

# TLP3351

## 1. Applications

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

## 2. General

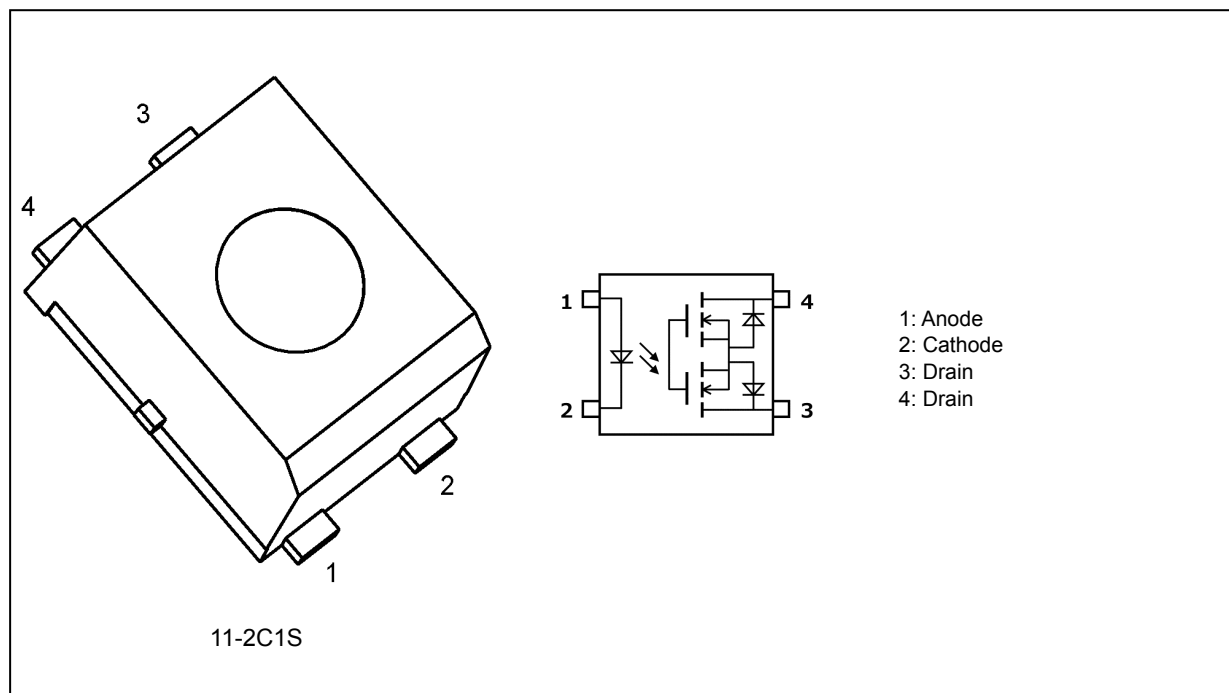
The TLP3351 is a photorelay in a 4-pin USOP that consists of a photo MOSFET optically coupled with an infrared LED. The TLP3351 features low output capacitance,  $C_{OFF}$ , and thus fast on/off switching of a high-frequency signal, making it ideal for switching applications in high-speed testers.

## 3. Features

- (1) Normally opened (1-Form-A)
- (2) OFF-state output terminal voltage: 60 V (min)
- (3) Trigger LED current: 3 mA (max)
- (4) ON-state current: 120 mA (max)
- (5) ON-state resistance: 10  $\Omega$  (typ.), 15  $\Omega$  (max)
- (6) OFF-state Capacitance: 0.7 pF (typ.), 1.3 pF (max)
- (7) Isolation voltage: 1000 Vrms (min)
- (8) Safety standard

UL-recognized: UL 1577, File No.E67349

## 4. Packaging and Pin Configuration



Start of commercial production

2011-10

## 5. Internal Circuit

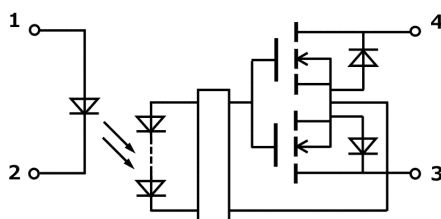


Fig. 5.1 Internal Circuit

## 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	$V_{OFF}$		60	V
	ON-state current	$I_{ON}$		120	mA
	ON-state current derating ( $T_a \geq 25\text{ }^{\circ}\text{C}$ )	$\Delta I_{ON} / \Delta T_a$		-1.2	mA/ $^{\circ}\text{C}$
	ON-state current (pulsed) ( $t = 100\text{ ms}$ , duty = 1/10)	$I_{ONP}$		360	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	
	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	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	$V_{DD}$		—	—	48	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.

## 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	$I_{OFF}$		$V_{OFF} = 60\text{ V}$	—	—	1	nA
	Output capacitance	$C_{OFF}$		$V = 0\text{ V}, f = 100\text{ MHz}, t < 1\text{ s}$	—	0.7	1.3	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	$I_{FT}$		$I_{ON} = 100\text{ mA}$	—	1.0	3	mA
Return LED current	$I_{FC}$		$I_{OFF} = 10\text{ μA}$	0.1	—	—	mA
ON-state resistance	$R_{ON}$		$I_{ON} = 120\text{ mA}, I_F = 5\text{ mA}, t < 1\text{ s}$	—	10	15	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)	$V_S = 500\text{ V}, \text{R.H.} \leq 60\%$	$5 \times 10^{10}$	$10^{14}$	—	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, $T_a = 25\text{ °C}$ )

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Turn-on time	$t_{ON}$		See Fig. 11.1 $R_L = 200\text{ Ω}, V_{DD} = 20\text{ V}, I_F = 5\text{ mA}$	—	40	200	μs
Turn-off time	$t_{OFF}$			—	120	200	

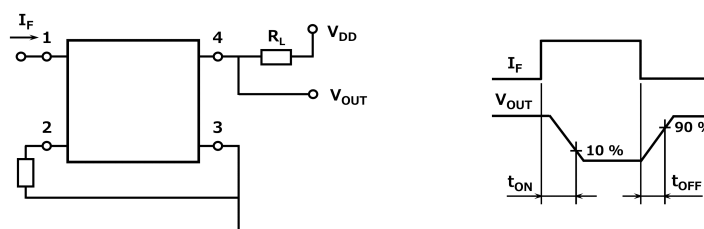


Fig. 11.1 Switching Time Test Circuit and Waveform

12. Characteristics Curves

12.1. Characteristics Curves (Note)

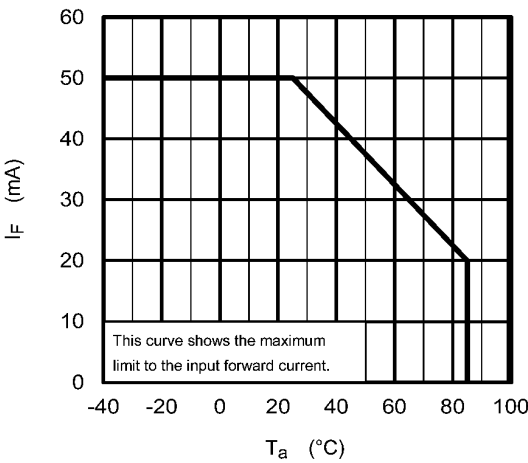


Fig. 12.1.1  $I_F - T_a$

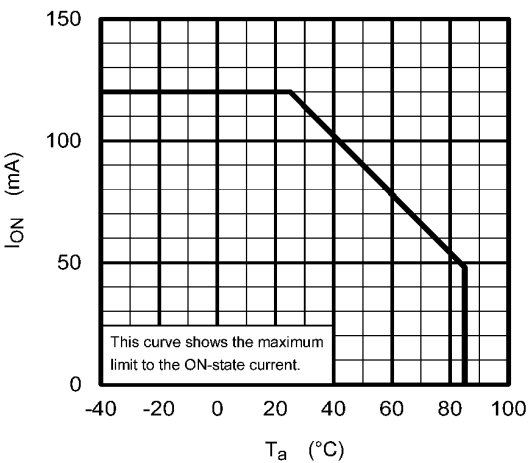


Fig. 12.1.2  $I_{ON} - T_a$

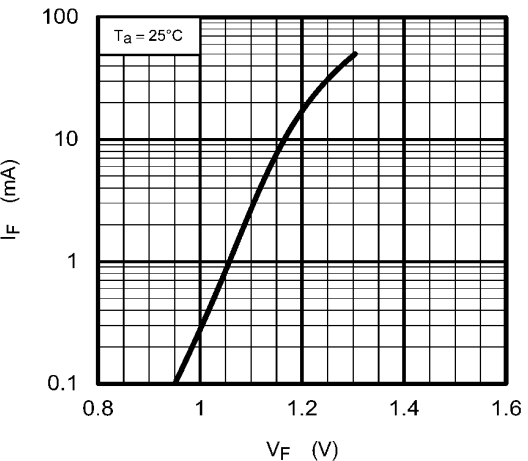


Fig. 12.1.3  $I_F - V_F$

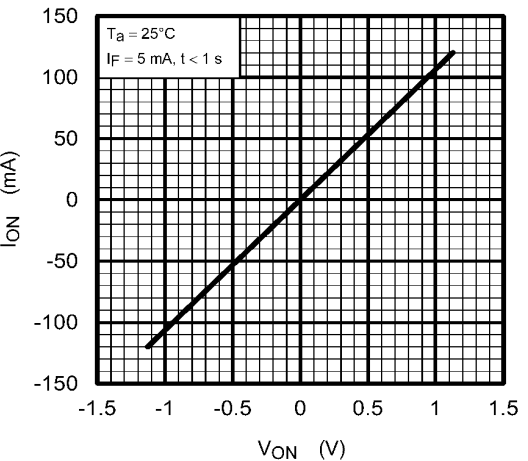


Fig. 12.1.4  $I_{ON} - V_{ON}$

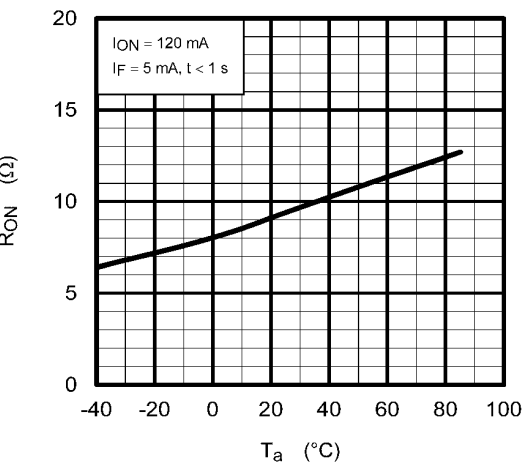


Fig. 12.1.5  $R_{ON} - T_a$

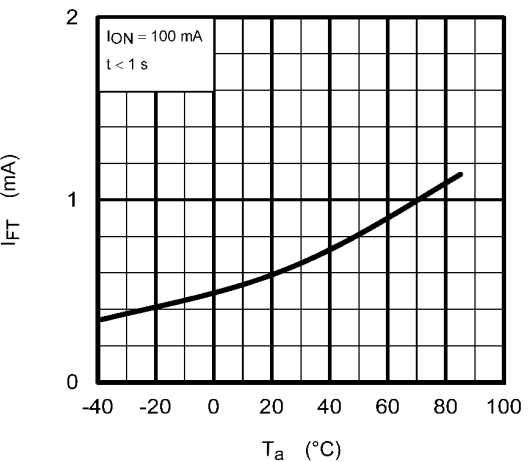


Fig. 12.1.6  $I_{FT} - T_a$

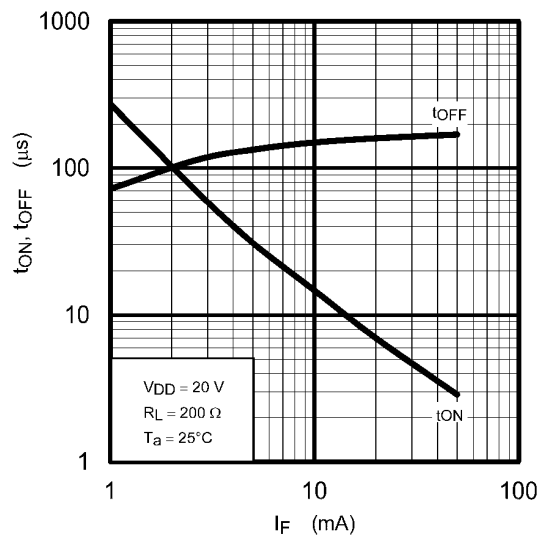


Fig. 12.1.7  $t_{ON}$ ,  $t_{OFF}$  -  $I_F$

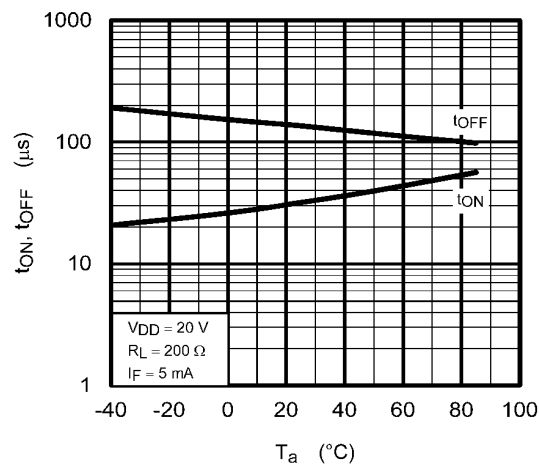


Fig. 12.1.8  $t_{ON}$ ,  $t_{OFF}$  -  $T_a$

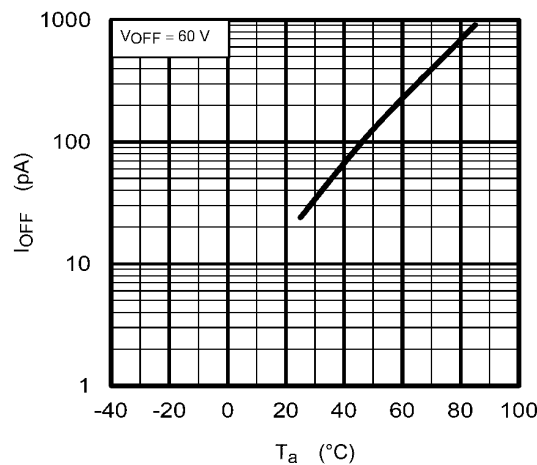


Fig. 12.1.9  $I_{OFF}$  -  $T_a$

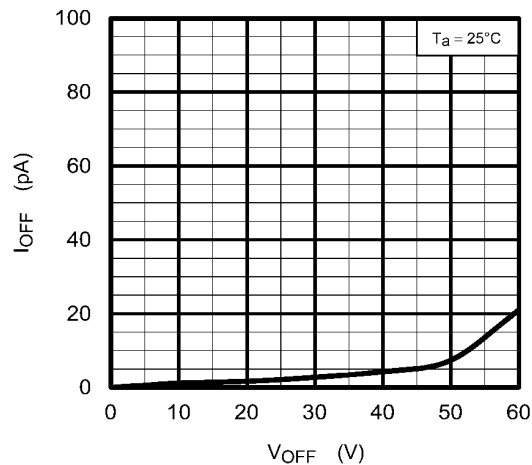


Fig. 12.1.10  $I_{OFF}$  -  $V_{OFF}$

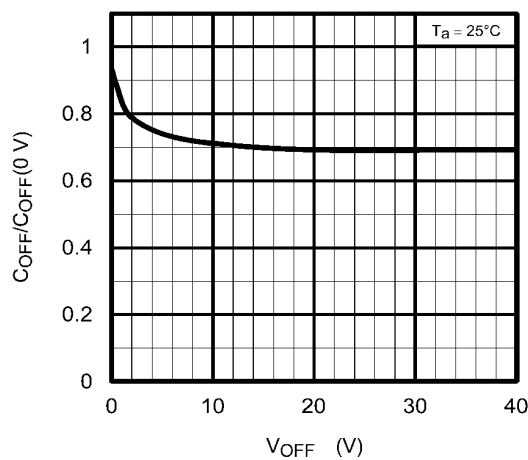
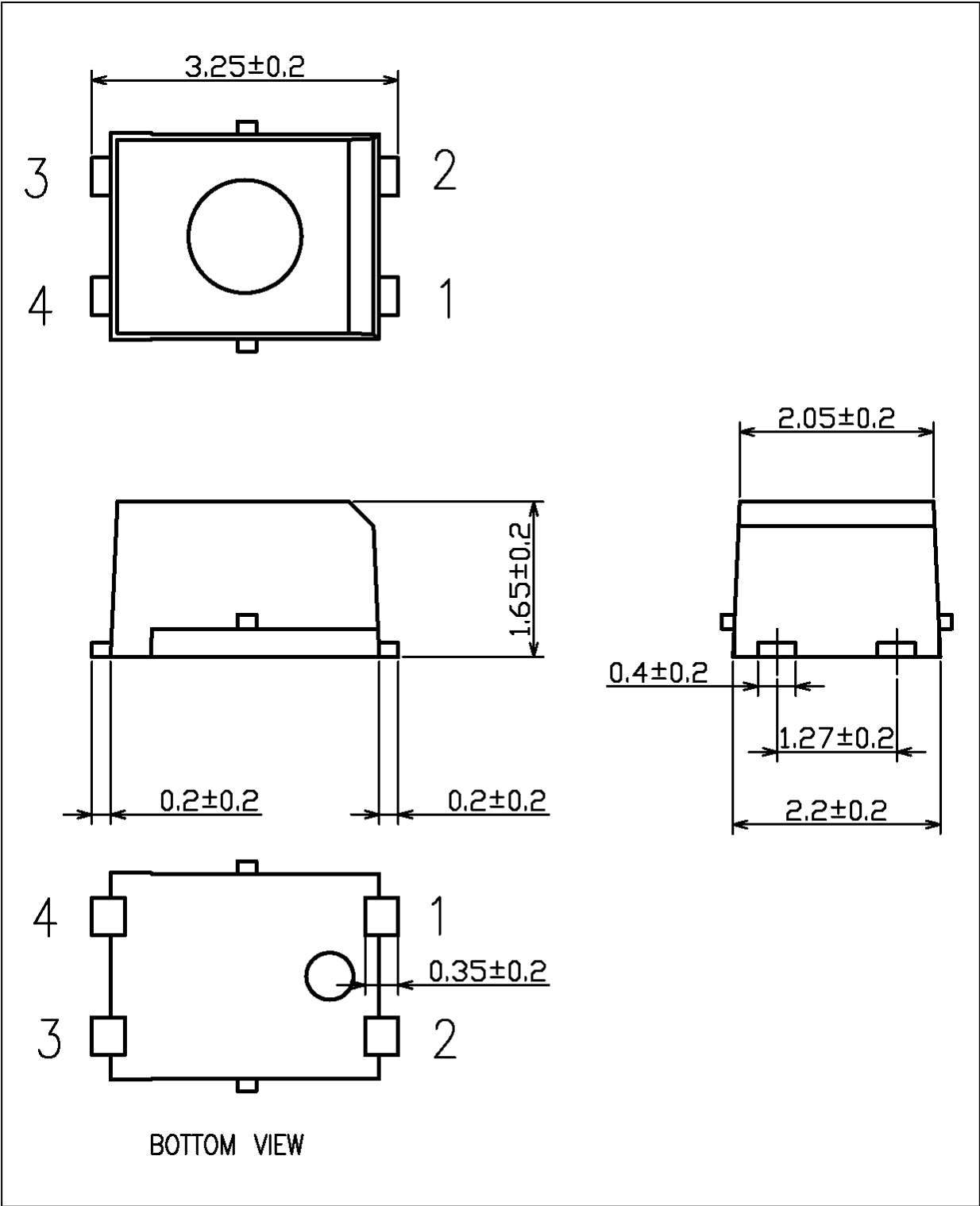


Fig. 12.1.11  $C_{OFF}/C_{OFF(0V)}$  -  $V_{OFF}$

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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