

TOSHIBA Photocoupler GaAs Ired & Photo-Transistor

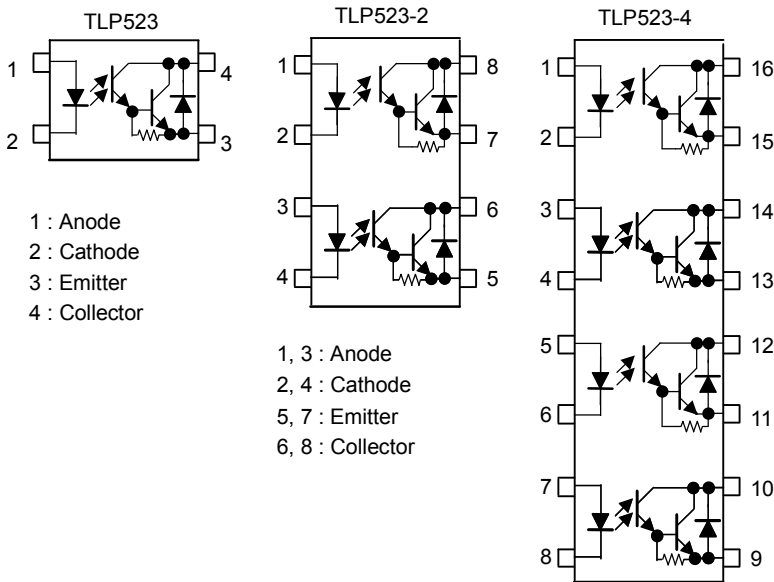
# TLP523, TLP523-2, TLP523-4

Programmable Controllers  
DC-Output Module  
Solid State Relay

The TOSHIBA TLP523, -2 and -4 consists of a gallium arsenide infrared emitting diode coupled with a silicon, darlington connected, phototransistor which has an integral base-emitter resistor to optimize switching speed and elevated temperature characteristics. The TLP523-2 offers two isolated channels in an eight lead plastic DIP package, while the TLP523-4 provide four isolated channels per package.

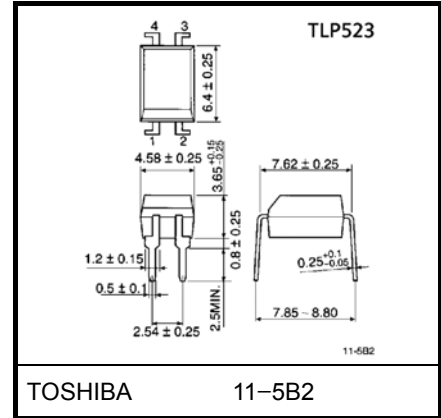
- Current transfer ratio: 500% (min.) ( $I_F = 1 \text{ mA}$ )
- Isolation voltage: 2500 Vrms (min.)
- Collector-emitter voltage: 55 V (min.)
- Leakage current: 10 $\mu$ A (max.) ( $T_a = 85^\circ\text{C}$ )
- UL recognized: UL1577, file no. E67349

## Pin Configurations (top view)

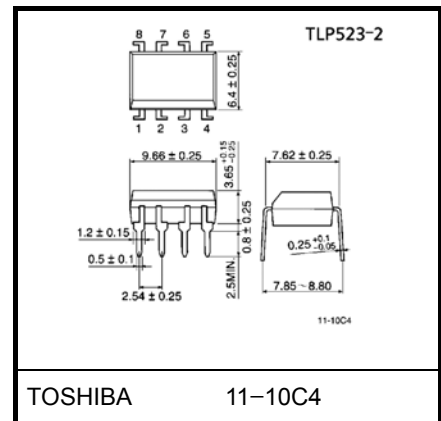


1, 3, 5, 7 : Anode  
2, 4, 6, 8 : Cathode  
9, 11, 13, 15 : Emitter  
10, 12, 14, 16: Collector

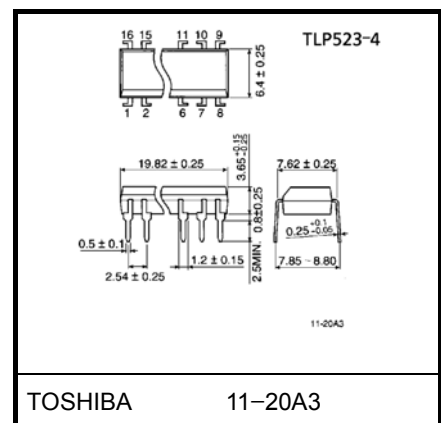
Unit in mm



Weight: 0.26 g (typ.)



Weight: 0.54 g (typ.)



Weight: 1.1 g (typ.)

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

Characteristic	Symbol	Rating		Unit	
		TLP523	TLP523-2 TLP523-4		
LED	Forward current	I <sub>F</sub>	60	50	mA
	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)		A
	Reverse voltage	V <sub>R</sub>	5		V
Detector	Collector-emitter voltage	V <sub>CEO</sub>	55		V
	Emitter-collector voltage	V <sub>ECO</sub>	0.3		V
	Collector current	I <sub>C</sub>	150		mA
	Collector power dissipation (1 circuit)	P <sub>C</sub>	150	100	mW
	Collector power dissipation derating (1 circuit (Ta ≥ 25°C))	ΔP <sub>C</sub> /°C	-1.5	-1.0	mW /°C
	Operating temperature range	T <sub>opr</sub>	-55~100		°C
Storage temperature range	T <sub>stg</sub>	-55~125		°C	
Lead soldering temperature (10 s)	T <sub>sol</sub>	260		°C	
Total power dissipation	P <sub>T</sub>	250	150	mW	
Total power dissipation derating (Ta ≥ 25°C)	ΔP <sub>T</sub> /°C	-2.5	-1.5	mW /°C	
Isolation voltage (Note 1)	BV <sub>S</sub>	2500 (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 considered 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 <sub>CC</sub>	—	5	24	V
Forward current	I <sub>F</sub>	—	16	20	mA
Operating temperature range	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.

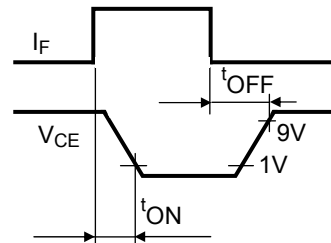
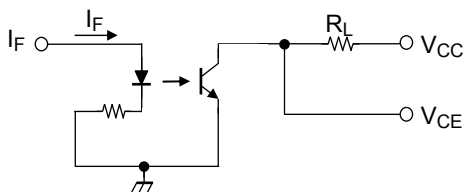
## Electrical Characteristics (Ta = 25°C)

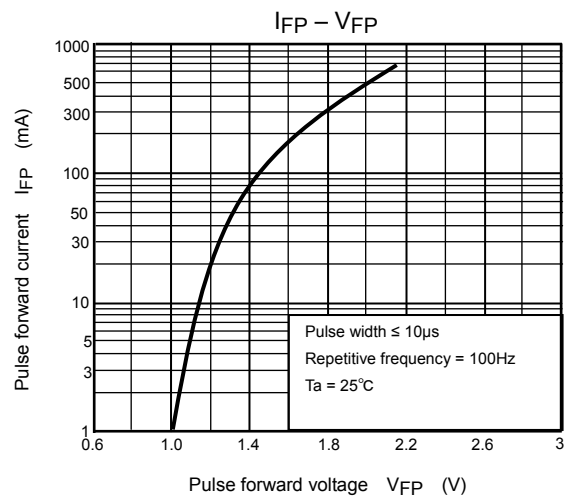
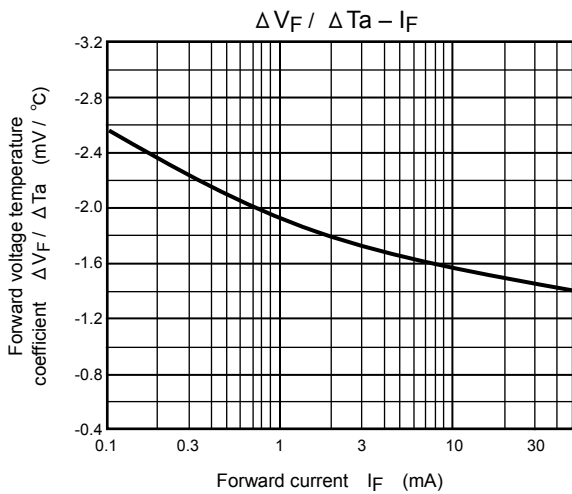
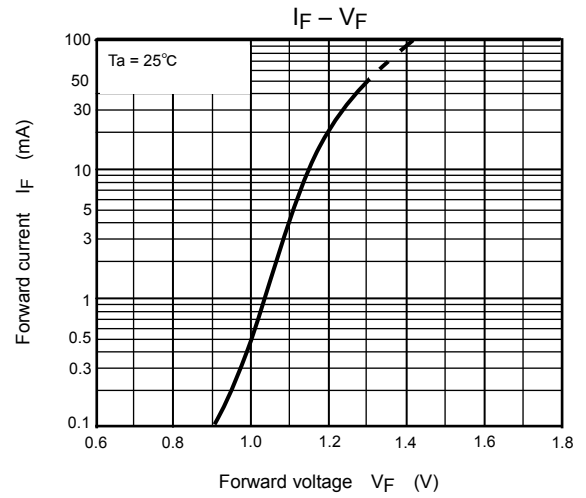
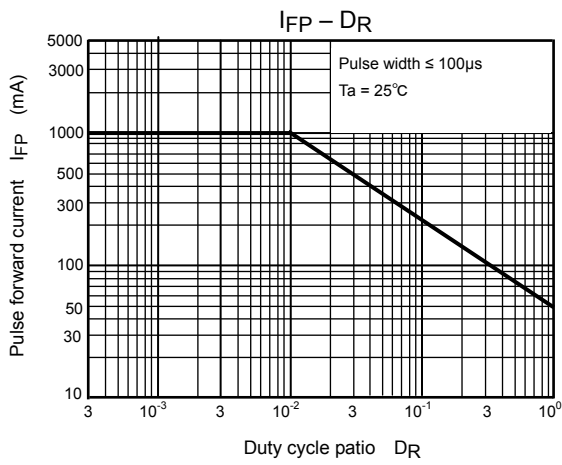
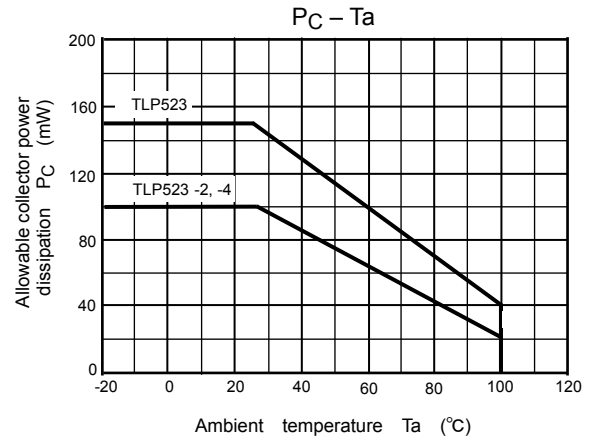
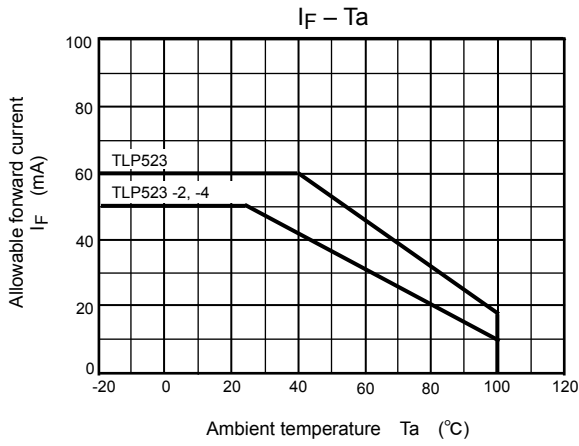
Characteristic		Symbol	Test Condition	Min.	Typ.	Max.	Unit
LED	Forward voltage	$V_F$	$I_F = 10 \text{ mA}$	1.0	1.15	1.3	V
	Reverse current	$I_R$	$V_R = 5 \text{ V}$	—	—	10	$\mu\text{A}$
	Capacitance	$C_T$	$V = 0, f = 1 \text{ MHz}$	—	30	—	pF
Detector	Collector-emitter breakdown voltage	$V_{(BR)CEO}$	$I_C = 1 \text{ mA}$	55	—	—	V
	Collector dark current	$I_{CEO}$	$V_{CE} = 24 \text{ V}$	—	10	200	nA
			$V_{CE} = 24 \text{ V}, T_a = 85^\circ\text{C}$	—	0.5	10	$\mu\text{A}$
Capacitance collector to emitter	$C_{CE}$	$V = 0, f = 1 \text{ MHz}$	—	10	—	pF	
Coupled	Current transfer ratio	$I_C / I_F$	$I_F = 1 \text{ mA}, V_{CE} = 1 \text{ V}$	500	2000	—	%
	Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = 50 \text{ mA}, I_F = 10 \text{ mA}$	—	—	1	V
	Capacitance input to output	$C_S$	$V_S = 0, f = 1 \text{ MHz}$	—	0.8	—	pF
	Isolation resistance	$R_S$	$V_S = 500 \text{ V}, R.H. \leq 60\%$	$5 \times 10^{10}$	$10^{14}$	—	$\Omega$

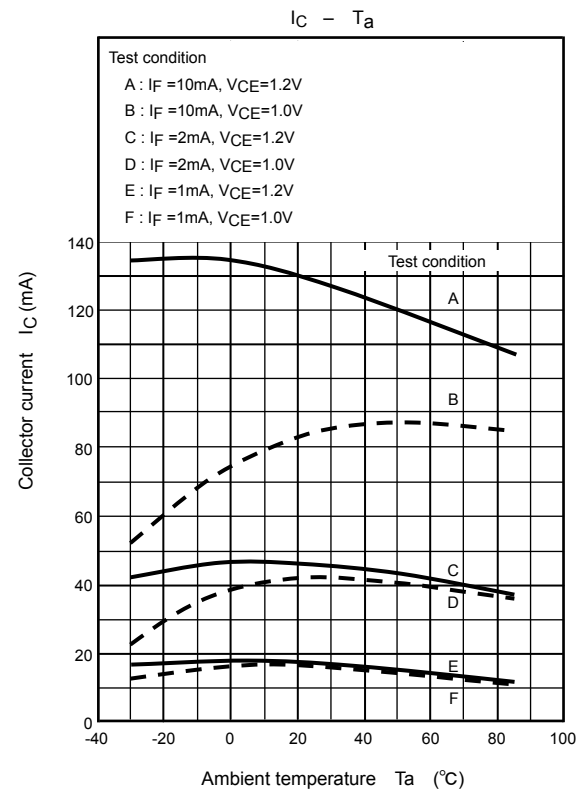
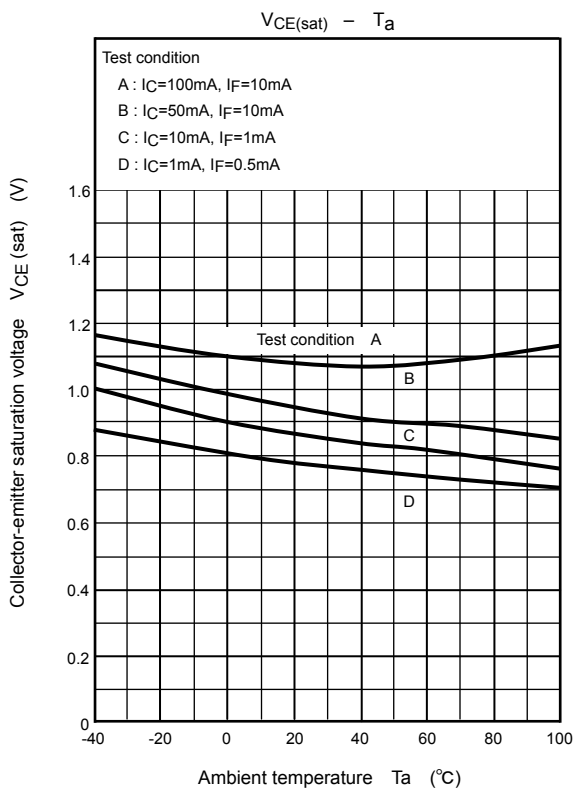
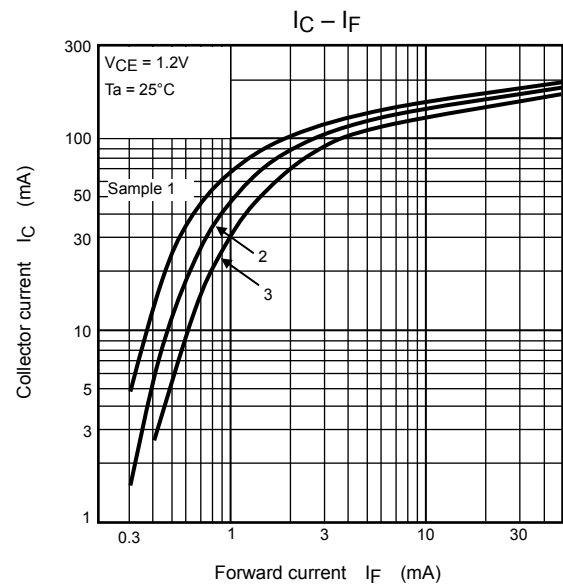
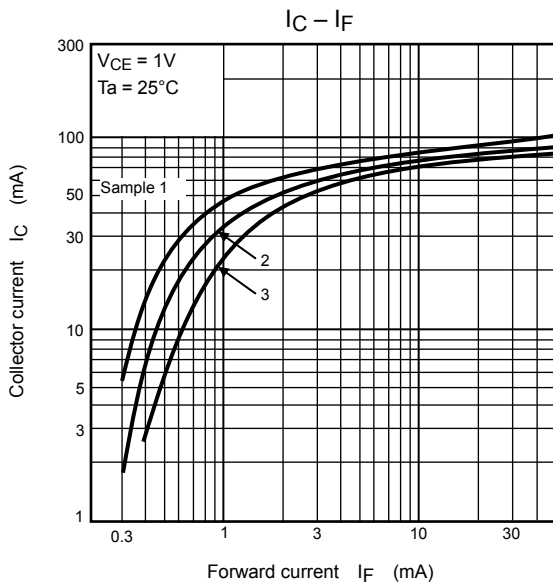
## Switching Characteristics (Ta = 25°C)

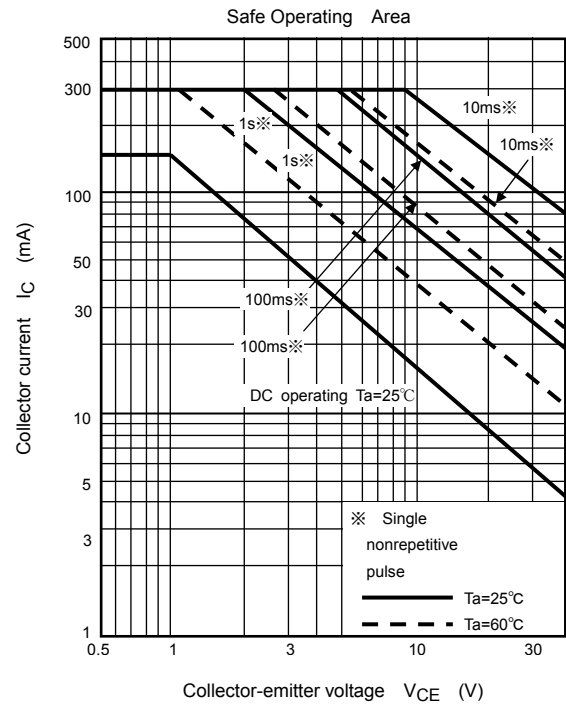
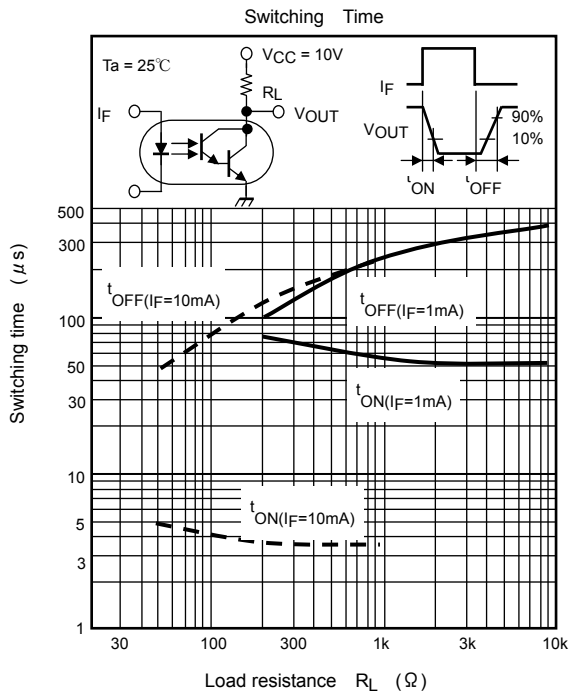
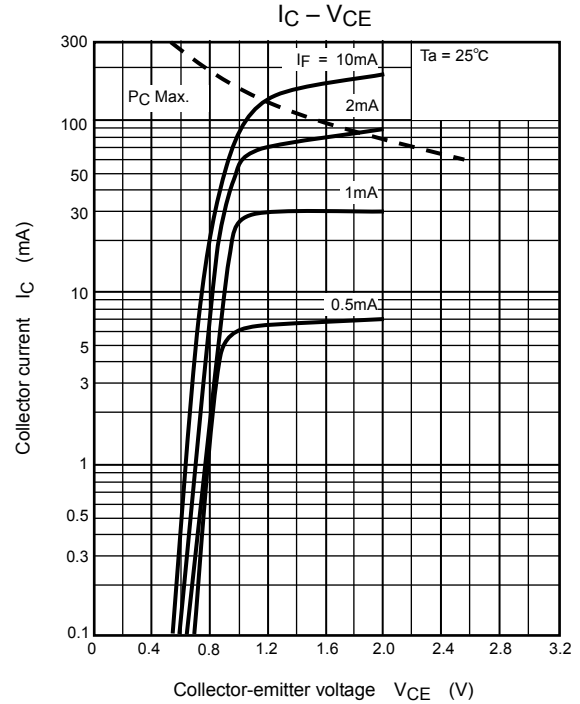
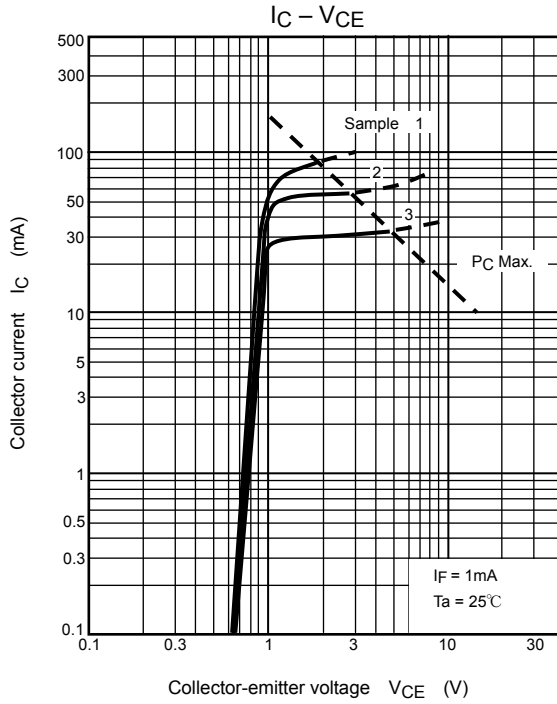
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Turn-on time	$t_{ON}$	$V_{CC} = 10 \text{ V}, R_L = 180 \Omega$	—	3	—	$\mu\text{s}$
Turn-off time	$t_{OFF}$	$I_F = 16 \text{ mA}$	—	80	—	$\mu\text{s}$

## Switching Time Test Circuit









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