

TOSHIBA PHOTOCOUPLER GaAs IRED & PHOTO-TRANSISTOR

# TLP321, TLP321-2, TLP321-4

PROGRAMMABLE CONTROLLERS

DC-OUTPUT MODULE

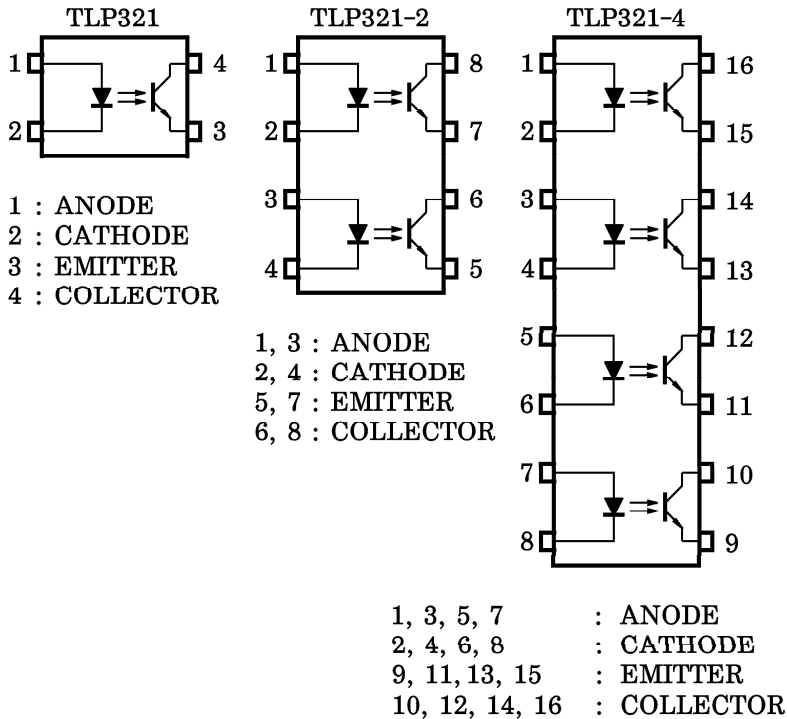
TELECOMMUNICATION

The TOSHIBA TLP321, -2 and -4 consist of a photo-transistor optically coupled to a gallium arsenide infrared emitting diode. The TLP321-2 offers two isolated channels in an eight lead plastic DIP package, while the TLP321-4 provides four isolated channels in a sixteen plastic DIP package.

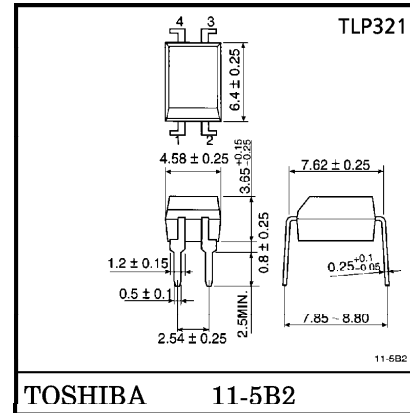
TLP321/-2/-4 have high  $V_{CEO}$  Voltage ( $V_{CEO}=80V$ ).

- Collector-Emitter Voltage : 80V (Min.)
- Current Transfer Ratio : 50% (Min.)  
Rank GB : 100% (Min.)
- Isolation Voltage : 5000Vrms (Min.)
- UL Recognized : UL1577, File No. E67349

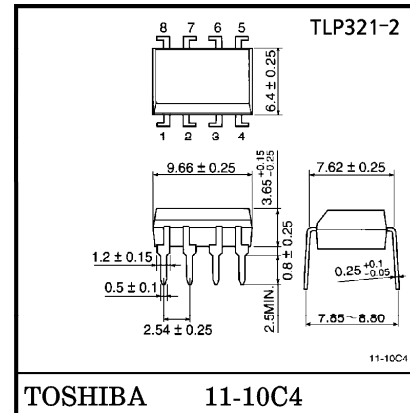
PIN CONFIGURATIONS (TOP VIEW)



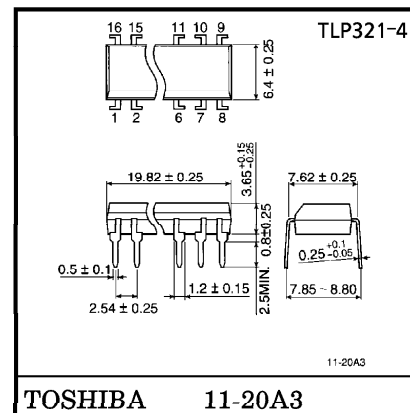
Unit in mm



Weight : 0.26g



Weight : 0.54g



Weight : 1.1g

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● 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 RATIO<br>(%) (I <sub>C</sub> / I <sub>F</sub> )  |      | MARKING OF<br>CLASSIFICATION                                          |
|----------|-------------------------------|-------------------------------------------------------------------|------|-----------------------------------------------------------------------|
|          |                               | I <sub>F</sub> = 5mA, V <sub>CE</sub> = 5V, T <sub>a</sub> = 25°C |      |                                                                       |
|          |                               | MIN.                                                              | MAX. |                                                                       |
| TLP321   | (None)                        | 50                                                                | 600  | BLANK, Y, Y <sup>■</sup> , G, G <sup>■</sup> , B, B <sup>■</sup> , GB |
|          | Rank Y                        | 50                                                                | 150  | Y, Y <sup>■</sup>                                                     |
|          | Rank GR                       | 100                                                               | 300  | G, G <sup>■</sup>                                                     |
|          | Rank BL                       | 200                                                               | 600  | B, B <sup>■</sup>                                                     |
|          | Rank GB                       | 100                                                               | 600  | G, G <sup>■</sup> , B, B <sup>■</sup> , GB                            |
| TLP321-2 | (None)                        | 50                                                                | 600  | BLANK, GR, BL, GB                                                     |
| TLP321-4 | Rank GB                       | 100                                                               | 600  | GR, BL, GB                                                            |

\*1 : Ex. Rank GB : TLP321 (GB)

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

TLP321 (GB) : TLP321

TLP321-2 (GB) : TLP321-2

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- Gallium arsenide (GaAs) is a substance used in the products described in this document. GaAs dust and fumes are toxic. Do not break, cut or pulverize the product, or use chemicals to dissolve them. When disposing of the products, follow the appropriate regulations. Do not dispose of the products with other industrial waste or with domestic garbage.
- The products described in this document are subject to foreign exchange and foreign trade control laws.
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## MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC                                               |                                                                     | SYMBOL                        | RATING                           |                       | UNIT             |
|--------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------|----------------------------------|-----------------------|------------------|
|                                                              |                                                                     |                               | TLP321-1                         | TLP321-2<br>TLP321-4  |                  |
| LED                                                          | Forward Current                                                     | I <sub>F</sub>                | 60                               | 50                    | mA               |
|                                                              | Forward Current Derating                                            | $\Delta I_F / ^\circ\text{C}$ | -0.7 (Ta $\geq$ 39°C)            | -0.5 (Ta $\geq$ 25°C) | mA / °C          |
|                                                              | Pulse Forward Current                                               | I <sub>FP</sub>               | 1 (100 $\mu$ s pulse, 100pps)    |                       | A                |
|                                                              | Reverse Voltage                                                     | V <sub>R</sub>                | 5                                |                       | V                |
|                                                              | Junction Temperature                                                | T <sub>j</sub>                | 125                              |                       | °C               |
| DETECTOR                                                     | Collector-Emitter Voltage                                           | V <sub>CEO</sub>              | 80                               |                       | V                |
|                                                              | Emitter-Collector Voltage                                           | V <sub>ECO</sub>              | 7                                |                       | V                |
|                                                              | Collector Current                                                   | I <sub>C</sub>                | 50                               |                       | mA               |
|                                                              | Collector Power Dissipation<br>(1 Circuit)                          | P <sub>C</sub>                | 150                              | 100                   | mW               |
|                                                              | Collector Power Dissipation<br>Derating (1 Circuit, Ta $\geq$ 25°C) | $\Delta P_C / ^\circ\text{C}$ | -1.5                             | -1.0                  | mW / °C          |
|                                                              | Junction Temperature                                                | T <sub>j</sub>                | 125                              |                       | °C               |
| Storage Temperature Range                                    |                                                                     | T <sub>stg</sub>              | -55~125                          |                       | °C               |
| Operating Temperature Range                                  |                                                                     | T <sub>opr</sub>              | -55~100                          |                       | °C               |
| Lead Soldering Temperature                                   |                                                                     | T <sub>sol</sub>              | 260 (10s)                        |                       | °C               |
| Total Package Power Dissipation                              |                                                                     | R <sub>T</sub>                | 250                              | 150                   | mW               |
| Total Package Power Dissipation<br>Derating (Ta $\geq$ 25°C) |                                                                     | $\Delta P_T / ^\circ\text{C}$ | -2.5                             | -1.5                  | mW / °C          |
| Isolation Voltage (Note 1)                                   |                                                                     | BV <sub>S</sub>               | 5000 (AC, 1 min., RH $\leq$ 60%) |                       | V <sub>rms</sub> |

(Note 1) Device considered a two terminal device : LED side pins shorted together and DETECTOR side pins shorted together.

## RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC        | SYMBOL    | MIN. | TYP. | MAX. | UNIT |
|-----------------------|-----------|------|------|------|------|
| Supply Voltage        | $V_{CC}$  | —    | 12   | 48   | V    |
| Forward Current       | $I_F$     | —    | 16   | 20   | 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         | 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 | $V_{(BR) CEO}$ | $I_C = 0.5\text{mA}$                          | 80   | —    | —    | V             |
|                | Emitter-Collector Breakdown Voltage | $V_{(BR) ECO}$ | $I_E = 0.1\text{mA}$                          | 7    | —    | —    | V             |
|                | Collector Dark Current              | $I_{CEO}$      | $V_{CE} = 48\text{V}$                         | —    | 10   | 100  | nA            |
|                |                                     |                | $V_{CE} = 48\text{V}, T_a = 85^\circ\text{C}$ | —    | 2    | 50   | $\mu\text{A}$ |
|                | Capacitance (Collector to Emitter)  | $C_{CE}$       | $V = 0, f = 1\text{MHz}$                      | —    | 10   | —    | pF            |

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

| CHARACTERISTIC                       | SYMBOL                   | 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   | —    | —    |      |
| 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  |      |

ISOLATION CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC                   | SYMBOL | TEST CONDITION       | MIN.               | TYP.             | MAX. | UNIT |
|----------------------------------|--------|----------------------|--------------------|------------------|------|------|
| Capacitance<br>(Input to Output) | CS     | VS=0, f=1MHz         | —                  | 0.8              | —    | pF   |
| Isolation Resistance             | RS     | VS=500V, R.H.≤60%    | 5×10 <sup>10</sup> | 10 <sup>14</sup> | —    | Ω    |
| Isolation Voltage                | BVS    | AC, 1 minute         | 5000               | —                | —    | Vrms |
|                                  |        | 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      | tr     | VCC=10V<br>IC=2mA<br>RL=100Ω        | —    | 2    | —    | μs   |
| Fall Time      | tf     |                                     | —    | 3    | —    |      |
| Turn-on Time   | ton    |                                     | —    | 3    | —    |      |
| Turn-off Time  | toff   |                                     | —    | 3    | —    |      |
| Turn-on Time   | tON    | RL=1.9kΩ (Fig.1)<br>VCC=5V, IF=16mA | —    | 2    | —    | μs   |
| Storage Time   | ts     |                                     | —    | 15   | —    |      |
| Turn-off Time  | tOFF   |                                     | —    | 25   | —    |      |

Fig.1 Switching Time Test Circuit

