Photocouplers Infrared LED & Photo IC

TLP351

1. Description

The TOSHIBA TLP351 consists of an infrared emitting diode and an integrated photodetector.
This unit is 8-lead DIP package.
TLP351 is suitable for gate driving circuit of IGBT or power MOS FET. Especially TLP351 is capable of "direct" gate drive of lower Power IGBTs.

2. Applications

- Industrial Inverter
- Inverter for Air Conditioner
- IGBT/Power MOS FET Gate Drive

3. Features

- Peak output current: ±0.6 A (max)
- Guaranteed performance over temperature: −40 to 100 °C
- Supply current: 2 mA (max)
- Power supply voltage: 10 to 30 V
- Threshold input current : IF = 5 mA (max)
- Switching time (tpLH/tpHL) : 700 ns (max)
- Common mode transient immunity: ±10 kV/μs
- Isolation voltage: 3750 Vrms
- Safety standards
  UL-recognized: UL 1577, File No.E67349
  cUL-recognized: CSA Component Acceptance Service No.5A File No.E67349
  VDE-approved: EN IEC 60747-5-5, EN IEC 62368-1 (Note 1)

  Note 1: When a VDE approved type is needed,please designate the Option(D4).

Start of commercial production
2002-05

4. Pin Assignment

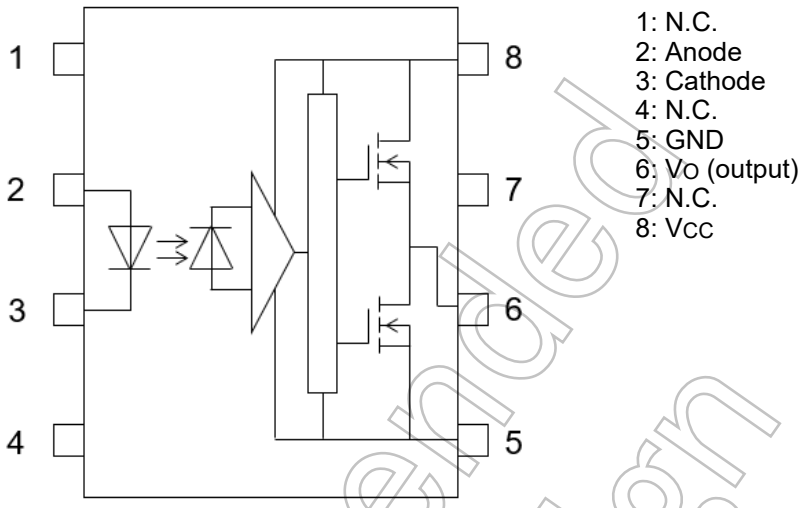


Figure 4.1 Pin Assignment

5. Internal Circuit

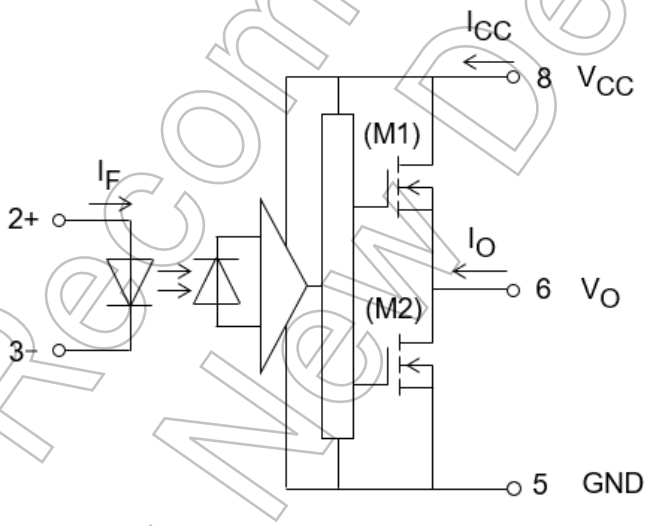


Figure 5.1 Internal Circuit

6. Function Description

6.1 Truth Table

Input	LED	Tr1	Tr2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

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

	Characteristics		Symbol	Rating	Unit
LED	Forward current		I_F	20	mA
	Forward current derating (Ta ≥ 85 °C)		$\Delta I_F/\Delta Ta$	−0.54	mA/°C
	Peak transient forward current	(Note 1)	I_{FP}	1	A
	Reverse voltage		V_R	5	V
	Power Dissipation		P_D	40	mW
	Power Dissipation Derating (Ta ≥ 85 °C)		ΔP_D /°C	-1.0	mW/°C
	Junction temperature		T_j	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	-0.5 to 35	V
	Supply voltage		V_{CC}	-0.5 to 35	V
	Output Power Dissipation		P_O	260	mW
	Output Power Dissipation Derating (Ta ≥ 85 °C)		ΔP_O /°C	-6.5	mW/°C
	Junction temperature		T_j	125	°C
Operating frequency		(Note 3)	f	25	kHz
Operating temperature range			T_{opr}	−40 to 100	°C
Storage temperature range			T_{stg}	−55 to 125	°C
Lead soldering temperature (10 s)		(Note 4)	T_{sol}	260	°C
Isolation voltage (AC, 60 s, R.H. ≤ 60 %)		(Note 5)	BV_S	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 P_W ≤ 1 μs, 300 pps

Note 2: Exponential waveform pulse width P_W ≤ 10 μs, f ≤ 15 kHz

Note 3: Exponential waveform I_{OPH} ≤ −0.4 A (≤ 2.0 μs), I_{OPL} ≤ +0.4 A (≤ 2.0 μs), Ta = 100 °C

Note 4: It is 2 mm or more from a lead root.

Note 5: Device considered a two-terminal device: pins 1, 2, 3 and 4 shorted together, and pins 5, 6, 7 and 8 shorted together.

8. Recommended Operating Conditions (Note)

Characteristics	Symbol	Min	Typ.	Max	Unit
Input current, ON (Note 1)	$I_{F\ (ON)}$	7.5	—	10	mA
Input voltage, OFF	$V_{F\ (OFF)}$	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

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: A ceramic capacitor (1 μF) should be connected between pin 8 (V_{CC}) and pin 5 (GND) 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: Input signal rise time (fall time) < 0.5 μs

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

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Forward voltage		V_F	—	I_F = 5 mA, Ta = 25 °C		—	1.55	1.70	V
Temperature coefficient of forward voltage		$\Delta V_F/\Delta Ta$	—	I_F = 5 mA		—	−2.0	—	mV/°C
Input reverse current		I_R	—	V_R = 5 V, Ta = 25 °C		—	—	10	μA
Input capacitance		C_T	—	V = 0 V , f = 1 MHz, Ta = 25 °C		—	95	—	pF
Output current (Note 1)	"H" Level	I_{OPH1}	Fig. 12.1.1	V_{CC} = 15 V, I_F = 5 mA	V_{8-6} = 4 V	—	−0.4	−0.2	A
		I_{OPH2}			V_{8-6} = 10 V	—	−0.67	−0.4	
	"L" Level	I_{OPL1}	Fig. 12.1.2	V_{CC} = 15 V, I_F = 0 mA	V_{6-5} = 2 V	0.2	0.35	—	
		I_{OPL2}			V_{6-5} = 10 V	0.4	0.63	—	
Output voltage	"H" Level	V_{OH}	Fig. 12.1.3	V_{CC} = 10 V	I_O = −100 mA, I_F = 5 mA	6.0	8.5	—	V
	"L" Level	V_{OL}	Fig. 12.1.4		I_O = 100 mA, V_F = 0.8 V	—	0.4	1.0	
Supply current	"H" Level	I_{CCH}	Fig. 12.1.5	V_{CC} = 10 to 30 V, V_O open	I_F = 10 mA	—	1.4	2.0	mA
	"L" Level	I_{CCL}	Fig. 12.1.6		I_F = 0 mA	—	1.3	2.0	
Threshold input current	L → H	I_{FLH}	—	V_{CC} = 15 V, V_O > 1 V		—	1.1	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

Note: All typical values are at Ta = 25°C

Note 1: I_O application time ≤ 50 μs; single pulse.

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

Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Capacitance input to output	C_S	V_S = 0V, f = 1MHz (Note)	—	1.0	—	pF
Isolation resistance	R_S	V_S = 500 V, R.H. ≤ 60 % (Note)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 60 s	3750	—	—	Vrms

Note : Device considered a two-terminal device: pins 1, 2, 3 and 4 shorted together, and pins 5, 6, 7 and 8 shorted together.

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

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Propagation delay time	L → H	t_{pLH}	Fig. 12.1.7	V_{CC} = 30 V, R_g = 47 Ω, C_g = 3 nF	I_F = 0 → 5 mA	100	—	700	ns
	H → L	t_{pHL}			I_F = 5 → 0 mA	100	—	700	
Output rise time (10-90%)		tr			I_F = 0 → 5 mA	—	50	—	ns
Output fall time (90-10%)		tf			I_F = 5 → 0 mA	—	50	—	
Propagation delay difference between any two parts or channels		PDD $\lvert t_{pHL}-t_{pLH}\rvert$		V_{CC} = 30 V, R_g = 47 Ω, C_g = 3 nF		−500	—	500	ns
Common mode transient immunity at high level output		CM_H	Fig. 12.1.8	V_{CM} = 1000 Vp-p, Ta = 25 °C, V_{CC} = 30 V	I_F = 5 mA, $V_{O\,(min)}$ = 26 V	−10	—	—	kV/μs
Common mode transient immunity at low level output		CM_L			I_F = 0 mA, $V_{O\,(max)}$ = 1 V	10	—	—	

Note: All typical values are at Ta = 25 °C

12. Test Circuits and Characteristics Curves

12.1. Test Circuits

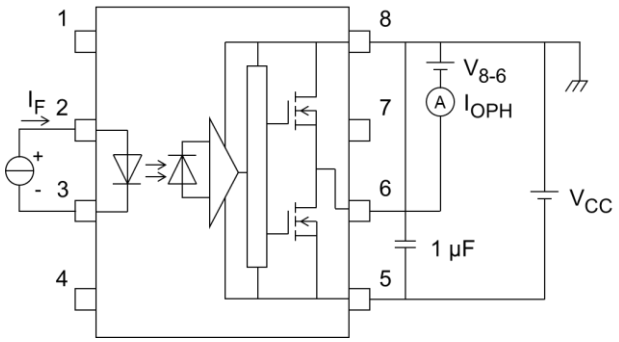


Fig. 12.1.1 I_{OPH} Test Circuit

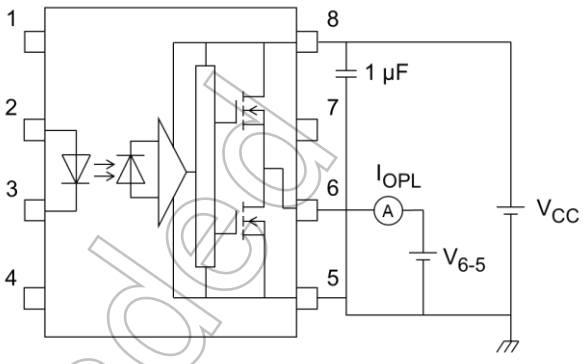
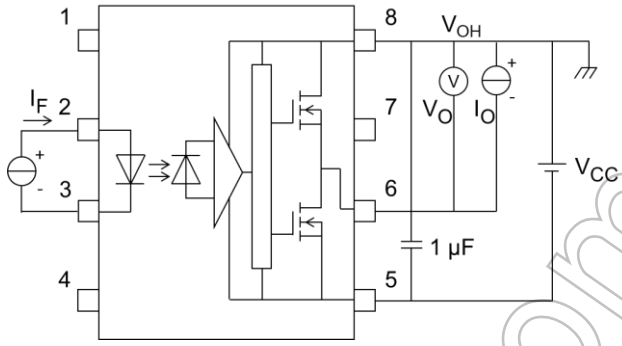


Fig. 12.1.2 I_{OPL} Test Circuit



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

Fig. 12.1.3 V_{OH} Test Circuit

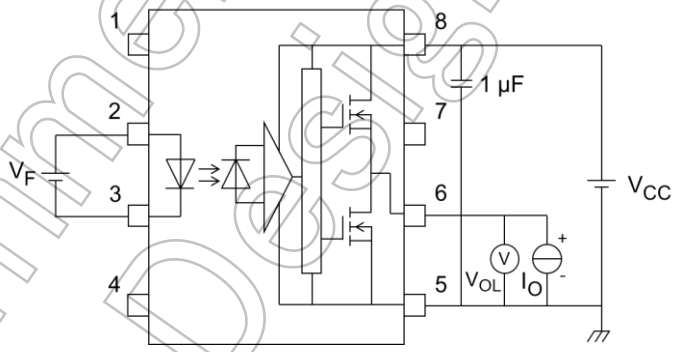


Fig. 12.1.4 V_{OL} Test Circuit

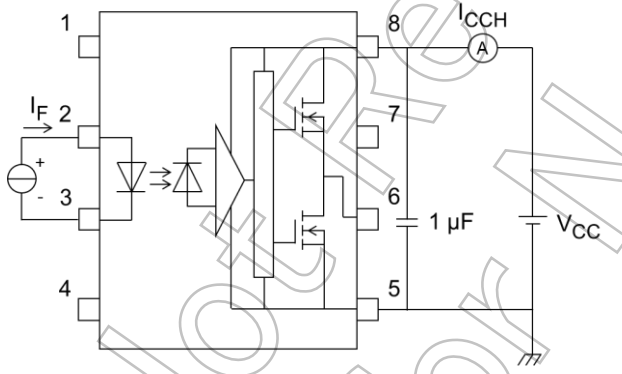


Fig. 12.1.5 I_{CCH} Test Circuit

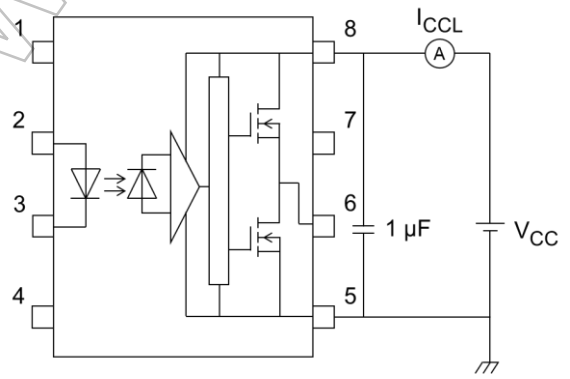


Fig. 12.1.6 I_{CCL} Test Circuit

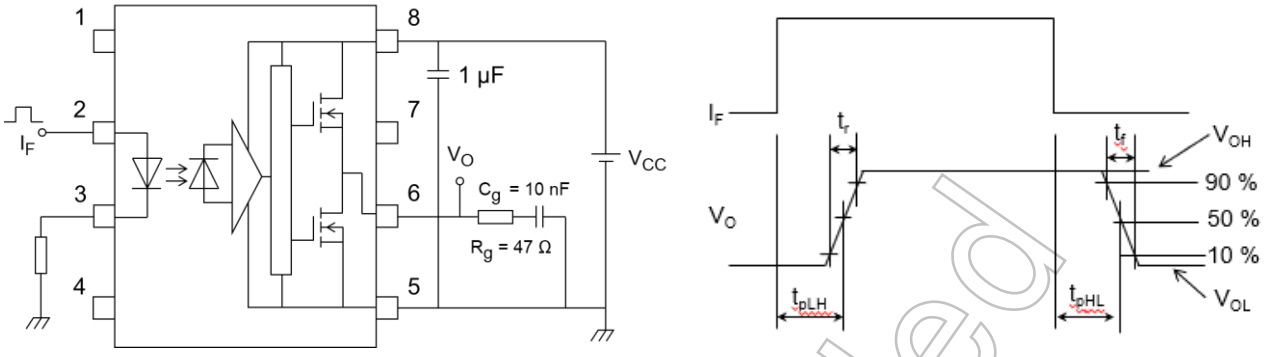
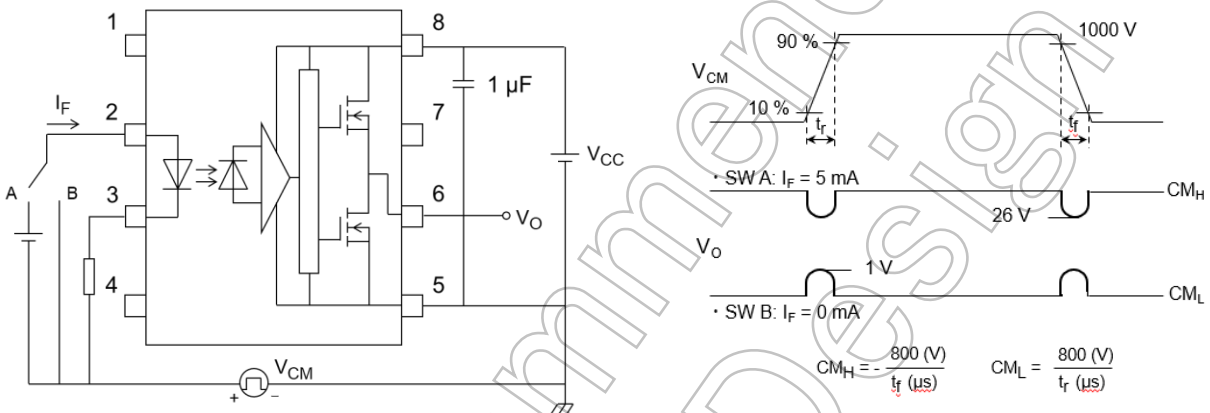


Fig. 12.1.7 t_{pLH}, t_{pHL}, t_r, t_f, PDD Test Circuit and Waveform



CML (CMH) 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.

Fig. 12.1.8 CM_H, CM_L Test Circuit and Waveform

13. Characteristics Curves (Note)

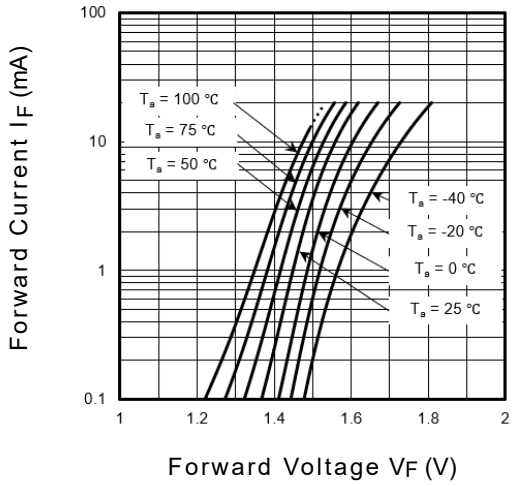


Figure 13.1 I_F - V_F

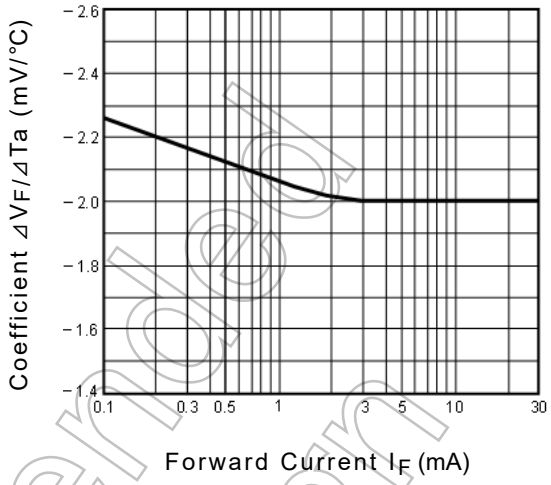


Figure 13.2 $\Delta V_F/\Delta Ta$ - I_F

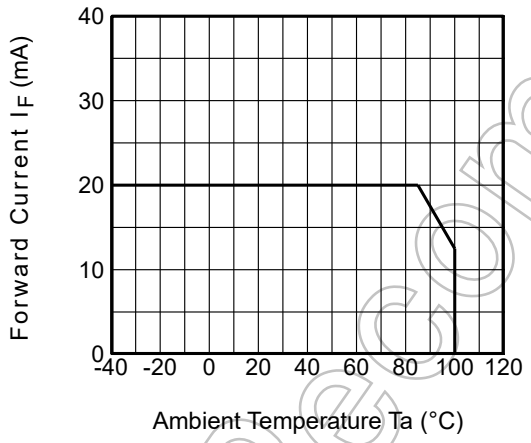


Figure 13.3 I_F -Ta

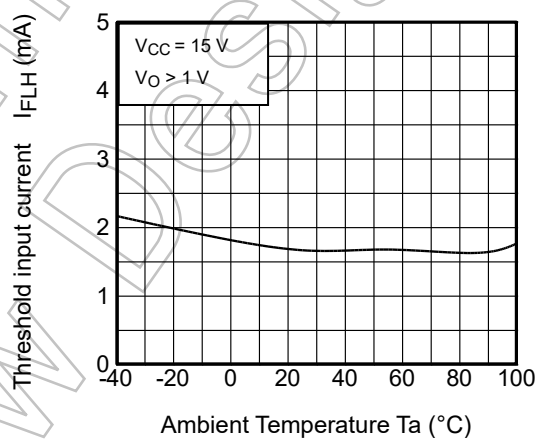


Figure 13.4 I_{FLH}-Ta

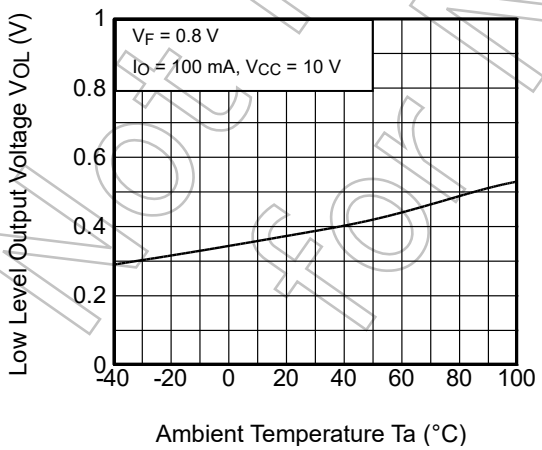


Figure 13.5 V_{OL} -Ta

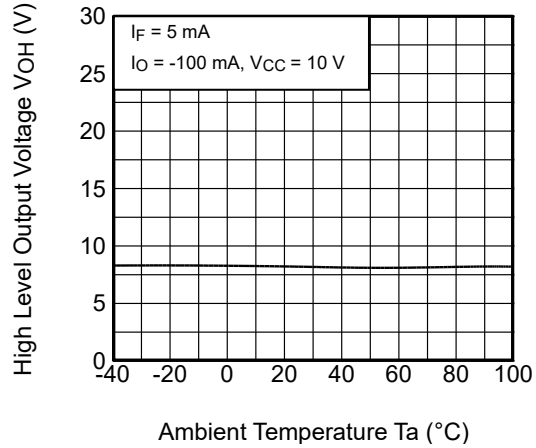


Figure 13.6 V_{OH} -Ta

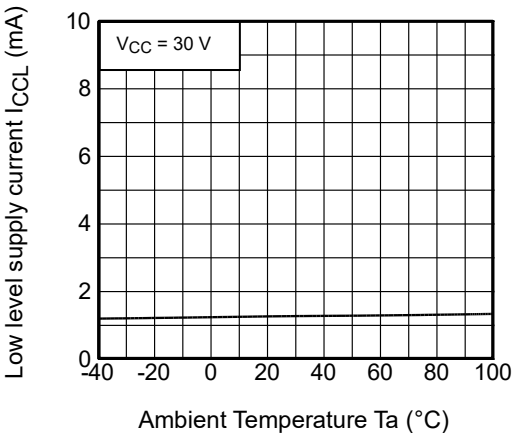


Figure 13.7 I_{CCL}-Ta

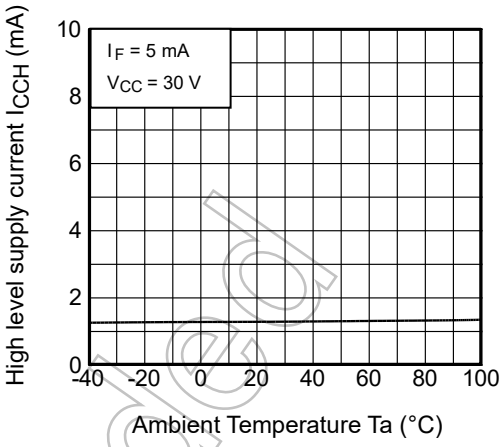


Figure 13.8 I_{CCH}-Ta

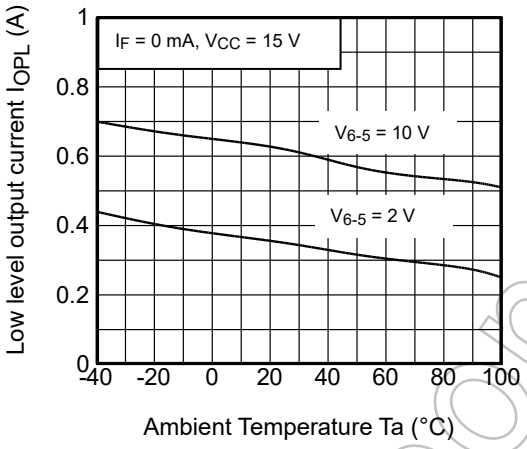


Figure 13.9 I_{OPL}-Ta

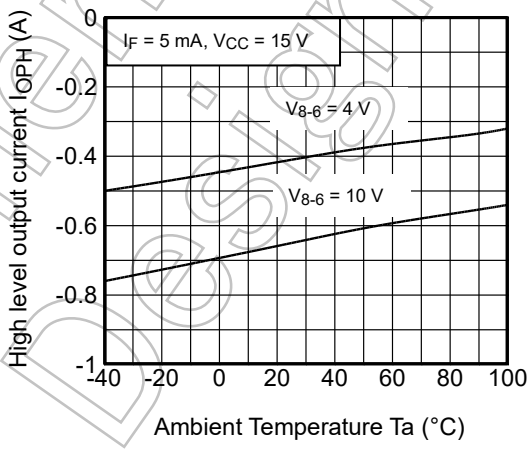


Figure 13.10 I_{OPH}-Ta

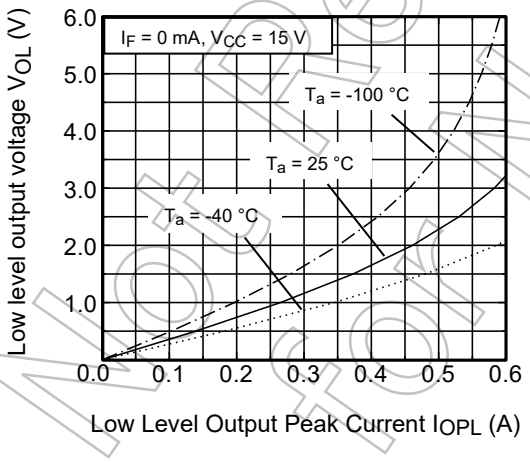


Figure 13.11 I_{OPL}-V_{OL}

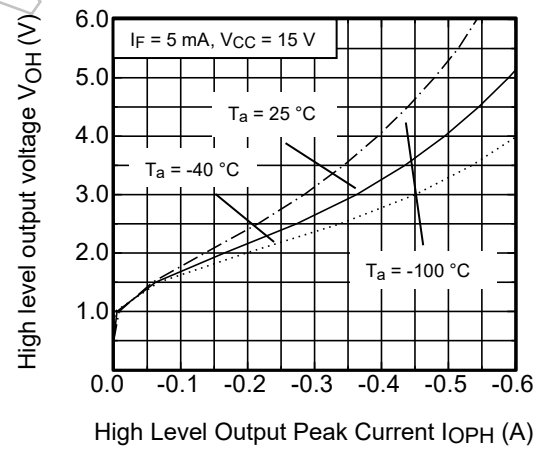


Figure 13.12 I_{OPH}-V_{OH}

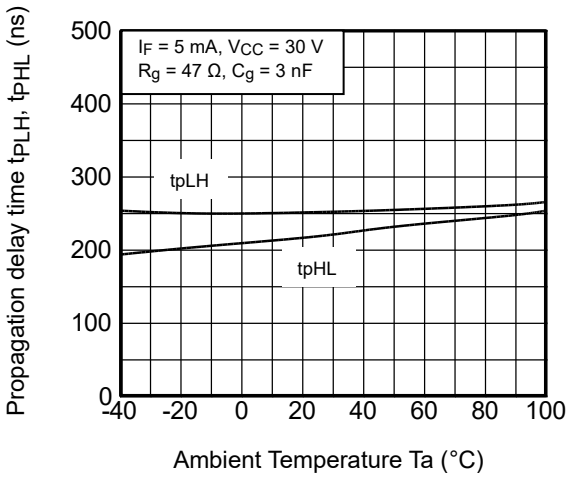
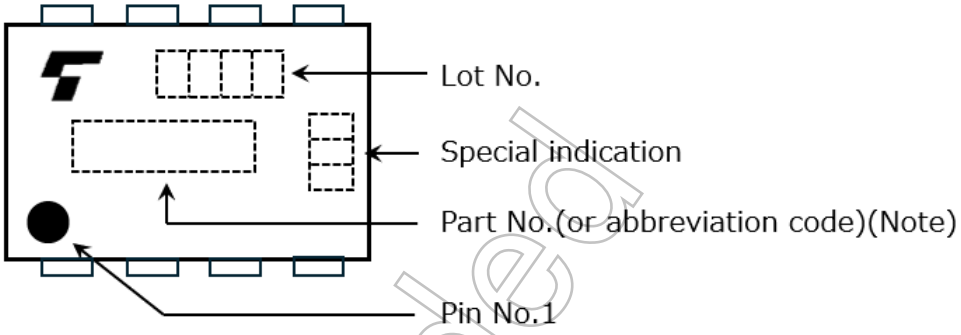


Figure 13.13 t_{pHL},t_{pLH}-Ta

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

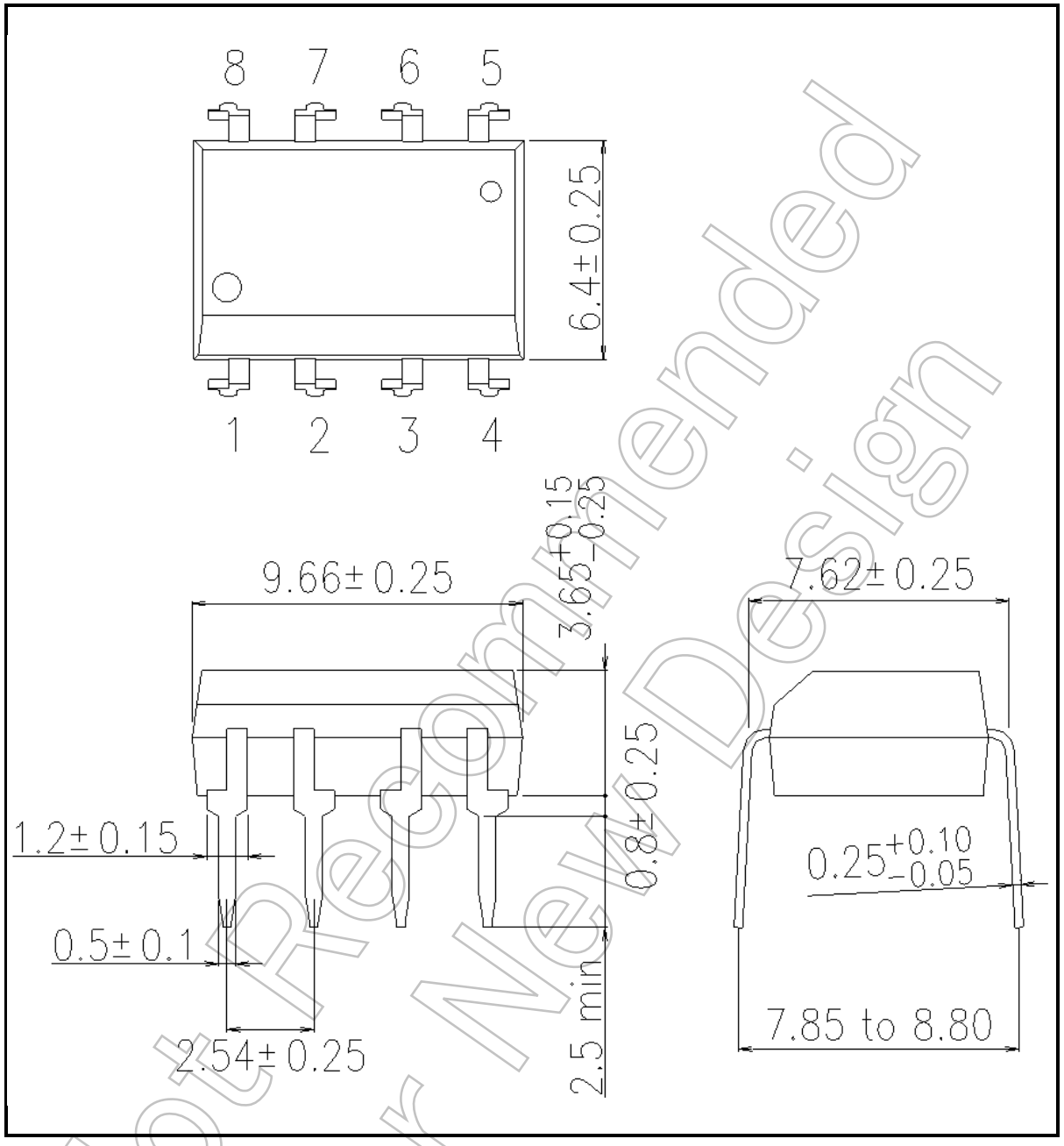
14. Marking



Note: TLP351

15. Package Dimensions

Unit: mm



Weight: 0.54 g (typ.)

Package Name(s)
TOSHIBA: 11-10C4S

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