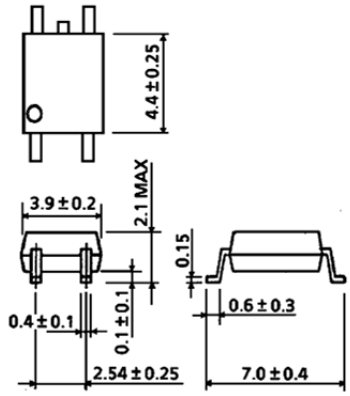
TOSHIBA Photocoupler GaAs IRED & Photo-MOSFET

# TLP176D

Modem in PC
Modem · Fax Card
Telecommunication

Unit: mm




| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | |

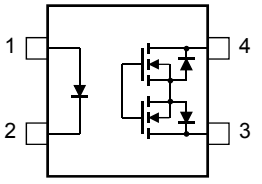
Weight: 0.1 g (typ.)

The TOSHIBA TLP176D consists of gallium arsenide infrared emitting diode optically coupled to a photo-MOSFET in a SOP, which is suitable for surface mount assembly.

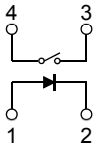
The TLP176D is suitable for modem and PBX applications which require space savings.

- SOP 4 pin (2.54SOP4): 1-form-A
- Peak off-state voltage: 200 V (min)
- Trigger LED current: 3 mA (max)
- On-state current: 200 mA (max)
- On-state resistance: 8 Ω (max)
- Isolation voltage: 1500 Vrms (min)
- UL recognized: UL1577, file No. E67349
- Option(V4):
  VDE approved: DIN EN 60747-5-2
  (Note) When an EN 60747-5-2 approved type is needed,
  Please designate the "Option(V4)"

## Pin Configuration (top view)

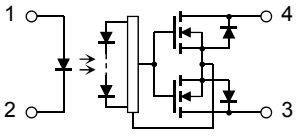



1-form A




1: Anode
2: Cathode
3: Drain
4: Drain

## Internal Circuit




Start of commercial production
1998/03

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

| Characteristics | | Symbol | Rating | Unit |
|---|---|---|---|---|
| LED | Forward current | $I_F$ | 50 | mA |
| | Forward current derating (Ta ≥ 25°C) | $\Delta I_F$/°C | −0.5 | mA/°C |
| | Pulse forward current (100 μs pulse, 100 pps) | $I_{FP}$ | 1 | A |
| | Reverse voltage | $V_R$ | 5 | V |
| | Junction temperature | $T_j$ | 125 | °C |
| Detector | Off-state output terminal voltage | $V_{OFF}$ | 200 | V |
| | On-state current | $I_{ON}$ | 200 | mA |
| | On-state RMS current derating (Ta ≥ 25°C) | $\Delta I_{ON}$/°C | −2.0 | mA/°C |
| | Junction temperature | $T_j$ | 125 | °C |
| Storage temperature range | | $T_{stg}$ | −55 to 125 | °C |
| Operating temperature range | | $T_{opr}$ | −40 to 85 | °C |
| Lead soldering temperature (10 s) | | $T_{sol}$ | 260 | °C |
| Isolation voltage (AC, 1 minute, R.H. ≤ 60%) (Note) | | $BV_S$ | 1500 | 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: Device considered a two-terminal device: pins1 and 2 shorted together and pins 3 and 4 shorted together.

## Recommended Operating Conditions

| Characteristics | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Supply voltage | $V_{DD}$ | — | 150 | 200 | V |
| Forward current | $I_F$ | 5 | 7.5 | 25 | mA |
| On-state current | $I_{ON}$ | — | — | 130 | mA |
| Operating temperature | $T_{opr}$ | −20 | — | 65 | °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)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| LED | Forward voltage | $V_F$ | $I_F$ = 10 mA | 1.0 | 1.15 | 1.3 | V |
| | Reverse current | $I_R$ | $V_R$ = 5 V | — | — | 10 | μA |
| | Capacitance | $C_T$ | V = 0, f = 1 MHz | — | 30 | — | pF |
| Detector | Off-state current | $I_{OFF}$ | $V_{OFF}$ = 200 V | — | — | 1 | μA |
| | Capacitance | $C_{OFF}$ | V = 0, f = 1 MHz | — | 100 | — | pF |

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

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Trigger LED current | $I_{FT}$ | $I_{ON}$ = 200 mA | — | 1 | 3 | mA |
| On-state resistance | $R_{ON}$ | $I_{ON}$ = 200 mA, $I_F$ = 5 mA | — | 5 | 8 | Ω |
| Return LED current | $I_{FC}$ | $I_{OFF}$ = 100 μA | 0.1 | — | — | mA |

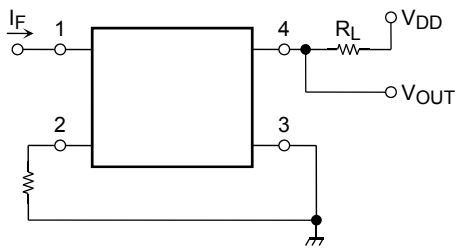
## Isolation Characteristics (Ta = 25°C)

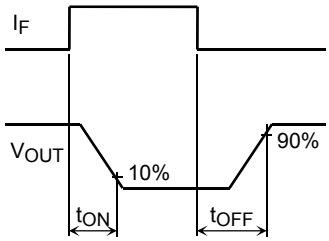
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Capacitance input to output | $C_S$ | $V_S$ = 0, f = 1 MHz | — | 0.8 | — | pF |
| Isolation resistance | $R_S$ | $V_S$ = 500 V, R.H. ≤ 60% | $5 \times 10^{10}$ | $10^{14}$ | — | Ω |
| Isolation voltage | $BV_S$ | AC, 1 minute | 1500 | — | — | Vrms |
| | | AC, 1 second, in oil | — | 3000 | — | |
| | | DC, 1 minute, in oil | — | 3000 | — | Vdc |

## Switching Characteristics (Ta = 25°C)

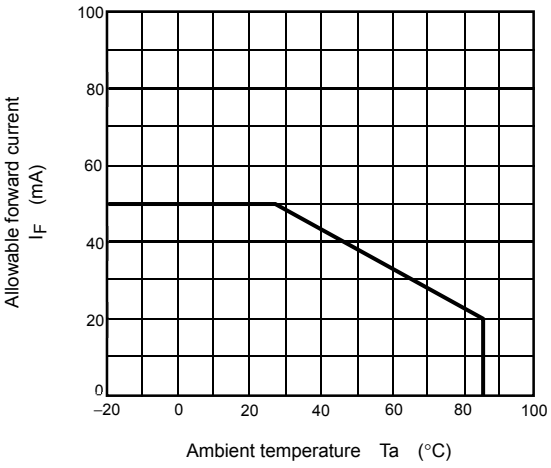
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Turn-on time | $t_{ON}$ | $R_L$ = 200 Ω (Note)<br>$V_{DD}$ = 20 V, $I_F$ = 5 mA | — | 0.6 | 1.5 | ms |
| Turn-off time | $t_{OFF}$ | $R_L$ = 200 Ω (Note)<br>$V_{DD}$ = 20 V, $I_F$ = 5 mA | — | 0.1 | 1.0 | ms |

Note: Switching time test circuit

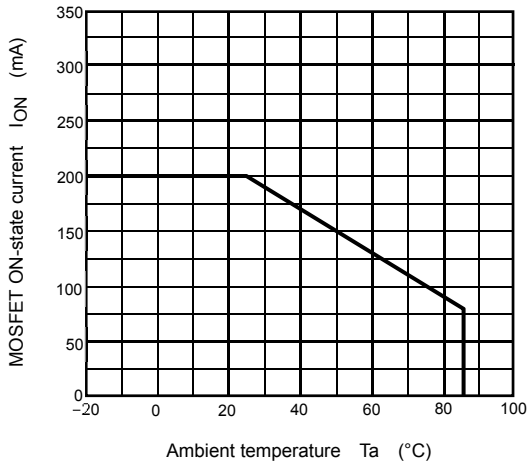


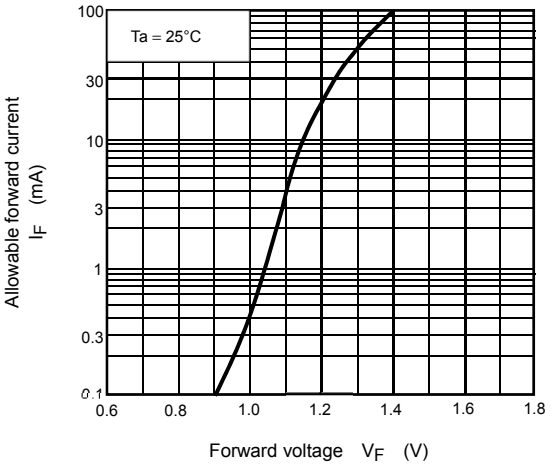
$I_F$ – Ta



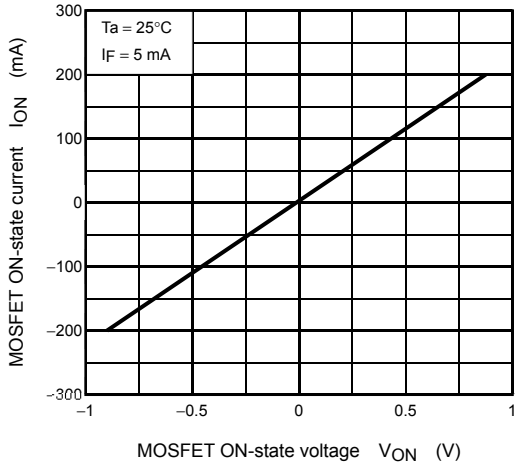

$I_{ON}$ – Ta



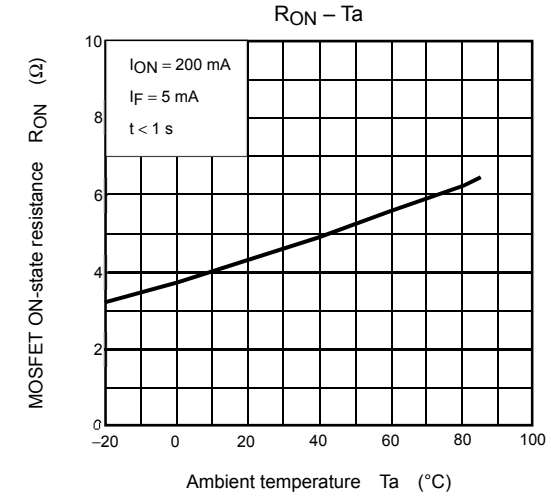

$I_F$ – $V_F$



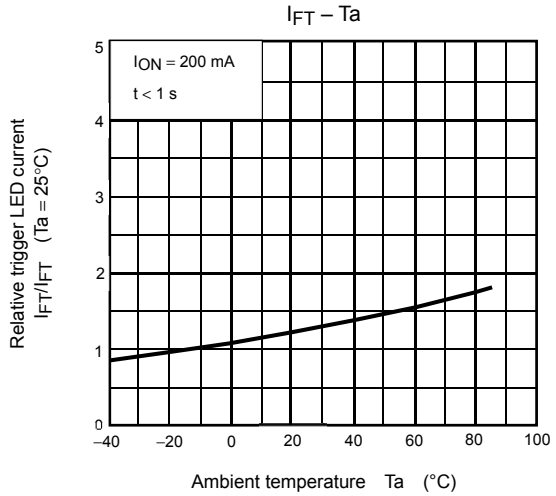

$I_{ON}$ – $V_{ON}$



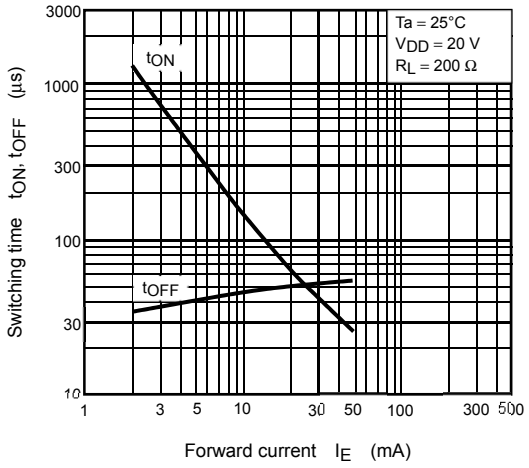

$R_{ON}$ – Ta



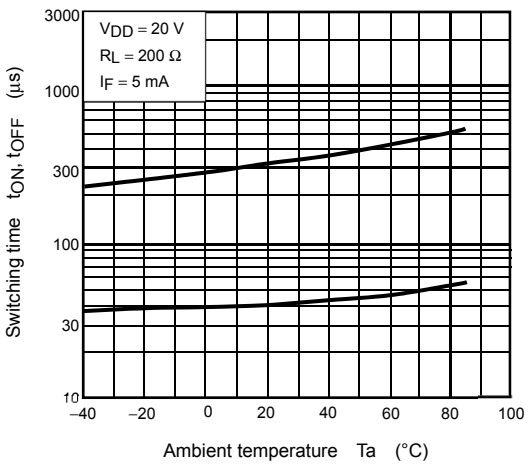

$I_{FT}$ – Ta



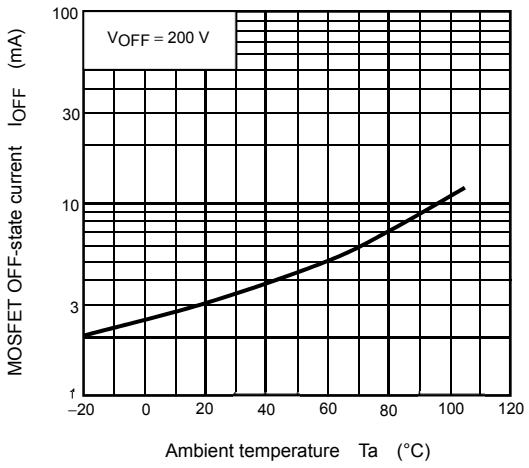
$t_{ON}$, $t_{OFF}$ – $I_F$




$t_{ON}$, $t_{OFF}$ – Ta




$I_{OFF}$ – Ta



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