

# TLP221AF

## 1. Applications

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

## 2. General

The TLP221AF 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

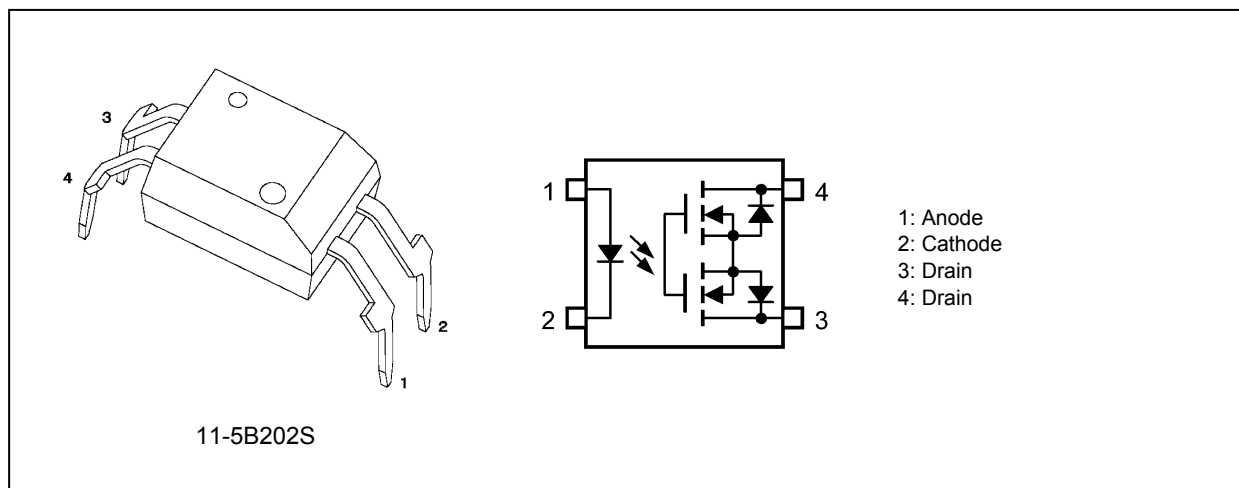
- (1) Normally off (1-Form-A)
- (2) OFF-state output terminal voltage: 40 V (min)
- (3) Trigger LED current: 2 mA (max)
- (4) ON-state current: 2.0 A (max)
- (5) ON-state resistance: 100 mΩ (max, t < 1s)
- (6) ON-state resistance: 150 mΩ (max, Continuous)
- (7) Isolation voltage: 5000 Vrms (min)
- (8) Safety standards

UL-under application: UL1577 File No. E67349

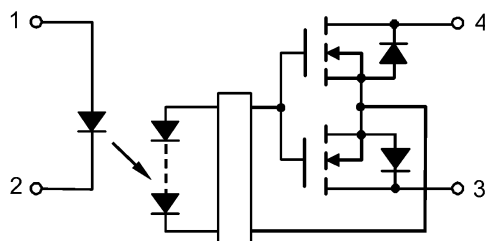
cUL-under application: CSA Component Acceptance Service No. 5A, File No. E67349

VDE-under application: Option (D4) EN60747-5-2

## 4. Packaging and Pin Configuration



**5. Internal Circuit**



**Fig. 5.1 Internal Circuit**

**6. Mechanical Parameters**

Characteristics	7.62-mm Pitch TLP221A	10.16-mm Pitch TLP221AF	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/°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	°C
Detector	OFF-state output terminal voltage	$V_{OFF}$		40	V
	ON-state current	$I_{ON}$		2.0	A
	ON-state current derating ( $T_a \geq 25^\circ\text{C}$ )	$\Delta I_{ON} / \Delta T_a$		-20	mA/°C
	ON-state current (pulsed) ( $t = 100 \text{ ms}$ , Duty = 1/10)	$I_{ONP}$		6.0	A
	Output power dissipation	$P_O$		500	mW
	Junction temperature	$T_j$		125	°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	$V_{DD}$		—	—	32	V
Input forward current	$I_F$		3	5	15	mA
ON-state current	$I_{ON}$		—	—	2.0	A
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	$I_{OFF}$		$V_{OFF} = 40\text{ V}$	—	—	1	$\mu\text{A}$
	Output capacitance	$C_{OFF}$		$V = 0\text{ V}, f = 1\text{ MHz}$	—	300	—	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	$I_{FT}$		$I_{ON} = 1.0\text{ A}$	—	0.3	2	mA
Return LED current	$I_{FC}$		$I_{OFF} = 10\ \mu\text{A}$	0.1	—	—	mA
ON-state resistance	$R_{ON}$		$I_{ON} = 2.0\text{ A}, I_F = 5\text{ mA}, t < 1\text{ s}$	—	60	100	m $\Omega$
		(Note 1)	$I_{ON} = 2.0\text{ A}, I_F = 5\text{ mA}, \text{Continuous}$	—	90	150	

Note 1: Thermally saturated state.

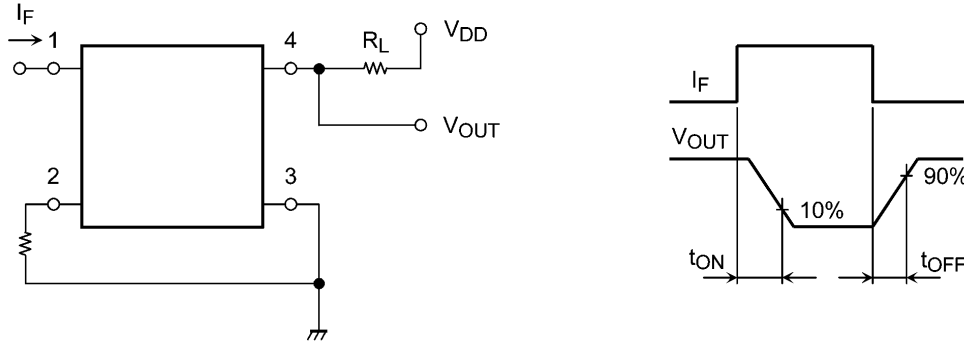
**11. Isolation Characteristics (Unless otherwise specified,  $T_a = 25^\circ\text{C}$ )**

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)	$V_S = 500\text{ V}, \text{R.H.} \leq 60\%$	$1 \times 10^{12}$	$10^{14}$	—	$\Omega$
Isolation voltage	$BV_S$		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,  $T_a = 25^\circ\text{C}$ )**

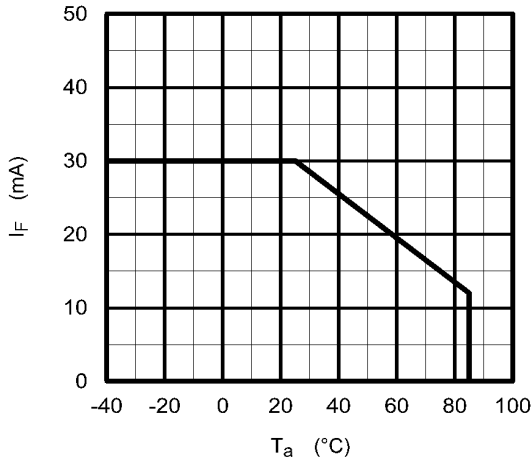
Characteristics	Symbol	Note	Test Condition	Min	Typ	Max	Unit
Turn-on time	$t_{ON}$		See Fig. 12.1. $R_L = 200 \Omega, V_{DD} = 20 \text{ V}, I_F = 5 \text{ mA}$	—	2	5	ms
Turn-off time	$t_{OFF}$			—	0.3	1	



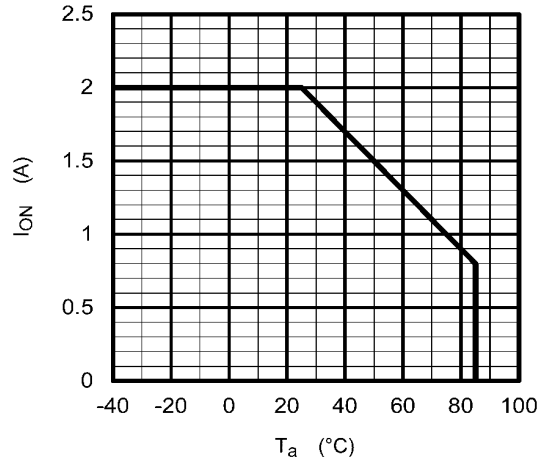
**Fig. 12.1 Switching Time Test Circuit**

**13. Characteristics Curves**

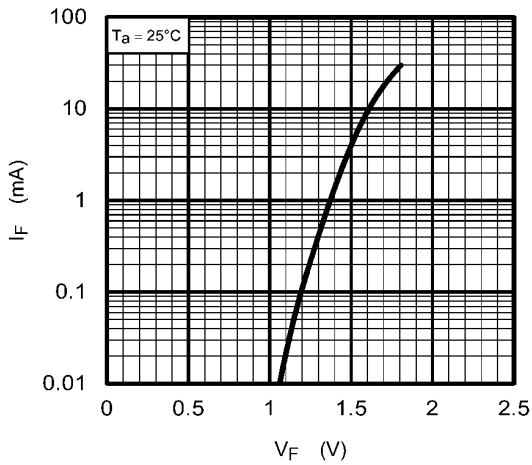
**13.1. Characteristics Curves (Note)**



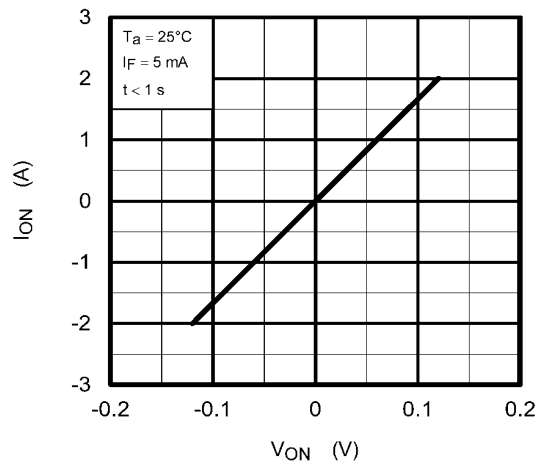
**Fig. 13.1.1 I<sub>F</sub> - T<sub>a</sub>**



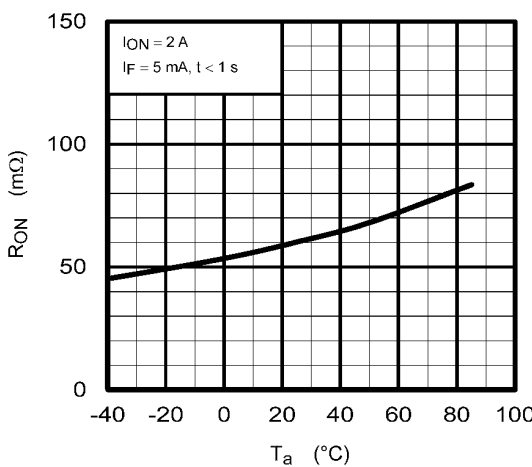
**Fig. 13.1.2 I<sub>ON</sub> - T<sub>a</sub>**



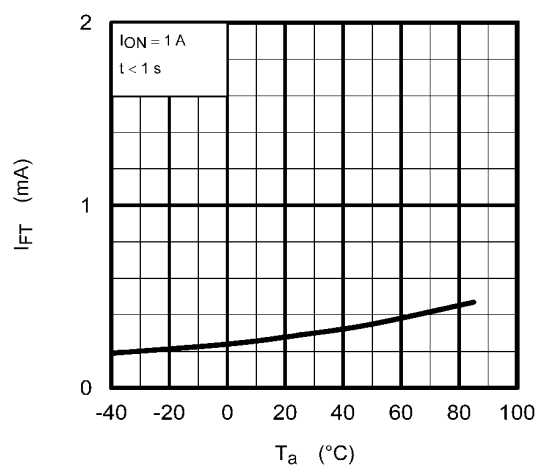
**Fig. 13.1.3 I<sub>F</sub> - V<sub>F</sub>**



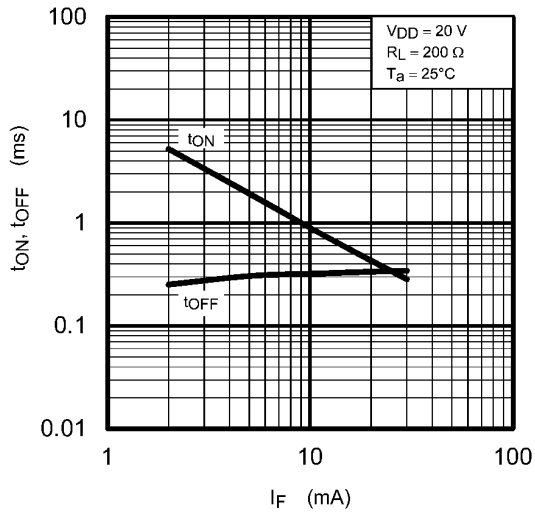
**Fig. 13.1.4 I<sub>ON</sub> - V<sub>ON</sub>**



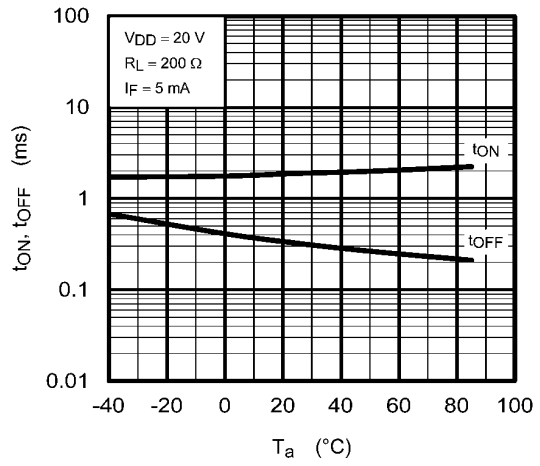
**Fig. 13.1.5 R<sub>ON</sub> - T<sub>a</sub>**



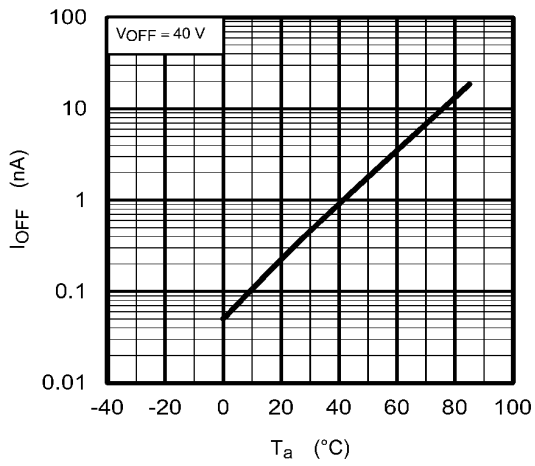
**Fig. 13.1.6 I<sub>FT</sub> - T<sub>a</sub>**



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



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

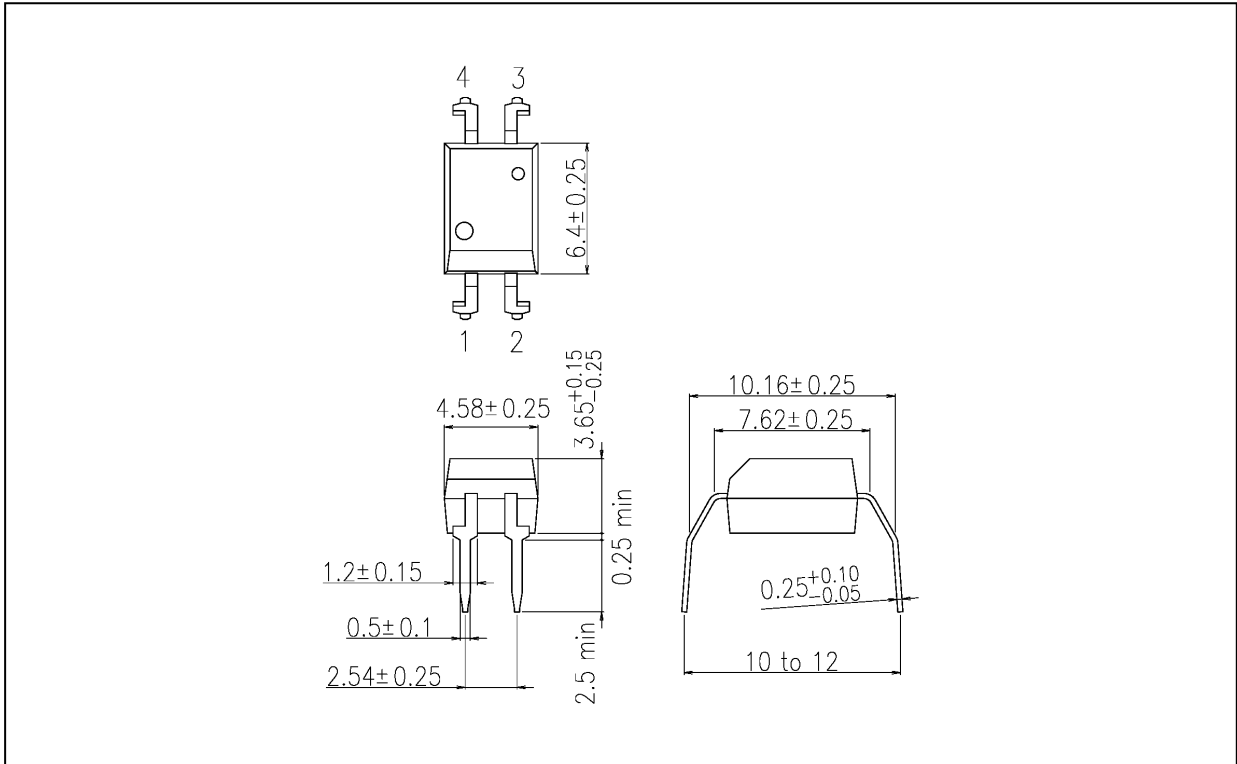


**Fig. 13.1.9  $I_{OFF} - T_a$**

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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