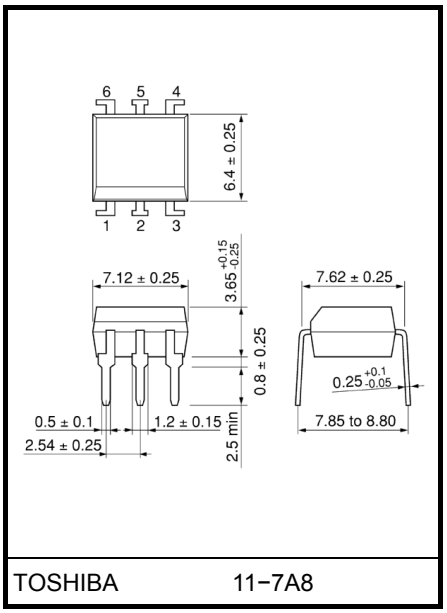
TOSHIBA Photocoupler GaAs Ired & Photo−Transistor

# TLP731, TLP732

Office Machine
Household Use Equipment
Solid State Relay
Switching Power Supply

Unit: mm




TOSHIBA 11−7A8

Weight: 0.35 g (typ.)

The TOSHIBA TLP731 and TLP732 consist of a photo−transistor optically coupled to a gallium arsenide infrared emitting diode in a six lead plastic DIP package.
TLP732 is no−base internal connection for high−EMI environments.

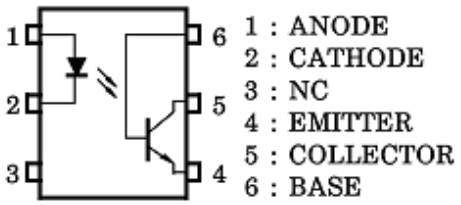
- Collector−emitter voltage: 55V (min)
- Current transfer ratio: 50% (min)
  Rank GB: 100% (min)
- UL recognized: UL1577, file No. E67349
- c-UL recognized: CSA Component Acceptance Service No. 5A
  File No.E67349
- BSI approved: BS EN60065: 2002
  Certificate No. 8877
  BS EN60950-1: 2002
  Certificate No. 8878
- Isolation voltage: 4000 $V_{rms}$ (min)
- Option (D4) type
  VDE approved: DIN EN 60747-5-2,
  Certificate No. 40009302
  Maximum operating insulation voltage: 630$V_{PK}$
  Highest permissible over voltage: 6000$V_{PK}$

**(Note) When a EN 60747-5-2 approved type is needed, please designate the "Option (D4)"**

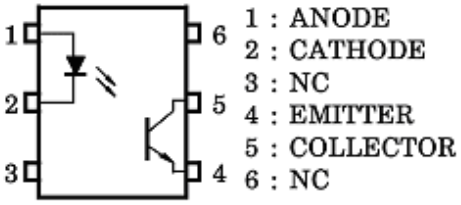
| | 7.62mm pich standard type | 10.16mm pich (LF2) type |
|---|---|---|
| • Creepage distance | : 7.0mm (min) | 8.0 mm (min) |
| Clearance | : 7.0 mm (min) | 8.0 mm (min) |
| Insulation thickness | : 0.5 mm (min) | 0.5 mm (min) |

## Pin Configurations (top view)

TLP731




TLP732




Start of commercial production
1985/02

## Absolute Maximum Ratings (Ta = 25°C)

| Characteristic | | Symbol | Rating | Unit |
|---|---|---|---|---|
| LED | Forward current | $I_F$ | 60 | mA |
| | Forward current derating (Ta ≥ 39°C) | $\Delta I_F$ / °C | −0.7 | mA / °C |
| | Peak forward current (100μs pulse, 100pps) | $I_{FP}$ | 1 | A |
| | Power dissipation | $P_D$ | 100 | mW |
| | Power dissipation derating (Ta ≥ 25°C) | $\Delta P_D$ / °C | −1.0 | mW / °C |
| | Reverse voltage | $V_R$ | 5 | V |
| | Junction temperature | $T_j$ | 125 | °C |
| Detector | Collector−emitter voltage | $V_{CEO}$ | 55 | V |
| | Collector−base voltage (TLP731) | $V_{CBO}$ | 80 | V |
| | Emitter−collector voltage | $V_{ECO}$ | 7 | V |
| | Emitter−base voltage (TLP731) | $V_{EBO}$ | 7 | V |
| | Collector current | $I_C$ | 50 | mA |
| | Power dissipation | $P_C$ | 150 | mW |
| | Power dissipation derating (Ta ≥ 25°C) | $\Delta P_C$ / °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 (10s) | | $T_{sol}$ | 260 | °C |
| Total package power dissipation | | $P_T$ | 250 | mW |
| Total package power dissipation derating (Ta ≥ 25°C) | | $\Delta P_T$ / °C | −2.5 | mW / °C |
| Isolation voltage (AC, 1minute, R.H. ≤ 60%) | | $BV_S$ | 4000 | $V_{rms}$ |

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).

## Recommended Operating Conditions

| Characteristic | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | — | 5 | 24 | V |
| Forward current | $I_F$ | — | 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.

## Individual 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 |
| | Reverse current | | $I_R$ | $V_R$ = 5V | — | — | 10 | μA |
| | Capacitance | | $C_T$ | V = 0, f = 1MHz | — | 30 | — | 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 | (TLP731) | $V_{(BR)CBO}$ | $I_C$ = 0.1mA | 80 | — | — | V |
| | Emitter−base breakdown voltage | (TLP731) | $V_{(BR)EBO}$ | $I_E$ = 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 | (TLP731) | $I_{CER}$ | $V_{CE}$ = 24V, Ta = 85°C<br>$R_{BE}$ = 1MΩ | — | 0.5 | 10 | μA |
| | Collector dark current | (TLP731) | $I_{CBO}$ | $V_{CB}$ = 10V | — | 0.1 | — | nA |
| | DC forward current gain | (TLP731) | $h_{FE}$ | $V_{CE}$ = 5V, $I_C$ = 0.5mA | — | 400 | — | — |
| | Capacitance collector to emitter | | $C_{CE}$ | V = 0, 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 | (TLP731) | $I_{PB}$ | $I_F$ = 5mA, $V_{CB}$ = 5V | | — | 10 | — | μA |
| Collector−emitter saturation voltage | | $V_{CE\ (sat)}$ | $I_C$ = 2.4mA, $I_F$ = 8mA | | — | — | 0.4 | V |
| | | | $I_C$ = 0.2mA, $I_F$ = 1mA | | — | 0.2 | — | |
| | | | | Rank GB | — | — | 0.4 | |

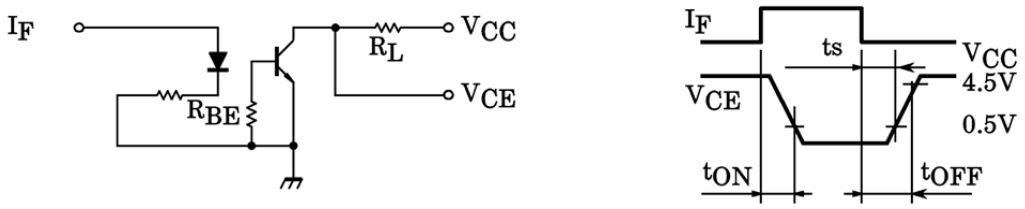
## Isolation Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Capacitance (input to output) | $C_S$ | $V_S$ = 0, f = 1MHz | — | 0.8 | — | pF |
| Isolation resistance | $R_S$ | $V_S$ = 500V, R.H.≦60% | $1\times10^{12}$ | $10^{14}$ | — | Ω |
| Isolation voltage | $BV_S$ | AC, 1 minute | 4000 | — | — | $V_{rms}$ |
| | | AC, 1 second, in oil | — | 10000 | — | |
| | | DC, 1 minute, in oil | — | 10000 | — | $V_{dc}$ |

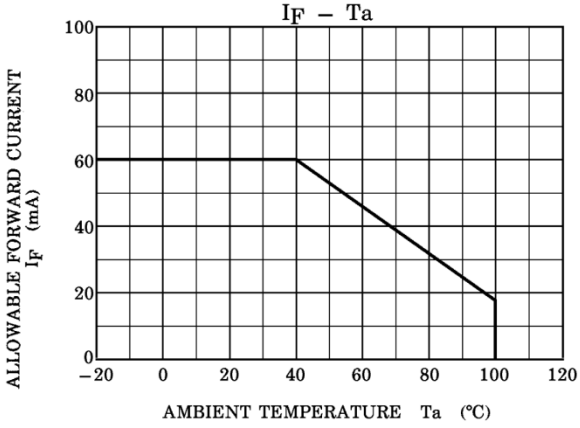
## Switching Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Rise time | $t_r$ | $V_{CC}$ = 10V, $I_C$ = 2mA<br>$R_L$ = 100Ω | — | 2 | — | μs |
| Fall time | $t_f$ | | — | 3 | — | |
| Turn−on time | $t_{on}$ | | — | 3 | 10 | |
| Turn−off time | $t_{off}$ | | — | 3 | 10 | |
| Turn−on time | $t_{ON}$ | $R_L$ = 1.9kΩ (Fig.1)<br>$R_{BE}$ = open<br>$V_{CC}$ = 5V, $I_F$ = 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)<br>$R_{BE}$ = 220kΩ (TLP731)<br>$V_{CC}$ = 5V, $I_F$ = 16mA | — | 2 | — | μs |
| Storage time | $t_s$ | | — | 12 | — | |
| Turn−off time | $t_{OFF}$ | | — | 20 | — | |

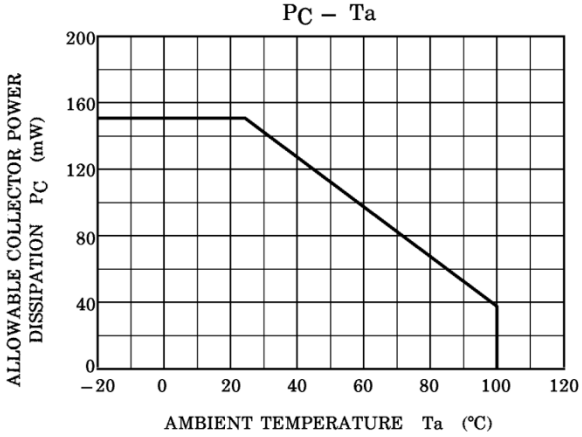
Fig. 1 Switching time test circuit



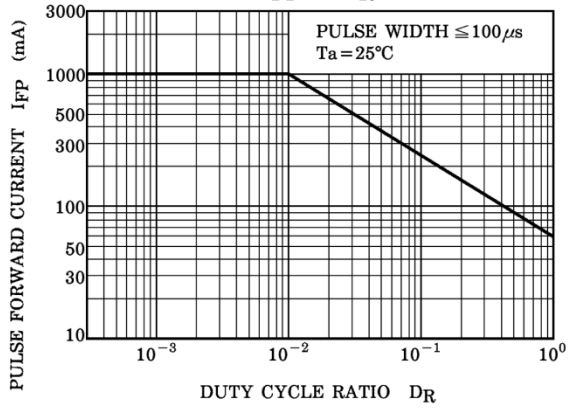
$I_F$ – Ta



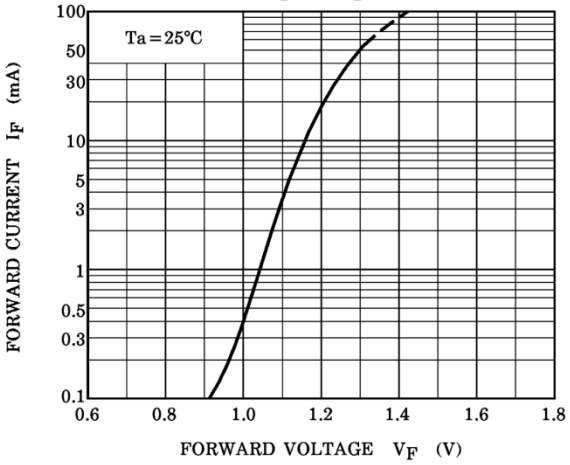

$P_C$ – Ta



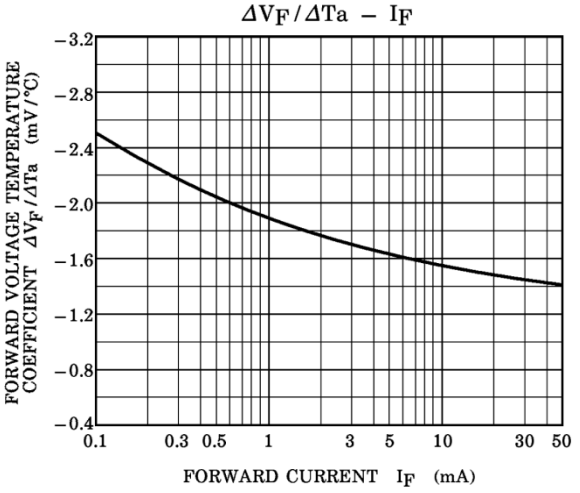

$I_{FP}$ – $D_R$



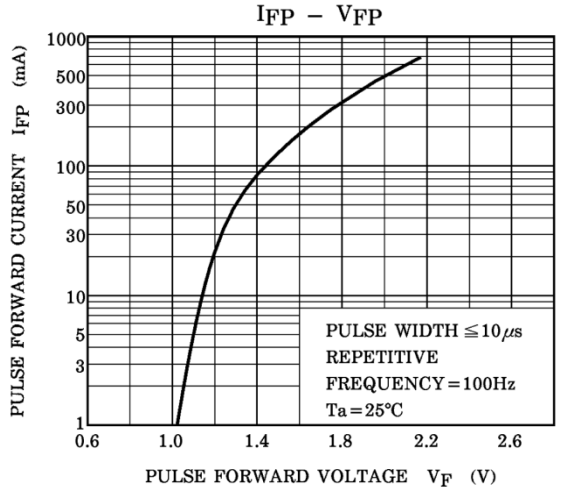

$I_F$ – $V_F$



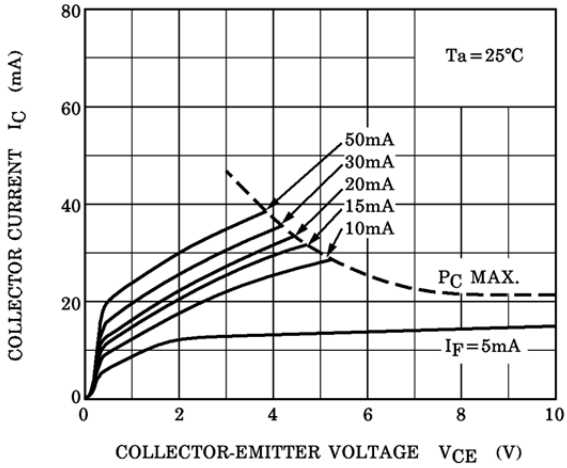

$\Delta V_F / \Delta Ta$ – $I_F$



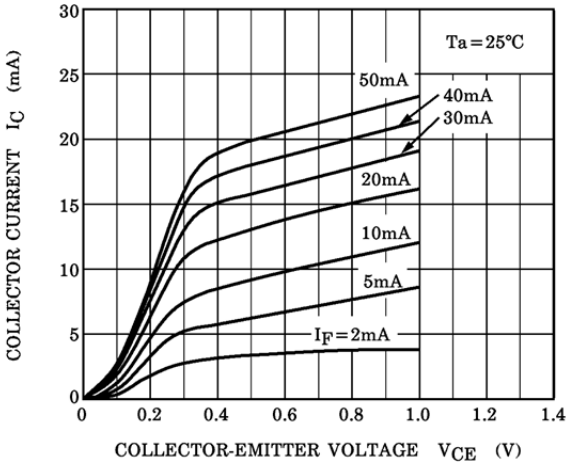

$I_{FP}$ – $V_{FP}$



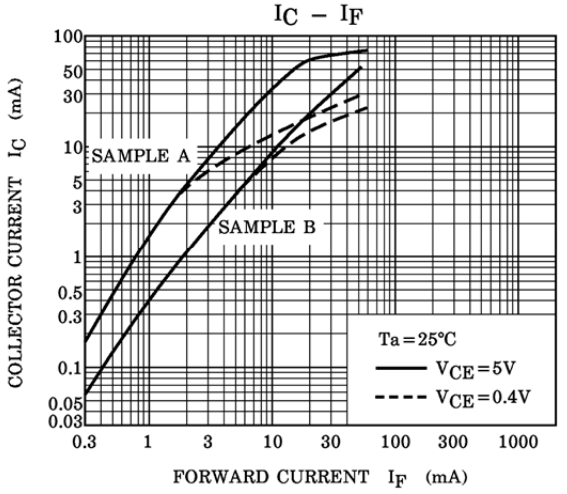
$I_C - V_{CE}$



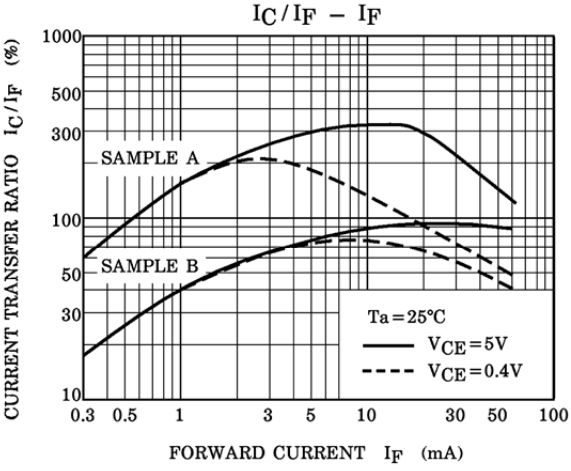

$I_C - V_{CE}$



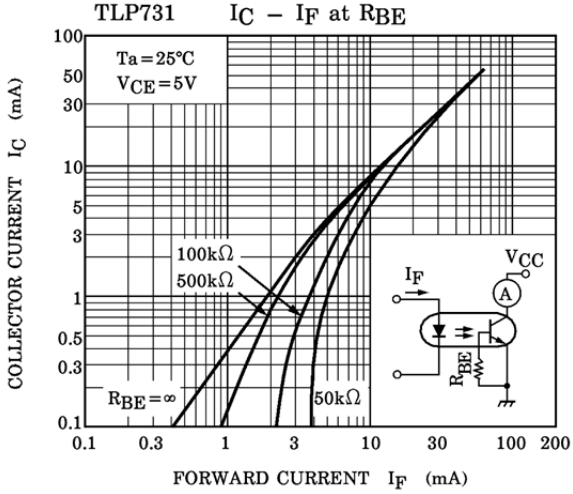

$I_C - I_F$



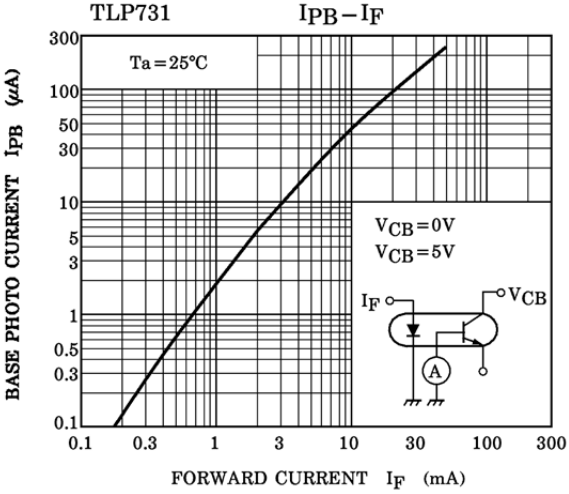

$I_C / I_F - I_F$



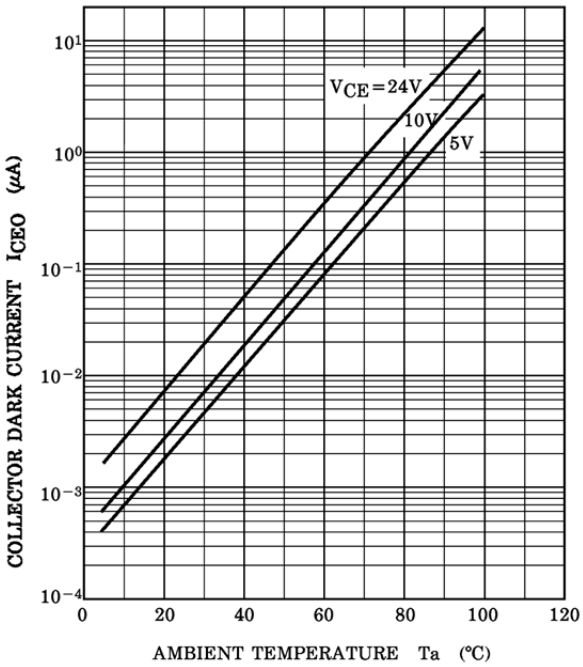

TLP731 $I_C - I_F$ at $R_{BE}$



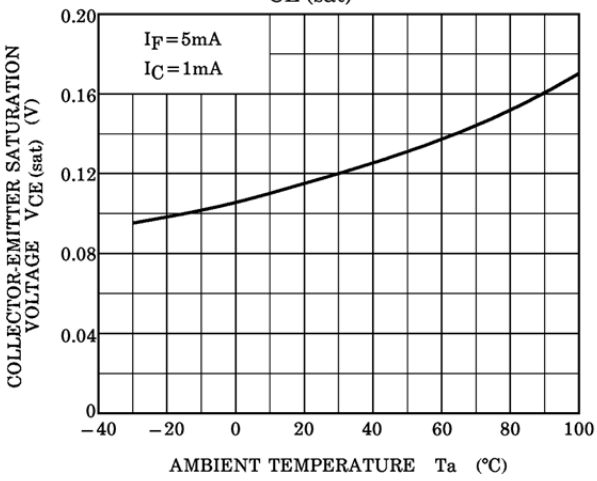

TLP731 $I_{PB} - I_F$



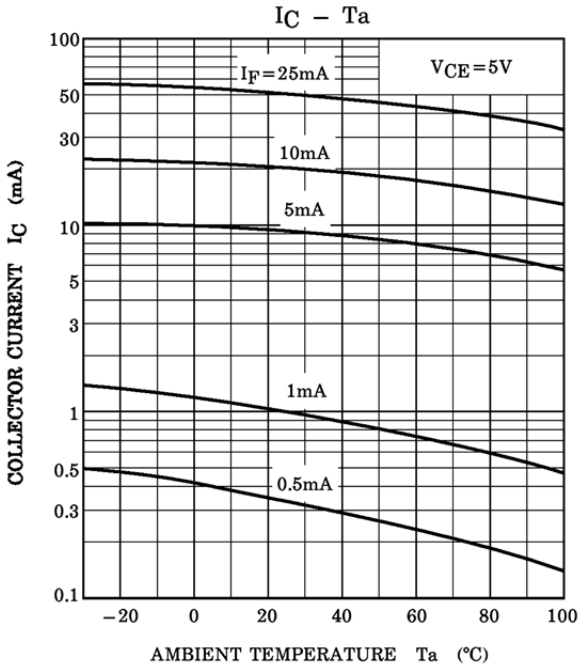
$I_{CEO}$ – Ta



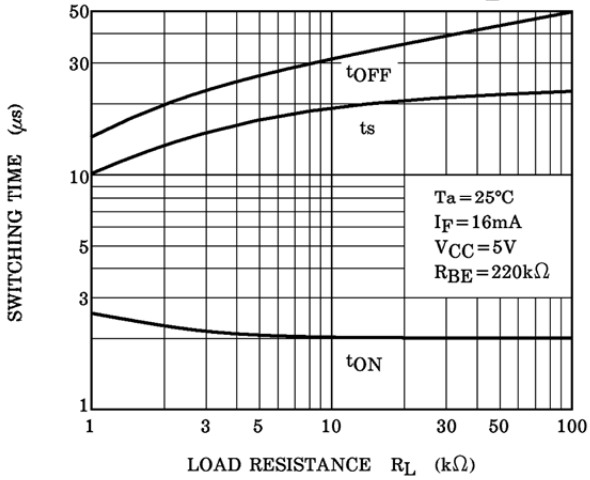

$V_{CE\,(sat)}$ – Ta



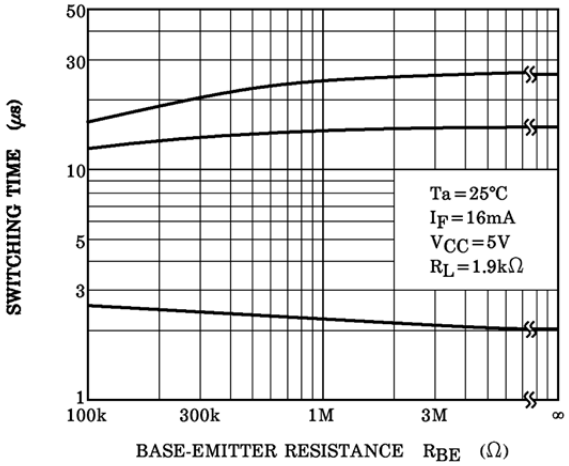

$I_C$ – Ta



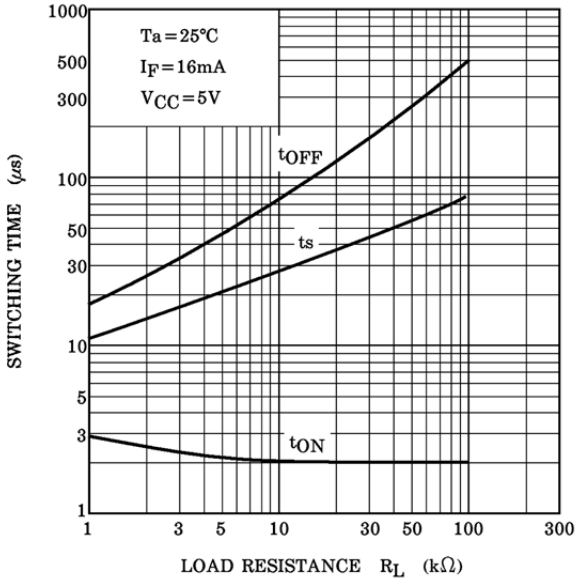

TLP731 SWITCHING TIME – $R_L$



TLP731 SWITCHING TIME – $R_{BE}$




SWITCHING TIME – $R_L$



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