

TOSHIBA PHOTOCOUPLER GaAs IRED &amp; PHOTO-TRANSISTOR

# TLP733, TLP734

OFFICE MACHINE  
HOUSEHOLD USE EQUIPMENT  
SOLID STATE RELAY  
SWITCHING POWER SUPPLY

The TOSHIBA TLP733 and TLP734 consist of a photo-transistor optically coupled to a gallium arsenide infrared emitting diode in a six lead plastic DIP.

TLP734 is no-base internal connection for high-EMI environments.

- Collector-Emitter Voltage : 55V (Min.)
- Current Transfer Ratio : 50% (Min.)  
Rank GB : 100% (Min.)
- UL Recognized : UL1577, File No. E67349
- BSI Approved : BS EN60065 : 1994  
Certificate No. 7364  
BS EN60950 : 1992  
Certificate No. 7365
- SEMKO Approved : SS4330784  
Certificate No. 9325163, 9522142
- Isolation Voltage : 4000Vrms (Min.)
- Option (D4) type  
VDE Approved : DIN VDE0884 / 06.92,  
Certificate No. 74286, 91808

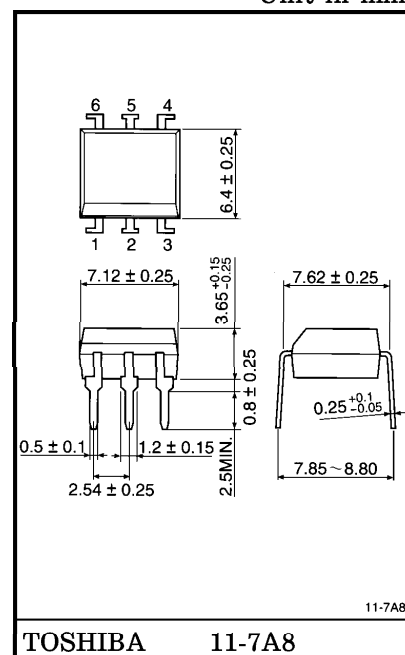
Maximum Operating Insulation Voltage : 630, 890V<sub>PK</sub>

Highest Permissible Over Voltage : 6000, 8000V<sub>PK</sub>

(Note) When a VDE0884 approved type is needed,  
please designate the "Option (D4)"

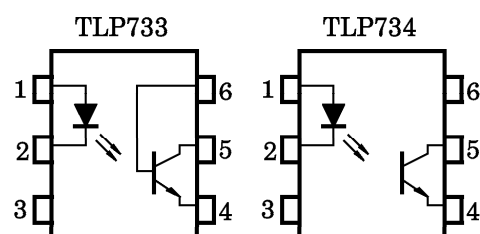
|                        | 7.62mm pich<br>standard type | 10.16mm pich<br>TLP×××F type |
|------------------------|------------------------------|------------------------------|
| Creepage Distance      | 7.0mm (Min.)                 | 8.0mm (Min.)                 |
| Clearance              | 7.0mm (Min.)                 | 8.0mm (Min.)                 |
| Internal Creepage Path | 4.0mm (Min.)                 | 4.0mm (Min.)                 |
| Insulation Thickness   | 0.5mm (Min.)                 | 0.5mm (Min.)                 |

Unit in mm



Weight : 0.42g

## PIN CONFIGURATIONS (TOP VIEW)



- |               |               |
|---------------|---------------|
| 1 : ANODE     | 1 : ANODE     |
| 2 : CATHODE   | 2 : CATHODE   |
| 3 : NC        | 3 : NC        |
| 4 : EMITTER   | 4 : EMITTER   |
| 5 : COLLECTOR | 5 : COLLECTOR |
| 6 : BASE      | 6 : NC        |

961001EAA2

TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

## Current Transfer Ratio

| TYPE   | CLASSI-<br>FICATION<br><br>*1 | CURRENT TRANSFER<br>RATIO (%)<br>(I <sub>C</sub> / I <sub>F</sub> ) |      | MARKING OF CLASSIFICATION      |
|--------|-------------------------------|---------------------------------------------------------------------|------|--------------------------------|
|        |                               | I <sub>F</sub> =5mA, V <sub>CE</sub> =5V, Ta=25°C                   |      |                                |
|        |                               | MIN.                                                                | MAX. |                                |
| TLP733 | (None)                        | 50                                                                  | 600  | BLANK, Y, Y■, G, G■, B, B■, GB |
|        |                               | 50                                                                  | 150  | Y, Y■                          |
| TLP734 | Rank GR                       | 100                                                                 | 300  | G, G■                          |
|        |                               | 200                                                                 | 600  | B, B■                          |
|        | Rank GB                       | 100                                                                 | 600  | G, G■, B, B■, GB               |

\*1 : Ex. Rank GB : TLP733 (GB)

Note : Application type name for certification test, please use standard product type name, i. e.

TLP733 (GB) : TLP733

MAXIMUM RATINGS ( $T_a = 25^\circ\text{C}$ )

| CHARACTERISTIC                                                           |                                                            | SYMBOL                        | RATING  | UNIT                  |
|--------------------------------------------------------------------------|------------------------------------------------------------|-------------------------------|---------|-----------------------|
| LED                                                                      | Forward Current                                            | $I_F$                         | 60      | mA                    |
|                                                                          | Forward Current Derating ( $T_a \geq 39^\circ\text{C}$ )   | $\Delta I_F / ^\circ\text{C}$ | -0.7    | mA / $^\circ\text{C}$ |
|                                                                          | Peak Forward Current (100 $\mu\text{s}$ pulse, 100pps)     | $I_{FP}$                      | 1       | A                     |
|                                                                          | Reverse Voltage                                            | $V_R$                         | 5       | V                     |
|                                                                          | Junction Temperature                                       | $T_j$                         | 125     | $^\circ\text{C}$      |
| DETECTOR                                                                 | Collector-Emitter Voltage                                  | $V_{CEO}$                     | 55      | V                     |
|                                                                          | Collector-Base Voltage (TLP733)                            | $V_{CBO}$                     | 80      | V                     |
|                                                                          | Emitter-Collector Voltage                                  | $V_{ECO}$                     | 7       | V                     |
|                                                                          | Emitter-Base Voltage (TLP733)                              | $V_{EBO}$                     | 7       | V                     |
|                                                                          | Collector Current                                          | $I_C$                         | 50      | mA                    |
|                                                                          | Power Dissipation                                          | $P_C$                         | 150     | mW                    |
|                                                                          | Power Dissipation Derating ( $T_a \geq 25^\circ\text{C}$ ) | $\Delta P_C / ^\circ\text{C}$ | -1.5    | mW / $^\circ\text{C}$ |
|                                                                          | Junction Temperature                                       | $T_j$                         | 125     | $^\circ\text{C}$      |
| Storage Temperature Range                                                |                                                            | $T_{stg}$                     | -55~125 | $^\circ\text{C}$      |
| Operating Temperature Range                                              |                                                            | $T_{opr}$                     | -40~100 | $^\circ\text{C}$      |
| Lead Soldering Temperature (10s)                                         |                                                            | $T_{sol}$                     | 260     | $^\circ\text{C}$      |
| Total Package Power Dissipation                                          |                                                            | $P_T$                         | 250     | mW                    |
| Total Package Power Dissipation Derating ( $T_a \geq 25^\circ\text{C}$ ) |                                                            | $\Delta P_T / ^\circ\text{C}$ | -2.5    | mW / $^\circ\text{C}$ |
| Isolation Voltage (AC, 1 min., R.H. $\leq 60\%$ )                        |                                                            | $BV_S$                        | 4000    | Vrms                  |

961001EAA2'

- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

## RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC        | SYMBOL    | MIN. | TYP. | MAX. | UNIT |
|-----------------------|-----------|------|------|------|------|
| Supply Voltage        | $V_{CC}$  | —    | 5    | 24   | V    |
| Forward Current       | $I_F$     | —    | 16   | 25   | mA   |
| Collector Current     | $I_C$     | —    | 1    | 10   | mA   |
| Operating Temperature | $T_{opr}$ | -25  | —    | 85   | °C   |

INDIVIDUAL ELECTRICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ )

| CHARACTERISTIC |                                           | SYMBOL         | TEST CONDITION                                                                  | MIN. | TYP.        | MAX.        | UNIT          |
|----------------|-------------------------------------------|----------------|---------------------------------------------------------------------------------|------|-------------|-------------|---------------|
| LED            | Forward Voltage                           | $V_F$          | $I_F = 10\text{mA}$                                                             | 1.0  | 1.15        | 1.3         | V             |
|                | Reverse Current                           | $I_R$          | $V_R = 5\text{V}$                                                               | —    | —           | 10          | $\mu\text{A}$ |
|                | Capacitance                               | $C_T$          | $V = 0, f = 1\text{MHz}$                                                        | —    | 30          | —           | pF            |
| DETECTOR       | Collector-Emitter Breakdown Voltage       | $V_{(BR) CEO}$ | $I_C = 0.5\text{mA}$                                                            | 55   | —           | —           | V             |
|                | Emitter-Collector Breakdown Voltage       | $V_{(BR) ECO}$ | $I_E = 0.1\text{mA}$                                                            | 7    | —           | —           | V             |
|                | Collector-Base Breakdown Voltage (TLP733) | $V_{(BR) CBO}$ | $I_C = 0.1\text{mA}$                                                            | 80   | —           | —           | V             |
|                | Emitter-Base Breakdown Voltage (TLP733)   | $V_{(BR) EBO}$ | $I_E = 0.1\text{mA}$                                                            | 7    | —           | —           | V             |
|                | Collector Dark Current                    | $I_{CEO}$      | $V_{CE} = 24\text{V}$ (Ambient Light)<br>Below 1000 lx                          | —    | 0.01<br>(2) | 0.1<br>(10) | $\mu\text{A}$ |
|                |                                           |                | $V_{CE} = 24\text{V}$ (Ambient Light)<br>$T_a = 85^\circ\text{C}$ Below 1000 lx | —    | 2<br>(4)    | 50<br>(50)  | $\mu\text{A}$ |
|                | Collector Dark Current (TLP733)           | $I_{CER}$      | $V_{CE} = 24\text{V}, T_a = 85^\circ\text{C}$<br>$R_{BE} = 1\text{M}\Omega$     | —    | 0.5         | 10          | $\mu\text{A}$ |
|                | Collector Dark Current (TLP733)           | $I_{CBO}$      | $V_{CB} = 10\text{V}$                                                           | —    | 0.1         | —           | nA            |
|                | DC Forward Current Gain (TLP733)          | $h_{FE}$       | $V_{CE} = 5\text{V}, I_C = 0.5\text{mA}$                                        | —    | 400         | —           | —             |
|                | Capacitance Collector to Emitter          | $C_{CE}$       | $V = 0, f = 1\text{MHz}$                                                        | —    | 10          | —           | pF            |

## COUPLED ELECTRICAL CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC                       | SYMBOL                   | TEST CONDITION                                         | MIN. | TYP. | MAX. | UNIT |
|--------------------------------------|--------------------------|--------------------------------------------------------|------|------|------|------|
| Current Transfer Ratio               | $I_C / I_F$              | $I_F = 5\text{mA}$ , $V_{CE} = 5\text{V}$<br>Rank GB   | 50   | —    | 600  | %    |
|                                      |                          |                                                        | 100  | —    | 600  |      |
| Saturated CTR                        | $I_C / I_F (\text{sat})$ | $I_F = 1\text{mA}$ , $V_{CE} = 0.4\text{V}$<br>Rank GB | —    | 60   | —    | %    |
|                                      |                          |                                                        | 30   | —    | —    |      |
| Base Photo-Current                   | $I_{PB}$                 | $I_F = 5\text{mA}$ , $V_{CB} = 5\text{V}$              | —    | 10   | —    | %    |
| Collector-Emitter Saturation Voltage | $V_{CE} (\text{sat})$    | $I_C = 2.4\text{mA}$ , $I_F = 8\text{mA}$              | —    | —    | 0.4  | V    |
|                                      |                          | $I_C = 0.2\text{mA}$ , $I_F = 1\text{mA}$<br>Rank GB   | —    | 0.2  | —    |      |
|                                      |                          |                                                        | —    | —    | 0.4  |      |

## ISOLATION CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC                | SYMBOL | TEST CONDITION                         | MIN.               | TYP.      | MAX. | UNIT      |
|-------------------------------|--------|----------------------------------------|--------------------|-----------|------|-----------|
| Capacitance (Input to Output) | $C_S$  | $V_S = 0$ , $f = 1\text{MHz}$          | —                  | 0.8       | —    | pF        |
| Isolation Resistance          | $R_S$  | $V_S = 500\text{V}$ , $R.H. \leq 60\%$ | $1 \times 10^{12}$ | $10^{14}$ | —    | $\Omega$  |
| Isolation Voltage             | $BV_S$ | AC, 1 minute                           | 4000               | —         | —    | $V_{rms}$ |
|                               |        | AC, 1 second, in oil                   | —                  | 10000     | —    |           |
|                               |        | DC, 1 minute, in oil                   | —                  | 10000     | —    | Vdc       |

## SWITCHING CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC | SYMBOL    | TEST CONDITION                                                                                                           | MIN. | TYP. | MAX. | UNIT          |
|----------------|-----------|--------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| Rise Time      | $t_r$     | $V_{CC} = 10\text{V}$ , $I_C = 2\text{mA}$<br>$R_L = 100\Omega$                                                          | —    | 2    | —    | $\mu\text{s}$ |
| Fall Time      | $t_f$     |                                                                                                                          | —    | 3    | —    |               |
| Turn-on Time   | $t_{ON}$  |                                                                                                                          | —    | 3    | 10   |               |
| Turn-off Time  | $t_{OFF}$ |                                                                                                                          | —    | 3    | 10   |               |
| Turn-on Time   | $t_{ON}$  | $R_L = 1.9\text{k}\Omega$ (Fig.1)<br>$R_{BE} = \text{OPEN}$<br>$V_{CC} = 5\text{V}$ , $I_F = 16\text{mA}$                | —    | 3    | —    | $\mu\text{s}$ |
| Storage Time   | $t_s$     |                                                                                                                          | —    | 40   | —    |               |
| Turn-off Time  | $t_{OFF}$ |                                                                                                                          | —    | 90   | —    |               |
| Turn-on Time   | $t_{ON}$  | $R_L = 1.9\text{k}\Omega$ (Fig.1)<br>$R_{BE} = 220\text{k}\Omega$ (TLP733)<br>$V_{CC} = 5\text{V}$ , $I_F = 16\text{mA}$ | —    | 3    | —    | $\mu\text{s}$ |
| Storage Time   | $t_s$     |                                                                                                                          | —    | 30   | —    |               |
| Turn-off Time  | $t_{OFF}$ |                                                                                                                          | —    | 60   | —    |               |

Fig. 1 SWITCHING TIME TEST CIRCUIT

