Preliminary

TOSHIBA Photocoupler GaAℓAs IRED + Photo IC

TLP350

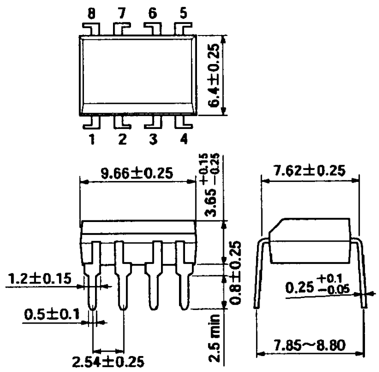
Industrial Inverter

Inverter for Air Conditioner

IGBT/Power MOSFET Gate Drive

IH(Induction Heating)

Unit: mm



TOSHIBA 11-10C4

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.

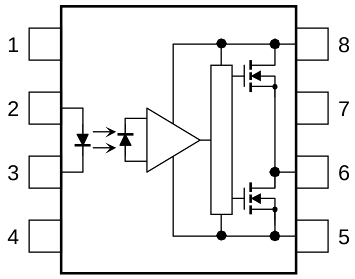
- Peak output current: $I_O = \pm 2.5A$ (max)
- Guaranteed performance over temperature: −40 to 100°C
- Supply current: I_{CC} = 2 mA (max)
- Power supply voltage: V_{CC} = 15 to 30 V
- Threshold input current : I_{FLH} = 5 mA (max)
- Switching time (t_{pLH}/t_{pHL}) : 500 ns (max)
- Common mode transient immunity: 15 kV/μs
- Isolation voltage: 3750 Vrms
- UL Recognized : UL1577,File No.E67349
- Option(D4)
  - VDE Approved : DIN EN60747-5-2
  - Maximum Operating Insulation Voltage : 890V_{PK}
  - Highest Permissible Over Voltage : 4000V_{PK}

(Note):When a EN60747-5-2 approved type is needed, Please designate "Option(D4)"

Truth Table

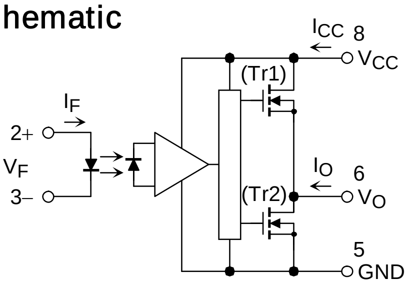
Input	LED	Tr1	Tr2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

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)

Maximum Ratings (Ta = 25°C)

	Characteristic		Symbol	Rating	Unit
LED	Forward current		I_F	20	mA
LED	Forward current de-rating (Ta ≥ 85°C)		$\Delta I_F/\Delta Ta$	−0.54	mA/°C
LED	Peak transient forward current	(Note 1)	I_{FP}	1	A
LED	Reverse voltage		V_R	5	V
LED	Junction temperature		T_j	125	°C
Detector	"H" peak output current	Ta = −40 to 100°C (Note 2)	I_{OPH}	−2.5	A
Detector	"L" peak output current	Ta = −40 to 100°C (Note 2)	I_{OPL}	2.5	A
Detector	Supply voltage	Ta < 95 °C	V_{CC}	35	V
Detector	Supply voltage Derating	Ta ≥ 95 °C	$\Delta V_{CC}/\Delta Ta$	-1.0	V /°C
Detector	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 1: Pulse width P_W ≤ 1 μs, 300 pps

Note 2: Exponential waveform pulse width P_W ≤ 0.3μs, f ≤ 15kHz

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

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 8)	"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	$V_{CC\ 1}$= +15 V, $V_{EE\ 1}$= -15 V, R_L = 200 Ω; 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	V_{CC} = 30 V, V_O open; I_F = 0 mA	—	1.3	2.0	
Threshold input current	L → H	I_{FLH}	—	V_{CC} = 15V , V_O > 1V , Io = 0mA	—	1.8	5	mA
Threshold input voltage	H → L	V_{FHL}	—	V_{CC} = 15V , V_O < 1V , Io = 0mA	0.8	—	—	V
Supply voltage		V_{CC}	—	—	15	—	30	V
UVLO threshhold		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 8: Duration of I_O : ≤ 50 μs(1PULSE)

Note 9: 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)

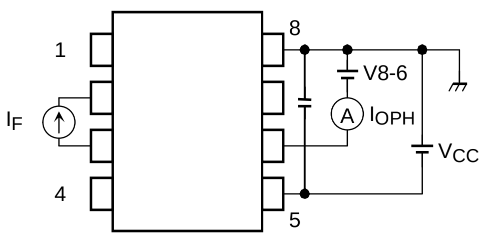
Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Capacitance input to output	C_S	V = 0,f = 1MHz (Note6)	—	1.0	—	pF
Isolation resistance	R_S	V_S = 500 V, Ta = 25°C, R.H. ≤ 60% (Note6)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC,1 minute	3750	—	—	V_{rms}
		AC,1 second,in oil	—	10000	—	
		DC,1 minute,in oil	—	10000	—	Vdc

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

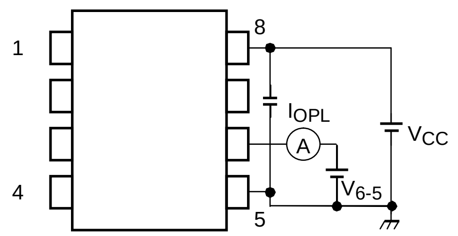
Characteristic		Symbol	Test Circuit	Test Conditions		Min	Typ.*	Max	Unit
Propagation delay time	L → H	t_{pLH}	7	V_{CC} = 30 V, R_g = 20 Ω, C_g = 10 nF	I_F = 0 → 5 mA	50	260	500	ns
	H → L	t_{pHL}			I_F = 5 → 0 mA	50	260	500	
Switching Time Dispersion between ON and OFF		$\|t_{pHL}-t_{pLH}\|$		V_{CC} = 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

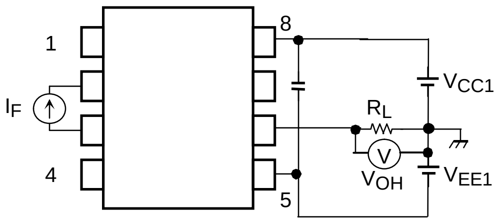
Test Circuit 1: I_{OPH}



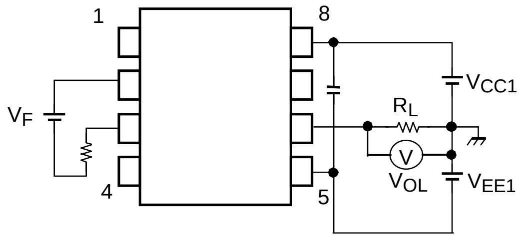
Test Circuit 2: I_{OPL}



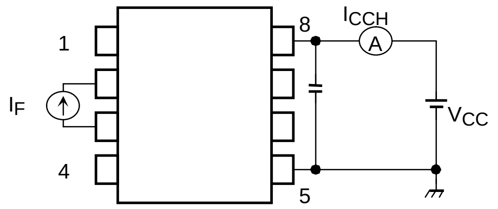
Test Circuit 3: V_{OH}



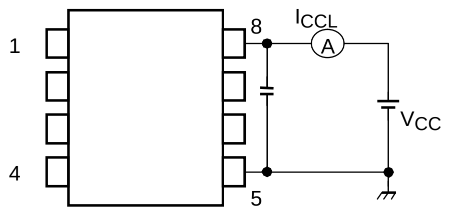
Test Circuit 4: V_{OL}



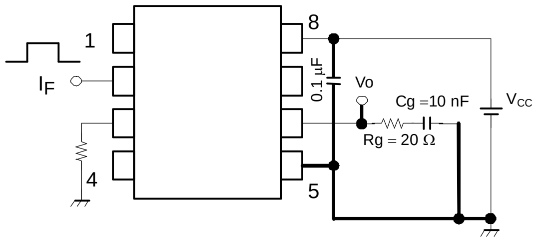
Test Circuit 5: I_{CCH}

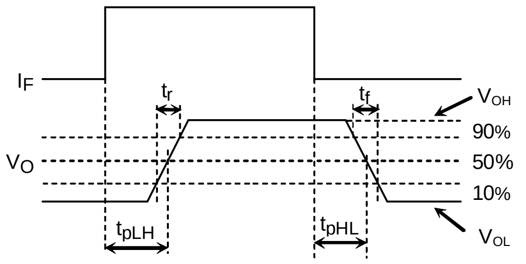


Test Circuit 6: I_{CCL}

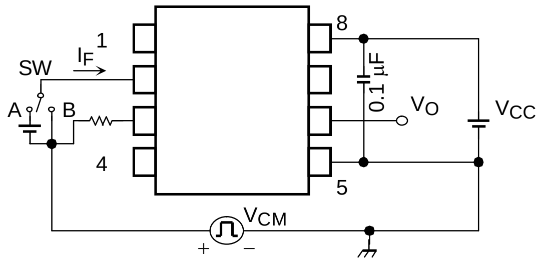


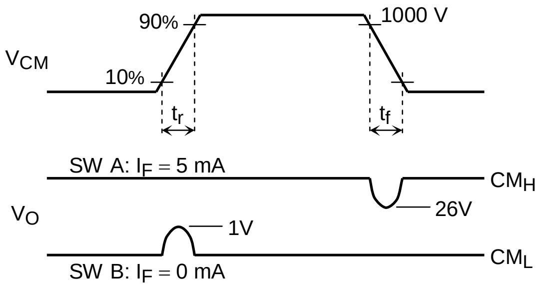
Test Circuit 7: t_{pLH}, t_{pHL}, t_r, t_f, PDD





Test Circuit 8: CM_H, CM_L

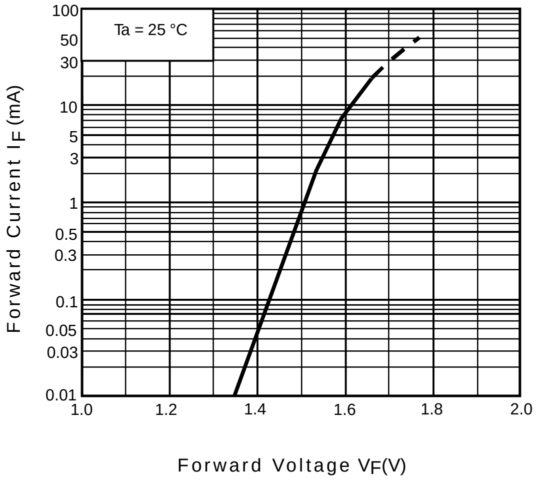




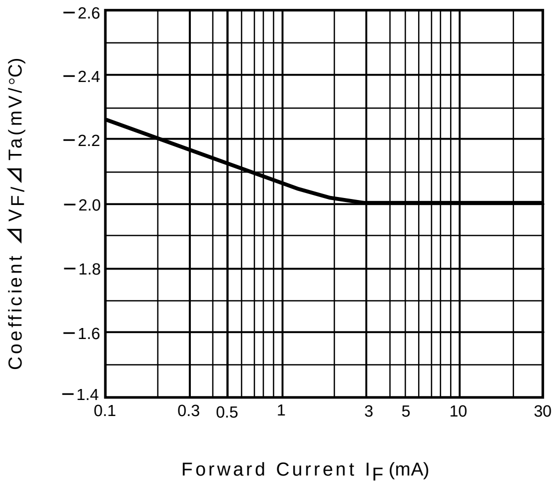
$$CM_L = \frac{800(V)}{t_r\ (\mu s)} \qquad CM_H = \frac{800(V)}{t_f\ (\mu s)}$$

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.

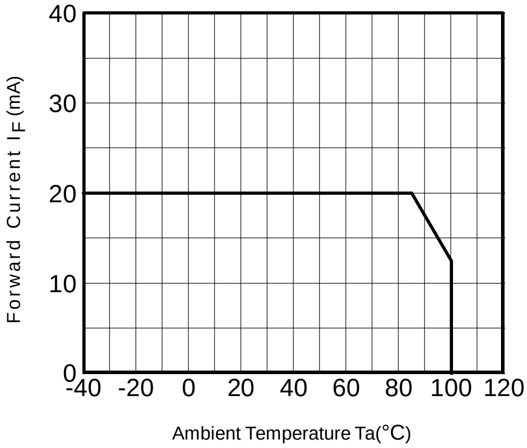
I_F – V_F



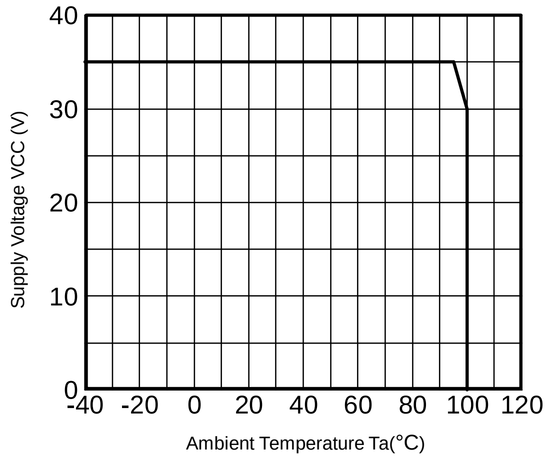
$\Delta V_F / \Delta Ta$ - I_F



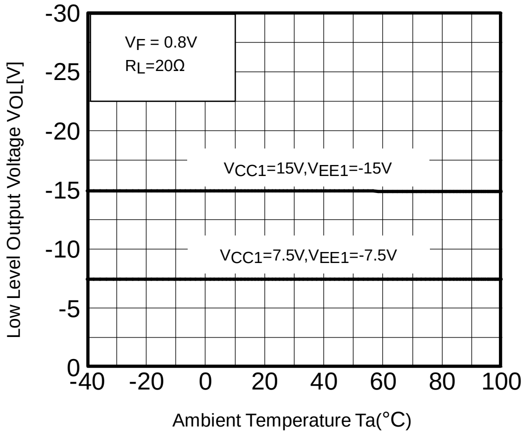
I_F -Ta



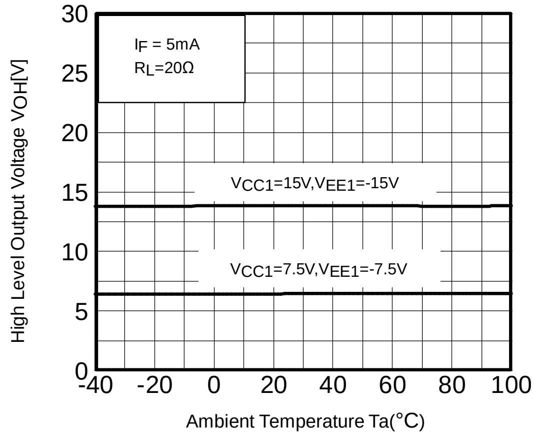
V_{CC} -Ta



V_{OL} -Ta

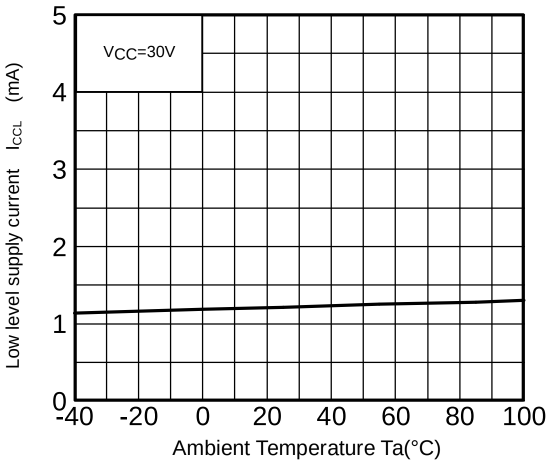


V_{OH} -Ta

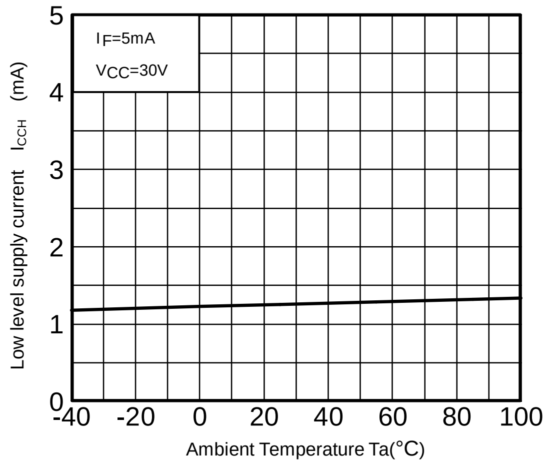


*: The above graphs show typical characteristics.

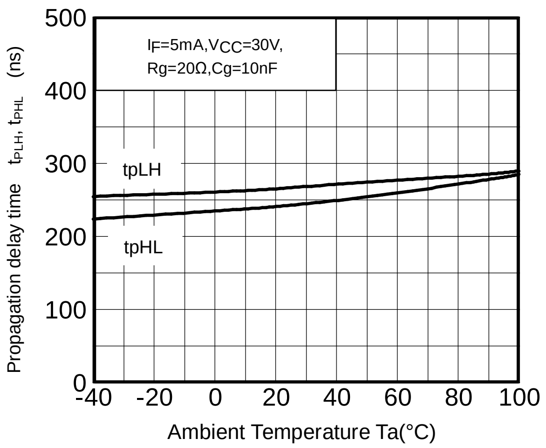
I_{CCL}-Ta



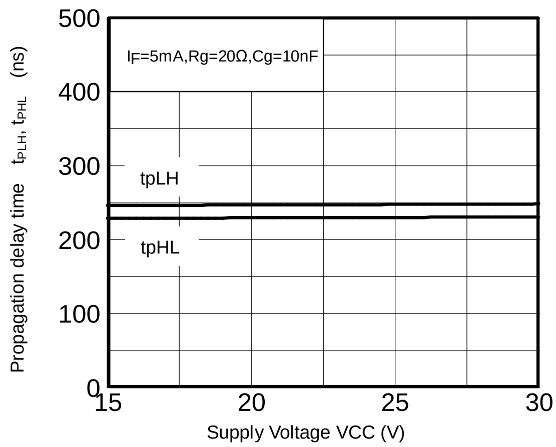
I_{CCH}-Ta



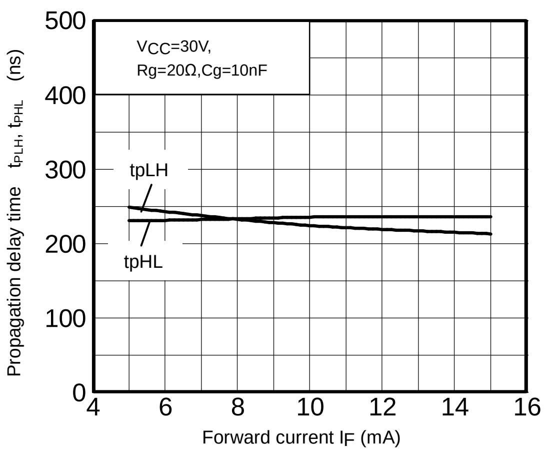
tpHL,tpLH-Ta



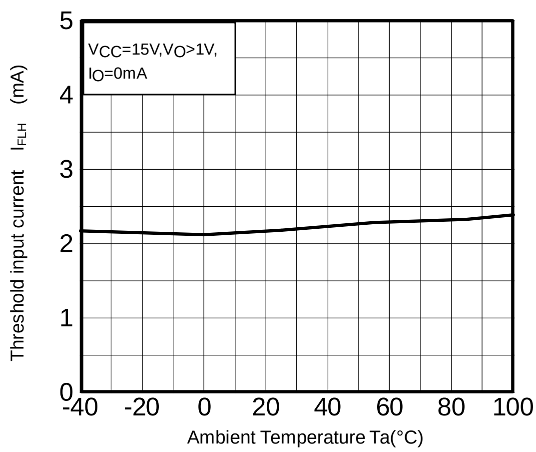
tpHL,tpLH-V_{CC}



tpHL,tpLH-I_F

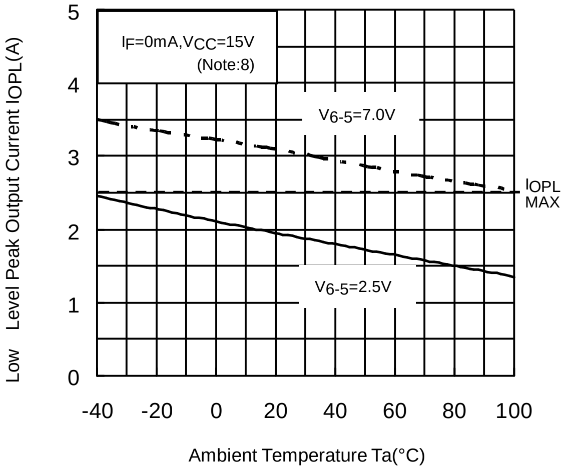


I_{FLH}-Ta

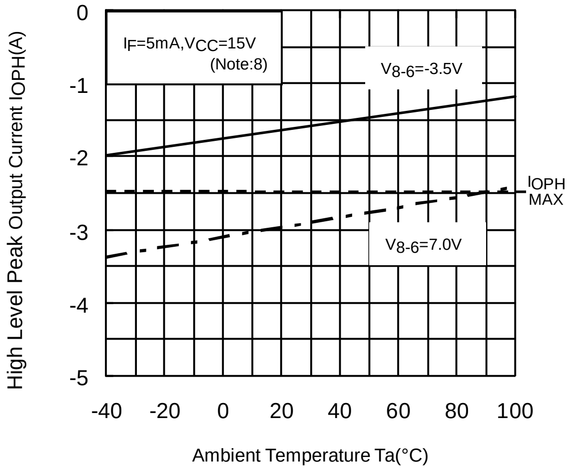


*: The above graphs show typical characteristics.

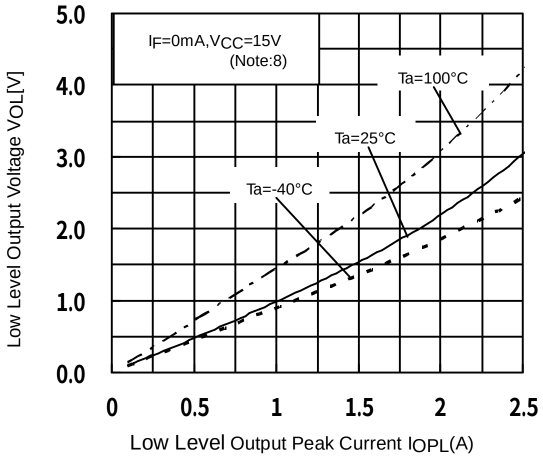
I_{OPL}-Ta



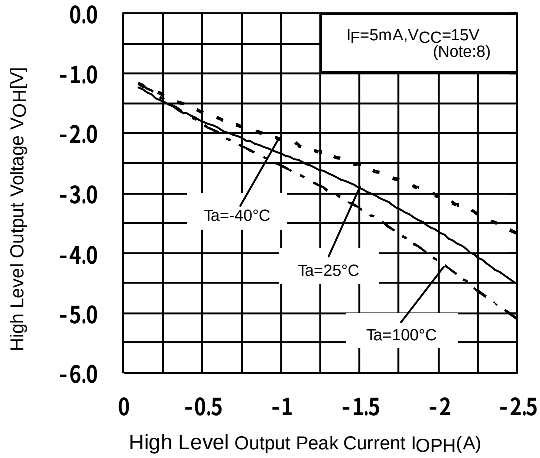
I_{OPH}-Ta



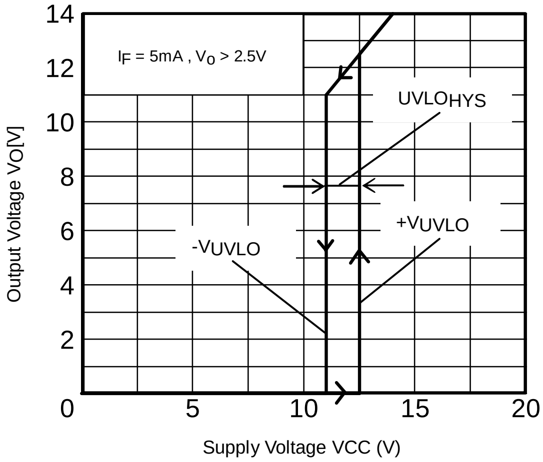
I_{OPL}-V_{OL}



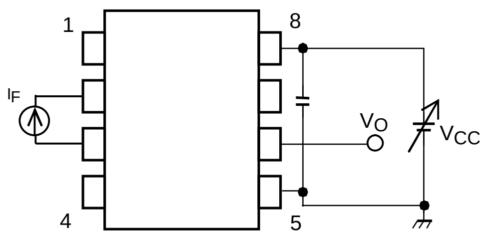
I_{OPH}-V_{OH}



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



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



*: The above graphs show typical characteristics.

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