

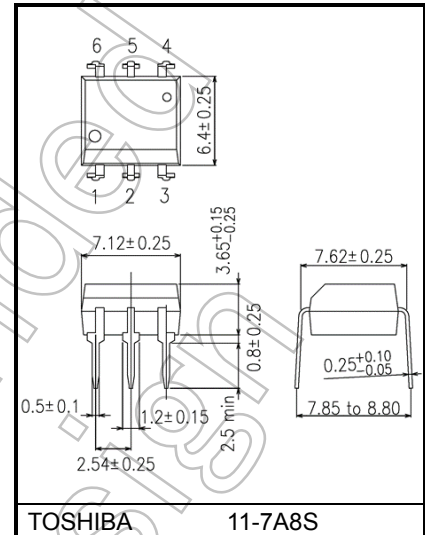
# TLP631, TLP632

Programmable Controllers  
AC/DC-Input Module  
Solid State Relay

The TOSHIBA TLP631 and TLP632 consist of a photo-transistor optically coupled to an infrared emitting diode in a six lead plastic DIP. TLP632 has no-base internal connection for high-EMI environments.

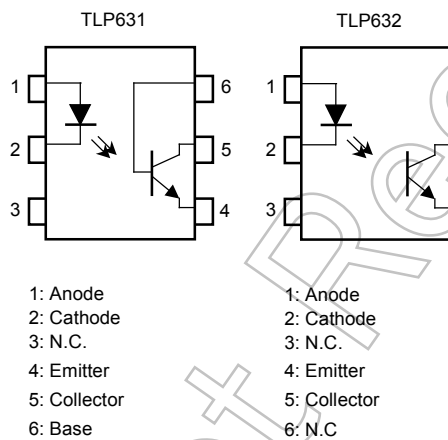
- Collector-emitter voltage: 55 V (min)
- Current transfer ratio: 50% (min)  
Rank GB: 100% (min)
- Isolation voltage: 5000 Vrms (min)
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A  
File No.E67349

Unit: mm



Weight: 0.4 g (typ.)

## Pin Configurations (top view)



Start of commercial production  
1983-05

## Current Transfer Ratio

| Classification<br>(Note 1) | Current Transfer Ratio (%)<br>(I <sub>C</sub> /I <sub>F</sub> )     |     | Marking Of Classification                                     |
|----------------------------|---------------------------------------------------------------------|-----|---------------------------------------------------------------|
|                            | I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V, T <sub>a</sub> = 25°C |     |                                                               |
|                            | Min                                                                 | Max |                                                               |
| Blank                      | 50                                                                  | 600 | Blank, Y <sup>■</sup> , YE, G, G <sup>■</sup> , GR, B, BL, GB |
| Rank Y                     | 50                                                                  | 150 | YE, Y <sup>■</sup>                                            |
| Rank GR                    | 100                                                                 | 300 | GR, G, G <sup>■</sup>                                         |
| Rank BL                    | 200                                                                 | 600 | BL, B                                                         |
| Rank GB                    | 100                                                                 | 600 | GB, GR, G, G <sup>■</sup> , BL, B                             |
| Rank YH                    | 75                                                                  | 150 | Y <sup>■</sup>                                                |
| Rank GRL                   | 100                                                                 | 200 | G                                                             |
| Rank GRH                   | 150                                                                 | 300 | G <sup>■</sup>                                                |
| Rank BLL                   | 200                                                                 | 400 | B                                                             |

Note 1: Ex, rank GB: TLP631 (GB)

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

TLP631 (GB): TLP631

TLP632 (GB): TLP632

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

| Characteristic                                       |                                               | Symbol              | Rating     | Unit             |
|------------------------------------------------------|-----------------------------------------------|---------------------|------------|------------------|
| LED                                                  | Forward current                               | I <sub>F</sub>      | 60         | mA               |
|                                                      | Forward current derating (Ta ≥ 39°C)          | ΔI <sub>F</sub> /°C | -0.7       | mA/°C            |
|                                                      | Peak forward current (100 μs pulse, 100 pps)  | I <sub>FP</sub>     | 1          | A                |
|                                                      | Reverse voltage                               | V <sub>R</sub>      | 5          | V                |
|                                                      | Diode power dissipation                       | P <sub>D</sub>      | 70         | mW               |
|                                                      | Diode power dissipation derating (Ta ≥ 39 °C) | ΔP <sub>D</sub> /°C | -0.82      | mW/°C            |
| Detector                                             | Collector-emitter voltage                     | V <sub>CEO</sub>    | 55         | V                |
|                                                      | Collector-base voltage (TLP631)               | V <sub>CBO</sub>    | 80         | V                |
|                                                      | Emitter-collector voltage                     | V <sub>ECO</sub>    | 7          | V                |
|                                                      | Emitter-base voltage (TLP631)                 | V <sub>EBO</sub>    | 7          | V                |
|                                                      | Collector current                             | I <sub>C</sub>      | 50         | mA               |
|                                                      | Power dissipation                             | P <sub>C</sub>      | 150        | mW               |
|                                                      | Power dissipation derating (Ta ≥ 25°C)        | ΔP <sub>C</sub> /°C | -1.5       | mW/°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>      | 250        | mW               |
| Total package power dissipation derating (Ta ≥ 25°C) |                                               | ΔP <sub>T</sub> /°C | -2.5       | mW/°C            |
| Isolation voltage (AC, 60 s, R.H. ≤ 60 %) (Note 1)   |                                               | BV <sub>S</sub>     | 5000       | 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: LED side pins Shorted together and DETECTOR side pins shorted together.

### Recommended Operating Conditions

| Characteristic        | Symbol           | Min | Typ. | Max | Unit |
|-----------------------|------------------|-----|------|-----|------|
| Supply voltage        | V <sub>CC</sub>  | —   | 5    | 24  | V    |
| Forward current       | I <sub>F</sub>   | —   | 16   | 25  | mA   |
| Collector current     | I <sub>C</sub>   | —   | 1    | 10  | mA   |
| Operating temperature | T <sub>opr</sub> | -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                           | $V_F$         | $I_F = 10 \text{ mA}$                           | 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       | $V_{(BR)CEO}$ | $I_C = 0.5 \text{ mA}$                          | 55  | —    | —   | V             |
|                | Emitter-collector breakdown voltage       | $V_{(BR)ECO}$ | $I_E = 0.1 \text{ mA}$                          | 7   | —    | —   | V             |
|                | Collector-base breakdown voltage (TLP631) | $V_{(BR)CBO}$ | $I_C = 0.1 \text{ mA}$                          | 80  | —    | —   | V             |
|                | Emitter-base breakdown voltage (TLP631)   | $V_{(BR)EBO}$ | $I_E = 0.1 \text{ mA}$                          | 7   | —    | —   | V             |
|                | Collector dark current                    | $I_{CEO}$     | $V_{CE} = 24 \text{ V}$                         | —   | 10   | 100 | nA            |
|                |                                           |               | $V_{CE} = 24 \text{ V}, T_a = 85^\circ\text{C}$ | —   | 2    | 50  | $\mu\text{A}$ |
|                | Capacitance collector to emitter          | $C_{CE}$      | $V = 0 \text{ V}, f = 1 \text{ MHz}$            | —   | 10   | —   | pF            |

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

| Characteristic                       | Symbol                | Test Condition                               | Min | Typ. | Max | Unit |
|--------------------------------------|-----------------------|----------------------------------------------|-----|------|-----|------|
| Current transfer ratio               | $I_C/I_F$             | $I_F = 5 \text{ mA}, V_{CE} = 5 \text{ V}$   | 50  | —    | 600 | %    |
|                                      |                       | Rank GB                                      | 100 | —    | 600 |      |
| Saturated CTR                        | $I_C/I_F(\text{sat})$ | $I_F = 1 \text{ mA}, V_{CE} = 0.4 \text{ V}$ | —   | 60   | —   | %    |
|                                      |                       | Rank GB                                      | 30  | —    | —   |      |
| Collector-emitter saturation voltage | $V_{CE(\text{sat})}$  | $I_C = 2.4 \text{ mA}, I_F = 8 \text{ mA}$   | —   | —    | 0.4 | V    |

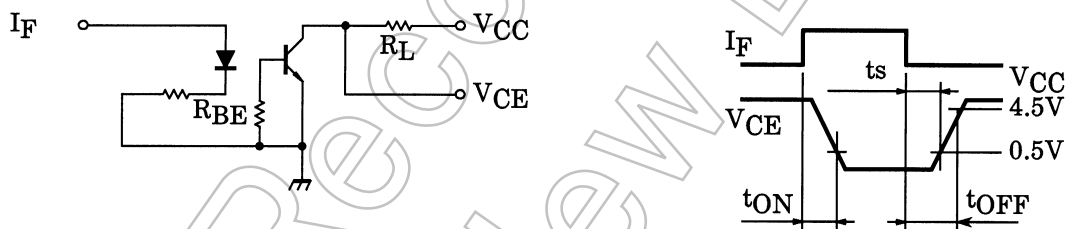
## Isolation Characteristics (Ta = 25°C)

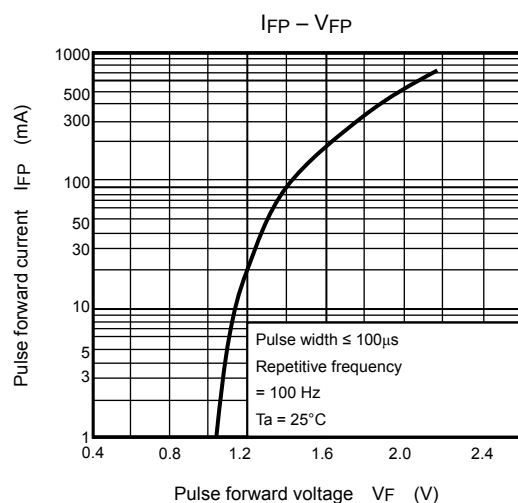
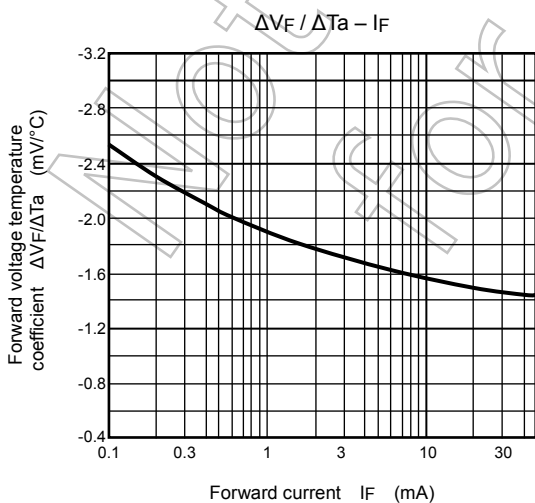
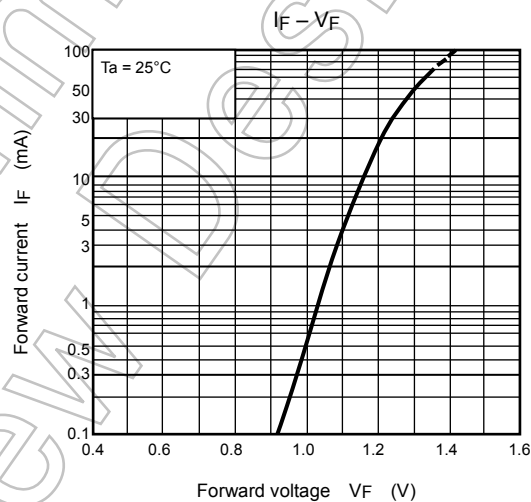
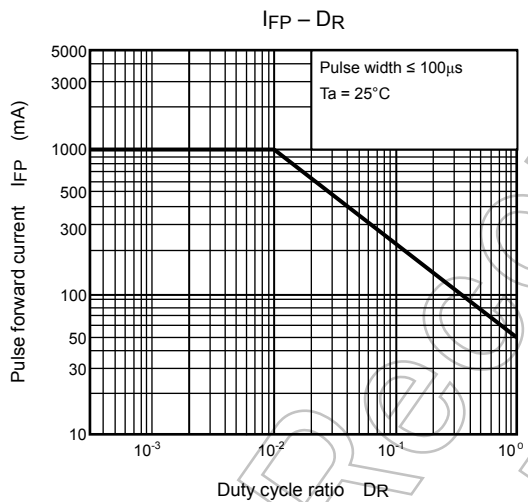
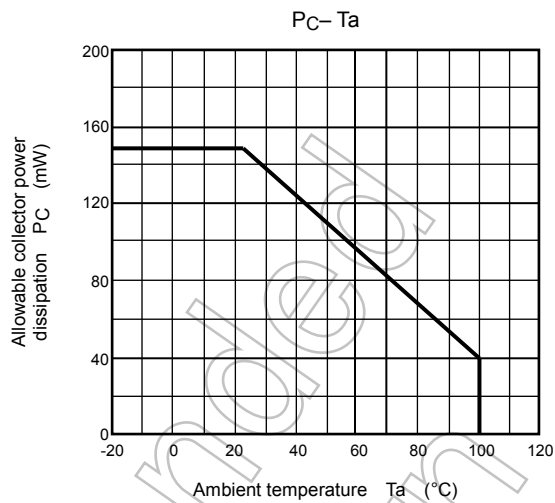
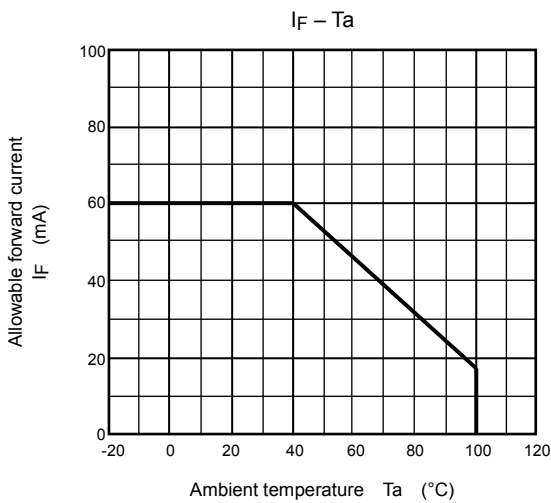
| Characteristic                | Symbol          | Test Condition                      | Min                | Typ.             | Max | Unit             |
|-------------------------------|-----------------|-------------------------------------|--------------------|------------------|-----|------------------|
| 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 <sub>S</sub> = 500 V, R.H. ≤ 60 % | 5×10 <sup>10</sup> | 10 <sup>14</sup> | —   | Ω                |
| Isolation voltage             | BV <sub>S</sub> | AC, 60 s                            | 5000               | —                | —   | V <sub>rms</sub> |

## Switching Characteristics (Ta = 25°C)

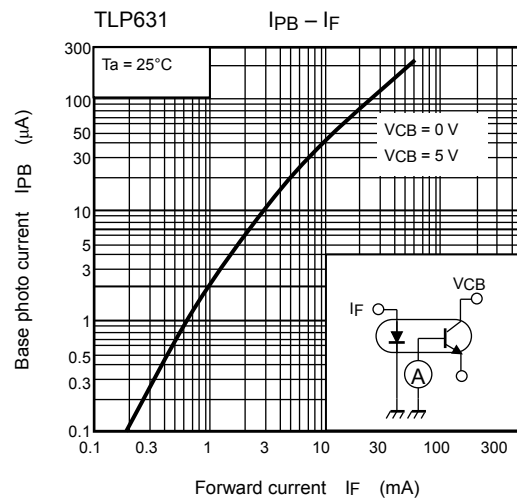
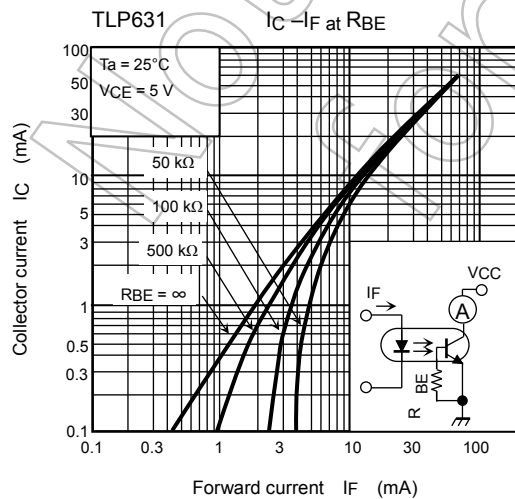
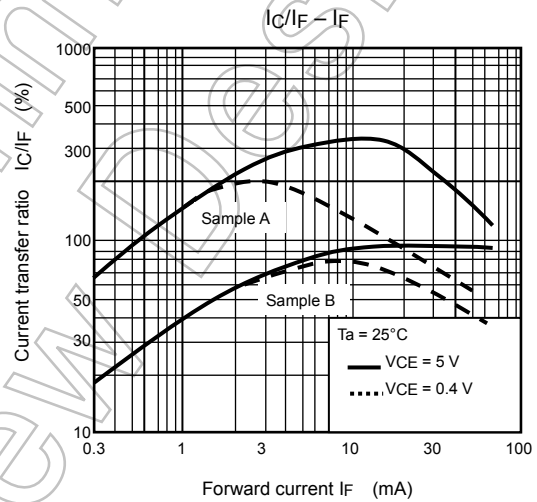
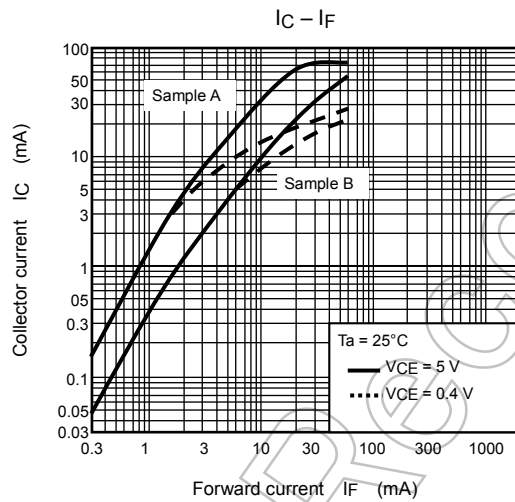
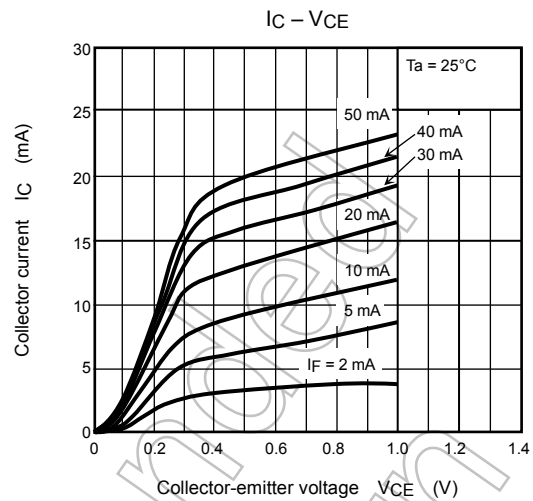
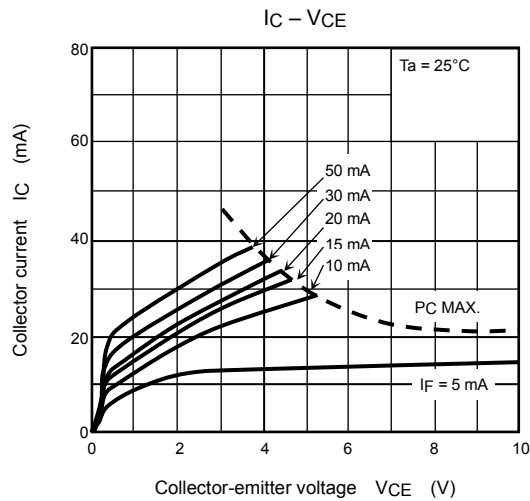
| Characteristic | Symbol           | Test Condition                                                                                                        | Min | Typ. | Max | Unit |
|----------------|------------------|-----------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| Rise time      | t <sub>r</sub>   | V <sub>CC</sub> = 10 V, I <sub>C</sub> = 2 mA<br>R <sub>L</sub> = 100 Ω                                               | —   | 2    | —   | μs   |
| Fall time      | t <sub>f</sub>   |                                                                                                                       | —   | 3    | —   |      |
| Turn-on time   | t <sub>on</sub>  |                                                                                                                       | —   | 3    | —   |      |
| Turn-off time  | t <sub>off</sub> |                                                                                                                       | —   | 3    | —   |      |
| Turn-on time   | t <sub>ON</sub>  | R <sub>L</sub> = 1.9 kΩ (Fig.1)<br>R <sub>BE</sub> = OPEN<br>V <sub>CC</sub> = 5 V, I <sub>F</sub> = 16 mA            | —   | 2    | —   | μs   |
| Storage time   | t <sub>s</sub>   |                                                                                                                       | —   | 15   | —   |      |
| Turn-off time  | t <sub>OFF</sub> |                                                                                                                       | —   | 25   | —   |      |
| Turn-on time   | t <sub>ON</sub>  | R <sub>L</sub> = 1.9 kΩ (Fig.1)<br>R <sub>BE</sub> = 220 kΩ (TLP631)<br>V <sub>CC</sub> = 5 V, I <sub>F</sub> = 16 mA | —   | 2    | —   | μs   |
| Storage time   | t <sub>s</sub>   |                                                                                                                       | —   | 12   | —   |      |
| Turn-off time  | t <sub>OFF</sub> |                                                                                                                       | —   | 20   | —   |      |

Fig. 1 Switching time test circuit

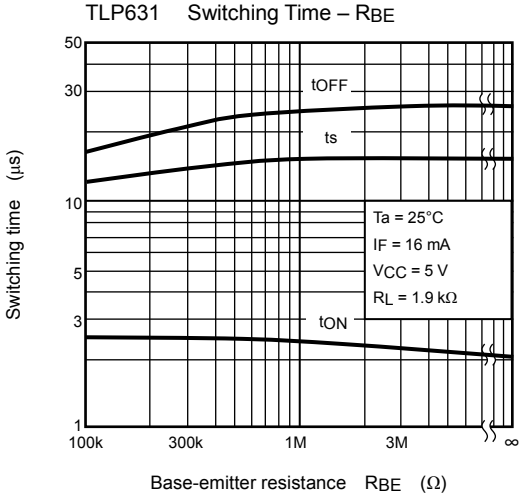
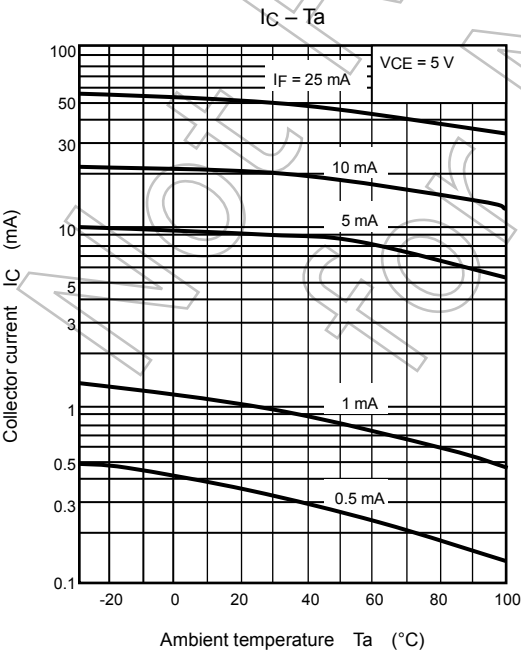
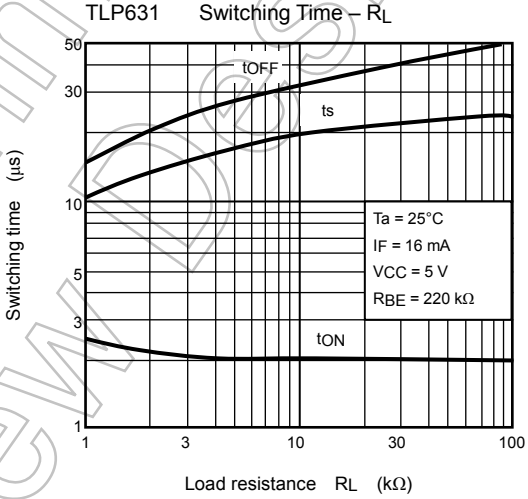
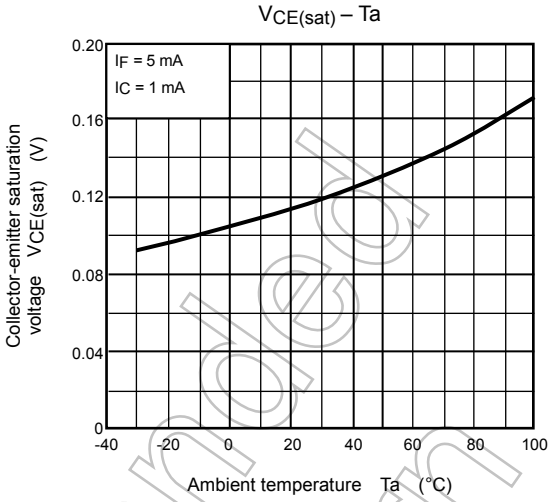
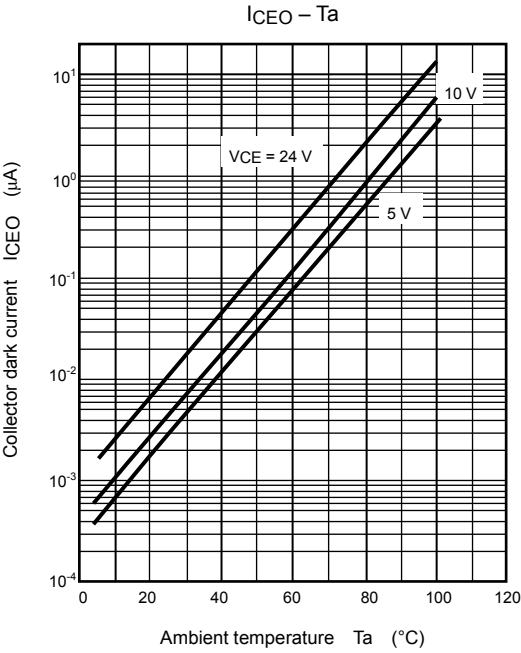




NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



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