Photocouplers Photorelay

TLP3316

1. Applications

- High-Speed Memory Testers
- High-Speed Logic IC Testers
- Radio-Frequency Measuring Instruments
- ATE (Automatic Test Equipment)

2. General

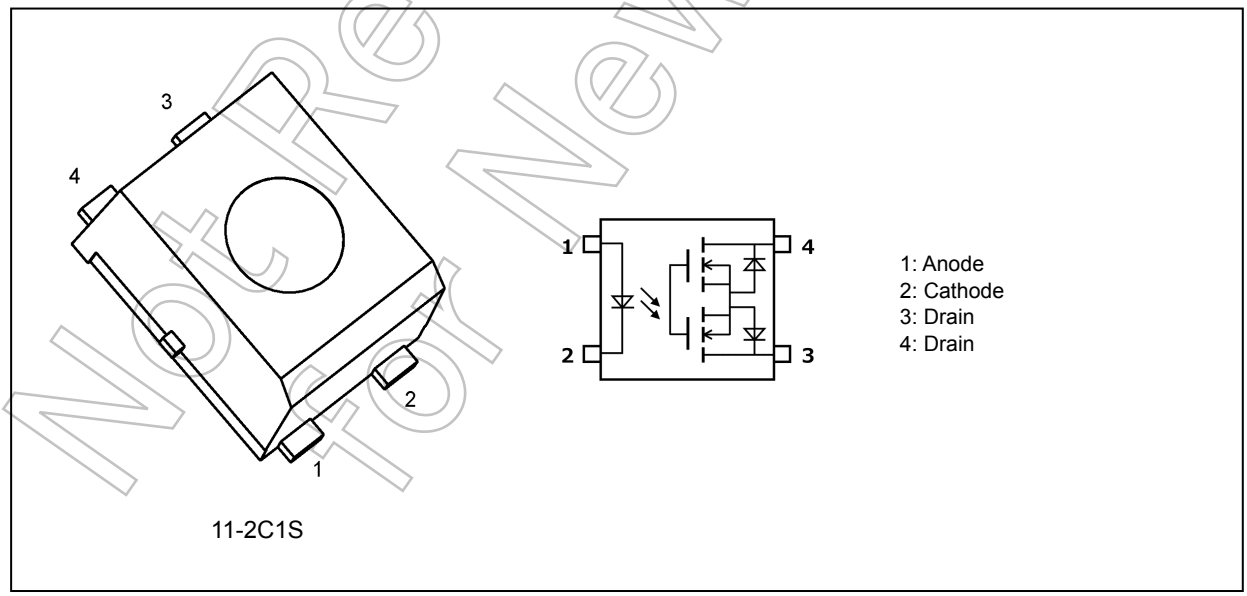
The TLP3316 is a photorelay in a 4-pin USOP that consists of a photo MOSFET optically coupled with an infrared LED. The TLP3316 features low CR multiplication and extremely low On-state resistance, allowing high On-state current.

Its features also include low Off-state current and low output pin capacitance, enabling it to be used for high-frequency measuring instrument applications.

3. Features

(1) Normally open (1-Form-A)
(2) OFF-state output terminal voltage: 40 V (min)
(3) Trigger LED current: 3 mA (max)
(4) ON-state current: 120 mA (max)
(5) ON-state resistance: 10 Ω (typ.), 15 Ω (max)
(6) OFF-state Capacitance: 1.0 pF (typ.), 2.0 pF (max)
(7) Isolation voltage: 1000 Vrms (min)
(8) Safety standards
UL-recognized: UL 1577, File No.E67349

4. Packaging and Pin Assignment



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Start of commercial production
2011-11

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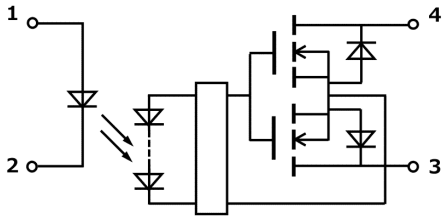
5. Internal Circuit



6. Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25 °C)

	Characteristics		Symbol	Note	Rating	Unit
LED	Input forward current		I_F		50	mA
	Input forward current derating	($T_a \geq 25$ °C)	$\Delta I_F/\Delta T_a$		-0.5	mA/°C
	Input reverse voltage		V_R		5	V
	Input power dissipation		P_D		50	mW
	Input power dissipation derating	($T_a \geq 25$ °C)	$\Delta P_D/\Delta T_a$		-0.5	mW/°C
	Junction temperature		T_j		125	°C
Detector	OFF-state output terminal voltage		V_{OFF}		40	V
	ON-state current		I_{ON}		120	mA
	ON-state current derating	($T_a \geq 25$ °C)	$\Delta I_{ON}/\Delta T_a$		-1.2	mA/°C
	ON-state current (pulsed)	(t = 100 ms, Duty = 1/10)	I_{ONP}		360	mA
	Output power dissipation		P_O		200	mW
	Output power dissipation derating	($T_a \geq 25$ °C)	$\Delta P_O/\Delta T_a$		-2.0	mW/°C
	Junction temperature		T_j		125	°C
Common	Storage temperature		T_{stg}		-40 to 125	
	Operating temperature		T_{opr}		-40 to 85	
	Lead soldering temperature	(10 s)	T_{sol}		260	
	Isolation voltage	AC, 60 s, R.H. ≤ 60 %	BV_S	(Note 1)	1000	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.

Caution: This device is sensitive to electrostatic discharge (ESD). Extreme ESD conditions should be guarded against by using proper antistatic precautions for the worktable, operator, solder iron, soldering equipment and so on.

7. Recommended Operating Conditions (Note)

Characteristics	Symbol	Note	Min	Typ.	Max	Unit
Supply voltage	V_{DD}		—	—	32	V
Input forward current	I_F		5	7.5	20	mA
ON-state current	I_{ON}		—	—	120	
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 data sheet should also be considered.

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8. Electrical Characteristics (Unless otherwise specified, T_a = 25 °C)

	Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
LED	Input forward voltage	V_F		I_F = 10 mA	1.0	1.15	1.3	V
	Input reverse current	I_R		V_R = 5 V	—	—	10	μA
	Input capacitance	C_t		V = 0 V, f = 1 MHz	—	15	—	pF
Detector	OFF-state current	I_{OFF}		V_{OFF} = 40 V	—	—	200	pA
	Output capacitance	C_{OFF}		V = 0 V, f = 100 MHz, t < 1s	—	1.0	2.0	pF

9. Coupled Electrical Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Trigger LED current	I_{FT}		I_{ON} = 100 mA	—	0.6	3	mA
Return LED current	I_{FC}		I_{OFF} = 10 μA	0.1	—	—	
ON-state resistance	R_{ON}		I_{ON} = 120 mA, I_F = 5 mA, t < 1 s	—	10	15	Ω

10. Isolation Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Total capacitance (input to output)	C_S	(Note 1)	V_S = 0 V, f = 1 MHz	—	0.4	—	pF
Isolation resistance	R_S	(Note 1)	V_S = 500 V, R.H. ≤ 60 %	5×10^{10}	10^{14}	—	Ω
Isolation voltage	BV_S	(Note 1)	AC, 60 s	1000	—	—	Vrms

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.

11. Switching Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Turn-on time	t_{ON}		See Fig. 11.1. R_L = 200 Ω, V_{DD} = 20 V, I_F = 5 mA	—	50	200	μs
Turn-off time	t_{OFF}			—	160	300	

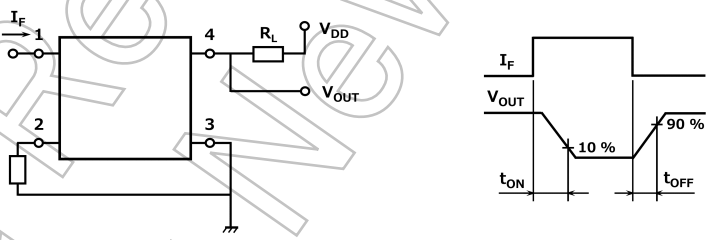

Fig. 11.1 Switching Time Test Circuit and Waveform

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12. Characteristics Curves and Circuit Connections

12.1. Characteristics Curves (Note)

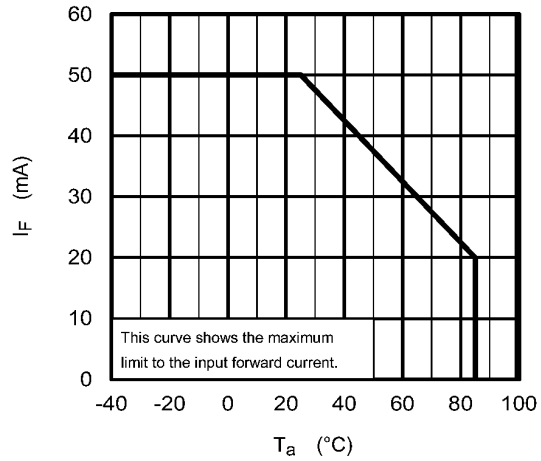

Fig. 12.1.1 I_F - T_a

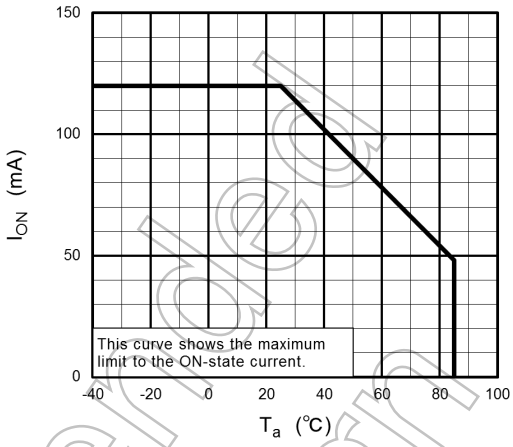

Fig. 12.1.2 I_{ON} - T_a

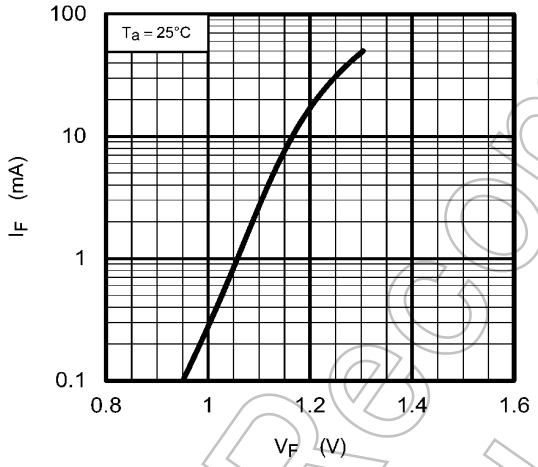

Fig. 12.1.3 I_F - V_F

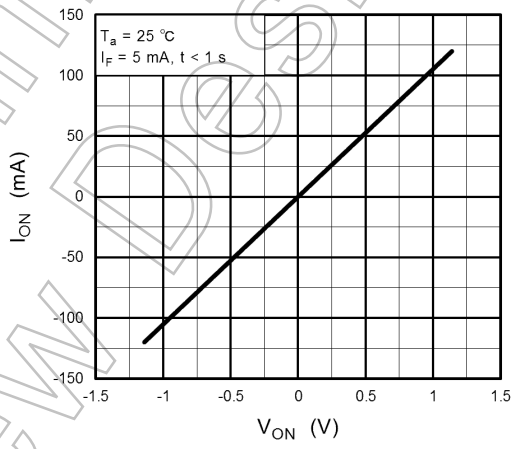

Fig. 12.1.4 I_{ON} - V_{ON}

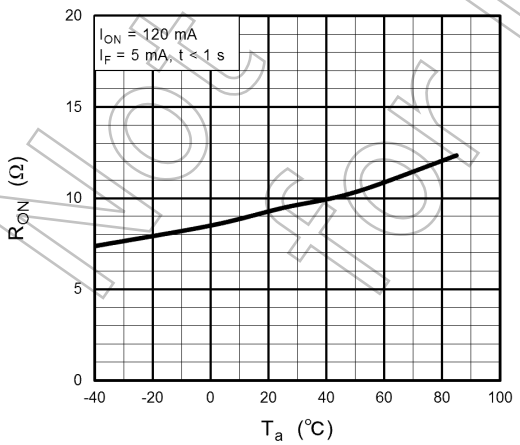

Fig. 12.1.5 R_{ON} - T_a

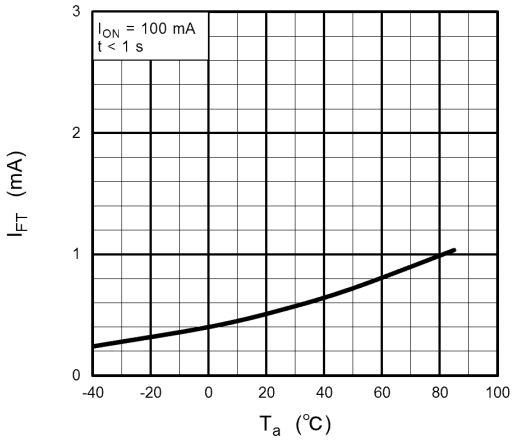

Fig. 12.1.6 I_{FT} - T_a

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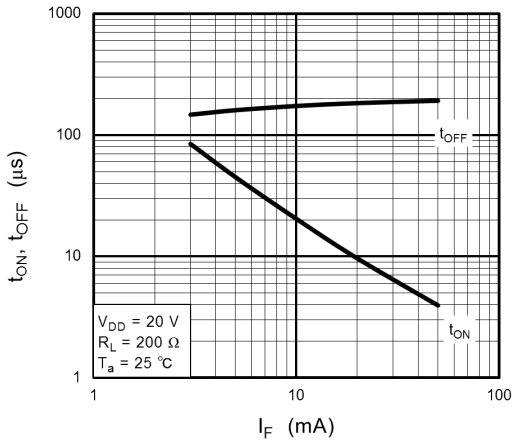

Fig. 12.1.7 t_{ON}, t_{OFF} - I_F

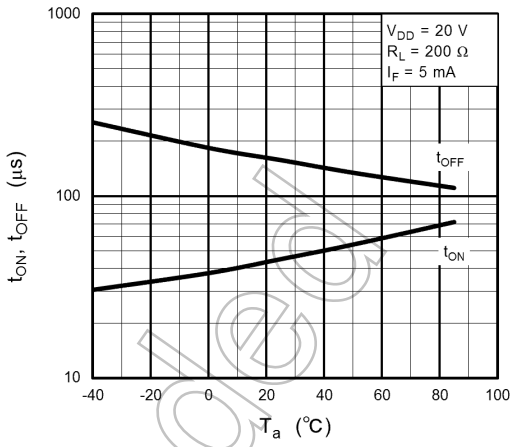

Fig. 12.1.8 t_{ON}, t_{OFF} - T_a

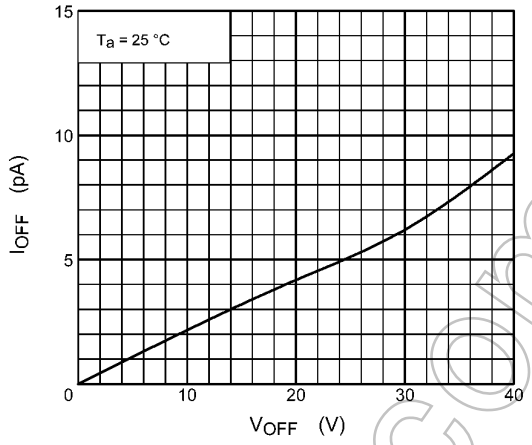

Fig. 12.1.9 I_{OFF} - V_{OFF}

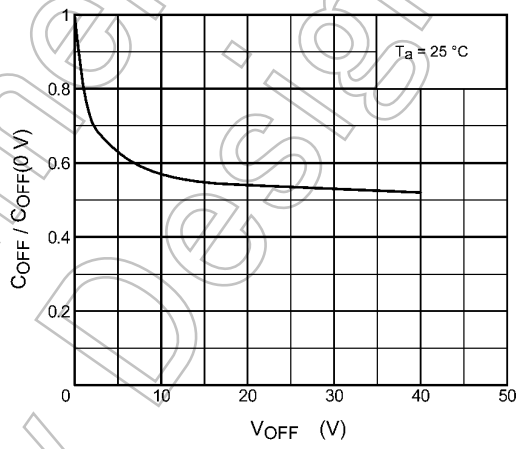

Fig. 12.1.10 C_{OFF}/C_{OFF}(0 V) - V_{OFF}

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

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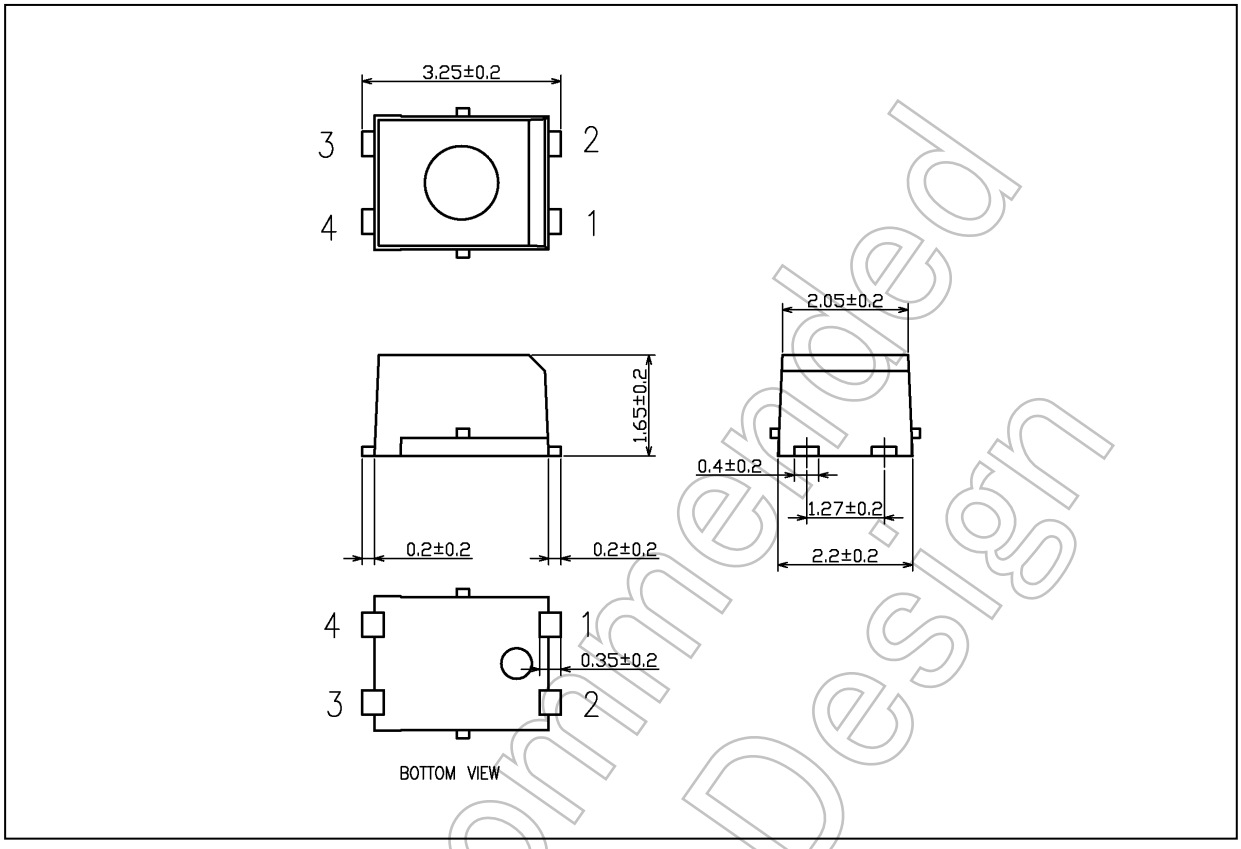
Package Dimensions

Unit: mm



Weight: 0.03 g (typ.)

Package Name(s)
TOSHIBA: 11-2C1S

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