

TOSHIBA Photocoupler GaAs Ired & Photo-Transistor

## TLP320, TLP320-2, TLP320-4

Telecommunication

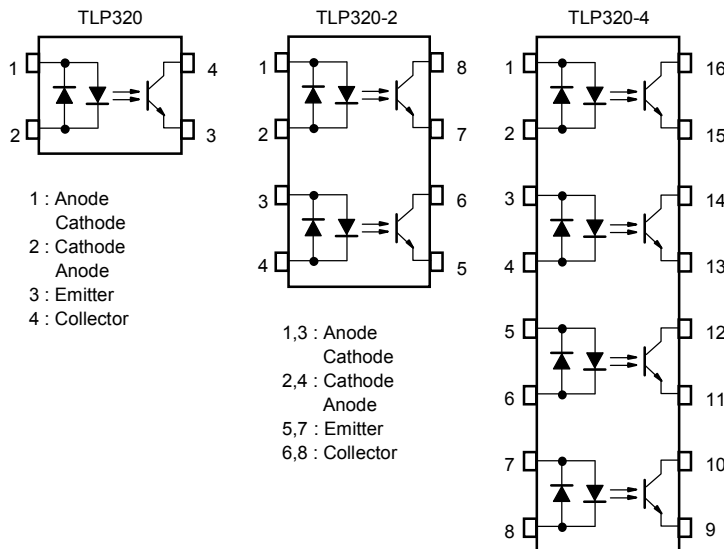
Office Machine

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.

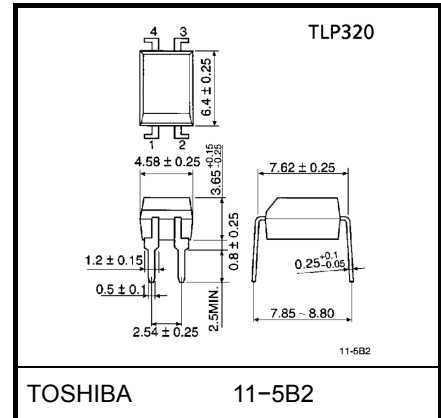
- I<sub>F</sub> maximum rating: ±150mA
- Collector-emitter voltage: 55V (min.)
- Current transfer ratio: 25% (min.) (I<sub>F</sub> = 20mA)
- Isolation voltage: 5000V<sub>rms</sub> (min.)
- UL recognized: file No. E67349
- BSI approved: BS EN60065:2002, certificate no.7426  
BS EN60950-1:2002, certificate no.7427

### Pin Configurations (top view)

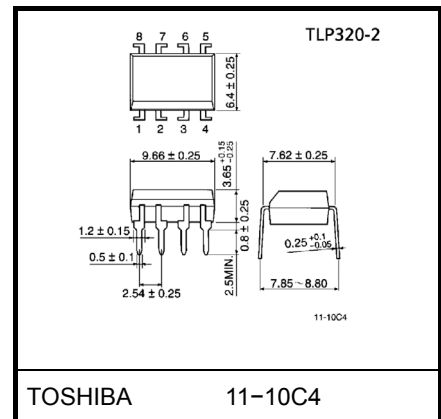


- 1,3,5,7 : Anode  
Cathode  
2,4,6,8 : Cathode  
Anode  
9,11,13,15 : Emitter  
10,12,14,16 : Collector

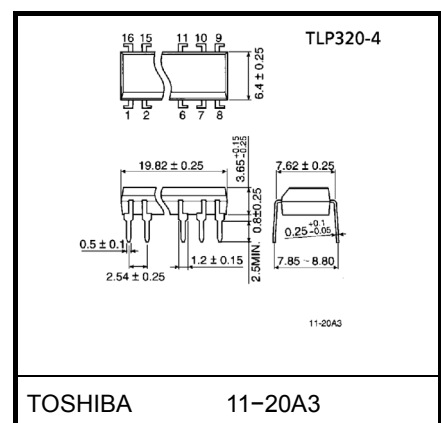
Unit in mm



TOSHIBA 11-5B2  
Weight: 0.26g



TOSHIBA 11-10C4  
Weight: 0.54g



TOSHIBA 11-20A3  
Weight: 1.1g

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

Characteristic	Symbol	Rating		Unit
		TLP320	TLP320-2 TLP320-4	
LED	Forward current	±150		mA
	Forward current derating	-1.5 (Ta ≥ 25°C)		mA / °C
	Pulse forward current	±1 (100µs pulse, 100pps)		A
	Junction temperature	125		°C
Detector	Collector-emitter voltage	55		V
	Emitter-collector voltage	7		V
	Collector current	80		mA
	Collector power dissipation (1 circuit)	150	100	mW
	Collector power dissipation derating (1 circuit, Ta ≥ 25°C)	-1.5	-1.0	mW / °C
	Junction temperature	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	P <sub>T</sub>	250	200	mW
Total package power dissipation derating (Ta ≥ 25°C)	ΔP <sub>T</sub> / °C	-2.5	2.0	mW / °C
Isolation voltage (Note 1)	BV <sub>S</sub>	5000 (AC, 1min., R.H. ≤ 60%)		V <sub>rms</sub>

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).

(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 <sub>CC</sub>	—	5	24	V
Forward current	I <sub>F</sub>	—	20	120	mA
Collector current	I <sub>C</sub>	—	1	10	mA
Operating temperature	T <sub>opr</sub>	-25	—	85	°C

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.

## 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)

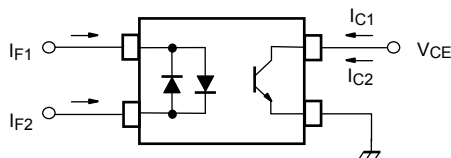
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Current transfer ratio	$I_C / I_F$	$I_F = \pm 20 \text{ mA}, V_{CE} = 1 \text{ V}$	25	—	—	%
	$I_C / I_F$ (high)	$I_F = \pm 100 \text{ mA}, V_{CE} = 1 \text{ V}$	20	—	80	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = 2.4 \text{ mA}, I_F = \pm 20 \text{ mA}$	—	—	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	—	$V_{dc}$
		DC, 1 minute, in oil	—	10000	—	

(Note)

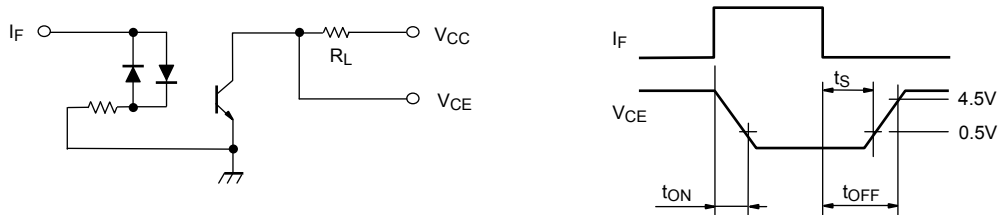
$$I_C(\text{ratio}) = \frac{I_{C2}(I_F = I_{F2}, V_{CE} = 1\text{V})}{I_{C1}(I_F = I_{F1}, V_{CE} = 1\text{V})}$$

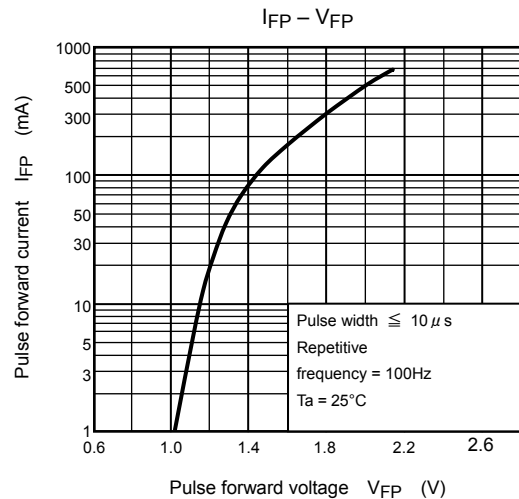
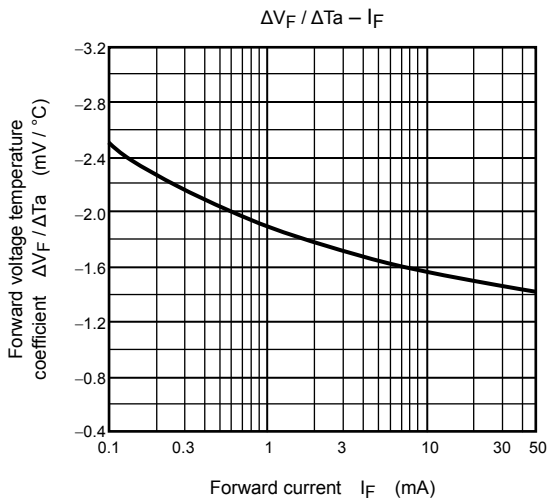
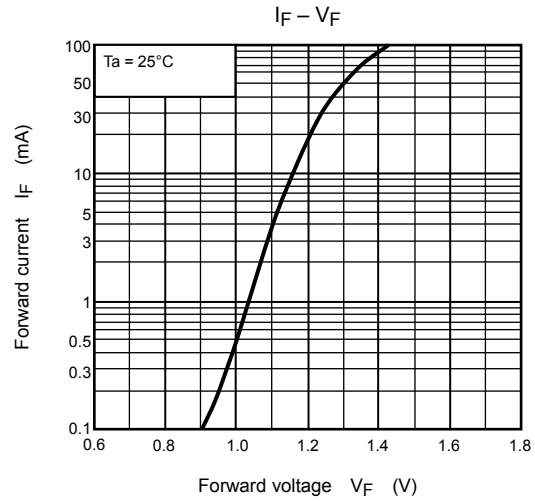
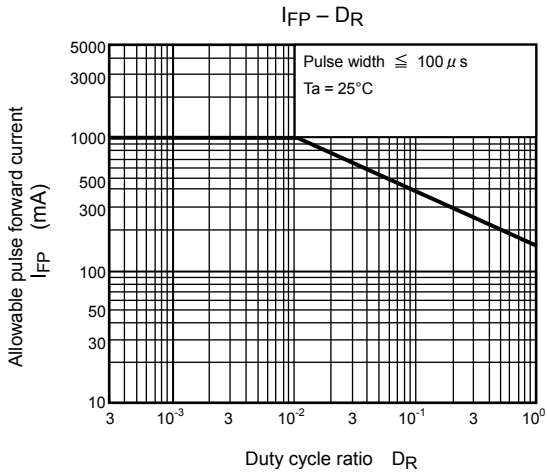
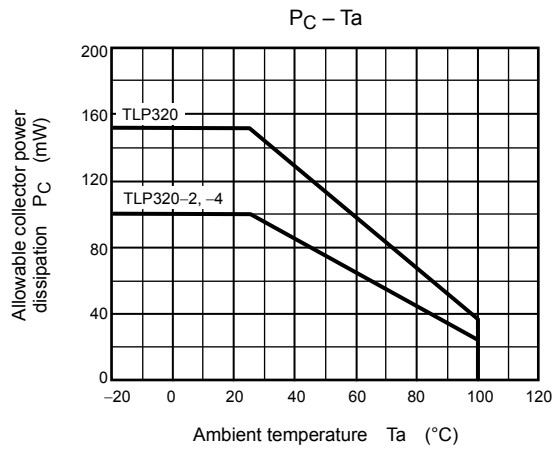
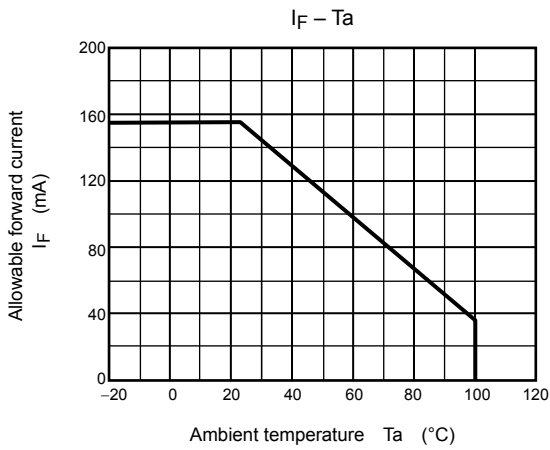


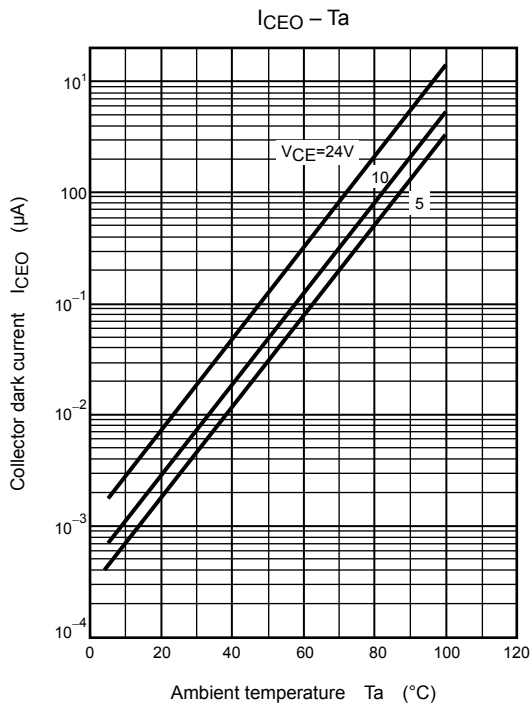
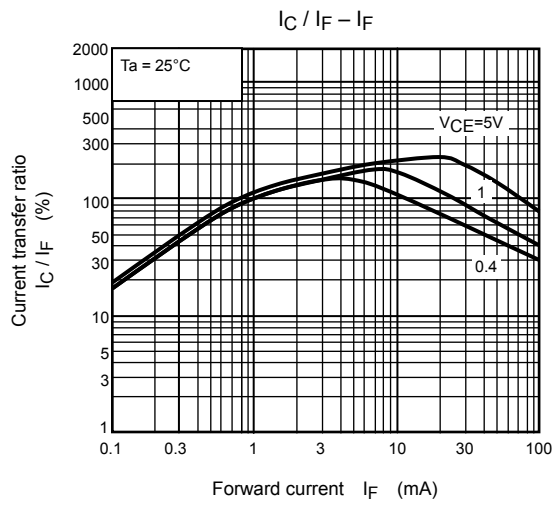
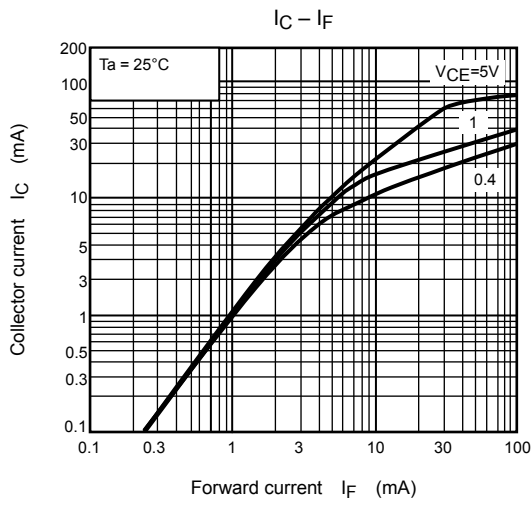
**Switching Characteristics (Ta = 25°C)**

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Rise time	$t_r$	$V_{CC} = 10\text{ V}, I_C = 2\text{ mA}$ $R_L = 100\Omega$	—	2	—	$\mu\text{s}$
Fall time	$t_f$		—	3	—	
Turn-on time	$t_{on}$		—	3	—	
Turn-off time	$t_{off}$		—	3	—	
Turn-on time	$t_{ON}$	$R_L = 1.9\text{ k}\Omega$ (Fig.1) $V_{CC} = 5\text{ V}, I_F = \pm 16\text{ mA}$	—	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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