

TENTATIVE TOSHIBA PHOTOCOUPLER GaAs IRED &amp; PHOTO-MOS FET / PHOTO-TRANSISTOR

# TLP270G

MOBILE / NOTE PCS

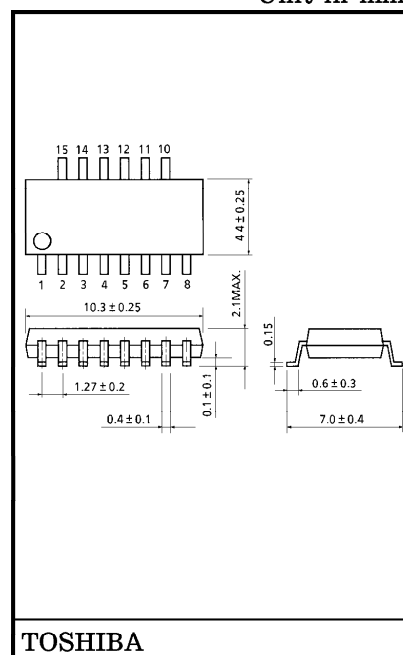
PDAS

MULTIMEDIA TVS

MODEMS

TLP270G has many required multi-functions in DAA circuits for modems, which is a fully integrated design photocoupler in a 14 pin (SOP16).

Unit in mm



Weight : 0.2 g

## ① Photorelay

Dial pulsing switch, Hookswitch

- 1 Form A
- Peak Off-State Voltage : 350 V (MIN.)
- Trigger LED Current : 3 mA (MAX.)
- On-State Current : 120 mA (MAX.)

## ② Photocoupler

Ring detection

- Collector-Emitter Voltage : 80 V (MIN.)
- Current Transfer Ratio : 50% (MIN.)

## ③ Darlington Transistor

Electronic inductor

- Collector-Emitter Voltage : 30 V (MIN.)
- Collector Current : 120 mA (MAX.)

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## ④ Bridge Rectifier

Polarity protection

- Reverse Voltage : 30 V (MIN.)
- Forward Voltage : 1.7 V (MAX.)

## ⑤ Zener Diode

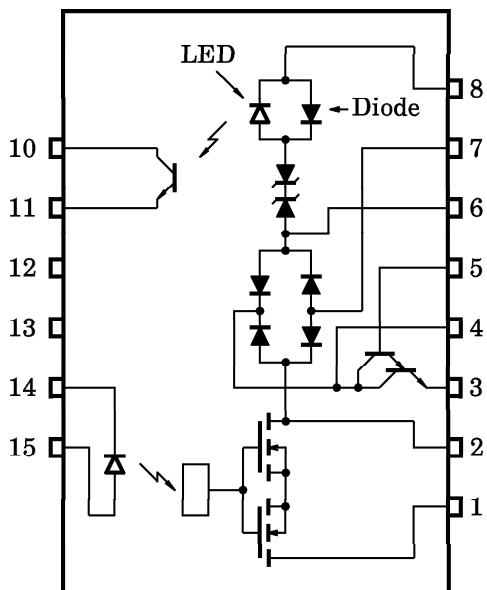
Ring detection protector

- Zener Voltage : 22~32 V

(Common)

- Isolation Voltage : 1500 Vrms (MIN.)
- UL Recognized : UL1577, File No. E67349

## PIN CONFIGURATION (TOP VIEW)



- 1 : MOSFET Drain
- 2 : MOSFET Drain / Bridge Rectifier Input
- 3 : Darlington Emitter
- 4 : Darlington Collector / Bridge Rectifier Output
- 5 : Darlington Base
- 6 : Bridge Rectifier Input / LED Anode (Diode Cathode)
- 7 : Bridge Rectifier Input
- 8 : LED Cathode / Diode Anode
- 10 : Photo Tr. Collector
- 11 : Photo Tr. Emitter
- 12 : NC
- 13 : NC
- 14 : LED Cathode
- 15 : LED Anode

## PHOTORELAY (1-Form-A)

## MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC |                                                            | SYMBOL                           | RATING | UNIT    |
|----------------|------------------------------------------------------------|----------------------------------|--------|---------|
| LED            | Forward Current                                            | $I_F$                            | 50     | mA      |
|                | Forward Current Derating<br>(Ta $\geq$ 25°C)               | $\Delta I_F / ^\circ\text{C}$    | -0.5   | mA / °C |
|                | Peak Forward Current<br>(100 $\mu\text{s}$ pulse, 100 pps) | $I_{FP}$                         | 1      | A       |
|                | Reverse Voltage                                            | $V_R$                            | 5      | V       |
|                | Junction Temperature                                       | $T_j$                            | 125    | °C      |
| DETECTOR       | Off-State Output Terminal<br>Voltage                       | $V_{OFF}$                        | 350    | V       |
|                | On-State RMS Current                                       | $I_{ON}$                         | 120    | mA      |
|                | On-State RMS Current<br>Derating (Ta $\geq$ 25°C)          | $\Delta I_{ON} / ^\circ\text{C}$ | -1.2   | mA / °C |
|                | Junction Temperature                                       | $T_j$                            | 125    | °C      |

## INDIVIDUAL ELECTRICAL CHARACTERISTICS (Ta = 25°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       | Off-State Current | $I_{OFF}$ | $V_{OFF} = 350 \text{ V}$  | —    | —    | 1    | $\mu\text{A}$ |
|                | Capacitance       | $C_{OFF}$ | $V = 0, f = 1 \text{ MHz}$ | —    | 40   | —    | pF            |

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

| CHARACTERISTIC      | SYMBOL   | TEST CONDITION                                | MIN. | TYP. | MAX. | UNIT     |
|---------------------|----------|-----------------------------------------------|------|------|------|----------|
| Trigger LED Current | $I_{FT}$ | $I_{ON} = 120 \text{ mA}$                     | —    | 1    | 3    | mA       |
| On-State Resistance | $R_{ON}$ | $I_{ON} = 120 \text{ mA}, I_F = 5 \text{ mA}$ | —    | 22   | 35   | $\Omega$ |

## SWITCHING CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC | SYMBOL    | TEST CONDITION                                                     | MIN. | TYP. | MAX. | UNIT |
|----------------|-----------|--------------------------------------------------------------------|------|------|------|------|
| Turn-on Time   | $t_{ON}$  | $R_L = 200 \Omega, V_{CC} = 20 \text{ V},$<br>$I_F = 5 \text{ mA}$ | —    | —    | 1    | ms   |
| Turn-off Time  | $t_{OFF}$ |                                                                    | —    | —    | 1    |      |

## PHOTOCOUPLER (AC-Input Transistor output)

## MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC |                                                                                   | SYMBOL                        | RATING   | UNIT                  |
|----------------|-----------------------------------------------------------------------------------|-------------------------------|----------|-----------------------|
| LED            | Forward Current                                                                   | $I_F$                         | $\pm 50$ | mA                    |
|                | Forward Current Derating<br>(Ta $\geq 25^\circ\text{C}$ )                         | $\Delta I_F / ^\circ\text{C}$ | -0.5     | mA / $^\circ\text{C}$ |
|                | Pulse Forward Current<br>(100 $\mu\text{s}$ pulse, 100 ppc)                       | $I_{FP}$                      | 1        | A                     |
|                | Junction Temperature                                                              | $T_j$                         | 125      | $^\circ\text{C}$      |
| DETECTOR       | Collector-Emitter Voltage                                                         | $V_{CEO}$                     | 80       | V                     |
|                | Emitter-Collector Voltage                                                         | $V_{ECO}$                     | 7        | V                     |
|                | Collector Current                                                                 | $I_C$                         | 50       | mA                    |
|                | Collector Power Dissipation<br>(1 Circuit)                                        | $P_C$                         | 150      | mW                    |
|                | Collector Power Dissipation<br>Derating (Ta $\geq 25^\circ\text{C}$ ) (1 Circuit) | $\Delta P_C / ^\circ\text{C}$ | -1.5     | mW / $^\circ\text{C}$ |
|                | Junction Temperature                                                              | $T_j$                         | 125      | $^\circ\text{C}$      |

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

| CHARACTERISTIC |                                        | SYMBOL        | TEST CONDITION                                                              | MIN. | TYP.        | MAX.        | UNIT          |
|----------------|----------------------------------------|---------------|-----------------------------------------------------------------------------|------|-------------|-------------|---------------|
| LED            | Forward Voltage                        | $V_F$         | $I_F = \pm 10 \text{ mA}$                                                   | 1.0  | 1.15        | 1.3         | V             |
|                | Capacitance                            | $C_T$         | $V = 0, f = 1 \text{ MHz}$                                                  | —    | 60          | —           | pF            |
| DETECTOR       | Collector-Emitter<br>Breakdown Voltage | $V_{(BR)CEO}$ | $I_C = 0.5 \text{ mA}$                                                      | 80   | —           | —           | V             |
|                | Emitter-Collector<br>Breakdown Voltage | $V_{(BR)ECO}$ | $I_E = 0.1 \text{ mA}$                                                      | 7    | —           | —           | V             |
|                | Collector Dark Current                 | $I_D$         | $V_{CE} = 48 \text{ V}$<br>(Ambient Light : 100 lx)                         | —    | 0.01<br>(2) | 0.1<br>(10) | $\mu\text{A}$ |
|                |                                        |               | $V_{CE} = 48 \text{ V}, T_a = 85^\circ\text{C}$<br>(Ambient Light : 100 lx) | —    | 2<br>(4)    | 50<br>(50)  | $\mu\text{A}$ |
|                | Capacitance                            | $C_{CE}$      | $V = 0, f = 1 \text{ MHz}$                                                  | —    | 10          | —           | pF            |

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

| CHARACTERISTIC                       | SYMBOL                 | TEST CONDITION                                             | MIN. | TYP. | MAX. | UNIT          |
|--------------------------------------|------------------------|------------------------------------------------------------|------|------|------|---------------|
| Current Transfer Ratio (CTR)         | $I_C / I_F$            | $I_F = 5 \text{ mA}$ , $V_{CE} = 5 \text{ V}$<br>Rank GB   | 50   | —    | —    | %             |
|                                      |                        |                                                            | 100  | —    | —    |               |
| Saturated CTR                        | $I_C / I_F$<br>(sat)   | $I_F = 1 \text{ mA}$ , $V_{CE} = 0.4 \text{ V}$<br>Rank GB | —    | 60   | —    | %             |
|                                      |                        |                                                            | 30   | —    | —    |               |
| Collector-Emitter Saturation Voltage | $V_{CE} \text{ (sat)}$ | $I_C = 2.4 \text{ mA}$ , $I_F = 8 \text{ mA}$              | —    | —    | 0.4  | V             |
|                                      |                        | $I_C = 0.2 \text{ mA}$ , $I_F = 1 \text{ mA}$              | —    | 0.2  | —    |               |
|                                      |                        | Rank GB                                                    | —    | —    | 0.4  |               |
| Off-State Collector Current          | $I_C \text{ (off)}$    | $V_F = 0.7 \text{ V}$ , $V_{CE} = 48 \text{ V}$            | —    | —    | 10   | $\mu\text{A}$ |

## 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    | —    |               |
| Turn-off Time  | $t_{off}$ |                                                                                 | —    | 3    | —    |               |
| Turn-on Time   | $t_{ON}$  | $R_L = 1.9 \text{ k}\Omega$ , $V_{CC} = 5 \text{ V}$ ,<br>$I_F = 16 \text{ mA}$ | —    | 2    | —    |               |
| Storage Time   | $t_s$     |                                                                                 | —    | 25   | —    |               |
| Turn-off Time  | $t_{OFF}$ |                                                                                 | —    | 40   | —    |               |

ZENER DIODE

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

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|----------------|--------|----------------|------|------|------|------|
| Zener Voltage  | $V_Z$  | —              | 22   | 27   | 32   | V    |

DARLINGTON TRANSISTOR

## MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC              | SYMBOL           | RATING | UNIT |
|-----------------------------|------------------|--------|------|
| Collector-Base Voltage      | V <sub>CBO</sub> | 30     | V    |
| Collector-Emitter Voltage   | V <sub>CEO</sub> | 30     | V    |
| Emitter-Base Voltage        | V <sub>EBO</sub> | 10     | V    |
| Collector Current           | I <sub>C</sub>   | 0.12   | A    |
| Base Current                | I <sub>B</sub>   | 20     | mA   |
| Collector Power Dissipation | P <sub>C</sub>   | 350    | mW   |
| Junction Temperature        | T <sub>j</sub>   | 125    | °C   |

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

| CHARACTERISTIC                       |              | SYMBOL                | TEST CONDITION                                                          | MIN. | TYP. | MAX. | UNIT |
|--------------------------------------|--------------|-----------------------|-------------------------------------------------------------------------|------|------|------|------|
| Collector Off Current                |              | I <sub>CBO</sub>      | V <sub>CB</sub> = 30 V, I <sub>E</sub> = 0                              | —    | —    | 10   | μA   |
| Emitter Off Current                  |              | I <sub>EBO</sub>      | V <sub>EB</sub> = 10 V, I <sub>C</sub> = 0                              | —    | —    | 10   | μA   |
| Collector-Emitter Breakdown Voltage  |              | V <sub>(BR)</sub> CEO | I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0                              | 30   | —    | —    | V    |
| DC Current Gain                      |              | h <sub>FE</sub>       | V <sub>CE</sub> = 2 V, I <sub>C</sub> = 120 mA                          | 4000 | —    | —    |      |
| Collector-Emitter Saturation Voltage |              | V <sub>CE</sub> (sat) | I <sub>C</sub> = 0.12 A, I <sub>B</sub> = 1 mA                          | —    | —    | 1.5  | V    |
| Switching Time                       | Turn-on Time | t <sub>on</sub>       | I <sub>B</sub> = 1 mA, V <sub>CC</sub> = 15 V,<br>R <sub>L</sub> = 15 Ω | —    | 0.20 | —    | μs   |
|                                      | Storage Time | t <sub>stg</sub>      |                                                                         | —    | 0.6  | —    |      |
|                                      | Fall Time    | t <sub>f</sub>        |                                                                         | —    | 0.3  | —    |      |

BRIDGE RECTIFIER

## MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC                       | SYMBOL           | RATING | UNIT |
|--------------------------------------|------------------|--------|------|
| Repetitive Peak Reverse Voltage      | V <sub>RRM</sub> | 30     | V    |
| Average Output Rectified Current     | I <sub>O</sub>   | 0.12   | A    |
| Peak One Cycle Surge Forward Current | I <sub>FSM</sub> | 0.5    | A    |
| Junction Temperature                 | T <sub>j</sub>   | 125    | °C   |

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

| CHARACTERISTIC                  | SYMBOL           | TEST CONDITION           | MIN. | TYP. | MAX. | UNIT |
|---------------------------------|------------------|--------------------------|------|------|------|------|
| Forward Voltage                 | V <sub>FM</sub>  | I <sub>FM</sub> = 0.12 A | —    | —    | 1.7  | V    |
| Repetitive Peak Reverse Current | I <sub>RRM</sub> | V <sub>RRM</sub> = Rated | —    | —    | 10   | μA   |

PACKAGE (Common)

## MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC                                         | SYMBOL           | RATING  | UNIT             |
|--------------------------------------------------------|------------------|---------|------------------|
| Total Package Power Dissipation                        | P <sub>T</sub>   | 650     | mW               |
| Storage Temperature Range                              | T <sub>stg</sub> | −55~100 | °C               |
| Operating Temperature Range                            | T <sub>opr</sub> | −20~85  | °C               |
| Lead Soldering Temperature (10 s)                      | T <sub>sol</sub> | 260     | °C               |
| Isolation Voltage<br>(AC, 1 min., R.H. ≤ 60%) (Note 1) | BV <sub>S</sub>  | 1500    | V <sub>rms</sub> |

(Note 1) : Device considered a two-terminal device : Pins 1, 2, 3, 4, 5, 6, 7 and 8 shorted together and pins 10, 11, 12, 13, 14 and 15 shorted together.

## ISOLATION CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC              | SYMBOL          | TEST CONDITION                     | MIN.               | TYP.             | MAX. | UNIT             |
|-----------------------------|-----------------|------------------------------------|--------------------|------------------|------|------------------|
| Capacitance Input to Output | C <sub>S</sub>  | V <sub>S</sub> = 0, f = 1 MHz      | —                  | 0.8              | —    | pF               |
| Isolation Resistance        | R <sub>S</sub>  | V <sub>S</sub> = 500 V, R.H. ≤ 60% | $5 \times 10^{10}$ | 10 <sup>14</sup> | —    | Ω                |
| Isolation Voltage           | BV <sub>S</sub> | AC, 1 minute                       | 1500               | —                | —    | V <sub>rms</sub> |
|                             |                 | AC, 1 second, in oil               | —                  | 3000             | —    |                  |
|                             |                 | DC, 1 minute, in oil               | —                  | 3000             | —    | V <sub>dc</sub>  |