TOSHIBA Photocoupler IRED & Photo-Transistor

TLP504A, TLP504A-2

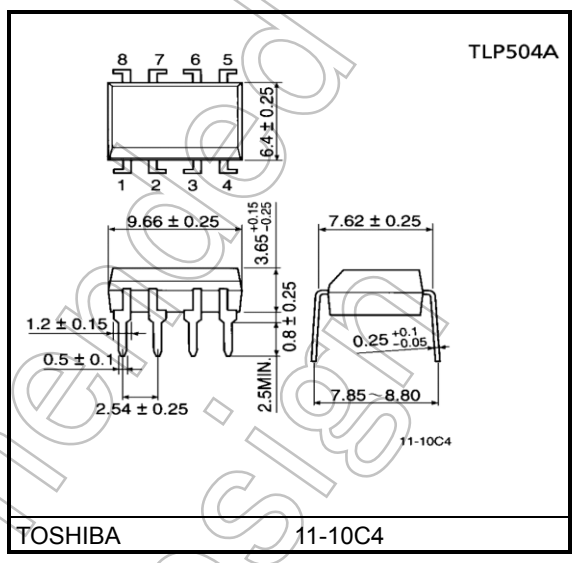
Programmable Controllers
AC/DC-Input Module
Solid State Relay

The TOSHIBA TLP504A and TLP504A-2 consists of a photo-transistor optically coupled to an infrared emitting diode. The TLP504A offers two isolated channels in an eight lead plastic DIP package, while the TLP504A-2 provides four isolated channels in a sixteen plastic DIP package.

- Collector-emitter voltage: 55 V (min)
- Current transfer ratio: 50% (min)
  Rank GB: 100% (min)
- Isolation voltage: 2500 Vrms (min)
- UL-recognized: UL 1577, File No.E67349

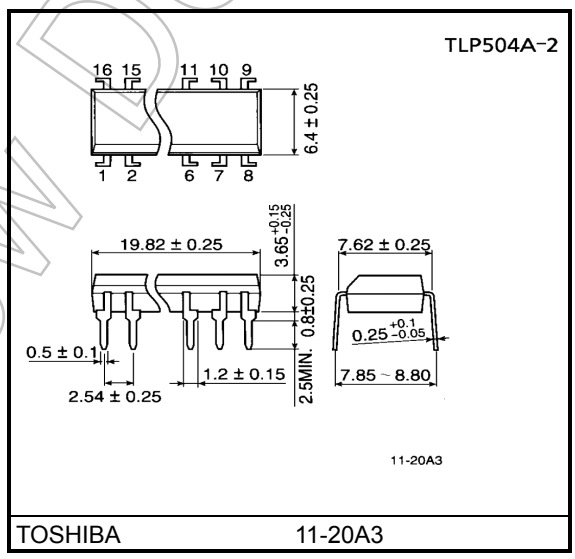
,

Unit: mm



TOSHIBA	11-10C4

Weight: 0.54 g (typ.)

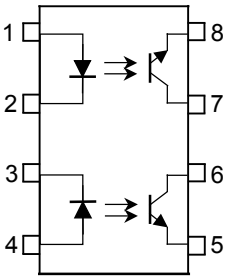


TOSHIBA	11-20A3

Weight: 1.1 g (typ.)

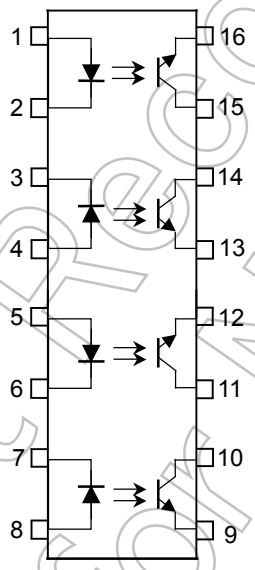
Pin Configurations (top view)

TLP504A



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

TLP504A-2



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

Start of commercial production
1981-01

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating		Unit
			TLP504A	TLP504A-2	
LED	Forward current	I_F	60	50	mA
	Forward current derating	ΔI_F/°C	-0.7 (Ta ≥ 39°C)	-0.5 (Ta ≥ 25°C)	mA/°C
	Pulse forward current (100μs pulse, 100pps)	I_{FP}	1		A
	Reverse voltage	V_R	5		V
	Diode power dissipation	P_D	100		mW
	Diode power dissipation derating	ΔP_D/°C	-1.2 (Ta ≥ 39°C)	-1.0 (Ta ≥ 25°C)	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	50		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 150		°C
Operating temperature range		T_{opr}	-55 to 100		°C
Lead soldering temperature (10 s)		T_{sol}	260		°C
Total package power dissipation		R_T	250	150	mW
Total package power dissipation derating (Ta ≥ 25°C)		ΔP_T/°C	-2.5	-1.5	mW/°C
Isolation voltage (AC, 60 s, R.H.≤ 60 %) (Note 1)		BV_S	2500		Vrms

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 considered a two terminal device: LED side pins shorted together and detector side pins shorted together.

Recommended Operating Conditions

Characteristicss	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	—	5	24	V
Forward current	I_F	—	16	20	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 = 10 mA	1.0	1.15	1.3	V
	Reverse current	I_R	V_R = 5 V	—	—	10	μA
	Capacitance	C_T	V = 0 V, f = 1 MHz	—	30	—	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 = 5 mA, V_{CE} = 5 V		50	—	600	%
			Rank GB	100	—	600	
Saturated CTR	$I_C/I_{F(sat)}$	IF = 1 mA, V_{CE} = 0.4 V		—	60	—	%
			Rank GB	30	—	—	
Collector-emitter saturation voltage	$V_{CE(sat)}$	I_C = 2.4 mA, I_F = 8 mA		—	—	0.4	V
		I_C = 0.2 mA, I_F = 1 mA		—	0.2	—	
			Rank GB	—	—	0.4	

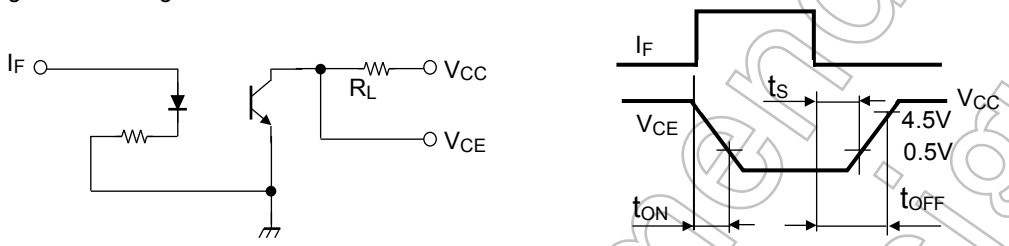
Isolation Characteristics (Ta = 25°C)

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	2500	—	—	Vrms

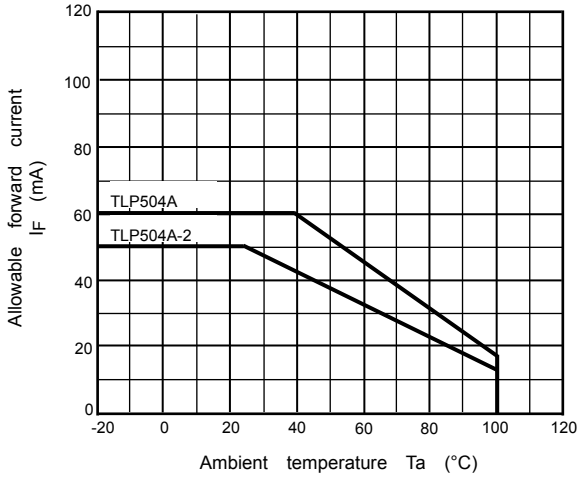
Switching Characteristics (Ta = 25°C)

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	—	

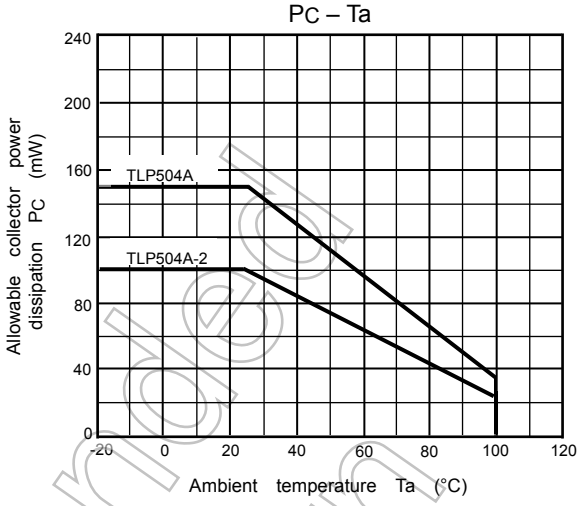
Fig. 1 Switching time test circuit



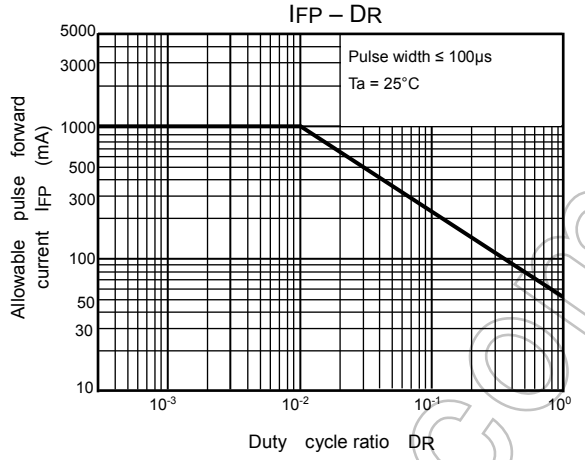
I_F – Ta



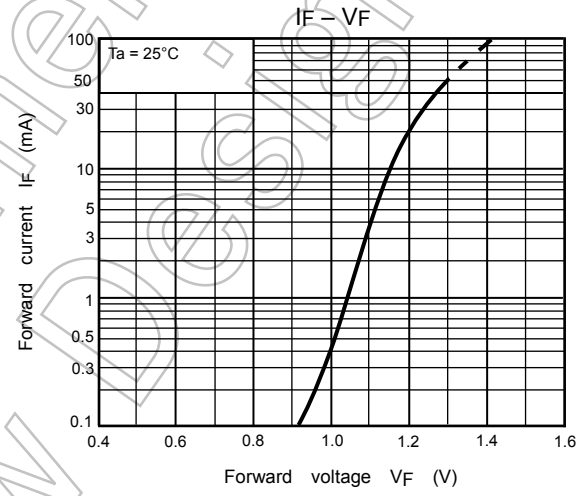
P_C – Ta



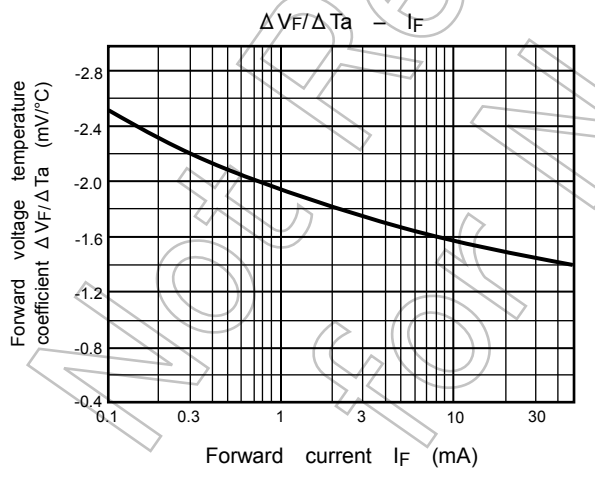
I_{FP} – DR



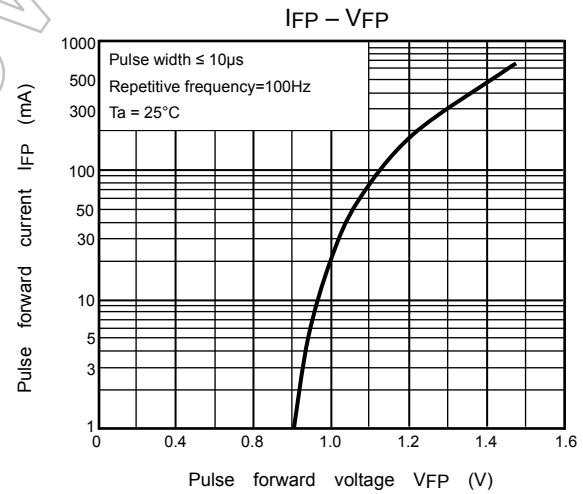
I_F – V_F



$\Delta V_F / \Delta Ta$ – I_F

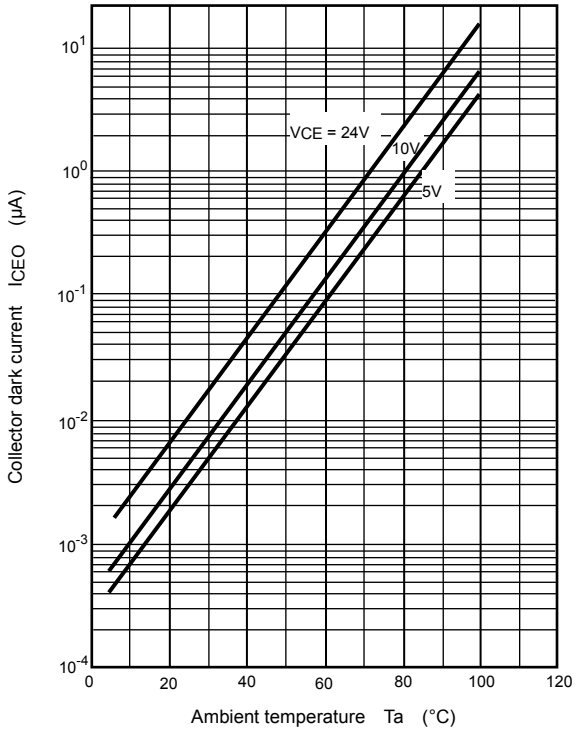


I_{FP} – V_{FP}

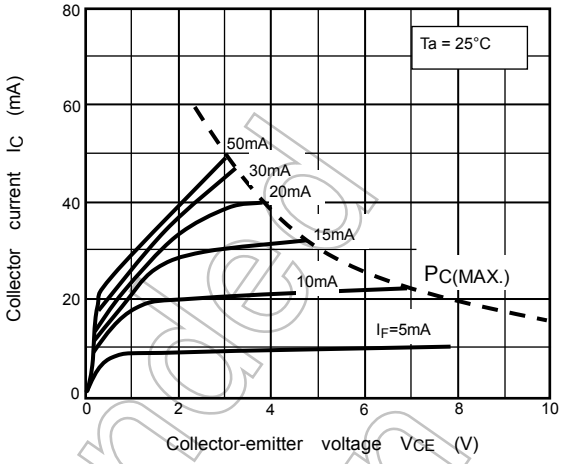


NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

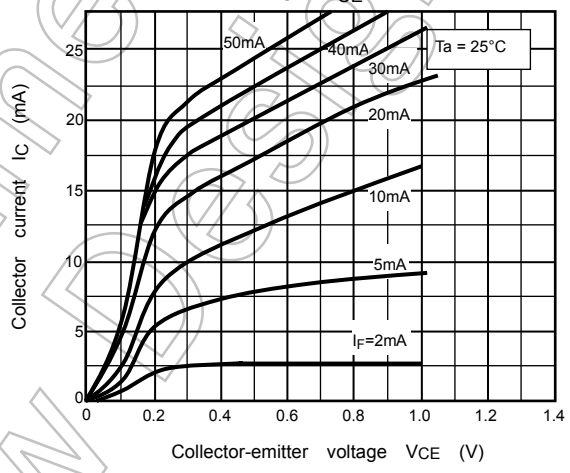
I_{CEO} – Ta



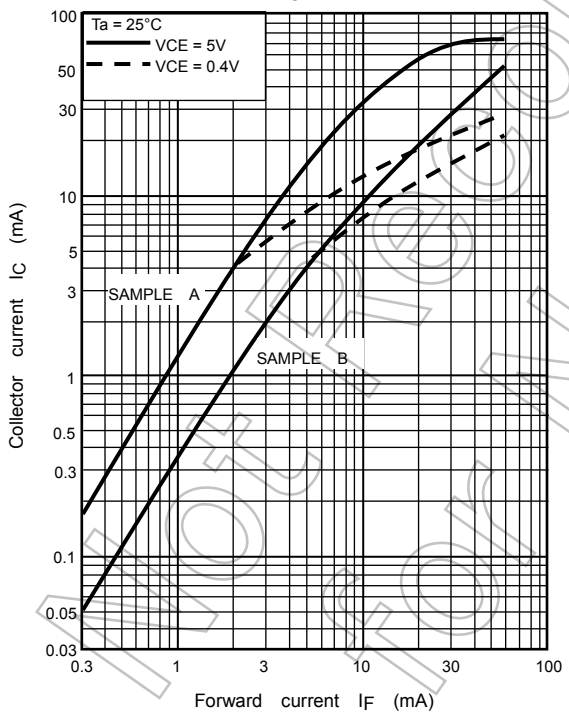
I_C – V_{CE}



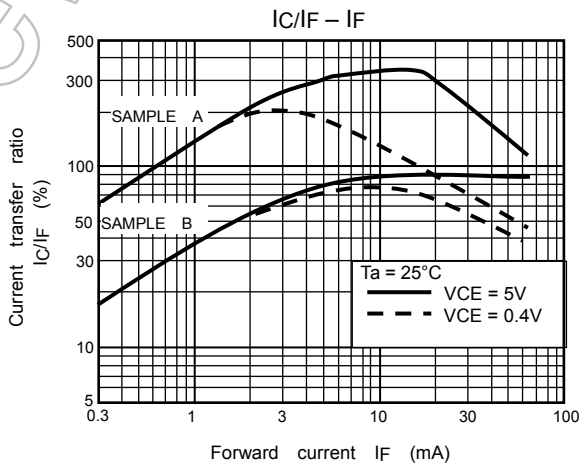
I_C – V_{CE}



I_C – I_F



I_C/I_F – I_F



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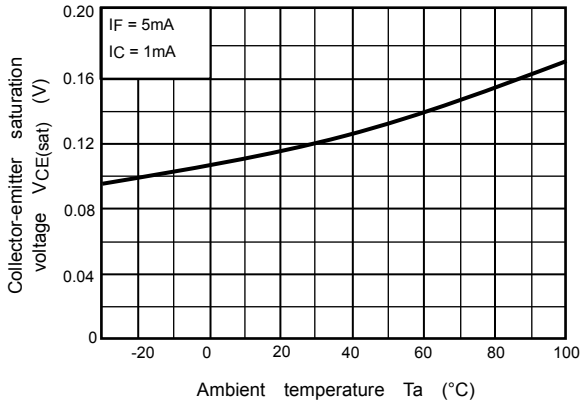
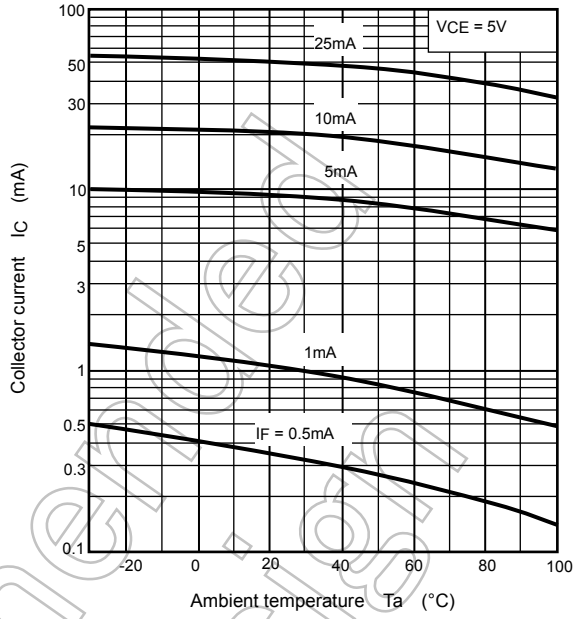
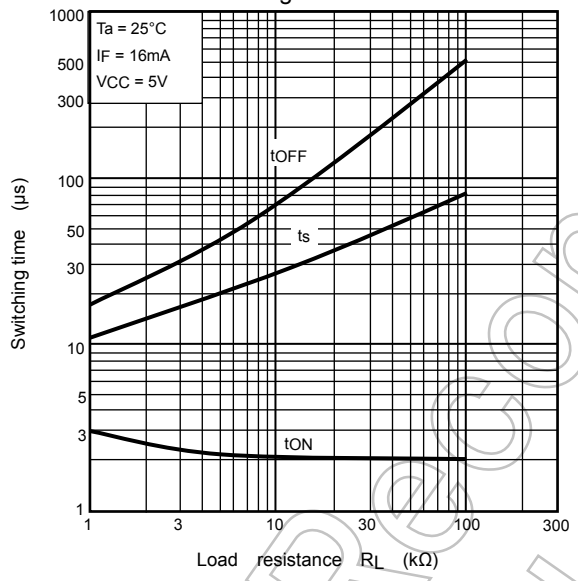
VCE (sat) – Ta



IC – Ta



Switching Time – RL



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