     | —    | —    | 10   | μA    |
| Input capacitance                          | C <sub>T</sub>       | —            | V=0, f=1MHz, Ta=25°C                            | —    | 60   | —    | pF    |
| Logic low output voltage                   | V <sub>OL</sub>      | 1            | I <sub>OL</sub> =1.6mA, I <sub>F</sub> =12mA    | —    | —    | 0.6  | V     |
| Logic high output voltage                  | V <sub>OH</sub>      | 2            | I <sub>OH</sub> =-0.02mA, V <sub>F</sub> =1.05V | 2.0  | —    | —    | V     |
| Logic low supply current                   | I <sub>CCL</sub>     | 3            | I <sub>F</sub> =12mA, VCC=3.3V                  | —    | —    | 5.0  | mA    |
| Logic high supply current                  | I <sub>CCH</sub>     | 4            | V <sub>F</sub> =0V, VCC=3.3V (Note 3)           | —    | —    | 5.0  | mA    |
| Supply voltage                             | VCC                  | —            | —   | 3.0  | —    | 3.6  | V     |
| Input current logic low output             | I <sub>FHL</sub>     | —            | I <sub>O</sub> =1.6mA, V <sub>O</sub> <0.6V     | —    | —    | 5    | mA    |
| Input voltage logic high output            | V <sub>FLH</sub>     | —            | I <sub>O</sub> =-0.02mA, V <sub>O</sub> >2.0V   | 0.8  | —    | —    | V     |

\*All typical values are at Ta=25°C, VCC=3.3V, I<sub>F</sub> (ON) =12mA unless otherwise specified

## Isolation Characteristics (Ta = 25°C)

| Characteristic              | Symbol          | Test Conditions                            | Min.               | Typ.             | Max. | Unit             |
|-----------------------------|-----------------|--|--------------------|------------------|------|------------------|
| Capacitance input to output | C <sub>S</sub>  | V <sub>s</sub> = 0, f = 1MHz (Note 2)      | —                  | 0.8              | —    | pF               |
| Isolation resistance        | R <sub>S</sub>  | R.H. ≤ 60%, V <sub>S</sub> = 500V (Note 2) | 1×10 <sup>12</sup> | 10 <sup>14</sup> | —    | Ω                |
| Isolation voltage           | BV <sub>S</sub> | AC, 1 minute                               | 3750               | —                | —    | V <sub>rms</sub> |
|                             |                 | AC, 1 second, in oil                       | —                  | 10000            | —    |                  |
|                             |                 | DC, 1 minute, in oil                       | —                  | 10000            | —    | V <sub>dc</sub>  |

Note 4: 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 bypass may impair the switching property.  
The total lead length between capacitor and coupler should not exceed 1 cm.

## Switching Characteristics

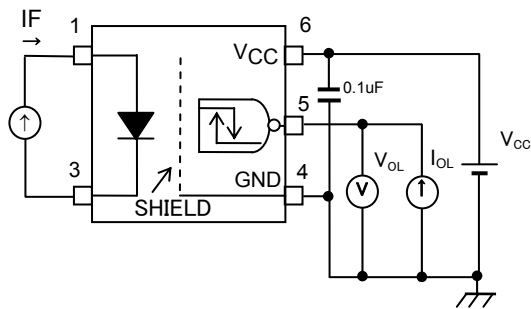
(Unless otherwise specified,  $T_a = -40 \sim 100^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V}$ )

| Characteristic                                      | Symbol                | Test Circuit | Conditions   | Min.  | Typ.   | Max. | Unit |                        |    |
|---|-----------------------|--------------|--|---|--------|------|------|------------------------|----|
| Propagation delay time to logic high output         | $t_{pHL}$             | 5            | $I_F = 0 \rightarrow 12\text{mA}$  | $R_{IN} = 100\Omega$<br>$C_L = 15\text{pF}$<br>(Note 5)                           | —      | —    | 60   | ns                     |    |
| Propagation delay time to logic low output          | $t_{pLH}$             |              | $I_F = 12 \rightarrow 0\text{mA}$  |   | —      | —    | 60   | ns                     |    |
| Propagation delay time to logic high output         | $t_{pHL}$             | 6            | $V_{IN} = 0 \rightarrow 3.3\text{V}$<br>( $I_F = 0 \rightarrow 8\text{mA}$ )                                     | $R_{IN} = 220\Omega$<br>$C_{IN} = 47\text{pF}$<br>$C_L = 15\text{pF}$<br>(Note 5) | —      | —    | 60   | ns                     |    |
| Propagation delay time to logic low output          | $t_{pLH}$             |              | $V_{IN} = 3.3 \rightarrow 0\text{V}$<br>( $I_F = 8 \rightarrow 0\text{mA}$ )                                     |   | —      | —    | 60   | ns                     |    |
| Switching time dispersion between ON and OFF        | $ t_{pHL} - t_{pLH} $ | 5            | $I_F = 12\text{mA}$ , $R_{IN} = 100\Omega$ ,<br>$C_L = 15\text{pF}$ (Note 5)                                     |   | —      | —    | 30   | ns                     |    |
| Output fall time (90-10%)                           | $t_f$                 |              | $I_F = 0 \rightarrow 12\text{mA}$  | $R_{IN} = 100\Omega$<br>$C_L = 15\text{pF}$<br>(Note 5)                           |        | —    | 4    | —                      | ns |
| Output rise time (10-90%)                           | $t_r$                 |              | $I_F = 12 \rightarrow 0\text{mA}$  |   |        | —    | 5    | —                      | ns |
| Common mode transient immunity at high Level output | $CM_H$                | 7            | $V_{CM} = 1000\text{Vp-p}$ , $I_F = 0\text{mA}$ ,<br>$V_o(\text{Min}) = 2\text{V}$ , $T_a = 25^\circ\text{C}$    |   | 15000  | —    | —    | $\text{V}/\mu\text{s}$ |    |
| Common mode transient immunity at low level output  | $CM_L$                |              | $V_{CM} = 1000\text{Vp-p}$ , $I_F = 12\text{mA}$ ,<br>$V_o(\text{Max}) = 0.8\text{V}$ , $T_a = 25^\circ\text{C}$ |   | -15000 | —    | —    | $\text{V}/\mu\text{s}$ |    |

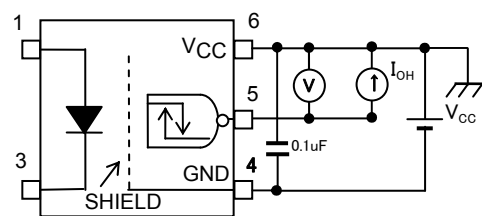
\*All typical values are at  $T_a = 25^\circ\text{C}$

Note 5:  $C_L$  is approximately 15pF which includes probe and Jig/stray wiring capacitance.

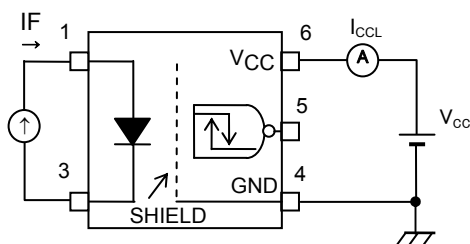
TEST CIRCUIT 1: VOL



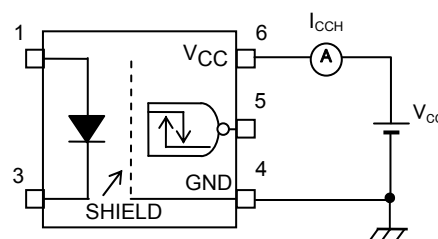
TEST CIRCUIT 2: VOH



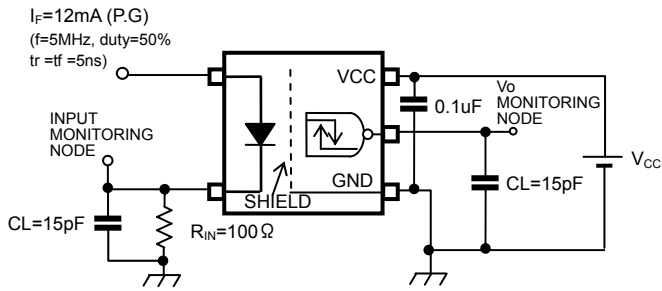
TEST CIRCUIT 3: ICCL



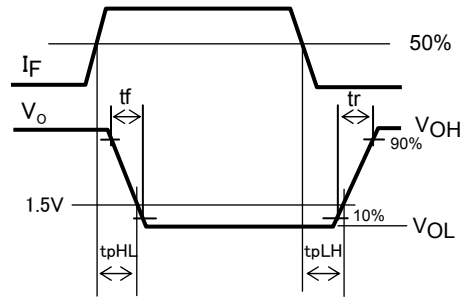
TEST CIRCUIT 4: ICCH



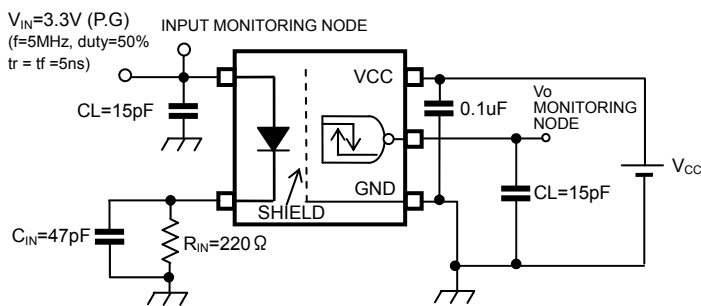
### TEST CIRCUIT 5: tpHL , tpLH



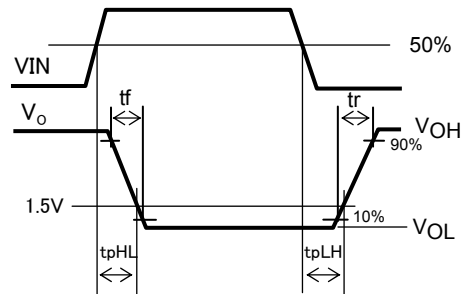
CL is capacitance of the probe and JIG.  
(P.G): Pulse Generator



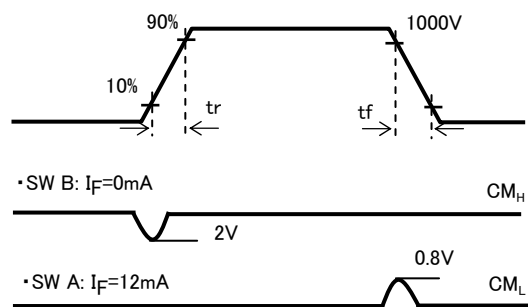
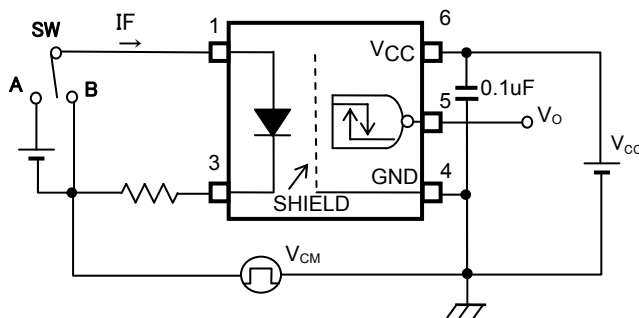
### TEST CIRCUIT 6: tpHL, tpLH



CL is capacitance of the probe and JIG.  
(P.G): Pulse Generator



### TEST CIRCUIT 7: Common-Mode Transient Immunity Test Circuit



$$CM_H = \frac{800(V)}{tr(\mu s)} \quad CM_L = \frac{800(V)}{tf(\mu s)}$$

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