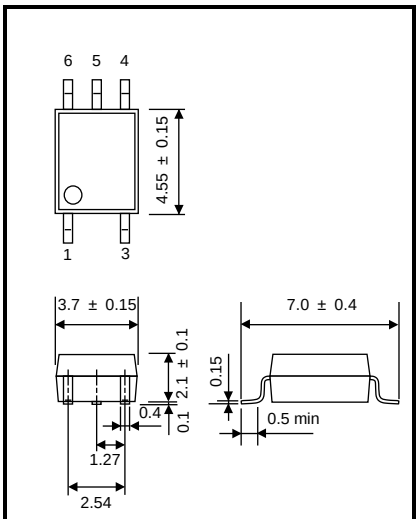
TOSHIBA Photocoupler IRED + Photo IC

TLP155E

Plasma Display Panel (PDP)
Industrial Inverter
MOS FET / IGBT Gate Driver

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	11-4L1

weight: 0.08 g (typ.)

The Toshiba TLP155E consists of an infrared emitting diodes and integrated high gain, high-speed photodetectors. The TLP155E is housed in the SO6 package.

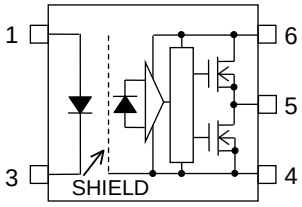
The photodetector has an internal Faraday shield that provides a guaranteed common-mode transient immunity of ±15 kV/μs. TLP155E is suitable for direct gate driving circuit for IGBTs or power MOSFETs.

- Buffer logic type (Totem pole output)
- Package type: SO6
- Peak Output Current : I_{OP} = ±0.6 A (max)
- Guaranteed performance over temperature: -40 to 100 °C
- Threshold Input Current: I_{FLH} = 7.5 mA (max)
- Propagation delay time : t_{pLH} / t_{pHL} = 200 ns (max)
- Common mode transient immunity : ±15 kV/μs (min)
- Isolation voltage : 3750 V_{rms} (min)
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A
  File No.E67349
- VDE-approved: EN 60747-5-5, EN 62368-1 (Note 1)
- CQC-approved: GB4943.1, GB8898 Thailand Factory

仅适用于海拔 2000m 以下地区安全使用

Note 1: When a EN 60747-5-5 approved type is needed, please designate the **Option(V4)**.

Pin Configuration (Top View)

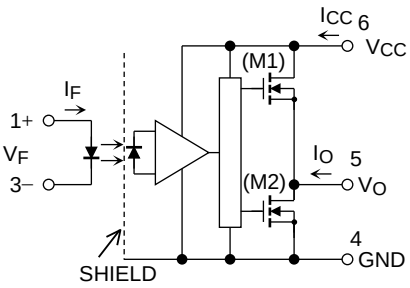


1:ANODE
3:CATHODE
4:GND
5:V_O (Output)
6:V_{CC}

Truth Table

Input	LED	M1	M2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

Schematic



Construction Mechanical Ratings

Creepage distance	5.0 mm (min)
Clearance distance	5.0 mm (min)
Insulation thickness	0.4 mm (min)

Start of commercial production
2010-08

Absolute Maximum Ratings (Ta = 25 °C)

Characteristics		Symbol	Rating	Unit
LED	Forward Current	I_F	20	mA
	Forward Current Derating (Ta ≥ 92°C)	ΔI_F /°C	-0.63	mA/°C
	Pulse Forward Current (Note 1)	I_{FPT}	1	A
	Reverse Voltage	V_R	5	V
	Input Power Dissipation	PD	40	mW
	Input Power Dissipation Derating (Ta ≥ 92°C)	ΔPD/°C	-1.2	mW/°C
	Junction Temperature	Tj	125	°C
DETECTOR	"H" Peak Output Current (Note 2)	I_{OPH}	-0.6	A
	"L" Peak Output Current (Note 2)	I_{OPL}	0.6	A
	Output Voltage	V_O	35	V
	Supply Voltage	V_{CC}	35	V
	Output Power Dissipation	PO	80	mW
	Output Power Dissipation Derating (Ta ≥ 85°C)	ΔPO/°C	-2.0	mW/°C
	Junction Temperature	Tj	125	°C
Operating frequency (Note 3)		f	250	kHz
Operating Temperature Range		T_{opr}	-40 to 100	°C
Storage Temperature Range		T_{stg}	-55 to 125	°C
Lead Soldering Temperature (10 s)		T_{sol}	260	°C
Isolation Voltage (AC, 60 s, R.H.≤ 60 %) (Note 4)		BV_S	3750	V_{rms}

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 ≤ 1 μs, 300 pps.

Note 2: Exponential waveform pulse width P_W ≤ 2 μs, f ≤ 10 kHz, V_{CC} = 20 V, Ta = -40 to 100 °C

Note 3: Exponential waveform pulse width P_W ≤ 80 ns, I_{OPH} ≥ -0.25 A, I_{OPL} ≤ 0.25 A, V_{CC} = 20V, Ta = -40 to 100 °C

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

Recommended Operating Conditions

Characteristics	Symbol	Min	Typ.	Max	Unit
Input Current, High Level (Note 1)	I_{FLH}	10	-	15	mA
Input Voltage, Low Level	V_{FHL}	0	-	0.8	V
Supply Voltage*	V_{CC}	10	-	30	V
Peak output current	I_{OPH}/ I_{OPL}	-	-	±0.2	A
Operating Temperature	T_{opr}	-40	-	100	°C

* This item denotes operating range, not meaning of recommended operating conditions.

Note: Recommended operating conditions are given as a design guideline to obtain expected performance of the device. Additionally, each item is an independent guideline respectively. In developing designs using this product, please confirm specified characteristics shown in this document.

Note 1: Input signal rise time (fall time) < 0.5 μs.

Electrical Characteristics (Ta = −40 to 100 °C, unless otherwise specified)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.*	Max	Unit
Forward voltage		V_F	—	I_F = 10 mA, Ta = 25 °C		1.40	1.55	1.80	V
Temperature coefficient of forward voltage		$\Delta V_F/\Delta Ta$	—	I_F = 10 mA		—	-1.8	—	mV/°C
Input reverse current		I_R	—	V_R = 5 V, Ta = 25 °C		—	—	10	μA
Input capacitance		C_T	—	V_F = 0 V, f = 1 MHz, Ta = 25 °C		—	60	—	pF
Output current (Note 1)	"H" Level	I_{OPH1}	1	V_{CC} = 15 V, I_F = 10 mA	V6-5 = 4 V	—	-0.5	-0.2	A
		I_{OPH2}			V6-5 = 10 V	—	—	-0.4	
	"L" Level	I_{OPL1}	2	V_{CC} = 15 V, I_F = 0 mA	V5-4 = 2 V	0.2	0.5	—	
		I_{OPL2}			V5-4 = 10 V	0.4	—	—	
Output voltage	"H" Level	V_{OH}	3	V_{CC} = 10 V	I_O = −100 mA, I_F = 10 mA	6.0	8.4	—	V
	"L" Level	V_{OL}	4		I_O = 100 mA, V_F = 0.8 V	—	0.3	1.0	
Supply current	"H" Level	I_{CCH}	5	V_{CC} = 10 to 20 V, V_O=Open	I_F = 10 mA	—	1.5	3.0	mA
	"L" Level	I_{CCL}	6		I_F = 0 mA	—	1.5	3.0	
Threshold input current	L → H	I_{FLH}	—	V_{CC} = 15 V, V_O > 1 V		—	1.0	7.5	mA
Threshold input voltage	H → L	V_{FHL}	—	V_{CC} = 15 V, V_O < 1 V		0.8	—	—	V
Supply voltage		V_{CC}	—	—		10	—	30	V

*All typical values are at Ta=25°C.

Note: This product is more sensitive than conventional products to electrostatic discharge (ESD) owing to its low power consumption design. It is therefore all the more necessary to observe general precautions regarding ESD when handling this component.

Note 1: Duration of I_O time ≤ 50 μs, 1 pulse

Isolation Characteristics (Ta = 25 °C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Capacitance input to output	C_S	V_S = 0 V , f = 1MHz (Note 1)	—	0.8	—	pF
Isolation resistance	R_S	R.H. ≤ 60 %, V_S = 500 V (Note 1)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 60 s	3750	—	—	V_{rms}

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

Switching Characteristics (NOTE)(Ta = −40 to 100 °C, unless otherwise specified)

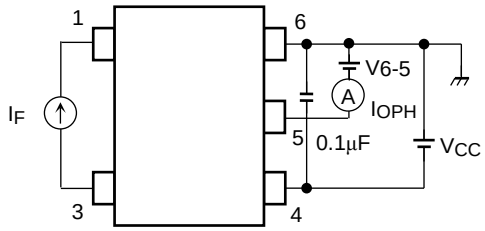
Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.*	Max	Unit
Propagation delay time	L → H	t_{pLH}	7	V_{CC} = 20 V R_g = 30 Ω C_g = 1 nF F = 250 kHz Duty = 50 %	Ta = 25 °C I_F = 0 → 10 mA	—	120	170	ns
	H → L	t_{pHL}			Ta = 25 °C I_F = 10 → 0 mA	—	120	170	
	L → H	t_{pLH}			I_F = 0 → 10 mA	50	120	200	
	H → L	t_{pHL}			I_F = 10 → 0 mA	50	120	200	
Propagation delay skew (Note 1)		t_{psk}			I_F = 0 ↔ 10 mA	-85	—	85	
Switching time dispersion		$\lvert t_{pHL}-t_{pLH} \rvert$			I_F = 0 ↔ 10 mA	—	5	50	
Output rise time (10−90 %)		t_r			I_F = 0 → 10 mA	—	35	—	
Output fall time (90−10 %)		t_f			I_F = 10 → 0 mA	—	15	—	
Common mode transient immunity at HIGH level output		CM_H	8	V_{CM} =1000 Vp-p V_{CC} = 20 V Ta = 25 °C	I_F = 10 mA $V_{O\ (min)}$ = 16 V	−15	—	—	kV/μs
Common mode transient immunity at LOW level output		CM_L			I_F = 0 mA $V_{O\ (max)}$ = 1 V	15	—	—	

(*): All typical values are at Ta = 25 °C.

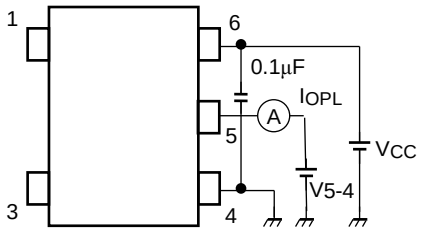
Note: A ceramic capacitor (0.1 μF) should be connected from pin 6 (V_{CC}) to pin 4 (GND) to stabilize the operation of the high gain linear amplifier. Failure to provide the bypass may impair the switching property.
The total lead length between capacitor and coupler should not exceed 1 cm.

Note 1: Propagation delay skew is defined as the difference between the largest and smallest propagation delay time (i.e. t_{pHL} or t_{pLH}) of multiple samples. Evaluations of these samples are conducted under identical test conditions (supply voltage, input current, temperature, etc.).

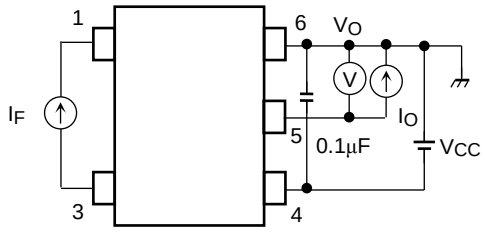
Test Circuit 1: I_{OPH}



Test Circuit 2: I_{OPL}

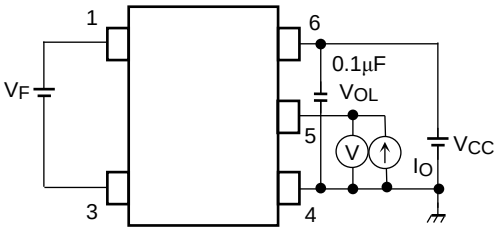


Test Circuit 3: V_{OH}

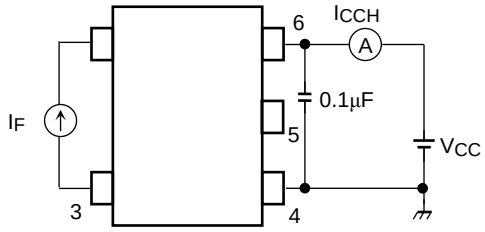


*$V_{OH} = V_{CC} - V_O$

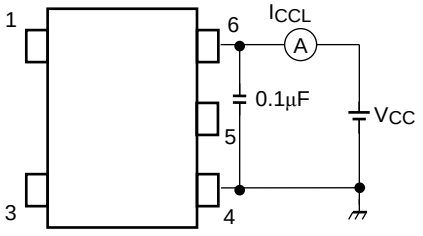
Test Circuit 4: V_{OL}



Test Circuit 5: I_{CCH}



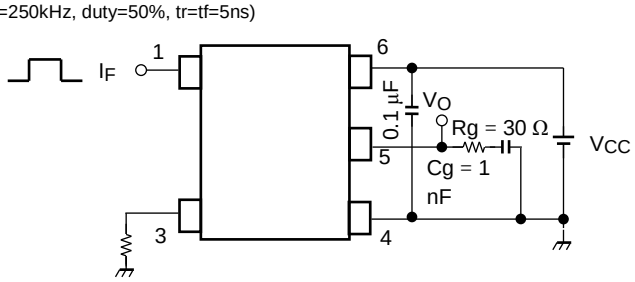
Test Circuit 6: I_{CCL}

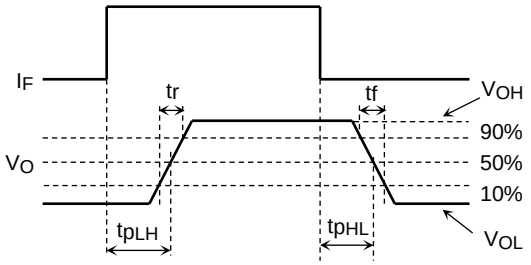


Test Circuit 7: t_{pLH}, t_{pHL}, t_r, t_f, $|t_{pHL}-t_{pLH}|$

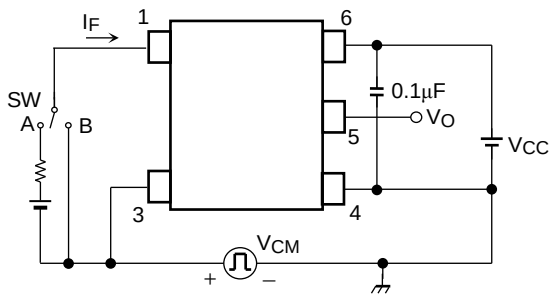
I_F=10mA (P.G)

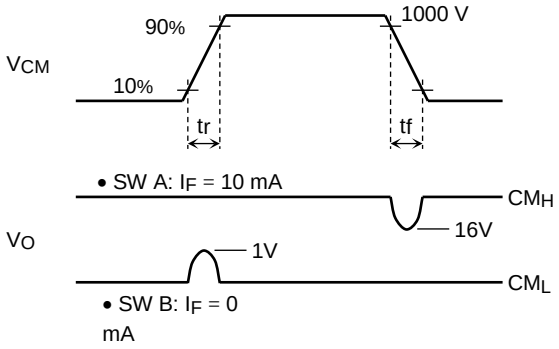
(f=250kHz, duty=50%, tr=tf=5ns)





Test Circuit 8: CM_H, CM_L



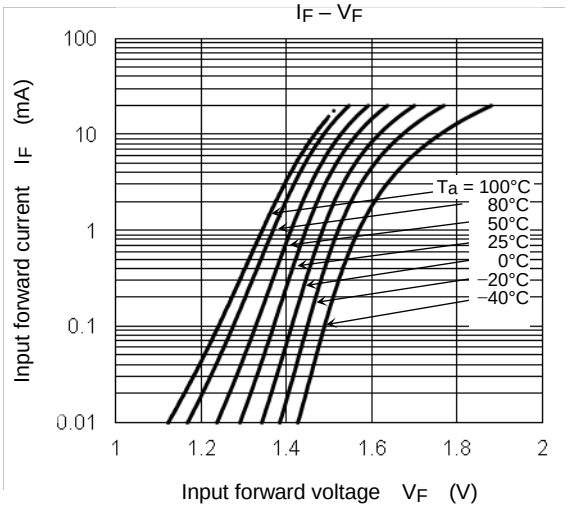


$$CM_L = \frac{800\ V}{tr\ (\mu s)}$$

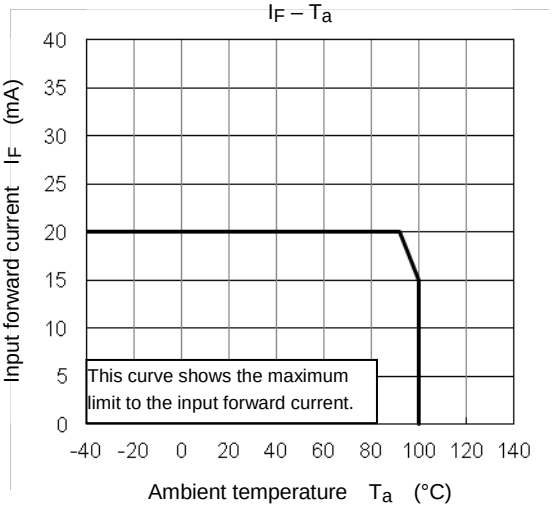
$$CM_H = -\frac{800\ V}{tf\ (\mu s)}$$

CM_L (CM_H) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the LOW (HIGH) state.

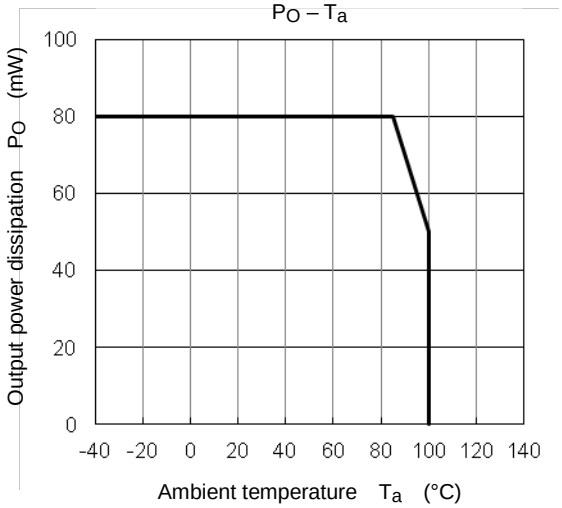
$I_F - V_F$



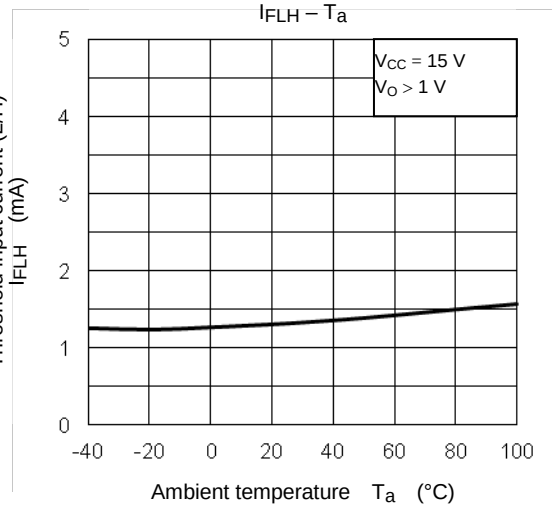
$I_F - T_a$



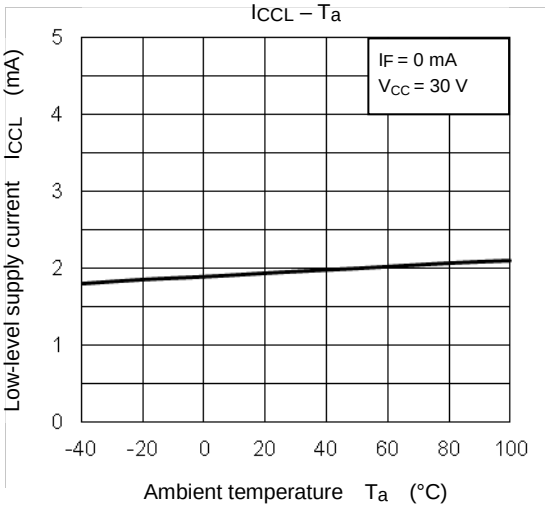
$P_O - T_a$



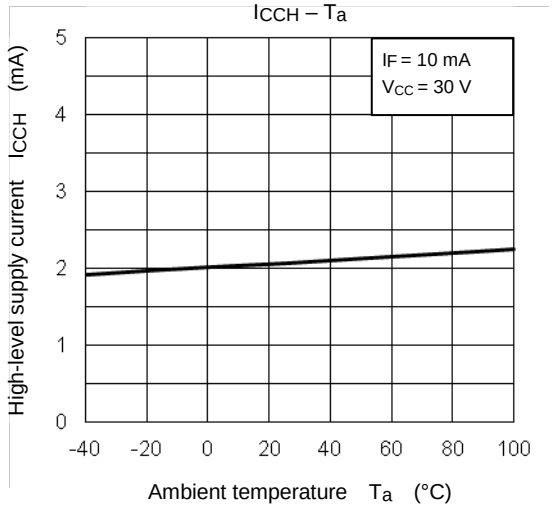
$I_{FLH} - T_a$



$I_{CCL} - T_a$

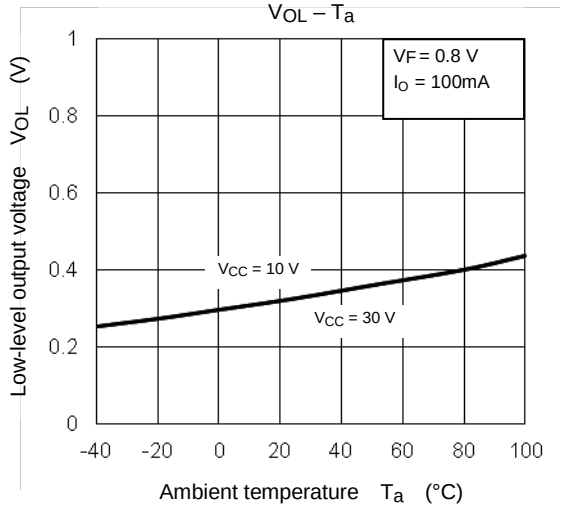


$I_{CCH} - T_a$

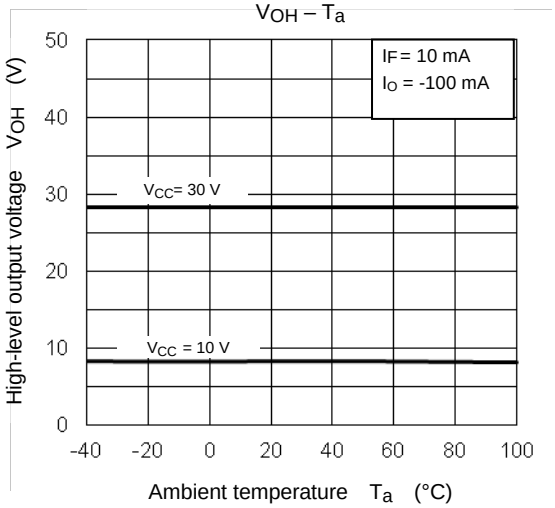


NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

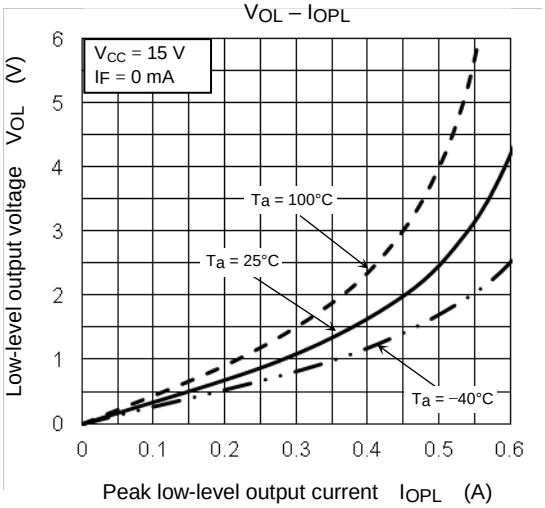
V_{OL} – T_a



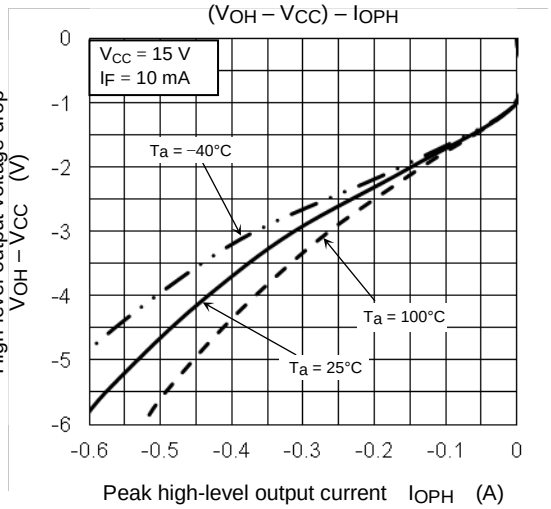
V_{OH} – T_a



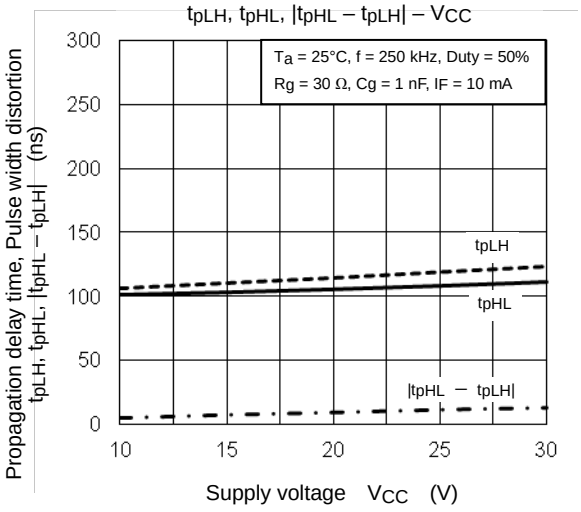
V_{OL} – I_{OPL}



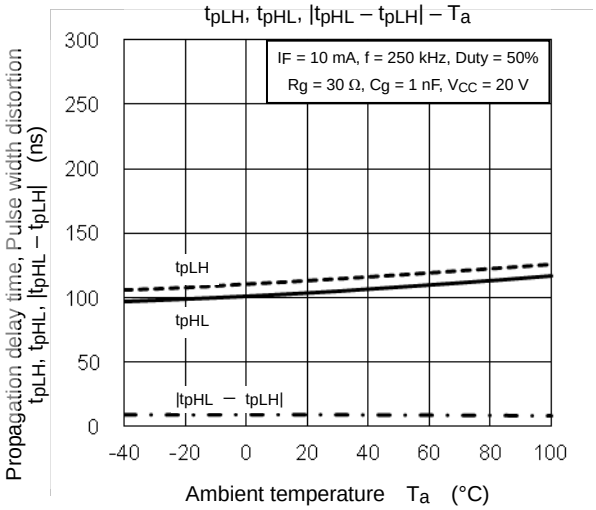
(V_{OH} – V_{CC}) – I_{OPH}



t_{pLH}, t_{pHL}, $|t_{pHL} - t_{pLH}|$ – V_{CC}



t_{pLH}, t_{pHL}, $|t_{pHL} - t_{pLH}|$ – T_a



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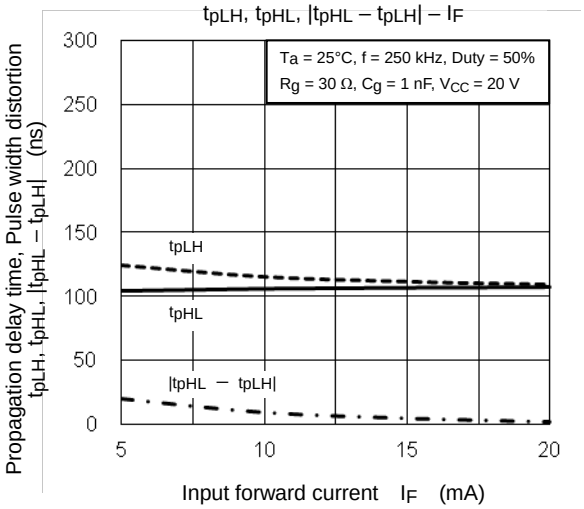


NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

PRECAUTIONS OF SURFACE MOUNTING TYPE PHOTOCOUPLER SOLDERING & GENERAL STORAGE

(1) Precautions for Soldering

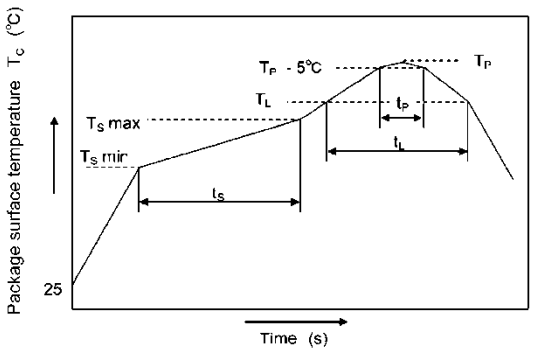
When soldering, please prevent the temperature rise of this product as much as possible within the following conditions for both soldering iron method and reflow method.

The following profile is indicated as the maximum value of the heat resistance of this product.

Depending on the type of solder paste to be used, please set the preheat temperature and thermal temperature to optimized temperature within the profile.

1) When Using Soldering Reflow

- An example of a temperature profile when lead(Pb)-free solder is used



	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

- The soldering temperature profile is based on the package surface temperature (See the figure above.)
- 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.

2) When using soldering Flow

- Preheat the device at a temperature of 150 °C (package surface temperature) for 60 to 120 seconds.
- Mounting condition of 260 °C within 10 seconds is recommended
- Flow soldering must be performed once.

3) When using soldering Iron

- 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

(2) Precautions for General Storage

1) Do not store devices at any place where they will be exposed to moisture or direct sunlight.

2) When transportation or storage of devices, follow the cautions indicated on the carton box.

3) The storage area temperature should be kept within a temperature range of 5 ˚C to 35 ˚C, and relative humidity should be maintained at between 45% and 75%.

4) Do not store devices in the presence of harmful (especially corrosive) gases, or in dusty conditions.

5) Use storage areas where there is minimal temperature fluctuation. Because rapid temperature changes can cause condensation to occur on stored devices, resulting in lead oxidation or corrosion, as a result, the solderability of the leads will be degraded.

6) When repacking devices, use anti-static containers.

7) Do not apply any external force or load directly to devices while they are in storage.

8) If devices have been stored for more than two years, even though the above conditions have been followed, it is recommended that solderability of them should be tested before they are used.

Specification for Embossed–Tape Packing (TPL)(TPR) for SO6 Coupler

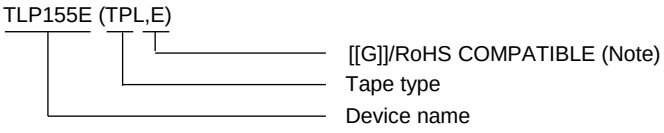
1. Applicable Package

Package	Product Type
SO6	Mini-flat coupler

2. Product Naming System

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

(Example)



3. Tape Dimensions

3.1 Specification Classification Are as Shown in Table 1

Table 1 Tape Type Classification

Tape type	Classification	Quantity (pcs / reel)
TPL	L direction	3000
TPR	R direction	3000

3.2 Orientation of Device in Relation to Direction of Tape Movement

Device orientation in the recesses is as shown in Figure 1.

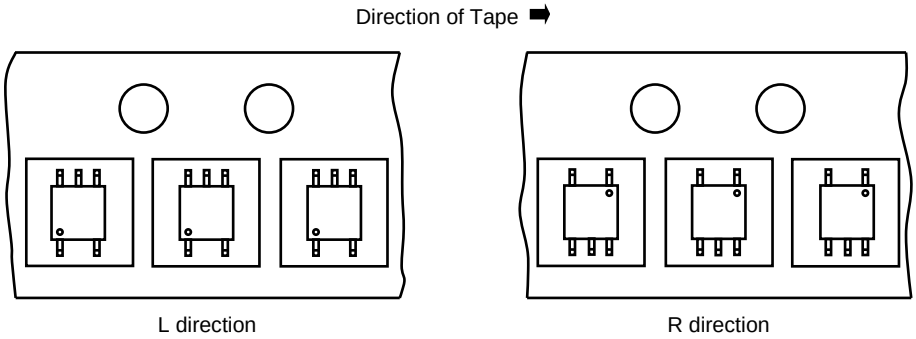


Figure 1 Device Orientation

3.3 Empty Device Recesses Are as Shown in Table 2.

Table 2 Empty Device Recesses

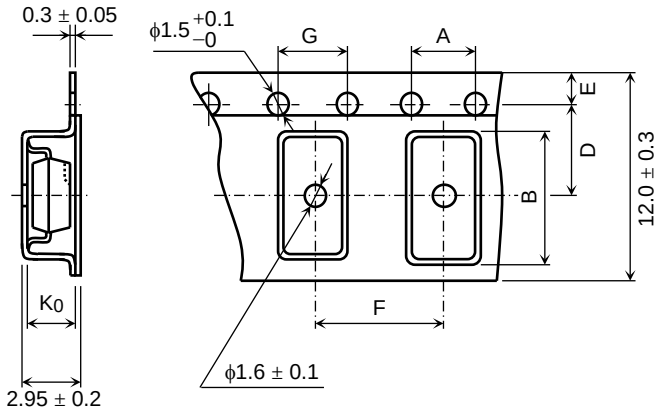
	Standard	Remarks
Occurrences of 2 or more successive empty device recesses	0 device	Within any given 40mm section of tape, not including leader and trailer
Single empty device recesses	6 devices (max) per reel	Not including leader and trailer

3.4 Start and End of Tape

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

3.5 Tape Specification

(1) Tape material: Plastic (protection against electrostatics)
(2) Dimensions: The tape dimensions are as shown in Figure 2 and Table 3.



Unit:mm

Figure 2 Tape Forms

Table 3 Tape Dimensions

Unit: mm
Unless otherwise specified: ±0.1

Symbol	Dimension	Remark
A	4.0	—
B	7.6	—
D	5.5	Center line of indented square hole and sprocket hole
E	1.75	Distance between tape edge and hole center
F	8.0	Cumulative error $^{+0.1}_{-0.3}$ (max) per 10 feed holes
G	4.0	Cumulative error $^{+0.1}_{-0.3}$ (max) per 10 feed holes
K_0	2.6	Internal space

3.6 Reel

(1) Material: Plastic
(2) Dimensions: The reel dimensions are as shown in Figure 3 and Table 4.

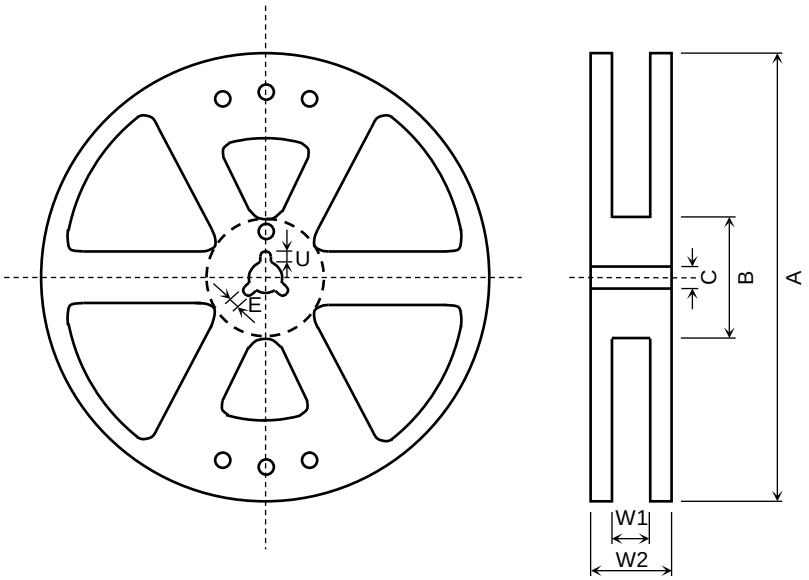


Figure 3 Reel Form

Table 4 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

4. Packing

Packed in a shipping carton.

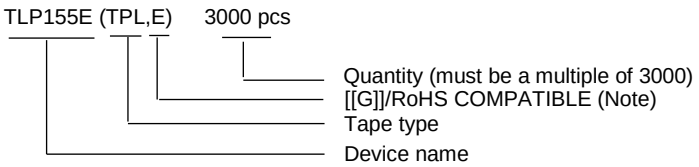
5. Label Indication

The carton bears a label indicating the product number, the symbol representing classification of standard, the quantity, the lot number and the Toshiba company name.

6. Ordering Method

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

(Example)



Note : Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.
The 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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