

Photocouplers Photorelay

TLP3412SRHB

1. Applications

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

2. General

The TOSHIBATLP3412SRHB is a very small outline non-leaded photorelay suitable for surface-mount assembly. It is housed in a S-VSON4T package. TLP3412SRHB has a Built-in input resistor, which eliminates an external input resistor for space saving. Its features include low off-state current and low output pin capacitance.

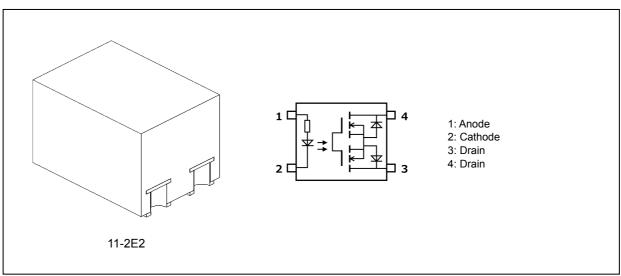
3. Features

- (1) S-VSON4T: 2.0 (L) mm \times 1.45 (W) mm \times 1.3 (H) mm
- (2) Operating temperature: -40 °C to 135 °C
- (3) Normally opened (1-Form-A)
- (4) OFF-state output terminal voltage: 60 V (min)
- (5) Operating voltage: 3.9 V (max)
- (6) ON-state current: 400 mA (max)
- (7) ON-state resistance: 1Ω (typ.), 1.5Ω (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.

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.

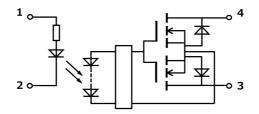
4. Packaging and Pin Assignment



Start of commercial production



5. Internal Circuit



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

	Characteristics		Symbol	Note	Rating	Unit
LED	Applied input forward voltage		V _{IN}		6	V
	Applied input forward voltage derating	(T _a ≥ 125 °C)	$\Delta V_{IN}/\Delta T_{a}$		-0.05	V/°C
	Input reverse voltage		V _R		6	V
	Input power dissipation		P _D		30	mW
	Input power dissipation derating	(T _a ≥ 125 °C)	$\Delta P_D/\Delta T_a$		-1.12	mW/°C
	Junction temperature		Tj		150	°C
Detector	OFF-state output terminal voltage		V _{OFF}		60	V
	ON-state current		I _{ON}		400	mA
	ON-state current derating	(T _a ≥ 25 °C)	Δl _{ON} /ΔT _a		-3.2	mA/°C
	ON-state current (pulsed)	(t = 100 ms, Duty = 1/10)	I _{ONP}		1200	mA
	Output power dissipation		Po		240	mW
	Output power dissipation derating	(T _a ≥ 25 °C)	$\Delta P_O/\Delta T_a$		-1.92	mW/°C
	Junction temperature		Tj		150	°C
Common	Storage temperature		T _{stg}		-40 to 150	°C
	Operating temperature		T _{opr}		-40 to 135	
	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.

7. Recommended Operating Conditions (Note)

Characteristics	Symbol	Note	Min	Тур.	Max	Unit
Supply voltage	V_{DD}		_	_	48	V
Applied input forward voltage	V _{IN}		4.5	5	5.5	V
ON-state current	I _{ON}				400	mA
Operating temperature	T _{opr}		-40		135	°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, Ta = 25 °C)

	Characteristics	Symbol	Note	Test Condition	Min	Тур.	Max	Unit
LED	Input forward current	I _{IN}		V _{IN} = 5.5 V		1.1		mA
	Input reverse current	I _R		V _R = 5 V			10	μΑ
	Input capacitance	Ct		V = 0 V, f = 1 MHz	_	12		pF
Detector	OFF-state current	I _{OFF}		V _{OFF} = 60 V			1	μА
		I _{OFF}		V _{OFF} = 50 V			1	nA
	Output capacitance	C _{OFF}		V = 0 V, f = 1 MHz, t < 1 s	_	_	20	pF

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

Characteristics	Symbol	Note	Test Condition	Min	Тур.	Max	Unit
Operating voltage	V_{FON}		I _{ON} = 100 mA		1.5	3.9	V
			I _{ON} = 48 mA, Ta = 135 °C	_	2	4.5	V
Turn-off voltage	V _{FOFF}		I _{OFF} = 10 μA	0.8	1.5	_	V
Limited LED current	I _{LIM(LED)}		V_{IN} = 5.5 V, I_{ON} = 48 mA, T_a = 135°C	_		2	mA
ON-state resistance	R _{ON}		I _{ON} = 400 mA, V _{IN} = 5 V, t < 1 s	_	1	1.5	Ω

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

Characteristics	Symbol	Note	Test Condition	Min	Тур.	Max	Unit
Total capacitance (input to output)	C _S	(Note 1)	V _S = 0 V, f = 1 MHz	_	0.6	_	pF
Isolation resistance	R _S	(Note 1)	V _S = 500 V, R.H. ≤ 60 %	_	1014	_	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	Тур.	Max	Unit
Turn-on time	t _{ON}		See Fig. 11.1.	_	0.7	1.5	ms
Turn-off time	t _{OFF}		$R_L = 200 \Omega, V_{DD} = 20 V, V_{IN} = 5 V$		0.3	0.5	

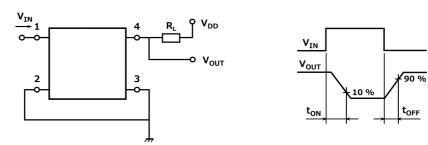


Fig. 11.1 Switching Time Test Circuit and Waveform



12. Characteristics Curves (Note)

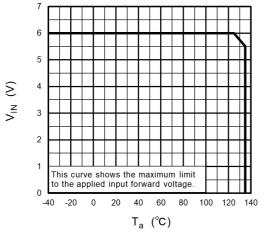


Fig. 12.1 V_{IN} - T_a

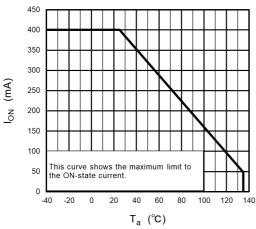


Fig. 12.3 I_{ON} - T_a

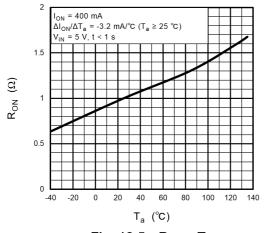


Fig. 12.5 R_{ON} - T_a

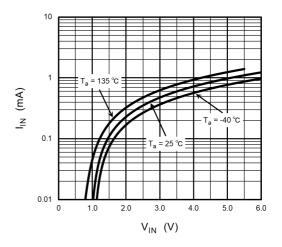


Fig. 12.2 I_{IN} - V_{IN}

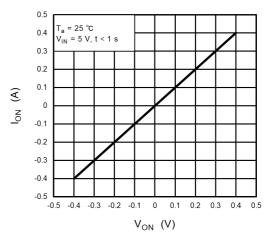


Fig. 12.4 I_{ON} - V_{ON}

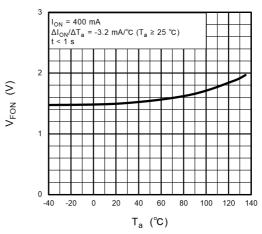


Fig. 12.6 V_{FON} - T_a



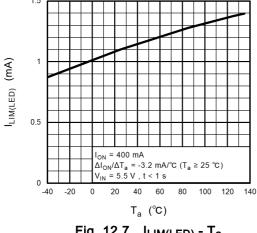


Fig. 12.7 $I_{LIM(LED)}$ - T_a

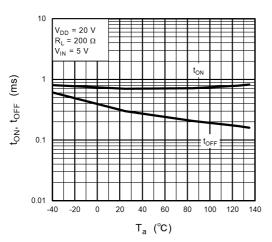


Fig. 12.9 toN, toFF - Ta

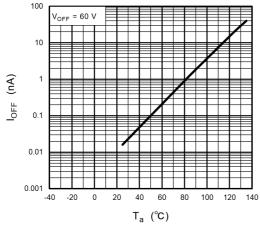


Fig. 12.11 I_{OFF} - T_a

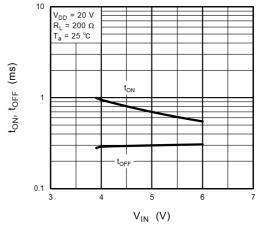


Fig. 12.8 ton, toff - Vin

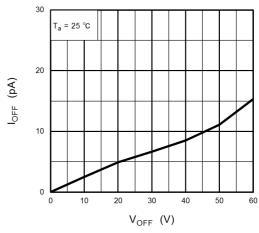


Fig. 12.10 I_{OFF} - V_{OFF}

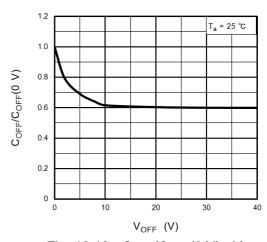


Fig. 12.12 Coff/Coff(0 V) - Voff

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



13. Soldering and Storage

13.1. Precautions for Soldering

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

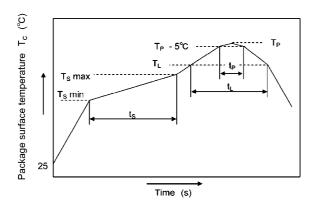
· When using soldering reflow

(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	Ts	150	200	°C
Preheat time	ts	60	120	S
Ramp-up rate (T _L to T _P)			3	°C/s
Liquidus temperature	TL	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 $(T_P \text{ to } T_L)$			6	°C/s

· When using soldering Iron

Complete soldering within 10 seconds for lead temperature not exceeding 260 °C, or within 3 seconds for lead temperature not exceeding 350 °C.

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

In the case of removal, please take care so that the land on the board does not exfoliate. In addition,

 $To shib a \ warrants \ neither \ for \ reusing \ of \ the \ removal \ package \ nor \ the \ soldering \ reliability \ of \ removal \ part.$

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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 °C to 30 °C Humidity: 90 % (max)

- 2. After opening the moisture-proof bag, the devices should be assembled within 168 hours in an environment of 5 °C to 30 °C/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 °C, for 64 to 72 hours.

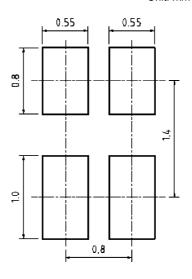
Expiration date: 24 months from the sealing date, which is imprinted on the label affixed.

- 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.

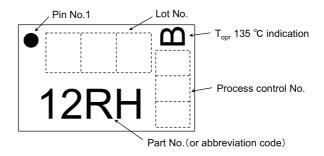


14. Land Pattern Dimensions (for reference only)

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) TLP3412SRHB(TP,E $\,$ 2500 pcs

Part number: TLP3412SRHB

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.



17. Devices in Halogen-Free Resin Packages

· 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 a statine (At).

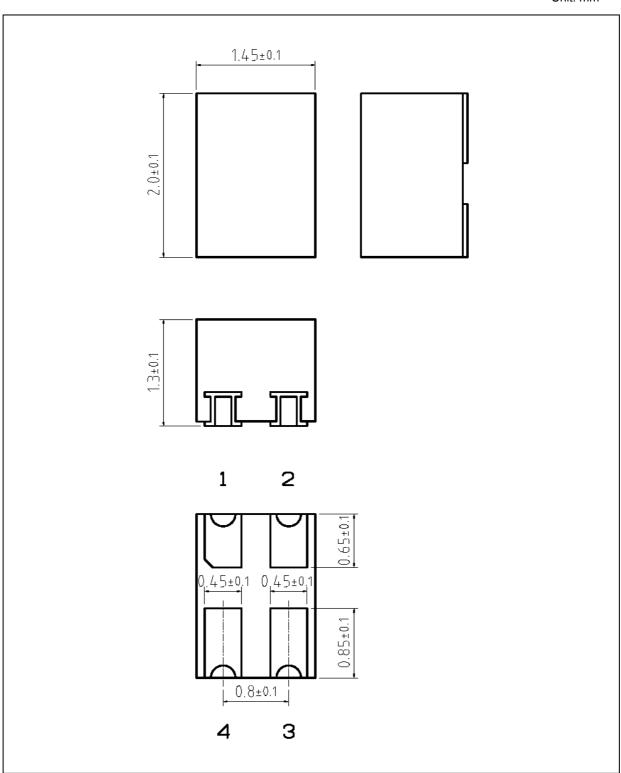
In addition, a Halogen-Free resin semiconductor product may contain antimony and/or any of the elements of the halogen family as mentioned in the above paragraph in one or more portion(s) of the semiconductor product other than the encapsulating resins and the resin portion(s) in printed circuit boards.

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Package Dimensions

Unit: mm



Weight: 0.01 g (typ.)

	Package Name(s)	
TOSHIBA: 11-2E2		



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