

TOSHIBA Photocoupler GaAs Ired &amp; Photo-Transistor

# TLP523, TLP523-2, TLP523-4

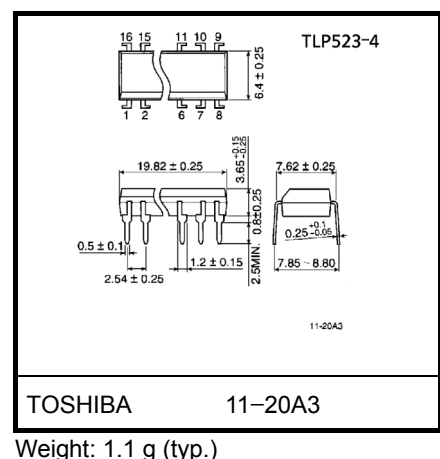
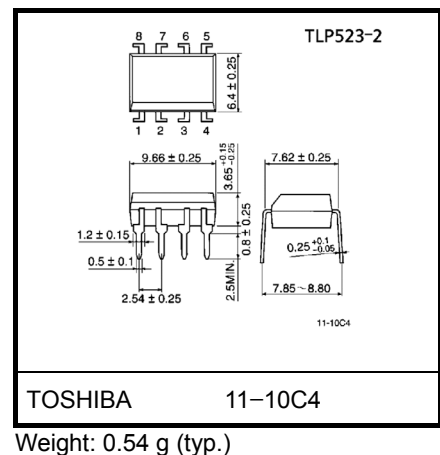
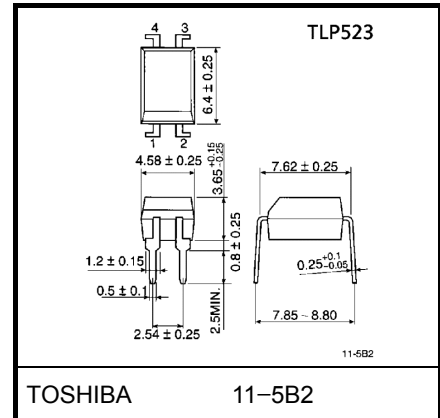
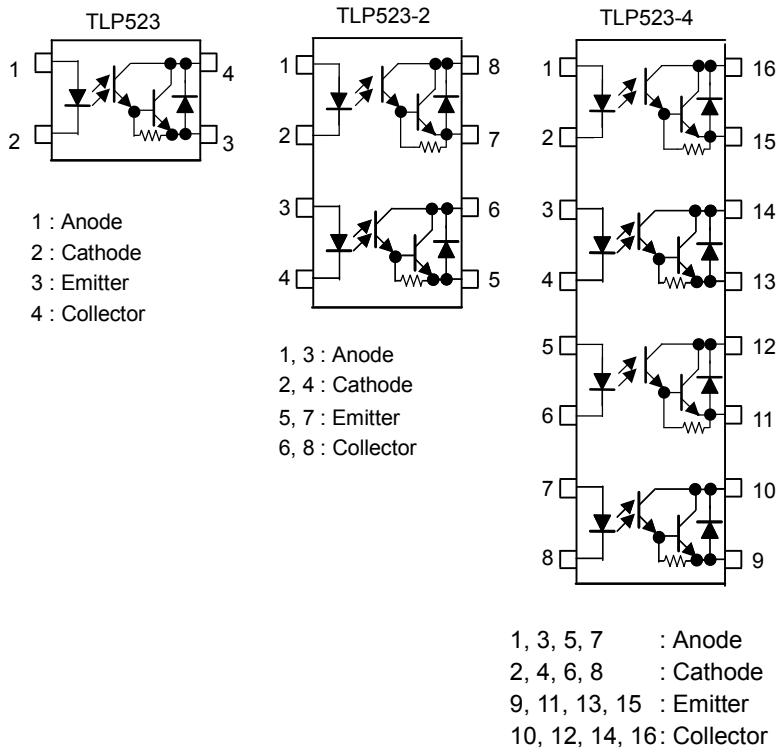
Unit: mm

Programmable Controllers  
 DC-Output Module  
 Solid State Relay

The TOSHIBA TLP523, -2 and -4 consist of a gallium arsenide infrared emitting diode coupled with a silicon, Darlington connected, phototransistor which has an integral base-emitter resistor to optimize switching speed and elevated temperature characteristics. The TLP523-2 offers two isolated channels in an eight lead plastic DIP package, while the TLP523-4 provides four isolated channels per package.

- Current transfer ratio: 500% (min) ( $I_F = 1 \text{ mA}$ )
- Isolation voltage: 2500 Vrms (min)
- Collector-emitter voltage: 55 V (min)
- Leakage current: 10  $\mu\text{A}$  (max) ( $T_a = 85^\circ\text{C}$ )
- UL recognized: UL1577, file no. E67349

## Pin Configurations (top view)



Start of commercial production  
 1984/08

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

| Characteristic                                                 |                                                                                | Symbol                        | Rating                                |                                    | Unit                  |
|----------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------|---------------------------------------|------------------------------------|-----------------------|
|                                                                |                                                                                |                               | TLP523                                | TLP523-2<br>TLP523-4               |                       |
| LED                                                            | Forward current                                                                | $I_F$                         | 60                                    | 50                                 | mA                    |
|                                                                | Forward current derating                                                       | $\Delta I_F / ^\circ\text{C}$ | -0.7 (Ta $\geq 39^\circ\text{C}$ )    | -0.5 (Ta $\geq 25^\circ\text{C}$ ) | mA / $^\circ\text{C}$ |
|                                                                | Pulse forward current                                                          | $I_{FP}$                      | 1 (100 $\mu\text{s}$ pulse, 100pps)   |                                    | A                     |
|                                                                | Reverse voltage                                                                | $V_R$                         | 5                                     |                                    | V                     |
| Detector                                                       | Collector-emitter voltage                                                      | $V_{CEO}$                     | 55                                    |                                    | V                     |
|                                                                | Emitter-collector voltage                                                      | $V_{ECO}$                     | 0.3                                   |                                    | V                     |
|                                                                | Collector current                                                              | $I_C$                         | 150                                   |                                    | mA                    |
|                                                                | Collector power dissipation (1 circuit)                                        | $P_C$                         | 150                                   | 100                                | mW                    |
|                                                                | Collector power dissipation derating (1 circuit (Ta $\geq 25^\circ\text{C}$ )) | $\Delta P_C / ^\circ\text{C}$ | -1.5                                  | -1.0                               | mW / $^\circ\text{C}$ |
| Operating temperature range                                    |                                                                                | $T_{opr}$                     | -55 to 100                            |                                    | $^\circ\text{C}$      |
| Storage temperature range                                      |                                                                                | $T_{stg}$                     | -55 to 125                            |                                    | $^\circ\text{C}$      |
| Lead soldering temperature (10 s)                              |                                                                                | $T_{sol}$                     | 260                                   |                                    | $^\circ\text{C}$      |
| Total power dissipation                                        |                                                                                | $P_T$                         | 250                                   | 150                                | mW                    |
| Total power dissipation derating (Ta $\geq 25^\circ\text{C}$ ) |                                                                                | $\Delta P_T / ^\circ\text{C}$ | -2.5                                  | -1.5                               | mW / $^\circ\text{C}$ |
| Isolation voltage (Note 1)                                     |                                                                                | $BV_S$                        | 2500 (AC, 1minute, R.H. $\leq 60\%$ ) |                                    | 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: LED side pins shorted together and detector side pins shorted together.

## Recommended Operating Conditions

| Characteristic              | Symbol    | Min | Typ. | Max | Unit             |
|-----------------------------|-----------|-----|------|-----|------------------|
| Supply voltage              | $V_{CC}$  | —   | 5    | 24  | V                |
| Forward current             | $I_F$     | —   | 16   | 20  | mA               |
| Operating temperature range | $T_{opr}$ | -25 | —    | 85  | $^\circ\text{C}$ |

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.

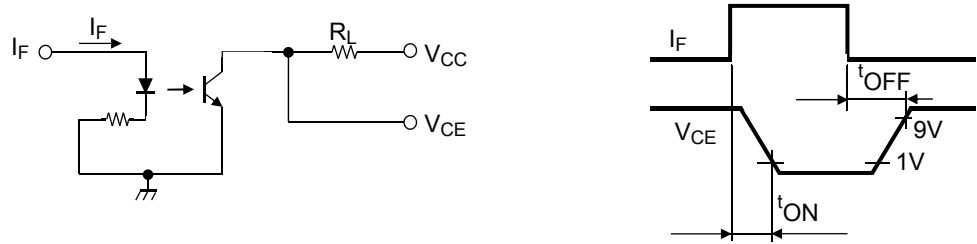
Electrical Characteristics (Ta = 25°C)

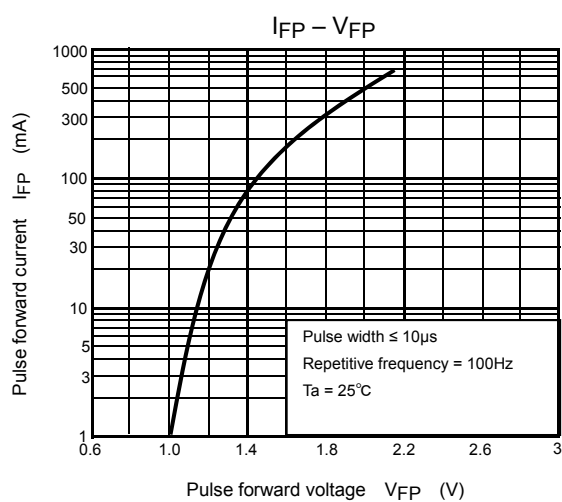
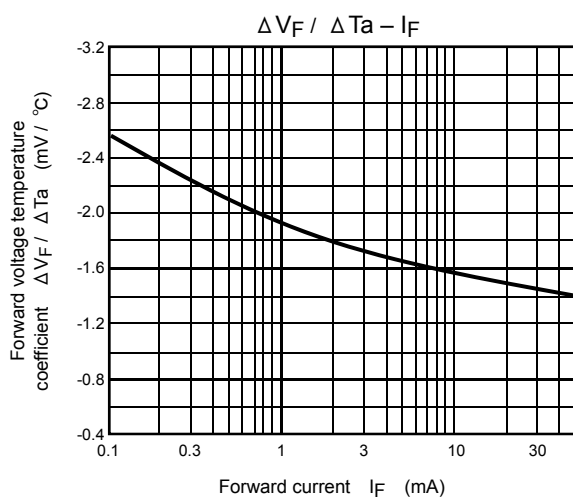
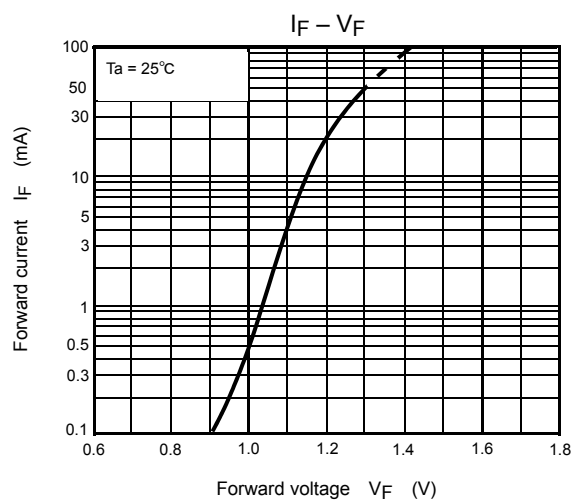
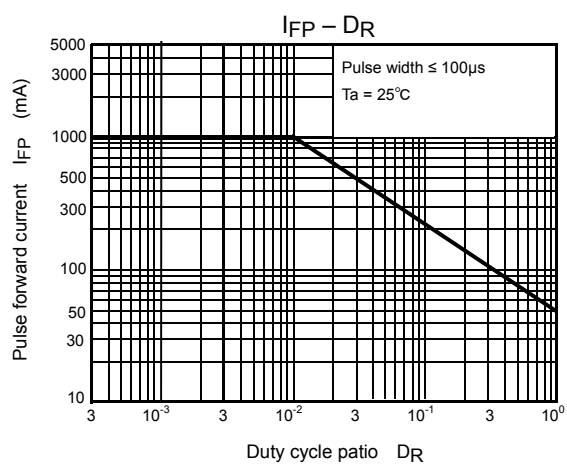
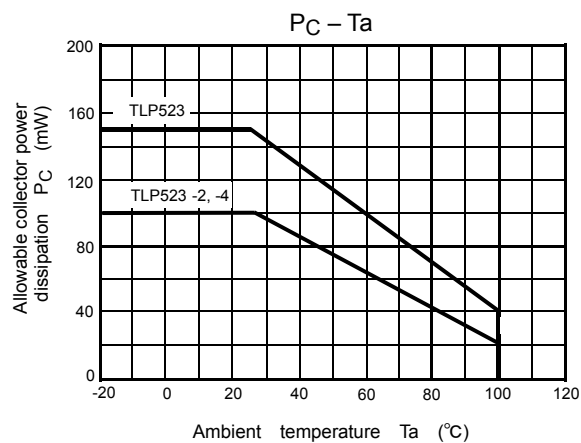
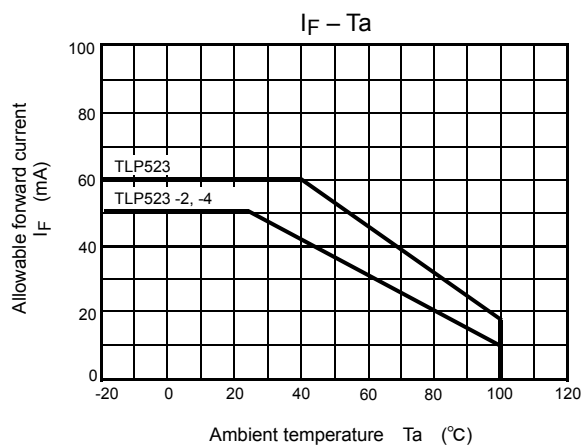
| Characteristic |                                      | Symbol                | Test Condition                                        | Min                | Typ.      | Max | Unit          |
|----------------|--------------------------------------|-----------------------|-------------------------------------------------------|--------------------|-----------|-----|---------------|
| 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                          | $C_T$                 | $V = 0, f = 1\text{ MHz}$                             | —                  | 30        | —   | pF            |
| Detector       | Collector-emitter breakdown voltage  | $V_{(BR)\text{ CEO}}$ | $I_C = 1\text{ mA}$                                   | 55                 | —         | —   | V             |
|                | Collector dark current               | $I_{\text{CEO}}$      | $V_{\text{CE}} = 24\text{ V}$                         | —                  | 10        | 200 | nA            |
|                |                                      |                       | $V_{\text{CE}} = 24\text{ V}, T_a = 85^\circ\text{C}$ | —                  | 0.5       | 10  | $\mu\text{A}$ |
|                | Capacitance collector to emitter     | $C_{\text{CE}}$       | $V = 0, f = 1\text{ MHz}$                             | —                  | 10        | —   | pF            |
| Coupled        | Current transfer ratio               | $I_C / I_F$           | $I_F = 1\text{ mA}, V_{\text{CE}} = 1\text{ V}$       | 500                | 2000      | —   | %             |
|                | Collector-emitter saturation voltage | $V_{\text{CE(sat)}}$  | $I_C = 50\text{ mA}, I_F = 10\text{ mA}$              | —                  | —         | 1   | V             |
|                | Capacitance input to output          | $C_S$                 | $V_S = 0, f = 1\text{ MHz}$                           | —                  | 0.8       | —   | pF            |
|                | Isolation resistance                 | $R_S$                 | $V_S = 500\text{ V}, \text{R.H.} \leq 60\%$           | $5 \times 10^{10}$ | $10^{14}$ | —   | $\Omega$      |

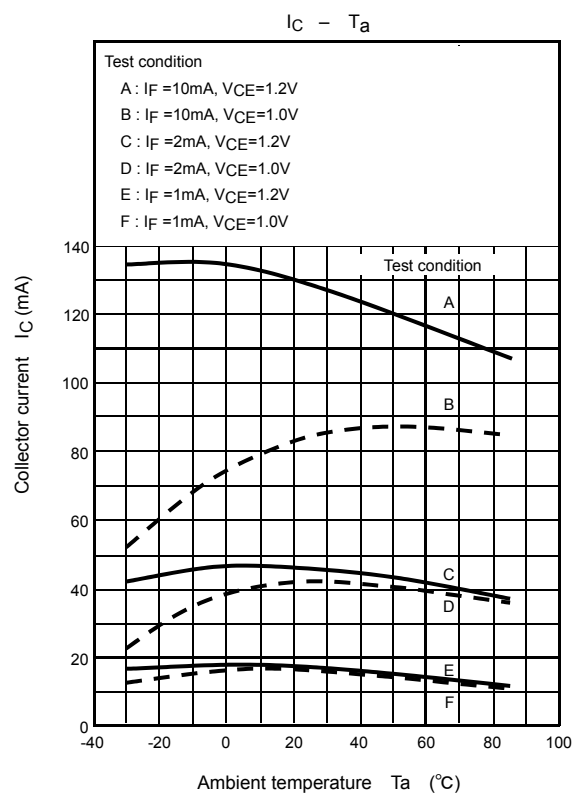
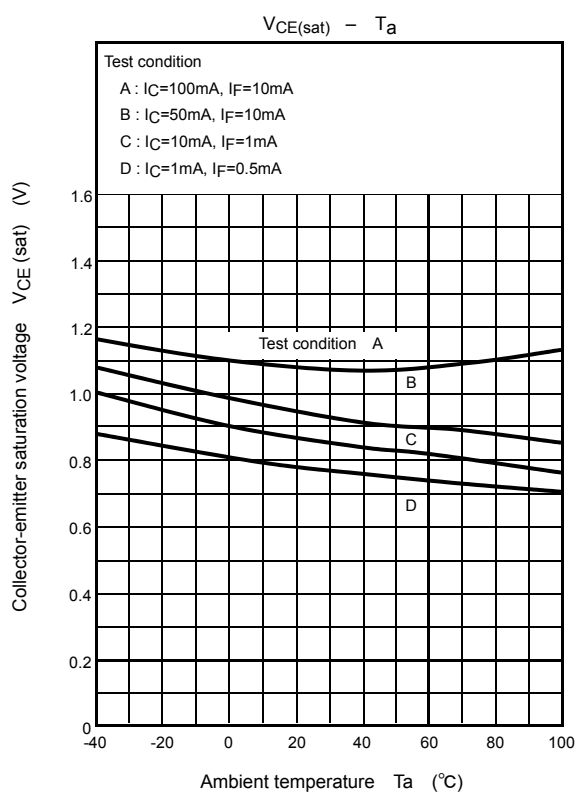
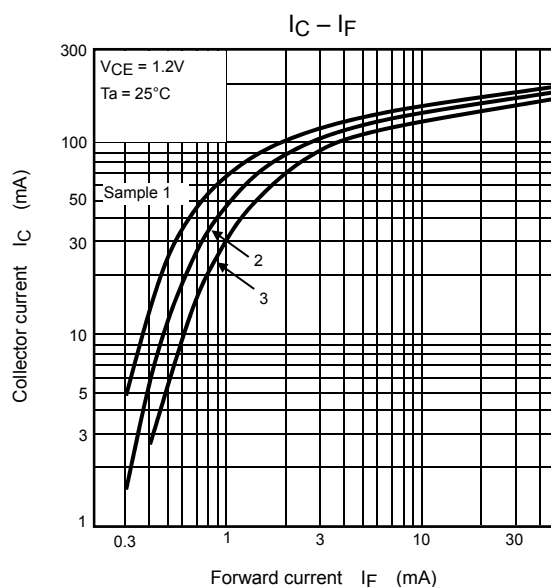
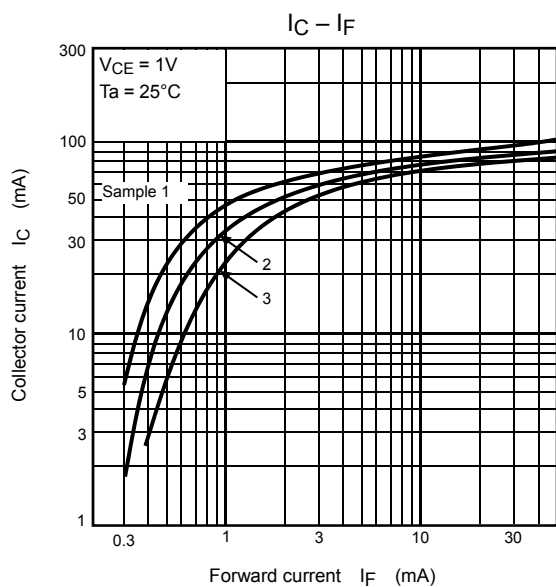
Switching Characteristics (Ta = 25°C)

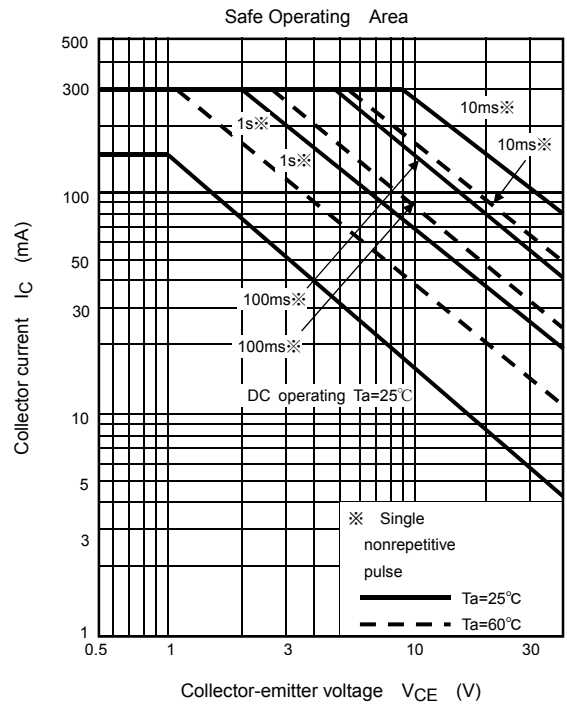
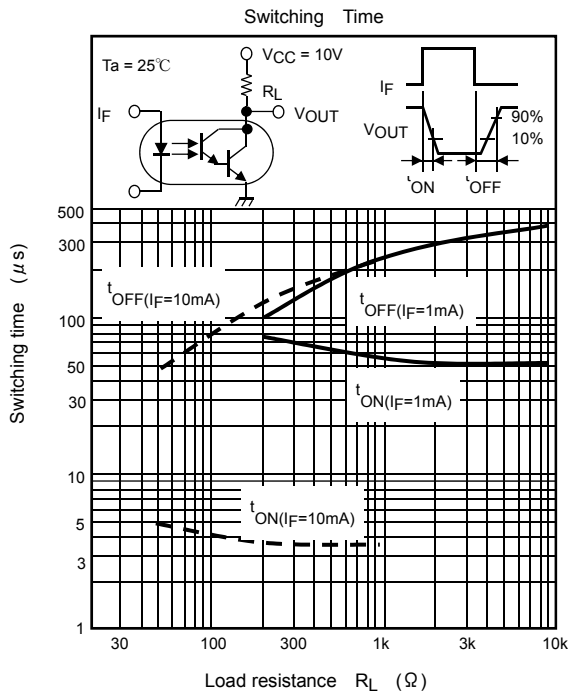
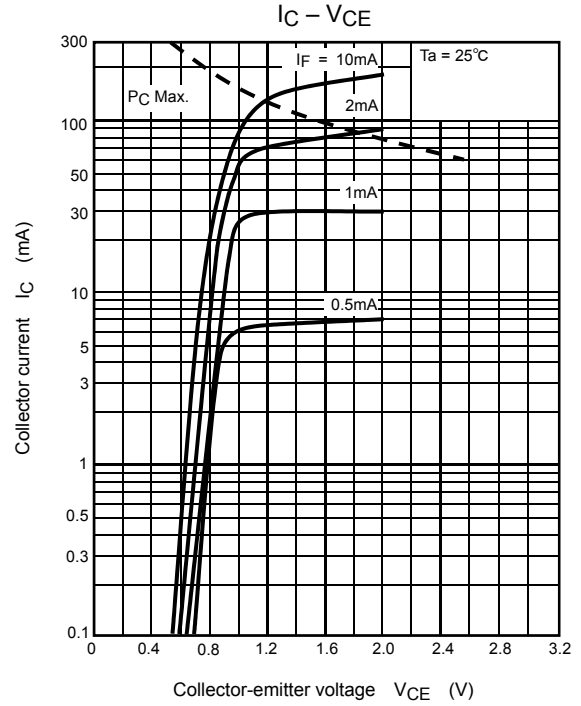
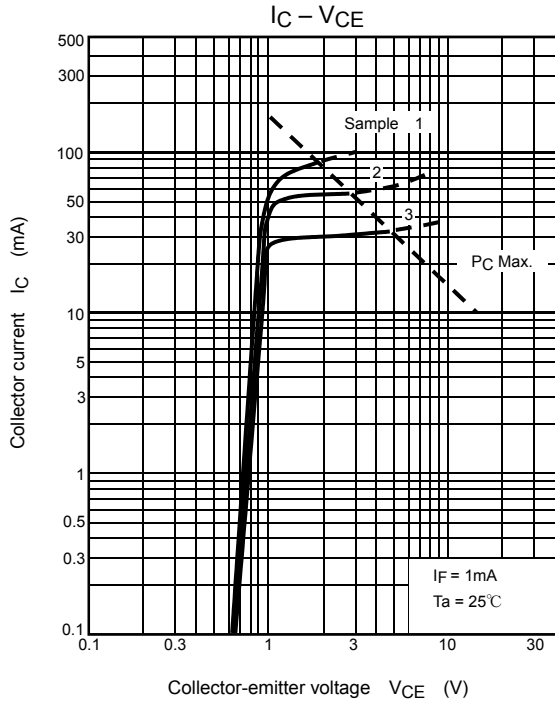
| Characteristic | Symbol           | Test Condition                                                           | Min | Typ. | Max | Unit          |
|----------------|------------------|--------------------------------------------------------------------------|-----|------|-----|---------------|
| Turn-on time   | $t_{\text{ON}}$  | $V_{\text{CC}} = 10\text{ V}, R_L = 180\ \Omega$<br>$I_F = 16\text{ mA}$ | —   | 3    | —   | $\mu\text{s}$ |
| Turn-off time  | $t_{\text{OFF}}$ |                                                                          | —   | 80   | —   | $\mu\text{s}$ |

Switching Time Test Circuit









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