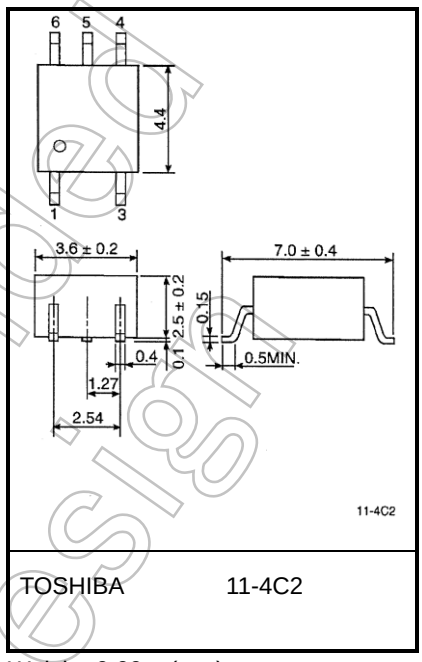
TOSHIBA PHOTOCOUPLER IRED & PHOTO-IC

TLP116

PDP(Plasma Display Panel)
High Speed Interface
FA(Factory Automation)

Unit : mm



TOSHIBA	11-4C2

Weight: 0.09 g (typ.)

The Toshiba TLP116 consists of an infrared emitting diode and an integrated high-gain, high-speed photodetector.

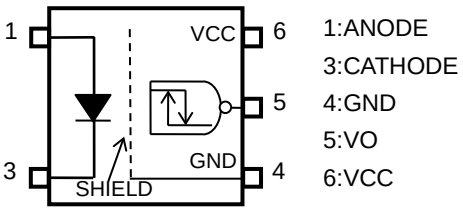
- Inverter logic (totem pole output)
- Package type : MFSOP6
- Guaranteed performance over temperature : -40 to 100°C
- Power supply voltage : 4.5 to 5.5V
- Input thresholds current : I_{FHL}=5mA(Max)
- Propagation delay time (tpHL/tpLH) : 60ns(Max)
- Switching speed : 20MBd(TYP.)
- Common mode transient immunity : 10kV/μs
- Isolation voltage : 3750Vrms
- UL-recognized : UL 1577, File No.E67349
- cUL-recognized : CSA Component Acceptance Service No.5A
  File No.E67349
- VDE-approved : EN 60747-5-5 (Note 1)

Note 1 : When a VDE approved type is needed, please designate the **Option(V4)**.

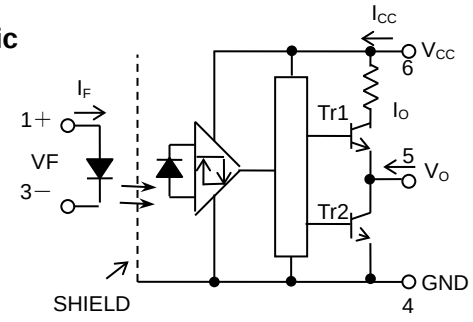
Truth Table

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

Pin Configuration (Top View)



Schematic



0.1uF bypass capacitor must be connected between pins 6 and 4

Start of commercial production
2005-04

Absolute Maximum Ratings (Ta=25°C)

Characteristic		Symbol	Rating	Unit
LED	Forward current	I_F	20	mA
	Forward current derating (Ta≥85°C)	ΔIF/°C	-0.5	mA/°C
	Peak transient forward current (Note 1)	I_{FPT}	1	A
	Reverse voltage	V_R	5	V
	Input power dissipation	P_D	40	mW
	Input power dissipation derating(Ta≥85°C)	ΔP_D/°C	-1.0	mW/°C
DETECTOR	Output current	I_O	10	mA
	Output current derating (Ta≥85°C)	IO/°C	0.25	mA/°C
	Output voltage	V_O	6	V
	Supply voltage	V_{CC}	6	V
	Output power dissipation	P_O	40	mW
	Output power dissipation derating(Ta≥85°C)	ΔP_O/°C	-1.0	mW/°C
Operating temperature range		Topr	-40 to 100	°C
Storage temperature range		Tstg	-55 to 125	°C
Lead solder temperature(10 s)		Tsol	260	°C
Isolation voltage (AC,60 s.,R.H.≤60 %) (Note 2)		BVs	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 and the operating ranges.
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 us,300 pps.

Note 2 : 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

Characteristic	Symbol	Min	Typ.	Max	Unit
Input current , ON	$I_{F(ON)}$	8	—	18	mA
Input voltage , OFF	$V_{F(OFF)}$	0	—	0.8	V
Supply voltage (Note 3)	V_{CC}	4.5	5.0	5.5	V
Operating temperature	Topr	-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 3 : The detector of this product requires a power supply voltage (VCC) of 4.5 V or higher for stable operation. If the VCC is lower than this value, an ICC may increase, or an output may be unstable.
Be sure to use the product after checking the supply current, and the operation of a power on/off.

Correlation between Input current , switching speed and drive circuit (reference information).

Input current (IF)	test Circuit	Typical switching speed
12mA	1 (Page 4)	21 – 23 MBd
8mA	1 (Page 4)	18 – 20 MBd
8mA	2 (Page 4,With Speed up capacitor)	23 – 27 MBd

Electrical Characteristics (Unless otherwise specified, Ta=-40 to 100°C,VCC=4.5 to 5.5V)

Characteristic	Symbol	Test Circuit	Conditions	Min	Typ.	Max	Unit
Input forward voltage	V_F	—	I_F = 10 mA ,Ta = 25 °C	—	1.3	1.5	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
Capacitance between Input terminals	C_T	—	V = 0 V, f = 1 MHz, Ta = 25 °C	—	70	—	pF
Logic low output voltage	V_{OL}	1	I_{OL} = 1.6 mA, I_F = 12 mA, V_{CC} = 5 V	—	—	0.4	V
Logic high output voltage	V_{OH}	2	I_{OH} = -0.02 mA, V_F = 1.05 V, V_{CC} = 5 V	4.0	—	—	V
Logic low supply current	I_{CCL}	3	I_F = 12 mA	—	—	5.0	mA
Logic high supply current	I_{CCH}	4	V_F = 0 V	—	—	5.0	mA
Input current logic low output	I_{FHL}	—	I_O = 1.6 mA, V_O < 0.4 V	—	—	5	mA
Input voltage logic high output	V_{FLH}	—	I_O = -0.02 mA, V_O > 4.0 V	0.8	—	—	V

*All typical values are at Ta = 25 °C,V_{CC} = 5 V,I_F(ON) = 12 mA unless otherwise specified

Isolation Characteristics (Ta = 25°C)

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

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

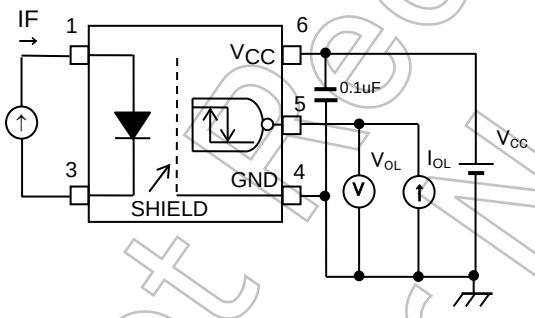
Switching Characteristics
(Unless otherwise specified, Ta=-40 to 100°C,V_{CC}=4.5 to 5.5V)

Characteristic	Symbol	Test Circuit	Conditions		Min	Typ.	Max	Unit
Propagation delay time to logic high output	tpHL	5	I_F = 0→12 mA	R_{IN} = 100 Ω, C_L = 15 pF (Note 1)	—	—	60	ns
Propagation delay time to logic low output	tpLH		I_F = 12→0 mA		—	—	60	ns
Propagation delay time to logic high output	tpHL	6	V_{IN} = 0→5 V (I_F=0→8 mA)	R_{IN} = 470 Ω, C_{IN} = 27 pF, C_L=15 pF (Note 1)	—	—	60	ns
Propagation delay time to logic low output	tpLH		V_{IN} = 5→0 V (I_F = 8→0 mA)		—	—	60	ns
Switching time dispersion between ON and OFF	|tpHL-tpLH|	5	I_F = 12 mA , R_{IN} = 100 Ω, CL = 15 pF (Note 1)		—	—	30	ns
Output fall time(90-10%)	tf		I_F = 0→12 mA	R_{IN} = 100 Ω, C_L = 15 pF (Note 1)	—	15	—	ns
Output rise time(10-90%)	tr		I_F = 12→0 mA		—	15	—	ns
Common mode transient immunity at high Level output	CM_H	7	V_{CM} = 1000 Vp-p, I_F = 0 mA, Vo(Min) = 4 V, Ta = 25 °C		10000	—	—	V/us
Common mode transient immunity at low level output	CM_L		V_{CM} = 1000 Vp-p, I_F = 12 mA, Vo(Max) = 0.4 V, Ta = 25 °C		-10000	—	—	V/us

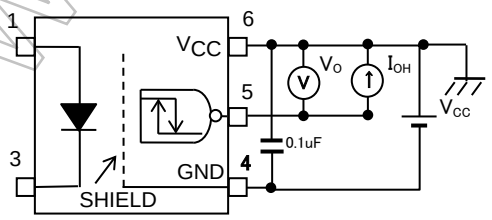
*All typical values are at Ta = 25 °C

Note 1 : C_L is approximately 15pF which includes probe and Jig/stray wiring capacitance.

TEST CIRCUIT 1 : V_{OL}

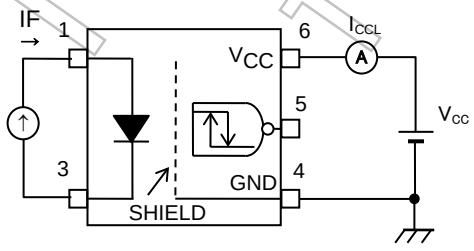


TEST CIRCUIT 2 : V_{OH}

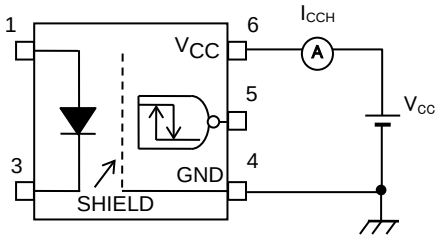


$V_{OH} = V_{CC} - V_O$

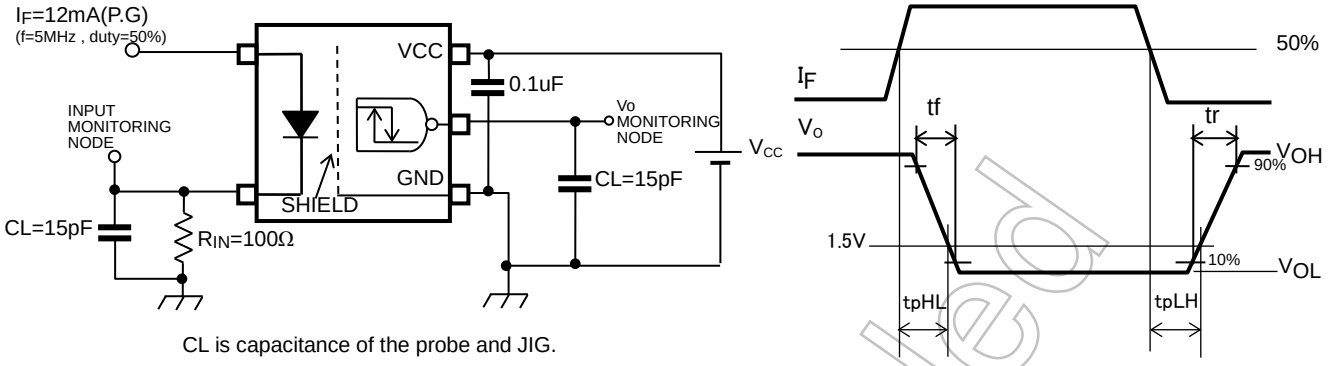
TEST CIRCUIT 3 : I_{CCL}



TEST CIRCUIT 4: I_{CCH}

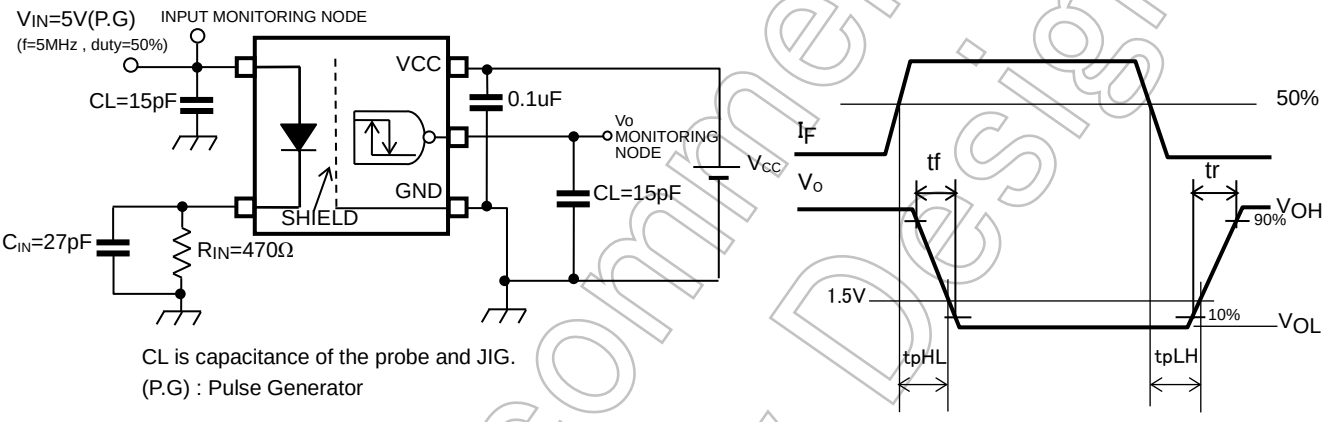


TEST CIRCUIT 5 : tpHL , tpLH



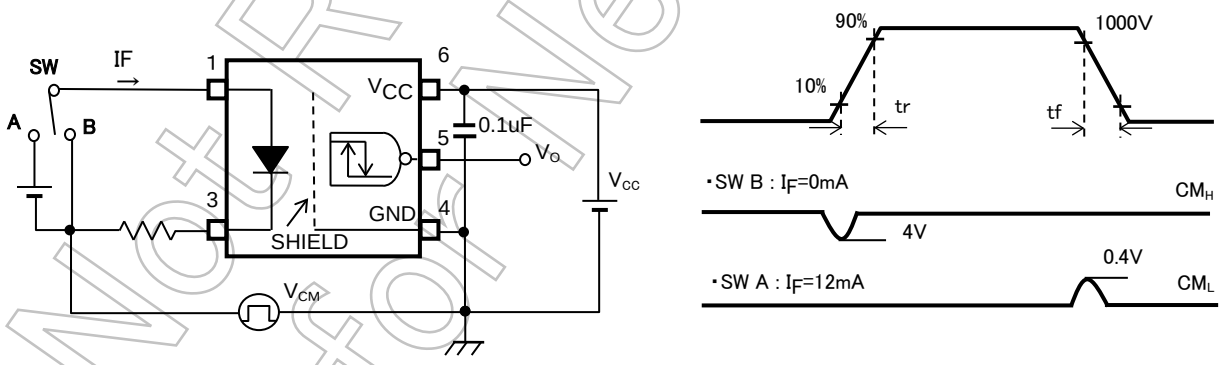
CL is capacitance of the probe and JIG.
(P.G) : Pulse Generator

TEST CIRCUIT 6 : tpHL , tpLH



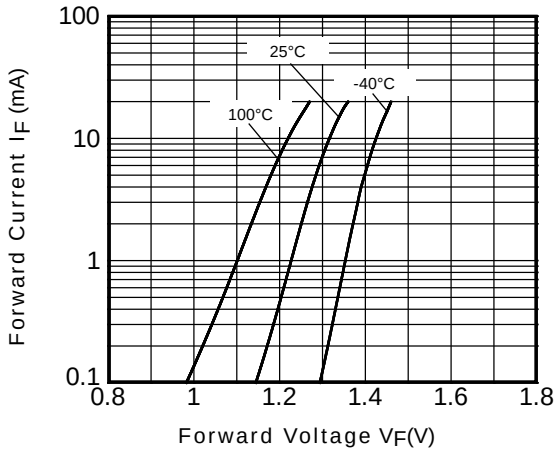
CL is capacitance of the probe and JIG.
(P.G) : Pulse Generator

TEST CIRCUIT 7 : Common-Mode Transient Immunity Test Circuit

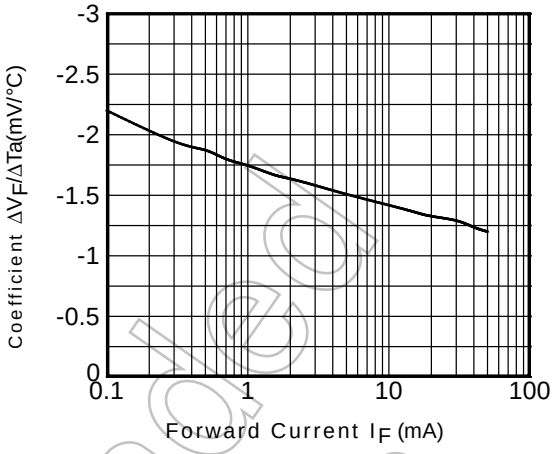


$$CM_H = \frac{800(V)}{t_r(\mu s)} \qquad CM_L = \frac{800(V)}{t_f(\mu s)}$$

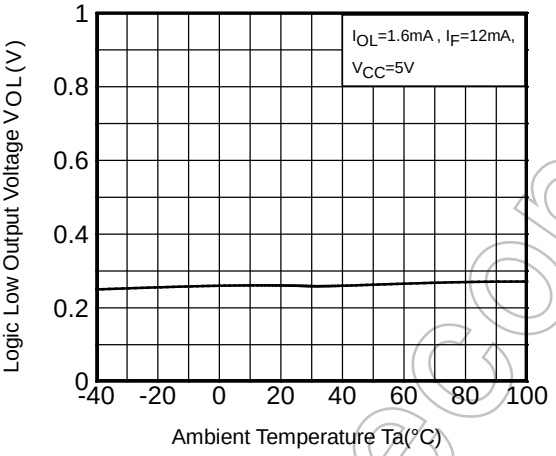
I_F-V_F



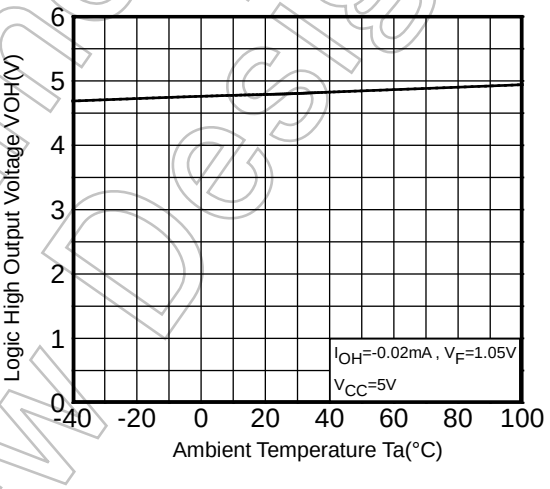
$\Delta V_F/\Delta Ta$-I_F



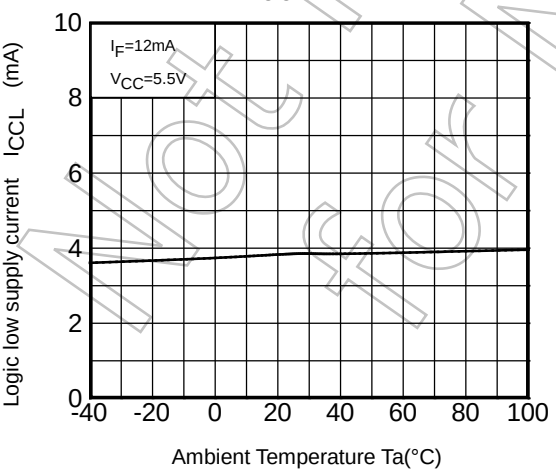
V_{OL}-Ta



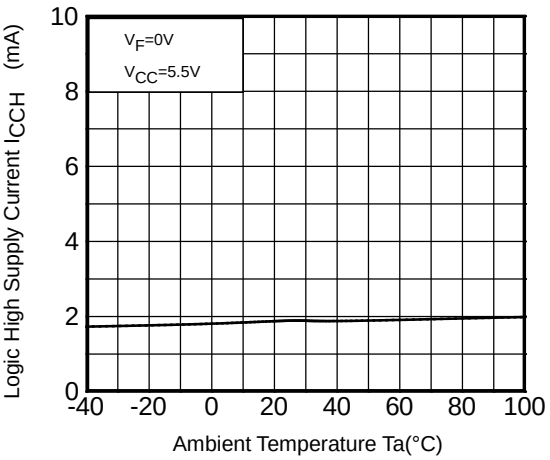
V_{OH}-Ta



I_{CCL}-Ta

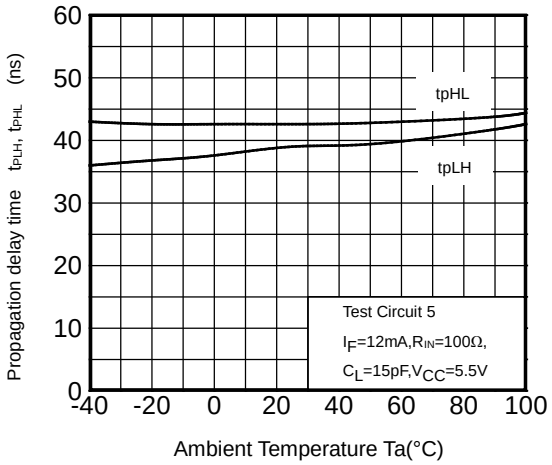


I_{CCH}-Ta

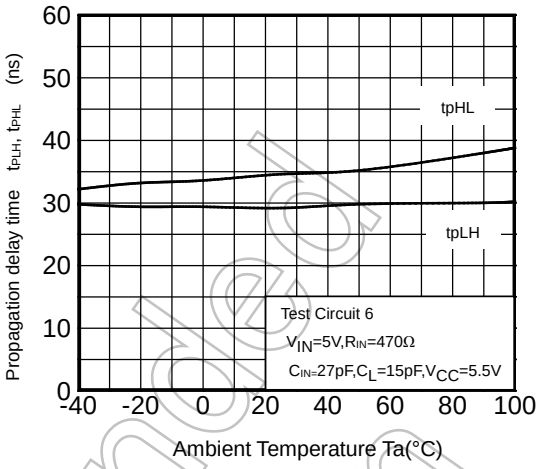


NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

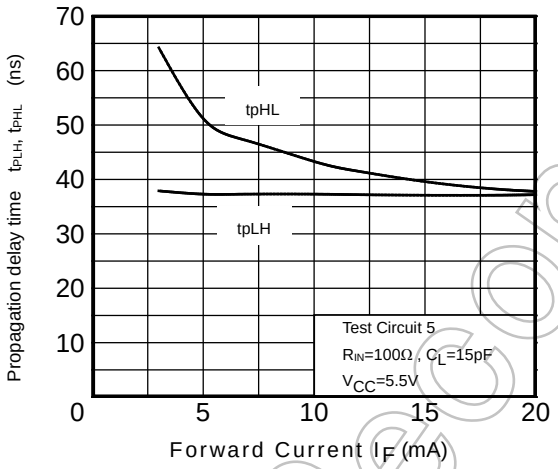
t_{pHL},t_{pLH}-Ta



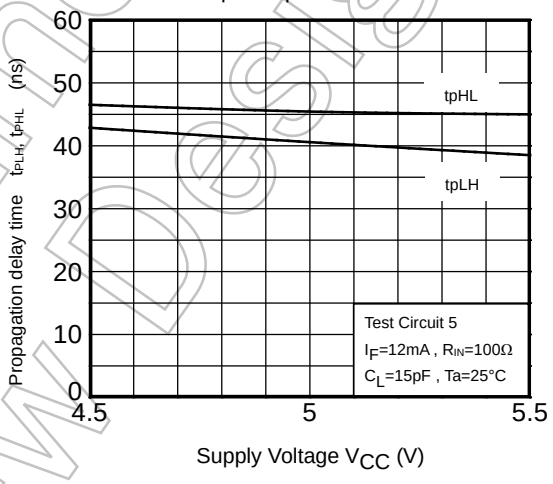
t_{pHL},t_{pLH}-Ta



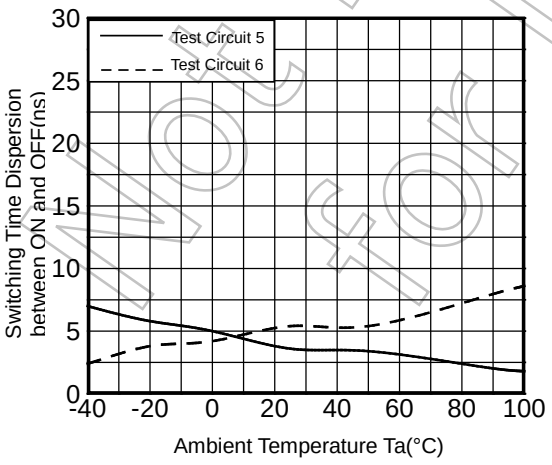
t_{pHL},t_{pLH}-I_F



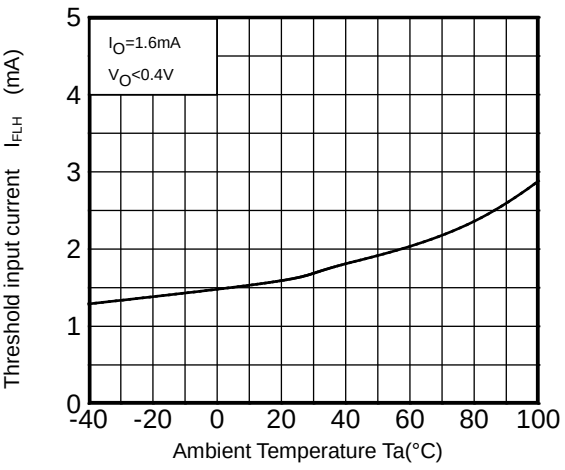
t_{pHL},t_{pLH}-V_{CC}



|t_{pHL}-t_{pLH}|-Ta



I_{FLH}-Ta



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