Photocouplers Photorelay

TLP3475S

1. Applications

- Measuring Instruments
- High-Speed Memory Testers
- High-Speed Logic IC Testers
- ATE (Automatic Test Equipment)
- Probe Cards

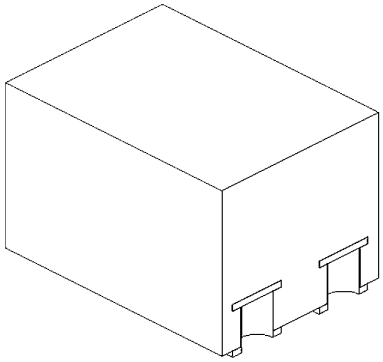
2. General

The TLP3475S photorelay consists of a photo MOSFET optically coupled to an infrared LED. It is housed in a S-VSON4T package. The TLP3475S features a low CR product and extremely low on-state resistance,and thus delivers high on-state current. Additionally, the TLP3475S offers low insertion loss of a high-frequency signal and thus prevents the degradation of a rapidly rising signal. The TLP3475S also features low off-state current and low output pin capacitance, making it suitable for high-frequency measuring instrument applications.

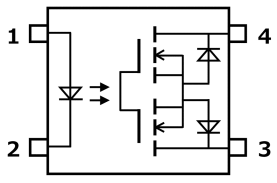
3. Features

(1) S-VSON4T: height = 1.4 mm (max), area = 1.45 mm × 2.0 mm (typ.)
(2) Normally opened (1-Form-A)
(3) OFF-state output terminal voltage: 60 V (min)
(4) Trigger LED current: 3 mA (max)
(5) ON-state current: 0.4 A (max)
(6) ON-state resistance: 1.5 Ω (max)
(7) Output capacitance: 12 pF (typ.), 20 pF (max)
(8) Isolation voltage: 500 Vrms (min)
(9) Halogen-free
For details, see "Devices in Halogen-Free Resin Packages" at the end of this datasheet.

4. Packaging and Pin Assignment



11-2E2

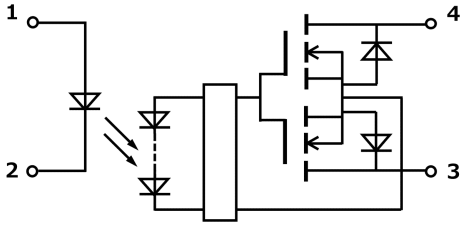


1: Anode
2: Cathode
3: Drain
4: Drain

Start of commercial production
2017-03

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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		30	mA
	Input forward current derating	($T_a \geq$ 25 °C)	$\Delta I_F/\Delta T_a$		-0.3	mA/°C
	Input reverse voltage		V_R		6	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}		60	V
	ON-state current		I_{ON}		0.4	A
	ON-state current derating	($T_a \geq$ 25 °C)	$\Delta I_{ON}/\Delta T_a$		-4	mA/°C
	ON-state current (pulsed)	(t = 100 ms, Duty = 1/10)	I_{ONP}		1.2	A
	Output power dissipation		P_O		240	mW
	Output power dissipation derating	($T_a \geq$ 25 °C)	$\Delta P_O/\Delta T_a$		-2.4	mW/°C
	Junction temperature		T_j		125	°C
Common	Storage temperature		T_{stg}		-40 to 125	
	Operating temperature		T_{opr}		-40 to 110	
	Lead soldering temperature	(10 s)	T_{sol}		260	
	Isolation voltage	AC, 60 s, R.H. ≤ 60 %	BV_S	(Note 1)	500	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.

Note: 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}		—	—	0.4	A
Operating temperature	T_{opr}		-20	—	100	°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	1.1	1.24	1.4	V
	Input reverse current	I_R		V_R = 5 V	—	—	10	μA
	Input capacitance	C_t		V = 0 V, f = 1 MHz	—	30	—	pF
Detector	OFF-state current	I_{OFF}		V_{OFF} = 60 V	—	—	1	μA
				V_{OFF} = 50 V	—	—	1	nA
	Output capacitance	C_{OFF}		V = 0 V, f = 100 MHz, t < 1 s	—	12	20	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	—	—	3.0	mA
Return LED current	I_{FC}		I_{OFF} = 10 μA	0.1	—	—	
ON-state resistance	R_{ON}		I_{ON} = 0.4 A, I_F = 5 mA, t < 1 s	—	1.1	1.5	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	—	0.9	—	pF
Isolation resistance	R_S	(Note 1)	V_S = 500 V, R.H. ≤ 60 %	—	10^{14}	—	Ω
Isolation voltage	BV_S	(Note 1)	AC, 60 s	500	—	—	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	—	0.12	0.5	ms
			See Fig. 11.1. R_L = 200 Ω, V_{DD} = 20 V, I_F = 10 mA	—	0.06	0.25	
Turn-off time	t_{OFF}		See Fig. 11.1. R_L = 200 Ω, V_{DD} = 20 V, I_F = 5 mA	—	0.04	0.3	ms
			See Fig. 11.1. R_L = 200 Ω, V_{DD} = 20 V, I_F = 10 mA	—	0.05	0.3	

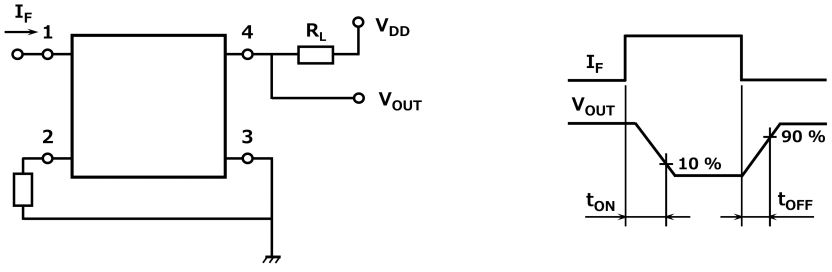


Fig. 11.1 Switching Time Test Circuit and Waveform

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12. Characteristics Curves (Note)

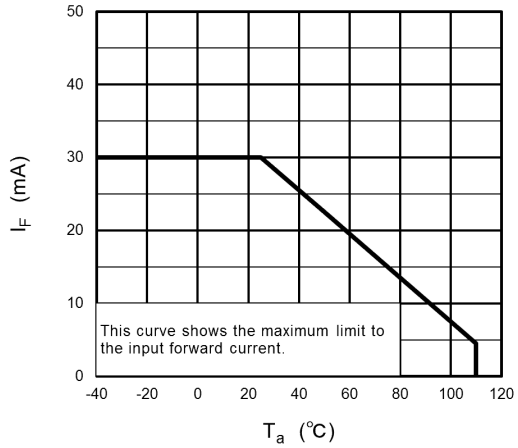


Fig. 12.1 I_F - T_a

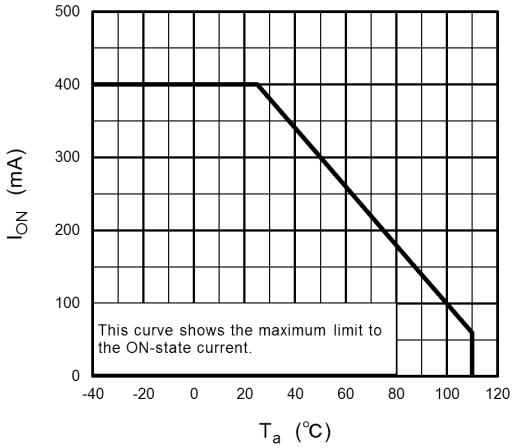


Fig. 12.2 I_{ON} - T_a

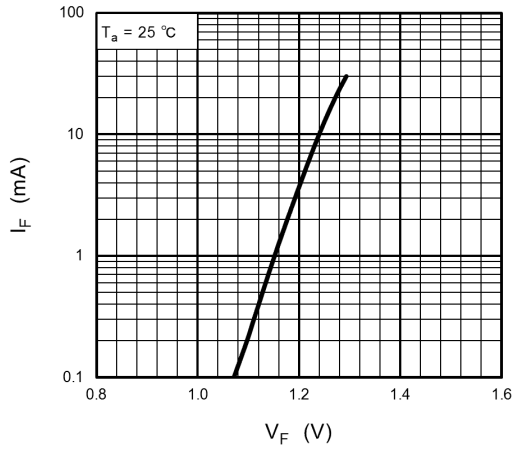


Fig. 12.3 I_F - V_F

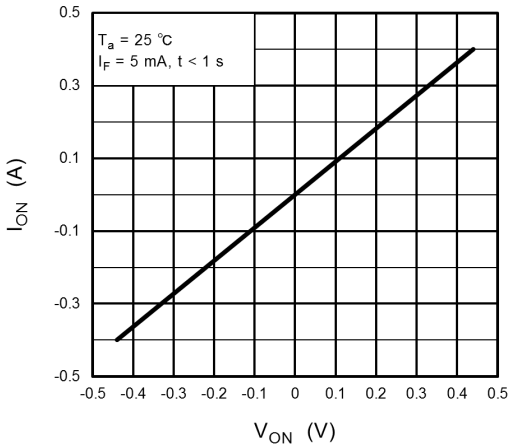


Fig. 12.4 I_{ON} - V_{ON}

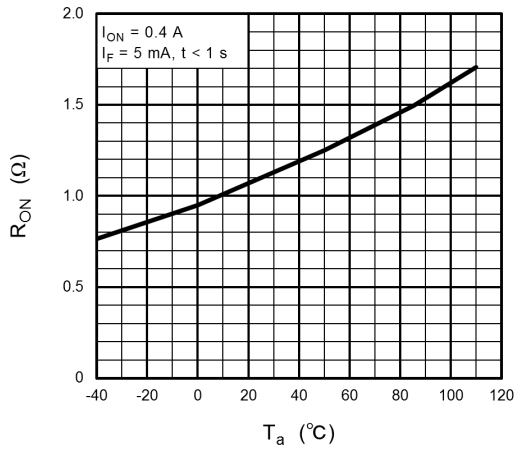


Fig. 12.5 R_{ON} - T_a

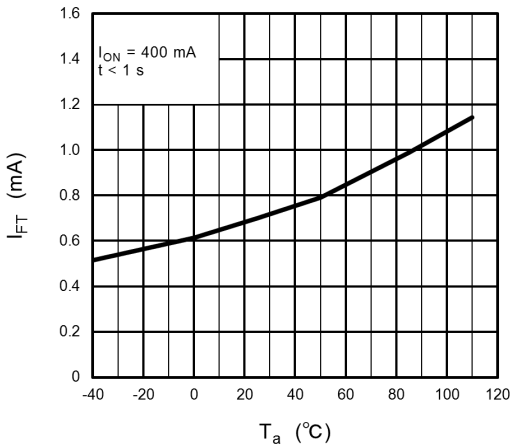


Fig. 12.6 I_{FT} - T_a

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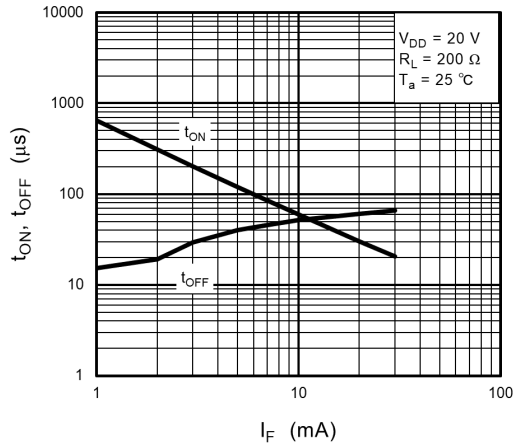


Fig. 12.7 t_{ON}, t_{OFF} - I_F

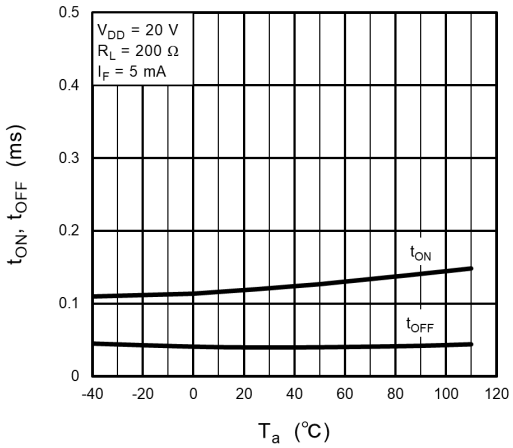


Fig. 12.8 t_{ON}, t_{OFF} - T_a

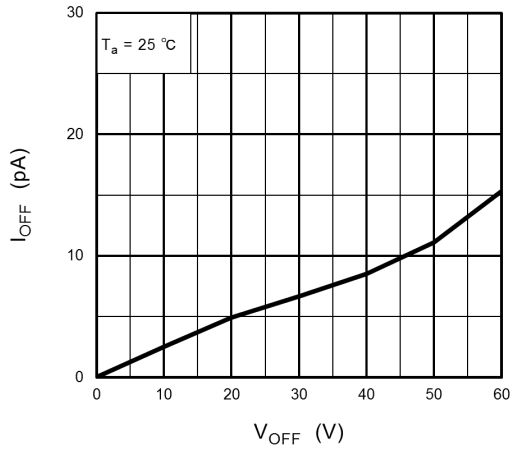


Fig. 12.9 I_{OFF} - V_{OFF}

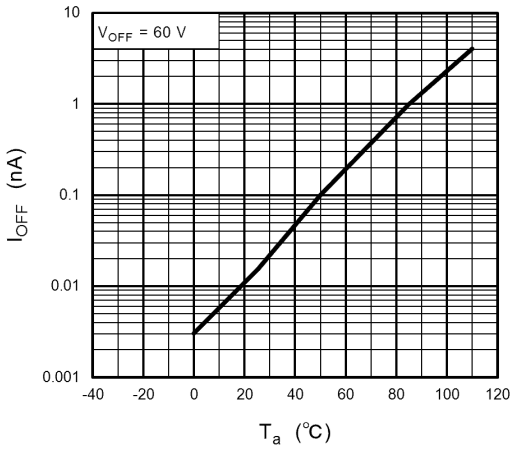


Fig. 12.10 I_{OFF} - T_a

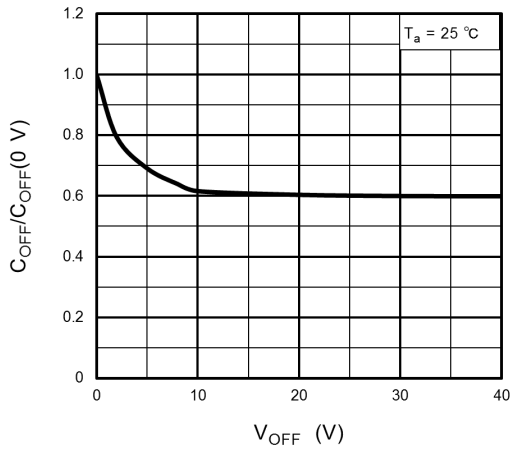


Fig. 12.11 C_{OFF} - V_{OFF}

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

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13. Soldering and Storage

13.1. Precautions for Soldering

The soldering temperature should be controlled as closely as possible to the conditions shown below.

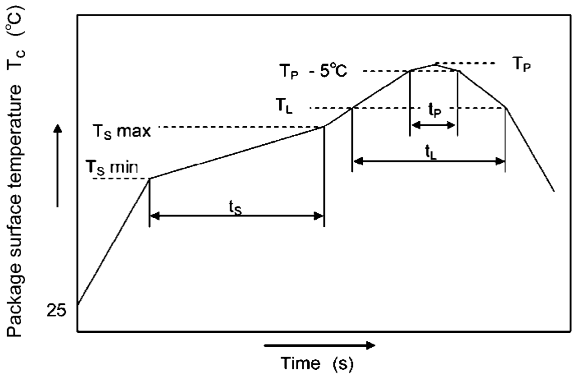
- When using soldering reflow

  (See the figure shown below, which is based on the package surface temperature.)

  Reflow soldering may be performed up to twice.

  The first reflow soldering should be performed within 168 hours after opening the moisture-proof packaging.

  The second reflow soldering must be performed within 168 hours of the first reflow.



	Symbol	Min	Max	Unit
Preheat temperature	T_S	150	200	°C
Preheat time	t_S	60	120	s
Ramp-up rate (T_L to T_P)			3	°C/s
Liquidus temperature	T_L	217		°C
Time above T_L	t_L	60	150	s
Peak temperature	T_P		260	°C
Time during which T_c is between (T_P – 5) and T_P	t_P		30	s
Ramp-down rate (T_P to T_L)			6	°C/s

- When using soldering Iron

  Complete soldering within 10 seconds for lead temperature not exceeding 260 °C.

  Heating by soldering iron(less than 150 W) must be done only once per lead.

  During heating, ensure that the soldering tip does not come into contact with the package, and avoid applying mechanical stress to the product.

  In the case of removal, please take care so that the land on the board does not exfoliate. In addition, Toshiba warrants neither for reusing of the removal package nor the soldering reliability of removal part.

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13.2. Precautions for General Storage

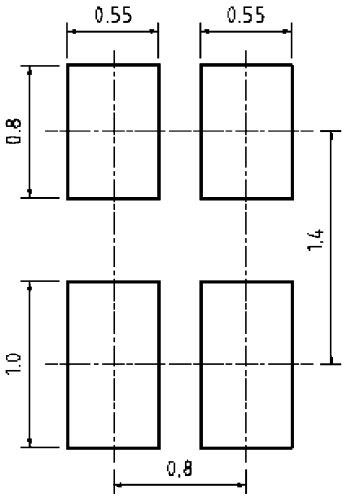
- Avoid storage locations where devices may be exposed to moisture or direct sunlight.
- Do not store the products in locations with poisonous gases (especially corrosive gases) or in dusty conditions.
- Store the products in locations with minimal temperature fluctuations. Rapid temperature changes during storage can cause condensation, resulting in lead oxidation or corrosion, which will deteriorate the solderability of the leads.
- Do not allow loads to be applied directly to devices while they are in storage.
- Follow the precautions printed on the packing label of the device for transportation and storage.
- Thermal stress may cause a crack in surface-mount products during surface-mount assembly if they have absorbed atmospheric moisture. To prevent a crack, please observe the following precautions.

  1. Moisture-proof bags may be stored unopened for up to 24 months under the following conditions.
  Temperature: 5 ℃ to 30 ℃
  Humidity: 90 % (max)
  2. After opening the moisture-proof bag, the devices should be assembled within 168 hours in an environment of 5 ℃ to 30 ℃/70 %RH or below.
  3. If, upon opening, the moisture indicator card shows a humidity of 30 % or above (i.e., has turned pink) or the expiration date has passed, the devices should be baked in tape and reel.
  After baking, use the baked devices within 72 hours, but perform baking only once.
  Baking conditions: 60±5 ℃, for 64 to 72 hours.
  Expiration date: 24 months from the sealing date, which is imprinted on the label affixed.
  4. Repeated baking can affect the peeling strength of taping and cause a trouble during mounting. Furthermore, protect the devices against static electricity for baking.
  5. If the laminated packing material is broken, its hermeticity deteriorates. Therefore, do not throw or drop the packed devices.
  6. When restoring devices after removal from their packing, use anti-static containers.

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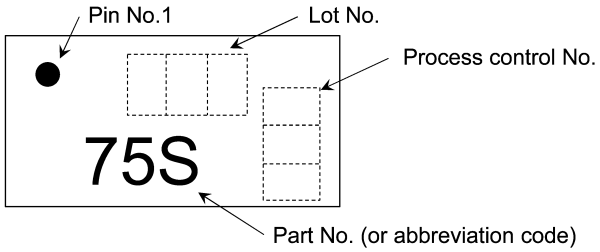
14. Land Pattern Dimensions (for reference only)

Unit: mm



Unit: mm

15. Marking



16. Ordering Information

When placing an order, please specify the part number, tape type and quantity as shown in the following example.

Example) TLP3475S(TP,E 2500 pcs

Part number: TLP3475S
Tape type: TP
[[G]]/RoHS COMPATIBLE: E **(Note 1)**
Quantity (must be a multiple of 2500): 2500 pcs

Note 1: Please contact your Toshiba sales representative for details on environmental information such as the product's RoHS compatibility.
RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

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17. Devices in Halogen-Free Resin Package

・This product is Halogen-Free

Toshiba Electronic Devices & Storage Corporation ("Toshiba") defines a "Halogen-Free resin semiconductor product" as a semiconductor product in which:

(1) the encapsulating resins do not contain any of the following elements: bromine (Br), chlorine (Cl) and antimony (Sb), respectively, in an amount exceeding 0.09 weight percent, and do not contain chlorine and bromine in an aggregate amount exceeding 0.15 weight percent of the encapsulating resins, and/or

(2) the resin portion(s) in printed circuit boards do not contain any of the following elements: bromine, chlorine and antimony, respectively, in an amount exceeding 0.09 weight percent, and do not contain chlorine and bromine in an aggregate amount exceeding 0.15 weight percent of the each resin portion(s) in printed circuit boards.

For avoidance of doubt, "Halogen-Free resin semiconductor product" does not mean, and Toshiba does not make any warranty of any kind, that said semiconductor product is entirely free of antimony or of any of the following elements of the halogen family: bromine, chlorine, iodine (I), fluorine (F) and astatine (At).

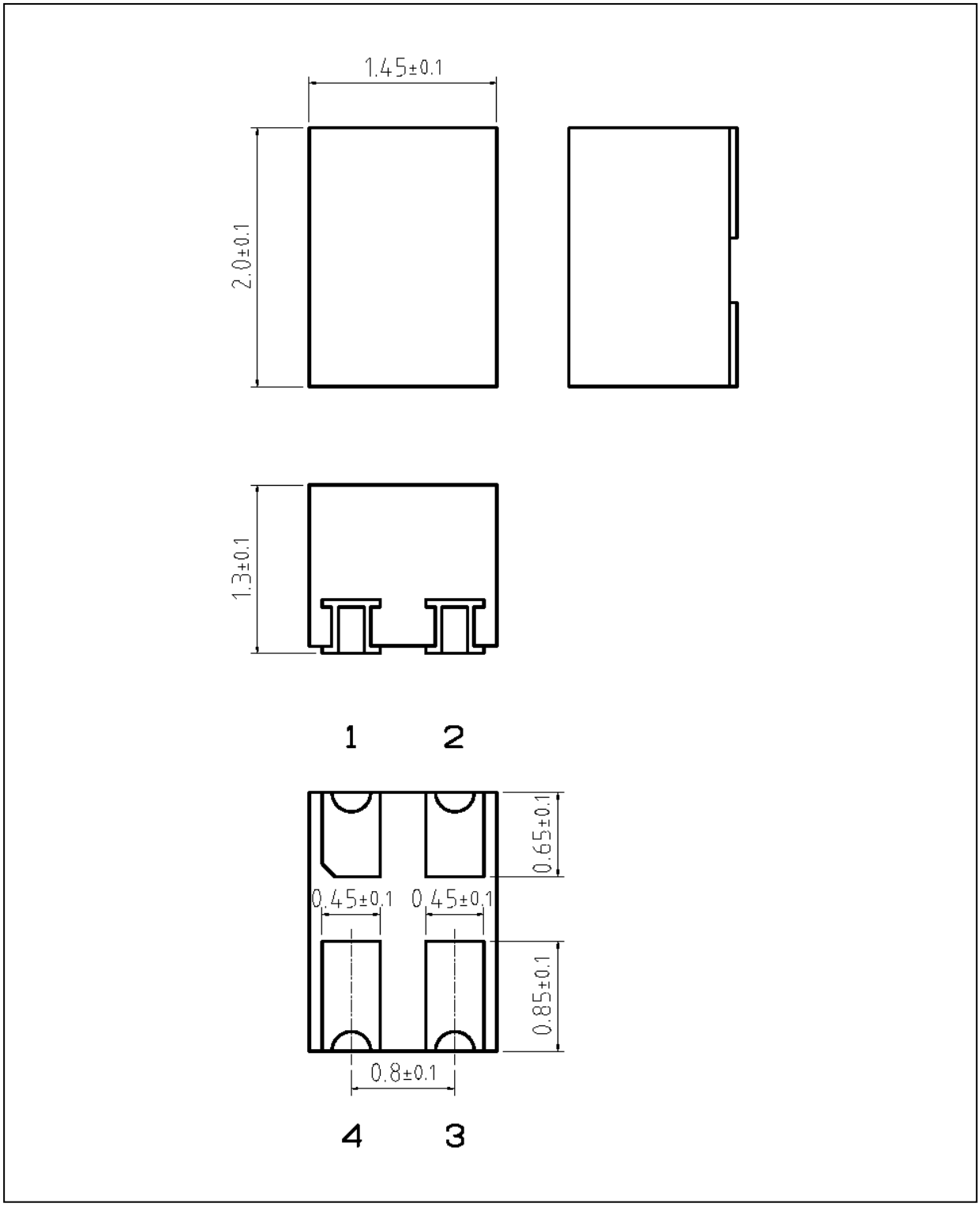
In addition, a Halogen-Free resin semiconductor product may contain antimony and/or any of the elements of the halogen family as mentioned in the above paragraph in one or more portion(s) of the semiconductor product other than the encapsulating resins and the resin portion(s) in printed circuit boards.

The information provided herein is accurate as of the date that it was provided, to the best of the knowledge and belief of the Toshiba Electronic Devices & Storage Corporation ("Toshiba"), Toshiba bases such knowledge and belief on information provided by third parties, and Toshiba makes no representation or warranty as to the accuracy of such third party information. Toshiba has taken and will continue to take, reasonable steps to provide accurate information to its customers, but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals.

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Package Dimensions

Unit: mm



Weight: 0.01 g (typ.)

Package Name(s)
TOSHIBA: 11-2E2

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