

TOSHIBA Photocoupler GaAs IRed & Photo-Transistor

# TLP531, TLP532

Programmable Controllers

AC / DC-Input Module

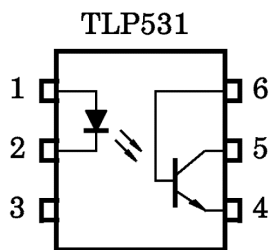
Solid State Relay

The TOSHIBA TLP531 and TLP532 consist of a photo-transistor optically coupled to a gallium arsenide infrared emitting diode in a six lead plastic DIP.

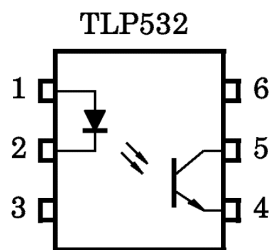
TLP532 is no-base internal connection for high-EMI environments.

- Collector-emitter voltage: 55 V (min.)
- Current transfer ratio: 50% (min.)  
Rank GB: 100% (min.)
- Isolation voltage: 2500 V<sub>rms</sub> (min.)
- UL recognized: UL1577, file no. E67349

## Pin Configurations (top view)

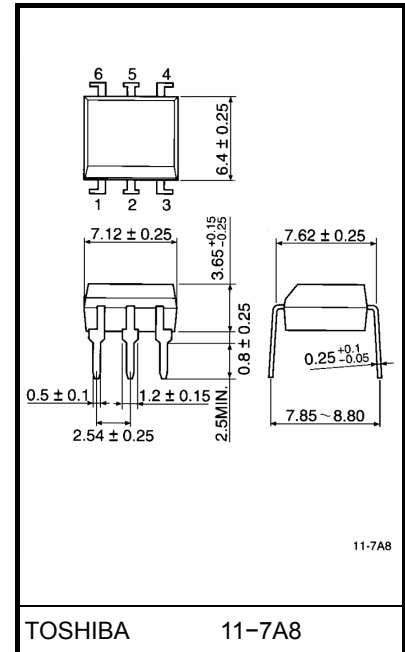


- TLP531**
- 1 : ANODE
  - 2 : CATHODE
  - 3 : N.C.
  - 4 : EMITTER
  - 5 : COLLECTOR
  - 6 : BASE



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Unit in mm



Weight: 0.4g

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

Characteristic		Symbol	Rating	Unit
LED	Forward current	$I_F$	70	mA
	Forward current derating (Ta ≥ 50°C)	$\Delta I_F / ^\circ\text{C}$	0.93	mA / °C
	Peak forward current (100 μs pulse, 100pps)	$I_{FP}$	1	A
	Reverse voltage	$V_R$	5	V
	Junction temperature	$T_j$	125	°C
Detector	Collector-emitter voltage	$V_{CEO}$	55	V
	Collector-base voltage (TLP531)	$V_{CBO}$	80	V
	Emitter-collector voltage	$V_{ECO}$	7	V
	Emitter-base voltage (TLP531)	$V_{EBO}$	7	V
	Collector current	$I_C$	50	mA
	Power dissipation	$P_C$	150	mW
	Power dissipation derating (Ta ≥ 25°C)	$\Delta P_C / ^\circ\text{C}$	-1.5	mW / °C
	Junction temperature	$T_j$	125	°C
Storage temperature range		$T_{stg}$	-55~125	°C
Operating temperature range		$T_{opr}$	-55~100	°C
Lead soldering temperature (10s)		$T_{sol}$	260	°C
Total package power dissipation		$P_T$	250	mW
Total package power dissipation derating (Ta ≥ 25°C)		$\Delta P_T / ^\circ\text{C}$	-2.5	mW / °C
Isolation voltage (AC, 1min., R.H. ≤ 60%)		$BV_S$	2500	$V_{rms}$

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).

## Recommends Operating Conditions

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	$V_{CC}$	—	5	24	V
Forward current	$I_F$	—	16	25	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.

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

Characteristic		Symbol	Test Condition	Min.	Typ.	Max.	Unit
LED	Forward voltage	$V_F$	$I_F = 10\text{mA}$	1.0	1.15	1.3	V
	Reverse current	$I_R$	$V_R = 5\text{V}$	—	—	10	$\mu\text{A}$
	Capacitance	$C_T$	$V = 0, f = 1\text{MHz}$	—	30	—	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-base breakdown voltage (TLP531)	$V_{(BR)CBO}$	$I_C = 0.1\text{mA}$	80	—	—	V
	Emitter-base breakdown voltage (TLP531)	$V_{(BR)EBO}$	$I_E = 0.1\text{mA}$	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	$I_C / I_F$	$I_F = 5\text{mA}, V_{CE} = 5\text{V}$	50	200	600	%
		Rank Y	50	—	150	
		Rank YG	50	—	300	
		Rank GR	100	—	300	
		Rank GB	100	—	600	
		Rank BL	200	—	600	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = 2.4\text{mA}, I_F = 8\text{mA}$	—	—	0.4	V

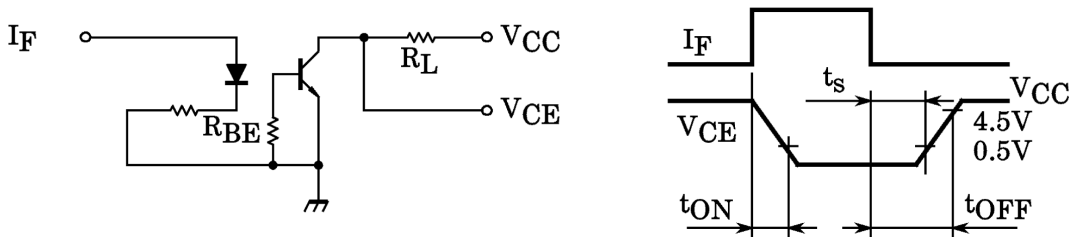
**Isolation Characteristics (Ta = 25°C)**

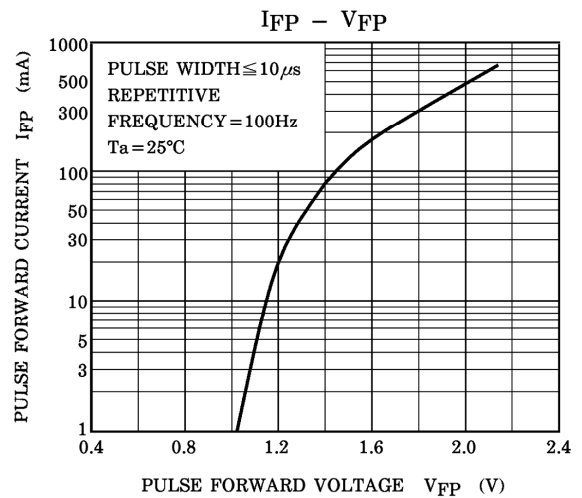
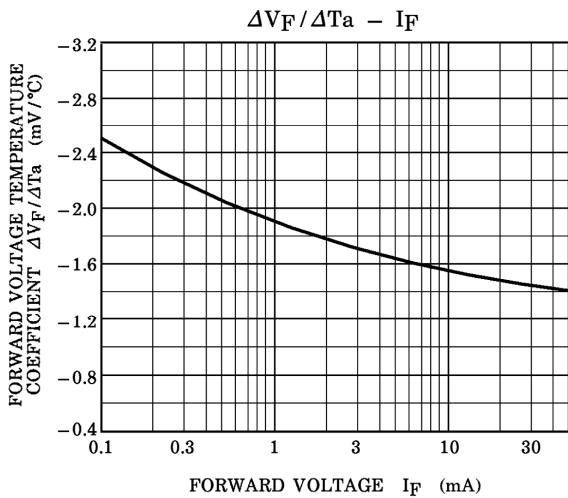
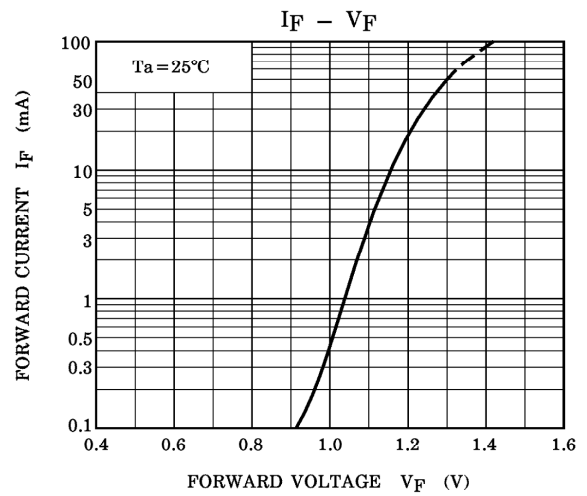
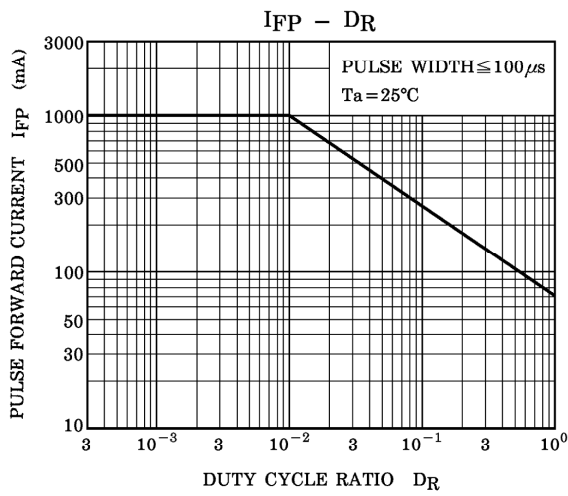
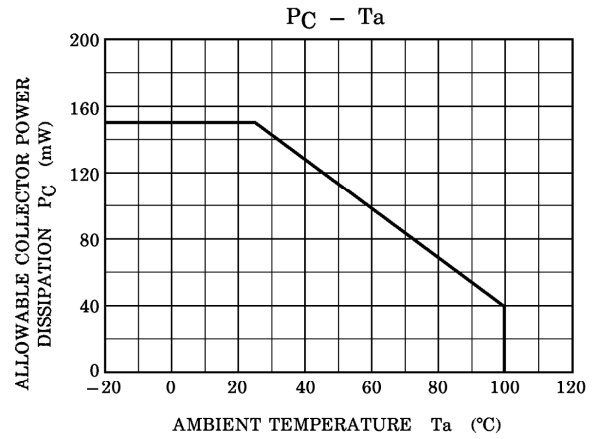
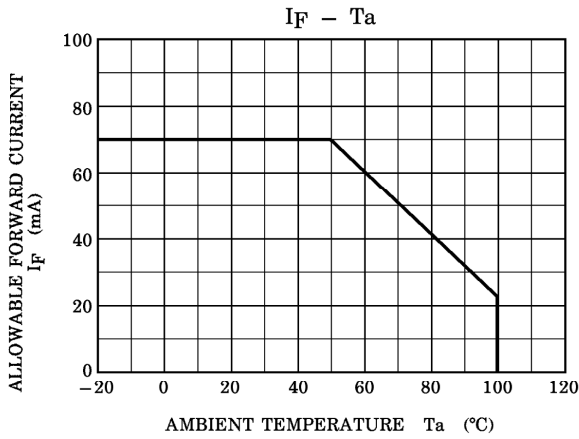
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Capacitance (input to output)	C <sub>S</sub>	V <sub>S</sub> = 0, f = 1MHz	—	0.8	—	pF
Isolation resistance	R <sub>S</sub>	V <sub>S</sub> = 500V, R.H. ≤ 60%	5 × 10 <sup>10</sup>	10 <sup>14</sup>	—	Ω
Isolation voltage	BV <sub>S</sub>	AC, 1 minute	2500	—	—	V <sub>rms</sub>

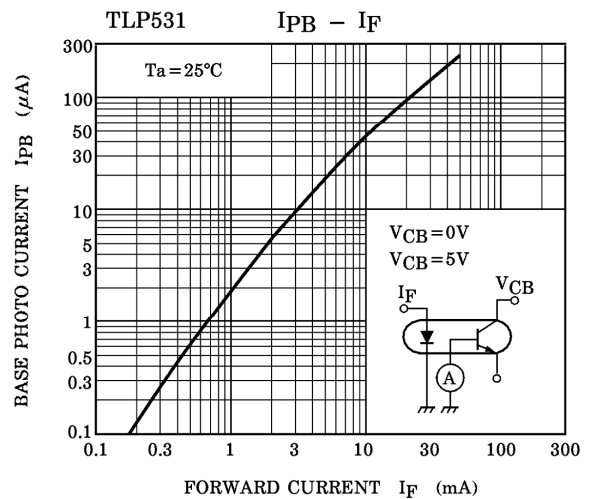
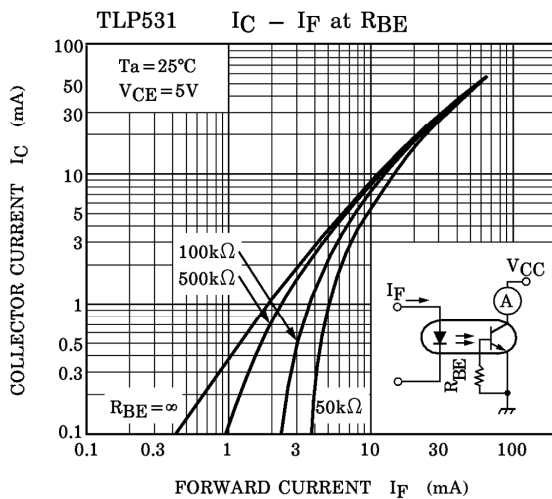
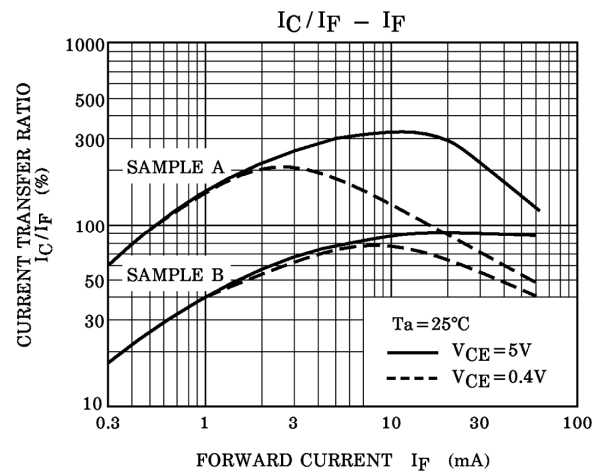
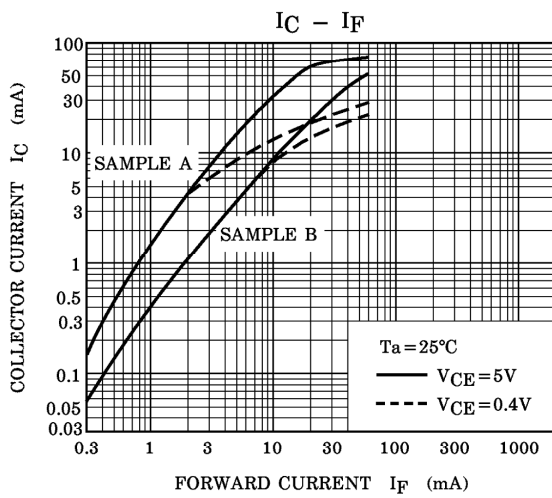
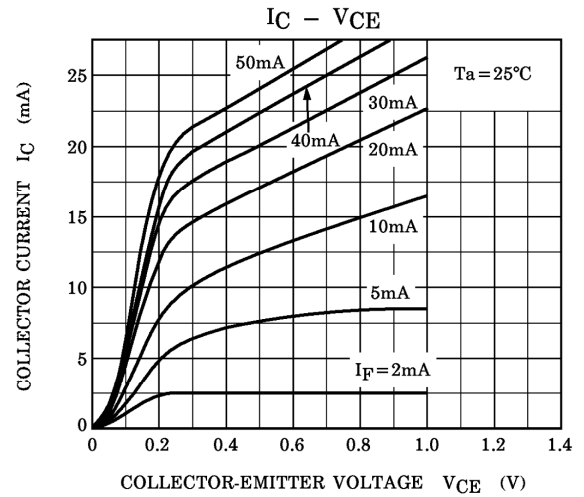
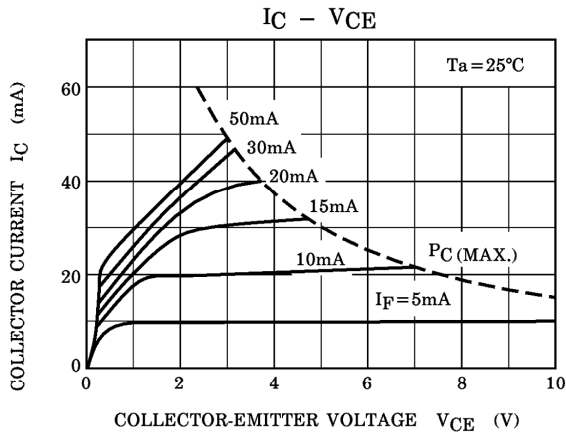
**Switching Characteristics (Ta = 25°C)**

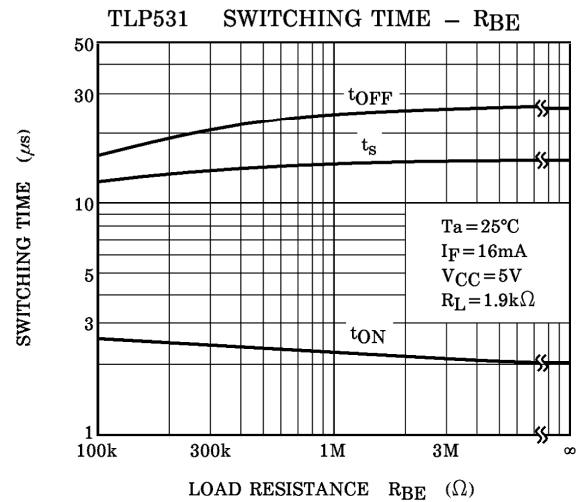
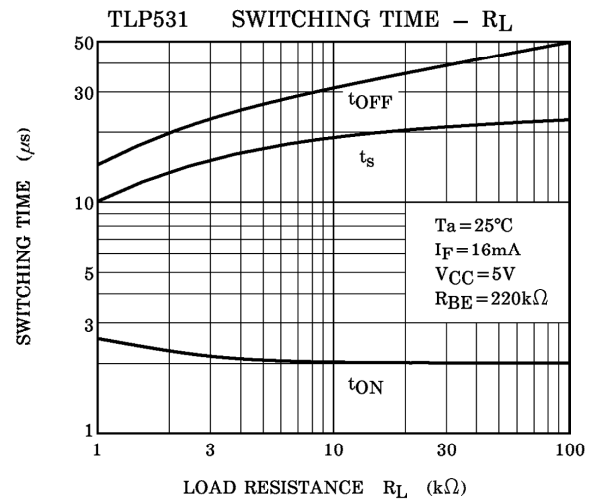
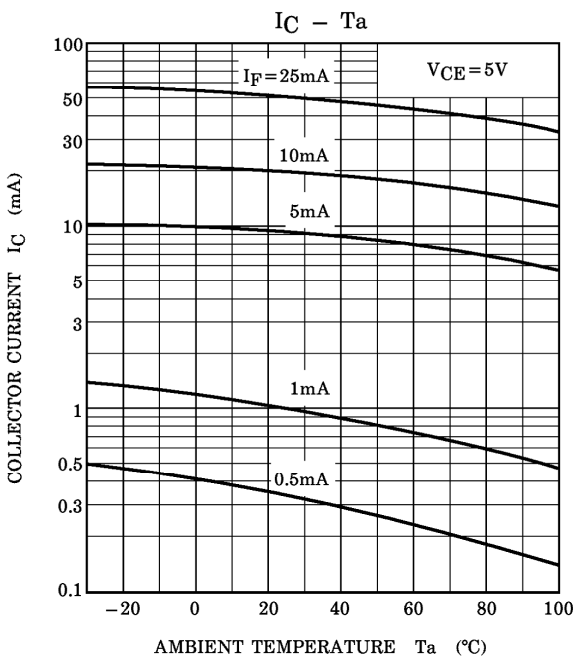
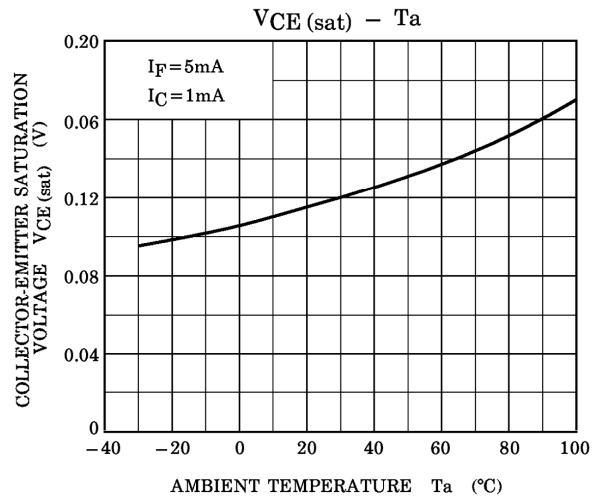
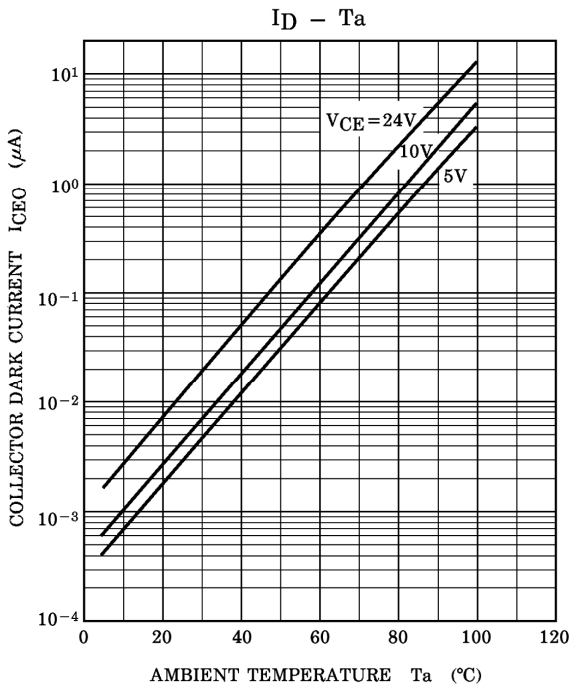
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Rise time	t <sub>r</sub>	V <sub>CC</sub> = 10V I <sub>C</sub> = 2mA R <sub>L</sub> = 100Ω	—	2	—	μs	
Fall time	t <sub>f</sub>		—	3	—		
Turn-on time	t <sub>ON</sub>		—	3	—		
Turn-off time	t <sub>OFF</sub>		—	3	—		
Turn-on time	t <sub>ON</sub>	R <sub>L</sub> = 1.9kΩ R <sub>BE</sub> = open V <sub>CC</sub> = 5V, I <sub>F</sub> = 16mA	(Fig.1)	—	2	—	μs
Storage time	t <sub>s</sub>		—	15	—		
Turn-off time	t <sub>OFF</sub>		—	25	—		
Turn-on time	t <sub>ON</sub>	R <sub>L</sub> = 1.9Ω R <sub>BE</sub> = 220kΩ (TLP531) V <sub>CC</sub> = 5V, I <sub>F</sub> = 16mA	(Fig.1)	—	2	—	μs
Storage time	t <sub>s</sub>		—	12	—		
Turn-off time	t <sub>OFF</sub>		—	20	—		

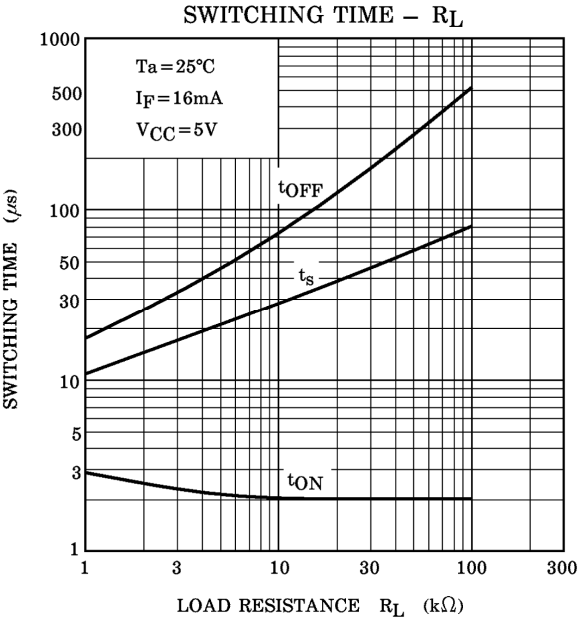
Fig. 1 Switching time test circuit













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