

Photocouplers Photorelay

TLP220DF

1. Applications

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

2. General

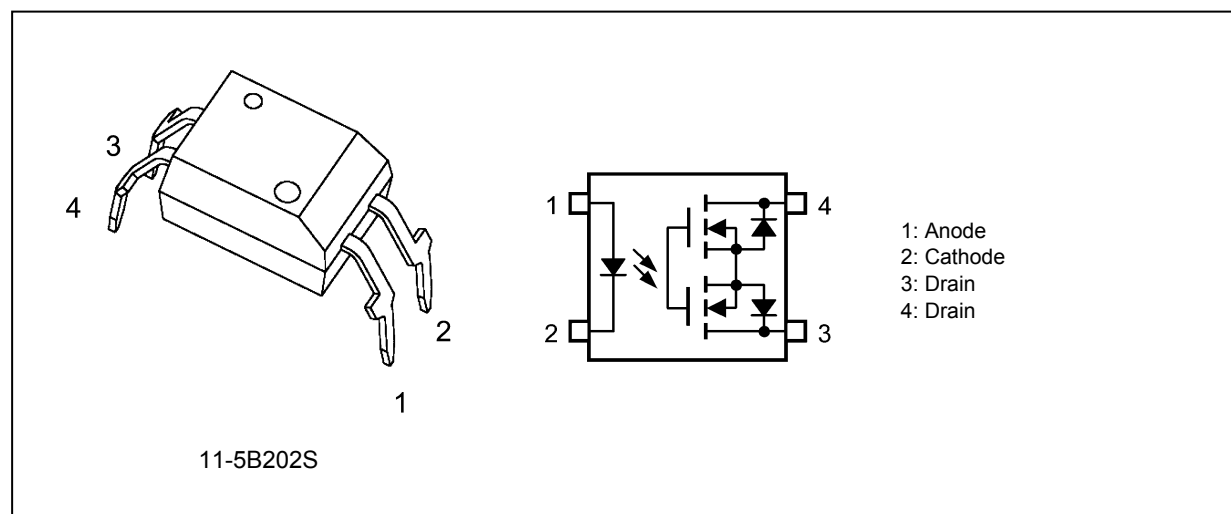
The TLP220DF photorelay consists of a photo MOSFET optically coupled to an infrared light emitting diode. It is housed in a 4-pin DIP package. It provides an isolation voltage of 5000 Vrms, making it suitable for applications that require reinforced insulation.

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 Ω (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: EN60747-5-5 (**Note 1**)
 - CQC-approved: GB4943.1, GB8898 Japan Factory

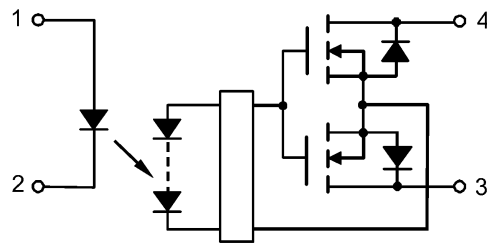
Note 1: When an EN60747-5-5 approved type is needed, please designate the **Option (D4)**.

4. Packaging and Pin Configuration



Start of commercial production
2011-09

5. Internal Circuit



6. Mechanical Parameters

| Characteristics | 7.62-mm Pitch TLP220D | 10.16-mm Pitch 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, $T_a = 25\text{ }^\circ\text{C}$)

| | Characteristics | Symbol | Note | Rating | Unit |
|----------|--|----------------------------|----------|------------|----------------------|
| LED | Input forward current | I_F | | 30 | mA |
| | Input forward current derating ($T_a \geq 25\text{ }^\circ\text{C}$) | $\Delta I_F/\Delta T_a$ | | -0.3 | mA/ $^\circ\text{C}$ |
| | Input forward current (pulsed) (100 μs pulse, 100 pps) | I_{FP} | | 1 | A |
| | Input reverse voltage | V_R | | 5 | V |
| | Input power dissipation | P_D | | 50 | mW |
| | Input power dissipation derating ($T_a \geq 25\text{ }^\circ\text{C}$) | $\Delta P_D/\Delta T_a$ | | -0.5 | mW/ $^\circ\text{C}$ |
| | 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 ($T_a \geq 25\text{ }^\circ\text{C}$) | $\Delta I_{ON}/\Delta T_a$ | | -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 |
| | Output power dissipation derating ($T_a \geq 25\text{ }^\circ\text{C}$) | $\Delta P_O/\Delta T_a$ | | -5.0 | mW/ $^\circ\text{C}$ |
| | Junction temperature | T_j | | 125 | $^\circ\text{C}$ |
| Common | Storage temperature | T_{stg} | | -55 to 125 | $^\circ\text{C}$ |
| | Operating temperature | T_{opr} | | -40 to 85 | $^\circ\text{C}$ |
| | Lead soldering temperature (10 s) | T_{sol} | | 260 | $^\circ\text{C}$ |
| | Isolation voltage (AC, 60 s, 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, $T_a = 25\text{ °C}$)

| | 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 | μA |
| | 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 | μA |
| | Output capacitance | C_{OFF} | | $V = 0\text{ V}, f = 1\text{ MHz}$ | — | 90 | — | pF |

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

| 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) | $I_{ON} = 250\text{ mA}, I_F = 5\text{ mA}, \text{Continuous}$ | — | 5 | 8 | Ω |

Note 1: Thermally saturated state.

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

| 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) | $V_S = 500\text{ V}, \text{R.H.} \leq 60\%$ | 1×10^{12} | 10^{14} | — | Ω |
| Isolation voltage | BV_S | (Note 1) | AC, 60 s | 5000 | — | — | Vrms |
| | | | AC, 1 s in oil | — | 10000 | — | |
| | | | DC, 60 s 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, $T_a = 25\text{ }^\circ\text{C}$)

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

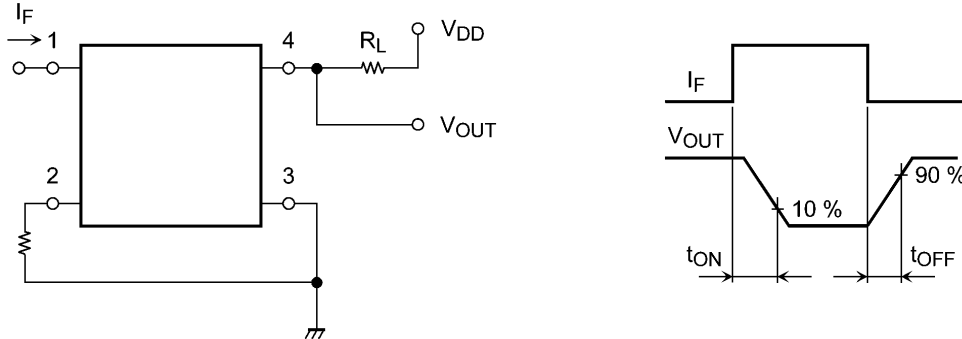


Fig. 12.1 Switching Time Test Circuit and Waveform

13. Characteristics Curves

13.1. Characteristics Curves (Note)

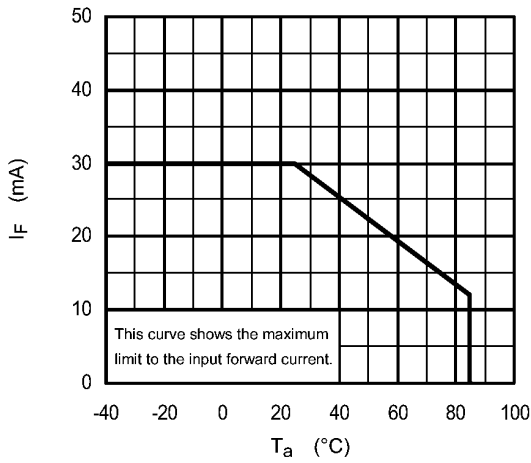


Fig. 13.1.1 $I_F - T_a$

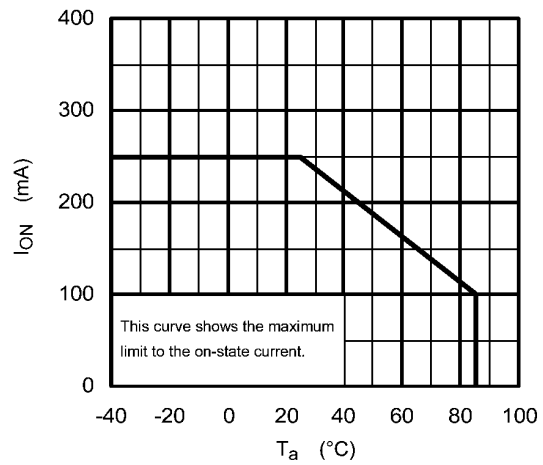


Fig. 13.1.2 $I_{ON} - T_a$

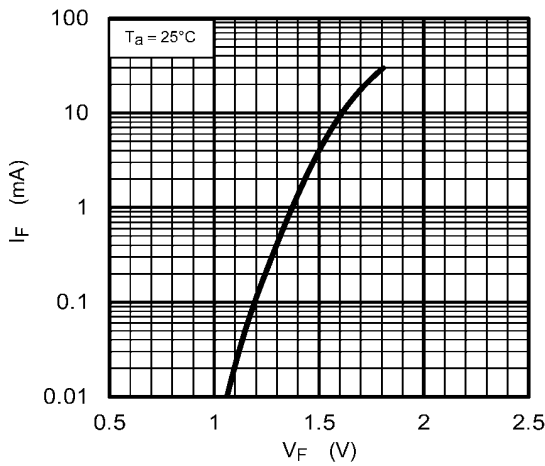


Fig. 13.1.3 $I_F - V_F$

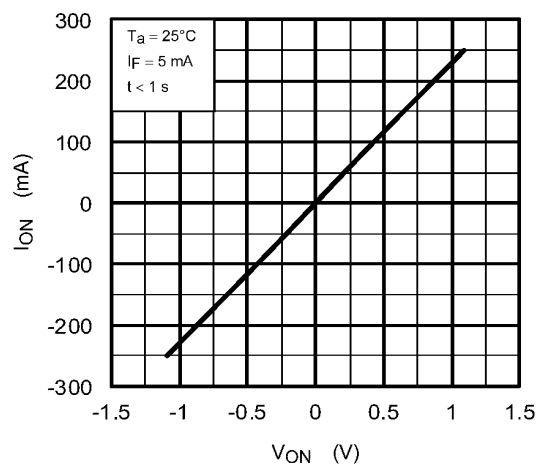


Fig. 13.1.4 $I_{ON} - V_{ON}$

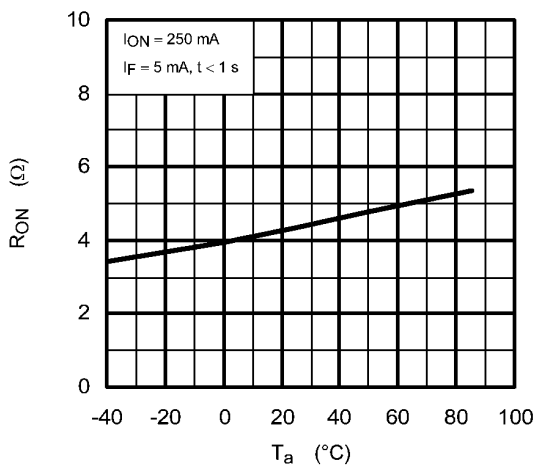


Fig. 13.1.5 $R_{ON} - T_a$

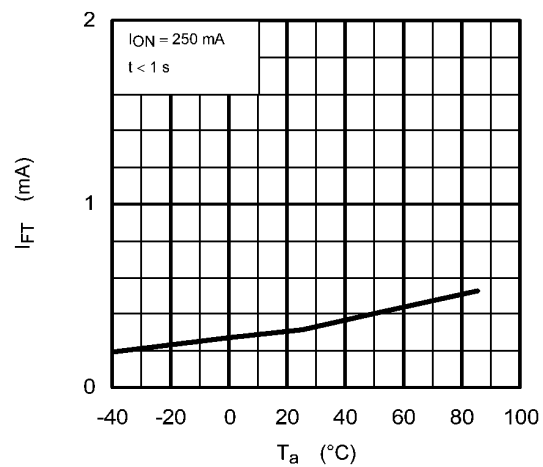


Fig. 13.1.6 $I_{FT} - T_a$

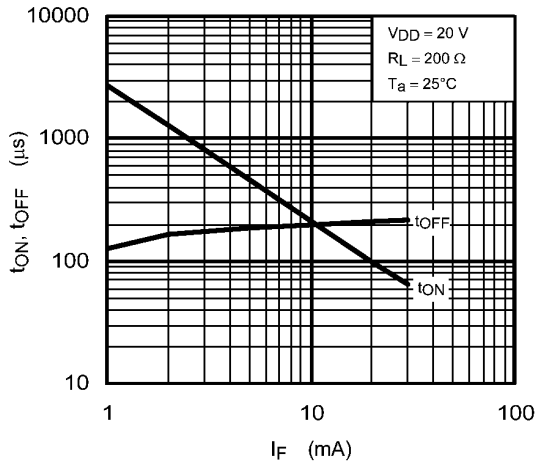


Fig. 13.1.7 t_{ON} , t_{OFF} - I_F

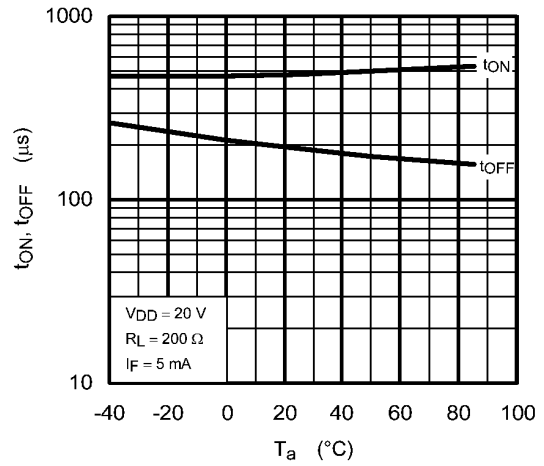


Fig. 13.1.8 t_{ON} , t_{OFF} - T_a

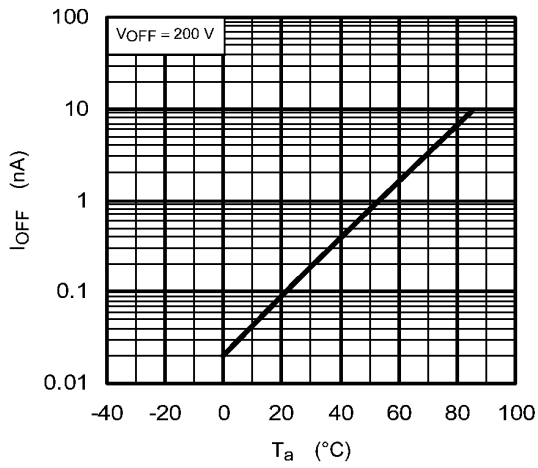
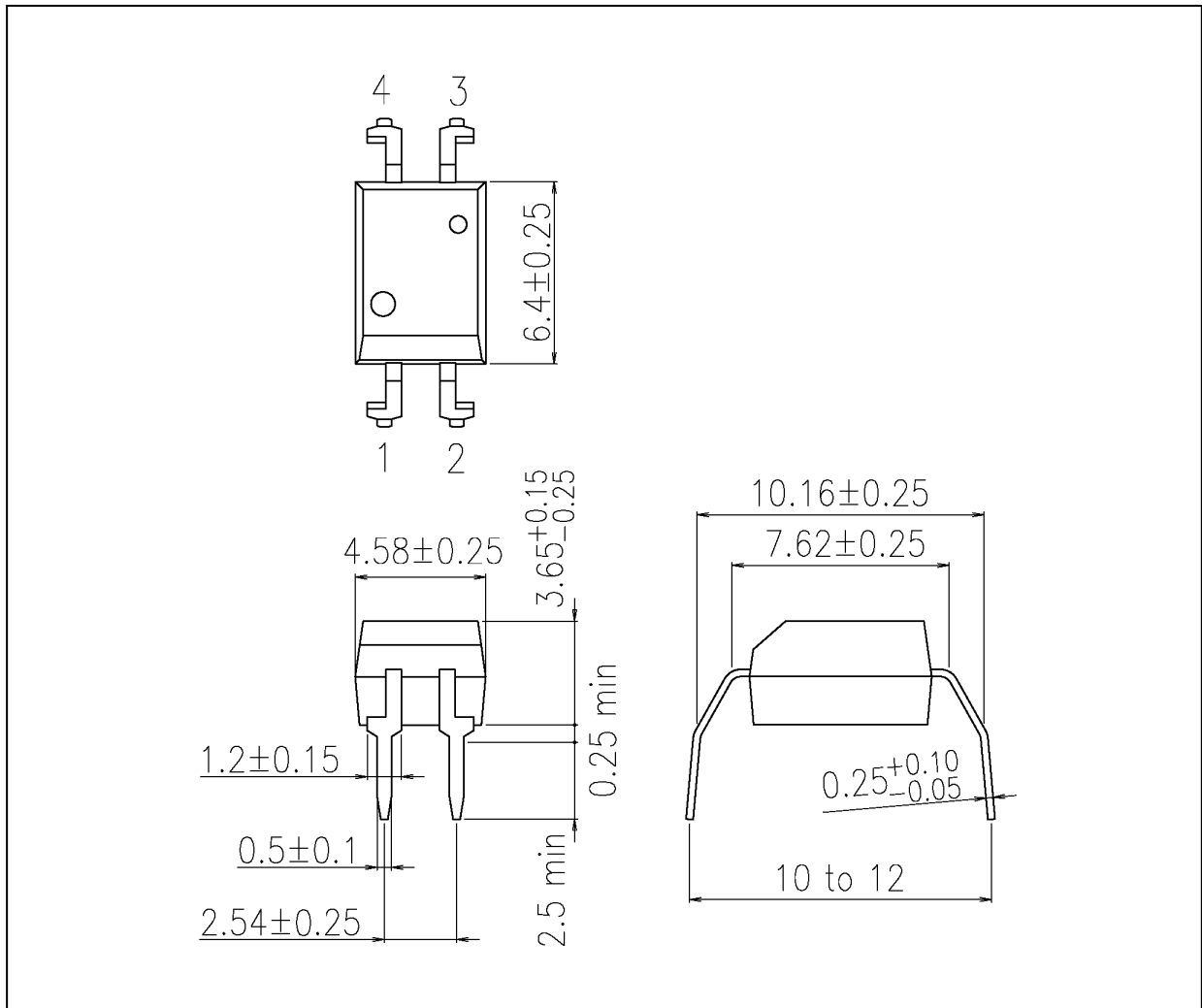


Fig. 13.1.9 I_{OFF} - T_a

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: 11-5B202S |

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