SEMICONDUCTOR TOSHIBA

TECHNICAL DATA

TOSHIBA PHOTOCOUPLER

6N138, 6N139

GaA_ℓAs IRDE & PHOTO IC

(6N138)

CURRENT LOOP DRIVER.

LOW INPUT CURRENT LINE RECEIVER.

CMOS LOGIC INTERFACE.

The TOSHIBA 6N138 and 6N139 consists of a GaAlAs infrared emitting diode coupled with a split-Darlington output configuration.

A high speed GaAlAs IRED manufactured with an unique LPE junction, has the virtue of fast rise and fall time at low drive current.

Isolation Voltage: 2500Vrms (Min.)

Current Transfer Ratio

: 6N138 - 300% (Min.) (I_F=1.6mA)

: 6N139 - 400% (Min.) (I_F=0.5mA)

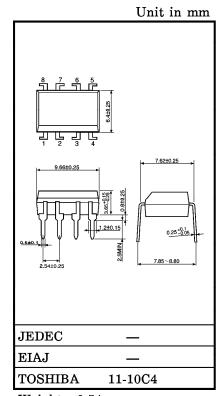
Switching time : 6N138 - $t_{PHL} = 10 \mu s$ (Max.)

- $t_{PLH} = 35 \mu s (Max.)$

 $6N139 - t_{PHL} = 1 \mu s (Max.)$

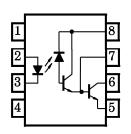
- $tp_{LH} = 7\mu s (Max.)$

UL Recognized: UL1577, File No. E67349



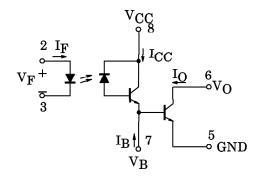
Weight: 0.54g

PIN CONFIGURATION (TOP VIEW)



- 1. N.C.
- 2. ANODE
- 3. CATHODE
- 4. N.C.
- 5. GND
- 6. OUTPUT
- 7. OUTPUT BASE
- 8. VCC

SCHEMATIC



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TECHNICAL DATA

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(6N138)

MAXIMUM RATINGS* (Ta = 0° C to + 70° C)

	CHARACTERISTIC		SYMBOL	RATING	UNIT
	Forward Current	${f I_F}$	20	mA	
lα	Pulse Forward Current		$\mathrm{I_{FP}}^{*1}$	40	mA
LE]	Total Pulse Forward Current		$\mathbf{I_{FP}}^{*2}$	1	A
Ι	Reverse Voltage		$v_{ m R}$	5	V
	Diode Power Dissipation	(Note 2)	$P_{\mathbf{D}}$	35	mW
R	Output Current	(Note 3)	$I_{\mathbf{O}}$	60	mA
ΤO	Emitter-Base Reverse Voltage		$ m V_{EB}$	0.5	V
EC	Supply Voltage		${ m V_{CC}}^{*_3}$	-0.5 to 18	V
ET	Output Voltage		VO^{*_3}	-0.5 to 18	V
D	Output Power Dissipation (Note 4		P_{O}	100	mW
Or	perating Temperature Range	$T_{ m opr}$	0 to 70	°C	
Storage Temperature Range			$ m T_{stg}$	-55 to 125	°C
Lead Solder Temperature (10s) *4			$T_{ m sol}$	260	°C
Tar	Isolation Voltage (1min., R.H. ≤ 60%)		BVs**	2500	Vrms
150			вν	3540	$ m V_{dc}$

- * JEDEC Registered Data
- ** Not Registered JEDEC
- *1 50% duty cycle, 1ms pulse width
- *2 Pulse width 1\(\mu\)s, 300pps *3 6N138\(\cdots 0.5\) to 7V
- *4 1.6mm below seating plane

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TECHNICAL DATA

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(6N138) **ELECTRICAL CHARACTERISTICS** OVER RECOMMENDED TEMPERATURE (Ta = 0°C to + 70°C, Unless otherwise noted)

CHARACTERIS	CHARACTERISTIC SYMBOL TEST CONDITION		MIN.	*5TYP.	MAX.	UNIT		
Current Transfer	6N139	amp.	$I_{F} = 0.5 \text{mA}, V_{O} = 0.4 \text{V}$ $V_{CC} = 4.5 \text{V}$	400	800	_		
Ratio (Note 5, 6)		CTR*	$I_{\rm F} = 1.6 {\rm mA}, \ {\rm V_O} = 0.4 {\rm V}$	500	900		%	
	6N138		$V_{\rm CC}$ =4.5 V	300	600	_		
	6N139 6N138	$ m v_{OL}$	$I_{\rm F}$ =1.6mA, $I_{\rm O}$ =6.4mA $V_{\rm CC}$ =4.5V	_	0.1	0.4	V	
Logic Low Output			I_F =5mA, I_O =15mA V_{CC} =4.5V	_	0.1	0.4		
Voltage (Note 6)			$I_F = 12$ mA, $I_O = 24$ mA $V_{CC} = 4.5$ V	_	0.2	0.4	V	
			$I_{\rm F}$ =1.6mA, $I_{\rm O}$ =4.8mA $V_{\rm CC}$ =4.5V	_	0.1	0.4		
Logic High Output	6N139	T*	$I_F=0$ mA, $V_O=V_{CC}=18V$	_	0.05	100		
Current (Note 6)	Current (Note 6) 6N138 IOH*		$I_F=0$ mA, $V_O=V_{CC}=7$ V	_	0.05	250	μ A	
Logic Low Supply Current (Note 6)		ICCL	$egin{array}{l} I_{ m F}=1.6{ m mA,\ V_O}={ m Open} \\ V_{ m CC}=5{ m V} \end{array}$	_	0.2	_	mA	
Logic High Supply Current (Note 6)		ICCH	I _F =0mA, V _O =Open, V _{CC} =5V	_	10	_	nA	
Input Forward Voltage		$V_{\mathbf{F}}^*$	I _F =1.6mA, Ta=25°C	_	1.65	1.7	V	
Input Reverse Breakdown Voltage		BV_{R}^{*}	$I_R=10\mu A$, Ta=25°C	5	_	_	V	
Temperature Coefficient of Forward Voltage		ΔV _F /ΔTa	I _F =1.6mA	_	-1.9	_	mV/°C	
Input Capacitance		$c_{ m IN}$	$f=1MHz, V_{\overline{F}}=0$	_	60	_	pF	
Resistance (Input-Output) R		R _{I-O}	$V_{\text{I-O}} = 500 \text{V (Note 7) R.H.} \le 60\%$	_	1012	_	Ω	
Capacitance (Input-Output)		$\mathrm{C}_{ ext{I-O}}$	f=1MHz (Note 7)	_	0.6	_	рF	

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^{**} JEDEC Registered Data. *5 All typicals at Ta=25°C and $\rm V_{\hbox{CC}}\!=\!5V,$ Unless otherwise noted.

TECHNICAL DATA

(6N138)

SWITCHING SPECIFICATIONS (Ta = 25°C, V_{CC} = 5V, Unless otherwise specified)

CHARACTERIST	IC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation Delay	6N139			$I_{\rm F}$ =0.5mA, RL=4.7k Ω	_	5	25	
Time to Logic Low	011100	${ m t_{pHL}}^*$	1	$I_F=12$ mA, $R_L=270\Omega$		0.2	1	μ s
at Output (Note 6, 8)	6N138	_		I_{F} =1.6mA, R_{L} =2.2k Ω	_	1	10	
Propagation Delay	6N138			$I_{\rm F}$ =0.5mA, RL=4.7k Ω		5	60	
Time to Logic High	021200	$t_{ m pLH}^*$	1	$I_F=12$ mA, $R_L=270\Omega$	-	1	7	μs
at Output (Note 6, 8)	6N139	9		$I_{\mathrm{F}} = 1.6 \mathrm{mA}, \ \mathrm{R_L} = 2.2 \mathrm{k}\Omega$	_	4	35	
Common Mode Transient Immunity at Logic High Level Output (Note 9)		CM_{H}	2	$ \begin{vmatrix} I_F\!=\!0\text{mA},\ R_L\!=\!2.2k\Omega \\ V_{\text{CM}}\!=\!400V_{\text{p-p}} \end{vmatrix} $	_	500	_	V/μs
Common Mode Transient Immunity at Logic Low Level Output (Note 9)		$ m CM_L$	2	I_{F} =1.6mA, R_{L} =2.2k Ω V_{CM} =400 V_{p-p}	_	-500	_	V/μs

^{*} JEDEC Registered Data.

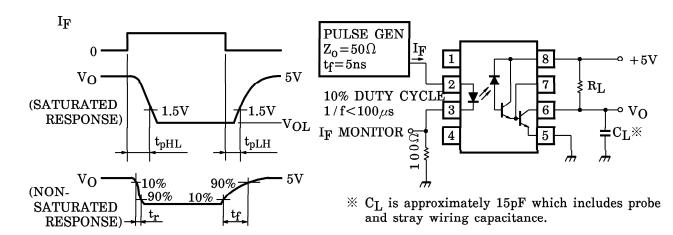
NOTES:

- 1. Derate linearly above 50°C free-air temperature at a rate of 0.4mA/°C.
- 2. Derate linearly above 50°C free-air temperature at a rate of 0.7mW/°C.
- 3. Derate linearly above 25°C free-air temperature at a rate of 0.7mA/°C.
- 4. Derate linearly above 25°C free-air temperature at a rate of 2.0mW/°C.
- 5. DC CURRENT TRANSFER RATIO is defined as the ratio of output collector current, IO, to the forward LED input current, IF, times 100%.
- 6. Pin 7 Open.
- 7. Device considered a two-terminal device: Pins 1, 2, 3, and 4 shorted together and Pins 5, 6, 7, and 8 shorted together.
- 8. Use of a resistor between pin 5 and 7 will decrease gain and delay time.
- 9. Common mode transient immunity in Logic High level is the maximum tolerable (positive) dV_{CM}/dt on the leading edge of the common mode pulse, V_{CM} , to assure that the output will remain in a Logic High state (i.e., $V_O\!>\!2.0V)$. Common mode transient immunity in Logic Low level is the maximum tolerable (negative) dV_{CM}/dt on the trailing edge of the common mode pulse signal, V_{CM} , to assure that the output will remain in a Logic Low state (i.e., $V_O\!<\!0.8V)$.

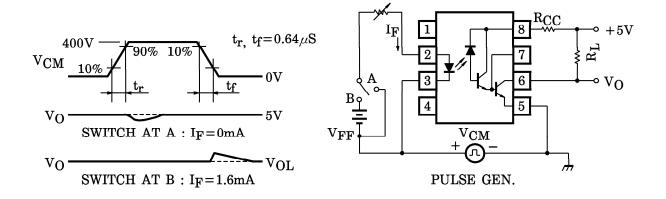
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TECHNICAL DATA

(6N138) TEST CIRCUIT 1.



TEST CIRCUIT 2.



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