

Photocouplers Photorelay

TLP3375

1. Applications

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

2. General

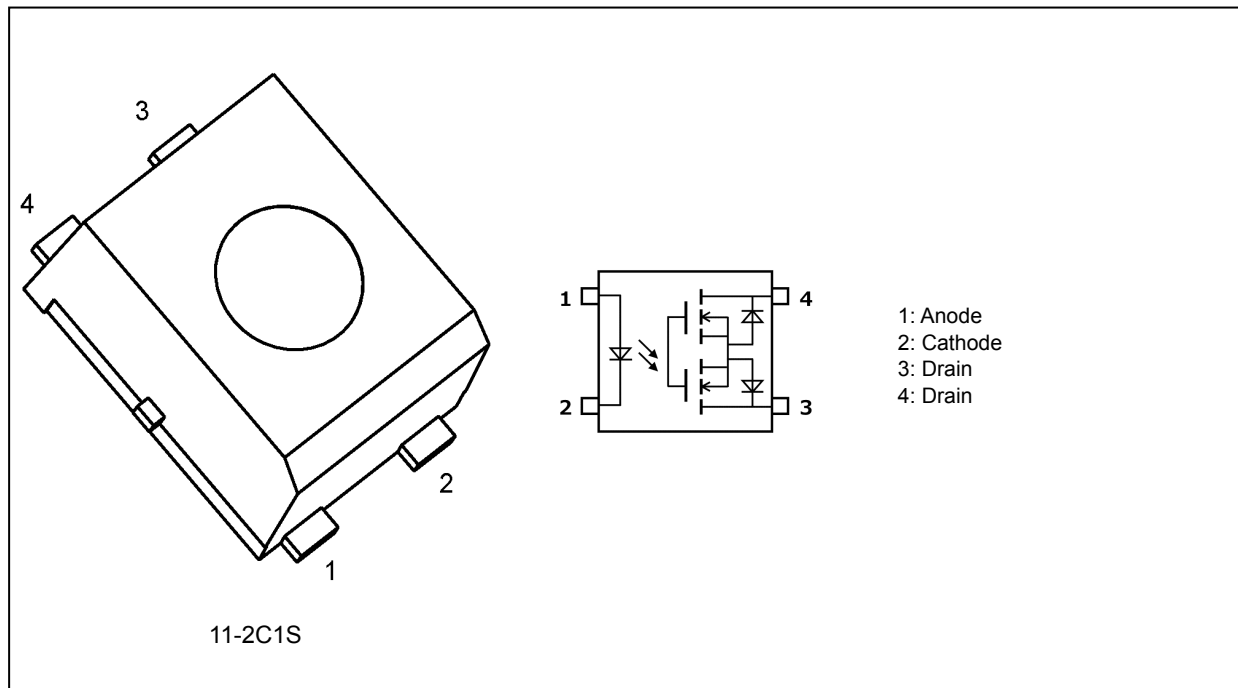
The TLP3375 photorelay consists of a photo MOSFET optically coupled to an infrared LED. It is housed in a 4-pin USOP package. The TLP3375 is designed to exhibit a fast rise time and reduce signal degradation. It is primarily suitable as a replacement for a mechanical relay to be used as a switching device in high-speed testers.

3. Features

- (1) Normally opened (1-Form-A)
- (2) OFF-state output terminal voltage: 50 V (min)
- (3) Trigger LED current: 3 mA (max)
- (4) ON-state current: 300 mA (max)
- (5) ON-state resistance: 1.0 Ω (typ.), 1.5 Ω (max)
- (6) OFF-state Capacitance: 12 pF (typ.)
- (7) Isolation voltage: 1000 V_{rms} (min)
- (8) ERT(Equivalent Rise Time): 40 ps (typ.), 90 ps (max)
- (9) Safety standard

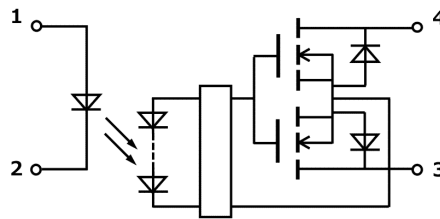
UL-recognized: UL 1577, File No.E67349

4. Packaging and Pin Configuration



Start of commercial production
2010-10

5. Internal Circuit



6. 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		50	mA
	Input forward current derating ($T_a \geq 25\text{ }^\circ\text{C}$)	$\Delta I_F / \Delta T_a$		-0.5	mA/ $^\circ\text{C}$
	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}		50	V
	ON-state current	I_{ON}		300	mA
	ON-state current derating ($T_a \geq 25\text{ }^\circ\text{C}$)	$\Delta I_{ON} / \Delta T_a$		-3.0	mA/ $^\circ\text{C}$
	ON-state current (pulsed) ($t = 100\text{ ms}$, duty = 1/10)	I_{ONP}		900	mA
	Output power dissipation	P_O		200	mW
	Output power dissipation derating ($T_a \geq 25\text{ }^\circ\text{C}$)	$\Delta P_O / \Delta T_a$		-2.0	mW/ $^\circ\text{C}$
	Junction temperature	T_j		125	$^\circ\text{C}$
Common	Storage temperature	T_{stg}		-40 to 125	$^\circ\text{C}$
	Operating temperature	T_{opr}		-40 to 85	
	Lead soldering temperature (10 s)	T_{sol}		260	
	Isolation voltage (AC, 60 s, R.H. $\leq 60\%$)	BV_S	(Note 1)	1000	

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}		—	—	40	V
Input forward current	I_F		5	7.5	20	mA
ON-state current	I_{ON}		—	—	300	
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.

8. 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		$I_F = 10\text{ mA}$	1.0	1.15	1.3	V
	Input reverse current	I_R		$V_R = 5\text{ V}$	—	—	10	μA
	Input capacitance	C_t		$V = 0\text{ V}, f = 1\text{ MHz}$	—	15	—	pF
Detector	OFF-state current	I_{OFF}		$V_{OFF} = 50\text{ V}$	—	—	1	nA
	Output capacitance	C_{OFF}		$V = 0\text{ V}, f = 100\text{ MHz}, t < 1\text{ s}$	—	12	—	pF

9. 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}		$I_{ON} = 100\text{ mA}$	—	0.5	3	mA
Return LED current	I_{FC}		$I_{OFF} = 10\text{ μA}$	0.2	—	—	mA
ON-state resistance	R_{ON}		$I_{ON} = 300\text{ mA}, I_F = 5\text{ mA}, t < 1\text{ s}$	—	1.0	1.5	Ω

10. 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)	$V_S = 0\text{ V}, f = 1\text{ MHz}$	—	0.4	—	pF
Isolation resistance	R_S	(Note 1)	$V_S = 500\text{ V}, \text{R.H.} \leq 60\%$	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, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Turn-on time	t_{ON}		See Fig. 11.1	—	200	500	μs
Turn-off time	t_{OFF}		$R_L = 200\ \Omega, V_{DD} = 20\ \text{V}, I_F = 5\ \text{mA}$	—	100	400	
Turn-on time	t_{ON}		See Fig. 11.1	—	—	250	
Turn-off time	t_{OFF}		$R_L = 200\ \Omega, V_{DD} = 20\ \text{V}, I_F = 10\ \text{mA}$	—	—	400	
Equivalent rise time	ERT		See Fig. 11.2 $I_F = 5\ \text{mA}, V_{DD} = 0.25\ \text{V}, t_{r(in)} = 25\ \text{ps}$	—	40	90	ps

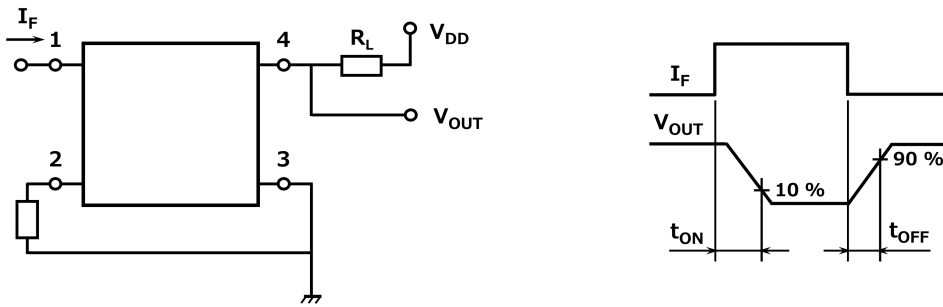


Fig. 11.1 Switching Time Test Circuit and Waveform

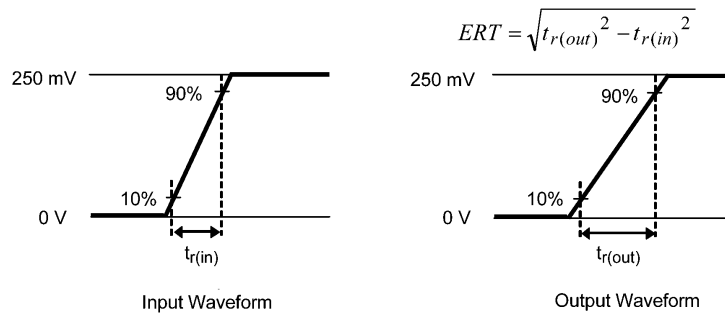


Fig. 11.2 ERT (Equivalent Rise Time)

12. Characteristics Curves and Circuit Connections

12.1. Characteristics Curves (Note)

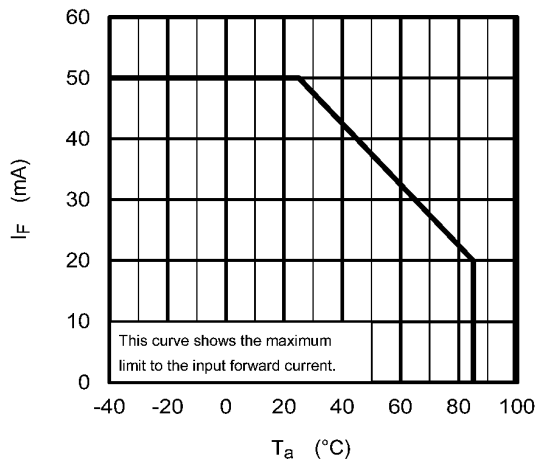


Fig. 12.1.1 $I_F - T_a$

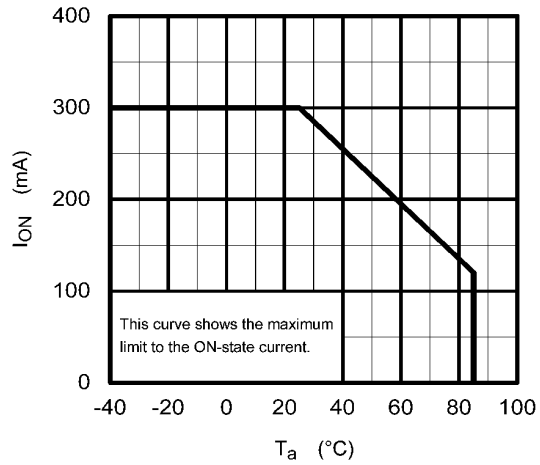


Fig. 12.1.2 $I_{ON} - T_a$

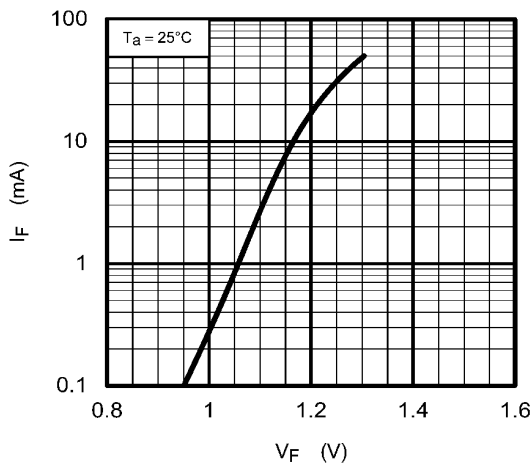


Fig. 12.1.3 $I_F - V_F$

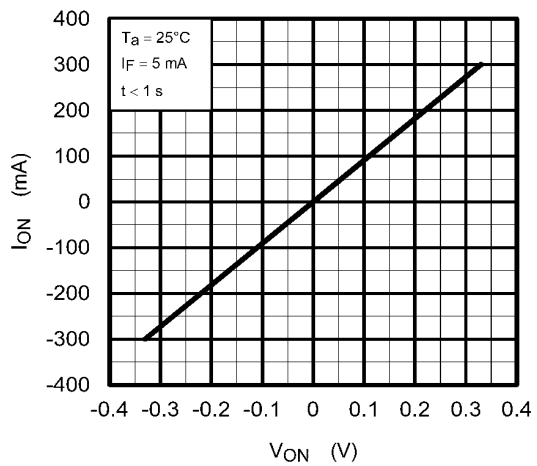


Fig. 12.1.4 $I_{ON} - V_{ON}$

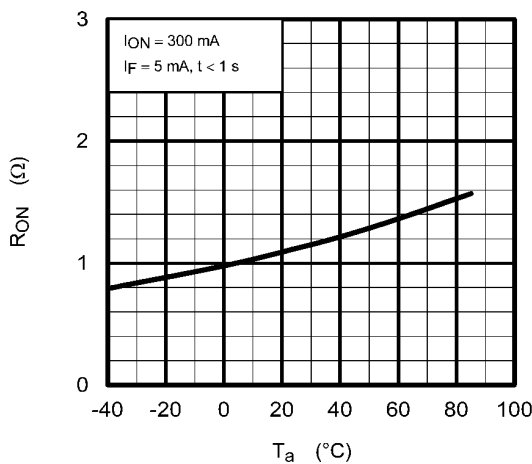


Fig. 12.1.5 $R_{ON} - T_a$

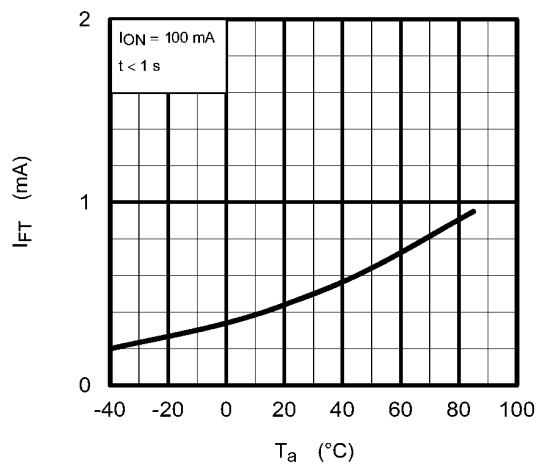


Fig. 12.1.6 $I_{FT} - T_a$

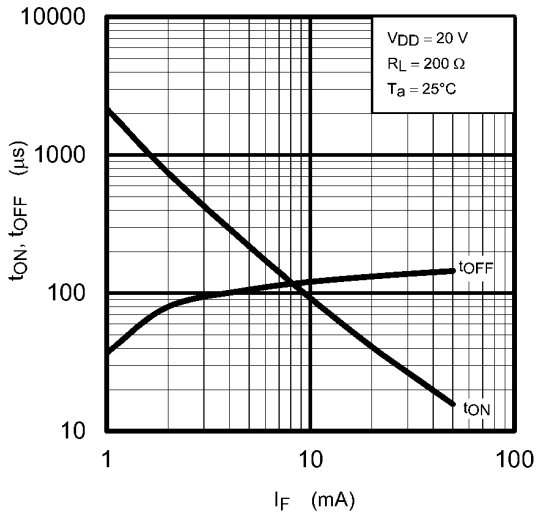


Fig. 12.1.7 t_{ON} , t_{OFF} - I_F

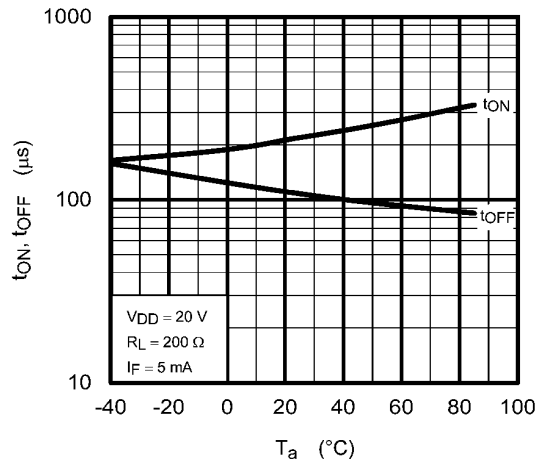


Fig. 12.1.8 t_{ON} , t_{OFF} - T_a

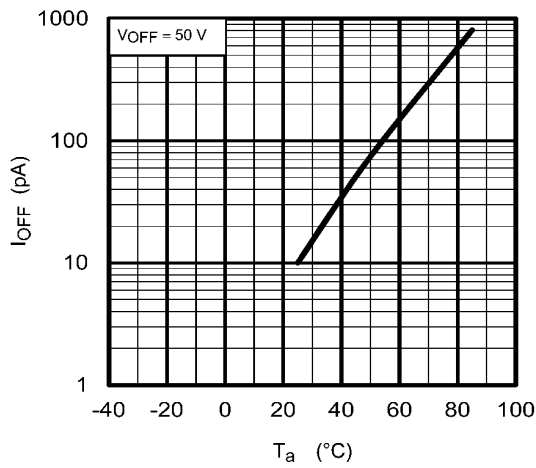


Fig. 12.1.9 I_{OFF} - T_a

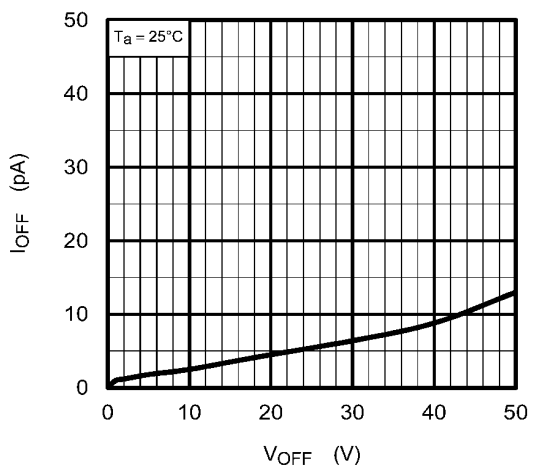


Fig. 12.1.10 I_{OFF} - V_{OFF}

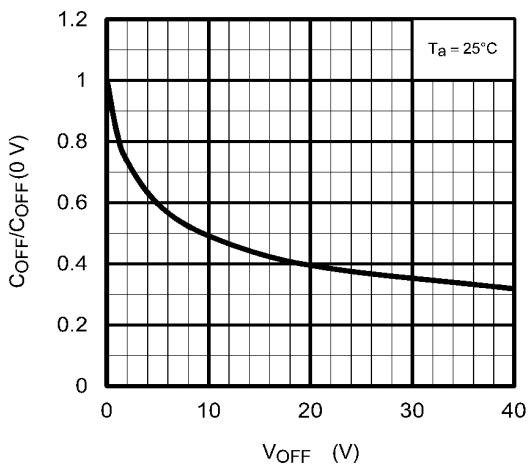
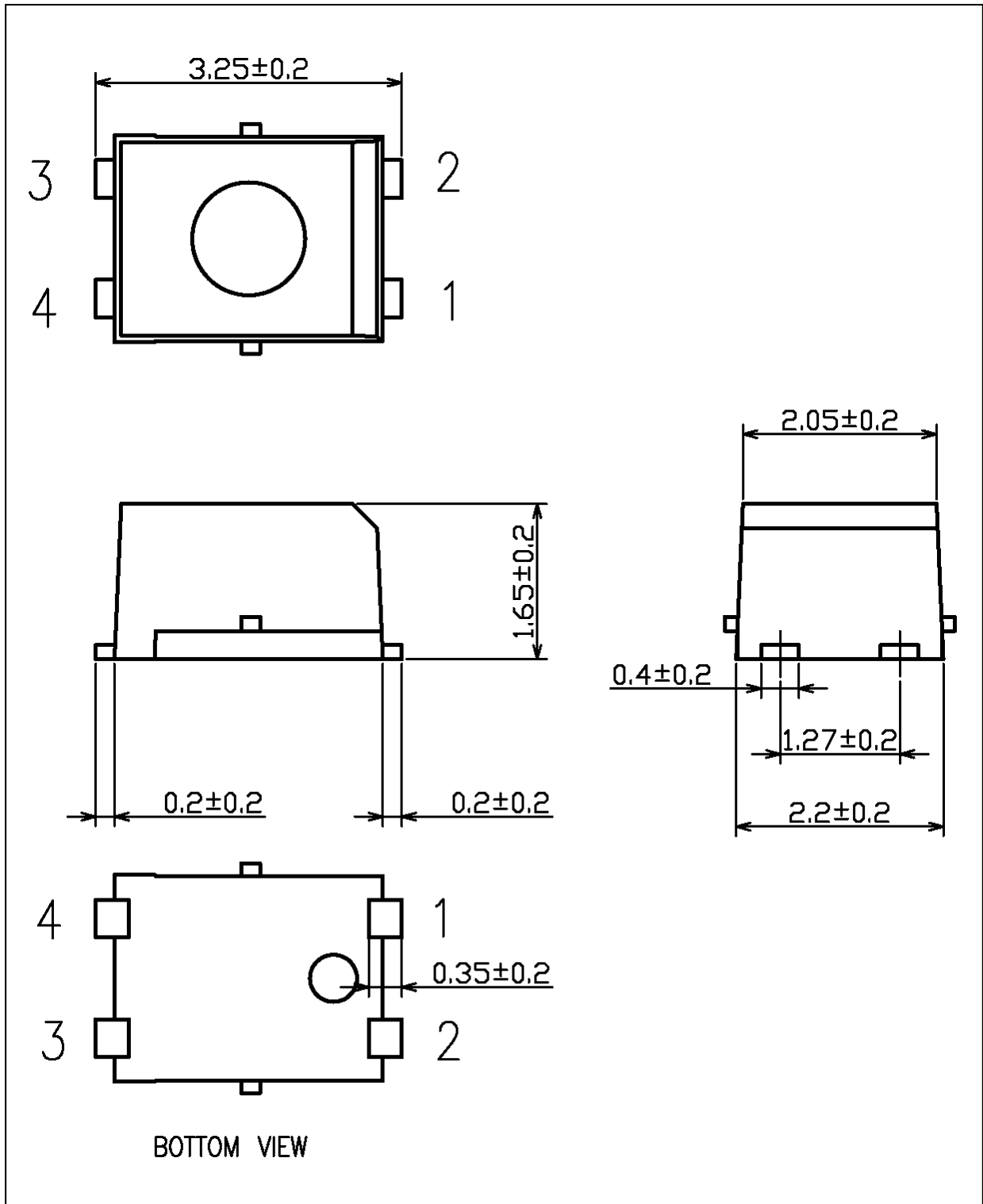


Fig. 12.1.11 $C_{OFF}/C_{OFF}(0\text{ V})$ - V_{OFF}

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

Package Dimensions

Unit: mm



Weight: 0.03 g (typ.)

Package Name(s)
TOSHIBA: 11-2C1S

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