TOSHIBA Photocoupler IRLED & Photo−Transistor

TLX9000

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

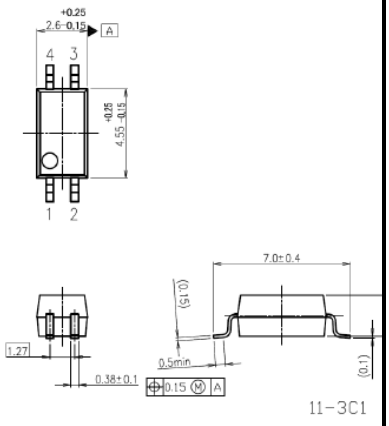
The TOSHIBA TLX9000 mini-flat photocoupler is suitable for surface-mount assembly. The TLX9000 consists of an infrared LED optically coupled to a photo-transistor.

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

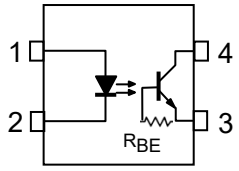
Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	11−3C1

Weight: 0.05 g (typ.)

Pin Configuration



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

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Absolute Maximum Ratings (Ta = 25°C)

Characteristic			Symbol	Rating	Unit
LED	Forward current		I_F	30	mA
	Forward current (Ta=125°C)		I_F	18	mA
	Forward current derating (Ta ≥ 108 °C)		ΔI_F / °C	-0.7	mA / °C
	Pulse forward current	(Note 1)	I_{FP}	1	A
	Input Power Dissipation		PD	50	mW
	Input Power Dissipation Derating (Ta≥50°C)		Δ PD/°C	-0.5	mW/°C
	Reverse voltage		V_R	5	V
Detector	Collector-emitter voltage		V_{CEO}	40	V
	Emitter-collector voltage		V_{ECO}	5	V
	Collector current		I_C	50	mA
	Collector power dissipation		P_C	150	mW
	Collector power dissipation derating (Ta ≥ 50°C)		ΔP_C / °C	-1.5	mW / °C
Operating temperature range			T_{opr}	-40 to 125	°C
Storage temperature range			T_{stg}	-55 to 150	°C
Lead soldering temperature (10 s)			T_{sol}	260	°C
Total package power dissipation			P_T	200	mW
Total package power dissipation derating (Ta ≥ 50°C)			ΔP_T / °C	-2.0	mW / °C
Isolation voltage (R.H.≤60%, AC 60 s)		(Note 2)	BV_S	3750	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: 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_{CC}	—	5	24	V
Forward current	I_F	—	10	15	mA
Collector current	I_C	—	1	10	mA
Operating temperature	T_{opr}	-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.

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

	Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	V_F	I_F = 10 mA, Ta=25 °C	1.1	1.25	1.4	V
			I_F = 10 mA	1.0	—	1.55	V
	Reverse current	I_R	V_R = 5 V	—	—	10	μA
	Capacitance	C_T	V = 0 V, f = 1 MHz, Ta=25 °C	—	35	—	pF
Detector	Collector-emitter breakdown voltage	$V_{(BR)\ CEO}$	I_C = 0.5 mA	40	—	—	V
	Emitter-collector breakdown voltage	$V_{(BR)\ ECO}$	I_E = 0.5 mA	5	—	—	V
	Collector dark current	I_{CEO}	V_{CE} = 24 V, Ta=25 °C	—	—	100	nA
			V_{CE} = 24 V, Ta=105 °C	—	0.1	5	μA
			V_{CE} = 24 V, Ta=125 °C	—	1	10	μA
	Capacitance (collector to emitter)	C_{CE}	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_C / I_F	I_F = 5 mA, V_{CE} = 5 V	20	—	900	%
		I_F = 5 mA, V_{CE} = 5 V, Ta=25 °C	100	—	900	
Saturated CTR	I_C / $I_{F\ (sat)}$	I_F = 1 mA, V_{CE} = 0.4 V, Ta=25 °C	30	—	—	%
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	I_C = 2.4 mA, I_F = 8 mA, Ta=25 °C	—	—	0.4	V
		I_C = 0.2 mA, I_F = 1 mA, Ta=25 °C	—	—	0.4	
Off-state collector current	$I_{C\ (off)}$	V_F = 0.7V, V_{CE} = 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_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	3750	—	—	Vrms

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

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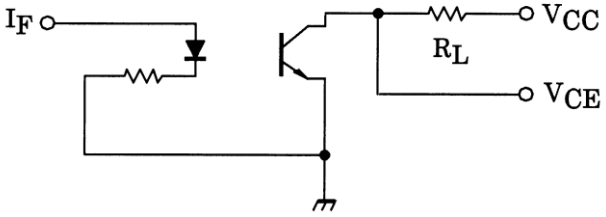
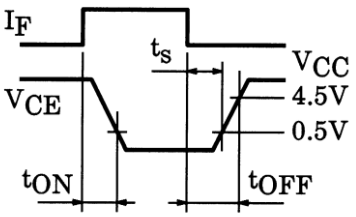
Switching Characteristics (Unless otherwise specified Ta = -40 to 125°C)

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

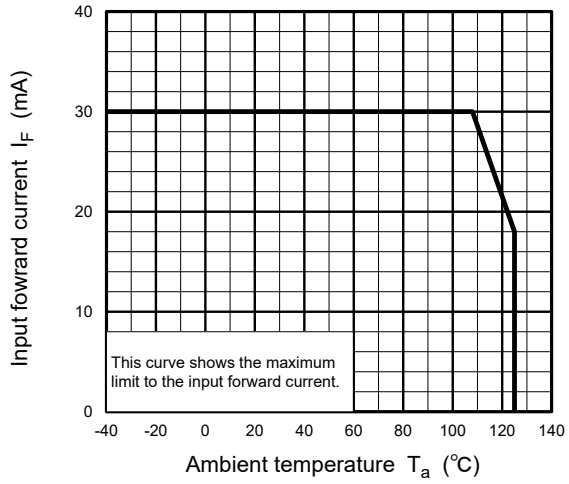
Note 1: Switching time test circuit



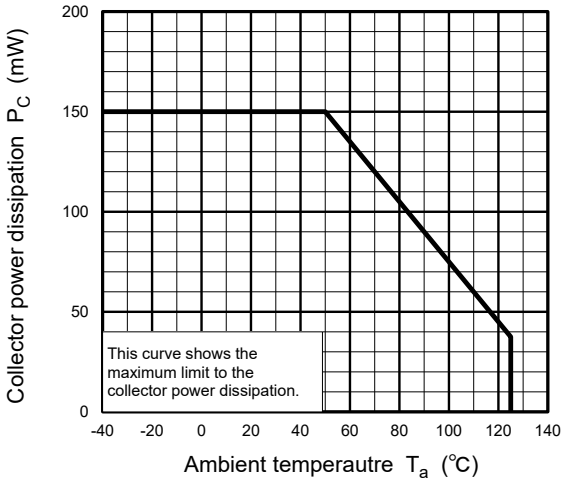


Characteristic Curves (Note)

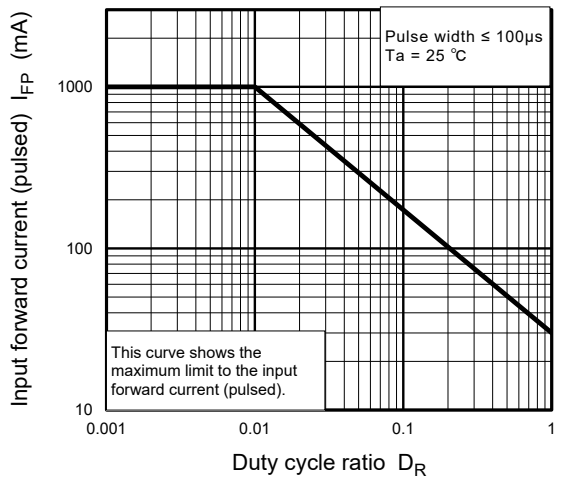
$I_F - T_a$



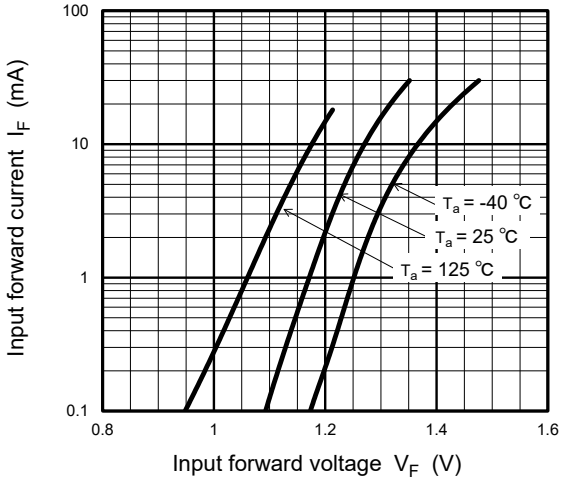
$P_C - T_a$



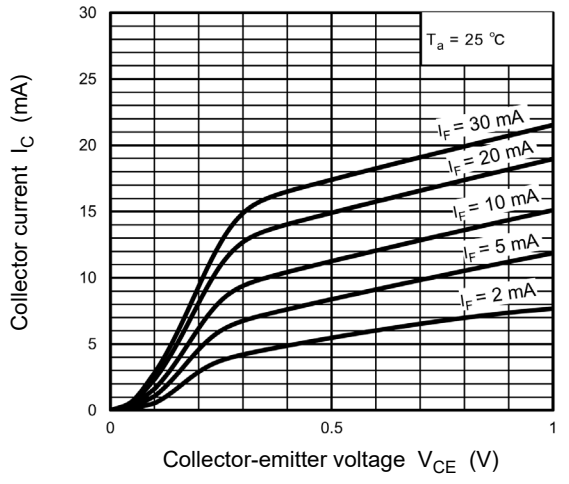
$I_{FP} - D_R$



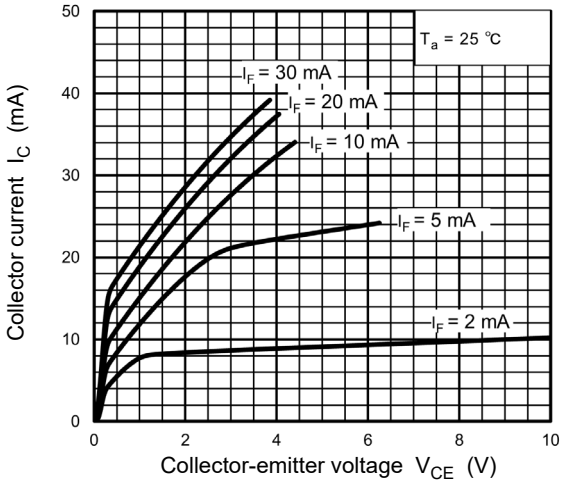
$I_F - V_F$



$I_C - V_{CE}$



$I_C - V_{CE}$



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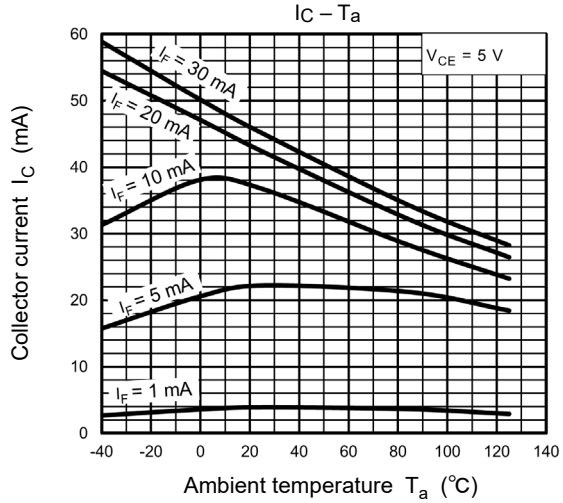
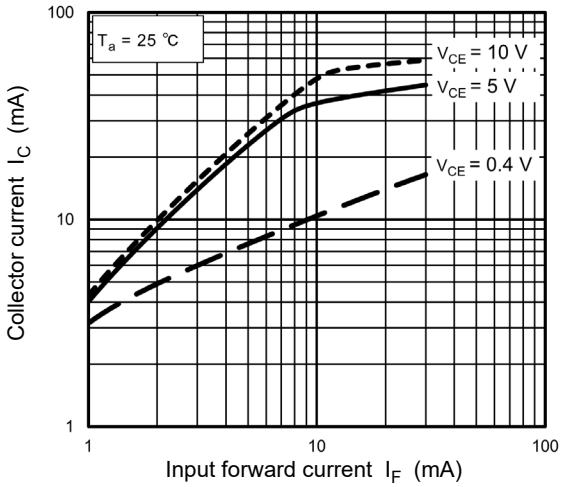
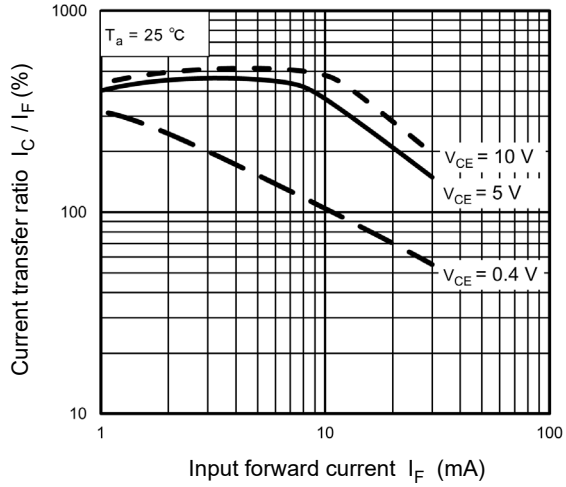
$I_C - T_a$



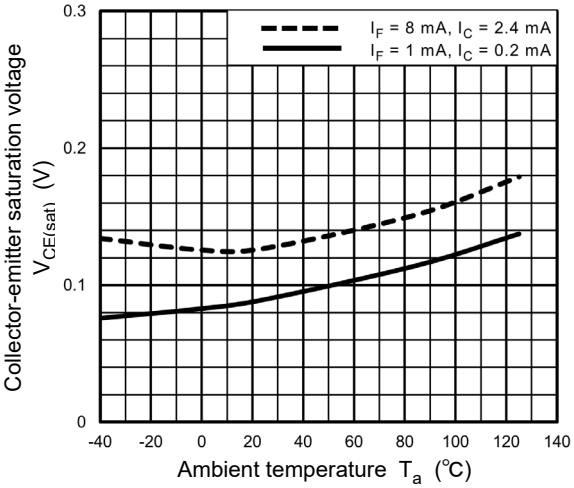
$I_C - I_F$



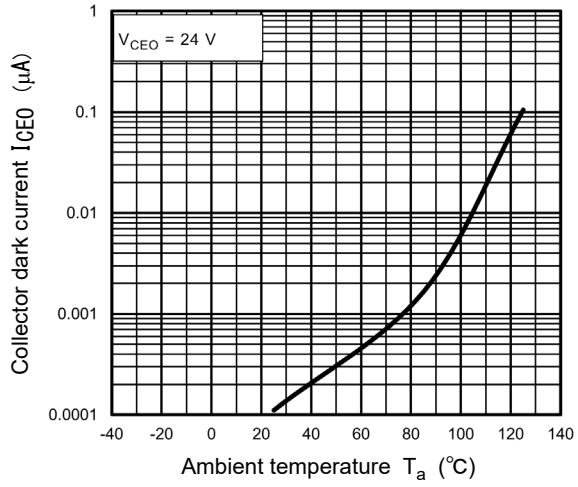
$I_C / I_F - I_F$



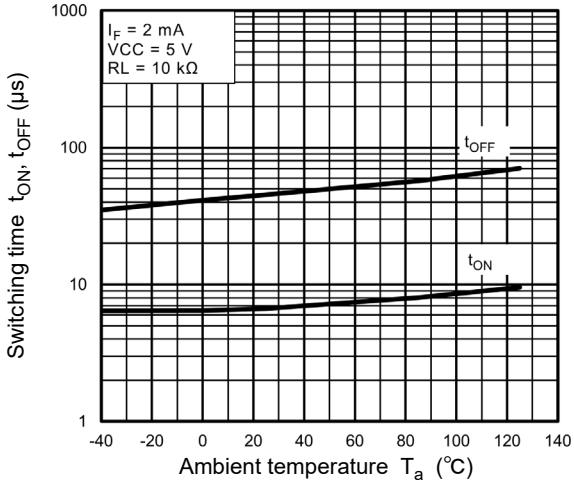
$V_{CE(sat)} - T_a$



$I_{CEO} - T_a$



t_{on}, $t_{off} - T_a$



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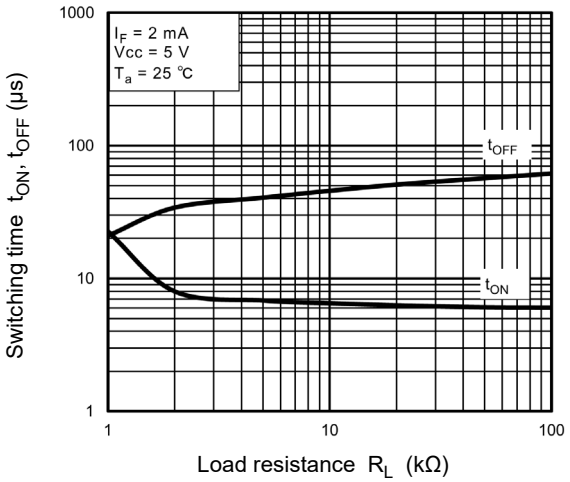
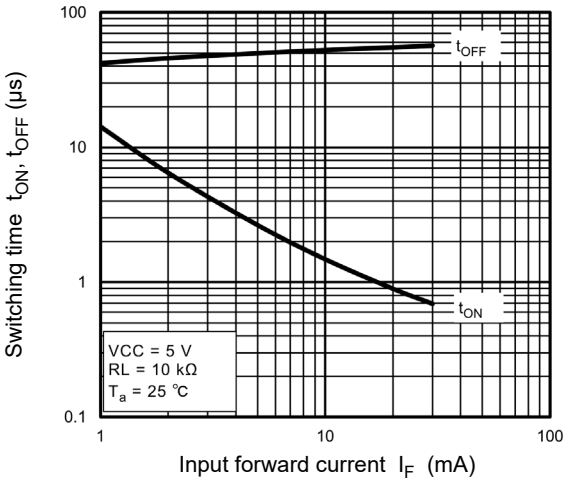
t_{on}, t_{off} – R_L



t_{on}, t_{off} – I_F



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

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