

**TENTATIVE** TOSHIBA Photocoupler GaAs Ired & Photo-Transistor

# TLP320, TLP320-2, TLP320-4

Telecommunication

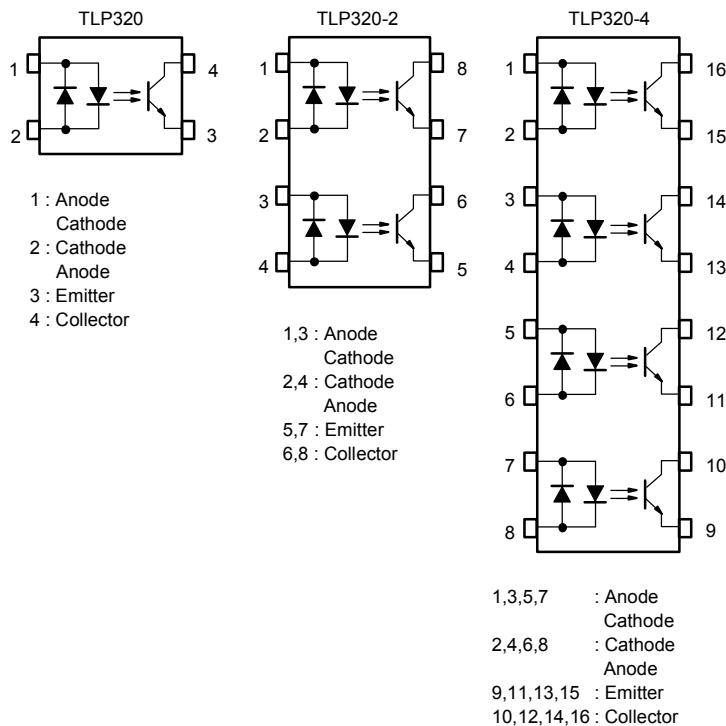
Office Machine

Telephone Use Equipment

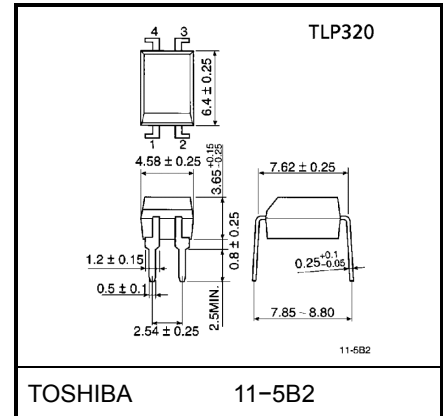
The TOSHIBA TLP320, -2 and -4 consists of a photo-transistor optically coupled to a gallium arsenide infrared emitting diode. The TLP320-2 offers two isolated channels in an eight lead plastic DIP package, while the TLP320-4 provides four isolated channels in a sixteen plastic DIP package. This is suitable for application of AC input current up to 150mA.

- $I_F$  maximum rating:  $\pm 150\text{mA}$
- Collector-emitter voltage: 55V (min.)
- Current transfer ratio: 25% (min.) ( $I_F = 20\text{mA}$ )
- Isolation voltage:  $5000V_{\text{rms}}$  (min.)
- UL recognized: file No. E67349

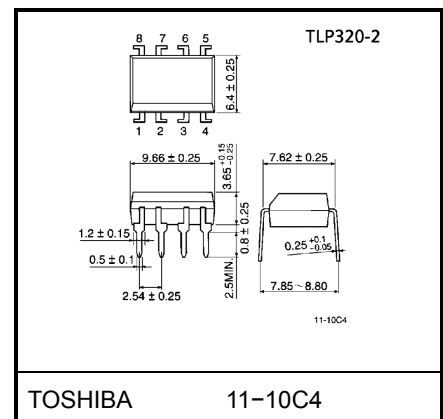
## Pin Configurations (top view)



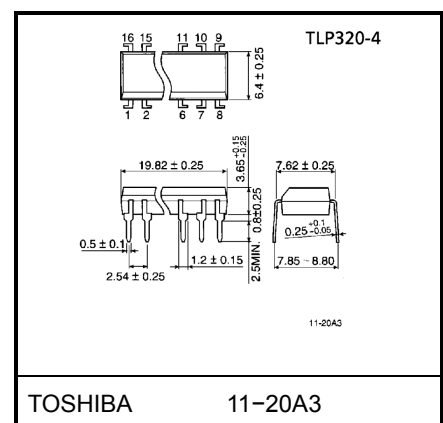
Unit in mm



Weight: 0.26g



Weight: 0.54g



Weight: 1.1g

## Maximum Ratings (Ta = 25°C)

| Characteristic                                                           |                                                                                | Symbol                        | Rating                                    |                      | Unit                  |
|--------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------|-------------------------------------------|----------------------|-----------------------|
|                                                                          |                                                                                |                               | TLP320                                    | TLP320-2<br>TLP320-4 |                       |
| LED                                                                      | Forward current                                                                | $I_F$                         | $\pm 150$                                 |                      | mA                    |
|                                                                          | Forward current derating                                                       | $\Delta I_F / ^\circ\text{C}$ | $-1.5 (T_a \geq 25^\circ\text{C})$        |                      | mA / $^\circ\text{C}$ |
|                                                                          | Pulse forward current                                                          | $I_{FP}$                      | $\pm 1$ (100 $\mu\text{s}$ pulse, 100pps) |                      | A                     |
|                                                                          | Junction temperature                                                           | $T_j$                         | 125                                       |                      | $^\circ\text{C}$      |
| Detector                                                                 | Collector-emitter voltage                                                      | $V_{CEO}$                     | 55                                        |                      | V                     |
|                                                                          | Emitter-collector voltage                                                      | $V_{ECO}$                     | 7                                         |                      | V                     |
|                                                                          | Collector current                                                              | $I_C$                         | 80                                        |                      | mA                    |
|                                                                          | Collector power dissipation (1 circuit)                                        | $P_C$                         | 150                                       | 100                  | mW                    |
|                                                                          | Collector power dissipation derating (1 circuit, $T_a \geq 25^\circ\text{C}$ ) | $\Delta P_C / ^\circ\text{C}$ | $-1.5$                                    | $-1.0$               | mW / $^\circ\text{C}$ |
|                                                                          | Junction temperature                                                           | $T_j$                         | 125                                       |                      | $^\circ\text{C}$      |
| Storage temperature range                                                |                                                                                | $T_{stg}$                     | $-55 \sim 125$                            |                      | $^\circ\text{C}$      |
| Operating temperature range                                              |                                                                                | $T_{opr}$                     | $-55 \sim 100$                            |                      | $^\circ\text{C}$      |
| Lead soldering temperature                                               |                                                                                | $T_{sol}$                     | 260 (10s)                                 |                      | $^\circ\text{C}$      |
| Total package power dissipation                                          |                                                                                | $P_T$                         | 250                                       | 200                  | mW                    |
| Total package power dissipation derating ( $T_a \geq 25^\circ\text{C}$ ) |                                                                                | $\Delta P_T / ^\circ\text{C}$ | $-2.5$                                    | 2.0                  | mW / $^\circ\text{C}$ |
| Isolation voltage (Note 1)                                               |                                                                                | $BV_S$                        | 5000 (AC, 1min., R.H. $\leq 60\%$ )       |                      | $V_{rms}$             |

(Note 1) Device consider a two terminal: LED side pins shorted together and detector side pins shorted together.

## Recommended Operating Conditions

| Characteristic        | Symbol    | Min.  | Typ. | Max. | Unit             |
|-----------------------|-----------|-------|------|------|------------------|
| Supply voltage        | $V_{CC}$  | —     | 5    | 24   | V                |
| Forward current       | $I_F$     | —     | 20   | 120  | mA               |
| Collector current     | $I_C$     | —     | 1    | 10   | mA               |
| Operating temperature | $T_{opr}$ | $-25$ | —    | 85   | $^\circ\text{C}$ |

## Individual Electrical Characteristics (Ta = 25°C)

| Characteristic |                                     | Symbol        | Test Condition                                  | Min. | Typ. | Max. | Unit          |
|----------------|-------------------------------------|---------------|-------------------------------------------------|------|------|------|---------------|
| LED            | Forward voltage                     | $V_F$         | $I_F = \pm 100 \text{ mA}$                      | —    | 1.4  | 1.7  | V             |
|                | Forward current                     | $I_F$         | $V_F = \pm 0.7 \text{ V}$                       | —    | 2.5  | 20   | $\mu\text{A}$ |
|                | Capacitance                         | $C_T$         | $V = 0, f = 1 \text{ MHz}$                      | —    | 60   | —    | 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 dark current              | $I_{CEO}$     | $V_{CE} = 24 \text{ V}$                         | —    | 10   | 100  | nA            |
|                |                                     |               | $V_{CE} = 24 \text{ V}, T_a = 85^\circ\text{C}$ | —    | 2    | 50   | $\mu\text{A}$ |
|                | Capacitance collector to emitter    | $C_{CE}$      | $V = 0, f = 1 \text{ MHz}$                      | —    | 10   | —    | pF            |

## Coupled Electrical Characteristics (Ta = 25°C)

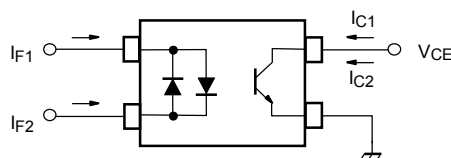
| Characteristic                       | Symbol             | Test Condition                                                   | Min. | Typ. | Max. | Unit          |
|--------------------------------------|--------------------|------------------------------------------------------------------|------|------|------|---------------|
| Current transfer ratio               | $I_C / I_F$        | $I_F = \pm 20 \text{ mA}, V_{CE} = 1 \text{ V}$                  | 25   | —    | —    | %             |
|                                      | $I_C / I_F$ (high) | $I_F = \pm 100 \text{ mA}, V_{CE} = 1 \text{ V}$                 | 20   | —    | 80   |               |
| Collector-emitter saturation voltage | $V_{CE(sat)}$      | $I_C = 2.4 \text{ mA}, I_F = \pm 20 \text{ mA}$                  | —    | —    | 0.4  | V             |
|                                      |                    | $I_C = 2.4 \text{ mA}, I_F = \pm 100 \text{ mA}$                 | —    | —    | 0.4  |               |
| Off-state collector current          | $I_{C(off)}$       | $V_F = \pm 0.7 \text{ V}, V_{CE} = 24 \text{ V}$                 | —    | 1    | 10   | $\mu\text{A}$ |
| CTR symmetry (Note)                  | $I_C$ (ratio)      | $I_C (I_F = -20 \text{ mA}) / I_C (I_F = +20 \text{ mA})$ (Note) | 0.5  | 1    | 2    | —             |

## 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        | $R_S$  | $V_S = 500 \text{ V}, \text{R.H.} \leq 60\%$ | $5 \times 10^{10}$ | $10^{14}$ | —    | $\Omega$  |
| Isolation voltage           | $BV_S$ | AC, 1 minute                                 | 5000               | —         | —    | $V_{rms}$ |
|                             |        | AC, 1 second, in oil                         | —                  | 10000     | —    |           |
|                             |        | DC, 1 minute, in oil                         | —                  | 10000     | —    | $V_{dc}$  |

(Note)

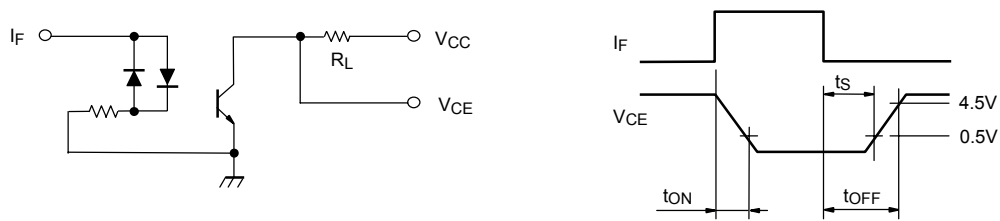
$$I_C(\text{ratio}) = \frac{I_{C2}(I_F = I_{F2}, V_{CE} = 1 \text{ V})}{I_{C1}(I_F = I_{F1}, V_{CE} = 1 \text{ V})}$$

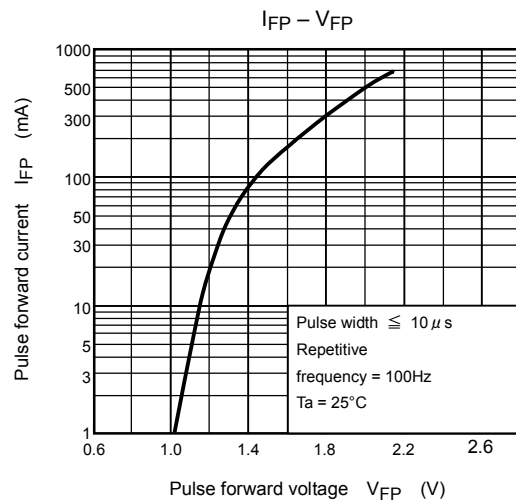
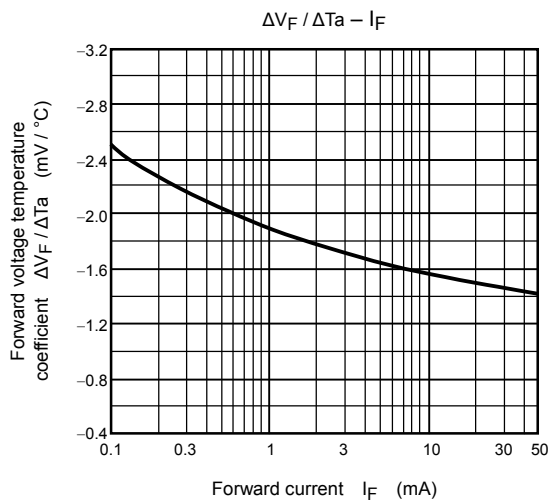
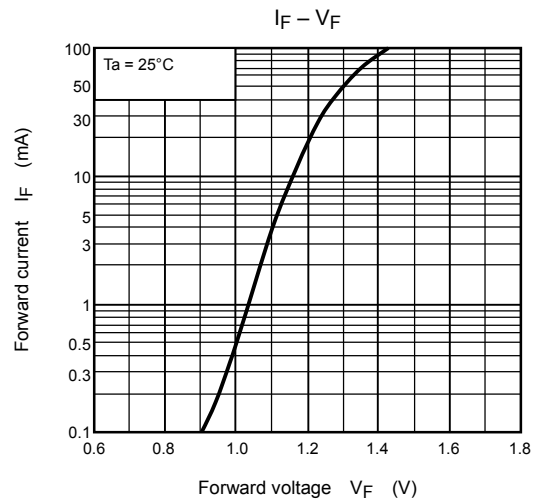
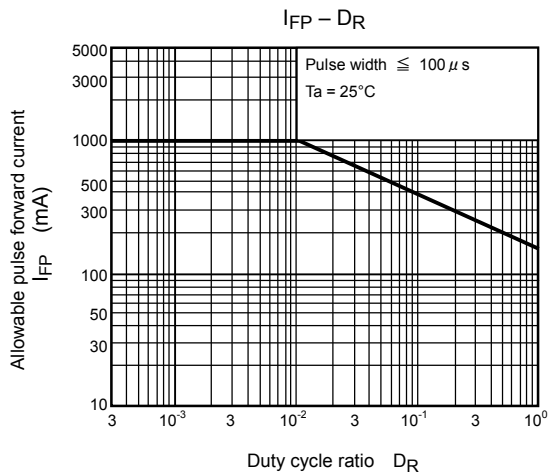
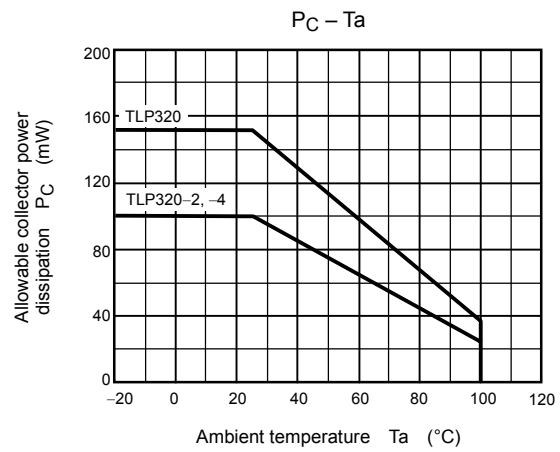
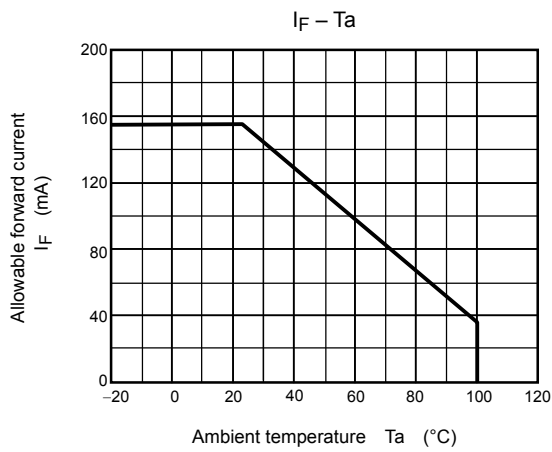


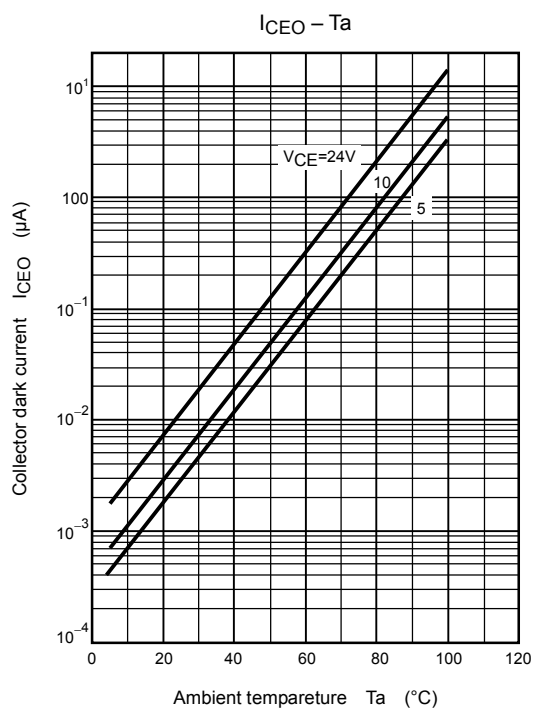
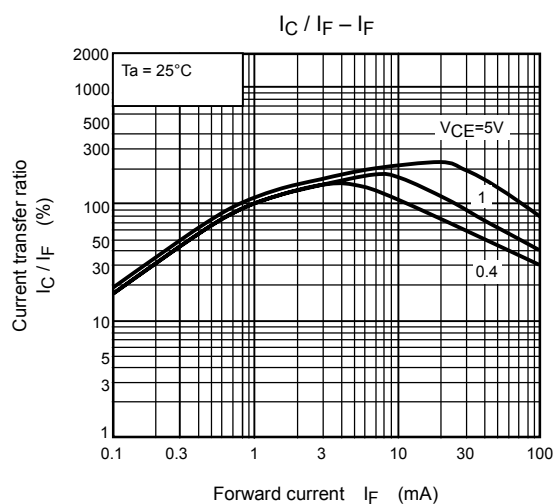
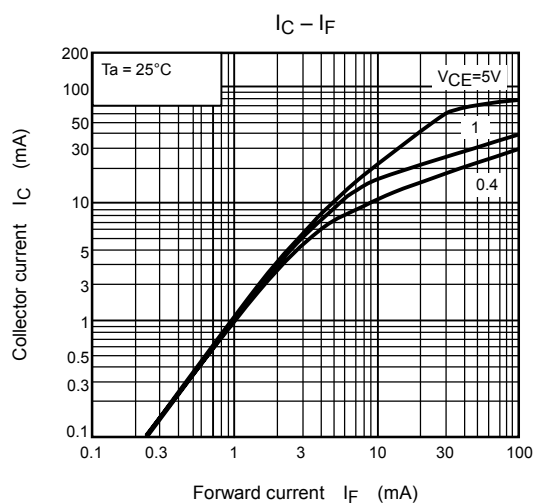
Switching Characteristics (Ta = 25°C)

| 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   | $t_{ON}$  | $R_L = 1.9\text{ k}\Omega$<br>$V_{CC} = 5\text{ V}, I_F = \pm 16\text{ mA}$<br>(Fig.1) | —    | 2    | —    | $\mu\text{s}$ |
| Storage time   | $t_s$     |                                                                                        | —    | 15   | —    |               |
| Turn-off time  | $t_{OFF}$ |                                                                                        | —    | 25   | —    |               |

Fig. 1 Switching time test circuit







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