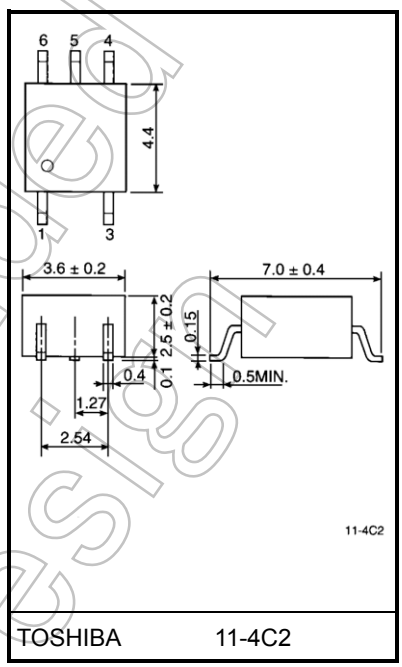
TOSHIBA Photocoupler IRED & Photo-Transistor

TLP130

Programmable Controllers
AC / DC-Input Module
Telecommunication

Unit: mm



TOSHIBA 11-4C2

Weight: 0.09 g (typ.)

The TOSHIBA mini flat coupler TLP130 is a small outline coupler, suitable for surface mount assembly.
TLP130 consists of a photo transistor, optically coupled to two infrared emitting diodes connected inverse parallel, and operate directly by AC input current.

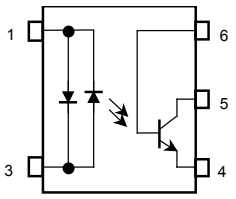
- Collector-emitter voltage: 80 V (min)
- Current transfer ratio: 50 % (min)
  Rank GB: 100 % (min)
- Isolation voltage: 3750 Vrms (min)
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A
  File No.E67349

- Current transfer ratio

Classification	Current Transfer Ratio (%) (I_C/I_F) I_F = ±5mA, V_{CE} = 5V, Ta = 25°C		Marking of Classification
	Min	Max	
Standard	50	600	Blank, GB
Rank GB	100	600	GB

Note: Application type name for certification test,
please use standard product type name, i.e.
TLP130(GB): TLP130

Pin Configurations (top view)



1 : Anode, Cathode
3 : Cathode, Anode
4 : Emitter
5 : Collector
6 : Base

Start of commercial production
1988-04

Absolute Maximum Ratings (Ta = 25°C)

Characteristics			Symbol	Rating	Unit
LED	Forward current		$I_{F(RMS)}$	50	mA
	Forward current derating	(Ta≥53°C)	ΔI_F/°C	−0.7	mA/°C
	Peak forward current (100 μs pulse, 100pps)		I_{FP}	1	A
	Diode power dissipation		P_D	100	mW
	Diode power dissipation derating	(Ta ≥ 53°C)	ΔP_D/°C	-1.39	mW/°C
	Junction temperature		T_j	125	°C
Detector	Collector−emitter voltage		V_{CEO}	80	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
	Peak collector current	(10 ms pulse, 100 pps)	I_{CP}	100	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 to 125	°C
Operating temperature range			T_{opr}	−55 to 100	°C
Lead soldering temperature		(10 s)	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, 60 s, R.H. ≤ 60 %)	(Note 1)	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: Device considered a two terminal device: Pins 1 and 3 shorted together and pins 4, 5 and 6 shorted together.

Recommended Operating Conditions

Characteristics	Symbol	Min	Typ.	Max	Unit
Supply voltage	V_{CC}	—	5	48	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.

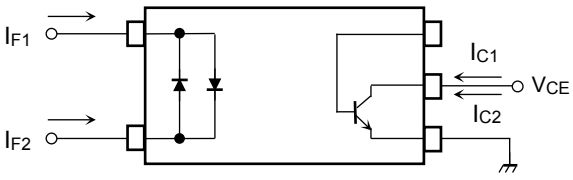
Electrical Characteristics (Ta = 25°C)

	Characteristics	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 V, 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-base breakdown voltage	$V_{(BR)CBO}$	I_C = 0.1 mA	80	—	—	V
	Emitter-base breakdown voltage	$V_{(BR)EBO}$	I_E = 0.1 mA	7	—	—	V
	Collector dark current	I_{CEO}	V_{CE} = 48 V	—	10	100	nA
			V_{CE} = 48 V, Ta = 85 °C	—	2	50	μA
	Collector dark current	I_{CER}	V_{CE} = 48 V, Ta = 85 °C R_{BE} = 1 MΩ	—	0.5	10	μA
	Collector dark current	I_{CBO}	V_{CB} = 10 V	—	0.1	—	nA
	DC forward current gain	h_{FE}	V_{CE} = 5 V, I_C = 0.5 mA	—	400	—	—
	Capacitance collector to emitter	C_{CE}	V = 0 V, f = 1 MHz	—	10	—	pF

Coupled Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Current transfer ratio	I_C/I_F	I_F = ±5 mA, V_{CE} = 5 V	50	—	600	%
		Rank GB	100	—	600	
Saturated CTR	$I_C/I_{F(sat)}$	I_F = ±1 mA, V_{CE} = 0.4 V	—	60	—	%
		Rank GB	30	—	—	
Base photo−current	I_{PB}	I_F = ±5 mA, V_{CB} = 5 V	—	10	—	μA
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	—	0.2	—	
		Rank GB	—	—	0.4	
Off−state collector current	$I_{C(off)}$	I_F = ±0.7 mA, V_{CE} = 48 V	—	1	10	μA
CTR symmetry	$I_{C(ratio)}$	$I_C(I_F = -5\ mA) / I_C(I_F = 5\ mA)$ (Note 1)	0.33	—	3	—

Note 1: $I_{C(ratio)} = \dfrac{I_{C2}(I_F = I_{F2},\ V_{CE} = 5V)}{I_{C1}(I_F = I_{F1},\ V_{CE} = 5V)}$



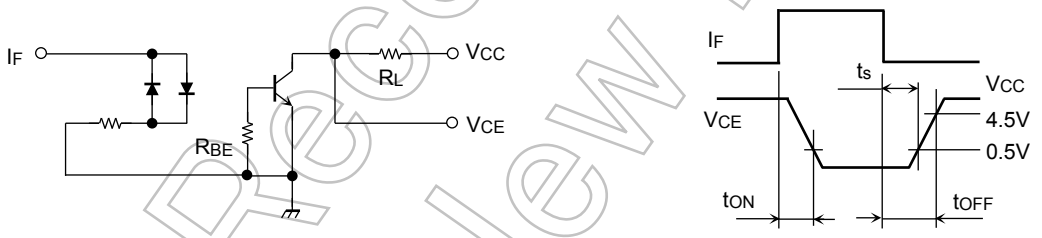
Isolation Characteristics (Ta = 25°C)

Characteristics	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

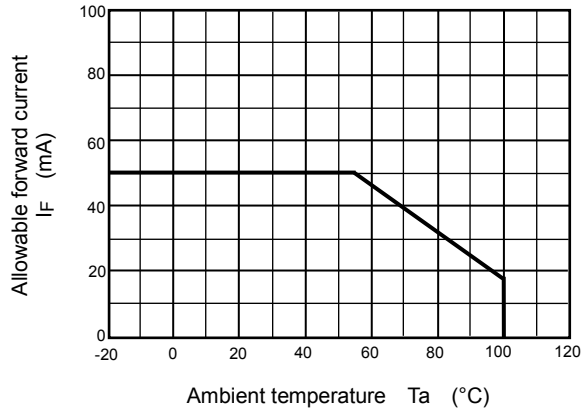
Switching Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Rise time	t_r	V_{CC} = 10 V, I_C = 2 mA R_L = 100 Ω	—	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 = ±16 mA	—	2	—	μs
Storage time	t_s		—	25	—	
Turn-off time	t_{OFF}		—	40	—	
Turn-on time	t_{ON}	R_L = 1.9 kΩ (Fig.1) R_{BE} = 220 kΩ V_{CC} = 5 V, I_F = ±16 mA	—	2	—	μs
Storage time	t_s		—	20	—	
Turn-off time	t_{OFF}		—	30	—	

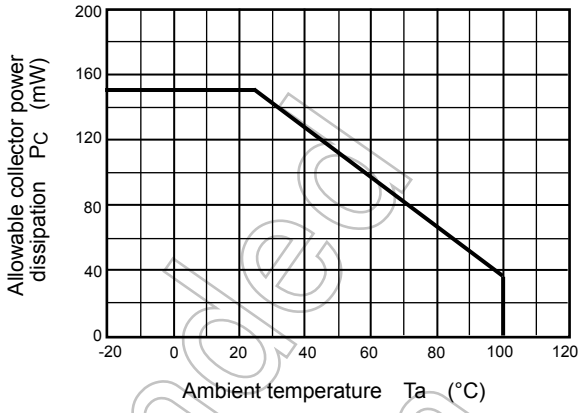
Fig. 1 Switching time test circuit



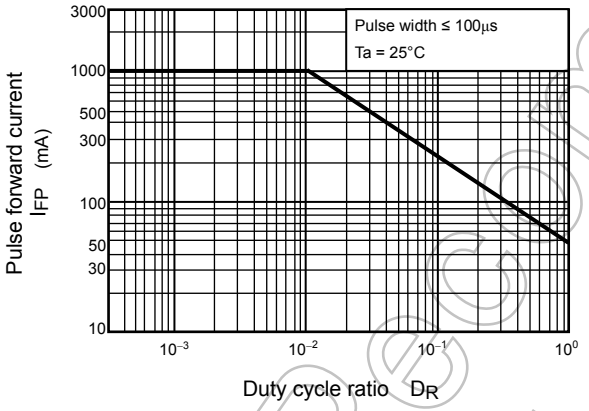
I_F – Ta



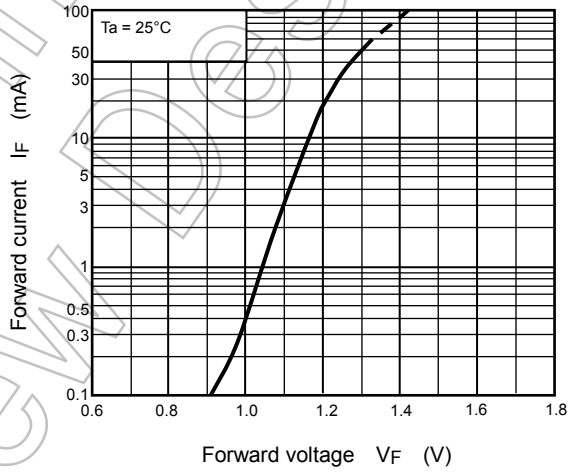
P_C – Ta



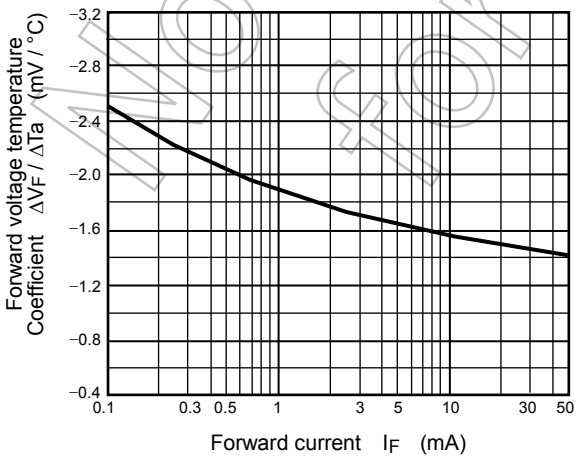
I_{FP} – D_R



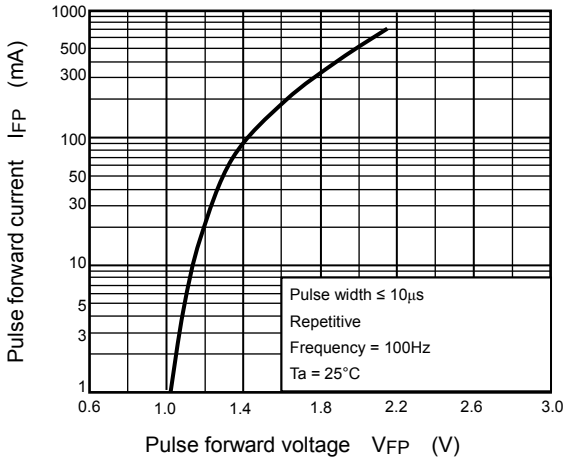
I_F – V_F



$\Delta V_F / \Delta Ta$ – I_F

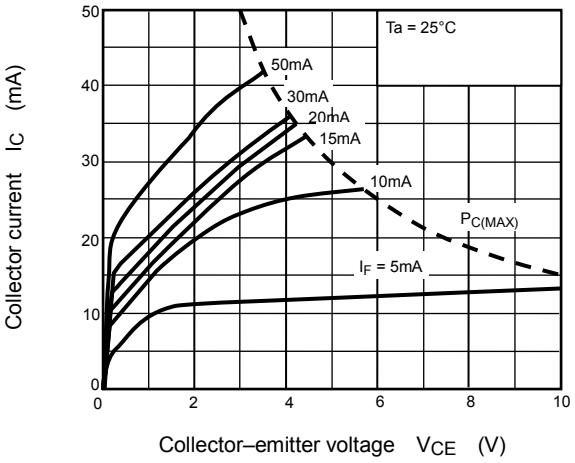


I_{FP} – V_{FP}

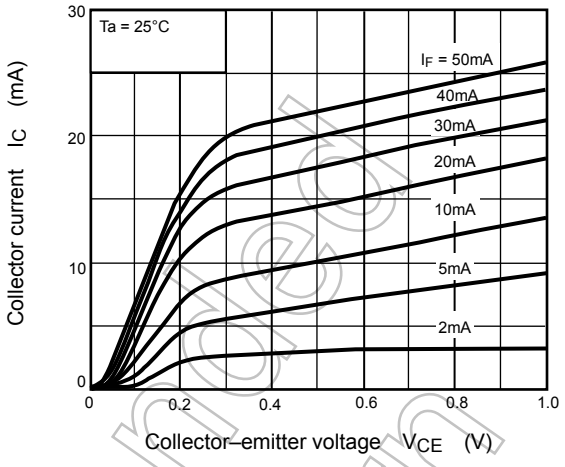


NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

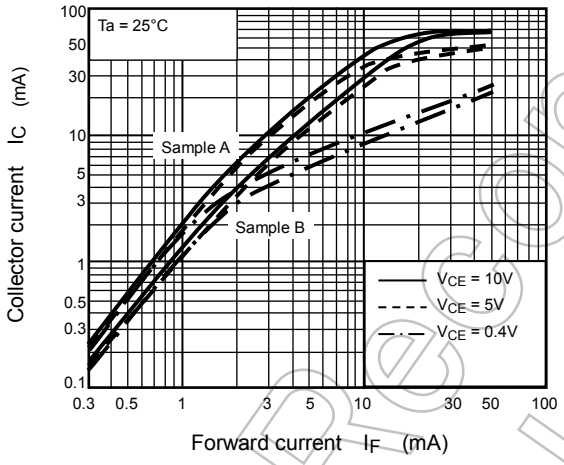
$I_C - V_{CE}$



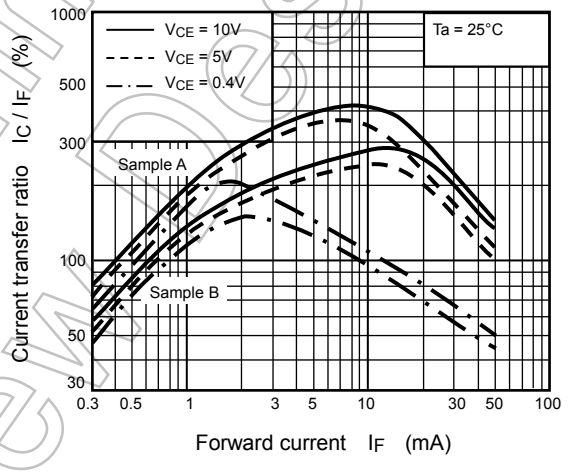
$I_C - V_{CE}$



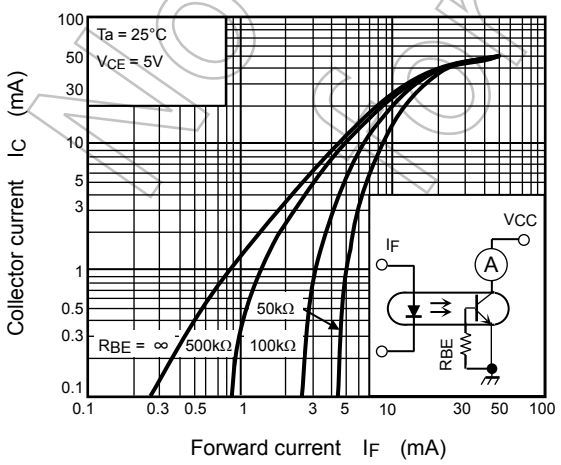
$I_C - I_F$



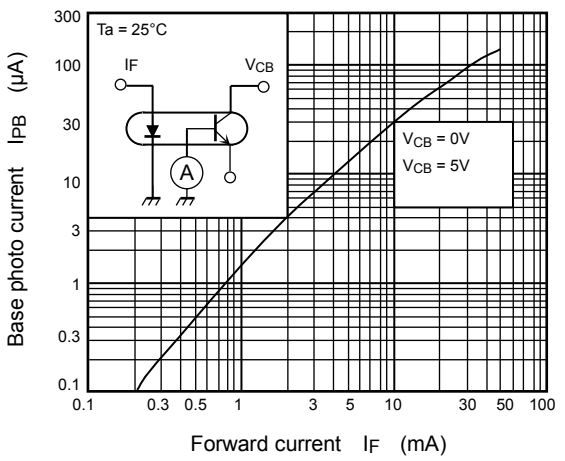
$I_C / I_F - I_F$



$I_C - I_F$ at R_{BE}



$I_{PB} - I_F$



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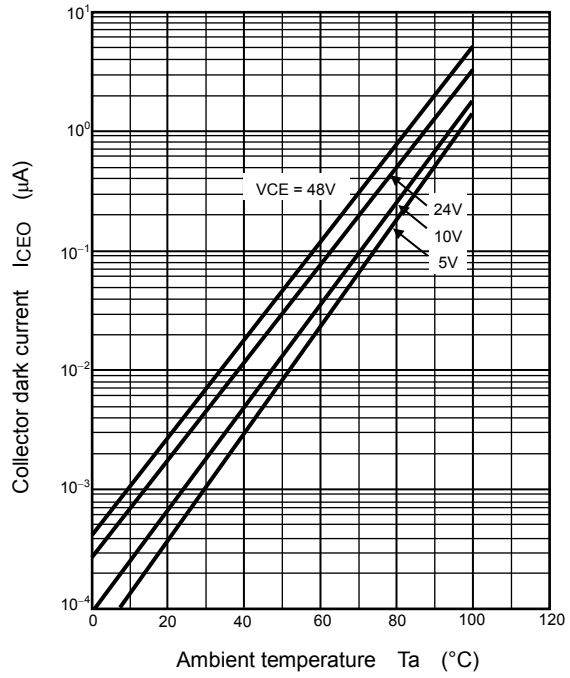
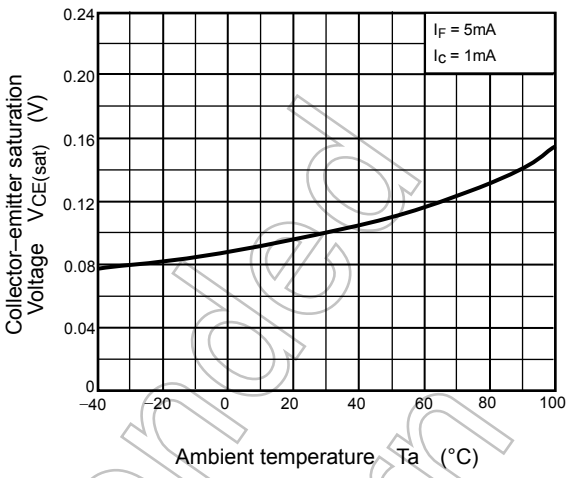
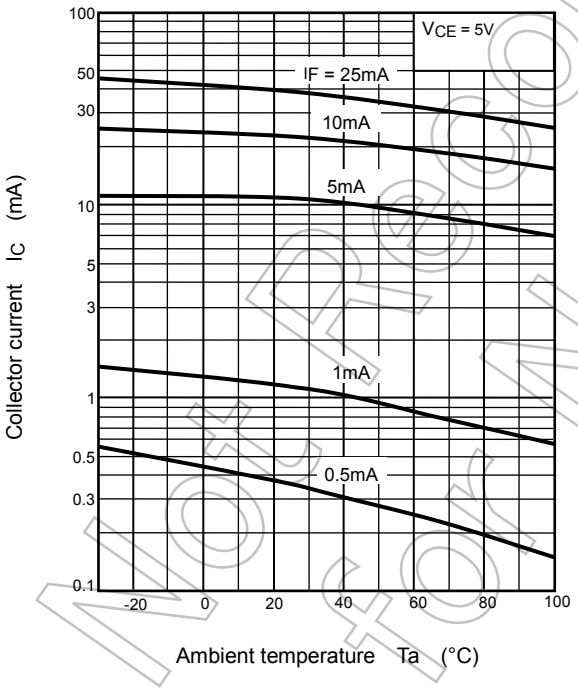
I_{CEO} – Ta



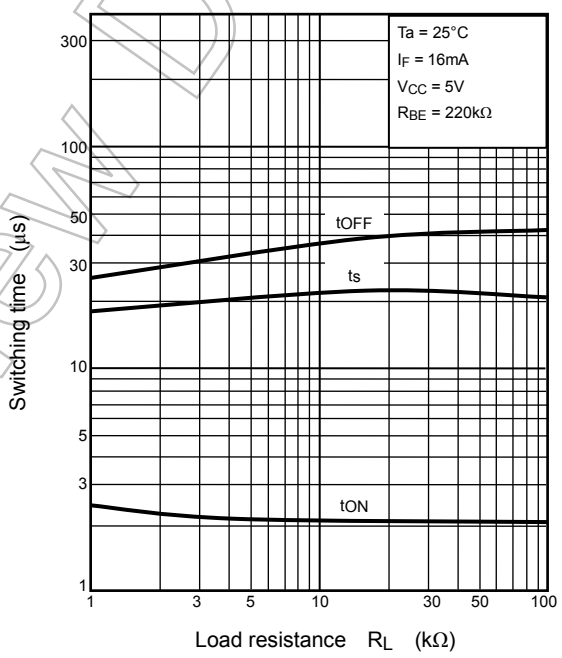
$V_{CE(sat)}$ – Ta



I_C – Ta



Switching Time – R_L



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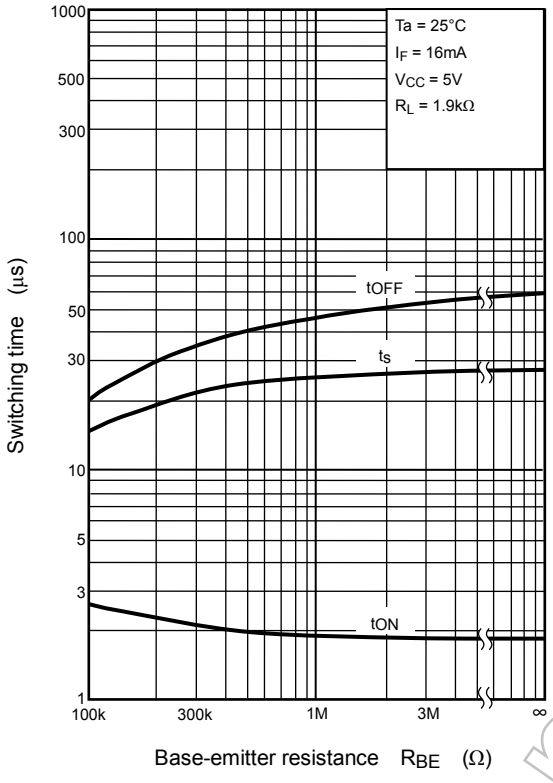
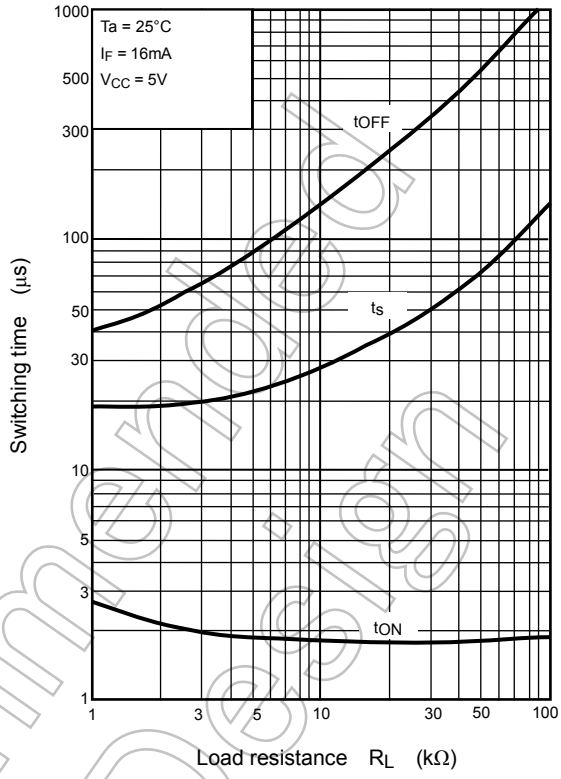
Switching Time – R_{BE}



Switching Time – R_L



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