



TOSHIBA Photocoupler GaAlAs Ired & Photo IC

# 6N137

Digital Logic Isolation  
Tele-Communication  
Analog Data Equipment Control

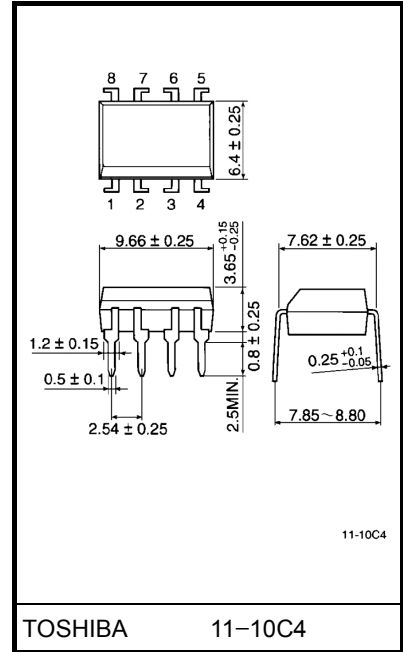
The TOSHIBA 6N137 consist of a high emitting diode and a one chip photo IC. This unit is 8-lead DIP package.

- LSTTL / TTL compatible: 5V Supply
- Ultra high speed: 10MBd
- Guaranteed performance over temperature: 0°C to 70°C
- High isolation voltage: 2500Vrms (min)
- UL recognized: UL1577, file no. E67349

### Truth Table

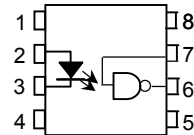
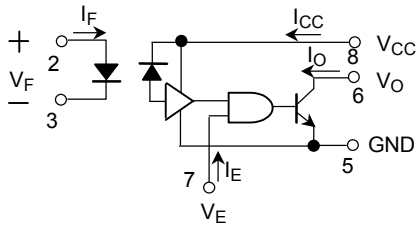
Input	Enable	Output
H	H	L
L	H	H
H	L	H
L	L	H

Unit: mm



Weight: 0.54 g (typ.)

### Pin Configurations (top view)



- 1 : N.C.
- 2 : Anode
- 3 : Cathode
- 4 : N.C.
- 5 : GND
- 6 : Output(Open collector)
- 7 : Enable
- 8 : VCC

Start of commercial production  
1982/11



**Absolute Maximum Ratings**

Characteristic		Symbol	Rating	Unit
LED	Forward current	$I_F$	20	mA
	Pulse forward current (Note 1)	$I_{FP}$	40	mA
	Reverse voltage	$V_R$	5	V
Detector	Output current	$I_O$	50	mA
	Output voltage	$V_O$	7	V
	Supply voltage (1 minute maximum)	$V_{CC}$	7	V
	Enable input voltage (not to exceed $V_{CC}$ by more than 500mV)	$V_{EH}$	5.5	V
	Output collector power dissipation	$P_O$	85	mW
Operating temperature range		$T_{opr}$	0 to 70	°C
Storage temperature range		$T_{stg}$	-55 to 125	°C
Lead solder temperature (10 s) (Note 2)		$T_{sol}$	260	°C

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) 50% duty cycle, 1ms pulse width.

(Note 2) Soldering portion of lead: Up to 2mm from the body of the device.

**Recommended Operating Conditions**

Characteristic	Symbol	Min	Max	Unit
Input current, low level each channel	$I_{FL}$	0	250	μA
Input current, high level each channel	$I_{FH}$	7	20	mA
High level enable voltage	$V_{EH}$	2.0	$V_{CC}$	V
Low level enable voltage (output high)	$V_{EL}$	0	0.8	V
Supply voltage, output*	$V_{CC}$	4.5	5.5	V
Fan out (TTL load)	N	—	8	—
Operating temperature	$T_a$	0	70	°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.

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

**Precaution**

Please be careful of the followings.

A ceramic capacitor (0.1μF) should be connected from pin 8 to pin 5 to stabilize the operation of the high gain linear amplifier. Failure to provide the bypassing may impair the switching property. The total lead length between capacitor and coupler should not exceed 1cm.



### Electrical Characteristics Over Recommended Temperature ( $T_a = 0\sim 70^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Test Condition	Min	(**)Typ.	Max	Unit
High level output current	$I_{OH}$	$V_{CC}=5.5V, V_O=5.5V$ $I_F=250\mu A, V_E=2.0V$	—	1	250	$\mu A$
Low level output voltage	$V_{OL}$	$V_{CC}=5.5V, I_F=5mA$ $V_{EH}=2.0V$ $I_{OL}(\text{sinking})=13mA$	—	0.4	0.6	V
High level enable current	$I_{EH}$	$V_{CC}=5.5V, V_E=2.0V$	—	-1.0	—	mA
Low level enable current	$I_{EL}$	$V_{CC}=5.5V, V_E=0.5V$	—	-1.6	-2.0	mA
High level supply current	$I_{CCH}$	$V_{CC}=5.5V, I_F=0, V_E=0.5V$	—	7	15	mA
Low level supply current	$I_{CCL}$	$V_{CC}=5.5V, I_F=10mA, V_E=0.5V$	—	12	18	mA
Resistance (input-output) (Note 3)	$R_{I-O}$	$V_{I-O}=500V, T_a=25^\circ\text{C}$ R.H. $\leq 60\%$	—	$10^{12}$	—	$\Omega$
Capacitance (input-output) (Note 3)	$C_{I-O}$	$f=1\text{MHz}, T_a=25^\circ\text{C}$	—	0.6	—	pF
Input forward voltage	$V_F$	$I_F=10mA, T_a=25^\circ\text{C}$	—	1.65	1.75	V
Input reverse breakdown voltage	$BV_R$	$I_R=10\mu A, T_a=25^\circ\text{C}$	5	—	—	V
Input capacitance	$C_{IN}$	$V_F=0, f=1\text{MHz}$	—	45	—	pF
Current transfer ratio	CTR	$I_F=5.0mA, R_L=100\Omega$	—	1000	—	%

(\*\*) All typical values are at  $V_{CC}=5V, T_a=25^\circ\text{C}$

(Note 3) Pins 1, 2, 3 and 4 shorted together and pins 5, 6, 7 and 8 shorted together.





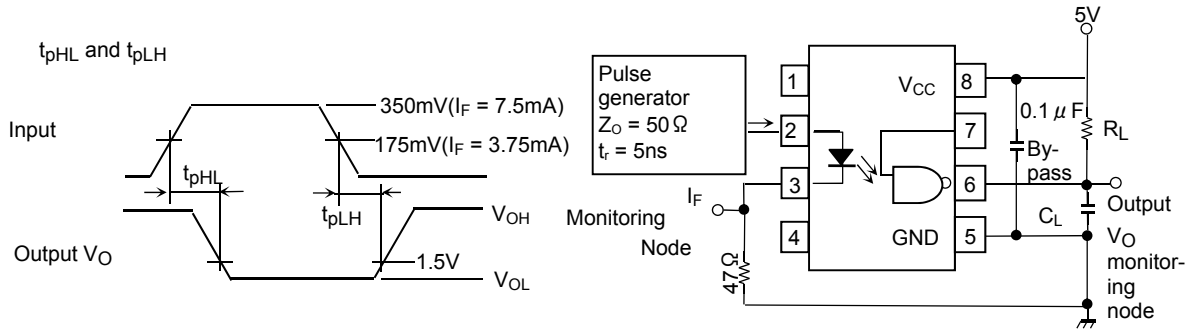
**Switching Characteristics (Ta = 25°C, Vcc = 5V)**

Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time to high output level	t <sub>pLH</sub>	1	R <sub>L</sub> =350Ω, C <sub>L</sub> =15pF I <sub>F</sub> =7.5mA	—	60	75	ns
Propagation delay time to low output level	t <sub>pHL</sub>	1	R <sub>L</sub> =350Ω, C <sub>L</sub> =15pF I <sub>F</sub> =7.5mA	—	60	75	ns
Output rise–fall time (10–90%)	t <sub>r</sub> , t <sub>f</sub>	—	R <sub>L</sub> =350Ω, C <sub>L</sub> =15pF I <sub>F</sub> =7.5mA	—	30	—	ns
Propagation delay time of enable from V <sub>EH</sub> to V <sub>EL</sub>	t <sub>ELH</sub>	2	R <sub>L</sub> =350Ω, C <sub>L</sub> =15pF I <sub>F</sub> =7.5mA V <sub>EH</sub> =3.0V V <sub>EL</sub> =0.5V	—	25	—	ns
Propagation delay time of enable from V <sub>EL</sub> to V <sub>EH</sub>	t <sub>EHL</sub>	2	R <sub>L</sub> =350Ω, C <sub>L</sub> =15pF I <sub>F</sub> =7.5mA V <sub>EH</sub> =3.0V V <sub>EL</sub> =0.5V	—	25	—	ns
Common mode transient immunity at logic high output level	CM <sub>H</sub>	3	V <sub>CM</sub> =10V R <sub>L</sub> =350Ω V <sub>O(min)</sub> =2V I <sub>F</sub> =0mA	—	200	—	V / μs
Common mode transient Immunity at logic low output level	CM <sub>L</sub>	3	V <sub>CM</sub> =10V R <sub>L</sub> =350Ω V <sub>O(max)</sub> =0.8V I <sub>F</sub> =5mA	—	-500	—	V / μs



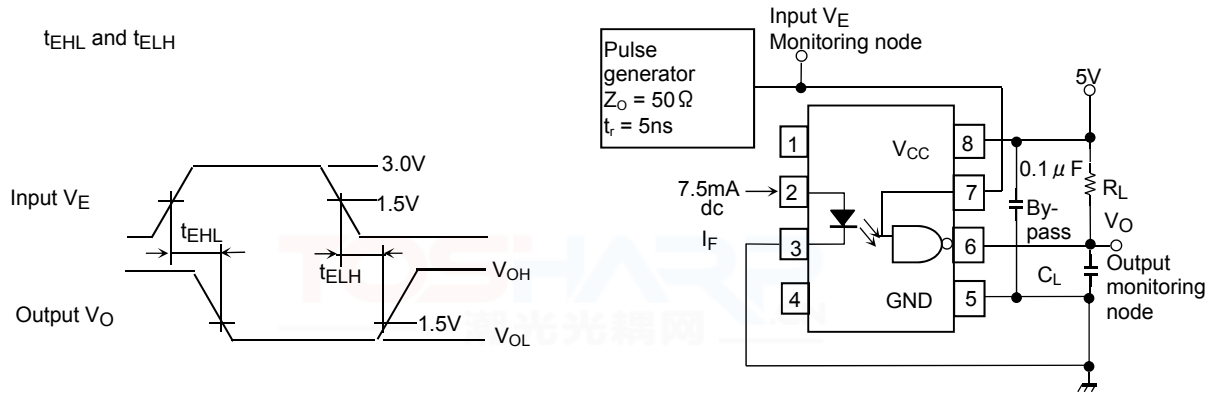


Test Circuit 1.



·  $C_L$  is approximately 15pF which includes probe and stray wiring capacitance.

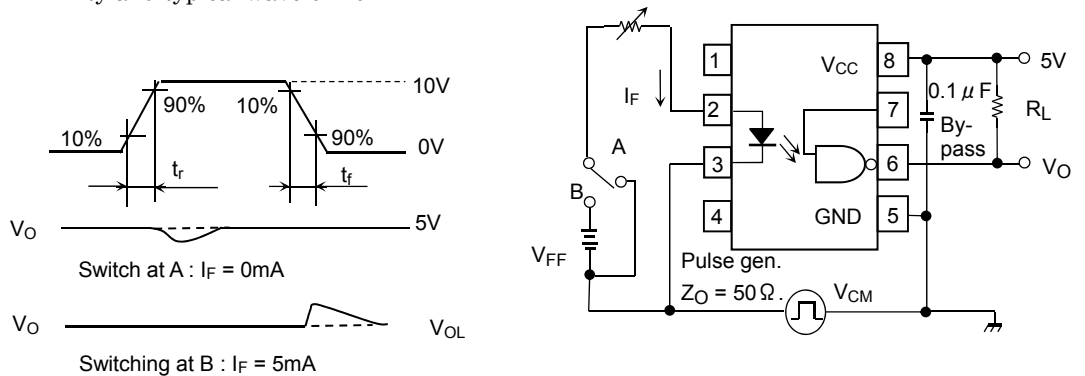
Test Circuit 2.

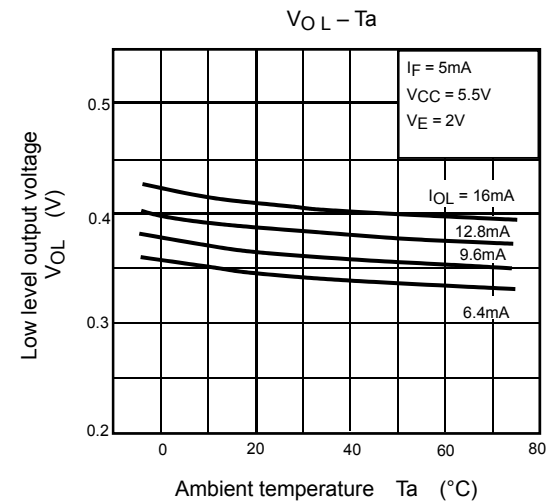
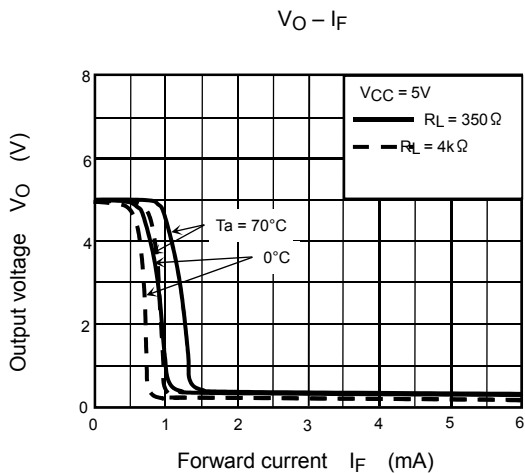
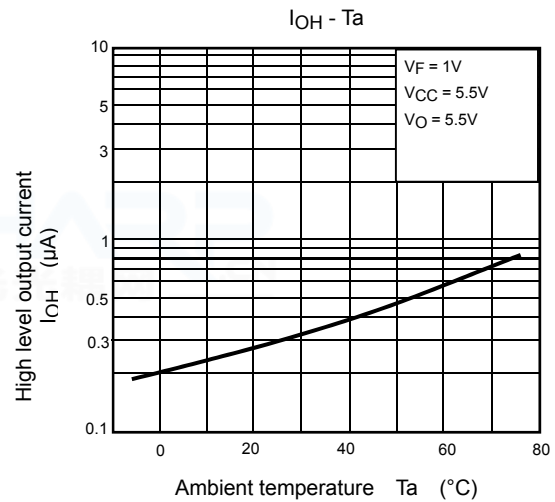
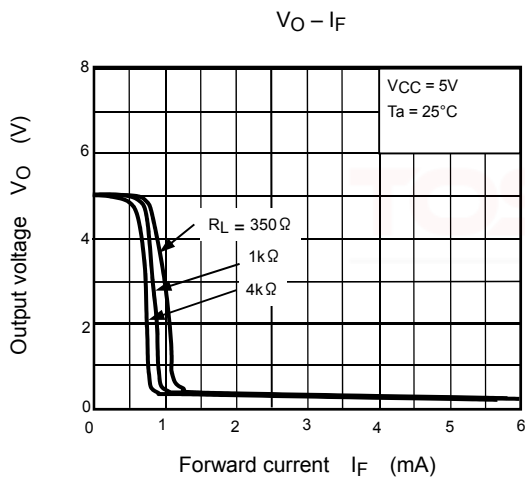
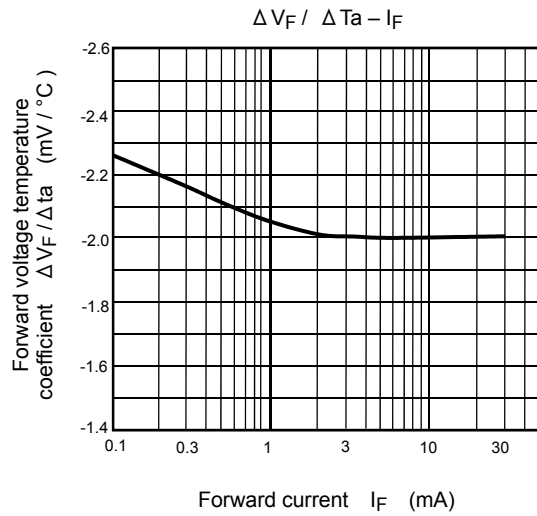
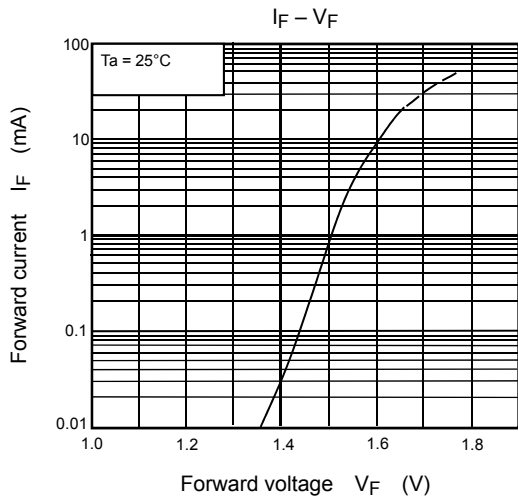


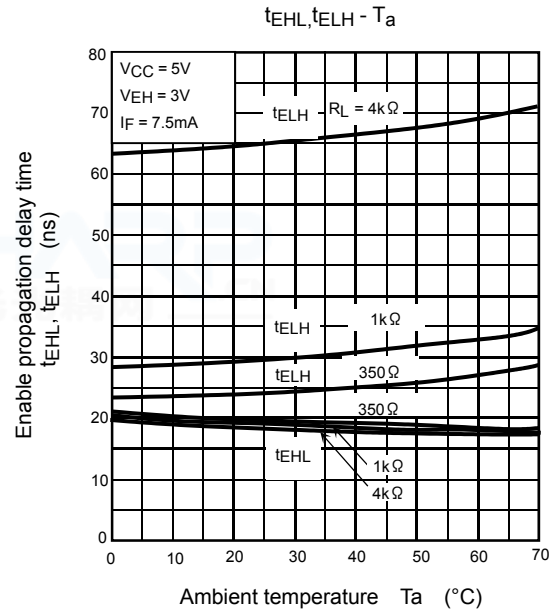
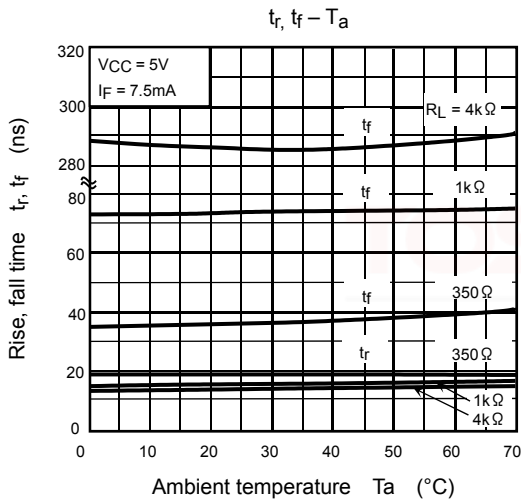
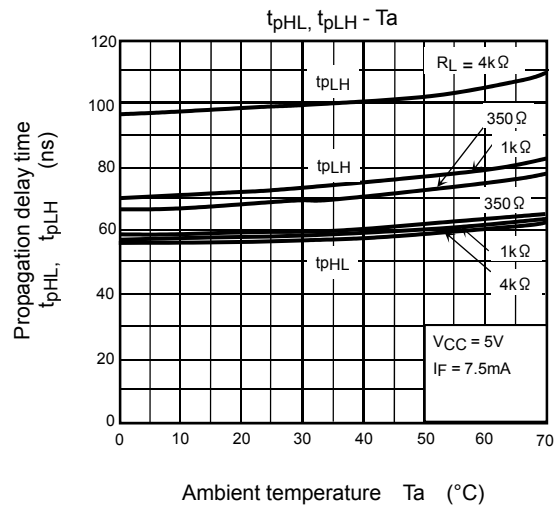
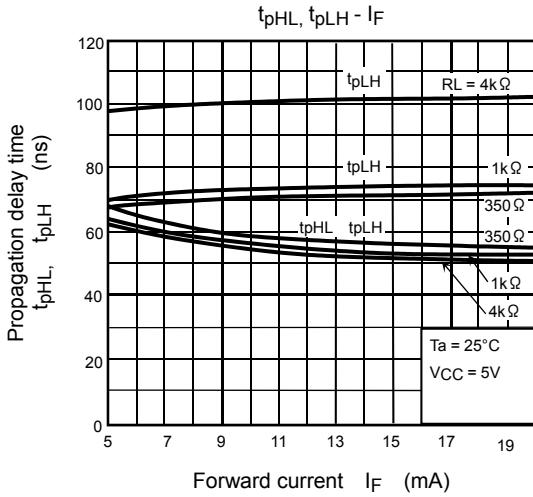
·  $C_L$  is approximately 15pF which includes prove and stray wiring capacitance.

Test Circuit 3.

Transient immunity and typical waveforms









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