

TOSHIBA Photocoupler GaAs Ired & Photo-Transistor

# TLP504A,TLP504A-2

Programmable Controllers AC / DC–Input Module Solid State Relay

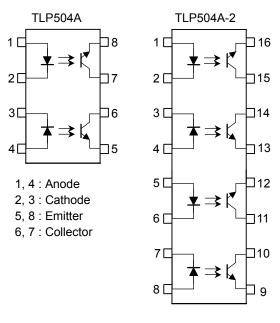
The TOSHIBA TLP504A and TLP504A–2 consists of a photo–transistor optically coupled to a gallium arsenide infrared emitting diode.

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.

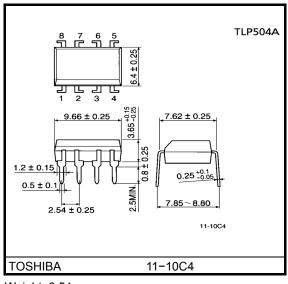
- Collector-emitter voltage: 55 V (min.)
- Current transfer ratio: 50% (min.) Rank GB: 100% (min.)
- Isolation voltage: 2500 Vrms (min.)
- UL recognized: UL1577,

File no. E67349

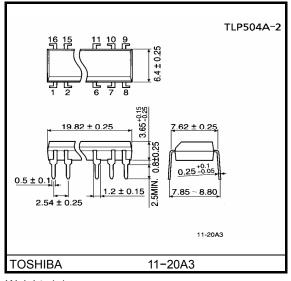
#### Pin Configurations (top view)



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



Weight: 0.54 g



Weight: 1.1 g

Unit in mm

Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Cumbol	Rat	Unit		
	Characteristic	Symbol	TLP504A	TLP504A-2		
	Forward current	١ <sub>F</sub>	60	50	mA	
LED	Forward current derating	ΔI <sub>F</sub> / °C	–0.7 (Ta ≥ 39°C)	–0.5 (Ta ≥ 25°C)	mA /°C	
	Pulse forward current	I <sub>FP</sub>	1 (100µs pulse, 100pps)		А	
	Reverse voltage	VR	5		V	
	Junction temperature	Tj	12	°C		
	Collector-emitter voltage	V <sub>CEO</sub>	5	55		
	Emitter-collector voltage	V <sub>ECO</sub>	7	7	V	
۲	Collector current	Ι <sub>C</sub>	5	50		
Detector	Collector power dissipation (1 circuit)	PC	150	100	mW	
	Collector power dissipation derating (1 circuit Ta $\ge 25^{\circ}$ C)	ΔP <sub>C</sub> / °C	-1.5	-1.0	mW /°C	
	Junction temperature	Тj	12	125		
Sto	rage temperature range	T <sub>stg</sub>	-55~150		°C	
Ope	erating temperature range	T <sub>opr</sub>	-55~100		°C	
Lead soldering temperature		T <sub>sol</sub>	260 (10 s)		°C	
Total package power dissipation		R <sub>T</sub>	250	150	mW	
Total package power dissipation derating (Ta ≥ 25°C)		ΔP <sub>T</sub> / °C	-2.5	-1.5	mW / °C	
Isol	ation voltage	BVS	2500 (AC, 1min., R.H.≤ 60%) (Note 1)		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**

Characteristics	Symbol	Min.	Тур.	Max.	Unit
Supply voltage	V <sub>CC</sub>	_	5	24	V
Forward current	١ <sub>F</sub>	_	16	20	mA
Collector current	ΙC	_	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.	Тур.	Max.	Unit
	Forward voltage	VF	I <sub>F</sub> = 10 mA	1.0	1.15	1.3	V
LED	Reverse current	I <sub>R</sub>	V <sub>R</sub> = 5 V	_	_	10	μA
	Capacitance	CT	V = 0, f = 1 MHz	-	30		pF
	Collector–emitter breakdown voltage	V <sub>(BR)</sub> CEO	I <sub>C</sub> = 0.5 mA	55	_		V
Detector	Emitter–collector breakdown voltage	V <sub>(BR) ECO</sub>	I <sub>E</sub> = 0.1 mA	7	_	_	V
	Collector dark current	$I_{CEO} \qquad \frac{V_{CE} = 24 \text{ V}}{V_{CE} = 24 \text{ V}},$	V <sub>CE</sub> = 24 V	_	10	100	nA
			V <sub>CE</sub> = 24 V, Ta = 85°C	_	2	50	μA
	Capacitance collector to emitter	C <sub>CE</sub>	V = 0, f = 1 MHz	_	10	_	pF

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

Characteristic	Symbol	Test Condition	Min.	Тур.	Max.	Unit
Current transfer ratio	I <sub>C</sub> / I <sub>F</sub>	I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V Rank GB	50	_	600	%
			100	—	600	
Saturated CTR	I <sub>C</sub> / I <sub>F (sat)</sub>	IF = 1 mA, V <sub>CE</sub> = 0.4 V Rank GB	—	60	—	%
			30	—	—	
Collector–emitter saturation voltage	V <sub>CE (sat)</sub>	I <sub>C</sub> = 2.4 mA, I <sub>F</sub> = 8 mA	_	_	0.4	
		I <sub>C</sub> = 0.2 mA, I <sub>F</sub> = 1 mA Rank GB	_	0.2	_	V
			_	_	0.4	

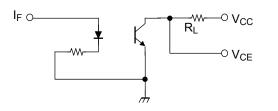
### Isolation Characteristics (Ta = 25°C)

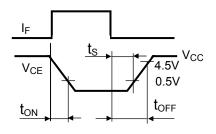
Characteristic	Symbol	Test Condition	Min.	Тур.	Max.	Unit
Capacitance input to output	CS	V <sub>S</sub> = 0, f = 1 MHz	—	0.8	_	pF
Isolation resistance	R <sub>S</sub>	V <sub>S</sub> = 500 V	5×10 <sup>10</sup>	10 <sup>14</sup>	_	Ω
		AC, 1 minute	2500	_	_	Vrms
Isolation voltage	BVS	AC, 1 second, in oil	_	5000		VIIIS
		DC, 1 minute, in oil	—	5000	_	Vdc

Switching Characteristics (Ta = 25°C)

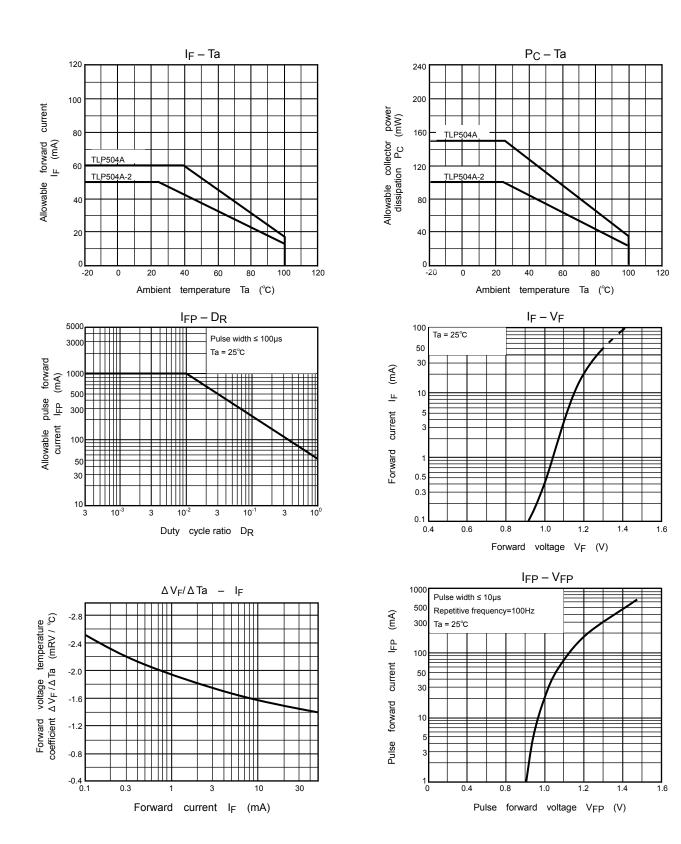
Characteristic	Symbol	Test Condition	Min.	Тур.	Max.	Unit
Rise time	tr		—	2	—	
Fall time	t <sub>f</sub>	V <sub>CC</sub> = 10 V, I <sub>C</sub> = 2 mA	_	3	_	μs
Turn-on time	t <sub>on</sub>	R <sub>L</sub> = 100Ω	_	3	_	
Turn-off time	t <sub>off</sub>		_	3	_	
Turn-on time	t <sub>ON</sub>		_	2	_	
Storage time	ts	$R_L$ = 1.9 kΩ (Fig.1) V <sub>CC</sub> = 5 V, I <sub>F</sub> = 16 mA	_	15	_	μs
Turn-off time	tOFF		_	25	_	

Fig. 1 Switching time test circuit

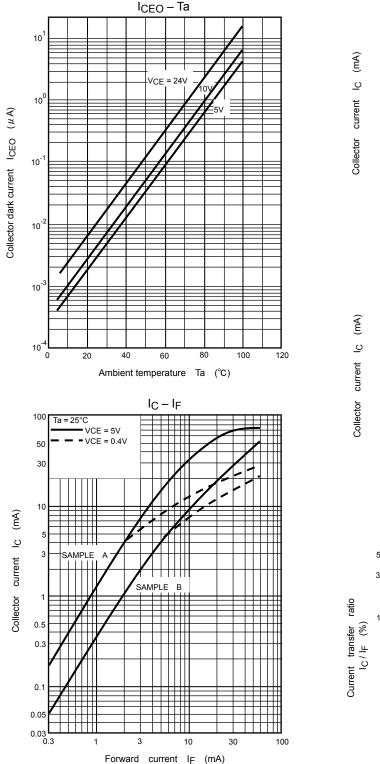


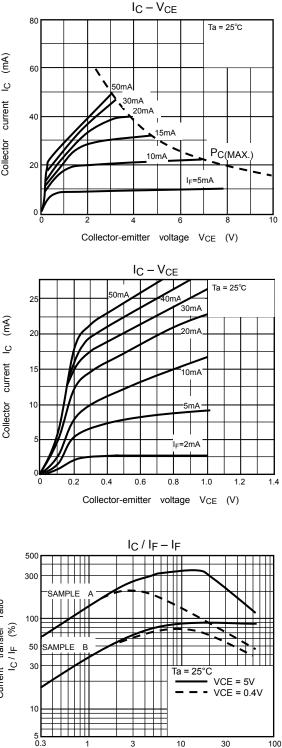


# TOSHIBA



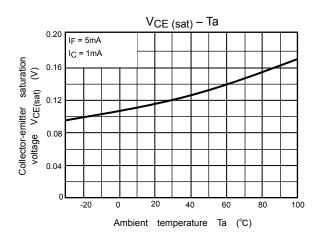
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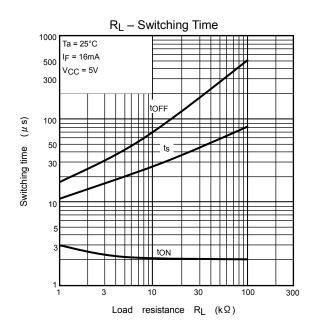


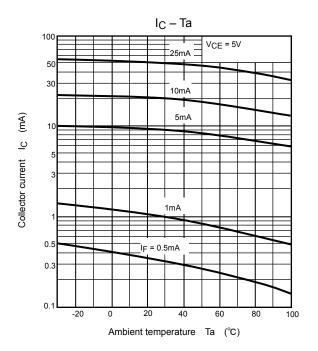


Forward current IF (mA)

# **TOSHIBA**







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  In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc.
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