

# TLP220D

## 1. Applications

- Mechanical relay replacements
- Security Systems
- Measuring Instruments
- Factory Automation (FA)
- Amusement Equipment
- Smart Meters
- Electricity Meters

## 2. General

The TLP220D photorelay consists of a photo MOSFET optically coupled to an infrared light emitting diode. It is housed in a 4-pin DIP package. It provides an isolation voltage of 5000 Vrms, making it suitable for applications that require reinforced insulation.

## 3. Features

- (1) Normally open (1-Form-A)
- (2) OFF-state output terminal voltage: 200 V (min)
- (3) Trigger LED current: 2 mA (max)
- (4) ON-state current: 250 mA (max)
- (5) ON-state resistance: 8  $\Omega$  (max)
- (6) Isolation voltage: 5000 Vrms (min)
- (7) Safety standards

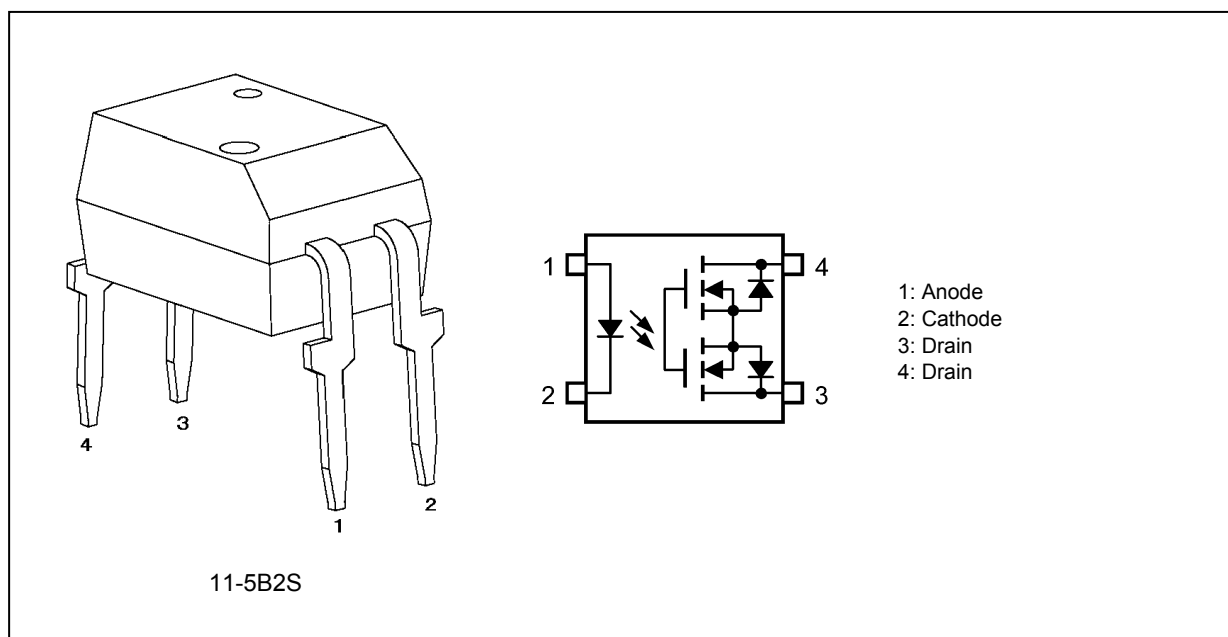
UL-approved: UL1577 File No. E67349

cUL-approved: CSA Component Acceptance Service No. 5A, File No. E67349

VDE-approved: Option (D4) EN60747-5-5 (Note)

Note: When an EN60747-5-5 approved type is needed, please designate the Option (D4)

## 4. Packaging and Pin Configuration



## 5. Internal Circuit

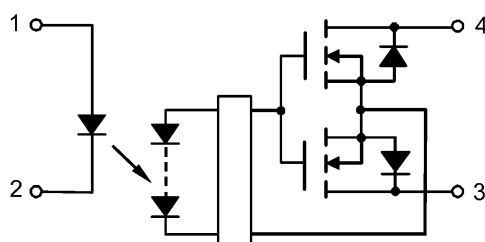


Fig. 5.1 Internal Circuit

## 6. Mechanical Parameters

| Characteristics              | 7.62-mm Pitch<br>TLP220D | 10.16-mm Pitch<br>TLP220DF | Unit |
|------------------------------|--------------------------|----------------------------|------|
| Creepage distances           | 7.0 (min)                | 8.0 (min)                  | mm   |
| Clearance distances          | 7.0 (min)                | 8.0 (min)                  |      |
| Internal isolation thickness | 0.4 (min)                | 0.4 (min)                  |      |

## 7. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25^\circ\text{C}$ )

|          | Characteristics                                                   | Symbol                       | Note     | Rating     | Unit                 |
|----------|-------------------------------------------------------------------|------------------------------|----------|------------|----------------------|
| LED      | Input forward current                                             | $I_F$                        |          | 30         | mA                   |
|          | Input forward current derating ( $T_a \geq 25^\circ\text{C}$ )    | $\Delta I_F / \Delta T_a$    |          | -0.3       | mA/ $^\circ\text{C}$ |
|          | Input forward current (pulsed) (100 $\mu\text{s}$ pulse, 100 pps) | $I_{FP}$                     |          | 1          | A                    |
|          | Input reverse voltage                                             | $V_R$                        |          | 5          | V                    |
|          | Input power dissipation                                           | $P_D$                        |          | 50         | mW                   |
|          | Junction temperature                                              | $T_j$                        |          | 125        | $^\circ\text{C}$     |
| Detector | OFF-state output terminal voltage                                 | $V_{OFF}$                    |          | 200        | V                    |
|          | ON-state current                                                  | $I_{ON}$                     |          | 250        | mA                   |
|          | ON-state current derating ( $T_a \geq 25^\circ\text{C}$ )         | $\Delta I_{ON} / \Delta T_a$ |          | -2.5       | mA/ $^\circ\text{C}$ |
|          | ON-state current (pulsed) ( $t = 100 \text{ ms}$ , Duty = 1/10)   | $I_{ONP}$                    |          | 750        | mA                   |
|          | Output power dissipation                                          | $P_O$                        |          | 500        | mW                   |
|          | Junction temperature                                              | $T_j$                        |          | 125        | $^\circ\text{C}$     |
| Common   | Storage temperature                                               | $T_{stg}$                    |          | -55 to 125 |                      |
|          | Operating temperature                                             | $T_{opr}$                    |          | -40 to 85  |                      |
|          | Lead soldering temperature (10 s)                                 | $T_{sol}$                    |          | 260        |                      |
|          | Isolation voltage AC, 1 min, R.H. $\leq 60\%$                     | $BV_S$                       | (Note 1) | 5000       | 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: This device is considered as a two-terminal device: Pins 1 and 2 are shorted together, and pins 3 and 4 are shorted together.

## 8. Recommended Operating Conditions (Note)

| Characteristics       | Symbol    | Note | Min | Typ. | Max | Unit |
|-----------------------|-----------|------|-----|------|-----|------|
| Supply voltage        | $V_{DD}$  |      | —   | —    | 160 | V    |
| Input forward current | $I_F$     |      | 3   | 5    | 15  | mA   |
| ON-state current      | $I_{ON}$  |      | —   | —    | 250 |      |
| Operating temperature | $T_{opr}$ |      | -20 | —    | 65  | °C   |

Note: The recommended operating conditions are given as a design guide necessary to obtain the intended performance of the device. Each parameter is an independent value. When creating a system design using this device, the electrical characteristics specified in this datasheet should also be considered.

9. Electrical Characteristics (Unless otherwise specified,  $T_a = 25^\circ\text{C}$ )

|          | Characteristics       | Symbol    | Note | Test Condition                        | Min  | Typ. | Max  | Unit          |
|----------|-----------------------|-----------|------|---------------------------------------|------|------|------|---------------|
| LED      | Input forward voltage | $V_F$     |      | $I_F = 10\text{ mA}$                  | 1.45 | 1.63 | 1.75 | V             |
|          | Input reverse current | $I_R$     |      | $V_R = 5\text{ V}$                    | —    | —    | 10   | $\mu\text{A}$ |
|          | Input capacitance     | $C_t$     |      | $V = 0\text{ V}$ , $f = 1\text{ MHz}$ | —    | 40   | —    | pF            |
| Detector | OFF-state current     | $I_{OFF}$ |      | $V_{OFF} = 200\text{ V}$              | —    | —    | 1    | $\mu\text{A}$ |
|          | Output capacitance    | $C_{OFF}$ |      | $V = 0\text{ V}$ , $f = 1\text{ MHz}$ | —    | 90   | —    | pF            |

10. Coupled Electrical Characteristics (Unless otherwise specified,  $T_a = 25^\circ\text{C}$ )

| Characteristics     | Symbol   | Note     | Test Condition                                              | Min | Typ. | Max | Unit     |
|---------------------|----------|----------|-------------------------------------------------------------|-----|------|-----|----------|
| Trigger LED current | $I_{FT}$ |          | $I_{ON} = 250\text{ mA}$                                    | —   | 0.3  | 2   | mA       |
| Return LED current  | $I_{FC}$ |          | $I_{OFF} = 10\text{ }\mu\text{A}$                           | 0.1 | —    | —   | mA       |
| ON-state resistance | $R_{ON}$ | (Note 1) | $I_{ON} = 250\text{ mA}$ , $I_F = 5\text{ mA}$ , Continuous | —   | 5    | 8   | $\Omega$ |

Note 1: Thermally saturated state.

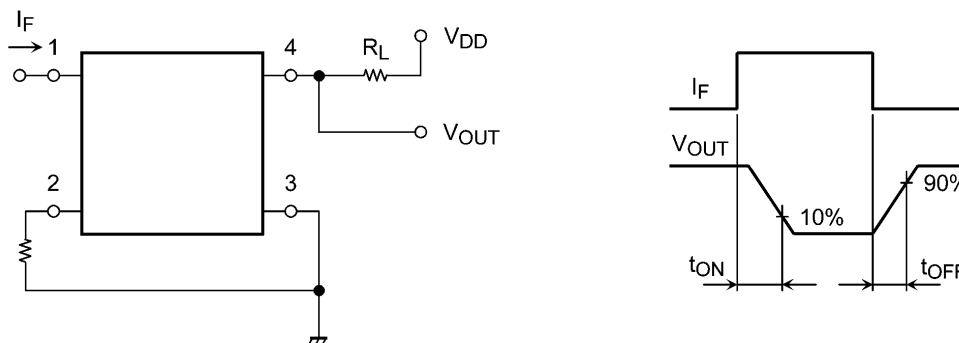
11. Isolation Characteristics (Unless otherwise specified,  $T_a = 25^\circ\text{C}$ )

| Characteristics                     | Symbol | Note     | Test Condition                          | Min                | Typ.      | Max | Unit     |
|-------------------------------------|--------|----------|-----------------------------------------|--------------------|-----------|-----|----------|
| Total capacitance (input to output) | $C_S$  | (Note 1) | $V_S = 0\text{ V}$ , $f = 1\text{ MHz}$ | —                  | 0.8       | —   | pF       |
| Isolation resistance                | $R_S$  | (Note 1) | $V_S = 500\text{ V}$ , R.H. $\leq 60\%$ | $1 \times 10^{12}$ | $10^{14}$ | —   | $\Omega$ |
| Isolation voltage                   | $BV_S$ | (Note 1) | AC, 1 min                               | 5000               | —         | —   | Vrms     |
|                                     |        |          | AC, 1s in oil                           | —                  | 10000     | —   |          |
|                                     |        |          | DC, 1 min, in oil                       | —                  | 10000     | —   | Vdc      |

Note 1: This device is considered as a two-terminal device: Pins 1 and 2 are shorted together, and pins 3 and 4 are shorted together.

## 12. Switching Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$ )

| Characteristics | Symbol           | Note | Test Condition                                                                                | Min | Typ | Max | Unit |
|-----------------|------------------|------|-----------------------------------------------------------------------------------------------|-----|-----|-----|------|
| Turn-on time    | $t_{\text{ON}}$  |      | See Fig. 12.1.<br>$R_L = 200\ \Omega$ , $V_{\text{DD}} = 20\ \text{V}$ , $I_F = 5\ \text{mA}$ | —   | 0.5 | 1   | ms   |
| Turn-off time   | $t_{\text{OFF}}$ |      |                                                                                               | —   | 0.2 | 1   |      |



**Fig. 12.1 Switching Time Test Circuit**

## 13. Characteristics Curves

### 13.1. Characteristics Curves (Note)

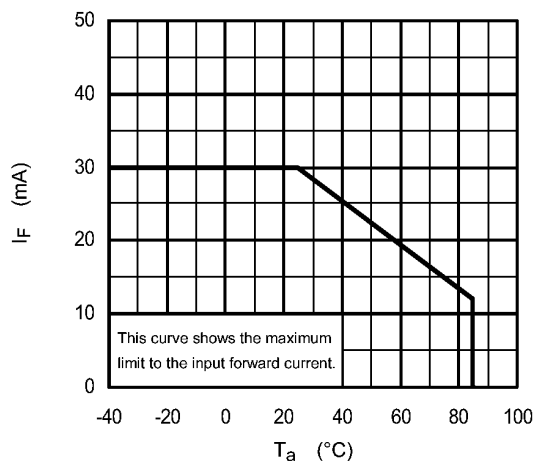


Fig. 13.1.1  $I_F - T_a$

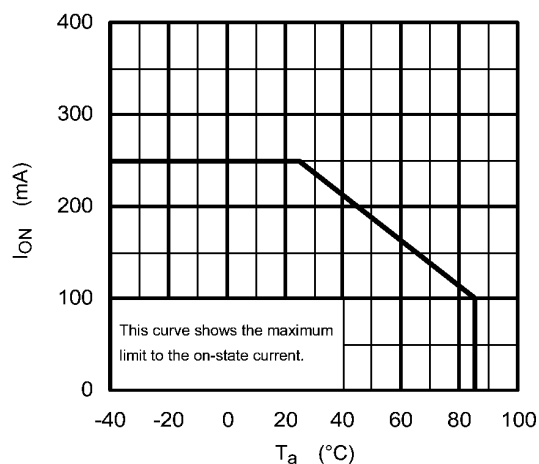


Fig. 13.1.2  $I_{ON} - T_a$

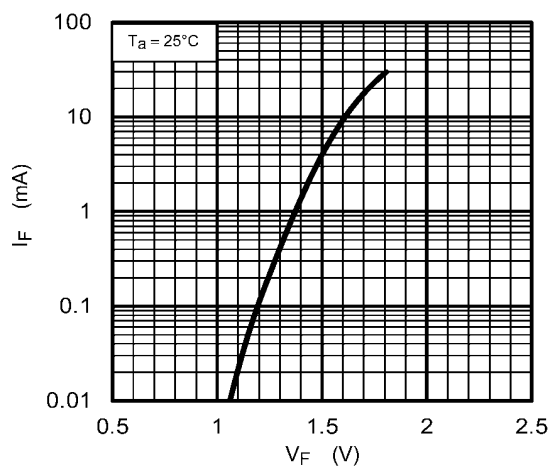


Fig. 13.1.3  $I_F - V_F$

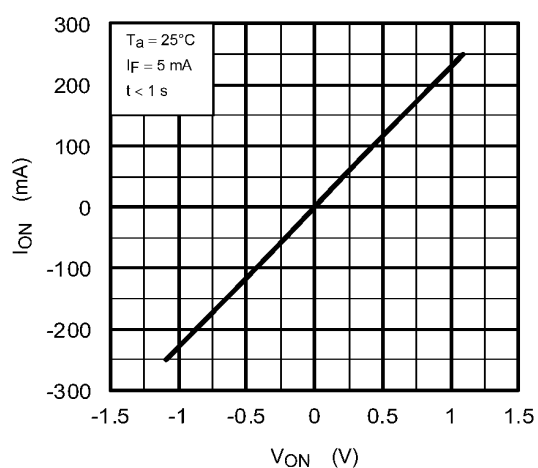


Fig. 13.1.4  $I_{ON} - V_{ON}$

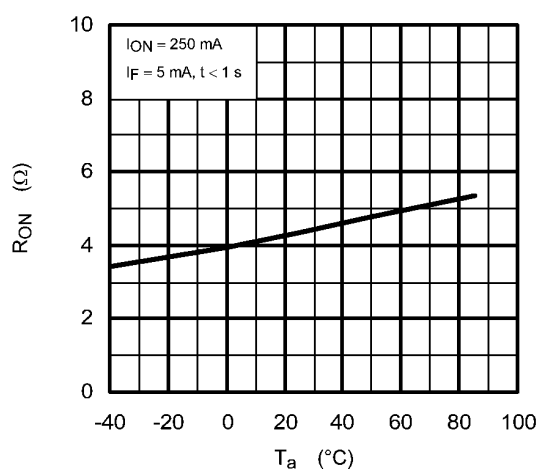


Fig. 13.1.5  $R_{ON} - T_a$

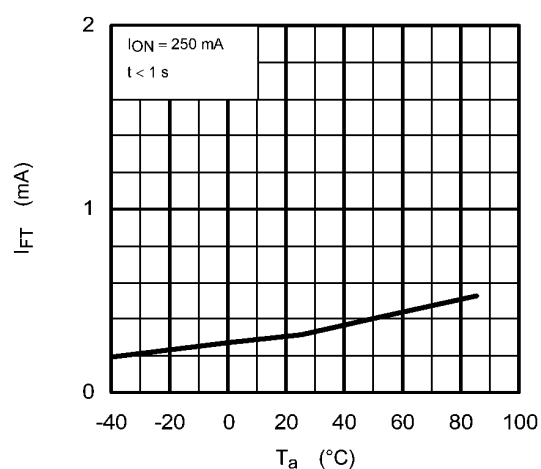
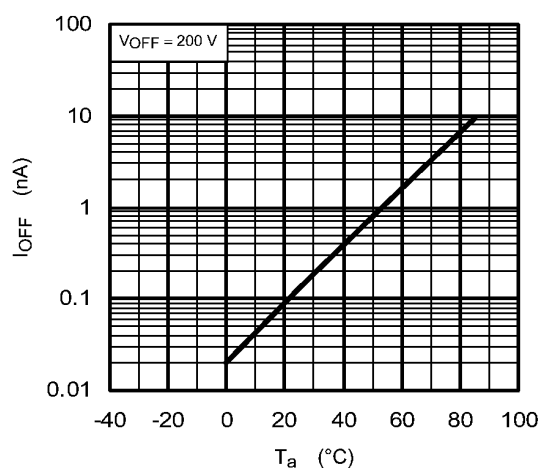
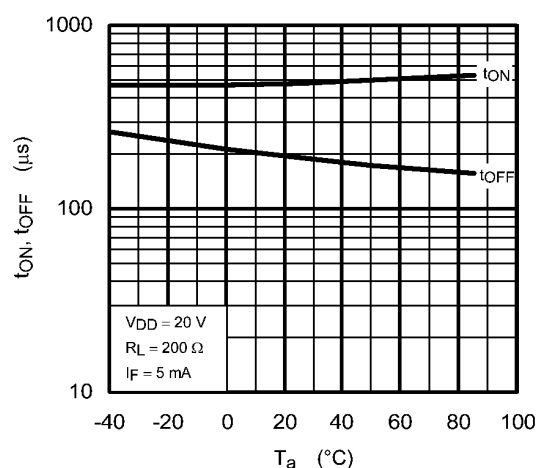
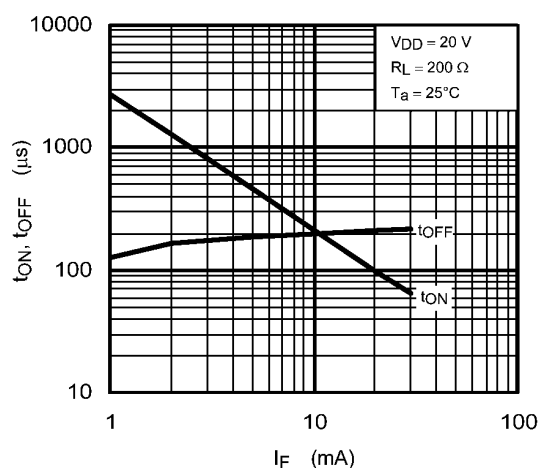


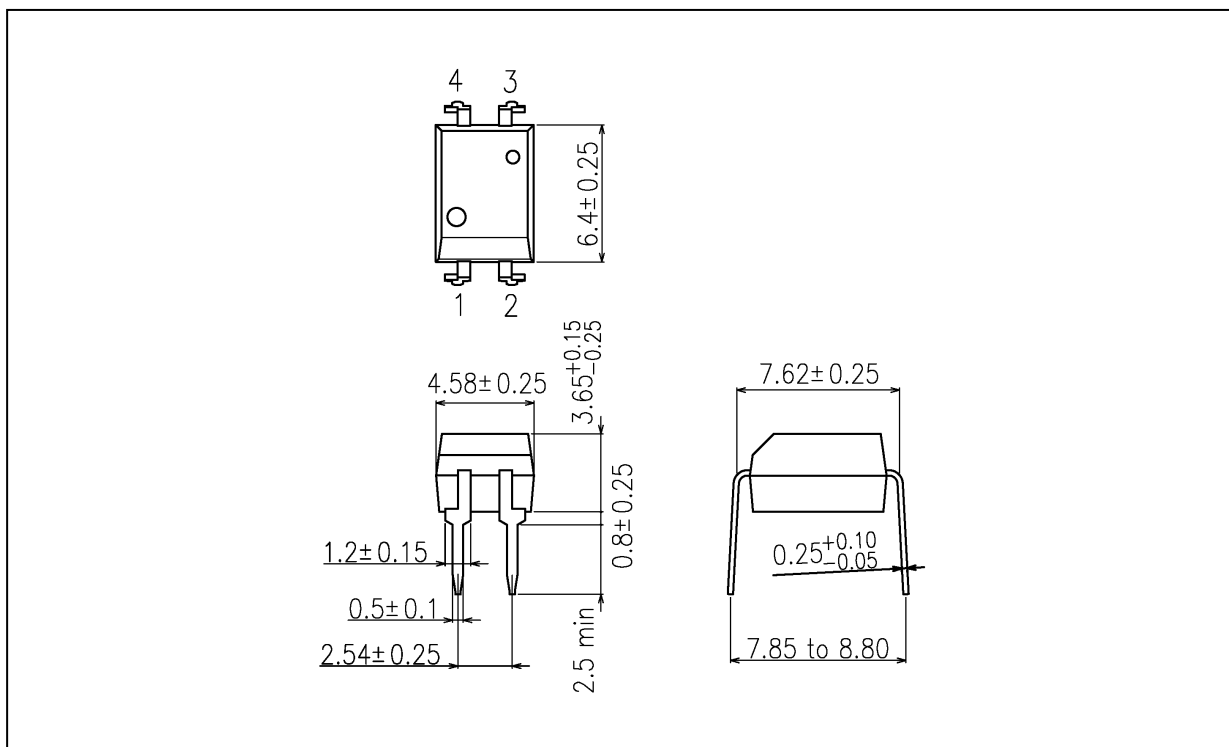
Fig. 13.1.6  $I_{FT} - T_a$



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

## Package Dimensions

Unit: mm



Weight: 0.26 g (typ.)

| Package Name(s)  |
|------------------|
| TOSHIBA: 11-5B2S |

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