Photocouplers GaAℓAs Infrared LED & Photo IC

TLP2345

1. Applications

- Intelligent Power Module Signal Isolation
- Programmable Logic Controllers (PLCs)
- High-Speed Digital Interfacing for Instrumentation and Control Devices

2. General

The Toshiba TLP2345 consists of high-output GaAℓAs light-emitting diode coupled with a high-gain, high-speed photo detector. It is housed in the SO6 package.

This product can operate in power supply voltage 4.5 V to 30 V with the maximum operative temperature of 110 ℃.

Since TLP2345 has guaranteed 3 mA low supply current (I_{CCL}/I_{CCH}), and 1.6 mA low threshold input current (I_{FLH}), it contributes to energy saving of devices. It can drive directly from a microcomputer for a low input current.

The detector has a totem-pole output stage with current sourcing and sinking capabilities. The TLP2345 has an internal Faraday shield that provides a guaranteed common-mode transient immunity of ±30 kV/μs.

The TLP2345 has a buffer output. An inverter output version, the TLP2348, is also available.

3. Features

(1) Buffer logic type (Totem pole output)

(2) Package: SO6

(3) Operating temperature: -40 to 110 ℃

(4) Supply voltage: 4.5 to 30 V

(5) Threshold input current: 1.6 mA (max)

(6) Supply current: 3 mA (max)

(7) Propagation delay time: t_{pHL}/t_{pLH} = 120 ns (max)

(8) Pulse width distortion: $|t_{pHL} - t_{pLH}|$ = 40 ns (max)

(9) Common-mode transient immunity: ±30 kV/μs (min)

(10) Isolation voltage: 3750 Vrms (min)

(11) Safety standards

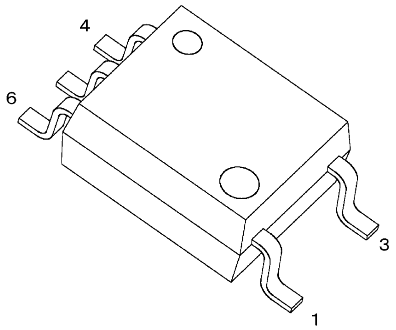
UL-under application: UL1577 File No.E67349

cUL-under application: CSA Component Acceptance Service No.5A, File No.E67349

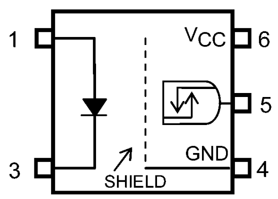
VDE-under application: Option (V4) EN60747-5-5 **(Note)**

Note: When an EN60747-5-5 approved type is needed, please designate the **Option (V4)**.

4. Packaging and Pin Configuration

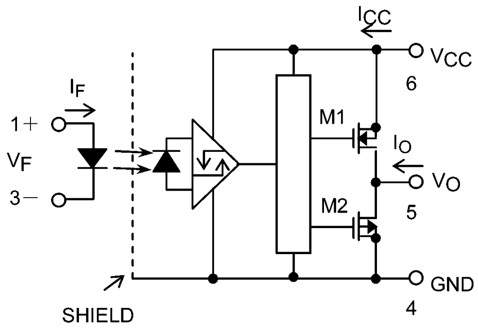


11-4L1S



1: Anode
3: Cathode
4: GND
5: V_O (Output)
6: V_{CC}

5. Internal Circuit (Note)



Note: A 0.1-µF bypass capacitor must be connected between pin 6 and pin 4.

6. Principle of Operation

6.1. Truth Table

Input	LED	Output
H	ON	H
L	OFF	L

6.2. Mechanical Parameters

Characteristics	Min	Unit
Creepage distances	5.0	mm
Clearance distances	5.0	
Internal isolation thickness	0.4	

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

	Characteristics		Symbol	Note	Rating	Unit
LED	Input forward current		I_F		15	mA
	Peak transient input forward current		I_{FPT}	(Note 1)	1	A
	Input power dissipation		P_D		40	mW
	Input reverse voltage		V_R		5	V
Detector	Output current		I_O		50 / -50	mA
	Output voltage		V_O		-0.5 to 30	V
	Supply voltage		V_{CC}		-0.5 to 30	V
	Output power dissipation		P_O		100	mW
	Output power dissipation derating	($T_a \geq 75$ °C)	$\Delta P_O/\Delta T_a$		-2	mW/°C
Common	Operating temperature		T_{opr}		-40 to 110	°C
	Storage temperature		T_{stg}		-55 to 125	°C
	Lead soldering temperature	(10 s)	T_{sol}		260	°C
	Isolation voltage	AC, 1 min., R.H. ≤ 60 %	BV_S	(Note 2)	3750	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: Pulse width (PW) ≤ 1 µs, 300 pps

Note 2: This device is considered as a two-terminal device: Pins 1 and 3 are shorted together, and pins 4, 5 and 6 are shorted together.

8. Recommended Operating Conditions (Note)

Characteristics	Symbol	Note	Min	Typ.	Max	Unit
Input on-state current	$I_{F(ON)}$	(Note 1)	2	—	10	mA
Input off-state voltage	$V_{F(OFF)}$		0	—	0.8	V
Supply voltage	V_{CC}	(Note 2)	4.5	—	30	
Operating temperature	T_{opr}	(Note 2)	-40	—	110	℃

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 datasheet should also be considered.

Note: A ceramic capacitor (0.1 μF) should be connected between pin 6 and pin 4 to stabilize the operation of a high-gain linear amplifier. Otherwise, this photocoupler may not switch properly. The bypass capacitor should be placed within 1 cm of each pin.

Note 1: The rise and fall times of the input on-current should be less than 0.5 μs.

Note 2: Denotes the operating range, not the recommended operating condition.

9. Electrical Characteristics (Note) (Unless otherwise specified, T_a = -40 to 110 ℃, V_{CC} = 4.5 to 30 V)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input forward voltage	V_F	—	I_F = 3 mA, T_a = 25 ℃	1.35	1.55	1.65	V
Input forward voltage temperature coefficient	$\Delta V_F/\Delta T_a$	—	I_F = 3 mA	—	-2.0	—	mV/℃
Input reverse current	I_R	—	V_R = 5 V, T_a = 25 ℃	—	—	10	μA
Input capacitance	C_t	—	V = 0 V, f = 1 MHz, T_a = 25 ℃	—	20	—	pF
Low-level output voltage	V_{OL}	Fig. 12.1.1	V_F = 0.8 V, I_O = 3.5 mA	—	0.026	0.2	V
			V_F = 0.8 V, I_O = 6.5 mA	—	0.047	0.4	
High-level output voltage	V_{OH}	Fig. 12.1.2	I_F = 3 mA, I_O = -3.5 mA	V_{CC} - 0.2	V_{CC} - 0.03	—	
			I_F = 3 mA, I_O = -6.5 mA	V_{CC} - 0.4	V_{CC} - 0.05	—	
Low-level supply current	I_{CCL}	Fig. 12.1.3	V_{CC} = 5.5 V	—	2.1	3	mA
			V_{CC} = 30 V	—	2.4	3	
High-level supply current	I_{CCH}	Fig. 12.1.4	I_F = 3 mA, V_{CC} = 5.5 V	—	2.1	3	
			I_F = 3 mA, V_{CC} = 30 V	—	2.4	3	
Low-level short-circuit output current	I_{OSL}	Fig. 12.1.5	V_{CC} = V_O = 5.5 V	150	270	—	
			V_{CC} = V_O = 20 V	160	300	—	
High-level short-circuit output current	I_{OSH}	Fig. 12.1.6	I_F = 3 mA, V_{CC} = 5.5 V, V_O = GND	—	-330	-150	
			I_F = 3 mA, V_{CC} = 20 V, V_O = GND	—	-350	-160	
Threshold input current (L/H)	I_{FLH}	—	I_O = -3.5 mA, V_O > 4.8 V, V_{CC} = 5 V	—	0.35	1.6	
Input current hysteresis	I_{HYS}	—	I_O = -3.5 mA	—	0.1	—	
Threshold input voltage (H/L)	V_{FHL}		I_O = 6.5 mA, V_O < 0.4 V	0.8	—	—	V

Note: All typical values are at V_{CC} = 5 V, T_a = 25 ℃, unless otherwise noted.

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 = 0 V, f = 1 MHz	—	0.8	—	pF
Isolation resistance	R_S	(Note 1)	V = 500 V, R.H. ≤ 60%	1×10^{12}	1×10^{14}	—	Ω
Isolation voltage	BV_S	(Note 1)	AC, 1 min.	3750	—	—	Vrms
			AC, 1 s in oil	—	10000	—	
			DC, 1 min. in oil	—	10000	—	Vdc

Note 1: This device is considered as a two-terminal device: Pins 1 and 3 are shorted together, and pins 4, 5 and 6 are shorted together.

11. Switching Characteristics (Note)
(Unless otherwise specified, T_a = -40 to 110 °C, V_{CC} = 4.5 to 30 V)

Characteristics	Symbol	Note	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time (H/L)	t_{pHL}	(Note 1)	Fig. 12.1.7, Fig. 12.1.8	I_F = 3 → 0 mA	35	61	120	ns
Propagation delay time (L/H)	t_{pLH}			I_F = 0 → 3 mA	35	65	120	
Pulse width distortion	$\|t_{pHL}-t_{pLH}\|$			I_F = 3 mA	—	4	40	
Propagation delay skew (device to device)	t_{psk}	(Note 1), (Note 2)		I_F = 3 mA	-70	—	70	
Fall time	t_f	(Note 1)		I_F = 3 → 0 mA	—	3	30	
Rise time	t_r			I_F = 0 → 3 mA	—	3	30	
Common-mode transient immunity at output high	CM_H		Fig. 12.1.9	I_F = 3 mA, V_{CC} = 30 V, V_{CM} = 1500 V_{p-p}, T_a = 25 °C	±30	±50	—	kV/μs
Common-mode transient immunity at output low	CM_L			I_F = 0 mA, V_{CC} = 30 V, V_{CM} = 1500 V_{p-p}, T_a = 25 °C	±30	±50	—	

Note: All typical values are at V_{CC} = 5 V, T_a = 25 °C, unless otherwise noted.

Note 1: f = 50 kHz, duty = 50 %, input current t_r = t_f = 5 ns, C_L is approximately 15 pF which includes probe and stray wiring capacitance.

Note 2: The propagation delay skew, t_{psk}, is equal to the magnitude of the worst-case difference in t_{pHL} and/or t_{pLH} that will be seen between units at the same given conditions (supply voltage, input current, temperature, etc).

12. Test Circuits and Characteristics Curves

12.1. Test Circuits

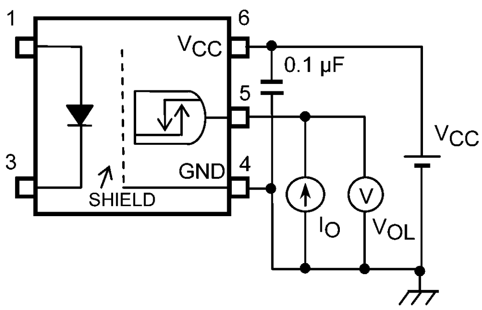


Fig. 12.1.1 V_{OL} Test Circuit

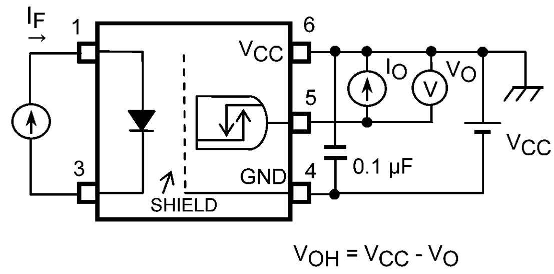


Fig. 12.1.2 V_{OH} Test Circuit

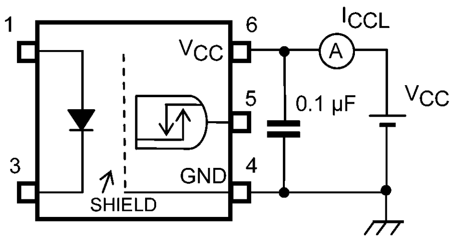


Fig. 12.1.3 I_{CCL} Test Circuit

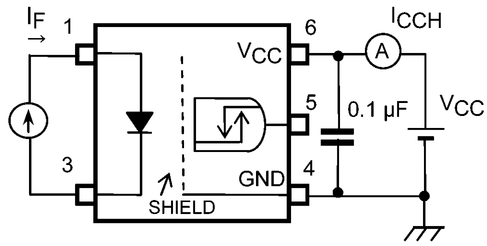


Fig. 12.1.4 I_{CCH} Test Circuit

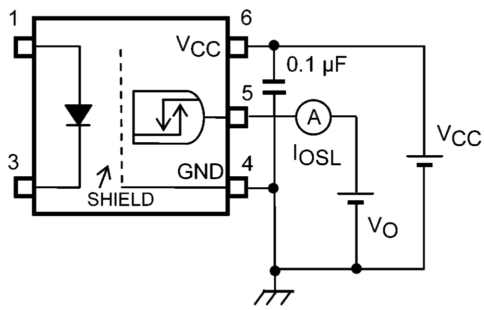


Fig. 12.1.5 I_{OSL} Test Circuit

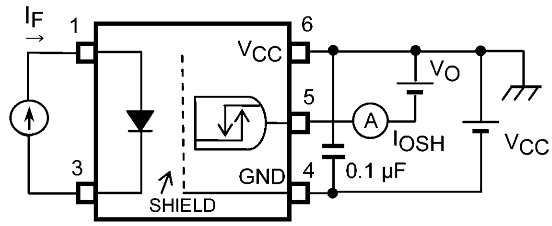
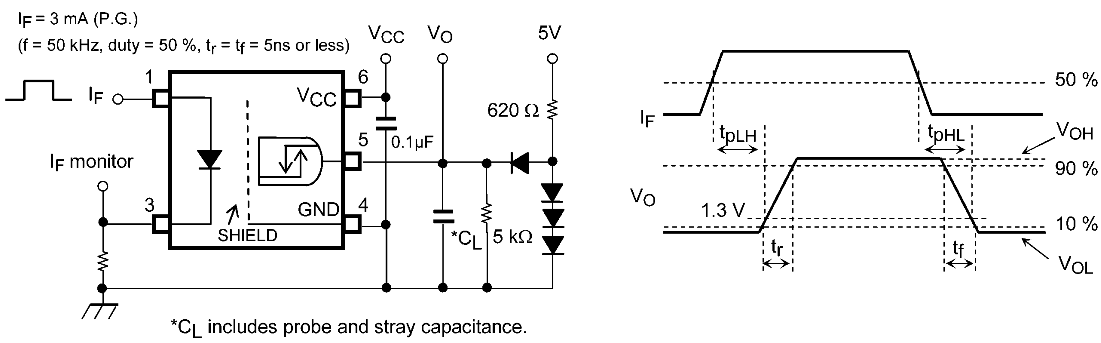


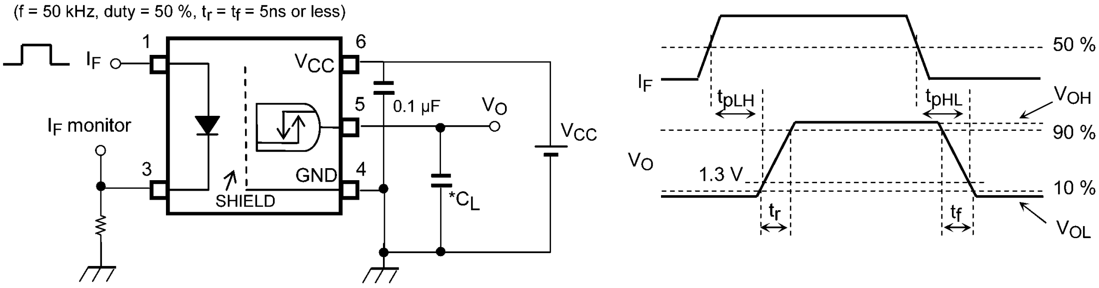
Fig. 12.1.6 I_{OSH} Test Circuit



*C_L includes probe and stray capacitance.

P.G.: Pulse generator

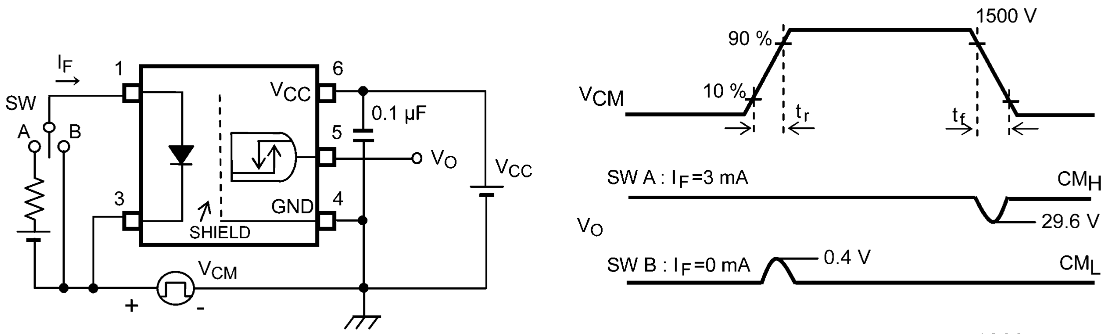
Fig. 12.1.7 Switching Time Test Circuit



*C_L includes probe and stray capacitance.

P.G.: Pulse generator

Fig. 12.1.8 Switching Time Test Circuit



$$CM_L = -\frac{1200\ (V)}{t_f\ (\mu s)} \qquad CM_H = \frac{1200\ (V)}{t_r\ (\mu s)}$$

Fig. 12.1.9 Common-Mode Transient Immunity and Waveform

12.2. Characteristics Curves (Note)

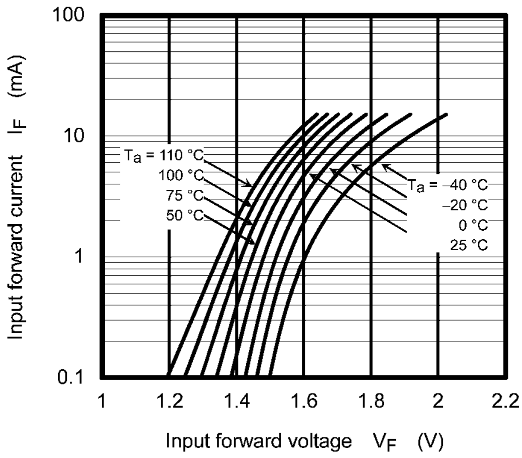


Fig. 12.2.1 I_F - V_F

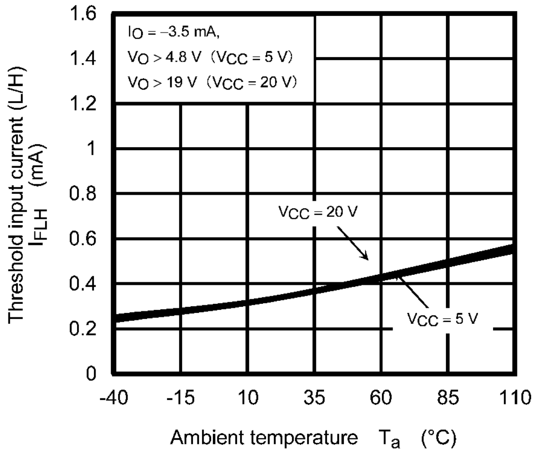


Fig. 12.2.2 I_{FLH} - T_a

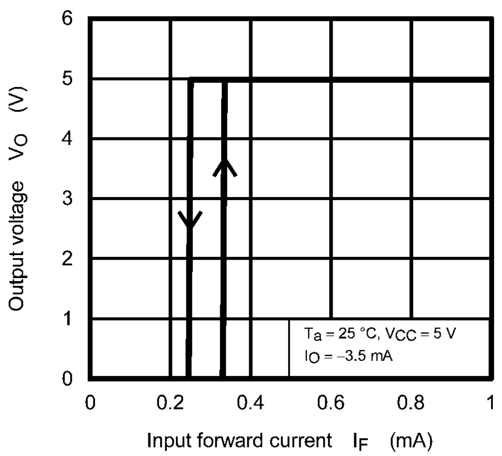


Fig. 12.2.3 V_O - $I_F(I_{HYS})$

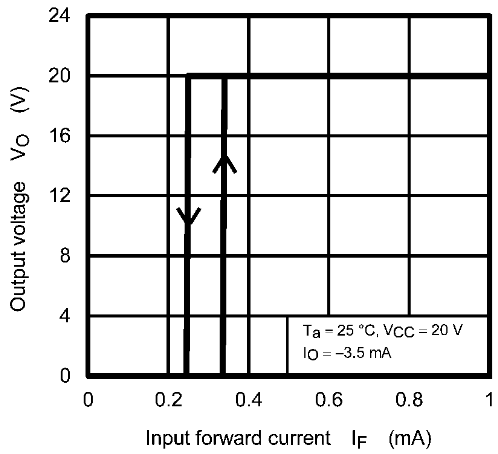


Fig. 12.2.4 V_O - $I_F(I_{HYS})$

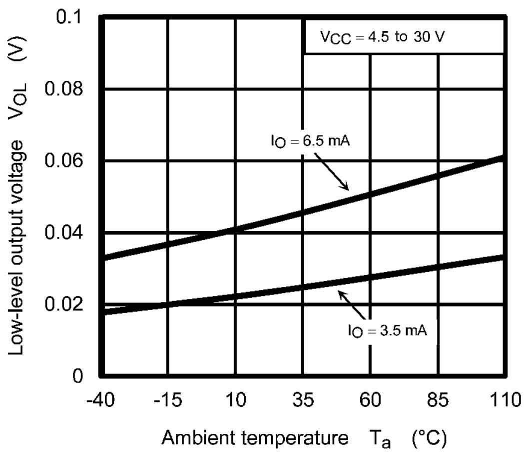


Fig. 12.2.5 V_{OL} - T_a

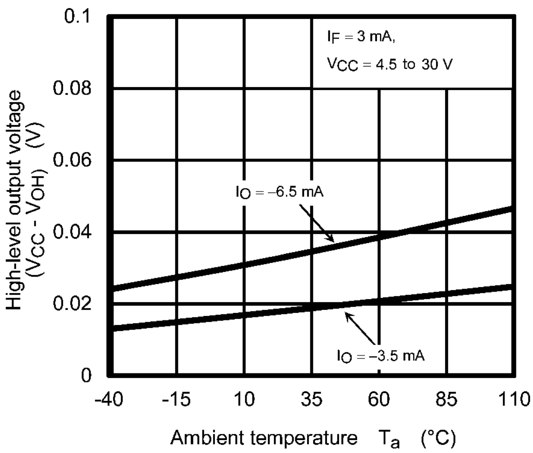


Fig. 12.2.6 $(V_{CC}-V_{OH})$ - T_a

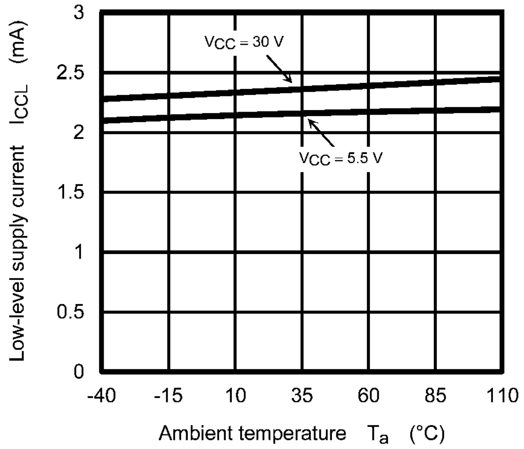


Fig. 12.2.7 I_{CCL} - T_a

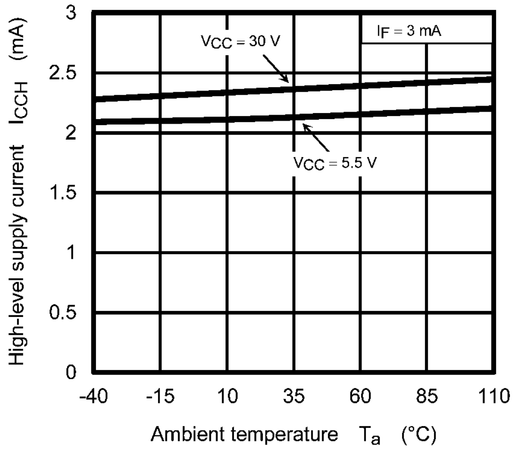


Fig. 12.2.8 I_{CCH} - T_a

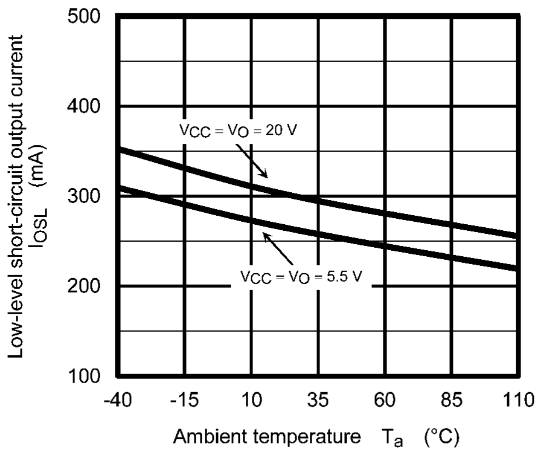


Fig. 12.2.9 I_{OSL} - T_a

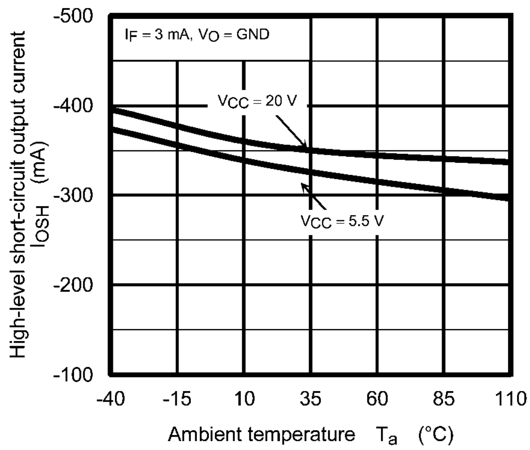


Fig. 12.2.10 I_{OSH} - T_a

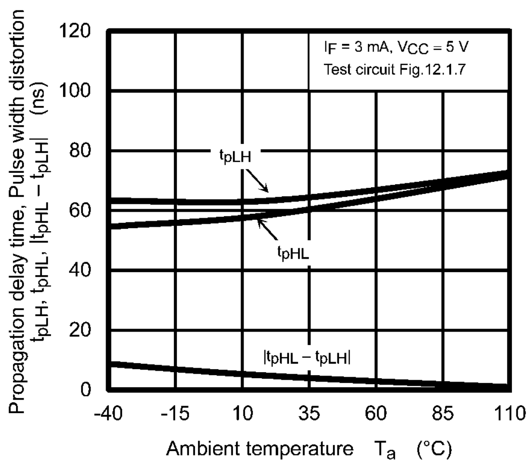


Fig. 12.2.11 t_{pLH}, t_{pHL}, $|t_{pHL}-t_{pLH}|$ - T_a (Test Circuit Fig. 12.1.7)

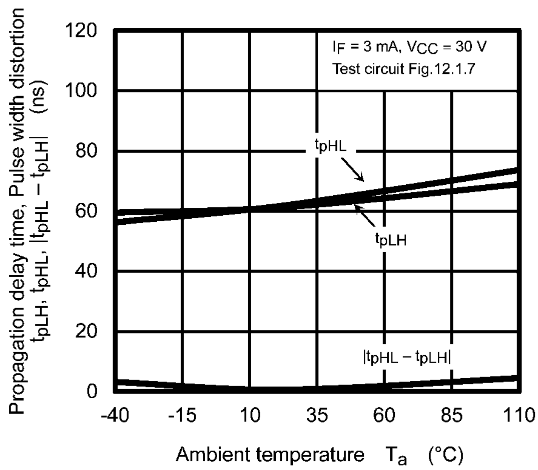


Fig. 12.2.12 t_{pLH}, t_{pHL}, $|t_{pHL}-t_{pLH}|$ - T_a (Test Circuit Fig. 12.1.7)

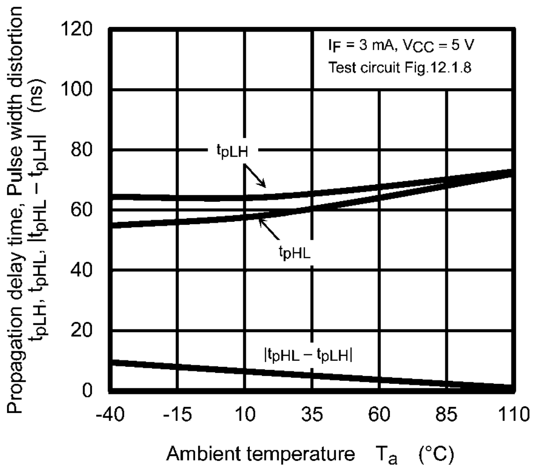


Fig. 12.2.13 t_{pLH}, t_{pHL}, $|t_{pHL}-t_{pLH}|$ - T_a (Test Circuit Fig. 12.1.8)

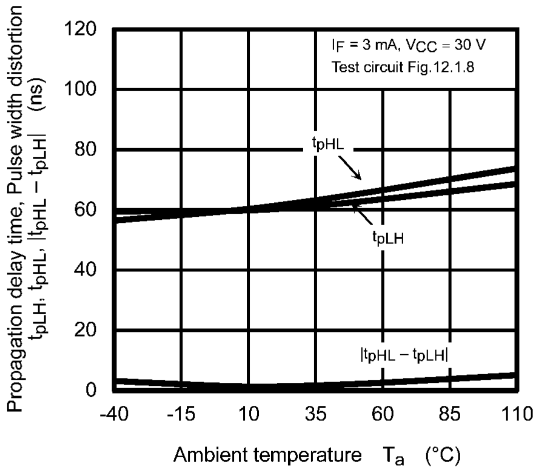


Fig. 12.2.14 t_{pLH}, t_{pHL}, $|t_{pHL}-t_{pLH}|$ - T_a (Test Circuit Fig. 12.1.8)

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, irrespective of whether a soldering iron or a reflow soldering method is used.

- When using soldering reflow (See Fig. 13.1.1 and 13.1.2)
  Reflow soldering must be performed once or twice.
  The mounting should be completed with the interval from the first to the last mountings being 2 weeks.

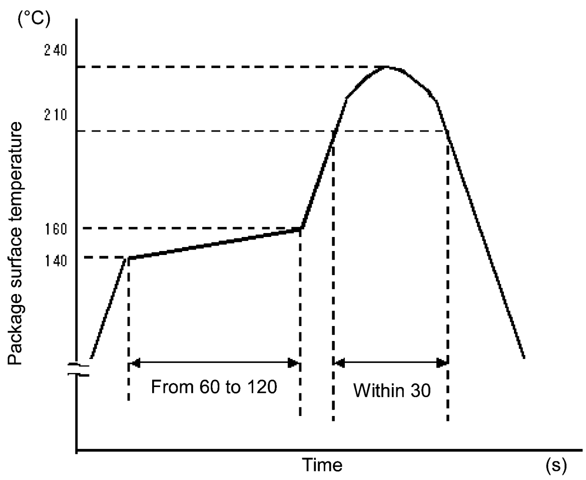


Fig. 13.1.1 An Example of a Temperature Profile When Sn-Pb Eutectic Solder Is Used

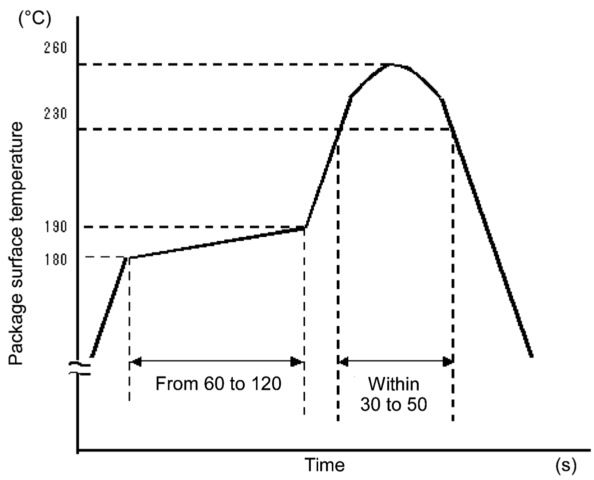


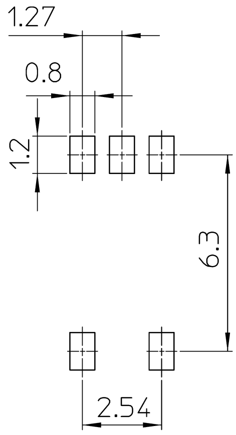
Fig. 13.1.2 An Example of a Temperature Profile When Lead(Pb)-free Solder Is Used

- When using soldering flow (Applicable to both eutectic solder and Lead(Pb)-Free solder)
  Apply preheating of 150 °C for 60 to 120 seconds.
  Mounting condition of 260 °C within 10 seconds is recommended.
  Flow soldering must be performed once.
- When using soldering Iron (Applicable to both eutectic solder and Lead(Pb)-Free solder)
  Complete soldering within 10 seconds for lead temperature not exceeding 260 °C or within 3 seconds not exceeding 350 °C
  Heating by soldering iron must be done only once per lead.

13.2. Precautions for General Storage

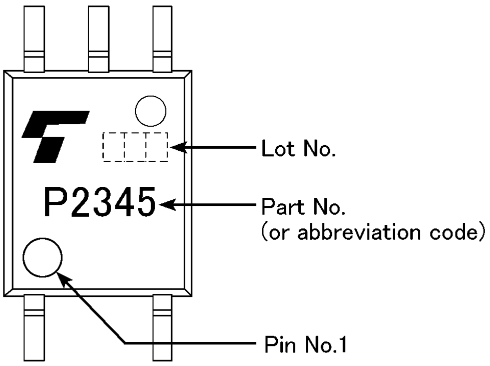
- Avoid storage locations where devices may be exposed to moisture or direct sunlight.
- Follow the precautions printed on the packing label of the device for transportation and storage.
- Keep the storage location temperature and humidity within a range of 5 °C to 35 °C and 45 % to 75 %, respectively.
- 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.
- When restoring devices after removal from their packing, use anti-static containers.
- Do not allow loads to be applied directly to devices while they are in storage.
- If devices have been stored for more than two years under normal storage conditions, it is recommended that you check the leads for ease of soldering prior to use.

14. Land Pattern Dimensions (for reference only)



(unit: mm)

15. Marking



16. Specifications for Embossed-Tape Packing (TPL) (TPR) for SO6 Coupler

16.1. Applicable Package

Package Name	Product Type
SO6	Photocoupler

16.2. Product Naming Conventions

Type of package used for shipment is denoted by a symbol suffix after a part number. The method of classification is as below.

Example) TLP2345 (TPL,E(O

Part number: TLP2345
Tape type: TPL
[[G]]/RoHS COMPATIBLE: E **(Note)**
Domestic ID (Country / Region of origin: Japan): (O

Note: 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 electronics equipment.

16.3. Tape Dimensions Specification

Table 16.3.1 Tape Specifications

Specification	Division	Packing Amount (A unit per reel)
TPL	L direction	3000
TPR	R direction	3000

16.3.1. Orientation of Device in Relation to Direction of Feed

Device orientation in the carrier cavities as shown in Fig. 16.3.1.1

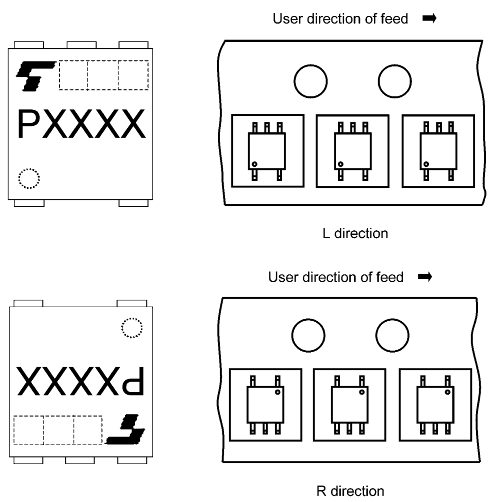


Fig. 16.3.1.1 Orientation of Device in Relation to Direction of Tape Movement

16.3.2. Packing Quantity

Reel: 3000 pcs per reel

16.3.3. Empty Device Recesses

Table 16.3.3.1 Empty Device Recesses

Characteristics	Standard	Remarks
Occurrences of 2 or more successive empty cavities	0	Within any given 40-mm section of tape, not including leader and trailer
Single empty cavity	6 devices (max) per reel	Not including leader and trailer

16.3.4. Tape Leader and Trailer

The start end of the tape has 50 or more empty cavities. The hub end of the tape has 50 or more empty cavities and two empty turns only for a cover tape.

16.3.5. Tape Dimensions

(1) Tape material: Plastic (for protection against static electricity)

(2) Dimensions: The tape dimensions area as shown in Table 16.3.5.1

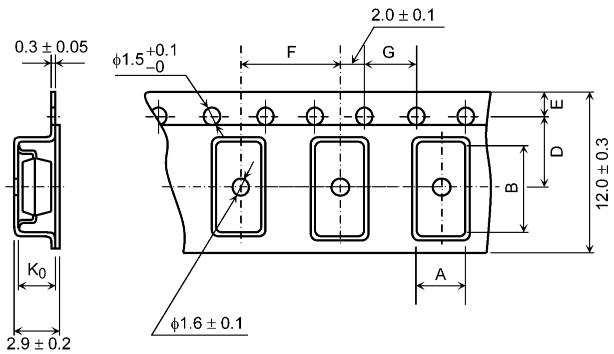


Fig. 16.3.5.1 Tape Forms

Table 16.3.5.1 Tape Dimensions (unit: mm, tolerance: ±0.1)

Symbol	Dimension	Remark
A	4.0	—
B	7.6	—
D	5.5	Center line of embossed cavity and sprocket hole
E	1.75	Distance between tape edge and sprocket hole center
F	8.0	Cumulative error +0.1/-0.3 (max) per 10 empty cavities holes
G	4.0	Cumulative error +0.1/-0.3 (max) per 10 empty cavities holes
K_0	2.6	Internal space

16.3.6. Reel Specification

(1) Material: Plastic

(2) Dimensions: The reel dimensions are as shown in Table 16.3.6.1

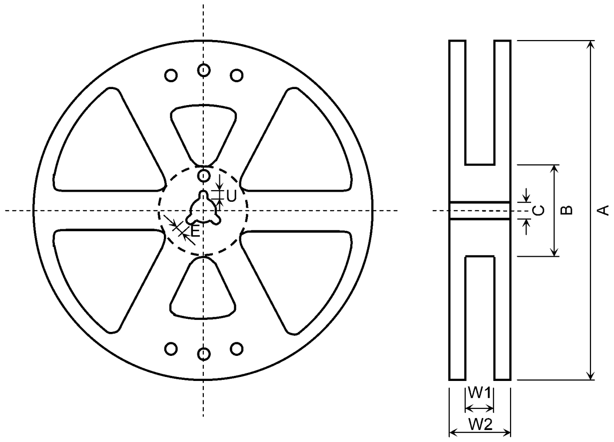


Fig. 16.3.6.1 Reel Forms

Table 16.3.6.1 Reel Dimensions (unit: mm)

Symbol	Dimension
A	ϕ330 ± 2
B	ϕ80 ± 1
C	ϕ13 ± 0.5
E	2.0 ± 0.5
U	4.0 ± 0.5
W1	13.5 ± 0.5
W2	17.5 ± 1.0

16.4. Packing (Note)

Either one reel or ten reels of photocouplers are packed in a shipping carton.

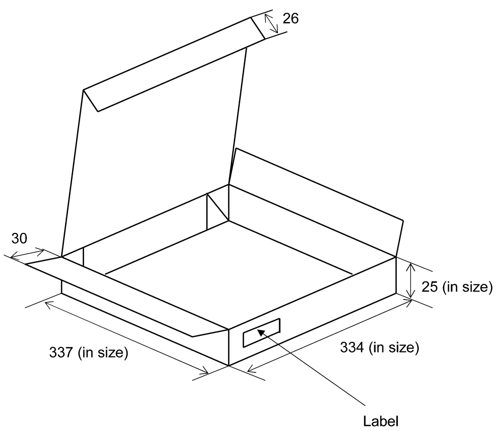


Fig. 16.4.1 1 reel/carton (unit: mm)

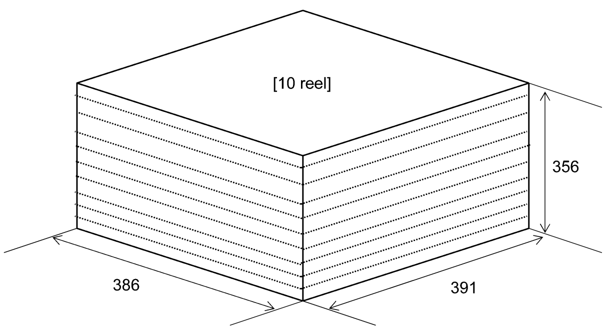


Fig. 16.4.2 10 reel/carton (unit: mm)

Note: Taping reel diameter: ϕ330 mm

16.5. Label Format

(1) Carton: The label provides the part number, quantity, lot number, the Toshiba logo, etc.

(2) Reel: The label provides the part number, the taping name (TPL), quantity, lot number, etc.

16.6. Ordering Information

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

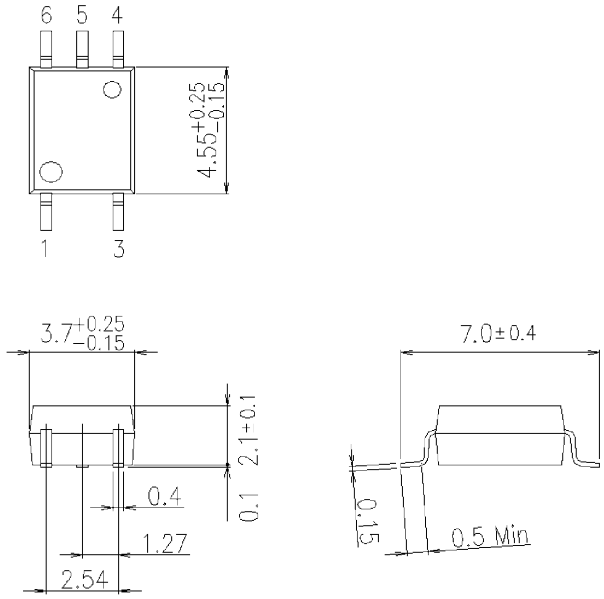
Example) TLP2345 (TPL,E(O 3000 pcs

Part number: TLP2345
Tape type: TPL
[[G]]/RoHS COMPATIBLE: E **(Note)**
Domestic ID (Country / Region of origin: Japan): (O
Quantity (must be a multiple of 3000): 3000 pcs

Note: 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 electronics equipment.

Package Dimensions

Unit: mm



Weight: 0.08 g (typ.)

Package Name(s)
TOSHIBA: 11-4L1S

RESTRICTIONS ON PRODUCT USE

- Toshiba Corporation, and its subsidiaries and affiliates (collectively "TOSHIBA"), reserve the right to make changes to the information in this document, and related hardware, software and systems (collectively "Product") without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. **TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.**
- **PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT ("UNINTENDED USE").** Except for specific applications as expressly stated in this document, Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. **IF YOU USE PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT.** For details, please contact your TOSHIBA sales representative.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- **ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.**
- GaAs (Gallium Arsenide) is used in Product. GaAs is harmful to humans if consumed or absorbed, whether in the form of dust or vapor. Handle with care and do not break, cut, crush, grind, dissolve chemically or otherwise expose GaAs in Product.
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. **TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.**