TOSHIBA Photocoupler IRED & Photo-Transistor

TLP320, TLP320-2, TLP320-4

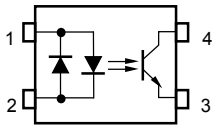
Telecommunication
Office Machine
Telephone Use Equipment

The TOSHIBA TLP320, -2 and -4 consists of a photo-transistor optically coupled to an 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 lead plastic DIP package. This is suitable for application of AC input current up to 150mA.

- I_F maximum rating: ±150 mA
- Collector-emitter voltage: 55 V (min)
- Current transfer ratio: 25% (min)
- Isolation voltage: 5000 Vrms (min)
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A
  File No.E67349

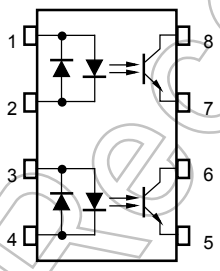
Pin Configurations (top view)

TLP320



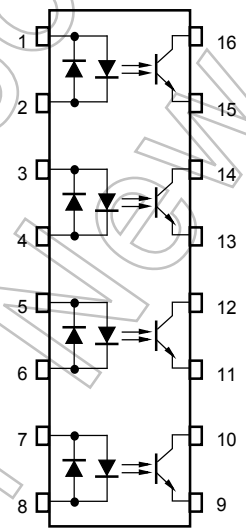
1 : Anode
Cathode
2 : Cathode
Anode
3 : Emitter
4 : Collector

TLP320-2



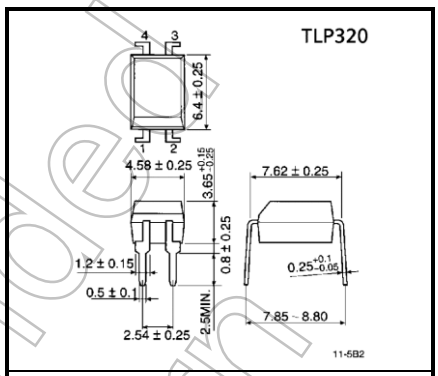
1,3 : Anode
Cathode
2,4 : Cathode
Anode
5,7 : Emitter
6,8 : Collector

TLP320-4



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

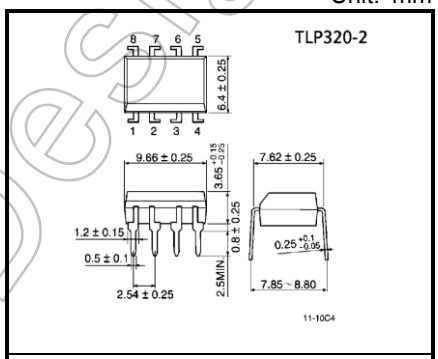
Unit: mm



TOSHIBA 11-5B2

Weight: 0.26g (typ.)

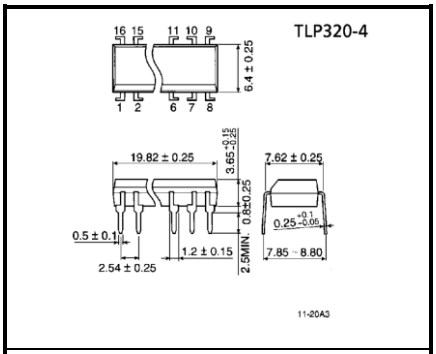
Unit: mm



TOSHIBA 11-10C4

Weight: 0.54g (typ.)

Unit: mm



TOSHIBA 11-20A3

Weight: 1.1 g (typ.)

Start of commercial production
1994-03

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating		Unit
			TLP320	TLP320−2 TLP320−4	
LED	Forward current	I_F	±150		mA
	Forward current derating (Ta ≥ 25°C)	ΔI_F/°C	-1.5		mA/°C
	Pulse forward current (100μs pulse, 100 pps)	I_{FP}	±1		A
	Diode power dissipation	P_D	200		mW
	Diode power dissipation derating (Ta ≥ 25°C)	ΔP_D/°C	-2.0		mW/°C
	Junction temperature	T_j	125		°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) (Ta ≥ 25°C)	ΔP_C/°C	-1.5	-1.0	mW/°C
	Junction temperature	T_j	125		°C
Storage temperature range		T_{stg}	−55 to 125		°C
Operating temperature range		T_{opr}	−55 to 100		°C
Lead soldering temperature (10 s)		T_{sol}	260		°C
Total package power dissipation (1 circuit)		P_T	250	200	mW
Total package power dissipation derating (1 circuit) (Ta≥25°C)		ΔP_T/°C	-2.5	-2.0	mW/°C
Isolation voltage (AC, 60 s, R.H. ≤ 60 %) (Note 1)		BV_S	5000		V_{rms}

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: The device is considered as 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}	—	5	24	V
Forward current	I_F	—	20	120	mA
Collector current	I_C	—	1	10	mA
Operating temperature	T_{opr}	-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.

Electrical Characteristics (Ta = 25°C)

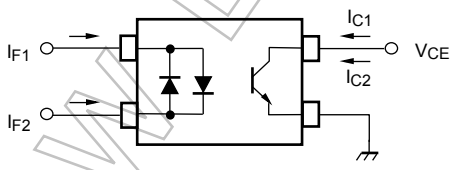
	Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	V_F	I_F = ±100 mA	—	1.4	1.7	V
	Forward current	I_F	V_F = ±0.7 V	—	2.5	10	μA
	Capacitance	C_T	V = 0 V, f = 1 MHz	—	60	—	pF
Detector	Collector−emitter breakdown voltage	$V_{(BR)CEO}$	I_C = 0.5 mA	55	—	—	V
	Emitter−collector breakdown voltage	$V_{(BR)ECO}$	I_E = 0.1 mA	7	—	—	V
	Collector dark current	I_{CEO}	V_{CE} = 24 V	—	10	100	nA
			V_{CE} = 24 V, Ta = 85 °C	—	2	50	μA
	Capacitance collector to emitter	C_{CE}	V = 0 V, f = 1 MHz	—	10	—	pF

Coupled Electrical Characteristics (Ta = 25°C)

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

Note 1:

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



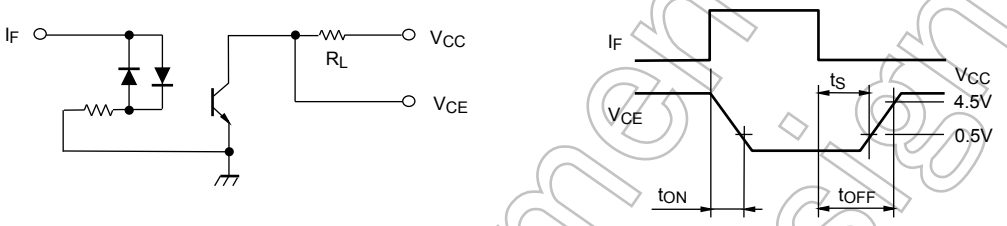
Isolation Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Capacitance input to output	C_S	V_S = 0 V, f = 1 MHz	—	0.8	—	pF
Isolation resistance	R_S	V_S = 500 V, R.H. ≤ 60 %	5×10^{10}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 60 s	5000	—	—	Vrms

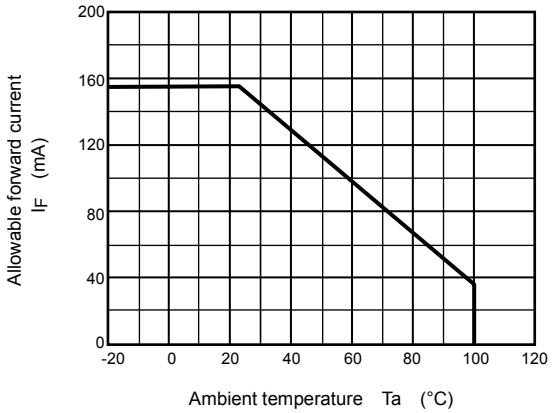
Switching Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Rise time	t_r	V_{CC} = 10 V, I_C = 2 mA R_L = 100 Ω	—	2	—	μs
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 kΩ (Fig.1) V_{CC} = 5 V, I_F = ±16 mA	—	2	—	μs
Storage time	t_s		—	15	—	
Turn−off time	t_{OFF}		—	25	—	

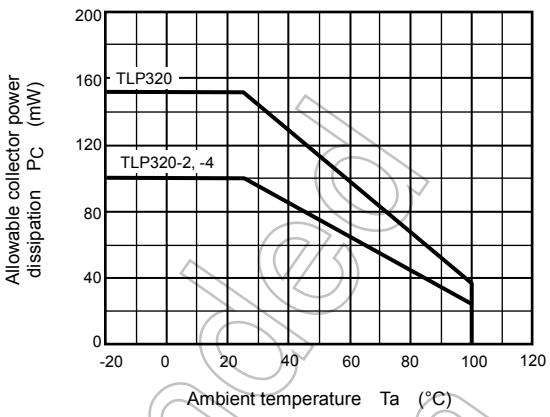
Fig. 1 Switching time test circuit



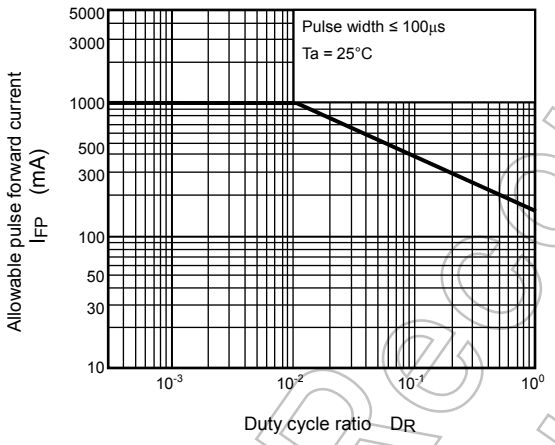
I_F – Ta



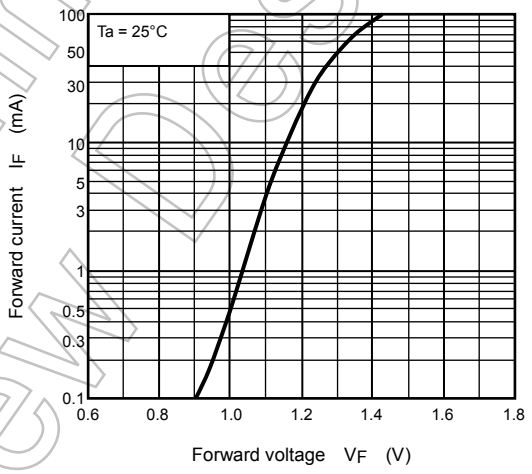
P_C – Ta



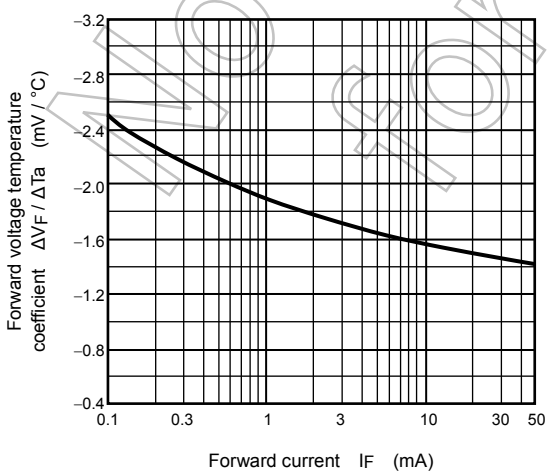
I_{FP} – D_R



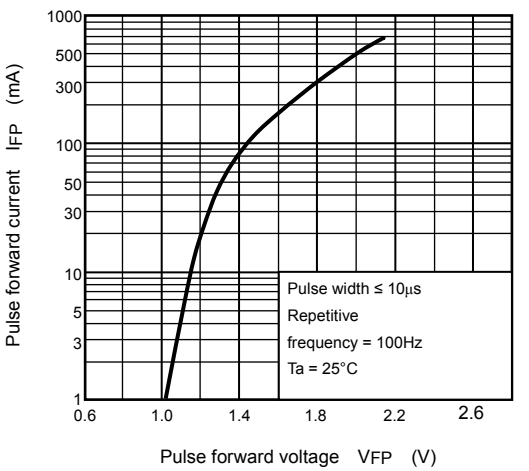
I_F – V_F



$\Delta V_F / \Delta Ta$ – I_F

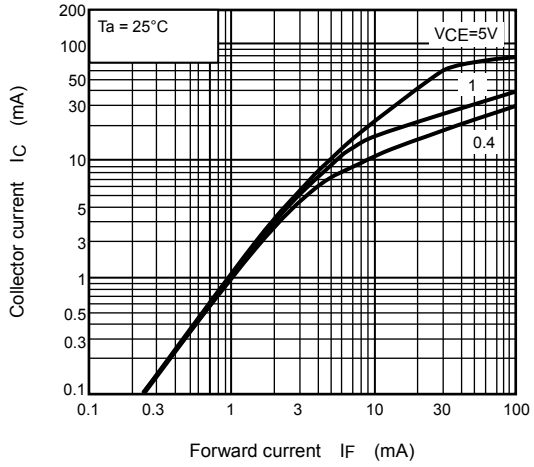


I_{FP} – V_{FP}

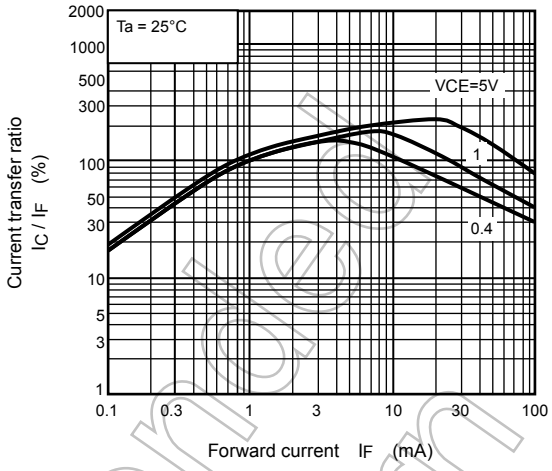


NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

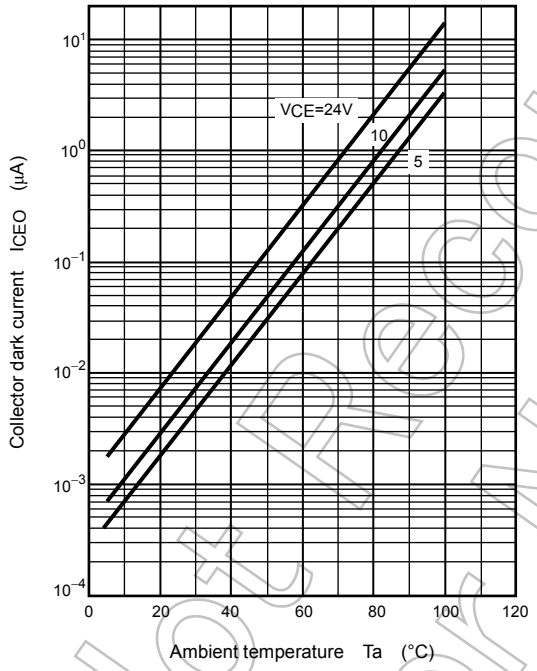
$I_C - I_F$



$I_C / I_F - I_F$



$I_{CEO} - Ta$



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