

# TLX9000

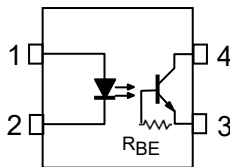
- Various Controllers
- Signal transmission between different circuit potential
- HEV (Hybrid Electric Vehicle) and EV (Electric Vehicle) Applications

The TOSHIBA TLX9000 mini-flat photocoupler is suitable for surface-mount assembly. The TLX9000 consists of an infrared LED optically coupled to a photo-transistor.

This photocoupler can be used to the extensive applications. It is generic speed transistor output.

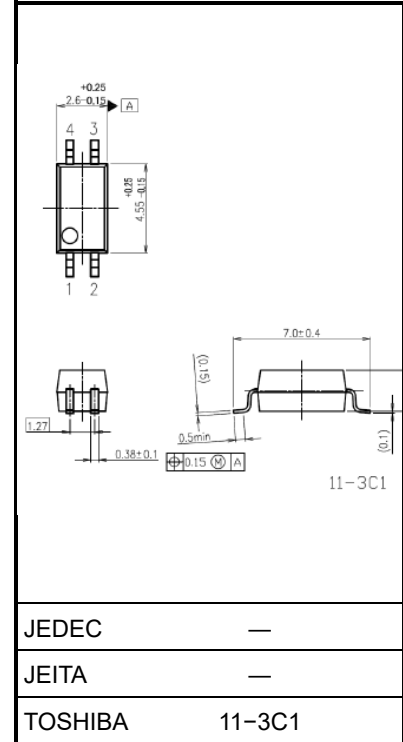
- Collector-emitter voltage: 40 V (min)
- Current transfer ratio: 100 % (min) to 900 % (max)
- Isolation voltage: 3750 Vrms (min)
- AEC-Q101 qualified

## Pin Configuration



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

Unit: mm



Weight: 0.05 g (typ.)

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

Characteristic		Symbol	Rating	Unit
LED	Forward current	I <sub>F</sub>	30	mA
	Forward current (Ta=125°C)	I <sub>F</sub>	18	mA
	Forward current derating (Ta ≥ 108 °C)	ΔI <sub>F</sub> / °C	-0.7	mA / °C
	Pulse forward current (Note 1)	I <sub>FP</sub>	1	A
	Input Power Dissipation	PD	50	mW
	Input Power Dissipation Derating (Ta≥50°C)	ΔPD/°C	-0.5	mW/°C
	Reverse voltage	V <sub>R</sub>	5	V
Detector	Collector-emitter voltage	V <sub>CEO</sub>	40	V
	Emitter-collector voltage	V <sub>ECO</sub>	5	V
	Collector current	I <sub>C</sub>	50	mA
	Collector power dissipation	P <sub>C</sub>	150	mW
	Collector power dissipation derating (Ta ≥ 50°C)	ΔP <sub>C</sub> / °C	-1.5	mW / °C
Operating temperature range		T <sub>opr</sub>	-40 to 125	°C
Storage temperature range		T <sub>stg</sub>	-55 to 150	°C
Lead soldering temperature (10 s)		T <sub>sol</sub>	260	°C
Total package power dissipation		P <sub>T</sub>	200	mW
Total package power dissipation derating (Ta ≥ 50°C)		ΔP <sub>T</sub> / °C	-2.0	mW / °C
Isolation voltage (R.H.≤60%, AC 60 s) (Note 2)		BV <sub>S</sub>	3750	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: Pulse width PW ≤ 100μs, 100 Hz

Note 2: This device is considered as a two terminal device: Pins 1 and 2 are shorted together, and pins 3 and 4 are 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>	—	10	15	mA
Collector current	I <sub>C</sub>	—	1	10	mA
Operating temperature	T <sub>opr</sub>	-40	—	125	°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 (Unless otherwise specified Ta = -40 to 125°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	V <sub>F</sub>	I <sub>F</sub> = 10 mA, Ta=25 °C	1.1	1.25	1.4	V
			I <sub>F</sub> = 10 mA	1.0	—	1.55	V
	Reverse current	I <sub>R</sub>	V <sub>R</sub> = 5 V	—	—	10	μA
	Capacitance	C <sub>T</sub>	V = 0 V, f = 1 MHz, Ta=25 °C	—	35	—	pF
Detector	Collector-emitter breakdown voltage	V <sub>(BR) CEO</sub>	I <sub>C</sub> = 0.5 mA	40	—	—	V
	Emitter-collector breakdown voltage	V <sub>(BR) ECO</sub>	I <sub>E</sub> = 0.5 mA	5	—	—	V
	Collector dark current	I <sub>CEO</sub>	V <sub>CE</sub> = 24 V, Ta=25 °C	—	—	100	nA
			V <sub>CE</sub> = 24 V, Ta=105 °C	—	0.1	5	μA
			V <sub>CE</sub> = 24 V, Ta=125 °C	—	1	10	μA
Capacitance (collector to emitter)	C <sub>CE</sub>	V = 0 V, f = 1 MHz, Ta=25 °C	—	10	—	pF	

## Coupled Electrical Characteristics (Unless otherwise specified Ta = -40 to 125°C)

Characteristic	Symbol	Test Condition	Min	Typ.	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	20	—	900	%
		I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V, Ta=25 °C	100	—	900	
Saturated CTR	I <sub>C</sub> / I <sub>F</sub> (sat)	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 0.4 V, Ta=25 °C	30	—	—	%
Collector-emitter saturation voltage	V <sub>CE</sub> (sat)	I <sub>C</sub> = 2.4 mA, I <sub>F</sub> = 8 mA, Ta=25 °C	—	—	0.4	V
		I <sub>C</sub> = 0.2 mA, I <sub>F</sub> = 1 mA, Ta=25 °C	—	—	0.4	
Off-state collector current	I <sub>C</sub> (off)	V <sub>F</sub> = 0.7V, V <sub>CE</sub> = 24 V, Ta=25 °C	—	—	10	μA

## Isolation Characteristics (Ta = 25°C)

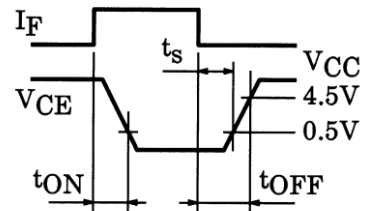
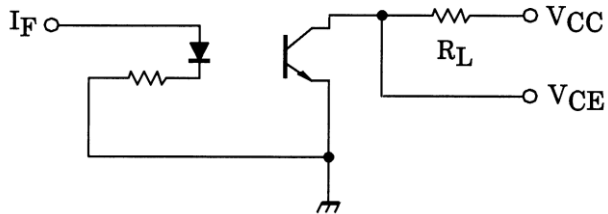
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Capacitance (input to output)	C <sub>S</sub>	V <sub>S</sub> = 0 V, f = 1 MHz	—	0.8	—	pF
Isolation resistance	R <sub>S</sub>	V <sub>S</sub> = 500 V, R.H. ≤ 60 %	5×10 <sup>10</sup>	10 <sup>14</sup>	—	Ω
Isolation voltage	B <sub>V</sub> S	AC, 60 s	3750	—	—	V <sub>rms</sub>

Note : Device considered a two terminal device: Pins 1 and 2 shorted together, and pins 3 and 4 shorted together.

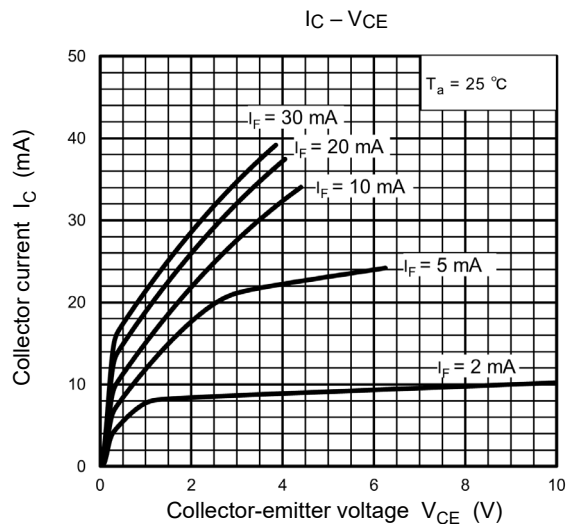
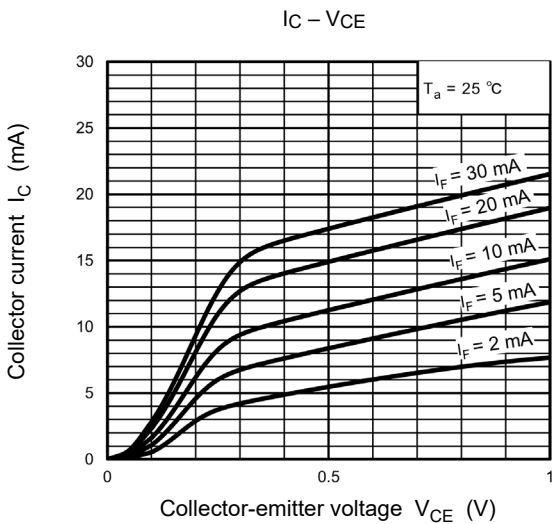
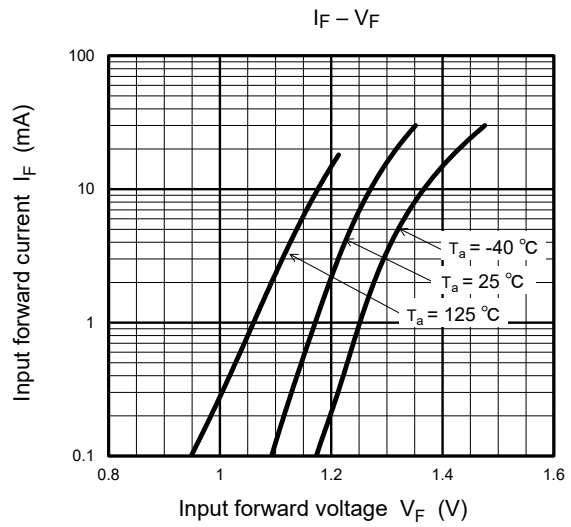
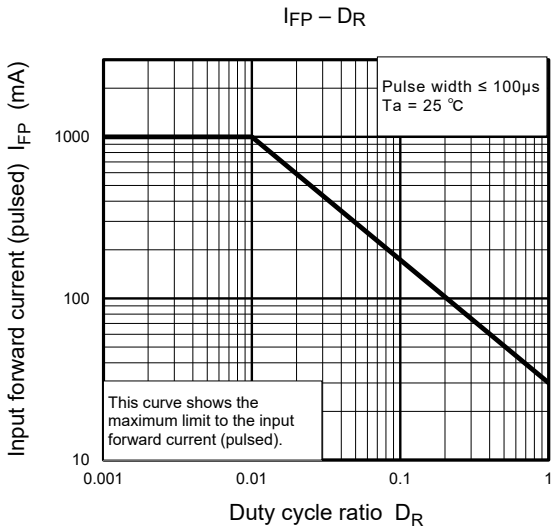
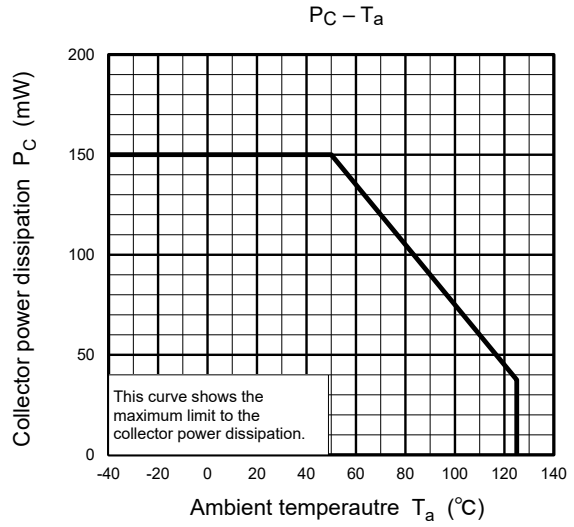
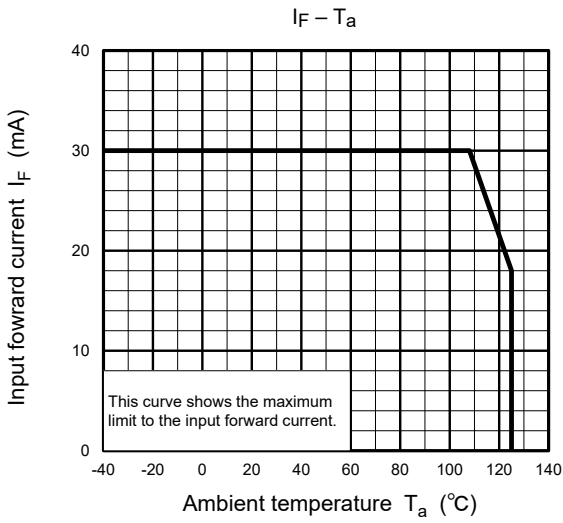
## Switching Characteristics (Unless otherwise specified Ta = -40 to 125°C)

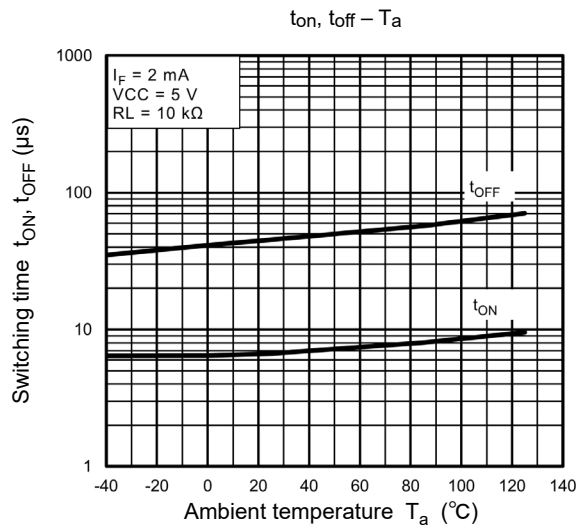
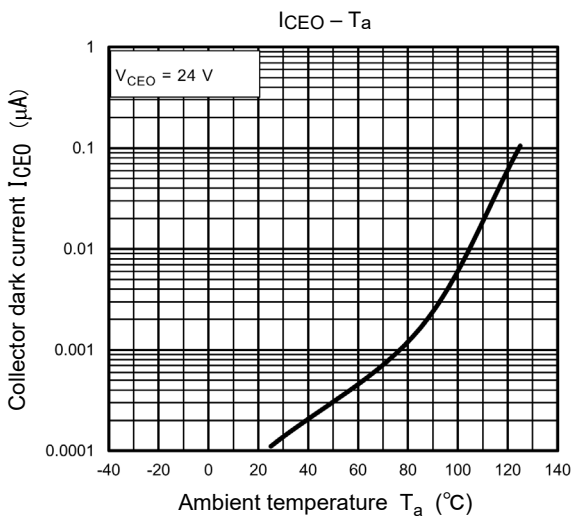
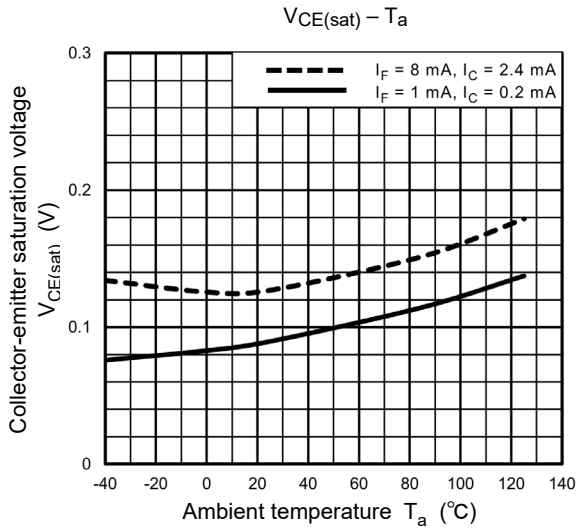
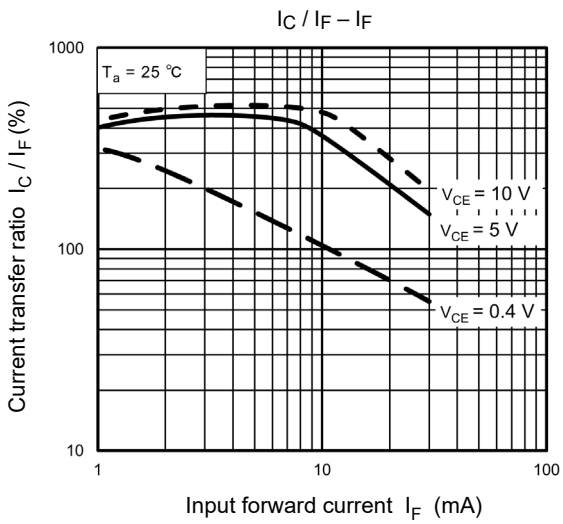
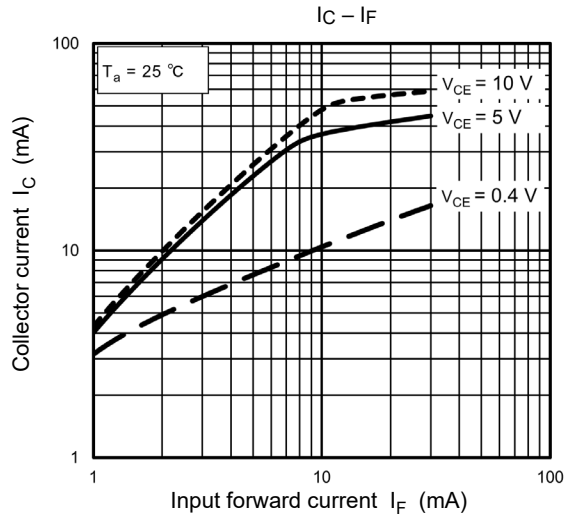
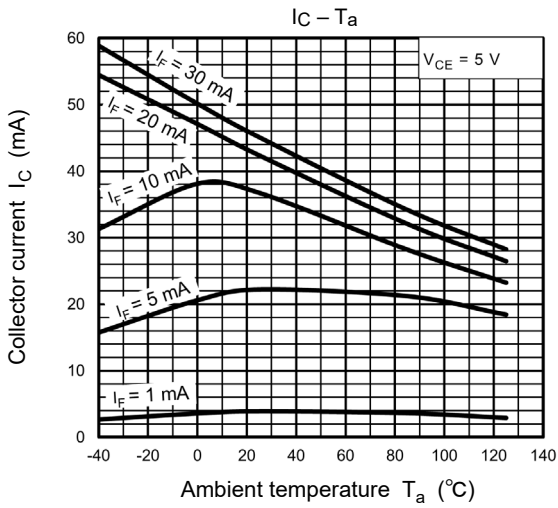
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Turn-on time	$t_{ON}$	$R_L = 10\text{ k}\Omega$ $V_{CC} = 5\text{ V}$ , $I_F = 2\text{ mA}$ (Note1)	1	15	100	$\mu\text{s}$
Storage time	$t_s$		—	20	200	
Turn-off time	$t_{OFF}$		1	50	300	

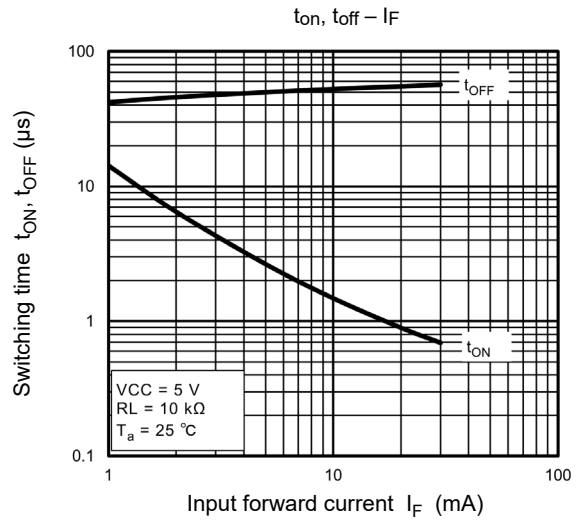
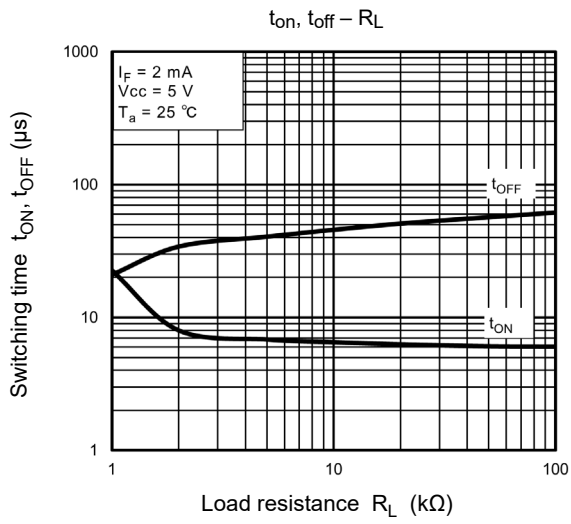
Note 1: Switching time test circuit



## Characteristic Curves (Note)







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

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