

# TLP137

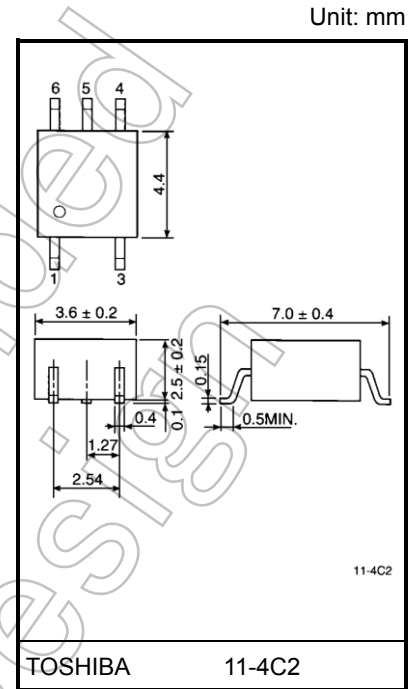
Programmable Controllers  
AC / DC-Input Module  
Telecommunication

The TOSHIBA mini flat coupler TLP137 is a small outline coupler, suitable for surface mount assembly.

TLP137 consists of an infrared emitting diode, optically coupled to a photo transistor, and provides high CTR at low input current.

- Collector-emitter voltage: 80 V (min.)
- Current transfer ratio: 100% (min.)  
Rank BV: 200% (min.)
- Isolation voltage: 3750 Vrms (min)
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A  
File No.E67349

TLP137 base terminal is for the improvement of speed, reduction of dark current, and enable operation. Using by base terminal opening is easy to receive the outside noise.



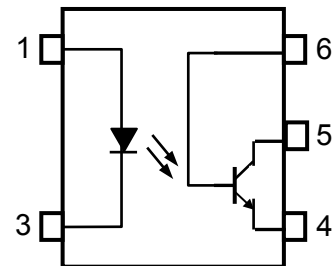
Weight: 0.09 g (typ.)

- Current transfer ratio

Classi- fication	Current Transfer Ratio (min)			Marking Of Classi- fication
	Ta = 25°C		Ta = -25 to 75°C	
	If = 1 mA VCE = 0.5 V	If = 0.5 mA VCE = 1.5 V	If = 1 mA VCE = 0.5 V	
Rank BV	200%	100%	100%	BV
Standard	100%	50%	50%	BV, Blank

Note: Application type name for certification test,  
please use standard product type name, i.e.  
TLP137 (BV): TLP137

### Pin Configurations (top view)



- 1: Anode
- 3: Cathode
- 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 <sub>F</sub>	50	mA
	Forward current derating (Ta ≥ 53°C)	ΔI <sub>F</sub> /°C	-0.7	mA/°C
	Peak forward current (100μs pulse, 100pps)	I <sub>FP</sub>	1	A
	Reverse voltage	V <sub>R</sub>	5	V
	Diode power dissipation	P <sub>D</sub>	100	mW
	Diode power dissipation derating (Ta ≥ 53°C)	ΔP <sub>D</sub> /°C	-1.39	mW/°C
	Junction temperature	T <sub>j</sub>	125	°C
Detector	Collector-emitter voltage	V <sub>CEO</sub>	80	V
	Collector-base voltage	V <sub>CBO</sub>	80	V
	Emitter-collector voltage	V <sub>ECO</sub>	7	V
	Emitter-base voltage	V <sub>EBO</sub>	7	V
	Collector current	I <sub>C</sub>	50	mA
	Peak collector current (10ms pulse, 100pps)	I <sub>CP</sub>	100	mA
	Power dissipation	P <sub>C</sub>	150	mW
	Power dissipation derating (Ta ≥ 25°C)	ΔP <sub>C</sub> /°C	-1.5	mW/°C
	Junction temperature	T <sub>j</sub>	125	°C
Storage temperature range		T <sub>stg</sub>	-55 to 125	°C
Operating temperature range		T <sub>opr</sub>	-55 to 100	°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 ≥ 25°C)		ΔP <sub>T</sub> /°C	-2.0	mW/°C
Isolation voltage (AC, 60 s, RH ≤ 60 %)		(Note 1) 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: 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 <sub>CC</sub>	—	5	48	V
Forward current	I <sub>F</sub>	—	1.6	25	mA
Collector current	I <sub>C</sub>	—	1	10	mA
Operating temperature	T <sub>opr</sub>	-25	—	75	°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	$V_F$	$I_F = 10 \text{ mA}$	1.0	1.15	1.3	V
	Reverse current	$I_R$	$V_R = 5 \text{ V}$	—	—	10	$\mu\text{A}$
	Capacitance	$C_T$	$V = 0 \text{ V}, f = 1 \text{ MHz}$	—	30	—	pF
Detector	Collector-emitter breakdown voltage	$V_{(BR)CEO}$	$I_C = 0.5 \text{ mA}$	80	—	—	V
	Emitter-collector breakdown voltage	$V_{(BR)ECO}$	$I_E = 0.1 \text{ mA}$	7	—	—	V
	Collector-base breakdown voltage	$V_{(BR)CBO}$	$I_C = 0.1 \text{ mA}$	80	—	—	V
	Emitter-base breakdown voltage	$V_{(BR)EBO}$	$I_E = 0.1 \text{ mA}$	7	—	—	V
	Collector dark current	$I_{CEO}$	$V_{CE} = 48 \text{ V}$	—	10	100	nA
			$V_{CE} = 48 \text{ V}, T_a = 85^\circ\text{C}$	—	2	50	$\mu\text{A}$
	Collector dark current	$I_{CER}$	$V_{CE} = 48 \text{ V}, T_a = 85^\circ\text{C}$ $R_{BE} = 1 \text{ M}\Omega$	—	0.5	10	$\mu\text{A}$
	Collector dark current	$I_{CBO}$	$V_{CB} = 10 \text{ V}$	—	0.1	—	nA
	DC forward current gain	$h_{FE}$	$V_{CE} = 5 \text{ V}, I_C = 0.5 \text{ mA}$	—	1000	—	—
	Capacitance (collector to emitter)	$C_{CE}$	$V = 0 \text{ V}, f = 1 \text{ MHz}$	—	12	—	pF

## Coupled Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Current transfer ratio	$I_C/I_F$	$I_F = 1 \text{ mA}, V_{CE} = 0.5 \text{ V}$	100	—	1200	%
		Rank BV	200	—	1200	
Low input CTR	$I_C/I_{F(\text{low})}$	$I_F = 0.5 \text{ mA}, V_{CE} = 1.5 \text{ V}$	50	—	—	%
		Rank BV	100	—	—	
Base photo-current	$I_{PB}$	$I_F = 1 \text{ mA}, V_{CB} = 5 \text{ V}$	—	5	—	$\mu\text{A}$
Collector-emitter saturation voltage	$V_{CE(\text{sat})}$	$I_C = 0.5 \text{ mA}, I_F = 1 \text{ mA}$	—	—	0.4	V
		$I_C = 1 \text{ mA}, I_F = 1 \text{ mA}$	—	0.2	—	
		Rank BV	—	—	0.4	
Off-state collector current	$I_{C(\text{off})}$	$V_F = 0.7 \text{ V}, V_{CE} = 48 \text{ V}$	—	—	10	$\mu\text{A}$

## Coupled Electrical Characteristics (Ta = -25 to 75°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Current transfer ratio	I <sub>C</sub> /I <sub>F</sub>	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 0.5 V Rank BV	50	—	—	%
			100	—	—	
Low input CTR	I <sub>C</sub> /I <sub>F(low)</sub>	I <sub>F</sub> = 0.5 mA, V <sub>CE</sub> = 1.5 V Rank BV	—	50	—	%
			—	100	—	

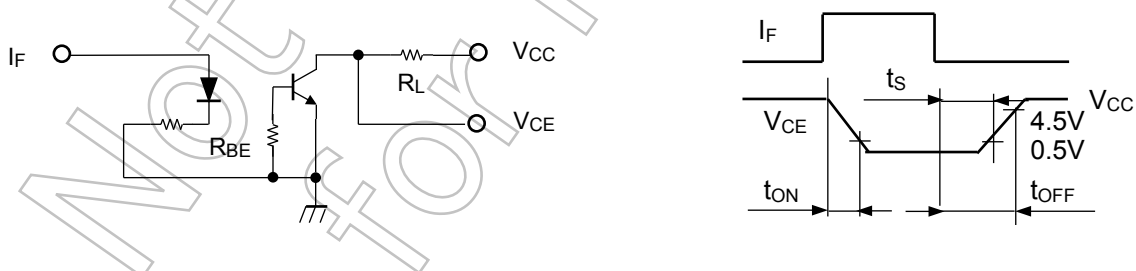
## Isolation Characteristics (Ta = 25°C)

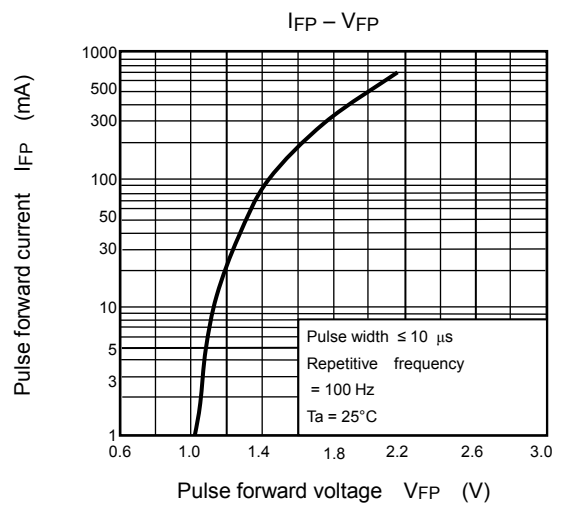
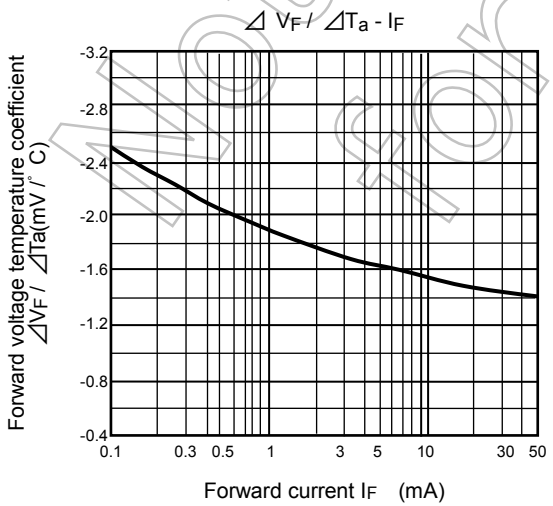
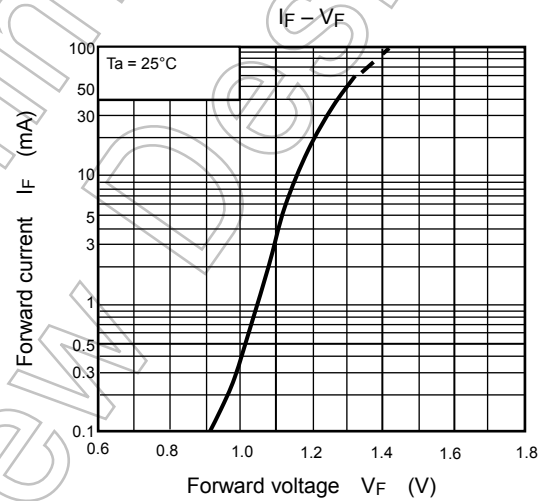
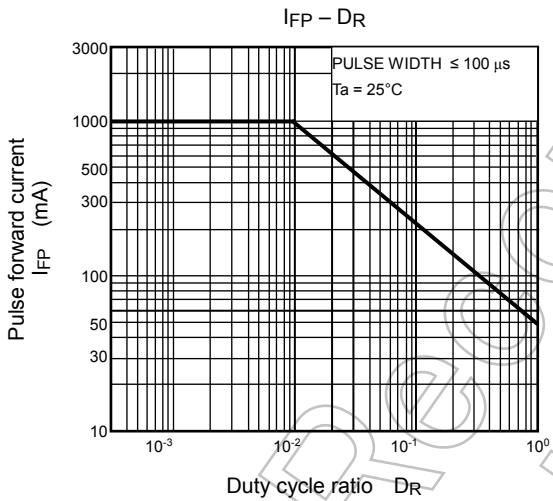
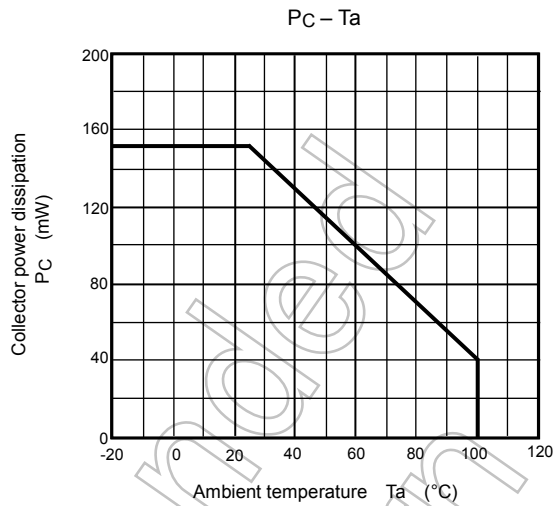
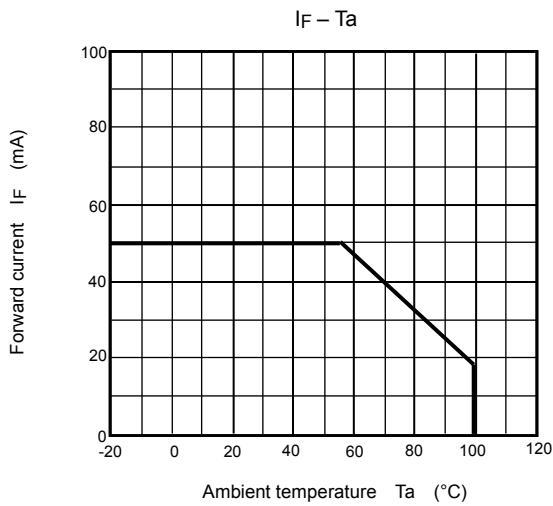
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Capacitance (input to output)	C <sub>S</sub>	V <sub>S</sub> = 0 V, f = 1 MHz	—	0.8	—	pF
Isolation resistance	R <sub>S</sub>	V = 500 V, RH ≤ 60 %	5×10 <sup>10</sup>	10 <sup>14</sup>	—	Ω
Isolation voltage	BV <sub>S</sub>	AC, 60 s	3750	—	—	V <sub>rms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

## Switching Characteristics (Ta = 25°C)

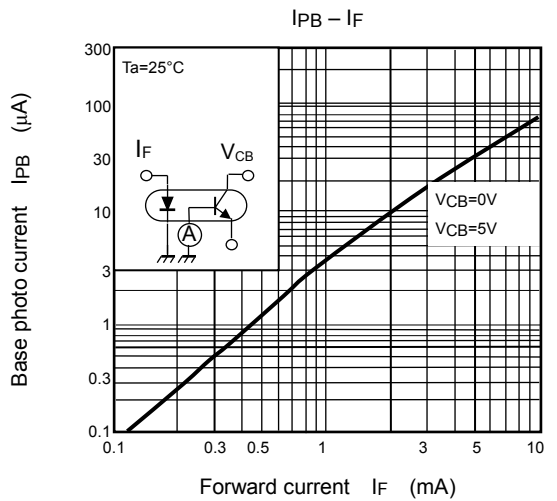
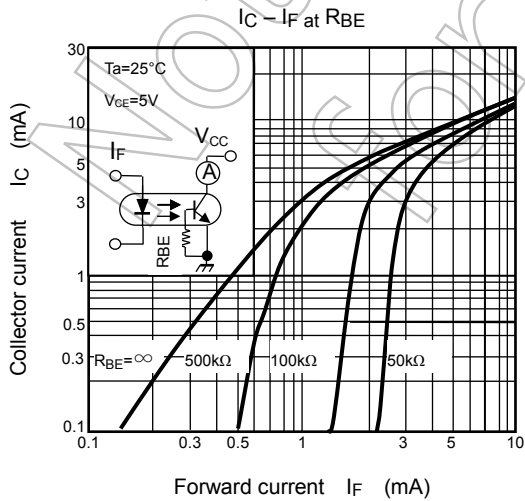
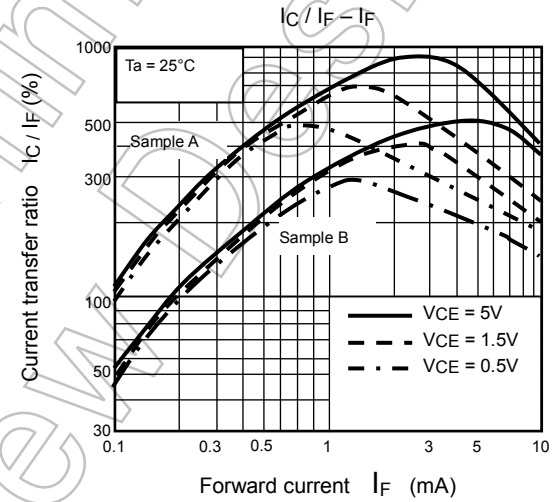
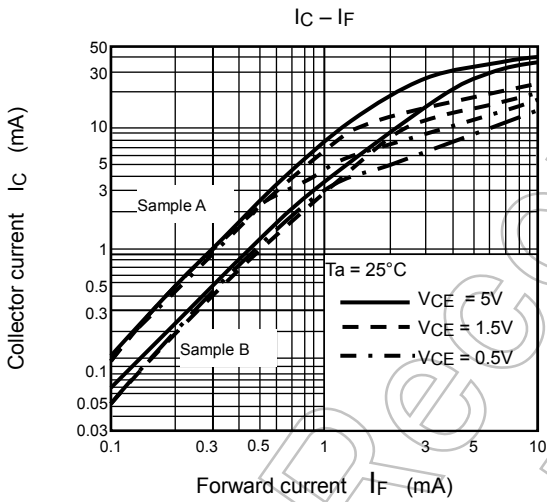
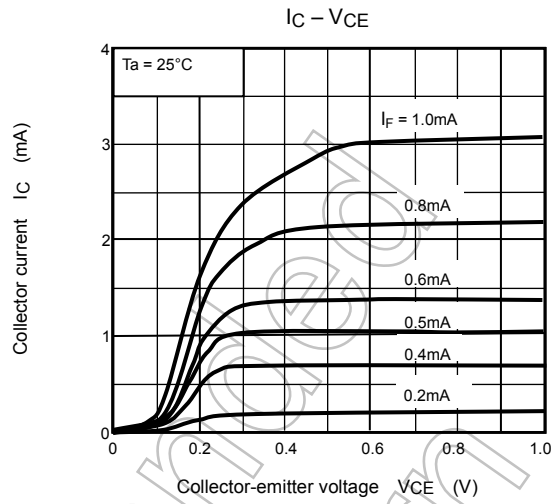
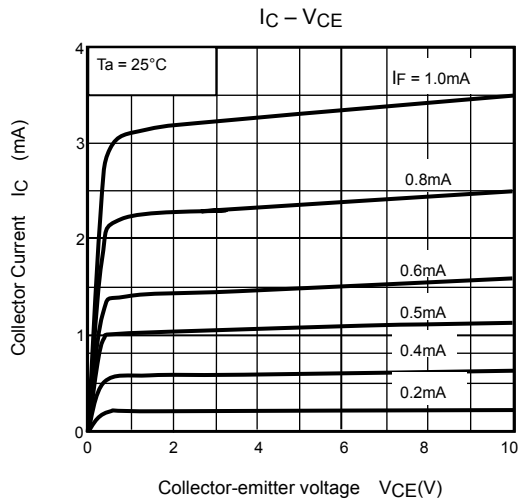
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Rise time	t <sub>r</sub>	V <sub>CC</sub> = 10 V, I <sub>C</sub> = 2 mA R <sub>L</sub> = 100 Ω	—	8	—	μs
Fall time	t <sub>f</sub>		—	8	—	
Turn-on time	t <sub>on</sub>		—	10	—	
Turn-off time	t <sub>off</sub>		—	8	—	
Turn-on time	t <sub>ON</sub>	R <sub>L</sub> = 4.7 kΩ (Fig.1)	—	10	—	μs
Storage time	t <sub>s</sub>	R <sub>BE</sub> = OPEN	—	50	—	
Turn-off time	t <sub>OFF</sub>	V <sub>CC</sub> = 5 V, I <sub>F</sub> = 1.6 mA	—	300	—	
Turn-on time	t <sub>ON</sub>	R <sub>L</sub> = 4.7 kΩ (Fig.1)	—	12	—	μs
Storage time	t <sub>s</sub>	R <sub>BE</sub> = 470 kΩ	—	30	—	
Turn-off time	t <sub>OFF</sub>	V <sub>CC</sub> = 5 V, I <sub>F</sub> = 1.6 mA	—	100	—	

Fig. 1 Switching time test circuit

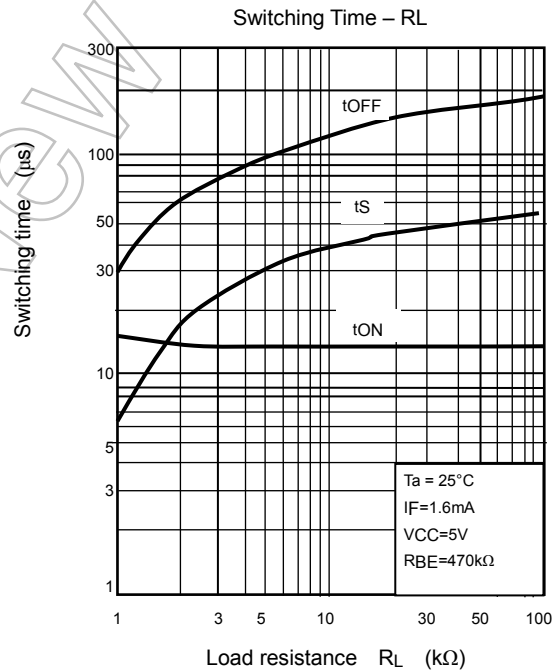
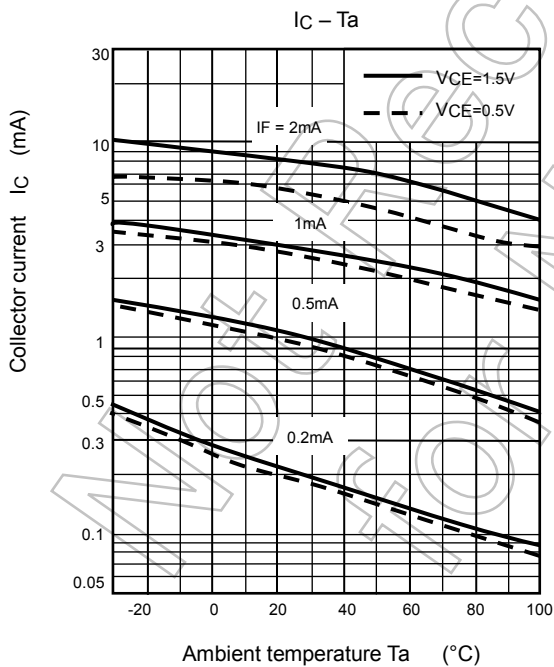
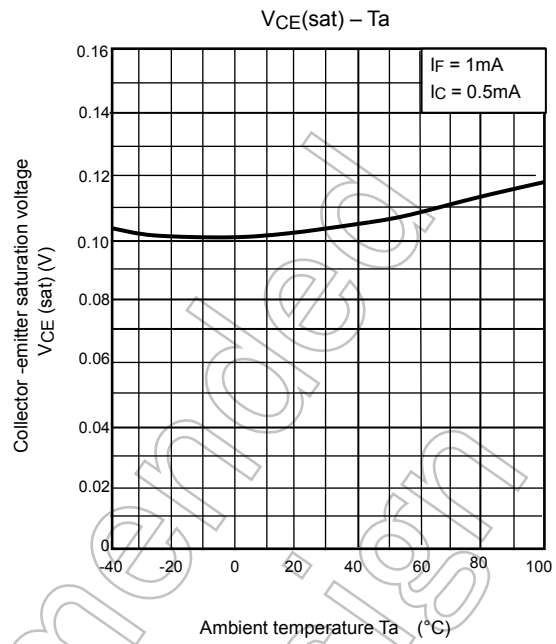
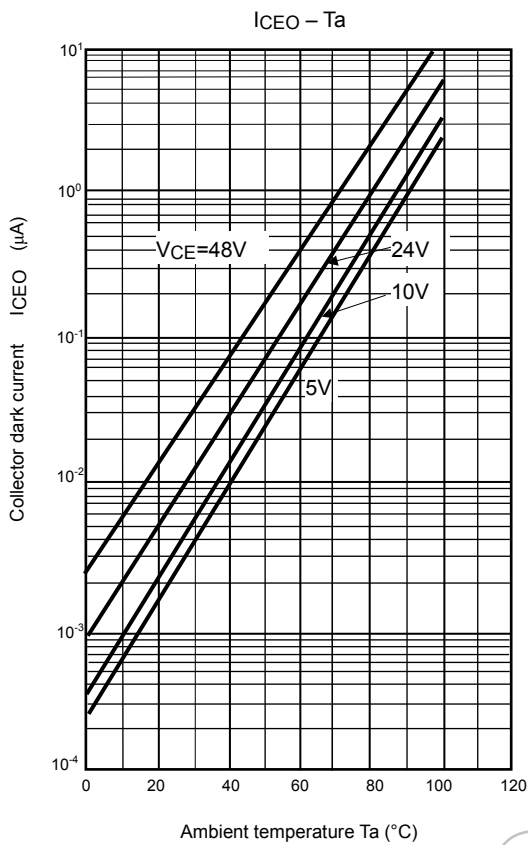




NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

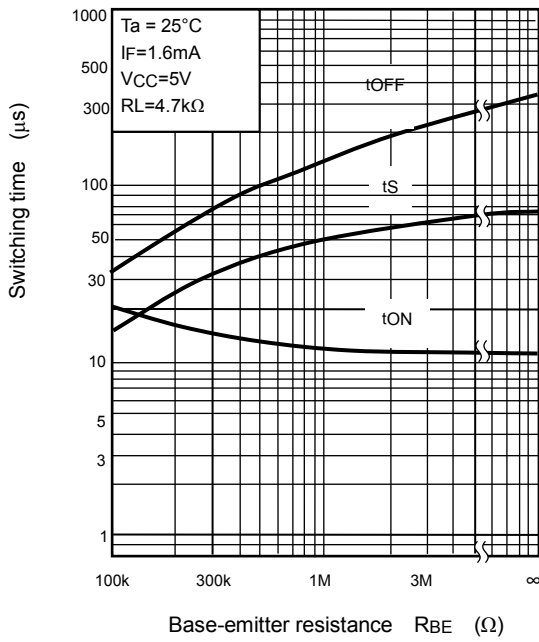


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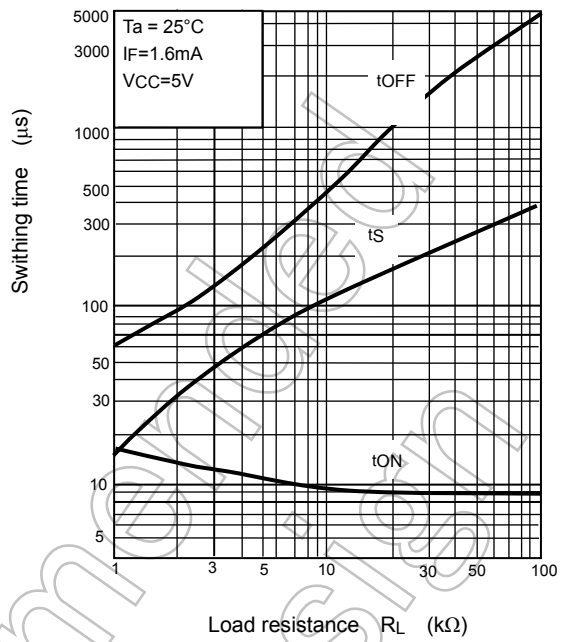


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Switching Time – RBE



Switching Time –  $R_L$



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Not Recommended for New Design



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