

# TLP280, TLP280-4

Programmable Controllers  
 AC/DC-Input Module  
 PC Card Modem (PCMCIA)

TLP280 and TLP280-4 is a very small and thin coupler, suitable for surface mount assembly in applications such as PCMCIA fax modem, programmable controllers.

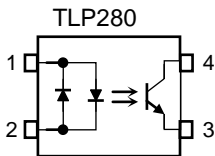
TLP280 and TLP280-4 consist of photo transistor, optically coupled to two gallium arsenide infrared emitting diodes connected inverse parallel, and can operate directly by AC input current.

- Collector-emitter voltage: 80 V (min)
- Current transfer ratio: 50% (min)  
 Rank GB: 100% (min)
- Isolation voltage: 2500 Vrms (min)
- UL recognized: UL1577, file No. E67349
- cUL approved: CSA Component Acceptance Service No. 5A  
 File No.E67349

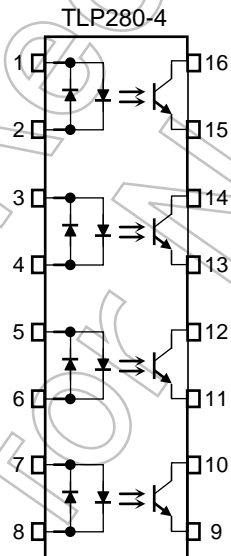
- Option (V4) type  
 VDE approved: EN60747-5-5

Note: When a EN60747-5-5 approved type is needed,  
 Please designate "Option(V4)"

### Pin Configuration (top view)

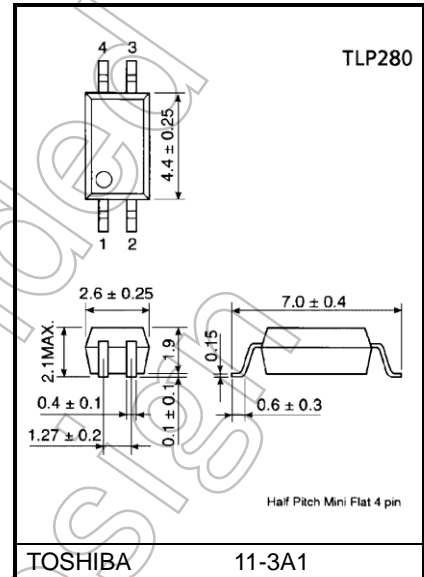


- 1 : Anode
- 2 : Cathode
- 3 : Emitter
- 4 : Collector



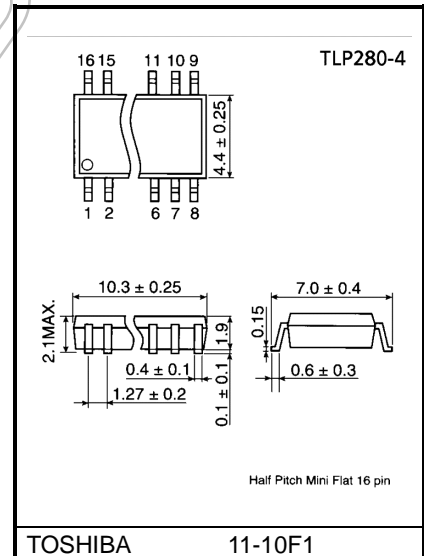
- 1,3,5,7 : Anode-Cathode
- 2,4,6,8 : Cathode-Anode
- 9,11,13,15 : Emitter
- 10,12,14,16 : Collector

Unit: mm



Weight: 0.05 g (typ.)

Unit: mm



Weight: 0.19 g (typ.)

Start of commercial production  
 1996-03

## Current Transfer Ratio

| Part Number | Classification<br>(Note 1) | Current Transfer Ratio (%)<br>( $I_C / I_F$ )                      |     | Marking of<br>Classification |
|-------------|----------------------------|--|-----|------------------------------|
|             |                            | $I_F = 5 \text{ mA}, V_{CE} = 5 \text{ V}, T_a = 25^\circ\text{C}$ |     |                              |
|             |                            | min  | max |                              |
| TLP280      | Blank                      | 50   | 600 | Blank, YE, GR, BL, GB        |
|             | Rank Y                     | 50   | 150 | YE                           |
|             | Rank GR                    | 100  | 300 | GR                           |
|             | Rank BL                    | 200  | 600 | BL                           |
|             | Rank GB                    | 100  | 600 | GB, GR, BL                   |
| TLP280-4    | Blank                      | 50   | 600 | Blank, GB                    |
|             | Rank GB                    | 100  | 600 | GB                           |

Note : For the supply status of TLP280 rank Y and BL products, please contact with our sales representative.

Note 1: When ordering product, please specify both the part number and the classification, e.g. TLP280(GB).

Note: Application type name for certification test, please use standard product type name, i.e.  
TLP280(GB): TLP280, TLP280-4(GB): TLP280-4.

## Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

| Characteristic   |  | Symbol                      | Rating     |          | Unit                 |
|--|--|-----------------------------|------------|----------|----------------------|
|  |  |                             | TLP280     | TLP280-4 |                      |
| LED  | Forward current  | $I_F(\text{RMS})$           | $\pm 50$   |          | mA                   |
|  | Forward current derating ( $T_a \geq 25^\circ\text{C}$ )                         | $\Delta I_F/^\circ\text{C}$ | -0.7       | -0.5     | mA/ $^\circ\text{C}$ |
|  | Pulse forward current (100 $\mu\text{s}$ pulse, 100 pps)                         | $I_{FP}$                    | $\pm 1$    |          | A                    |
|  | Diode power dissipation  | $P_D$                       | 100        | 70       | mW                   |
|  | Diode power dissipation derating ( $T_a \geq 25^\circ\text{C}$ )                 | $\Delta P_D/^\circ\text{C}$ | -1         | -0.7     | mW/ $^\circ\text{C}$ |
|  | Junction temperature   | $T_j$                       | 125        |          | $^\circ\text{C}$     |
| Detector   | Collector-emitter voltage  | $V_{CEO}$                   | 80         |          | V                    |
|  | Emitter-collector voltage  | $V_{ECO}$                   | 7          |          | V                    |
|  | Collector current  | $I_C$                       | 50         |          | mA                   |
|  | Collector power dissipation (1 circuit)  | $P_C$                       | 150        | 100      | mW                   |
|  | Collector power dissipation derating ( $T_a \geq 25^\circ\text{C}$ ) (1 circuit) | $\Delta P_C/^\circ\text{C}$ | -1.5       | -1.0     | mW/ $^\circ\text{C}$ |
|  | Junction temperature   | $T_j$                       | 125        |          | $^\circ\text{C}$     |
| Storage temperature range  |  | $T_{stg}$                   | -55 to 125 |          | $^\circ\text{C}$     |
| Operating temperature range  |  | $T_{opr}$                   | -55 to 100 |          | $^\circ\text{C}$     |
| Lead soldering temperature (10 s)  |  | $T_{sol}$                   | 260        |          | $^\circ\text{C}$     |
| Total package power dissipation (1 circuit)  |  | $P_T$                       | 200        | 170      | mW                   |
| Total package power dissipation derating ( $T_a \geq 25^\circ\text{C}$ ) (1 circuit) |  | $\Delta P_T/^\circ\text{C}$ | -2.0       | -1.7     | mW/ $^\circ\text{C}$ |
| Isolation voltage (AC, 60 s, R.H. $\leq 60\%$ ) (Note 1)                             |  | $BV_S$                      | 2500       |          | 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.

## Electrical Characteristics (Ta = 25°C)

| Characteristic                     |                                     | Symbol               | Test Condition                    | Min | Typ  | Max | Unit |
|------------------------------------|-------------------------------------|----------------------|-----------------------------------|-----|------|-----|------|
| LED                                | Forward voltage                     | V <sub>F</sub>       | I <sub>F</sub> = ±10 mA           | 1.0 | 1.15 | 1.3 | V    |
|                                    | Capacitance                         | C <sub>T</sub>       | V = 0 V, f = 1 MHz                | —   | 60   | —   | pF   |
| Detector                           | Collector-emitter breakdown voltage | V <sub>(BR)CEO</sub> | I <sub>C</sub> = 0.5 mA           | 80  | —    | —   | V    |
|                                    | Emitter-collector breakdown voltage | V <sub>(BR)ECO</sub> | I <sub>E</sub> = 0.1 mA           | 7   | —    | —   | V    |
|                                    | Collector dark current (Note 1)     | I <sub>CEO</sub>     | V <sub>CE</sub> = 48 V            | —   | 0.01 | 0.1 | μA   |
|                                    |                                     |                      | Ambient light below (100 lx)      | —   | 2    | 10  |      |
|                                    |                                     |                      | V <sub>CE</sub> = 48 V, Ta = 85°C | —   | 2    | 50  | μA   |
| Ambient light below (100 lx)       | —                                   | 4                    | 50                                |     |      |     |      |
| Capacitance (collector to emitter) | C <sub>CE</sub>                     | V = 0 V, f = 1 MHz   | —                                 | 10  | —    | pF  |      |

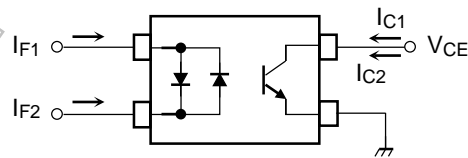
Note 1: Because of the construction, leak current might be increased by ambient light. Please use photocoupler with less ambient light.

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

| Characteristic                       | Symbol                              | Test Condition   | Min  | Typ | Max | Unit |
|--------------------------------------|-------------------------------------|--|------|-----|-----|------|
| Current transfer ratio               | I <sub>C</sub> /I <sub>F</sub>      | I <sub>F</sub> = ±5 mA, V <sub>CE</sub> = 5 V  | 50   | —   | 600 | %    |
|                                      |                                     | Rank GB  | 100  | —   | 600 |      |
| Saturated CTR                        | I <sub>C</sub> /I <sub>F(sat)</sub> | I <sub>F</sub> = ±1 mA, V <sub>CE</sub> = 0.4 V  | —    | 60  | —   | %    |
|                                      |                                     | Rank GB  | 30   | —   | —   |      |
| Collector-emitter saturation voltage | V <sub>CE(sat)</sub>                | I <sub>C</sub> = 2.4 mA, I <sub>F</sub> = ±8 mA  | —    | —   | 0.4 | V    |
|                                      |                                     | I <sub>C</sub> = 0.2 mA, I <sub>F</sub> = ±1 mA  | —    | 0.2 | —   |      |
|                                      |                                     | Rank GB  | —    | —   | 0.4 |      |
| Off-state collector current          | I <sub>C(off)</sub>                 | V <sub>F</sub> = ±0.7 V, V <sub>CE</sub> = 48 V  | —    | —   | 10  | μA   |
| CTR symmetry                         | I <sub>C(ratio)</sub>               | I <sub>C</sub> (I <sub>F</sub> = -5 mA) / I <sub>C</sub> (I <sub>F</sub> = 5 mA)<br>(Note 1) | 0.33 | —   | 3   | —    |

Note 1:

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



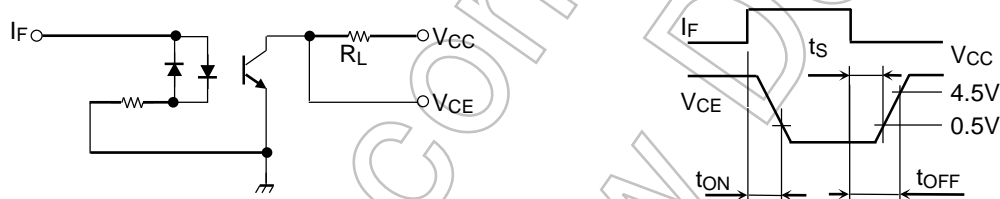
**Isolation Characteristics (Ta = 25°C)**

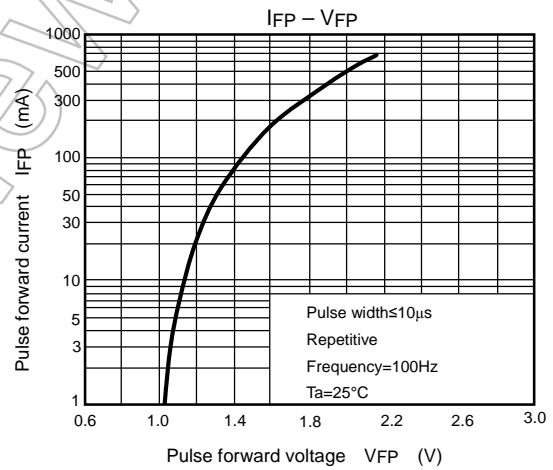
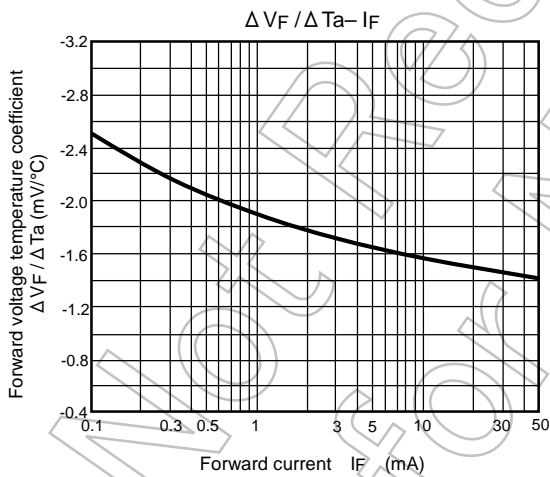
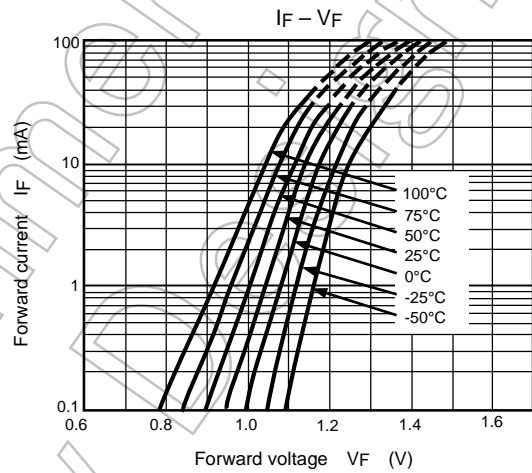
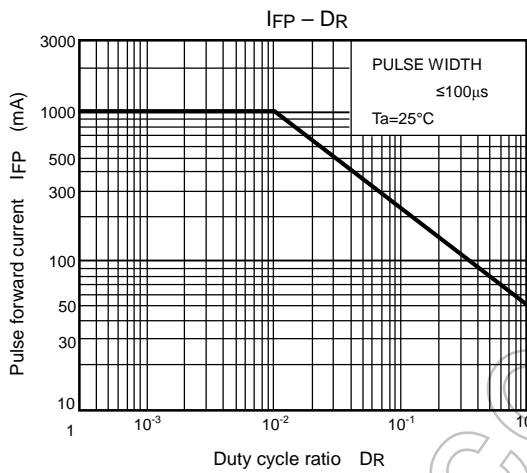
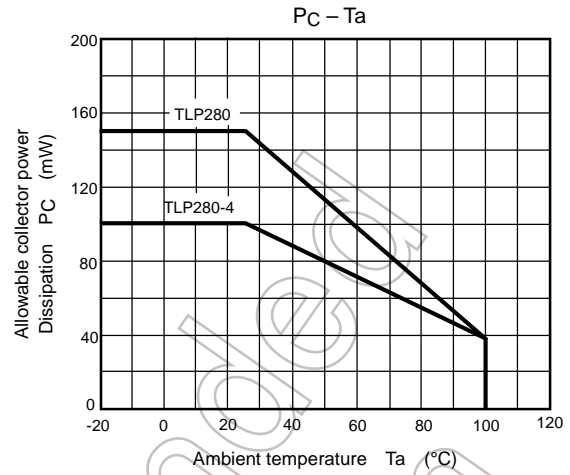
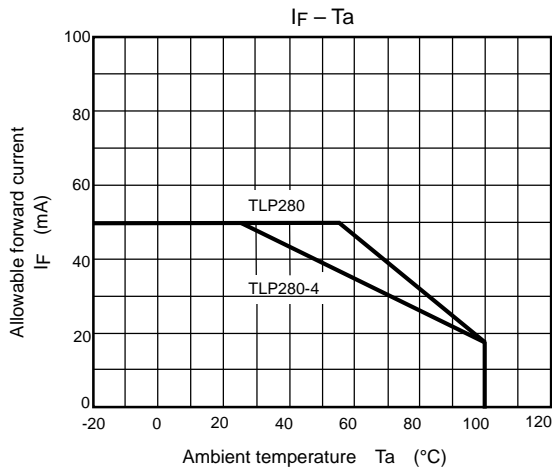
| Characteristic              | Symbol          | Test Condition                     | Min                | Typ.             | Max | Unit             |
|-----------------------------|-----------------|------------------------------------|--------------------|------------------|-----|------------------|
| Capacitance input to output | Cs              | 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                           | 2500               | —                | —   | V <sub>rms</sub> |
|                             |                 | AC, 1 s, in oil                    | —                  | 5000             | —   |                  |
|                             |                 | DC, 60 s, in oil                   | —                  | 5000             | —   | V <sub>dc</sub>  |

**Switching Characteristics (Ta = 25°C)**

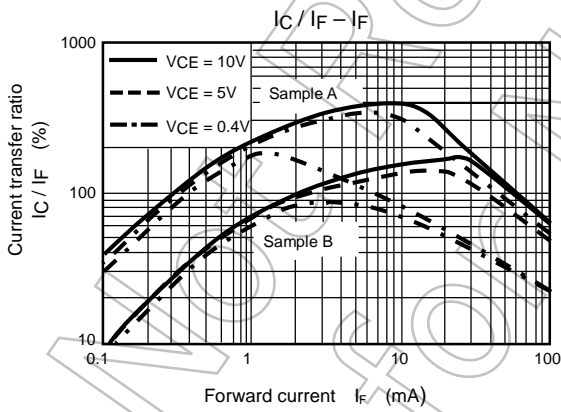
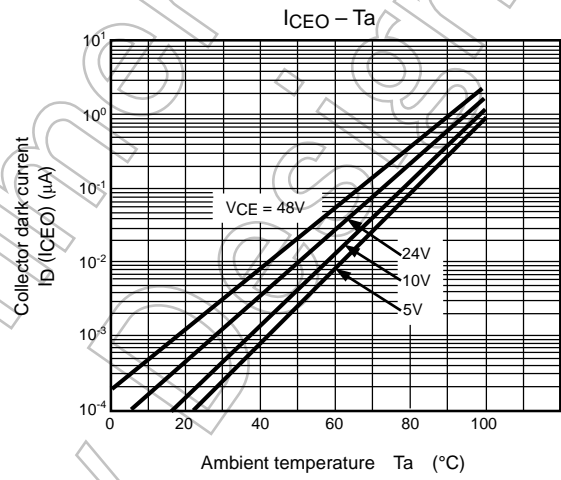
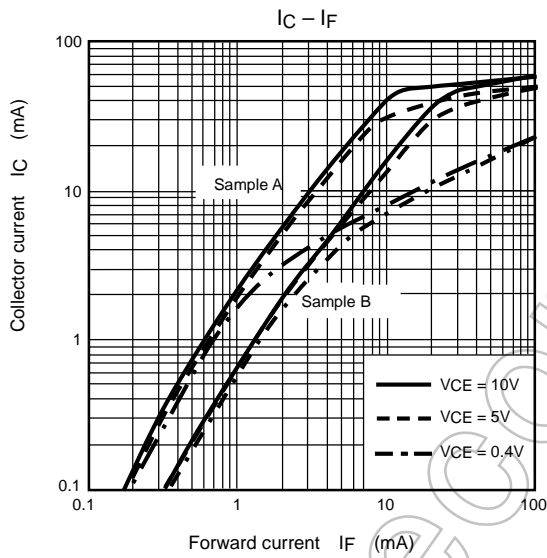
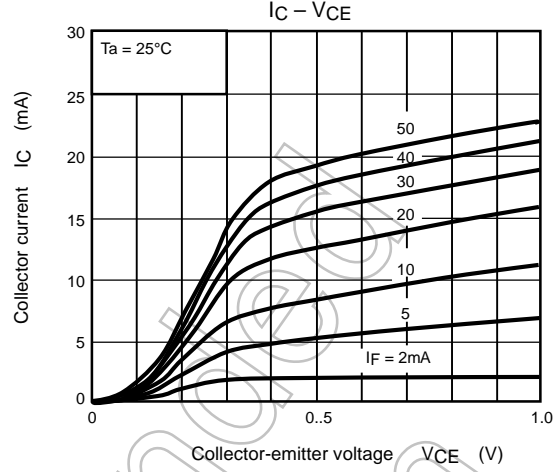
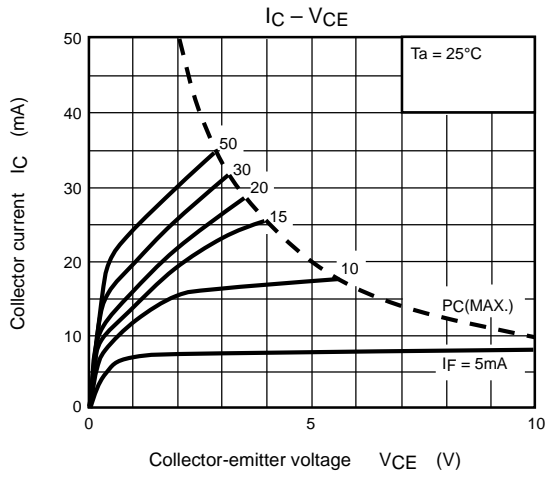
| Characteristic | Symbol           | Test Condition  | Min | Typ. | Max | Unit |
|----------------|------------------|---|-----|------|-----|------|
| Rise time      | t <sub>r</sub>   | V <sub>CC</sub> = 10 V, I <sub>C</sub> = 2 mA<br>R <sub>L</sub> = 100 Ω           | —   | 2    | —   | μs   |
| Fall 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<br>V <sub>CC</sub> = 5 V, I <sub>F</sub> = ±16 mA (Fig.1) | —   | 2    | —   | μs   |
| Storage time   | t <sub>s</sub>   |   | —   | 25   | —   |      |
| Turn-off time  | t <sub>OFF</sub> |   | —   | 40   | —   |      |

Fig. 1: Switching time test circuit

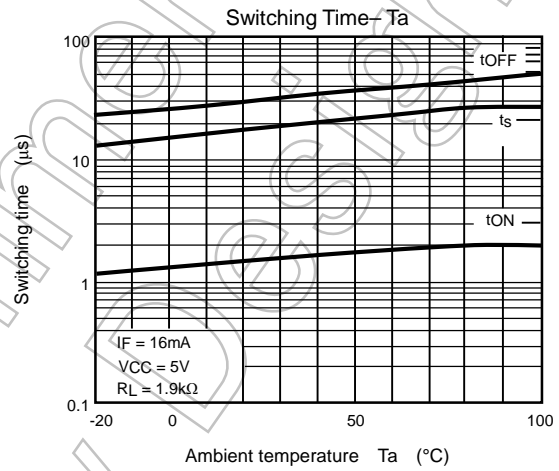
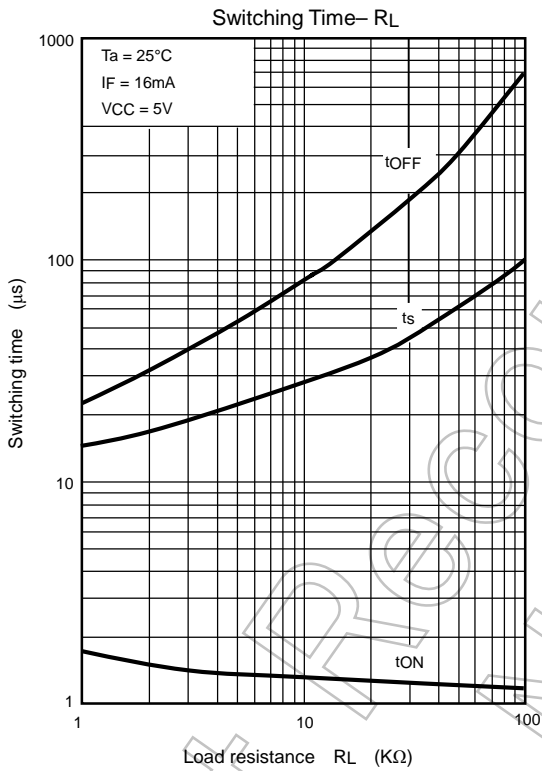
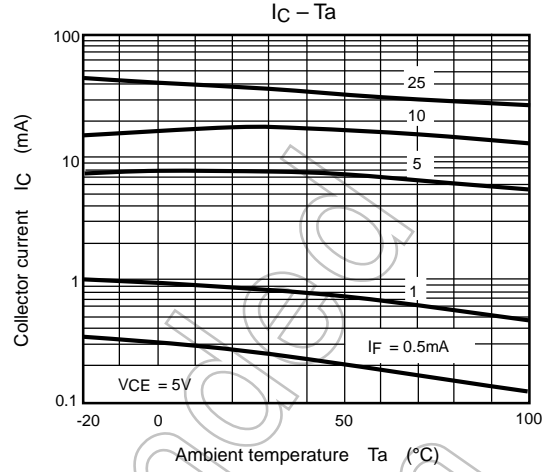
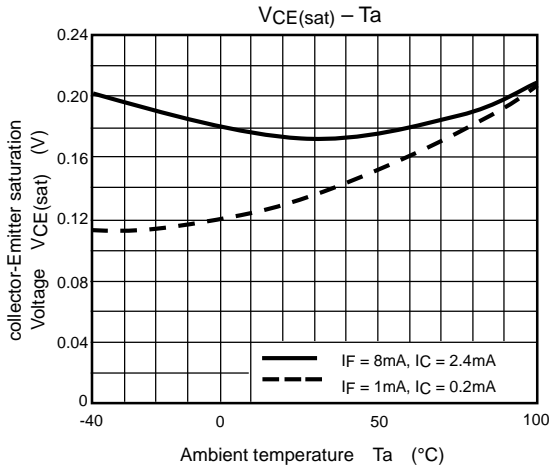




\*The above graphs show typical characteristic.



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