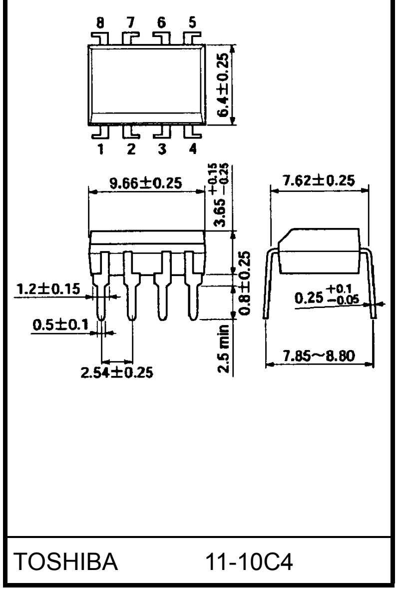
TOSHIBA Photocoupler GaAℓAs IRED + Photo IC

TLP350

Industrial Inverter
Inverter for Air Conditioner
IGBT/Power MOSFET Gate Drive
IH (Induction Heating)

Unit: mm



Weight: 0.54 g (typ.)

The TOSHIBA TLP350 consists of a GaAℓAs light-emitting diode and an integrated photodetector.
This unit is an 8-lead DIP package.
The TLP350 is suitable for gate driving IGBTs or power MOSFETs.

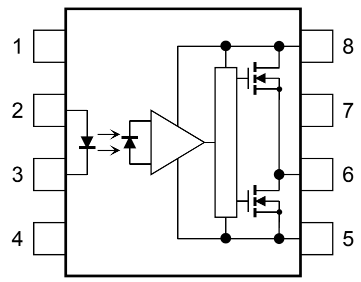
- Peak output current : I_O = ±2.5A (max)
- Guaranteed performance over temperature : -40 to 100°C
- Supply current : I_{CC} = 2 mA (max)
- Power supply voltage: V_{CC} = 15 to 30 V
- Threshold input current : I_{FLH} = 5 mA (max)
- Switching time (t_{pLH}/t_{pHL}) : 500 ns (max)
- Common mode transient immunity : 15 kV/μs
- Isolation voltage : 3750 Vrms
- UL Recognized : UL1577, File No.E67349
- Option(D4)
  VDE Approved : DIN EN 60747-5-2
  Maximum Operating Insulation Voltage : 890V_{PK}
  Highest Permissible Over Voltage : 6000V_{PK}

  (Note):When a EN 60747-5-2 approved type is needed,
  Please designate “Option(D4)”

Truth Table

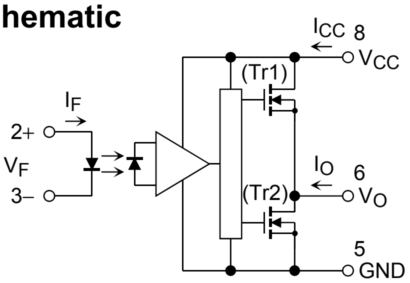
Input	LED	Tr1	Tr2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

Pin Configuration (top view)



1: NC
2: Anode
3: Cathode
4: NC
5: GND
6: V_O (output)
7: NC
8: V_{CC}

Schematic



A 0.1 μF bypass capacitor must be connected between pins 8 and 5. (See Note 6)

Start of commercial production
2005/05

Absolute Maximum Ratings (Ta = 25°C)

	Characteristic		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_{FPT}	1	A
	Reverse voltage		V_R	5	V
	Junction temperature		T_j	125	°C
Detector	"H" peak output current	Ta = −40 to 100°C (Note 2)	I_{OPH}	−2.5	A
	"L" peak output current	Ta = −40 to 100°C (Note 2)	I_{OPL}	2.5	A
	Supply voltage	Ta < 95 °C	V_{CC}	35	V
	Supply voltage Derating	Ta ≥ 95 °C	$\Delta V_{CC} / \Delta Ta$	-1.0	V /°C
	Junction temperature		T_j	125	°C
Operating frequency		(Note 3)	f	50	kHz
Storage temperature range			T_{stg}	−55 to 125	°C
Operating temperature range			T_{opr}	−40 to 100	°C
Lead soldering temperature (10 s)		(Note 4)	T_{sol}	260	°C
Isolation voltage (AC, 1 minute, 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 ≤ 0.3µs, f ≤ 15 kHz

Note 3: Exponential waveform I_{OPH} ≥ -2.0A (≤ 0.3µs), I_{OPL} ≤ 2.0A (≤ 0.3µs)

Note 4: At 2 mm or more from the lead root.

Note 5: This device is regarded as a two terminal device: pins 1, 2, 3 and 4 are shorted together, as are pins 5, 6, 7 and 8.

Note 6: A ceramic capacitor (0.1 µF) should be connected from pin 8 to pin 5 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.

Recommended Operating Conditions

Characteristic	Symbol	Min	Typ.	Max	Unit
Input current, ON (Note 7)	$I_{F\ (ON)}$	7.5	—	10	mA
Input voltage, OFF	$V_{F\ (OFF)}$	0	—	0.8	V
Supply voltage	V_{CC}	15	—	30	V
Peak output current	I_{OPH}/I_{OPL}	—	—	±2.0	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 7: Input signal rise time (fall time) < 0.5 µs.

Note 8: If the rising slope of the supply voltage (V_{CC}) for the detector is steep, stable operation of the internal circuits cannot be guaranteed.
Be sure to set 3.0V/µs or less for a rising slope of the V_{CC}.

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

Characteristic		Symbol	Test Circuit	Test Conditions		Min	Typ.*	Max	Unit
Forward voltage		V_F	—	I_F = 10 mA, Ta = 25°C		—	1.6	1.8	V
Temperature coefficient of forward voltage		$\Delta V_F/\Delta Ta$	—	I_F = 10 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 , f = 1 MHz, Ta = 25°C		—	45	250	pF
Output current (Note 9)	"H" Level	I_{OPH}	1	V_{CC} = 30 V, I_F = 5 mA $V_{8\text{-}6}$ = 3.5 V		—	–1.6	-1.0	A
				V_{CC} = 15 V, I_F = 5 mA $V_{8\text{-}6}$ = 7.0 V		—	—	-2.0	
	"L" Level	I_{OPL}	2	V_{CC} = 30 V, I_F = 0 mA $V_{6\text{-}5}$ = 2.5V		1.0	1.6	—	
				V_{CC} = 15 V, I_F = 0 mA $V_{6\text{-}5}$ = 7.0V		2.0	—	—	
Output voltage	"H" Level	V_{OH}	3	$V_{CC\ 1}$= +15 V $V_{EE\ 1}$= +15 V R_L = 200 Ω	I_F = 5 mA	11	13.7	—	V
	"L" Level	V_{OL}	4		V_F = 0.8 V	—	-14.9	-12.5	
Supply current	"H" Level	I_{CCH}	5	V_{CC} = 30 V V_O open	I_F = 10 mA	—	1.3	2.0	mA
	"L" Level	I_{CCL}	6		I_F = 0 mA	—	1.3	2.0	
Threshold input current	L → H	I_{FLH}	—	V_{CC} = 15V , V_O > 1V , I_O = 0mA		—	1.8	5	mA
Threshold input voltage	H → L	V_{FHL}	—	V_{CC} = 15V , V_O < 1V , I_O = 0mA		0.8	—	—	V
Supply voltage		V_{CC}	—	—		15	—	30	V
UVLO threshold		V_{UVLO+}	—	V_O > 2.5 V , I_F = 5 mA		11.0	12.5	13.5	V
		V_{UVLO-}	—			9.5	11.0	12.0	V
UVLO hysteresis		$UVLO_{HYS}$	—	—		—	1.5	—	V

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

Note 9: Duration of I_O: ≤ 50 μs (1 PULSE)

Note 10: This product is more sensitive to static electricity (ESD) than the conventional product because of its minimal power consumption design.
General static electricity precautions are necessary for handling this component.

Isolation Characteristics (Ta = 25°C)

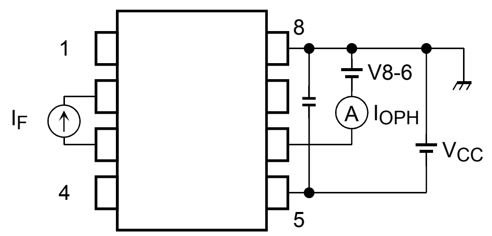
Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Capacitance input to output	C_S	V = 0,f = 1MHz (Note5)	—	1.0	—	pF
Isolation resistance	R_S	V_S = 500 V, R.H. ≤ 60% (Note5)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC,1 minute	3750	—	—	V_{rms}
		AC,1 second, in oil	—	10000	—	V_{rms}
		DC,1 minute, in oil	—	10000	—	Vdc

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

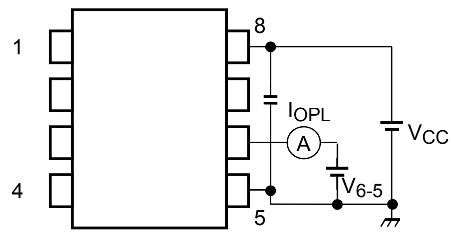
Characteristic		Symbol	Test Circuit	Test Conditions		Min	Typ.*	Max	Unit
Propagation delay time	L → H	t_{pLH}	7	V_{CC} = 30 V, R_g = 20 Ω, C_g = 10 nF	I_F = 0 → 5 mA	50	260	500	ns
	H → L	t_{pHL}			I_F = 5 → 0 mA	50	260	500	
Switching Time Dispersion between ON and OFF		$\lvert t_{pHL}$-$t_{pLH}\rvert$		V_{CC} = 30 V, R_g = 20 Ω, C_g = 10 nF		—	—	350	
Output rise time (10-90%)		t_r		V_{CC} = 30 V, R_g = 20 Ω, C_g = 10 nF	I_F = 0 → 5 mA	—	15	—	
Output fall time (90-10%)		t_f			I_F = 5 → 0 mA	—	8	—	
Common mode transient immunity at high level output		CM_H	8	V_{CM} = 1000 Vp-p, Ta = 25°C, V_{CC} = 30 V	I_F = 5 mA, $V_{O\ (min)}$ =26V	−15000	—	—	V/μs
Common mode transient immunity at low level output		CM_L			I_F = 0 mA, $V_{O\ (max)}$ =1V	15000	—	—	

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

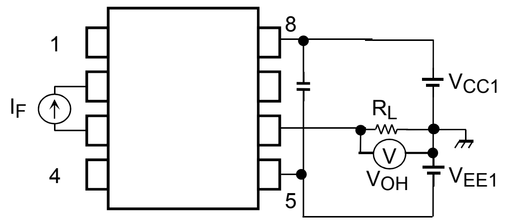
Test Circuit 1: I_{OPH}



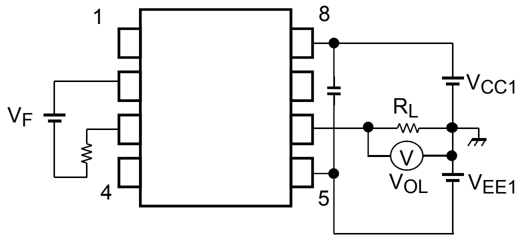
Test Circuit 2: I_{OPL}



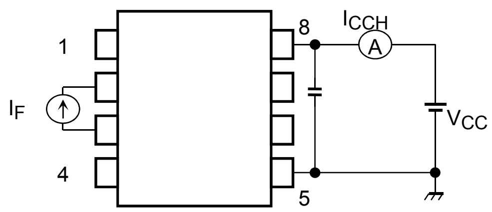
Test Circuit 3: V_{OH}



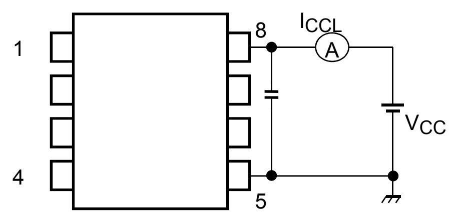
Test Circuit 4: V_{OL}



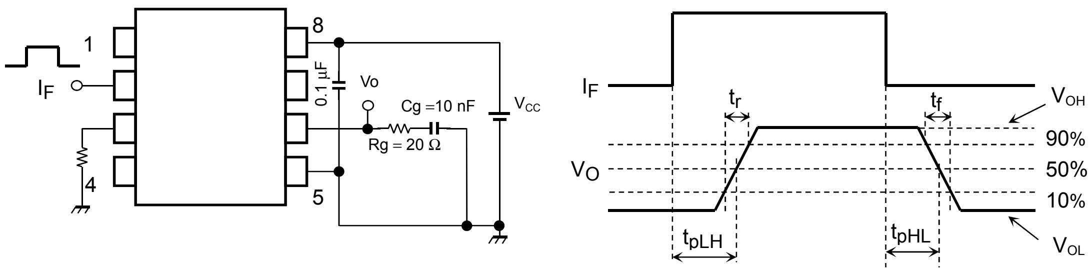
Test Circuit 5: I_{CCH}



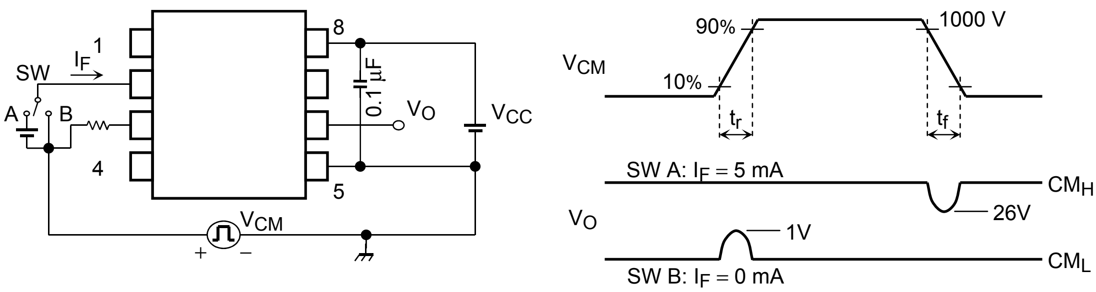
Test Circuit 6: I_{CCL}



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



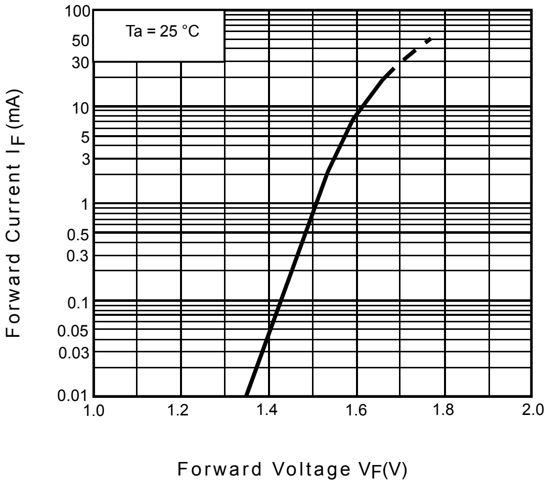
Test Circuit 8: CM_H, CM_L



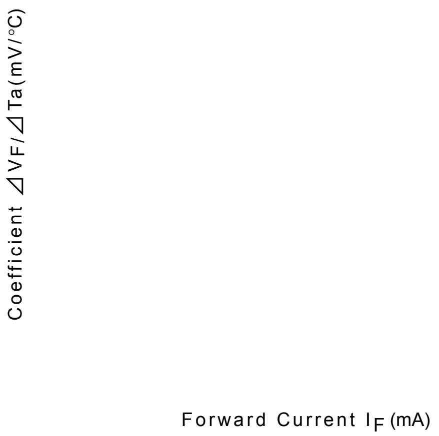
$$CM_L = \frac{800(V)}{t_r(\mu s)} \qquad CM_H = \frac{800(V)}{t_f(\mu s)}$$

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.

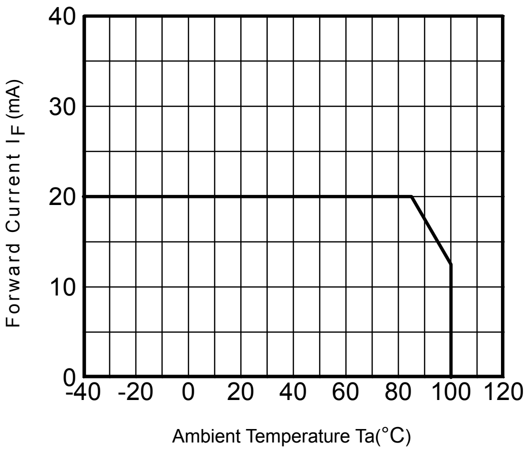
$I_F - V_F$



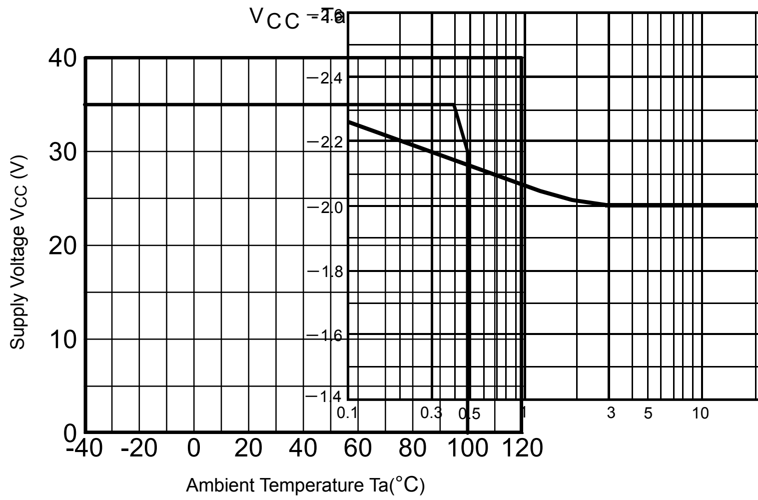
$\Delta V_F / \Delta Ta - I_F$



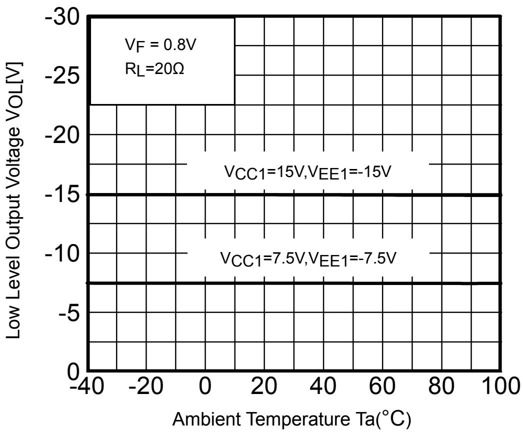
I_F -Ta



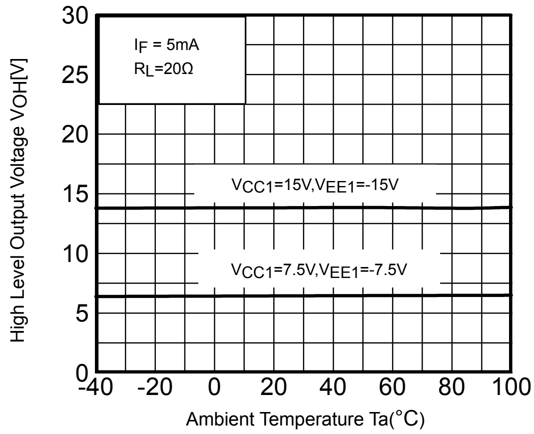
V_{CC} -Ta



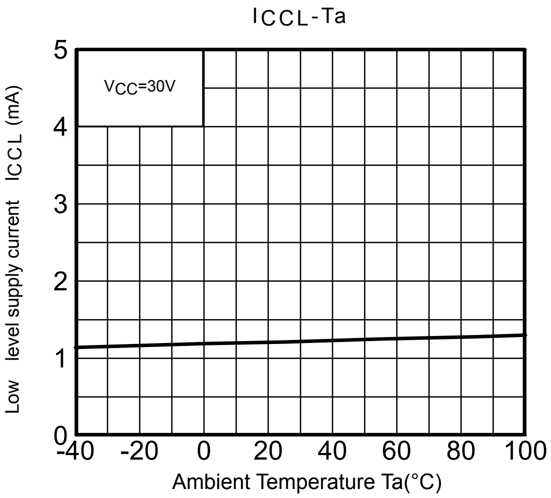
V_{OL} -Ta

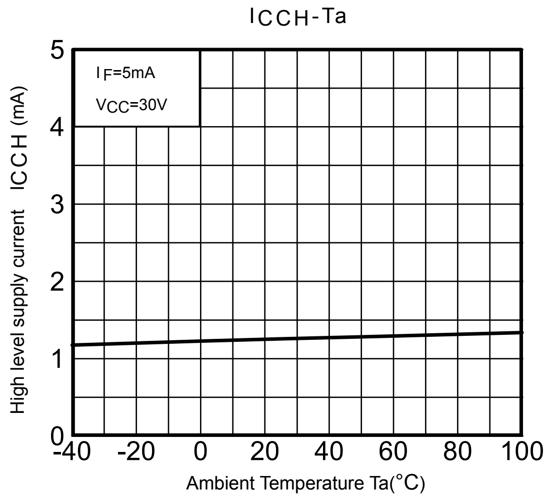


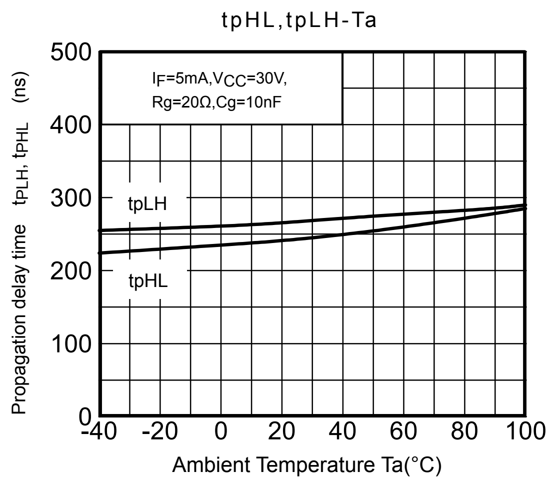
V_{OH} -Ta

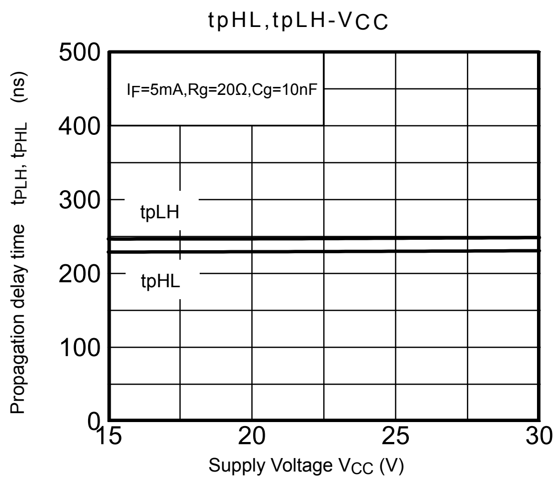


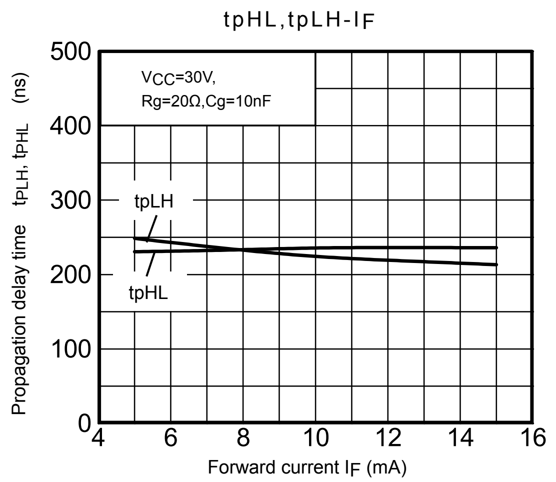
*: The above graphs show typical characteristics.

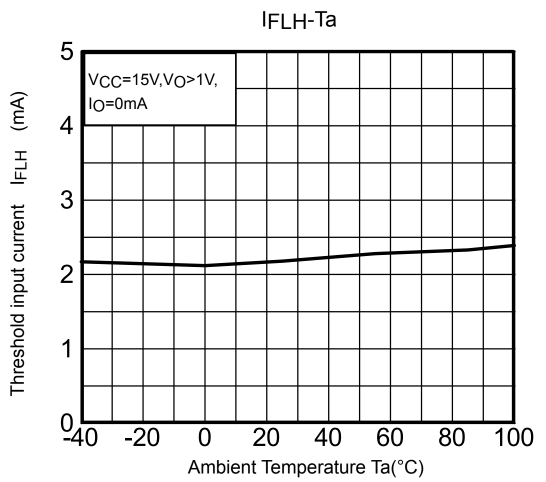






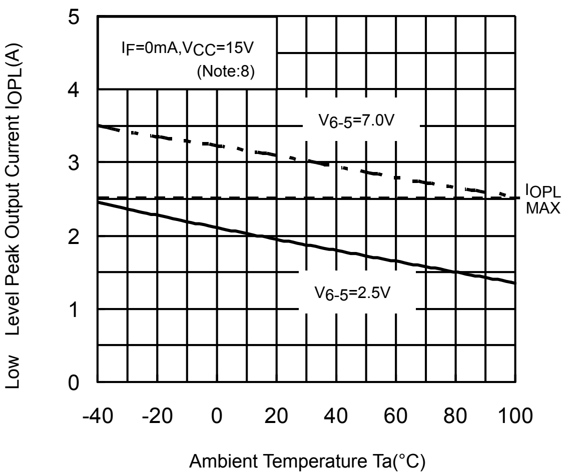




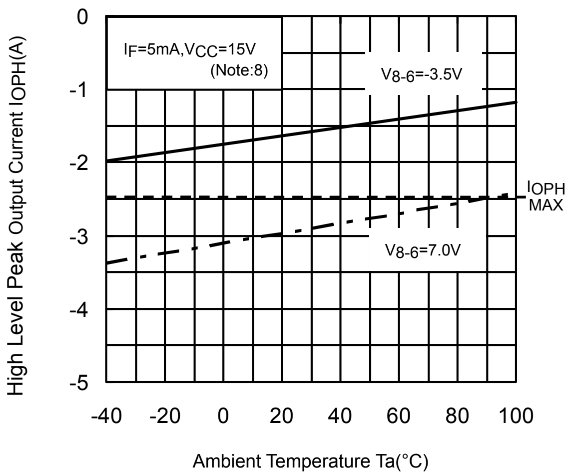


*: The above graphs show typical characteristics.

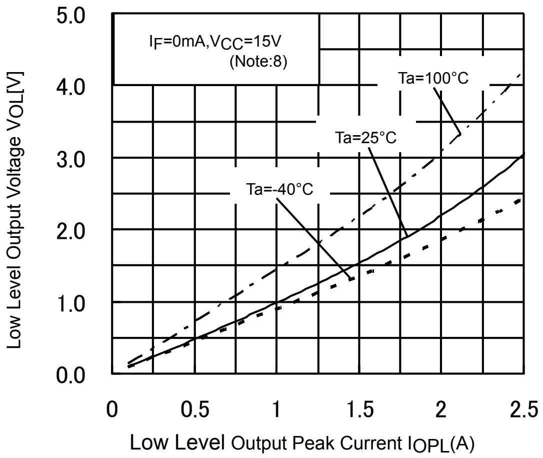
I_{OPL}-Ta



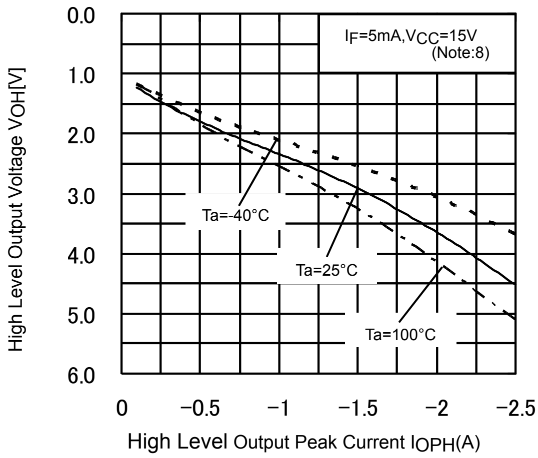
I_{OPH}-Ta



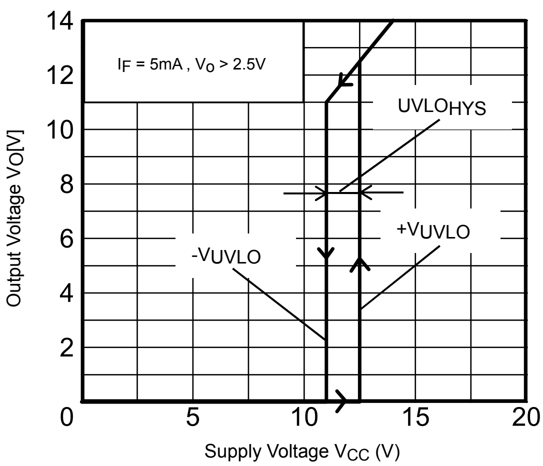
I_{OPL}-V_{OL}



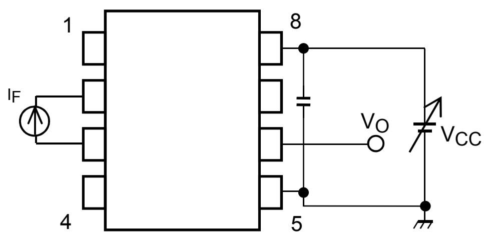
I_{OPH}-V_{OH}



V_{CC}-V_O(V_{UVLO})**



**Test Circuit : V_{CC}-V_O(V_{UVLO})



*: The above graphs show typical characteristics.

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