TOSHIBA Photocoupler GaAs Ired & Photo−Transistor

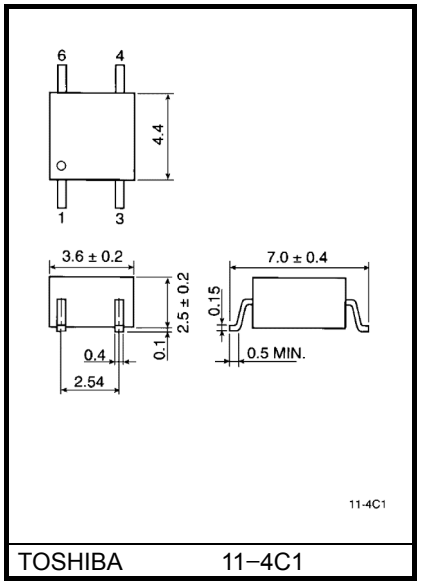
TLP180

Programmable Controllers

AC / DC−Input Module

Telecommunication

Unit in mm



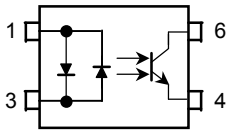
TOSHIBA 11−4C1

Weight: 0.09 g

The TOSHIBA mini flat coupler TLP180 is a small outline coupler, suitable for surface mount assembly.
TLP180 consist of a photo transistor, optically coupled to a gallium arsenide infrared emitting diode connected inverse parallel, and can operate directly by AC input current.

- Collector−emitter voltage: 80 V (min.)
- Current transfer ratio: 50% (min.)
  Rank GB: 100% (min.)
- Isolation voltage: 3750Vrms (min.)
- UL recognized: UL1577, file No. E67349
- BSI approved: BS EN60065:2002, certificate no.8285
  BS EN60950-1:2002, certificate no.8286

Pin Configuration (top view)



1: Anode, Cathode

3: Cathode, Anode

4: Emitter

6: Collector

Absolute Maximum Ratings (Ta = 25°C)

Characteristic			Symbol	Rating	Unit
LED	Forward current		$I_{F(RMS)}$	±50	mA
	Forward current detating (Ta≥53°C)		ΔI_F / °C	−0.7	mA / °C
	Pulse forward current	(Note1)	I_{FP}	±1	A
	Junction temperature		T_j	125	°C
Detector	Collector−emitter voltage		V_{CEO}	80	V
	Emitter−collector voltage		V_{ECO}	7	V
	Collector current		I_C	50	mA
	Power dissipation		P_C	150	mW
	Power dissipation derating (Ta ≥ 25°C)		ΔP_C / °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	200	mW
Total package power dissipation derating (Ta ≥ 25°C)			ΔP_T / °C	−2.0	mW / °C
Isolation voltage (AC,1min.,R.H. ≤ 60%)		(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 ≤ 100μs,f=100Hz

Note 2: Device considered a two terminal device: Pins 1 and 3 shorted together and 4 and 6 shorted together.

Recommended Operating Conditions

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	—	5	48	V
Forward current	$I_{F(RMS)}$	—	16	20	mA
Collector current	IC	—	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.

Electrical Characteristics (Ta = 25°C)

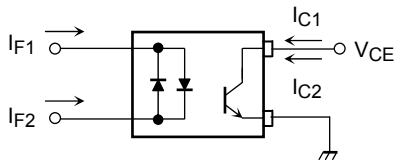
	Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
LED	Forward voltage	V_F	I_F = ±10 mA	1.0	1.15	1.3	V
	Capacitance	C_T	V = 0, f = 1 MHz	—	60	—	pF
Detector	Collector−emitter breakdown voltage	$V_{(BR)\ CEO}$	I_C = 0.5 mA	80	—	—	V
	Emitter−collector breakdown voltage	$V_{(BR)\ ECO}$	I_E = 0.1 mA	7	—	—	V
	Collector dark current	I_{CEO}	V_{CE} = 48 V (ambient light below 1000Lx) (Note3)	—	0.01 (2)	0.1 (10)	μA
			V_{CE} = 48 V (ambient light Ta = 85°C below 1000Lx) (Note3)	—	2 (4)	50 (50)	μA
	Capacitance (collector to emitter)	C_{CE}	V = 0, f = 1 MHz	—	10	—	pF

Note 3: Please use standard electric lamp to light up the device's marking surface.

Coupled Electrical Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	MIn.	Typ.	Max.	Unit
Current transfer ratio	I_C / I_F	I_F = ±5 mA, V_{CE} = 5 V Rank GB	50	—	600	%
			100	—	600	
Saturated CTR	I_C / $I_{F\ (sat)}$	IF = ±1 mA, V_{CE} = 0.4 V Rank GB	—	60	—	%
			30	—	—	
Collector−emitter saturation voltage	$V_{CE\ (sat)}$	I_C = 2.4 mA, I_F = ±8 mA	—	—	0.4	V
		I_C = 0.2 mA, I_F = ±1 mA Rank GB	—	0.2	—	
			—	—	0.4	
Off−state collector current	$I_{C(off)}$	V_F = ± 0.7V, V_{CE} = 48 V	—	1	10	μA
CTR symmetry	$I_{C\ (ratio)}$	I_C (I_F = −5mA) / I_C (I_F = 5mA) (Note4)	0.33	1	3	—

Note 4 : $I_C(ratio) = \frac{I_{C2}(I_F = I_{F2}, V_{CE} = 5V)}{I_{C1}(I_F = I_{F1}, V_{CE} = 5V)}$



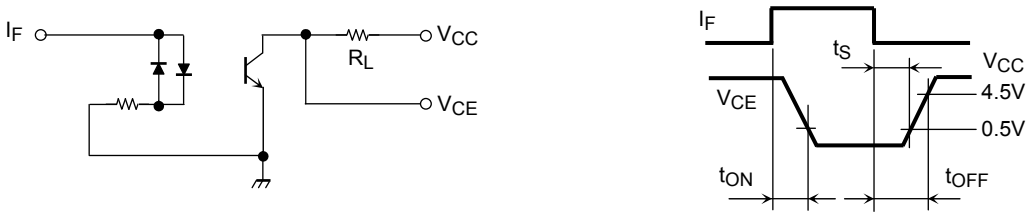
Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Capacitance input to output	C_S	V_S = 0V, 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, 1 minute	3750	—	—	V_{rms}
		AC, 1 second, in oil	—	10000	—	
		DC, 1 minute, in oil	—	10000	—	V_{dc}

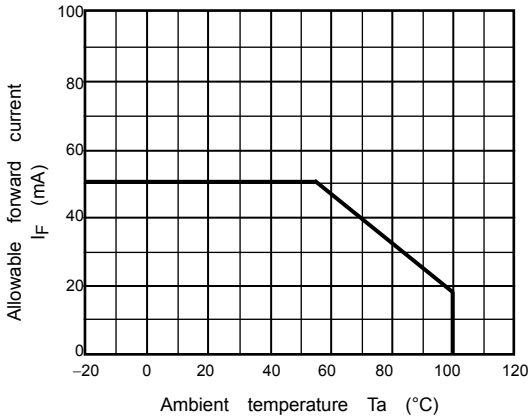
Switching Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Rise time	t_r	V_{CC} = 10 V, I_C = 2 mA R_L = 100Ω	—	2	—	μs
Fall time	t_f		—	3	—	
Turn−on time	t_{on}		—	3	—	
Turn−off time	t_{off}		—	3	—	
Turn−on time	t_{ON}	R_L = 1.9 kΩ (Fig.1) V_{CC} = 5 V, I_F = ±16 mA	—	2	—	μs
Storage time	t_s		—	25	—	
Turn−off time	t_{OFF}		—	40	—	

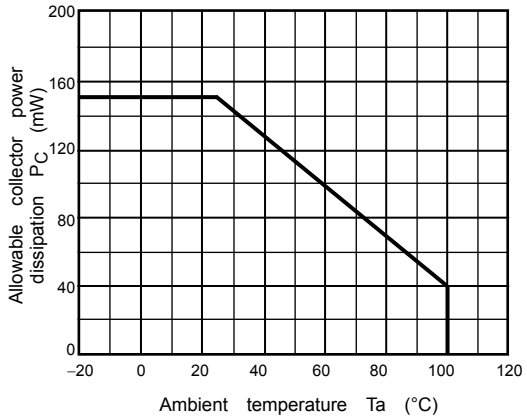
Fig. 1: Switching time test circuit



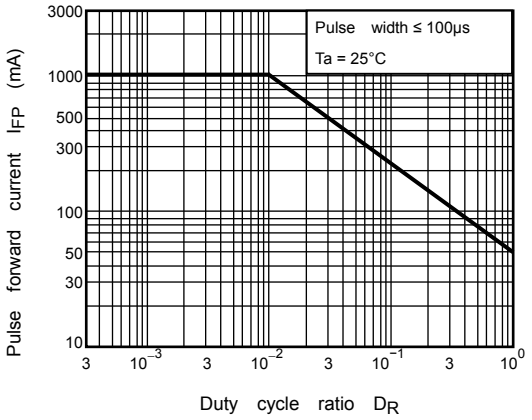
I_F – Ta



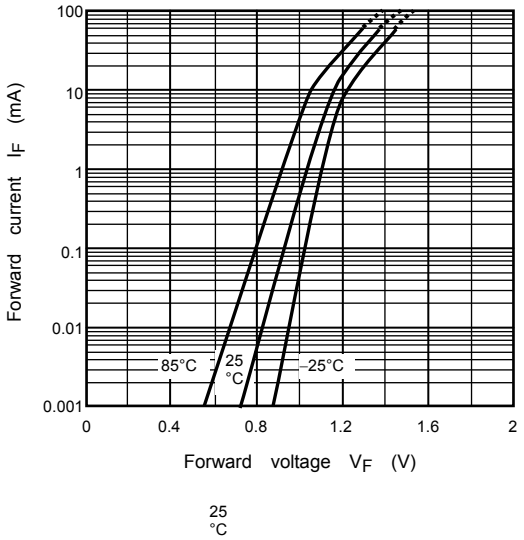
P_C – Ta



I_{FP} – D_R

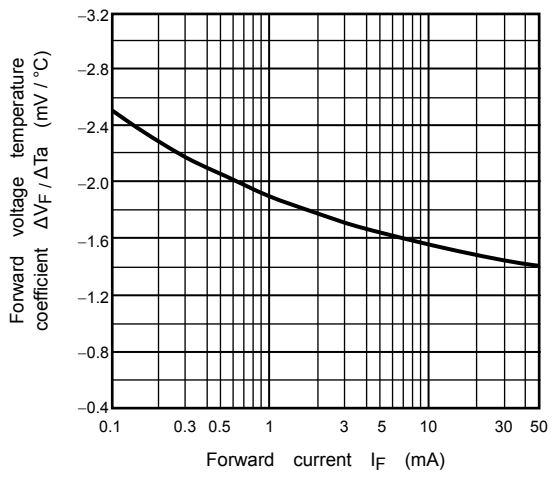


I_F – V_F

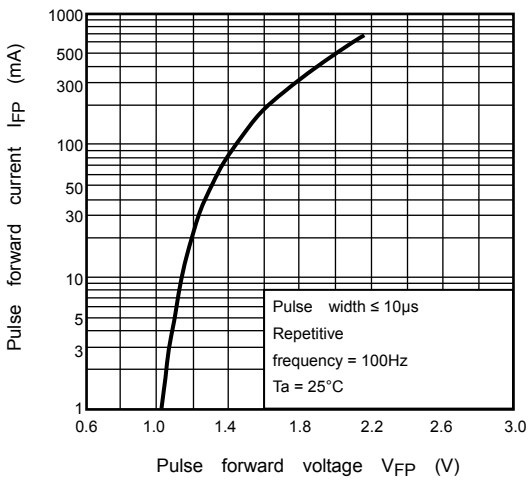


25 °C

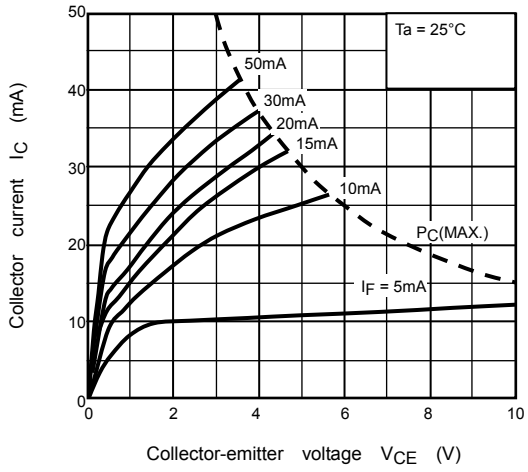
$\Delta V_F / \Delta Ta$ – I_F



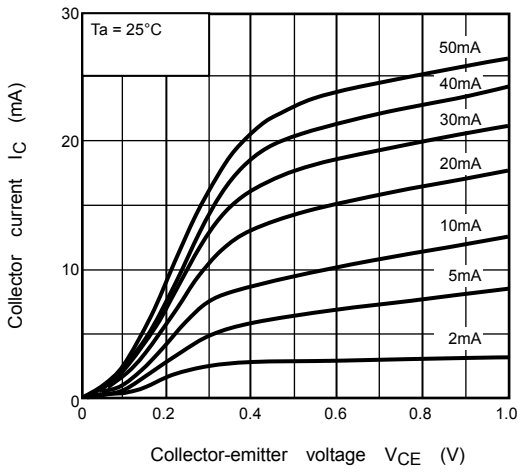
I_{FP} – V_{FP}



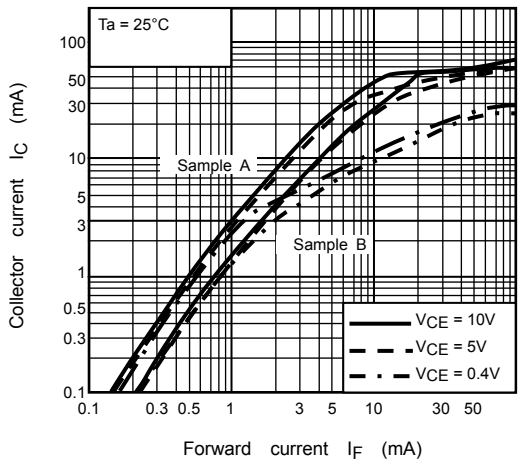
$I_C - V_{CE}$



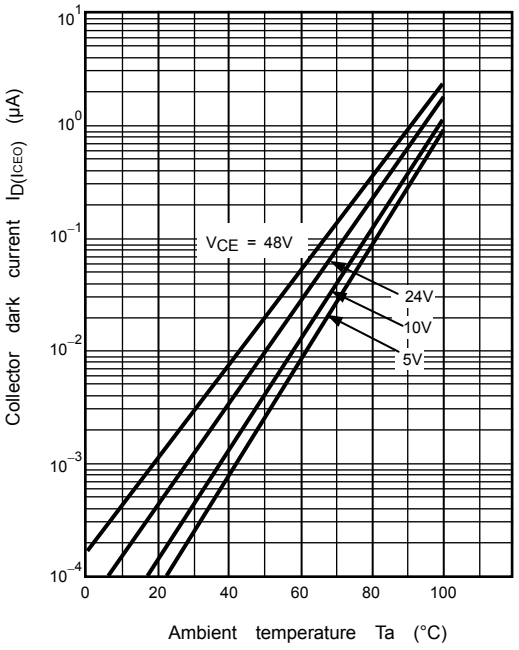
$I_C - V_{CE}$



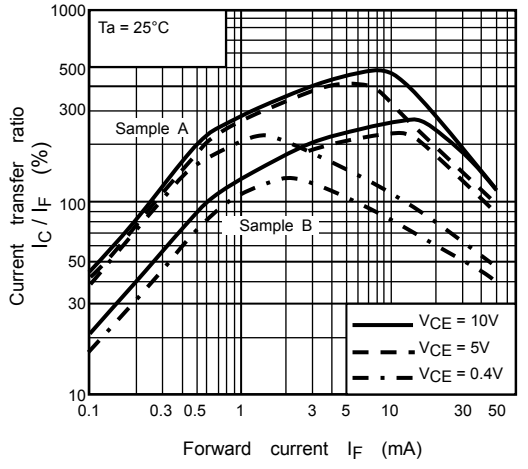
$I_C - I_F$



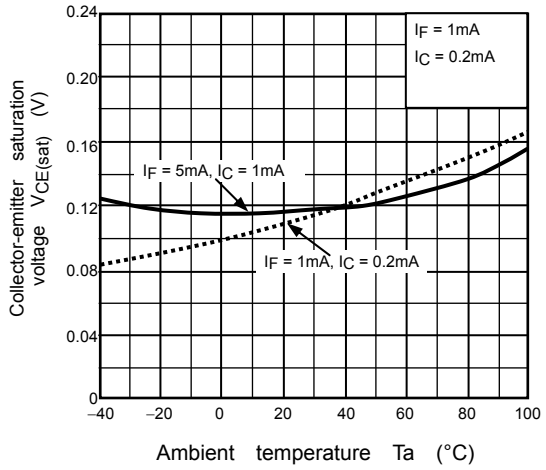
$I_{CEO} - Ta$



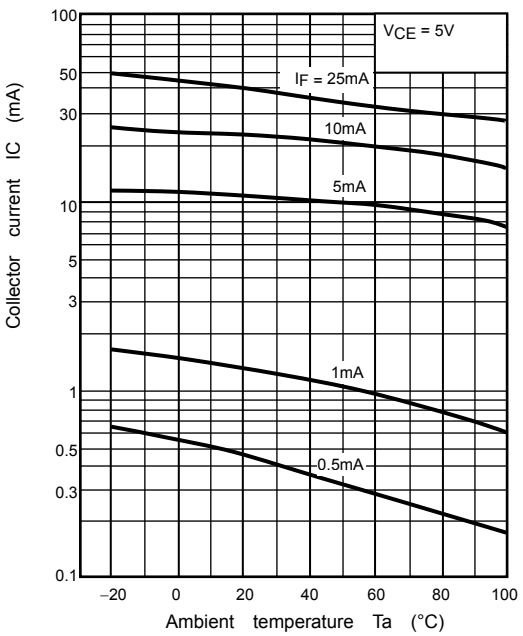
$I_C / I_F - I_F$



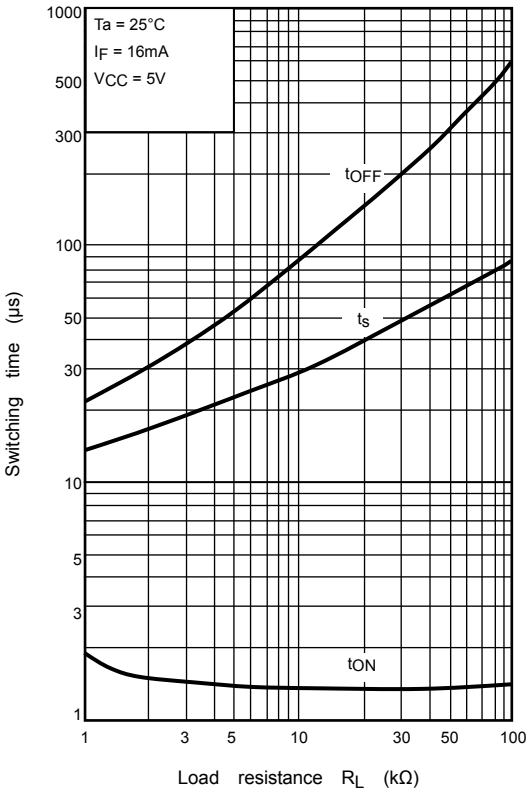
$V_{CE(sat)}$ – Ta



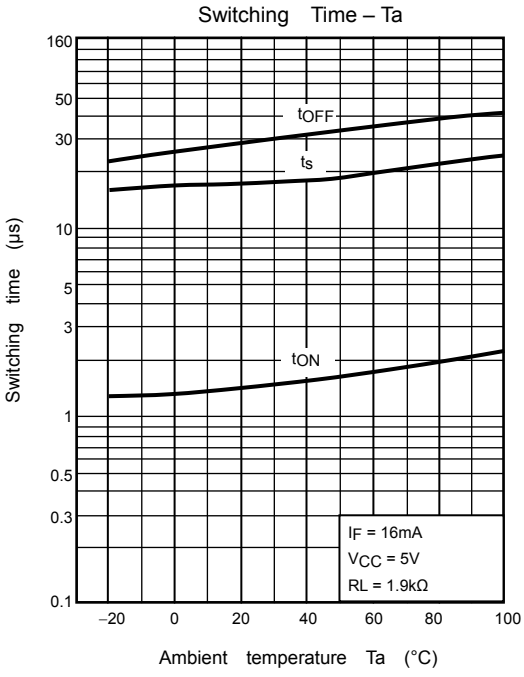
I_C – Ta



Switching Time – R_L



Switching Time – Ta



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