TOSHIBA Photocoupler GaAs IRed & Photo-Transistor

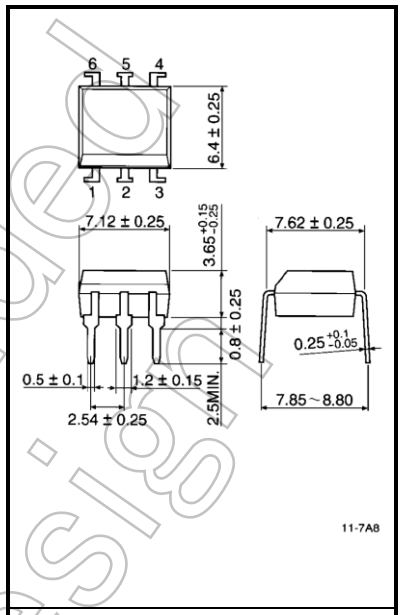
TLP630

Programmable Controllers
AC / DC-Input Module
Telecommunication

The TOSHIBA TLP630 consists of a photo-transistor optically coupled to two gallium arsenide infrared emitting diode connected inverse parallel in a six lead plastic DIP package.

- Collector-emitter voltage: 55 V (min)
- Current transfer ratio: 50% (min)
  Rank GB: 100% (min)
- Isolation voltage: 5000 Vrms (min)
- UL recognized: UL1577 file no. E67349

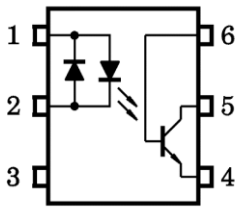
Unit: mm



TOSHIBA 11-7A8

Weight: 0.4 g (typ.)

Pin Configurations (top view)



1 : ANODE, CATHODE
2 : CATHODE, ANODE
3 : N.C.
4 : EMITTER
5 : COLLECTOR
6 : BASE

Start of commercial production
1983-05

Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
LED	Forward current	$I_{F(RMS)}$	60	mA
	Forward current derating (Ta ≥ 39°C)	ΔI_F / °C	-0.7	mA / °C
	Peak forward current (100 μs pulse, 100 pps)	I_{FPT}	±1	A
	Diode power dissipation	P_D	100	mW
	Diode power dissipation derating (Ta ≥ 39 °C)	ΔP_D /°C	-1.2	mW/°C
Detector	Collector-emitter voltage	V_{CEO}	55	V
	Collector-base voltage	V_{CBO}	80	V
	Emitter-collector voltage	V_{ECO}	7	V
	Emitter-base voltage	V_{EBO}	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
Operating temperature range		T_{opr}	-55 to 100	°C
Storage temperature range		T_{stg}	-55 to 125	°C
Lead soldering temperature (10 s)		T_{sol}	260	°C
Junction temperature		T_j	125	°C
Total package power dissipation		P_T	250	mW
Total package power dissipation derating (Ta ≥ 25°C)		ΔP_T / °C	-2.5	mW / °C
Isolation voltage (AC, 60 s, R.H. ≤ 60%) (Note 1)		BV_S	5000	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: 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_{CC}	—	5	24	V
Forward current	$I_{F(RMS)}$	—	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.

Electrical Characteristics (Ta = 25°C)

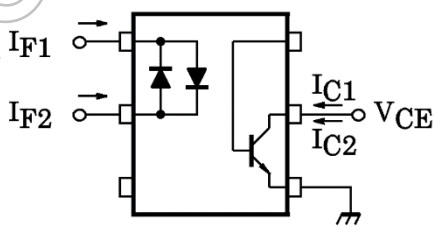
	Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	V_F	I_F = 10mA	1.0	1.15	1.3	V
	Forward current	I_F	V_F = 0.7V	—	2.5	10	μA
	Capacitance	C_T	V = 0 V, f = 1MHz	—	60	—	pF
Detector	Collector-emitter breakdown voltage	$V_{(BR)CEO}$	I_C = 0.5mA	55	—	—	V
	Emitter-collector breakdown voltage	$V_{(BR)ECO}$	I_E = 0.1mA	7	—	—	V
	Collector-base breakdown voltage	$V_{(BR)CBO}$	I_C = 0.1mA	80	—	—	V
	Emitter-base breakdown voltage	$V_{(BR)EBO}$	I_E = 0.1mA	7	—	—	V
	Collector dark current	I_{CEO}	V_{CE} = 24V	—	10	100	nA
			V_{CE} = 24V, Ta = 85°C	—	2	50	μA
	Collector dark current	I_{CBO}	V_{CB} = 10V	—	0.1	—	nA
	Capacitance (collector to emitter)	C_{CE}	V = 0 V, f = 1MHz	—	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 = ±5mA, V_{CE} = 5V	50	—	600	%
		Rank GB	100	—	600	
Saturated CTR	I_C / $I_{F(sat)}$	I_F = ±1mA, V_{CE} = 0.4V	—	60	—	%
		Rank GB	30	—	—	
Base photo-current	I_{PB}	I_F = ±5mA, V_{CB} = 5V	—	10	—	μA
Collector-emitter saturation voltage	$V_{CE(sat)}$	I_C = 2.4mA, I_F = ±8mA	—	—	0.4	V
Off-state collector current	$I_{C(off)}$	V_F = ±0.7V, V_{CE} = 24V	—	1	10	μA
CTR symmetry	$I_{C(ratio)}$	I_C(I_F = -5mA) / I_C(I_F = +5mA) (Note 1)	0.33	1	3	—

Note 1:

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



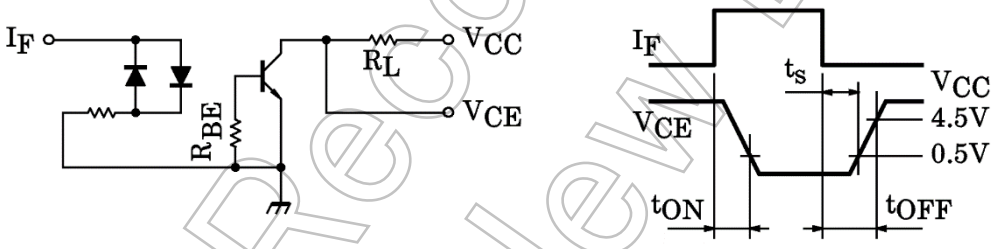
Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Capacitance (input to output)	C_S	V_S = 0 V, f = 1 MHz	—	0.8	—	pF
Isolation resistance	R_S	V_S = 500V, R.H. ≤ 60%	5×10^{10}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 60 s	5000	—	—	Vrms
		AC, 1 s, in oil	—	10000	—	
		DC, 60 s, in oil	—	10000	—	Vdc

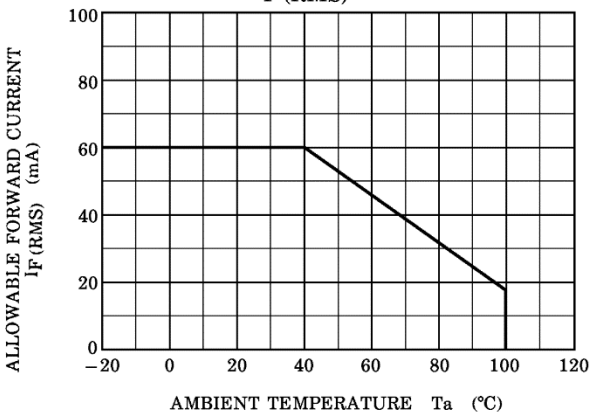
Switching Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Rise time	t_r	V_{CC} = 10V, I_C = 2mA 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) R_{BE} = OPEN V_{CC} = 5 V, I_F = ±16mA	—	2	—	μs
Storage time	t_S		—	15	—	
Turn-off time	t_{OFF}		—	25	—	
Turn-on time	t_{ON}	R_L = 1.9kΩ (Fig. 1) R_{BE} = 220kΩ, V_{CC} = 5 V I_F = ±16mA	—	2	—	μs
Storage time	t_S		—	12	—	
Turn-off time	t_{OFF}		—	20	—	

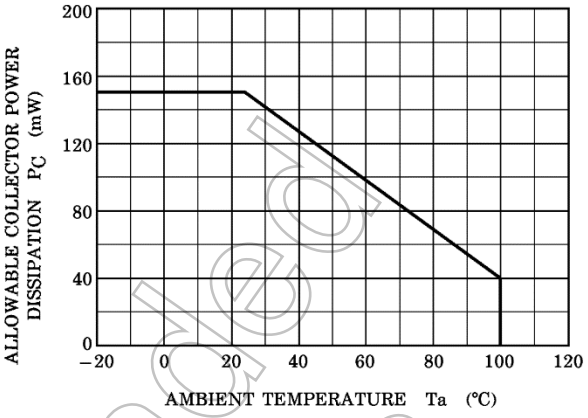
Fig. 1: Switching time test circuit



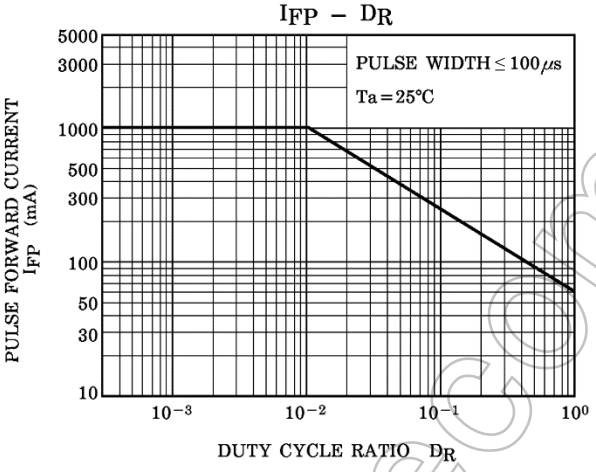
$I_{F\,(RMS)}$ – Ta



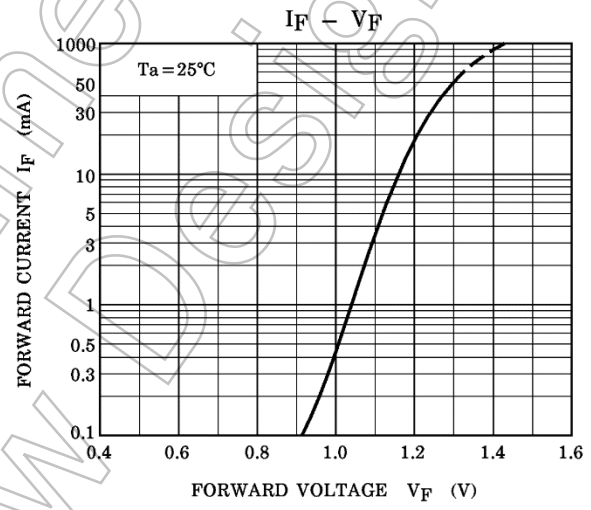
P_C – Ta



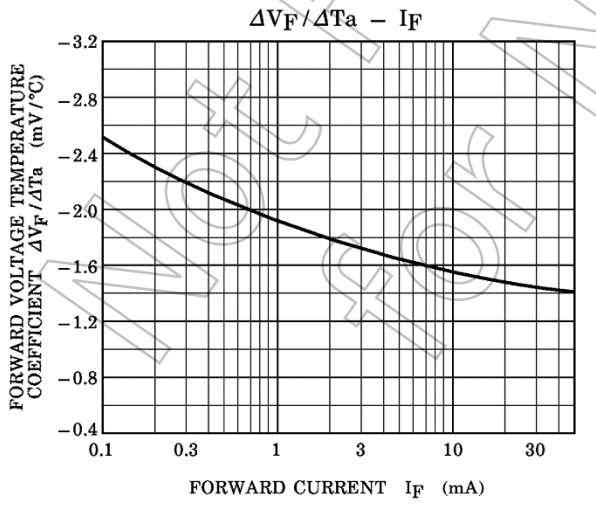
I_{FP} – D_R



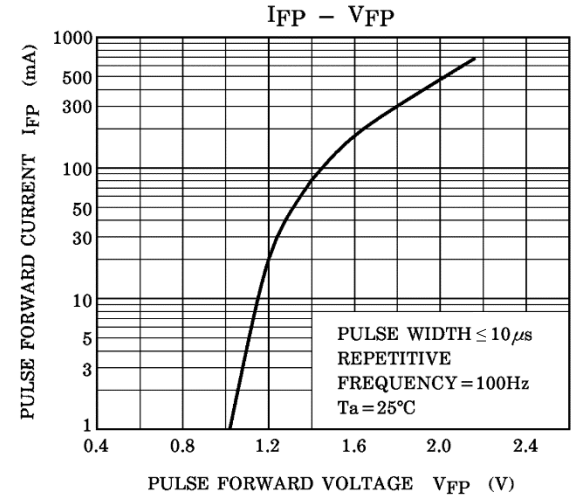
I_F – V_F



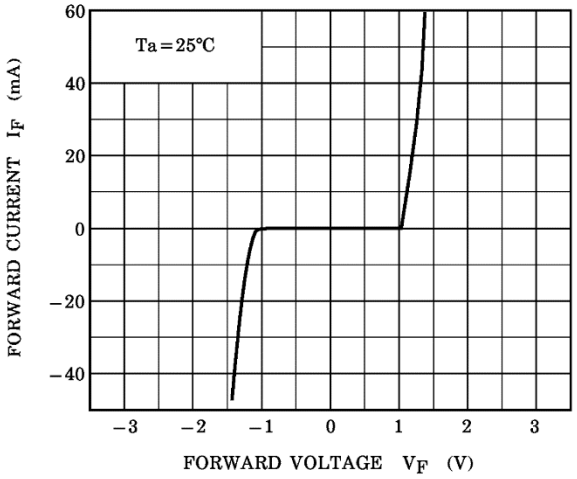
$\Delta V_F / \Delta Ta$ – I_F



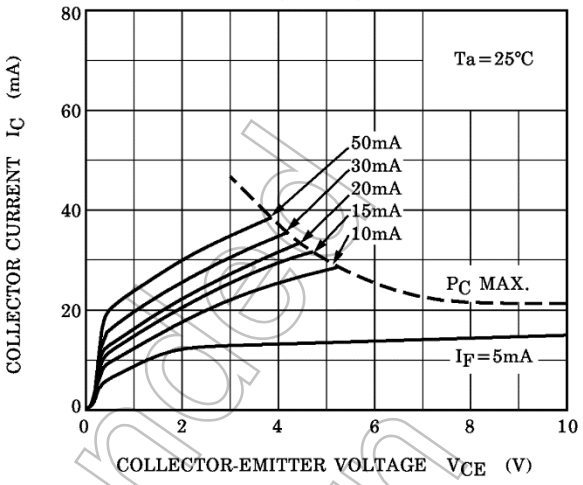
I_{FP} – V_{FP}



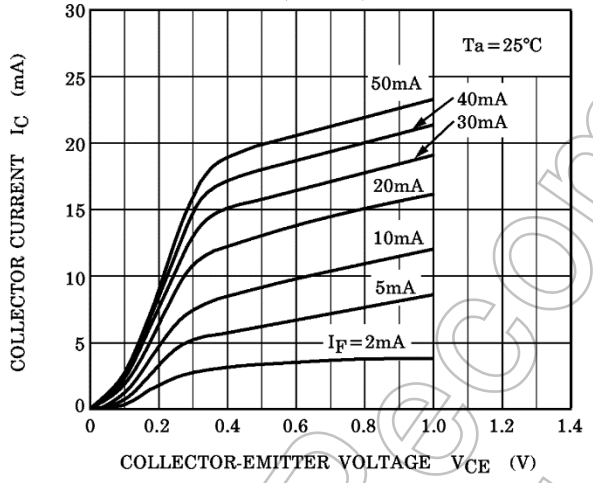
$I_F - V_F$



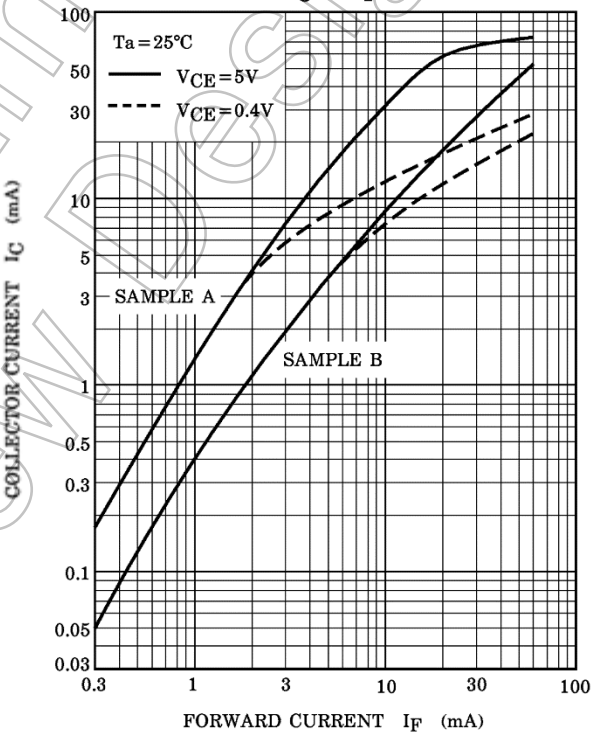
$I_C - V_{CE}$



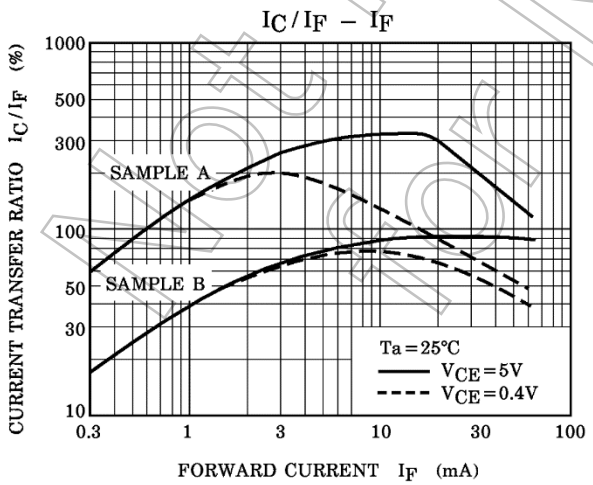
$I_C - V_{CE}$



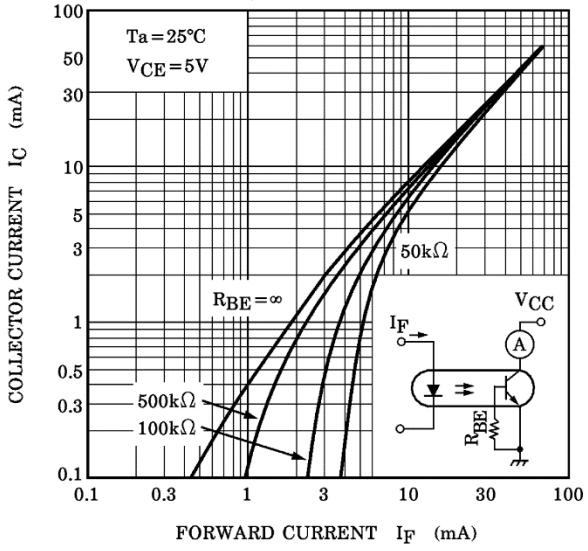
$I_C - I_F$



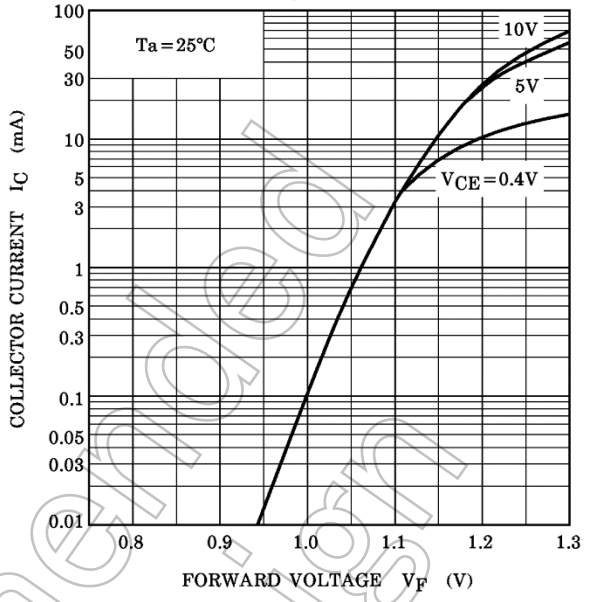
$I_C / I_F - I_F$



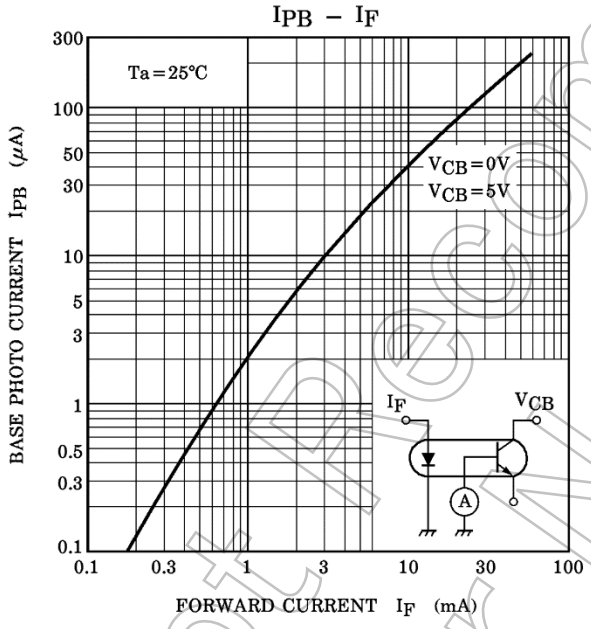
I_C – I_F at R_{BE}



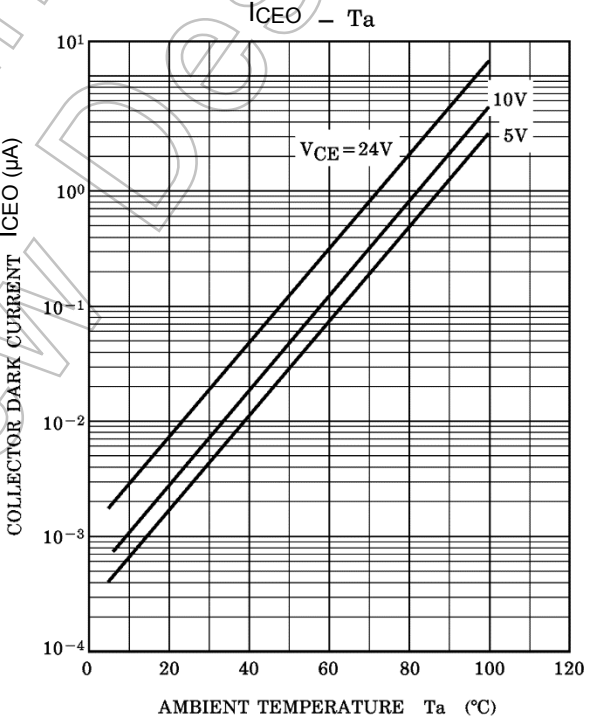
I_C – V_F



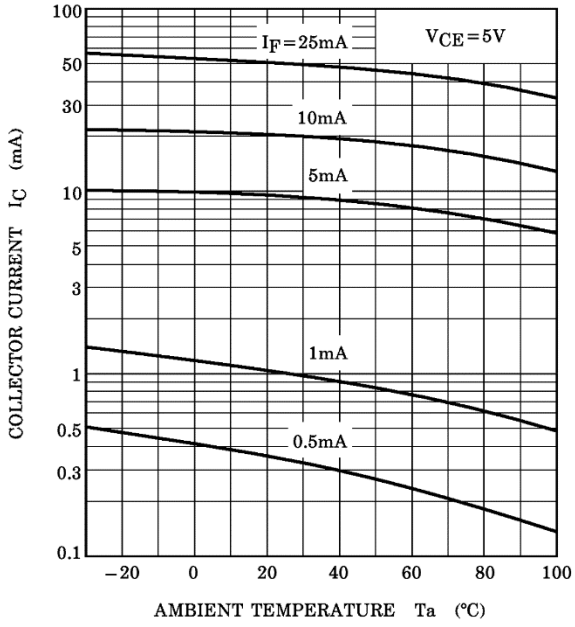
I_{PB} – I_F



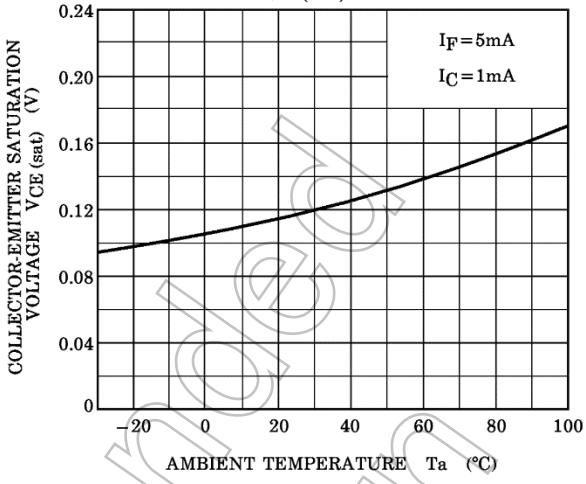
I_{CEO} – Ta



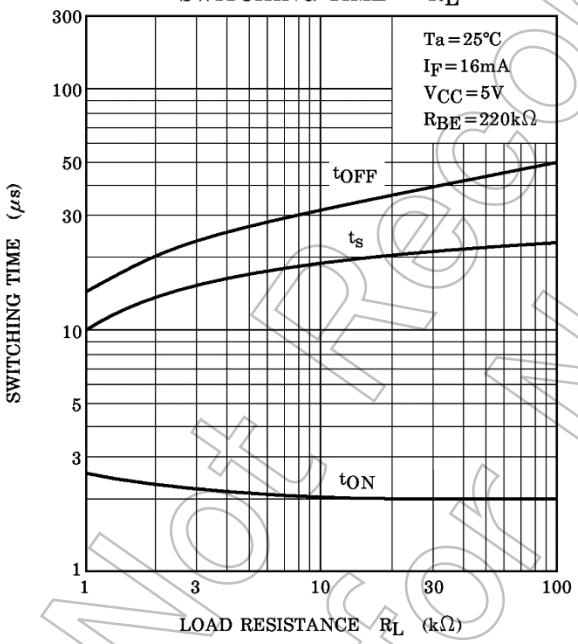
I_C – Ta



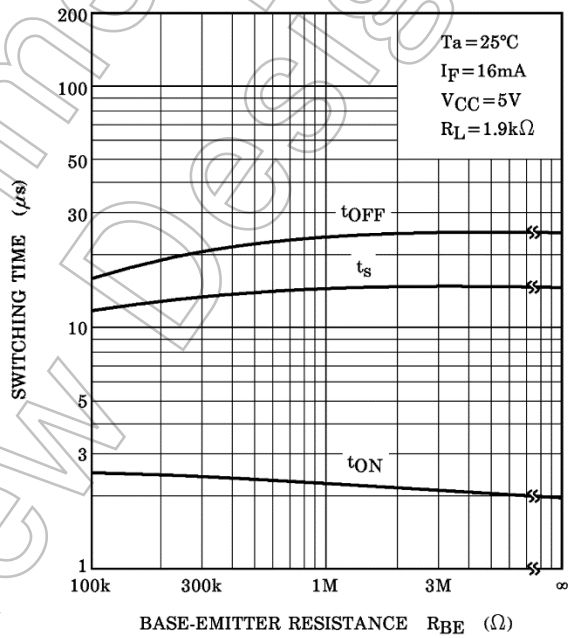
$V_{CE\,(sat)}$ – Ta



SWITCHING TIME – R_L



SWITCHING TIME - R_{BE}



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